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12,264	886	29,991	416	3093	350	6364	276	8652	643	10,792	679	12,613	795
		30,080	43	3105	254	6376	505	8664	529	10,794	679	12,625	812
		30,092	141	3119	88	6441	356	8711	138	10,795	205	12,633	815
1909.		36,229	123	3171	71	6463	73	8761	924	10,818	440	12,721	735
		30,233	72	3214	385	6486	909	8769	110	10,832	734	12,724	810
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26,264	27	**1910.**		4124	122	7042	353	9213	124	11,345	759	12,947	764
26,588	137			4125	202	7049	202	9219	1075	11,375	346	12,948	828
26,696	129	66	371	4180	816	7057	50	9250	76	11,415	675	12,949	765
26.844	36	132	615	4208	308	7060	16	9255	494	11,440	739	12,962	407
26,936	48	207	123	4244	424	7109	407	9258	41	11,441	87	12,993	440
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27,464	36	477	271	4572	816	7226	134	9391	96	11,521	773	13,088	361
27,558	493	496	279	4592	201	7249	525	9408	481	11,545	440	13,097	748
27,583	39	555	156	4613	409	7303	695	9409	345	11,546	731	13,098	407
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27,798	46	676	629	4661	814	7331	77	0478	764	11,693	905	13,128	815
27,806	32	684	220	4700	385	7404	16	9494	609	11,718	35	13,129	763
27,818	447	772	234	4701	275	7420	529	9511	631	11,730	10	13,187	685
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28,126	81	960	9	4959	19	7632	18	9686	375	11,877	738	13,432	911
28,131	92	1021	38	4976	129	7657	553	9777	974	11,878	362	13,470	793
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28,608	94	1212	275	5010	410	7704	273	9858	632	11,947	16	13,487	137
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28,612	92	1353	198	5018	439	7720	542	9869	621	12,013	1105	12,503	1218
28,613	99	1500	122	5145	119	7721	307	9897	632	12,062	73	13,504	1218
28,665	85	1558	292	5154	447	7722	1023	9940	93	12,136	407	13,506	793
28,701	81	1623	304	5232	695	7734	39	9955	16	12,137	542	13,518	736
28,718	78	1728	350	5264	9	7746	621	9964	36	12,138	753	13,591	791
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271	485	16,206	1053	17,898	678	19,602	130	21,210	1202	23,125	944	24,820	886
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28,847	1403
28,871	648
28,872	1373
28,892	1117
28,899	1099
28,922	1043
28,927	478
28,941	735
28,982	1366
29,046	1051
29,061	1102
29,071	567
29,073	1088
29,075	1398
29,084	1456
29,087	951
29,097	1099
29,145	941
29,165	804
29,176	1254
29,184	631
29,196	1368
29,246	888
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29,322	1404
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29,381	1448
29,386	1253
29,389	1072
29,422	731
29,473	553
29,485	1072
29,521	805
29,559	1087
29,564	1100
29,581	1038
29,582	485
29,673	1150
29,709	944
29,710	1122
29,715	1222
29,720	1245
29,721	1202
29,722	1203
29,723	631
29,814	1028
29,830	961
29,839	1456
29,891	1083
29,893	1211
29,901	1185
29,907	982
29,925	481
29,933	1299
29,935	1245
29,964	942
29,965	767
29,971	963
29,989	1089
29,997	1059
30,004	1100
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30,083	1441
30,091	806
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30,129	572
30,185	1072
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30,247	828
1910.	
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30,287	962
30,295	1067
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1911.	
20	1323
41	1069
61	1057
73	739
118	1200
132	883
133	1025
142	1265
153	1059
176	1168
207	633
309	484
319	684
332	798
401	1058
403	684
406	1308
411	508
412	534
419	1221
433	951
459	1365
468	1284
489	1208
491	759
534	1069
561	1115
568	1087
569	712
572	1377
580	811
595	882
608	1039
659	1337
669	1113
763	1303
778	1115
779	1376
833	1376
842	827
867	743
877	711
887	1135
894	1373
935	1388
974	1109
975	1230
993	1148
1046	1207
1059	1188
1123	1365
1131	1320
1211	810
1221	805
1235	1110
1327	1299
1436	888
1441	1310
1535	1320
1539	1309
1544	1245
1556	1309
1609	1265
1626	1253
1628	793
1655	1099
1687	1106
1688	1045
1703	1262
1704	1333
1706	944
1723	1268
1727	680
1729	612
1730	677
1819	1168
1832	1441
1859	1059
1911.	
1941	741
1980	967
2042	1212
2138	944
2232	680
2245	1039
2264	1183
2304	1058
2344	648
2347	896
2354	1246
2355	1369
2375	982
2392	1150
2455	1376
2500	650
2524	680
2581	1005
2615	1247
2618	754
2626	1301
2682	1089
2700	1249
2732	1154
2735	708
2797	1371
2812	1076
2820	925
2830	732
2834	1335
2865	1117
2963	1020
2984	1161
3049	1127
3065	1404
3078	902
3119	495
3124	961
3130	1207
3139	888
3140	638
3197	1004
3228	616
3241	1157
3245	706
3251	905
3269	941
3338	1329
3361	1122
3363	1156
3364	1301
3508	1445
3518	1042
3533	810
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3605	1241
3648	1070
3755	977
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3880	814
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3980	884
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4065	1154
4099	836
4158	678
4159	810
4171	1457
4177	1136
4262	1125
4268	1211
4401	1201
4409	1206
4410	792
4489	1037
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4519	914
4574	673
4586	967
4595	1378
4608	1373
4635	1100
4642	1212
4767	1365
4869	1248
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5079	1016
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5167	1070
5179	1299
5184	743
5188	1072
5251	1000
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5339	1329
5346	911
5569	1321
5577	902
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5667	955
5676	1462
5684	1392
5710	1162
5713	1058
5725	942
5734	1265
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5833	1115
5834	1115
5835	1115
5836	1115
5863	1276
5874	1157
5901	1301
6076	1088
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6227	1141
6258	1301
6267	1448
6296	1167
6328	1166
6441	1387
6444	1172
6445	1172
6540	1076
6617	1303
6642	969
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6664	1459
6684	1117
6762	1141
6763	1403
6858	817
6865	941
6924	1042
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7057	1208
7103	1014
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7204	982
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7228	1375
7325	970
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7394	1273
7404	1450
7422	1109
7492	1140
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7535	972
7536	1000
7591	1470
7615	1249
7616	1188
7617	1093
7630	1103
7639	638
7640	1365
7664	1200
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7726	1022
7735	820
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8694	1038
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8901	1067
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9295	1327
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9529	1112
9599	1147
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9743	926
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9842	1112
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11,422	1204
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1911.	
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12,012	1167
12,099	1006
12,132	1441
12,214	1457
12,227	1160
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12,477	1462
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13,193	1244
13,304	1307
13,335	1395
13,527	1266
13,549	1232
13,619	1246
13,731	1070
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13,990	1313
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14,121	1252
14,122	1252
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14,420	1210
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14,502	1409
14,588	1381
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14,768	1461
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14,912	1468
14,920	1331
15,034	1201
15,128	1168
15,188	1451
15,189	1314
15,287	1443
15,291	1299
15,371	1442
15,432	1251
15,439	1170
15,761	1224
15,809	1307
16,027	1443
16,110	1404
16,270	1331
16,294	1456
16,426	1381
16,431	1403
16,527	1271
16,557	1310
16,723	1310
17,010	1219
17,047	1071
17,124	1462
17,125	1462
17,143	1231
17,480	1201
17,723	1444
17,985	1280
18,207	1252
18,242	1240
18,330	1276
18,414	1392
18,770	1224
18,984	1467
19,032	1381
19,043	1325
21,600	1458
22,067	1372
22,357	1444

LIST OF JOURNALS ABSTRACTED, WITH ABBREVIATIONS USED, AND ADDRESSES OF PUBLISHERS.

Journal.	Abbreviation.	Address of Publisher.
Agricultural Ledger	Agric. Ledger	Reporter on Economic Products to the Government of India, Calcutta.
Allgemeine Zeitschrift für Bierbrauerei und Malzfabrikation	Allgem. Z. Bierbrau. u. Malzfabr.	Michaelerstrasse 25, Vienna XVIII/$_1$.
American Chemical Journal	Amer. Chem. J.	The Johns Hopkins Press, Baltimore, Md., U.S.A.
American Journal of Pharmacy	Amer. J. Pharm.	145, North Tenth Street, Philadelphia, Pa., U.S.A.
American Journal of Science	Amer. J. Sci.	New Haven, Conn., U.S.A.
Analyst	Analyst	Simpkin, Marshall, Hamilton, Kent, and Co., Ltd., 2, 4, 6, 8, Orange Street, London, S.W.
Annalen der Chemie	Annalen	C. F. Winter'sche Verlagshandlung, Leipsig, Germany.
Annales de Chimie Analytique	Ann. Chim. Analyt.	M. Crinon, 45, Rue Turenne, Paris, 3*e*.
Annales des Falsifications	Ann. Falsific.	56, Rue Madame, Paris, 6*e*.
Annali della R. Stazione Chimico Agraria Sperimentale di Roma	Ann. R. Staz. Chim. Agrar. Sperim. Roma	Soc. Typografica Modenese, Antica Tipografia Soliani, Modena, Italy.
Apotheker-Zeitung	Apoth.-Zeit.	Levetzowstrasse 16b, Berlin, N.W., 87.
Archiv der Pharmazie	Arch. Pharm.	Selbstverlag des Deutschen Apotheker-Vereins, Berlin, Germany.
Atti della Reale Accademia dei Lincei, Roma	Atti R. Accad. dei Lincei, Roma	Tipografia della R. Accademia dei Lincei, Rome.
Berichte der Deutschen Chemischen Gesellschaft	Ber.	R. Friedländer und Sohn, Karlstrasse 11, Berlin, N.W., 6, Germany.
Berichte der Deutschen Pharmazeutischen Gesellschaft	Ber. deuts. Pharm. Ges.	Verlag von Gebr. Bornträger, Berlin, W. 35, Schöneberger Ufer 12A, Germany.
Biedermann's Zentralblatt für Agricultur Chemie	Biedermann's Zentr.	O. Leiner, Königstrasse 26B, Leipsig, Germany.
Bio-chemical Journal	Bio-chem. J.	Bio-chemical Dept., The University, Liverpool.
Biochemische Zeitschrift	Biochem. Zeits.	Verlag von J. Springer, Berlin, N. 24, Monbijouplatz 3.
Board of Trade Journal	Bd. of Trade J.	Messrs. Wyman and Sons, Fetter Lane, London, E.C.
Brewers' Journal	Brewers' J.	F. W. Lyon, Eastcheap Buildings, Eastcheap, London, E.C.
British and Colonial Druggist	Brit. and Col. Drug.	194-200, Bishopgate, London, E.C.
Bulletin de l'Association Chimique de Sucre et de Distillerie	Bull. Assoc. Chim. Sucr.	M. le Trésorier, 156, Boulevard Magenta, Paris, 10*e*, France.
Bulletin de la Société Chimique de Belgique	Bull. Soc. Chim. Belg.	M. J. Wauters, Palais du Midi (Galerie du Travail, 7), Brussels.
Bulletin de la Société Chimique de France	Bull Soc. Chim.	Masson et Cie., 120, Boulevard Saint-Germain (6*e*), Paris.
Bulletin de la Société Française de Photographie	Bull. Soc. Franç. Phot.	51, Rue de Clichy, Paris, 9*e*.
Bulletin de la Société Industrielle du Nord de la France	Bull. Soc. Ind. Nord	Rue de l'Hôpital Militaire 116, Lille, France.
Bulletin de la Société Industrielle de Mulhouse	Bull. Soc. Ind. Mulhouse	Berger-Levrault et Cie., 5, Rue des Beaux-Arts, Paris.
Bulletin de la Société d'Encouragement pour l'Industrie Nationale	Bull. Soc. d'Encour.	Secrétariat, Rue de Rennes 44, Paris, France.
Bulletin of the College of Agriculture, Tokyo Imperial University, Japan	Bull. Coll. Agric., Tokyo	Director of the College of Agriculture, Tokyo Imperial University, Japan.
Le Caoutchouc et le Gutta-Percha	Caoutchouc et Gutta-Percha	A. D. Gillard fils, 49, Rue des Vinaigriers, Paris, X.
Chamber of Commerce Journal	Ch. of Comm. J.	Oxford Court, Cannon Street, London, E.C.
Chemical News	Chem. News	E. J. Davey, 16, Newcastle Street, Farringdon Street, London, E.C.
Chemical Trade Journal	Chem. Trade J.	Davis Bros., Danes Inn House, 265, Strand, London, W.C.
Chemiker-Zeitung	Chem.-Zeit.	Dr. v. Vietinghoff-Scheel, Cöthen, Anhalt, Germany.
Chemische Industrie	Chem. Ind.	Weidmann'sche Buchhandlung, Zimmerstrasse 94, Berlin, S.W., Germany.
Chemische Revue über die Fett- und Harz-Industrie	Chem. Rev. Fett-Ind.	Dr. L. Allen, Grosse Reichenstrasse 17, Hamburg, Germany.
Chemisches Zentralblatt	Chem. Zentr.	R. Friedländer und Sohn, Karlstrasse 11, Berlin, N.W., 6, Germany.
Chemist and Druggist	Chem. and Drug.	42, Cannon Street, London, E.C.
Collegium	Collegium	K. Schorlemmer, Sebastian-Munster-Strasse 28, Worms am Rhein, Germany.
Comptes-Rendus hebdomadaires des Séances de l'Académie des Sciences	Comptes rend.	Imprimerie Gauthier-Villars, Quai des Grands Augustins 55, Paris.

Journal.	Abbreviation.	Address of Publisher.
Comptes-Rendus des Travaux de Laboratoire de Carlsberg	Comptes-rend. Trav. Lab. Carlsberg	H. Hagerup, Copenhagen.
Deutsche Zuckerindustrie	Deuts. Zuckerind.	Verlag der Gesellschaft, Die Deuts. Zuckerindustrie, Berlin.
Electrician	Electrician	G. Tucker, Salisbury Court, Fleet Street, London, E.C.
Elektrochemische Zeitschrift	Elektrochem. Zeits.	M. Krayn, Kurfürstenstrasse 11, Berlin, W.
Engineer	Engineer	S. White, 33, Norfolk Street, London, W.C.
Engineering	Engineering	C. R. Johnson, 35 and 36, Bedford Street, Strand, London, W.C.
Engineering and Mining Journal	Eng. and Min. J.	505, Pearl Street, New York City.
Färber-Zeitung	Färber-Zeit.	Julius Springer, Monbijou-Platz 3, Berlin, N., Germany.
Foreign Office Annual Series (Cons. Reports)	F. O. Ann. Series	Wyman and Sons, Fetter Lane, London, E.C.
Gazzetta Chimica Italiana	Gazz. chim. ital.	La Direzione della "Gazzetta Chimica," Via Panisperna, 89, Rome.
Gerber	Gerber	VI/$_2$ Gumpendorferstrasse 89, Wien, Austria.
Gummi-Zeitung	Gummi-Zeit.	Geschäftsstelle der "Gummi-Zeitung," Blucherstrasse 31, Berlin, S. 61, Germany.
Hopper-Seyler's Zeitschrift für Physiologische Chemie	Z. physiol. Chem.	Verlag von K. J. Trübner, Strassburg, Germany.
Imperial Institute Journal and Bulletin	Imp. Inst. J. *or* Bull. Imp. Inst.	Imperial Institute, London, S.W.
India-Rubber Journal	India-rubber J.	Maclaren and Sons, 37 and 38, Shoe Lane, London, E.C.
International Sugar Journal	Int. Sugar J.	N. Rodger, Office of "The Sugar Cane," Mossburn Buildings, Altrincham, Manchester.
Internationale Zeitschrift für Metallographie	Internat. Z. Metallog.	Gebr. Bornträger, Schöneberger Ufer 12a, Berlin, W. 35.
Journal of Agricultural Science	J. Agric. Sci.	University Press, Cambridge.
Journal of the American Chemical Society	J. Amer. Chem. Soc.	C. L. Parsons, New Hampshire College, Durham, N.H., U.S.A.
Journal of the American Leather Chemists' Association	J. Amer. Leather Chem. Assoc.	American Leather Chemists' Assoc., Easton, Pa., U.S.A.
Journal of Biological Chemistry	J. Biol. Chem.	2427–9, York Road, Baltimore, Md., U.S.A.
Journal of the Canadian Mining Institute	J. Canad. Min. Inst.	3 & 4, Windsor Hotel, Montreal, Canada.
Journal of the Chemical Society of London, Transactions and Proceedings	Chem. Soc. Trans. *or* Chem. Soc. Proc.	Gurney and Jackson, 33, Paternoster Row, London, E.C.
Journal of the Chemical, Metallurgical, and Mining Society of South Africa	J. Chem. Met. Soc., S. Africa	F. Rowland, 9, South African School of Mines Building, Eloff Street, Johannesburg.
Journal de Chimie Physique	J. Chim. Phys.	Gauthier-Villars, 55, Quai des Grands Augustins, Paris.
Journal of the College of Science, Imperial University of Tokyo, Japan	J. Coll. Science, Tokyo	Director of the College of Science, Tokyo Imperial University, Japan.
Journal of the Franklin Institute	J. Franklin Inst.	The Actuary, The Franklin Institute, Philadelphia, Pa., U.S.A.
Journal für Gasbeleuchtung und Wasserversorgung	J. Gasbeleucht.	R. Oldenbourg, Glückstrasse 8, München, Germany.
Journal of Gas Lighting	J. Gas Lighting	W. King, 11, Bolt Court, Fleet Street, London, E.C.
Journal of Industrial and Engineering Chemistry	J. Ind. Eng. Chem.	C. L. Parsons, New Hampshire College, Durham, N.H., U.S.A.
Journal of the Institute of Brewing	J. Inst. Brewing	Harrison and Sons, 45, Pall Mall, London, W.
Journal of the Institution of Mechanical Engineers	J. Inst. Mech. Eng.	Storey's Gate, Westminster, S.W.
Journal of the Russian Physical-chemical Society	J. Russ. phys.-chem. Soc.	Laboratoire de Chimie, Université Imperiale, St. Petersbourg, Russia.
Journal of Physical Chemistry	J. Phys. Chem.	W. D. Bancroft, Ithaca, N.Y., U.S.A.
Journal de Pharmacie et de Chimie	J. Pharm. Chim.	O. Doin et fils, Place de l'Odéon, Paris, 8.
Journal für praktische Chemie	J. prakt. Chem.	J. A. Barth, Dorrienstr. 16, Leipsig, Germany.
Journal of the Royal Society of Arts	J. Soc. Arts	G. Bell and Sons, York House, Portugal Street, London, W.C.
Journal of the Society of Dyers and Colourists	J. Soc. Dyers and Col.	E. T. Holdsworth, 10, Merton Road, Bradford, Yorks.
Leather World	Leather World	Leather Trades Publishing Co., The Exchange, Southwark Street, London, S.E.
L'Industria Chimica	L'Ind. Chimica	Associazione Chimica Industriale, Via Roma 28 (Galleria Nazionale Scale A), Turin, Italy.
Memoirs of the College of Science and Engineering, Kyoto Imperial University	Mem. Coll. Sci. and Eng. Kyoto Imp. Univ.	The University, Kyoto, Japan.

JOURNAL.	ABBREVIATION.	ADDRESS OF PUBLISHER.
Mémoriale des Poudres et Salpêtres	Mém. Poudres et Salpêtres	Gauthier-Villars, 55, Quai des Grands Augustins, Paris.
Metallurgical and Chemical Engineering	Metall. and Chem. Eng.	Electrochemical Publishing Co., 239, West 39th Street, New York City, U.S.A.
Metallurgie	Metallurgie	W. Knapp, Halle a. S., Germany.
Mining Magazine	Mining Mag.	819, Salisbury House, London, E.C.
Mining and Engineering World ..	Min. and Eng. World	Monadnock Building, Chicago, Ill., U.S.A.
Mittheilungen aus dem königlichen Materialprüfungsamt zu Gross-Lichterfelde West	Mitt. k. Materialprüf.	Julius Springer, Monbijou-Platz 3, Berlin, N. Germany.
Mittheilungen aus der Centralstelle für wissenschaftlich-technische Untersuchungen	Mitt. Centralst. Wiss.-techn. Unters.	Prof. Dr. W. Will, Neu-Babelsberg, bei Berlin, Germany.
Mittheilungen des technischen Gewerbemuseums in Wien	Mitt. techn. Gew. Museums	Hörlgasse 5, Wien, IX/$_1$, Austria.
Monatshefte für Chemie der kaiserlichen Akademie der Wissenschaften, Wien	Monatsh.	A. Hölder, Rothenthurmstrasse 13, Wien, I, Austria.
Moniteur Scientifique	Monit. Scient. ..	Dr. G. Quesneville, 12, rue de Buci, Faubourg St. Germain, Paris.
Oesterreichische Chemiker-Zeitung	Oesterr. Chem.-Zeit. ..	Pestalozzigasse 6, Wien I, Austria.
Oesterreichische Zeitschrift für Berg- und Hüttenwesen	Oesterr. Z. Berg- u. Hüttenw.	Kohlenmarkt 20, Wien I, Austria.
Oil, Paint, and Drug Reporter..	Oil, Paint, and Drug Rep.	100, William Street, New York City, U.S.A.
Paper Making	Paper Making ..	5, Ludgate Circus Buildings, London, E.C.
Papier-Fabrikant	Papierfabr.	Otto Elsner, Oranienstr. 41, Berlin, S., 42.
Perfumery and Essential Oil Record	Perfumery and Essent. Oil Rec.	6, Serle Street, London, W.C.
Petroleum	Petroleum	Verlag für Fachtliteratur, Nollendorfplatz 6, Berlin, W. 30.
Pharmaceutical Journal	Pharm. J.	Pharmaceutical Soc. of Great Britain, 72, Great Russell Street, London, W.C.
Philippine Journal of Science ..	Philippine J. Sci. ..	Bureau of Science, Manila, Philippine Islands.
Philosophical Magazine and Journal of Science	Phil. Mag.	Taylor and Francis, Red Lion Court, Fleet Street, London, E.C.
Photographic Journal	Phot. J.	Harrison and Sons, 45, Pall Mall, London, S.W.
Proceedings of the American Electrochemical Society ..	Proc. Amer. Electrochem. Soc.	39, South Tenth Street, Philadelphia, Pa., U.S.A.
Proceedings of the American Institute of Mining Engineers, *and also* Bulletin	Proc. Amer. Inst. Min. Eng.; Bull. Amer. Inst. Min. Eng.	124-128, North Seventh Street, Philadelphia, Pa. U.S.A.
Proceedings of the American Society of Civil Engineers	Proc. Amer. Soc. Civ. Eng.	220, West 57th Street, New York City, U.S.A.
Proceedings of the Engineers' Society of Western Pennsylvania	Proc. Eng. Soc. W. Pa.	2511, Oliver Building, Pittsburg, Pa., U.S.A.
Proceedings of the Faraday Society	Proc. Faraday Soc. ..	The Secretary, Victoria Embankment, London, W.C.
Proceedings of the Institution of Civil Engineers	Proc. Inst. Civ. Eng...	The Secretary, Great George Street, London, S.W.
Proceedings of the Institution of Mining and Metallurgy	Proc. Inst. Min. and Met.	Salisbury House, London, E.C.
Proceedings of the Royal Society	Roy. Soc. Proc. ..	Harrison and Sons, 45, St. Martin's Lane, London, W.C.
Recueil des Travaux Chimiques de Pays-Bas	Rec. Trav. Chim. Pays-Bas	A. W. Sijthoff, Leiden, Holland.
Revue Générale des Matières Colorantes	Rev. Gen. Mat. Col. ..	L. Lefèvre, 4, rue de Stockholm, Gare St. Lazare, Paris, France.
Revue de Métallurgie	Rev. Mét.	H. Dunot and E. Pinat, 49, Quai des Grands-Augustins, Paris.
School of Mines Quarterly ..	Sch. Mines Quart. ..	T. H. Harrington, Columbia University, New York.
Science Abstracts	Science Abst... ..	E. and F. N. Spon, Ltd., 57, Haymarket, London, S.W.
Scientific American	Scient. Amer. ..	361, Broadway, New York City, U.S.A.
Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften	Sitzungsber. Kgl. Preuss. Akad. Wiss.	Verlag der Königlichen Akademie der Wissenschaften, Berlin.
Sprechsaal	Sprechsaal	Verlag von Müller und Schmidt, Coburg, Germany.
Stahl und Eisen	Stahl. u. Eisen ..	A. Bagel, Breitestr. 77, Düsseldorf 74, Germany.
Tonindustrie-Zeitung	Tonind.-Zeit.	Dreysestrasse 4, Berlin, N.W. 21, Germany.
Transactions of the American Brass Founders' Association	Trans. Amer. Brass Founders' Assoc.	Buffalo, N.Y , U.S.A
Transactions ot the American Ceramic Society	Trans. Amer. Ceram. Soc.	The Secretary, Columbus, Ohio, U.S.A.
Transactions of the American Electrochemical Society ..	Trans. Amer. Electrochem. Soc.	Lehigh University, South Bethlehem, Pa., U.S.A.

JOURNAL.	ABBREVIATION.	ADDRESS OF PUBLISHER.
Transactions of the American Foundrymen's Association	Trans. Amer. Foundrymen's Assoc.	R. Moldenke, Watchung, N.J., U.S.A.
Transactions of the Australian Institute of Mining Engineers	Tr. Austral. Inst. Min. Eng.	57–59, Swanston Street, Melbourne, Victoria, Australia.
Transactions of the English Ceramic Society	Trans. Engl. Ceram. Soc.	Victoria Institute, Tunstall, Staffordshire.
Transactions of the Institute of Metals	Trans. Inst. Metals ..	Institute of Metals, Caxton House, Westminster, London, S.W.
Transactions of the Iron and Steel Institute	Trans. Iron and Steel Inst.	28, Victoria Street, London, S.W.
Transactions of the Mining Institute of Scotland	Tr. Min. Inst. Scot. ..	Albany Buildings, 39, Victoria Street, London, S.W.
Transactions of the North of England Institute of Mining and Metallurgy	Tr. N. Eng. Inst. Min. and Met.	Newcastle-on-Tyne.
Tropenpflanzer	Tropenpflanzer ..	Unter den Linden 43, Berlin N.W., Germany.
West Indian Bulletin	West Ind. Bull. ..	Imperial Dept. of Agriculture, Barbados, W.I.
Wochenblatt für Papierfabrikation	Wochenbl. Papierfabr.	Güntter-Staib in Biberach a. d. Riss, Württemburg, Germany.
Wochenschrift für Brauerei ..	Woch. f. Brau. ..	P. Parey, Hedemannstrasse 10, Berlin, S.W., Germany.
Zeitschrift der allgemeine Oesterreichische Apotheker-Verein	Z. Allgem. Oesterr. Apoth.-Ver.	Spitalgasse 31, Vienna IX/$_2$, Austria.
Zeitschrift der analytischen Chemie	Z. anal. Chem. ..	C. W. Kreidel's Verlag, Wiesbaden, Germany.
Zeitschrift für angewandte Chemie	Z. angew. Chem. ..	Verlag von Otto Spamer, Leipzig-R, Germany.
Zeitschrift der anorganischen Chemie	Z. anorg. Chem. ..	Verlag von L. Voss, Leipzig, Germany.
Zeitschrift für Chemie und Industrie der Kolloide	Z. Chem. Ind. Kolloide	Verlag von T. Steinkopff, Dresden A. 14, Germany.
Zeitschrift des Vereins der deutschen Zucker-Industrie	Z. Ver. deut. Zuckerind.	Vereins-Direktorium, Kleiststrasse 32, Berlin, W. 62, Germany.
Zeitschrift für das gesammte Brauwesen	Z. ges. Brauw. ..	R. Oldenbourg, Glückstrasse 8, München, Germany.
Zeitschrift für das gesammte Schiess- und Sprengstoffwesen	Z. ges. Schiess- u. Sprengstoffw.	J. F. Lehmann, Paul Heysestrasse 26, München, Germany.
Zeitschrift für Elektrochemie und angewandte physikalische Chemie	Z. Elektrochem. ..	W. Knapp, Mühlweg 19, Halle a.S., Germany.
Zeitschrift für Farben-Industrie	Z. Farben-Ind. ..	Verlag für Textil-Industrie, Kotthuser Ufer 39/40, Berlin, S.O. 26, Germany.
Zeitschrift für öffentliche Chemie	Z. öffentl. Chem. ..	A. Kell's Buchhandlung, Marktstrasse 19, Plauen i. V., Germany.
Zeitschrift für physikalische Chemie	Z. physik. Chem. ..	W. Engelmann, Mittelstrasse 2, Leipzig, Germany.
Zeitschrift für Spiritusindustrie..	Z. Spiritusind. ..	P. Parey, Hedemannstrasse 10, Berlin, S.W., Germany.
Zeitschrift für Untersuchung der Nahrungs- und Genussmittel	Z. Unters. Nahr. u. Genussm.	Julius Springer, Monbijou-Platz 3, Berlin, N., Germany.
Zeitschrift für Zuckerindustrie in Böhmen	Z. Zuckerind. Böhm...	Die Administration, Heinrichsgasse 27, Prag, Bohemia.

ERRATA, 1911.

Issue.	Page.	Column.	Line from Top.	Line from Bottom.	Errata.
No. 1—Jan. 16	43	1	32	..	*For* " nitric " *read* " citric."
No. 3—Feb. 15	145	2	17	..	*Formula should be* "$f = 100 - \frac{100m}{100-b}$"
,, ,,	145	2	..	18 to 20	*In formula, insert* " 100 " *before* " Polarisation " *and for* " W " *read* " 100 " ; *also delete from* " W = the weight . . . . bagasse, and."
No. 4—Feb. 28	201	2	30	..	*For* " this J., 1910, 710," *read* " this J., 1909, 710."
,, ,,	222	1	1, 11, and 13	..	*For* " hours " *read* " days."
No. 5—Mar. 15	283	1	16	..	*In formula insert* " 11 " *before* " H_2O."
No. 6—Mar. 31	347	1	..	21	*For* " Tassa " *read* " Tassy."
No. 7—Apr. 15	428	2	..	11	*For* " Federow " *read* " Fedorow."
,, ,,	440	1	27	..	*For* " K_b " *read* " K_1."
No. 8—Apr. 29	488	1	..	34	*For* " Heinsch " *read* " Heinisch."
,, ,,	504	2	..	4	*For* " Dixon " *read* " Dickson."
No. 10—May 31	594	2	8	..	*Delete comma between* " might " *and* " be."
,, ,,	594	2	33	..	*For* " Nitroxysulphuric acid, $H_2N_2SO_5$ " *read* " Nitroxysulphurous," *etc.*
,, ,,	594	2	36	..	*For* " —(N_2O_2)." *read* " —(N_2O_2)—."
,, ,,	596	2	2	.	*For* " ates ubst " *read* " ate subst."
,, ,,	596	2	40	..	*For* " dioxides " *read* " dioxide."
,, ,,	597	1	middle		*For* $\begin{matrix}H\\O\\KN\\SO_3K\end{matrix}$ *read* $\begin{matrix}H\\O\\KN\\SO_3K\end{matrix}$
,, ,,	597	1	32	..	*Delete commas after* " intermediate " *and after* " $KN(OH)_2$."
,, ,,	597	2	14	..	*For* " sofution " *read* " solution."
,, ,,	599	2	5	..	*For* " intermediately " *read* " intermediate."
,, ,,	599	2	..	25	*For* " sul honate " *read* " sulphonate "
,, ,,	600	1	..	30	*For* " $HO)_2$ " *read* " $(HO)_2$."
,, ,,	600	2	20	..	*For* " salt " *read* " salts."
,, ,,	602	1	20	..	*Insert a comma after* " atom."
,, ,,	602	1	..	23	*For* " amined sulph " *read* " aminedisulph."
No. 11—June 15	698	1	..	5	*For* " 70° " *read* " 90°."
,, ,,	698	2	Table		*After* " oily layer " *delete* " (aromatic hydrocarbons)."
No. 12—June 30	729	2	..	8	*For* " pine tar " *read* " hardwood tar."
No. 13—July 15	788	2	1	..	*For* " 50° C." *read* " 50° F."
,, ,,	788	2	7	..	*For* " weighted " *read* " weighed."
,, ,,	788	2	15	..	*For* " 6.849 " *read* " 6.812."
No. 14—July 31	882	1	Title of 3rd abstract		*For* " Siebel " *read* " Seibel."
No. 16—Aug. 31	1004	1	..	8	*After* " 15,925 " *insert* " 18,578 and 18,720."
No. 17—Sept. 15	1040	2	31	..	*For* " Goutat " *read* " Goutal."
,, ,,	1014	1	20	..	*For* " throught " *read* " through."
,, ,,	1119	2	..	15	*For* " $\sqrt{\ }$ " *read* " $\sqrt{\frac{p}{m}}$ "
,, ,,	1268	1	30	..	*For* " 1312 " *read* " 1321."
,, ,,	1374	1	10	..	*Delete* " or sulphite."
No. 24—Dec. 31	1424	1	15	..	*For* " Diagram II." *read* " Diagram III."
,, ,,	1425	1	26 and 27	..	*For* " 200 gms. per sq. inch " read " 200 gms. per sq. millimetre."
,, ,,	1438	2	..	..	The block has been printed upside down.
,, ,,	1444	1	..	7	*For* " 18,174 " *read* " 18,176."

Journal of the Society of Chemical Industry.

No. 1, Vol. XXX. JANUARY 16, 1911. No. 1, Vol. XXX.

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Canadian Section.

GUAYULE RUBBER.

BY HAROLD VAN DER LINDE.

(This Journal, November 30, 1910, p. 1283.)

ERRATUM.

Page 1238, column 1, last line but 2, *for* "revenue" *read* "rubber."

London Section.

THE RELATION OF CHEMICAL INDUSTRY TO METALLURGY.

BY A. C. CLAUDET.

(This Journal, December 31, 1910, pp. 1421—1428).

ERRATA.

Page 1428, (Mr. R. Pearce's remarks), col. 1, lines 4 and 18, *for* "washing" *read* "roasting," and line 12, *for* "washed" *read* "roasted."

Nottingham Section.

Meeting held at Nottingham, on Friday, October 28th, 1910.

MR. S. J. PENTECOST IN THE CHAIR.

THE EMPLOYMENT OF THE ELECTROMETRIC METHOD FOR THE ESTIMATION OF THE ACIDITY OF TAN LIQUORS.

PART I.

BY HENRY J. S. SAND, PH.D., D.SC., AND DOUGLAS J. LAW, B.SC., F.I.C.

The determination of the acidity of tan-liquors is a matter which is at the present time undergoing a considerable amount of discussion. This is due not only to the difficulty of finding indicators which give a plain colour-change in the dark liquids to be titrated, but more still, to the uncertainty which has prevailed in the minds of tanners as to an exact definition of the terms acid, alkaline, and neutral. We may say that apart from the ionic theory, no attempt even has been made to fix these ideas in an objective manner. It is a commonplace that different indicators will turn at entirely different points when such weak acids as occur in tan-liquors are present, and also that the degree of acidity on which a property such as swelling power depends cannot be simply expressed by stating the equivalent concentration of the acid. As is well known, the ionic theory affirms that degree of acidity depends on the concentration of hydrogen ions, a strongly acid solution being one in which the hydrion concentration is great, an alkaline solution, one in which it is extraordinarily minute, and if we wish to adopt absolutely pure water as our standard of neutrality, a neutral solution is one in which the hydrion concentration is approximately 10^{-7} normal. The ionic theory also furnishes us with a direct means of estimating hydrion concentration, and this means consists in measuring the difference of potential between that liquid and a hydrogen electrode. Other methods for the same purpose must obviously be as numerous as are the functions of hydrogen-ion concentration, but more particularly for the determination of small hydrion concentration, the electrometric method is the most direct, and has in most cases served to standardise the others. Of the subsidiary methods that of indicators is by far the most important, and owing to the researches of Friedenthal (Zeits. Elektrochem. 1904, **10**, 113; *ibid.* 1908, **14**, 125); Salessky (Zeits. Elektrochem. 1904, **10**, 204); Fels (Zeits. Elektrochem. 1904, **10**, 208); Salm (Zeits. Elektrochem. 1904, **10**, 344. Zeits. Phys. Chem. 1907, **57**, 471); Sörensen (Sur la mésure et l'importance de la concentration des ions hydrogène dans les reactions enzymatiques. Comptea Rendes Laboratoire de Carlsberg, 1909, **8**, 1); and others, we now possess a whole range of indicators which have been standardised in such a manner that it is possible to select one or more, to indicate almost any arbitrarily fixed hydrogen ion concentration. For the investigation of tan liquors, however, only a small fraction of these is available owing to the deep colour of the solutions to be titrated; and the turning points of this fraction do not necessarily correspond to a hydrion concentration which is of importance to the tanner. The electrometric method, on the other hand, allows any arbitrarily fixed hydrion concentration to be determined, and it was this consideration which led Mr. J. T. Wood to suggest to us the desirability of testing the electrometric method, more especially in order to examine its practicability for determining the original hydrion concentration of a tan liquor and also the amount of alkali which must be added until a hydrion concentration corresponding to the turning point of some well-recognised indicator such as particularly phenolphthalein, is reached. There is reason to believe that the former is an essential factor on which the swelling power of the liquor depends, and that the latter will be connected with its capacity for dissolving lime (see table 2). A large field of investigation in these directions is open, and we are aware that much valuable work not yet published, on the acids in tan liquors and their action in the tanning process, has been done by Professor Procter and Mr. Arnold Seymour Jones. The present results are of a preliminary nature, and are given with a view to show the general practicability of the method, and in response to repeated requests that we should publish a complete and coherent account of the form in which the electrometric process is employed by us. This method of titrating acids and alkalies was first put forward by Böttger (Zeits. Phys. Chem., 1897, **24**, 253) working in Ostwald's laboratory in 1897, and may be said to depend on the fact that when metals and also hydrogen absorbed by platinum black, are brought in contact with solutions which contain these same substances in the ionised condition, a potential difference is established which depends, not only on the nature of the substances in contact, but also, on the concentration of the ions in solution. In the form in which the method was described by Böttger, it could however hardly be employed in the titration of the weak acids occurring in tan-liquors. It is generally believed that the complication of apparatus required for carrying out our estimations of this sort is so great as to render the method unsuitable for practical purposes. We have found however, that when the auxiliary electrode and a potentiometer-box devised by one of us for the purpose of the separation of metals by graded potential (Sand. Trans. Faraday Soc., 1909, **5**, 159; Trans. Chem. Soc., 1907, **91**, 373, and 1908, **93**, 1572) are employed, the method becomes easy and certain of application, and all the apparatus may be set up in a few minutes.*

Apart from the beaker containing the liquid to be examined and a burette for delivering alkali into it, the apparatus consists of the hydrogen and the auxiliary electrodes both dipping into the liquid; and the potentiometer box for measuring the difference of potential between them.

The accompanying figure shows the hydrogen electrode I. and the auxiliary electrode II., drawn to scale, on the right, whereas the electrical apparatus is explained diagrammatically on the left.

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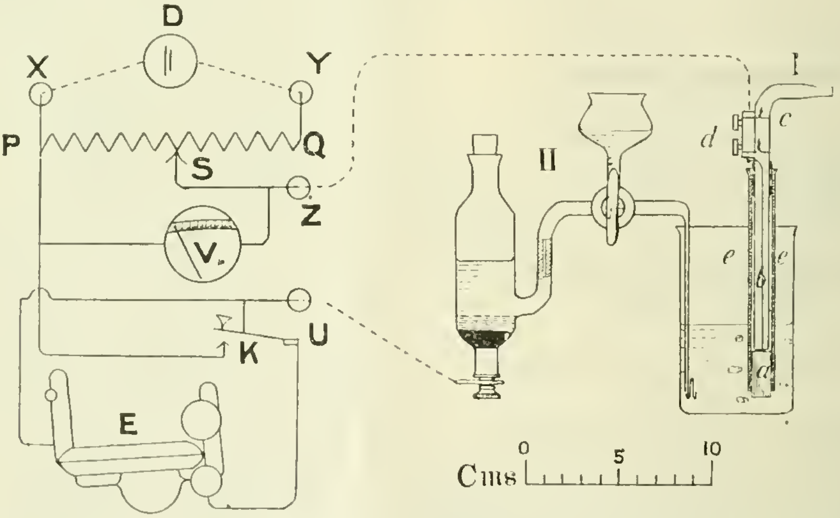
* The apparatus was made partly by Universitätsmechaniker Fritz Köhler, of Leipzig, and partly by Messrs. Griffin, of London.

We are at present engaged in examining various forms of hydrogen electrode in order to find which is the most suitable for our purpose. The one shown in the figure has been improvised for the experiments recorded here, and we therefore describe it, but do not on this account wish to put it forward as the best form available. It will be seen that it consists essentially of a thin platinum plate, *a*, which is fastened to a long thin platinum wire, *b*. The latter is fitted inside the glass tube, *c*, and is sealed through it near the top, and then ends in the terminal, *d*. The plate, *a*, is surrounded to within about 2 mm. from the bottom by the glass tube, *e*, which is fitted to *c* by a piece of rubber. The hydrogen escapes through the liquid at the bottom. The whole apparatus is suspended by means of a piece of string from a ring fitted on the burette-stand in such a manner that it may be employed for stirring the liquid, but cannot come in contact with the bottom of the beaker. The platinum plate, *a*, is coated with platinum black by the Lummer Kurlbaum method, *i.e.*, by making it the cathode in a 3 per cent. solution of platinum chloride containing one-fortieth per cent. lead acetate, the current being regulated so as to produce a moderately vigorous evolution of hydrogen. A single coating has lasted for more than fifty titrations. Hydrogen obtained by the action of hydrochloric acid on zinc and purified by means of alkaline permanganate solution enters at the tube, *c*, and escapes at the bottom. The initial saturation of the platinum black requires a passage of the gas for 25 to 30 minutes. When once saturated, however, the transference of the electrode from one liquid to another occasions no loss in saturation greater than can be remedied by allowing the hydrogen to pass for about one minute before proceeding with the titration.



The auxiliary electrode-vessel, II., will require little further explanation. For our purposes in which an accuracy of about one centivolt is sufficient, we believe that the normal calomel electrode is the most suitable. This electrode was made up according to the directions given by Ostwald-Luther's Handbuch* and not exposed unnecessarily to light. The left limb of the capillary connection is filled from the funnel with normal potassium cholride solution, whereas the other limb contains a 3·5 normal solution of the same substance. It is known that the diffusion-potential between this solution and the other solutions of small concentration is always small. In those cases in which Bjerrum (Zeits. Phys. Chem., 1905, **53**, 428), succeeded in determining such diffusion potentials, they did not exceed one centivolt. During use, the tap of the electrode, which must be maintained free from grease, is kept closed, the layer of liquid held by capillary attraction around the barrel forming the connection.

One of the most important points in every method of titration is what may be called the end-reaction. In the present case we have to decide which potential-difference between the calomel and the hydrogen electrode is to be taken as an index that the titration is complete. If the object of the titration be to estimate the number of equivalents of acid present, then this potential-difference can only be determined if it is known which is the acid present and what is the concentration of the sodium salt resulting from the titration.*

We have not gone into this matter fully as yet, and it is by no means certain that an end-reaction resulting from considerations of this kind would be of especial importance to the tanner. In the meantime we have adopted the value 0·69 volt as our end-voltage. This number was obtained primarily by running a $N/10$ soda solution into a $N/10$ acetic acid solution containing phenolphthaleïn until the first indication of pink was observed. At the dilution of this experiment the change of colour very nearly corresponds to the point at which the base has been added in a quantity equivalent to the acid originally present. The value 0·69 volt also corresponds very nearly to a hydrion concentration equal to that of pure water as is shown by the following considerations.

Taking the potential difference between a normal calomel electrode and a hydrogen electrode placed in contact with hydrions of normal concentration to have the value given by Wilsmore (Zeits. Phys. Chem., 1900, **35**, 302) of 0·283 volt, then Nernst's formula leads to the corresponding P. D. (π) for a hydrion concentration C, at 17° of

$$\pi = \left(0{\cdot}283 + 0{\cdot}0575 \log \frac{1}{C}\right) \text{ volt } \quad . \quad . \quad . \quad (1).$$

For a hydrion concentration C. of 10^{-7}, corresponding approximately to pure water, this leads to $\pi = 0{\cdot}283 + 0{\cdot}403 = 0{\cdot}69$ volt. Similarly, by the employment of a new method, Lorenz and Mohn (Zeit. Phys. Chem., 1907, **60**, 422), arrived at the value 0·75 volt for the potential difference between a $N/10$ calomel electrode and a hydrogen electrode placed in an accurately neutral liquid. This would correspond to a voltage between 0·69 and 0·70 if a N calomel electrode had been employed. Our results thus lead to the conclusion that phenolphthaleïn begins to change colour at a hydrion concentration of 10^{-7} normal. This value agrees with that given by Salessky (Zeit. Elektrochem, 1904, **10**, 204) but is greater that that of Friedenthal (*ibid* p. 117) and Salm (Zeit. Phys. Chem., 1906, **57**, 471).

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* Some pure mercury is poured into the electrode vessel. On this a layer of about 1 c.m. in height is poured of a paste made by shaking up mercury very thoroughly with calomel in a normal potassium chloride solution, pouring off the supernatant liquid and repeating the operation several times. Finally the vessel is charged with a normal solution of potassium chloride, which has been thoroughly saturated with mercurous chloride by shaking up with the above paste.—For a discussion of the sources of error in this electrode see Coggeshall. Zeit. Phys. Chem., 1895, **17**, 63.

* For a discussion of this matter see Salm und Friedenthal, Zeit. Elektrochem., 1907, **13**, 125.

The potentiometer-box already referred to is employed for measuring the potential-difference between the calomel and the hydrogen electrode. The principle of the method of measurement consists in connecting the two ends, P and Q, of a sliding rheostat to the terminals of a dry cell, D, and balancing the potential-difference to be measured against the potential-difference between one end, P, and the slider, S, by means of a special form of enclosed capillary electrometer, E. The value of this potential-difference is read directly on a delicate voltmeter, V. The connections, which are found ready-made in the box, have been drawn out, whereas those to be made by the operator are shown by dotted lines. The steps to be taken by the latter consist first in taking off the capillary electrometer and manipulating it in such a manner that on returning it into position the capillary may be partly filled with a thread of mercury and partly with the acid. The terminals, X and Y, marked battery + and —, are connected to a dry cell, and the terminals, Z and U, marked cathode and auxiliary respectively, to the hydrogen and the calomel electrode. Very careful insulation of the connection between the terminal marked auxiliary and the calomel-electrode is necessary. The hydrogen is passed through the hydrogen electrode until a constant P. D. between it and the calomel electrode is obtained. This P. D. is measured by moving the slider up and down until no movement of the mercury in the capillary electrometer is observed on depressing the key K marked electrometer. In carrying out this operation care must be taken not to touch any bare terminals or wires with the hand, as false earth-connexions may otherwise be introduced. The key should be depressed long enough to allow the mercury to move ; we have had occasion to observe that many operators have an exaggerated idea of the liability the instrument might show to become polarised. The initial P. D. is then read directly on the voltmeter on the scale ranging from 0 to 1·5 volt.* As already stated, this measures the original hydrion concentration of the liquid which there is reason to believe bears some relation to its swelling power. Alkali is then run in until, after equilibrium has been established, the voltmeter shows 0·69 volt, when the liquid is assumed to have been neutralised. When a hydrogen electrode is employed which has been saturated before the beginning of the experiment, a titration usually occupies about three minutes. The initial reading of the voltmeter during the titration of the tan-liquors which we have examined was usually found to be about 0·54 volt, which, according to equation (1), corresponds to the value :

$$x = \log \frac{1}{C} = \frac{1}{0{\cdot}0575}(0{\cdot}54 - 0{\cdot}283) = 4{\cdot}5.$$

Following the example of Sorensen (*loc. cit.*) we may call x the exponent of the hydrogen-ion concentration and may conveniently employ it to measure the smallness of the acidic action of our solution.

The readings of the voltmeter may be checked from time to time by means of a Clark or Weston cell connected to the terminals, cathode and auxiliary. If the voltmeter has been fitted in a hermetically sealed case, and mounted on rubber, there is little reason to apprehend that its readings will become untrustworthy. The instrument employed by us has been in use for about two years without showing any error.

The method was checked by first titrating a tan-liquor electrometically with $N/10$ alkali and then adding known quantities of $N/10$ acetic, lactic, or butyric acid to the neutralised liquids and titrating again. The acids had been standardised previously against $N/10$ soda by means of phenolphthaleïn. The following are typical results (table 1).

TABLE 1.

Acid : Acetic.		Lactic.		Butyric.	
c.c. added.	c.c. found.	c.c. added.	c.c. found.	c.c. added.	c.c. found.
5	4·9	5	5·0	9·9	9·85
10	9·9, 10·0, 10·05	10	9·90, 9·95, 9·90	14·85	14·75
15	15·1	15	15·08, 15·05	—	—

Table 2 gives a comparison between the acidity of various liquids determined electrometrically on the one hand and by Procter's lime-water method on the other.

TABLE 2.

c.c. $N/10$ *Alkali required to neutralise* 10 *c.c. of the liquors.*

No.	1	2	3	4	5	6	7
Electrometric	7·0	9·1	10·0	10·6	10·3	10·45	10·65
Lime-water	5·88	8·24	8·75	9·4	9·03	9·40	9·26

We hope shortly to be able to make definite proposals as to the most suitable form of hydrogen electrode and to be in a position to discuss more fully the information which may be derived from the different potentiometer-readings, more particularly in its bearing upon questions affecting the tanning of leather. We trust, however, that the preceding account may be of use to anyone wishing to employ the method in the meantime and may prove, that when carried out with the means at present at our disposal, the method is both simple in application and certain in its results.

Meeting held at Nottingham on Wednesday, December 7th, 1910.

MR. S. J. PENTECOST IN THE CHAIR.

SOME CHARACTERISTICS OF NEUTRALISED OLIVE-RESIDUUM OILS.

BY L. ARCHBUTT, F.I.C.

The scarcity of olive oil resulting from bad seasons has led during recent years to the working up for the lubricating oil market of the olive-residuum oils (*huiles des grignons d'olives*) obtained from the marc or pulp which remains after the greater part of the oil has been expressed from the fruit. This residual marc is sometimes kept until it has fermented, which facilitates the extraction of the oil but also causes it to become decomposed (*huile d'enfer*), and before being treated it is ground so as to crush the olive stones. It is then mixed with boiling water and subjected to strong pressure, and the resulting cake is further extracted with carbon bisulphide to obtain the last traces of oil. The residuum oils thus obtained contain variable proportions, sometimes very large proportions, of free fatty acid : they also contain the kernel oil and matters derived from the shell of the olive stone, etc. To remove the free acid they are washed with alkali and finally with water, and are put upon the market under the name of Neutral or "Saponified" oils, being sold under a guarantee of maximum acidity—1 per cent. or 4 per cent., as the case may be. As this class of oil presents several characteristic and abnormal features when compared with ordinary olive oil, I bring the results before the Society in the hope that they may be of interest, and also that an opportunity may be afforded of comparing notes with others who may have had to examine samples of the same class of oil.

Neutralised olive oils are usually characterised by turbidity, and sometimes they are dark in colour. They generally contain moisture, owing to the oil not being thoroughly dried after the last washing, and although it is difficult to get the merchants or manufacturers to admit its presence, or if they do admit it they characterise it as a trace and of no consequence, quite considerable traces of water can be expelled from some samples and caused to condense on the glass surface above the oil when some of it is heated in a dry boiling-tube. I cannot regard this moisture as of no consequence, because it is well known that free fatty acids pit and corrode metallic surfaces much more readily in the presence of moisture than in its absence. Sometimes the moisture is the principal cause of the turbidity of the oil, but in other cases separation of a solid fat at ordinary temperatures is a contributory or the main cause.

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* NOTE.—The potentiometer-box as used for purposes of electro-analysis contains in addition to the apparatus and terminals shown in the diagram, a terminal and a tapping key, both marked anode. When the latter is depressed the voltmeter reads directly the difference of potential between the terminals "anode" and "cathode" on a second scale ranging from 0 to 6 volts.

The olive-residuum oils used in the manufacture of neutralised oils may be obtained from various sources, and some kinds, especially those obtained from Tunisian olives, may contain sufficient solid fat to cause the oil to have an abnormally high viscosity. By warming such oils until the solid fat is dissolved, and cooling again, the viscosity can be greatly increased, so that it is difficult to obtain consistent results in the viscometer; 50 c.c. of normal olive oil usually take about 438 seconds in running from Redwood's viscometer at 60° F., the few samples of such oil containing less than 4 per cent. of acidity which I have tested having taken from 430 to 446 seconds in running from a viscometer which delivers 50 c.c. of water at 70° F. in 25·74 seconds. Samples of so-called "Saponified" oil have given very variable figures, ranging from the normal to as high as 561 seconds.

Another respect in which these oils are peculiar is in the amount of unsaponifiable matter they contain, which may exceed 3 per cent. From one sample I obtained as much as 3·32 per cent. of pale yellow, wax-like, unsaponifiable matter, after carefully re-saponifying the quantity at first extracted. According to Milliau, this unsaponifiable matter is derived from the shell of the olive nut, extracted presumably by carbon disulphide. The following figures show some characteristics of the unsaponifiable matter from two samples of olive oil which I examined:—

That from the first sample gave the following results:—Specific gravity at 60° F., 0·9346. Melting-point (Bensemann), 50·5°—52·5° C. Iodine value, 105·4.* Yield of mixed acetates, 105·2 per cent. Saponification value of mixed acetates, 8·53 per cent. KOH. Melting-point of mixed acetates, 35°—38° C.

That from the second sample was found to have an iodine value of 158·9. It was noticed that this unsaponifiable matter, though carefully re-saponified and giving a perfectly clear solution in ether, became quite turbid when the solvent was being expelled, and remained turbid when melted in the water oven. The liquid portion of this melted at 58°—60° C. In consequence of the high iodine value, I had the curiosity to extract some unsaponifiable matter from a sample of "Fine Malaga" olive oil containing 1·3 per cent. of unsaponifiable matter. This melted to a perfectly clear and bright golden-yellow oil, but I was surprised to find the iodine value as high as 259. The melting-point was 41°—42° C. It is evident that further investigation is required into the nature of the unsaponifiable matter from olive oils.

As might be expected, the abnormally high percentage of unsaponifiable matter in these residuum oils is associated with a low saponification value.

In testing these oils by Bellier's qualitative test for arachis oil, I have very frequently, in fact nearly always, obtained a small amount of flocculent precipitate, which must, I think, be caused by the excess of unsaponifiable matter, since it is not given by normal olive oils. One sample, containing 3·2 per cent. of unsaponifiable matter, which gave a precipitate in Bellier's test, gave no trace of arachidic acid in Renard's test, and another sample which gave an unusually marked indication of arachis oil in Bellier's test was found by Renard's process to contain not more than 5 per cent. of arachis oil. Therefore, it is evident that Bellier's test when applied to these particular olive oils requires careful interpretation, and unless a heavy precipitate is obtained the presence of arachis oil cannot be inferred. In any case, Renard's process should be used as a confirmatory test before certifying adulteration.

Another respect in which these olive oils are peculiar is in the colour they give when vigorously shaken in the cold with an equal volume of nitric acid of 1·375 sp. gr. Normal samples of genuine olive oil scarcely alter in colour, or at the most give a pale brownish-green or brownish-yellow colour on standing. These neutralised residuum oils give an immediate brown or greenish-brown emulsion when shaken with the nitric acid, darkening more or less rapidly, and the oil which separates on standing is dark brown. The colour is quite different from that given by cotton seed oil, and, moreover, these oils give no colour reaction with Halphen's reagent, and the iodine value of such as I have examined has been quite normal.

Some of these oils appear to thicken more readily on exposure to air than normal olive oils, but I am unable to say that this is a characteristic feature. They certainly do oxidise more readily than genuine neatsfoot or lard oil, but I consider them quite suitable for lubrication in admixture with mineral lubricating oil, and they have the advantage of low, sometimes very low, acidity.

The characteristic features of these oils, especially the colour reaction with nitric acid, the low saponification value and the abnormally high percentage of unsaponifiable matter, connect them with the abnormal Tunisian oils referred to in my paper read before the Society in April, 1907 (this Journal, 1907, 26, 453). No doubt the latter contained olive-residuum oils as well as arachis oil.

The results of examination of a few samples of commercial neutralised olive oil which have passed through my hands are given in the following table.

Specific gravity at 60° F.	0·9167	0·9165	0·9175	0·9186	0·9169	0·9175	0·9169	0·9161	0·9179
*Efflux time of 50 c.c. from Redwood's Viscometer at 60° F. (seconds) ..	516	450	437	478	480	561	524	428	465
Saponification value, per cent. ..	18·61	18·69	18·93	18·69	18·60	18.55	18·59	18·54	18·58
Iodine value, ,, ..	86·4	85·1	85·8	84·4	85·5	85·6	85·0	86·5	86·2
Free (oleic) acid, ,, ..	2·9	3·3	1·0	1·1	0·9	2·3	1·8	0·4	1·6
Unsaponifiable matter, ,, ..	2·49	2·34	2·08	2·70	3·30	3·32	3·23	2·98	2·67
Arachidic acid, by Renard's process..	—	—	—	—	—	—	nil	—	—
Ash	nil	—	—	—	—	—	—	—	—

* Normal olive oil, say, 430—446 seconds.

Yorkshire Section.

Meeting held at Leeds on Monday, December 12th, 1910.

MR. F. W. BRANSON IN THE CHAIR.

THE RELATION BETWEEN THE CHEMICAL CONSTITUTION OF MON-AZO DYES AND THEIR FASTNESS TO LIGHT AND OTHER AGENCIES.

BY EDWIN ROY WATSON, ANAKUL CHANDRA SIRCAR, M.A., AND JATINDRA MOHAN DUTTA, M.A.

The first object of this investigation was to put to a further test the theory formulated by one of us (Chem. Soc. Proc., 1909, 25, 224; J. Soc. Dyers and Col., 26, 237—238; see this J., 1909, 1189) as to the cause of fading of azo dyes in light. For this purpose a series of derivatives of benzene-azo-phenol was obtained by systematically introducing further hydroxyl groups, sulphonic acid groups, carboxyl groups, bromine atoms, and nitro groups, first on to the one side of the molecule, and then on to the other. A similar series of derivatives of benzene-azo-aniline was also prepared. The fastness to light of these series of dyes was examined. Having these series in our hands we also took the opportunity to study the relation between constitution and fastness to soaping, alkalis, and acids, and we were ultimately in a position to generalise as to how to obtain members of the azo-benzene series with the greatest fastness to all agencies—a point of the greatest practical importance.

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* Most certainly low, as the iodine was nearly all absorbed.

Methods of testing fastness to various agencies.—In all cases the textile dyed was wool. Thoroughly cleansed woollen cloth was dyed in a vat containing 2 per cent. of the dyestuff and 2 per cent. of sulphuric acid (reckoned on weight of cloth), the cloth was kept in the boiling vat for one hour, and a vat for 5 grms. of cloth was at the end of the operation reduced to 50 c.c.

Fastness to light.—Strips of the various samples were fastened on a sheet of white paper. Half of each sample was covered by an opaque screen and the whole arrangement was exposed to sunlight, the paper being in a horizontal position. The exposed parts of the samples were systematically and periodically compared with the screened parts. This enabled us to classify the dyes according to the British Association Committee's scale (B. A. Reports, this J., 1894, 803—807; 1896, 798—802), on which Class V indicates the greatest fastness and Class I the least.

Fastness to soaping.—The dyed samples were all steeped for 15 minutes at 60° C. in an aqueous solution of neutral soap containing 15 grms. per litre, rinsed out, dried, and compared with the original dyeing.

Fastness to alkali.—The samples were steeped for 10 minutes in a solution of sodium carbonate (10 grms. crystalline carbonate per litre) at 60° C.

Fastness to acid.—The samples were steeped for 1 hour in 10 per cent. acetic acid solution at 40° C.

An attempt was made to use Knecht's process of titration with titanous chloride (J. Soc. Dyers and Col., 1905, **21**, 3—6; this J., 1905, 154) to determine the amount of fading, washing out, etc., but after numerous trials of this process it had to be abandoned as unsatisfactory. Probably the titanous chloride is so strong a reducing agent that under the conditions of the titration it, to some extent decomposes the water of the solution or the carbon dioxide atmosphere in which the reduction is carried out.

From the results, as shown in Table I., it is seen that sulphonic groups introduced into the molecule have a good effect on the fastness to light, or at any rate no bad effect; and that hydroxyl or amino groups on either side have a bad effect. So far this is what was expected (Watson, *loc. cit.*). Bromine has scarcely any effect, though on the phenolic or anilino-side it somewhat reduces the fastness. The nitro-group has scarcely any effect on the phenolic or anilino-side, but on the benzene side a decided ill-effect. The most marked and unexpected feature is the injurious effect of the carboxyl group on the benzene side. These results, which have been obtained by the study of a carefully selected series, can rightly be examined in much greater detail than, say, the British Association Committee's results, which were not obtained for the elucidation of any particular point. It is now impossible to overlook the fact that the introduction of groups such as nitro and carboxyl into the benzene side of the molecule decreases the fastness of the dye. Also it is certainly established that, instead of improving the fastness, bromine atoms or nitro-groups on the phenolic or anilino-side somewhat decrease the stability of the dye. In the face of these facts, the theory previously formulated can no longer be maintained.

As regards fastness to *soaping and alkalis*, it appears that, of all the dyes examined, only benzene-azo-salicylic acid, fixed by a chrome mordant, could be considered as fast to the washing and alkali tests. The other dyeings lost from something less than 50 per cent. up to as much as 100 per cent. in these tests. The introduction of sulphonic groups into the molecule had a very bad effect on the fastness in these tests, hydroxyl groups had a worse effect than amino groups, nitro groups had scarcely any effect one way or the other; bromine had a decidedly good effect on benzene-azo-phenol, especially when on the phenolic side. A carboxyl group on the benzene side of benzene-azo-phenol had no appreciable effect, but a carboxyl group adjacent to the hydroxyl group allowed the dye to be fixed by chrome mordant, and raised it far above all other dyes in fastness to alkalis and soap. These experiments show that the washing-out of dyes by soap and alkali is not entirely due to the presence of acidic groups in the dye, otherwise benzene-azo-aniline would be quite fast to these agencies. On the other hand, the presence of strongly acidic groups, such as the sulphonic group, determines that the dye will be almost entirely washed out, and these experiments indicate that it would be almost useless to expect a dye containing SO_3H groups to be very fast to soap and alkali.

As regards fastness to *acid*:—Very few of the dyeings lost any appreciable percentage of their intensity on being subjected to the acid test. Chrysoidine, with two amino-groups, suffered the greatest loss, showing that here again chemical constitution had *some* direct influence on the fastness. But here, as in the preceding tests, the fastness is no doubt to a large extent determined by physical properties, such as solubility in water, and hence is only indirectly determined by the chemical constitution.

In considering together the results of the determinations of fastness to various agencies of our series of dyes, we see that benzene-azo-salicylic acid, fixed with a chrome mordant, is the only one of the series which is satisfactory in all respects. Nitro groups or bromine atoms could be added without any very prejudicial effect, but no other groups. Other hydroxyl or amino groups would decrease the fastness to light; sulphonic groups would not decrease the fastness to light, but would render the dye loose to washing: replacing the benzene nuclei by napthalene would injure the fastness to light. A possibility of increasing the fastness to washing lies in the fact that this is determined largely by physical characters, so the same dyes, if produced as ingrain colours, might be much better in this respect. Benzene-azo-phenol so produced might be a most excellent dye. Experiments on this subject are being undertaken. Experiments are also in progress, based on the experience here gained, to produce other azo-dyes with heavier molecules and more than one azo-group which will have the excellent fastness to all agencies of benzene-azo-salicylic acid and will be of different colours. The presence of sulphonic groups in almost all the commercial azo-dyes seems to prevent their attaining the highest fastness to washing, alkalis, and milling.

Preparation of the dyes examined.

The following points, not recorded in the literature, were noticed during the preparation of these dyes:—*Sulphobenzene-azo-aniline* (Griess. Ber., **15**, 2184). As described by Griess, sulphanilic acid was diazotised and coupled with aniline in acid solution. According to the original description, the mixture should be left for 24 hours, when a light yellow precipitate of sulphobenzene-azo-aniline would be precipitated. It was found that very soon a small orange-white precipitate came down, but on further standing there was decomposition with gas-evolution, and the solution became brown. After five days the precipitate was filtered off and the solution treated with sodium carbonate, but no precipitate came down even on standing. The original precipitate was washed and dissolved in warm dilute ammonia. On cooling, small, glancing, yellow plates of the ammonium salt came down. These were dissolved in hot water, filtered, and to the filtrate hydrochloric acid (strong) was added, which gave a purplish-coloured precipitate. This was washed and dried on a porous plate. This is the pure sulphobenzene-azo-aniline, but it has markedly different properties from those given by Griess, who describes it as yellowish-white, and practically insoluble in water and alcohol. It is, on the contrary, of a purplish colour and fairly soluble in water and alcohol. The substance was dissolved in water and filtered, and the filtrate was neutralised with potash. The solution was concentrated and cooled, when beautiful golden-yellow crystals were deposited. These crystals appeared as hexagonal plates under the microscope.

0·1100 of the substance gave 0·0288 K_2SO_4; K = 11·83 per cent. $SO_3K.C_6H_4N{:}N.C_6H_4NH_2$ or $C_{12}H_{10}O_3N_3SK$ requires K = 12·33 per cent. The purple coloured substance was therefore sulpho-benzene-azo-aniline, and these golden-yellow platelets its potassium salt.

TABLE I.

Dyeing.	Formula of dye.	Fastness to light on British Association Committee's scale.	Intensity of shade after soaping—expressed as percentage of original intensity.	Intensity of shade after alkali test—expressed as percentage of original intensity.	Intensity of shade after acid test—expressed as percentage of original intensity.
			Per cent.	Per cent.	Per cent.
Benzene-azo-phenol	$C_6H_5N=N(1).C_6H_4(OH)(4)$	V.	<25	much<25	60
Ditto chrome mordant	$C_6H_5N=N(1).C_6H_4(OH)(4)$	V.	<25	<25	60
Benzene-azo-resorcinol	$C_6H_5N=N(1).C_6H_3{<}\begin{smallmatrix}OH(2)\\OH(4)\end{smallmatrix}$	V.	33	25	unchanged
Ditto chrome mordant	$C_6H_5N=N(1).C_6H_3{<}\begin{smallmatrix}OH(2)\\OH(4)\end{smallmatrix}$	IV.	30	<50	unchanged
Azo-phenol	$(4)(OH).C_6H_4(1)N=N(1).C_6H_4(OH)(4)$	IV.	75	almost bleached	75
Sulphobenzene-azo-phenol	$(4).SO_3H.C_6H_4(1)N=N(1)C_6H_4(OH)(4)$	V.	0	practically 0	75
Ditto chrome mordant	$(4).SO_3H.C_6H_4(1)N=N(1)C_6H_4(OH)(4)$	V.	0	,, 0	85
Benzene-azo-phenol-*o*-sulphonic acid	$C_6H_5.N=N.(1).C_6H_3{<}\begin{smallmatrix}SO_3H(3)\\OH\ \ (4)\end{smallmatrix}$	V.	0	,, 0	85
Benzene-azo-phenoldisulphonic acid	$(4).SO_3H.C_6H_4(1)N=N(1).C_6H_3{<}\begin{smallmatrix}SO_3H(3)\\OH\ \ (4)\end{smallmatrix}$	V.	<25	—	—
Benzene-azo-phenoltrisulphonic acid	$(4).SO_3H.C_6H_4(1)N=N(1).C_6H_2{<}\begin{smallmatrix}SO_3H(3)\\OH\ \ (4)\\SO_3H(5)\end{smallmatrix}$	V.	<25	practically 0	85
m-carboxybenzene-azo-phenol.......	$(3).COOH.C_6H_4(1)N=N(1).C_6H_4(OH)(4)$	III.—IV.	much<25	much<25	85
Ditto chrome mordant	$(3).COOH.C_6H_4(1)N=N(1).C_6H_4(OH)(4)$	—	33	>50	—
Benzene-azo-salicylic acid	$C_6H_5.N=N(1).C_6H_3{<}\begin{smallmatrix}COOH\ (3)\\OH\ \ \ \ (4)\end{smallmatrix}$	IV.—V.	0	<25	unchanged
Ditto chrome mordant	$C_6H_5.N=N(1).C_6H_3{<}\begin{smallmatrix}COOH(3)\\OH\ \ \ (4)\end{smallmatrix}$	V.	75	100	unchanged
Brombenzene-azo-phenol	$(4).Br.C_6H_4(1)N=N.(1).C_6H_4(OH)(4)$	V.	<50	50	unchanged
Benzene-azo-dibromphenol	$C_6H_5.N=N(1)C_6H_2{<}\begin{smallmatrix}Br(3)\\OH(4)\\Br(5)\end{smallmatrix}$	V.	>50	100	unchanged
Nitrobenzene-azo-phenol	$(4).NO_2.C_6H_4(1)N=N.(1).C_6H_4(OH)(4)$	IV.	25	much<25	50
Benzene-azo-nitrophenol	$C_6H_5N=N(1).C_6H_3{<}\begin{smallmatrix}NO_2(3)\\OH\ (4)\end{smallmatrix}$	V.	25	25	75
Ditto chrome mordant	$C_6H_5N=N(1).C_6H_3{<}\begin{smallmatrix}NO_2(3)\\OH\ (4)\end{smallmatrix}$	V.	<25	25	60
Sulphobenzene-azo-nitrophenol......	$(4).SO_3H.C_6H_4(1)N=N(1)C_6H_3{<}\begin{smallmatrix}NO_2(3)\\OH\ (4)\end{smallmatrix}$	V.	25	practically 0	90
p-Amino-azo-benzene	$C_6H_5.N=N.(1).C_6H_4.NH_2(4)$	IV.	>50	much>50	50
m-Amino-azo-benzene	$C_6H_5.N=N.(1).C_6H_4.NH_2.(3)$	III.—IV.	>50	50	—
o-Amino-azo-toluene...............	$(4).CH_3.C_6H_4(1)N=N(1).C_6H_3{<}\begin{smallmatrix}NH_2(2)\\CH_3(5)\end{smallmatrix}$	I.	50	>50	90
Chrysoidine	$C_6H_5.N=N(1).C_6H_3{<}\begin{smallmatrix}NH_2(2)\\NH_2(4)\end{smallmatrix}$	I.	<25	much<25	25
Azo-aniline	$(4).NH_2.C_6H_4(1)N=N(1).C_6H_4.NH_2(4)$	I.—II.	25	25	85
Sulphobenzene-azo-aniline..........	$(4).SO_3H.C_6H_4(1)N=N(1).C_6H_4.NH_2(4)$	V.	25	25	unchanged
Helianthine	$(4).SO_3H.C_6H_4(1)N=N(1).C_6H_4N(CH_3)_2(4)$	III.	<25	practically 0	85
Benzene-azo-dibromaniline	$C_6H_5N=N(1)C_6H_2{<}\begin{smallmatrix}Br\ \ (3)\\NH_2(4)\\Br\ \ (5)\end{smallmatrix}$	IV.	50	>50	unchanged
Ditto sulphonic acid	——	IV.	<25	25	unchanged
Nitrobenzene-azo-aniline	$(3).NO_2.C_6H_4(1)N=N(1)C_6H_4.NH_2(4)$	III.	>50	much>50	85
Orange II.	——	III.	<25	<25	80
Metanil Yellow	——	III.	25	25	75
Naphthol Yellow S	——	I.—II.	<25	practically 0	unchanged

A sulphonic acid derivative of benzene-azo-dibromaniline.

$$SO_3H.C_6H_4N=N.C_6H_2Br_2NH_2 \text{ or}$$
$$C_6H_5N=N.C_6H.Br_2NH_2.SO_3H.$$

Benzene-azo-dibromaniline was dissolved in five times its weight of fuming sulphuric acid and heated on the water-bath for four hours. On cooling and standing fine crystals appeared. These were filtered off and washed with a little water, and were seen to be of a deep red colour. On treatment with potash the deep-red crystals were converted into an orange-yellow potassium salt, which was soluble in water, but not very soluble in potash solution. The potassium salt was filtered off, pressed on a porous plate, dried, and analysed. 0·1400 of the substance gave 0·0290K_2SO_4; K=9·2 per cent. The mono-sulphonate, $SO_3K.C_6H_4N{=}N.C_6H_2Br_2NH_2$ requires K=8·0 per cent. The disulphonate $(SO_3K)_2C_6H_3N{=}N.C_6H_2Br_2NH_2$ requires K=12·8 per cent. The substance analysed was therefore the potassium salt of the mono-sulphonate, not quite free from potash or potassium sulphate.

DISCUSSION.

Mr. F. W. Branson asked how the fastness had been standardised. He also pointed out how fugitive some of the aniline colours were. He had found a red dye on cloth fade completely after ten days' exposure to ordinary light.

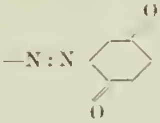
Mr. T. Fairley asked it any attempt had been made to find which rays of the spectrum were most active in causing fading. He supposed the fading was really due to bleaching.

Dr. L. L. Lloyd asked if it had been tried how the fastness was affected by phenylating amino-groups. Had the effect of introducing bromine in different positions in the auxochrome-containing part of the molecule been tried? Thus bromine in the *ortho*-position might, by steric hindrance, minimise the fading. What would be the effect of methylating the hydroxyl group? Had any after-treatment, say with copper or other metallic salts, been tried?

Mr. F. W. Richardson suggested that alkali or soap solution would have more action where a carboxyl group had been introduced into the molecule. Would the effect of introducing the heavier iodine atom instead of the bromine atom be a greater decrease in fastness of the dye? Was there any law connecting the atomic weight of the halogen atom introduced with the decrease in fastness produced?

Dr. H. Ingle asked if *ortho* and *para*-derivatives showed the same fasthess. He should expect them not to be so fast, but *meta* to be rather the faster. How would the introduction of a nitro group to form para-nitraniline red affect the fastness? He had found it a fairly fast colour if used mixed with barytes as a pigment.

Mr. E. R. Watson, in reply, said that the fastness had been determined by exposing the dyed fabrics fastened to a glass plate along with British Association Committee's standards. He had used ordinary daylight and had not investigated the effect of the different rays. Other investigators had found that the colour of the dye determined which rays of the spectrum would have the greatest effect in causing fading. The rays complementary to the colour of the dyeing were absorbed, and had the greatest effect in breaking up the dye-molecule. Helianthine was included in the series examined, and showed that methylating an amino-group had a bad effect on the fastness of the dye to light. It was known that phenylating an amino-group had also a bad effect. If the hydroxyl group, say in benzene-azo-phenol, was methylated, the dyeing properties of the molecule were destroyed. The effect of varying the position of bromine atoms in the auxochrome-containing part of the molecule had not been tried. After-treatment with copper had not been tried. Generally soap or alkalis more easily washed out the dye if it contained acid groups, though this was not invariably the case. Thus, benzene-azo-salicylic acid was an exception because the hydroxyl group directly adjacent to the carboxyl group enabled it to be mordanted. Fastness to washing, alkali, and acids depended on physical as well as chemical properties. A comparison of the effect of different halogens when introduced into the dye-molecule had not been made. With regard to Dr. Ingle's enquiry as to the effect of altering the orientation, the justa-position of hydroxyl and carboxyl groups had been shown by Kostanecki to be specially valuable as allowing the production of fast mordant dyeings. The present investigation had shown that *m*-amino-azo-benzene was not so fast to light as *p*-amino-azo-benzene, and this was contrary to expectation, for if fading in light was due to oxidation to form a quinone, one would expect the *para*-compound to fade the more readily. Professor Green had suggested, however, that the oxidation might not involve the azo-linking, but on that the first stage might be the production of quinonoid compounds of the type



and this would explain the *m*-compound not being so fast as the *para*. Para-nitraniline Red was an anomalous substance, and its fastness on cotton depended largely on its being produced on the fibre. Para-nitraniline Red developed on wool was quite different.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Patents.

Indicating an increase in temperature of a body by change of colour. E. Hughes, Cardiff. Eng. Pat. 960, July 8, 1910.

Nine parts of a mixture consisting of seven parts of a saturated solution of potassium iodide with 134 parts of a saturated solution of mercuric chloride are mixed with one part of powdered crystals of dry copper sulphate and the resulting mixture is made into a paint with linseed oil, "turps" and driers. Any surface or object that is likely to become heated is painted with this compound and a change of colour takes place at temperatures between 115° and 130° F. By slightly altering the proportions of the ingredients of the mixture, the range of temperature during which the change of colour takes place may be varied.—W. H. C.

Furnaces. Henning, Flodin and Co., Stockholm, Sweden Eng. Pat. 5264, March 2, 1910. Under Int. Conv. Oct. 21, 1909.

The furnace has the form of an inverted truncated cone. The gaseous or powdered fuel is introduced into an annular chamber surrounding the upper part of the furnace, is burnt, and the flames and hot gases pass into the furnace chamber proper through tangential ports. The molten material is tapped off from the bottom of the furnace chamber and the residual gases are discharged through a tangential flue at a slightly higher level.—W. H. C.

Treating liquids with gases; Apparatus for ——. G. K. Davis, Manchester. Eng. Pat. 5952, March 9, 1910. Addition to Eng. Pat. 2113 of 1909 (this J., 1910, 79).

The apparatus described in the original patent is modified to allow of its application to treating liquids with gases by arranging the liquid outlet from chamber to chamber below the surface of the liquid and by surrounding this outlet by a weir over which the liquid has to flow.—W. H. C.

Distilling, concentrating, evaporating and condensing liquids; Apparatus for ——. A. E. Bredin-Crawford, Brighton. Eng. Pat. 11,730, May 11, 1910.

Air or gas is forced by a blower or pump through a coil placed in the heated liquid in the still and provided with an upstanding portion which projects into the condensing chamber above. The air or gas is heated and sterilised by the hot liquid and enters the condenser in a suitable condition to be absorbed by the liquid which condenses there.—W. H. C.

Separation of liquids from gases or vapours; Apparatus for the ——. O. Bühring and O. Wagner, Mannheim, Germany. Eng. Pat. 12,542, May 23, 1910.

The mixture is caused to pass through a chamber which is packed with baffles of channel section having perforated sides. The baffles are of such a shape that they automatically keep each other in position without the aid of distance-pieces. The liquid which separates from the gas as it passes through the perforations flows down the channels to the outlet.—W. H. C.

Steam, gas or the like; Separating impurities from ——. J. Muchka, Vienna. Eng. Pat. 13,297, June 1, 1910.

The edges of the intercepting or depositing surfaces, which are turned away from the direction in which the gas or steam is flowing, have rounded projections formed on them to facilitate the discharge of the collected liquid in drops. The projections are formed by bending over the edges or by sliding a split tube on to the edges. Groups of curved guide plates, also provided with rounded edges, are placed before, between and after the intercepting plates to guide the gas at its entrance towards the periphery of the casing and towards the centre at the outlet.—W. H. C.

Pulverisers. R. Luckenbach, Colwyn, Pa., U.S.A. Eng. Pat. 20,664, Sept. 5, 1910.

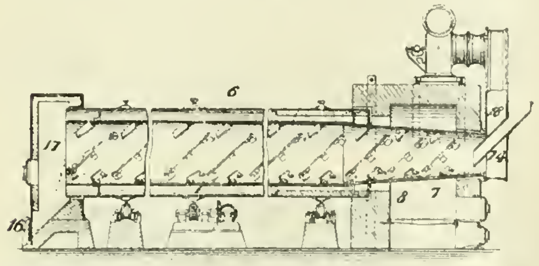
Two pairs of rotatable discs, each pair connected by arms or beaters, are mounted co-axially on a horizontal shaft in a casing, one pair being smaller than and disposed between the outer pair. By means of suitable gearing the two pairs of discs are caused to rotate in opposite directions and at different speeds. The material to be pulverised is fed through a hopper into the casing and is pulverised by the beaters. The pulverised material is discharged through perforated plates or screens.—W. H. C.

Settling, filtering and collecting solids from liquids; Tank for ——. J. E. Rothwell, Assignor to Colorado Iron Works Co., Denver, Colo. U.S. Pat. 976,923, Nov. 29, 1910.

The mixture of solids and liquid to be separated overflows from a feed chamber into the main settling tank, which is provided with inclined baffle-plates to promote settling and with a scraper conveyor to move the separated solids along the bottom of the tank to the solids outlet. —W. H. C.

Drying apparatus. S. Wiebe, Brooklyn, N.Y., Assignor to Wiebe Engineering Co., New York. U.S. Pat. 977,244, Nov. 29, 1910.

The material to be dried is fed through the shoot, 14, into the open end of the inner shell, 7, provided with baffle-plates. The inner shell, 7, is fixed to the outer shell, 6, and both are rotated together. The fire-gases from the furnace, 8, impinge first upon the outside of the projecting part of the inner shell, 7, and then pass through the annular space between the two shells into the chamber, 17. They then return through the inner shell, 7, to the flue, 18. The dried material falls from the lower end of the inner shell into the chamber, 17, and is discharged through the door, 16.—W. H. C.



Roasting, calcination or reduction and agglomeration and other operations permitting of an endothermic or exothermic reaction; Process for the treatment of finely divided and other materials by ——. F. W. Yost. First and Second Additions, dated June 28 and July 2, 1910 (Under Int. Conv., Sept. 4, 1909) to Fr. Pat. 417,037 of 1910 (this J., 1910, 1393).

The first addition claims the production of an agglomerative action through the mass in one direction simultaneously with an oxidising or other reaction which is propagated through the mass in the opposite direction. The second addition claims the production of the agglomerative action in one direction in one part of the furnace, and in the opposite direction in another part.—W. H. C.

Filter and process for preparing filtering layers. Kreuznacher-Maschinenfabrik Filter und Asbestwerke T. Seitz. Fr. Pat. 417,944, June 3, 1910.

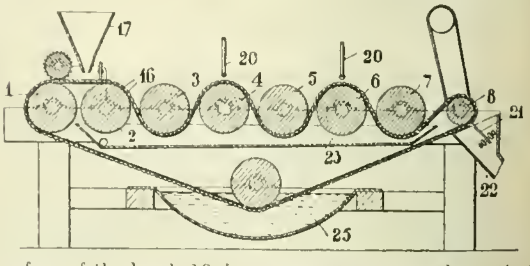
The filter is formed of superposed layers of compacted fibrous material, each layer being more impervious than the one below. Supporting fabric may be inserted between each layer if desired. The layers of filtering material are formed by mixing the fibrous material with a liquid and pouring the mixture on to a supporting fabric placed over the open mouth of a vessel; suction is then applied to the vessel and the mixture is also agitated so that the layer of compacted material formed is of even texture throughout. Layers of different degrees of permeability are formed, either by using fibrous materials of different degrees of permeability for the formation of each layer, or by using the same material but increasing the suction applied to each successive layer.—W. H. C.

Filtering apparatus. Just Process Co. Fr. Pat. 418,045, July 8, 1910. Under Int. Conv., May 13, 1910.

The filter consists of a wheel or drum having as the filtering surface either the lateral or the peripheral surface. The filtering surface is covered with a mineral filtering medium held in position by suitable frames. The wheel or drum is rotated, partially immersed, in a tank or vessel containing the liquid to be filtered, and the interior of the drum is provided with an axial discharge pipe and with a connection to a vacuum pump. The solid material collected on the surface of the drum is discharged by rakes or scrapers from that portion of the drum which is not immersed in the tank. The discharged solid matter is dropped into a mixing tank, mixed with water and again filtered in a similar apparatus. This process is repeated as often as is necessary to extract the soluble matter. —W. H. C.

Extracting liquids from solid materials; Continuous apparatus for ——. J. J. Berrigan. Fr. Pat. 418,156, July 12, 1910. Under Int. Conv., Aug. 27, 1909.

The material is fed from the hopper, 17, on to the upper surface of the endless band, 16, which passes as shown alternately over and under the rollers, 1—8. The upper surface of the band, 16, is corrugated transversely so that as the band passes alternately over and under the rollers,



the material is compressed alternately laterally and vertically. The expressed liquid falls into the trough, 23, from which it is discharged. Washing liquids may be supplied through the pipes, 20, and the residual solid matter is withdrawn by the scraper, 21, and discharged through the shoot, 22. The band is then passed through the liquid in the tank, 25, to wash off any adhering matter, and it is then ready to receive a fresh supply of the material to be treated.—W. H. C.

Crystals; Apparatus for obtaining large, well-formed —— from cold or hot saturated solutions. M. Melcher. Ger. Pat. 228,695, July 5, 1908.

A perforated drum of circular or polygonal cross-section is caused to rotate slowly, either continuously or intermittingly in the crystallisation vessel filled with the saturated solution. The drum is provided with one or more longitudinal partitions, and acts as support for the small crystals used as nuclei. The crystallisation vessel may be jacketed so that the solution can be kept at a temperature near its supersaturation point. It is stated that well formed crystals are obtained by means of this apparatus, any impurities or slime which separate from the solution, passing through the perforations of the drum and thus not interfering with the growth of the crystals.—A. S.

Measuring gases and vapours under pressure; Apparatus for ——. Chem. Fabr. Rhenania. Fr. Pat. 417,296, June 20, 1910. Under Int. Conv., Jan. 25, 1910.

See Eng. Pat. 19,169 of 1909; this J., 1910, 1144.—W.H.C.

Separation of mixtures of gases; Process and apparatus for the ——. A. Sinding-Larsen and O. J. Storm. Fr. Pat. 417,712, April 5, 1910.

See Eng. Pat. 8211 of 1910; this J., 1910, 1092.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Cyanogen from coal gas; Extracting ——. M. E. Mueller. J. Gas Lighting, 1910, 112, 851—855.

The author refers to the literature relating to the distribution of the nitrogen contained in coal among the products of carbonisation and concludes that the principal mode of formation of cyanogen during the carbonisation of coal is expressed by the equation:—$C + NH_3 = HCN + H_2$, the optimum temperature for this reaction being according to Bergmann 1100° C. At Astoria, U.S.A., it was found that the yield of ammonia and cyanogen varied simultaneously, a high or a low yield of both products being obtained at the same time, and it is concluded that much more ammonia is formed than is recovered and that a large proportion is decomposed in the retorts. It is advisable to remove the cyanogen from coal-gas, first because it is an objectionable impurity as it combines with a part of the oxide in the purifiers, thus rendering the life of the oxide shorter; and also it attacks the iron of the plant and the mains forming Prussian blue. Cyanogen is removed from gas either in the dry way in the oxide purifiers or in the wet way by washing the gas. The wet processes divide themselves into two groups, in one the cyanogen is removed as thiocyanate (sulphocyanide), the gas being washed with a solution of ammonium polysulphide made by dissolving sulphur in gas-liquor. The reaction given is as follows:—

$$(NH_4)_2S_2 + 2HCN = 2NH_4CNS + H_2S.$$

In the other wet processes the cyanogen is removed by washing the gas with an alkali containing an iron compound in suspension. In some cases the cyanogen is removed after the ammonia by washing with a solution of hydroxide or carbonate of sodium or potassium or milk of lime containing oxide, hydroxide or carbonate of iron in suspension. In the "Rohland" and the "Bueb" processes, the latter being the one adopted at Astoria, the alkali used is ammonia and is supplied from the gas itself. At Astoria the coal contains 1·35 per cent. of nitrogen and 3·1 per cent. of the total appears in the gas as cyanogen; of this quantity 85 per cent. is recovered, this being the average figure obtained after three months' working. For each ton of coal carbonised, 5·66 lb. of copperas are used and about 1·48 lb. of cyanogen are recovered; 4·8 lb. of ammonium sulphate are absorbed in the process, two-thirds of this reappearing later as a solution of ammonium sulphate and one-third as insoluble compounds, in the press cake. The gas after passing through the naphthalene washers is passed through a rotary scrubber-washer divided into several compartments through which a solution of ferrous sulphate is caused to flow in the contrary direction. In the first compartment the ferrous sulphate is converted into sulphide and the mixture of ferrous sulphide and ammonium sulphate solution overflows through the other compartments where it meets with gas containing cyanogen. The cyanogen exists in the gas as hydrogen cyanide and this is absorbed as indicated by the equation:—

$$2FeS + 2NH_3 + 6HCN = (NH_4)_2FeFe(CN)_6 + 2H_2S.$$

If, however, the mud is allowed to remain too long in the washer a further reaction takes place resulting in the formation of soluble ammonium ferrocyanide:—

$$(NH_4)_2FeFe(CN)_6 + 2NH_3 + H_2S = (NH_4)_4Fe(CN)_6 + FeS.$$

Only a slight quantity of this should occur in solution in the mud from the washer. The mud is placed in a tank, agitated, and rendered slightly acid with sulphuric acid; this causes the evolution of hydrogen sulphide and the precipitation of the whole of the cyanogen as ammonium ferrous ferrocyanide. The solution of ammonium sulphate is filtered off and evaporated to recover the salt and the press cake, which is at first of a light yellow colour but which soon turns blue on exposure owing to oxidation, is sold to prussiate manufacturers. The latter convert it into alkali ferrocyanides by boiling it with potassium or sodium hydroxide. The cake has the following approximate composition: water, 50 per cent.; cyanogen, 20—24; ammonia 5—6 per cent. To estimate the amount of cyanogen in the gas a measured quantity is bubbled through a solution of potassium hydroxide containing recently precipitated ferrous hydroxide in suspension. The clear liquid is filtered off and titrated with a solution of zinc sulphate, the end of the reaction being indicated by the clear liquid no longer giving a blue colour with dilute ferric chloride. The cyanogen in the press cake is estimated by boiling a weighed quantity with caustic potash and titrating the clear solution with zinc sulphate solution as described.—W. H. C.

Paraffin; Manufacturing processes serving for the obtaining of —— with the application of artificial cooling. J. Weiser-Mata. Internat. Low Temperature Congress, Vienna, 1910. Z. angew. Chem., 1910, 23, 2270.

The author has invented a method, called the pressure-sweating ["Press-schwitz"] method, for separating oil from the "gatsch" or residual mixture of paraffin and oil obtained by subjecting the paraffin fraction (from the crude oil distillation) to a low temperature and passing it through a filter-press. The "gatsch" is converted (for instance, by vigorous stirring) into a pulp, and this is pumped into perforated pipes lined with filtering material, which are attached to a high-pressure service (about 12 atmos.) in a chamber heated to about 60° C. The oil is thus separated and is returned to the refrigerator, or is mixed with the "gatsch," if rich in paraffin, and the pressed residue is melted out by means of steam and refined. The process is claimed to be very economical.—F. Sodn.

Petroleum production of the United States in 1909. U.S. Geol. Survey. [T.R.]

The total quantity of petroleum produced in the United States during 1909 was 182,134,274 barrels, valued at $128,248,783, compared with $178,527,355 barrels, valued at $129,079,184, in 1908. California took first place with 54,433,010 barrels, and Oklahoma and Illinois second and third, with 47,859,218 and 30,898,339 barrels, respectively.

Of the total produced, 19,939,394 barrels were consumed by railroads in the United States as compared with 16,889,070 barrels in 1908 and 18,855,002 barrels in 1907. The production in barrels by fields, in 1908 and 1909, is shown by the following figures :—

Field.	1908.	1909.
Appalachian	24,945,517	26,535,844
Lima-Indiana	10,032,305	8,211,443
Illinois	33,686,238	30,898,339
Mid-Continent.................	48,323,810	49,804,922
Gulf	16,272,074	11,912,058
California	44,854,737	54,433,010
Other	412,674	338,658
Totals	178,527,355	182,134,274

Standard specification for the manufacture and testing of retort material. *See* VIII.

Measurement of viscosity of lubricants and other liquids. Scarpa. *See* XXIII.

Patents.

Briquettes from coal; Production of smokeless ——. R. W. Pringle, Richmond, and L .S. Richards, London. Eng. Pat. 27,829, Nov. 29, 1909.

The coal, after preliminary carbonisation at a low temperature, is incorporated with a binding material, such as pitch or tar, and moulded. The briquettes are then heated sufficiently to expel the smoke-producing constituents of the binding material without exceeding the temperature employed in the initial carbonisation. —W. E. F. P.

Peat; Treatment [drying] of ——. E. Zohrab, Scotscalder, Scotland, and J. Dunham-Massey, London. Eng. Pat. 21,816 of 1910; date of Appl., Aug. 23, 1909.

The apparatus consists of a chamber of polygonal cross-section, adapted to rotate intermittently about a horizontal axis, and containing a number of steam-jacketed compartments (one for each side of the polygon) into which the moulded wet peat is fed and subjected to the action of hot, dry air. Each compartment is provided with a conveyor-band ; and the intermittent angular movements of the chamber, by which each segment is successively brought into position for discharging and recharging, also serve to bring fresh surfaces of the damp peat into contact with the hot walls and to expose other surfaces to the hot air current.—W. E. F. P.

Coke-ovens; Horizontal, regenerative ——. M. G. Christie, Crigglestone, Yorks. Eng. Pat. 6487, Mar. 15, 1910.

The reversal of gas and air occurs only in two of the vertical flues (or groups of flues) of the heating wall, these being situated one at each end of the latter. The remaining vertical flues are thus continuously heated by flame, and the employment of one flue for alternately conducting the waste heat to, and conveying the hot air from, the regenerator is obviated.—W. E. F. P.

Coke-oven installations; Regenerative ——. The Otto Hilgenstock Coke-oven Co., Ltd., Wakefield, Yorks. From Dr. C. Otto und Co., Ges. m. b. H., Dahlhausen, Germany. Eng. Pat. 17,547, July 23, 1910.

In coke-oven installations of the kind requiring two gas-supply pipes for each heating wall, such supply-pipes for two adjacent walls are controlled by means of a four-way cock. To reduce the power necessary for the simultaneous reversal of all the four-way cocks of the battery of ovens, the throw of each cock is limited to an angle of 45°.—W. E. F. P.

Coke-oven; Regenerative ——. E. Wagener, Dahlhausen-on-the-Ruhr, Germany. U.S. Pat. 977,348, Nov. 29, 1910.

In the apparatus described, sole channels are provided beneath the retorts, and vertical heating-flues (arranged in groups in which adjacent flues are connected at top and bottom alternately) are situated at the side of each retort, the end flues of each group being connected at their lower ends, so that a continuously open channel is formed between a pair of sole channels by each flue group. The regenerative connections are such that the flow of air through the sole channels, etc., may be reversed ; while continuously operating gas burners open into the passages formed by each group of flues, air-supply channels to these passages being provided in the oven structure.—W. E. F. P.

Gas; Manufacture of illuminating and heating ——. W. A. Burton, New Cleethorpes. Eng. Pat. 27,517, Nov. 26, 1909.

Powdered coal is introduced, continuously or intermittently, by means of a blast of water-gas or any hydrocarbon gas under pressure, into an ordinary coal-gas retort in the absence of steam or air.—A. T. L.

Gas-producer. W. B. Hughes, Cleveland, Ohio. U.S. Pat. 977,651, Dec. 6, 1910.

The rotatable combustion-chamber of the producer, to which the blast-box is attached, is provided with an ash-hopper and an ash-table at its lower end. Hollow horizontal arms, through which the blast passes, and from which the nearly vertical tuyères depend, are situated at the upper end of the chamber ; while an adjustable bar, disposed between the ash-hopper and the table, serves for breaking up and removing the ashes.—W. E. F. P.

[Producer-] gas; Manufacture of ——. W. B. Hughes, Cleveland, Ohio. U.S. Pat. 977,874, Dec. 6, 1910.

A producer is operated in alternate connection with two independent chambers, each having a valved chimney ; baffles are situated between the inlet and outlet of each chamber, the gas passing through a heater on its way to the chimney.—W. E. F. P.

Gas producers. V. Douge. Fr. Pat. 417,316, June 21, 1910.

Superheated steam is introduced into the upper layer of the incandescent charge through a vertical tuyère connected at the top with a boiler formed with two annular compartments, the outer one containing the water and the inner one serving to superheat the steam. The level of the water in the boiler is regulated by a float.—H. H.

Gas producers. L. Boutillier et Cie. Fr. Pat. 417,962, Sept. 15, 1909.

The greater portion of the air is admitted in a dry and heated condition at the foot of the producer, while the steam mixed with a smaller quantity of air is admitted through an annular opening a short distance above. The steam is produced in a vapouriser fitted around the middle portion of the producer, and is carried into the producer through a regulating valve by a small current of air induced by the suction within the producer. The hearth consists of a water-cooled plate, and the cinders are ejected through a pipe dipping into water below the producer. In consequence of the dry and heated condition of the air introduced into the bottom of the producer, the temperature at this point is higher than elsewhere, and the descent of the cinders is thereby facilitated. A small quantity of steam may be introduced into the lower air supply if necessary.—H. H.

Gases; Apparatus for the cooling and washing of coal and other ——. E. Whittaker, Manchester. Eng. Pat. 27,158, Nov. 23, 1909.

The apparatus comprises a vertical cylindrical casing with a series of downwardly inclined conical rings or baffle-plates secured to the inner wall, and a series of discs secured to a central shaft and arranged alternately with the baffles. Water is admitted at the top of the washer through jets so placed as to cause rotation of the shaft. The gas enters at the bottom of the washer and takes a circuitous path between the rotating discs and the conical baffles.—A. T. L.

By-products from gas manufacture and purification of gas. K. Burkheiser. First Addition, dated July 1, 1910 (Under Int. Conv., July 1, 1909) and Second Addition, dated July 2, 1910 (Under Int. Conv., July 22, 1909), to Fr. Pat. 394,926, Oct. 5, 1908 (this J., 1909, 359).

(1). The gas, after it has been freed from tar, is passed into an absorber containing acid liquors prepared by absorption of sulphur dioxide which is produced as described in the chief patent by the oxidation of the hydrogen sulphide in the retort furnace. As soon as the liquid in the absorber has become alkaline, it is caused to trickle downwards through a tower into which the combustion gases containing sulphur dioxide are led, so that the liquid again becomes acidified. By passing the liquid backwards and forwards from the absorbers to the tower the process is made continuous and the whole of the ammonia fixed. (2). Behind the purifiers containing an oxygen carrier (such as ferric oxide) for the oxidation of the hydrogen sulphide contained in the gas, is arranged a chamber for the production of sulphur trioxide by the contact process, the sulphuric acid prepared by the absorption of the sulphur trioxide being used to fix the ammonia in the absorbers.—H. H.

Carbon-black; Process for production of ——, together with combustible gas. W. H. Frost and J. J. Nix, Los Angeles, Cal. U.S. Pat. 977,000, Nov. 29, 1910.

A combustion chamber, maintained under a reduced pressure and having a restricted air-supply, is continuously fed with petroleum; the latter is atomised under its own expansive pressure, and the conditions are such as to effect the decomposition of the unconsumed petroleum into combustible gas and free carbon. Means are provided for the continuous withdrawal of the products so as to maintain the reduced pressure of the chamber, the free carbon being separated upon cooling surfaces and by the action of water.—W. E. F. P.

Calorific value of gases; Means for indicating and recording the ——. F. Sawford, Sydney, Nova Scotia. U.S. Pat. 977,970, Dec. 6, 1910.

In the combustion-chamber of the calorimeter, the thermometer bulb is in position to be enveloped by the flame from the burner, but is surrounded by a shield and flame distributor from which it is separated by an air insulating space. The thermometer is in direct communication with the recording apparatus. W. E. F. P.

Coke oven. F. W. C. Schniewind. Fr. Pat. 417,434, June 24, 1910.

See Eng. Pat. 10,484 of 1909; this J., 1910, 870.—T. F. B.

Coke; Manufacture and purification of —— and apparatus therefor. W. S. Simpson. Fr. Pat. 417,444, June 24, 1910. Under Int. Conv., Sept. 3, 1909.

See Eng. Pat. 20,237 of 1909; this J., 1910, 1193.—T.F.B.

Peat-gas-producing process. J. D. Oligny, Assignor to Peat Gas and Coal Co., Montreal. U.S. Pat. 977,469, Dec. 6, 1910.

See Fr. Pat. 409,263 of 1909; this J., 1910, 746.—T. F. B.

Gas-purifying apparatus. E. Temple, Sydney, N.S.W. U.S. Pat. 977,907, Dec. 6, 1910.

See Eng. Pat. 25,736 of 1908; this J., 1909, 1188.—T.F.B.

Gas; Process and apparatus for cooling ——. A. Klönne. Fr. Pat. 417,759, June 7, 1910.

See Eng. Pat. 13,978 of 1910; this J., 1910, 1418.—T. F. B.

Cannel-coals and other similarly-constituted bituminous materials; Process for the recovery of the paraffin ingredients from —— without change in their chemical composition. H. Wurtz, Newark, N.J., Assignor to American Chemical Eduction Co. U.S. Pat. 977,992, Dec. 6, 1910.

See Eng. Pat. 11,925 of 1906; this J., 1907, 754.—T. F. B.

Dehydrating and evaporating liquids such as tar, petroleum, etc. Fr. Pat. 417,209. *See* III.

Increasing the melting point and resistance to heat of tarry and analogous products. Ger. Pat. 228,497. *See* III.

Obtaining the solid constituents of fats, oils, paraffin, etc. Ger. Pat. 226,137. *See* XII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Incandescence neon tubes. G. Claude. Comptes rend., 1910, **151**, 1122–1124.

The dielectric coefficient of neon is very small, and the gas incandesces brilliantly under the influence of an electric discharge. The incandescence is much decreased, however, by the presence of small quantities of certain other gases, *e.g.*, nitrogen. The author purifies the neon by a method which depends on the fact that the gas is absorbed less readily by charcoal at low temperatures than the other gases introduced with it into the tube, or liberated from the walls and electrodes of the tube. One or more vessels containing charcoal are sealed to the tube and immersed in liquid air. The neon only, or together with a small quantity of hydrogen, remains in the gaseous state, whilst the other gases, disengaged by the passage of the electric current through the tube, are absorbed by the charcoal. A very long treatment is often necessary before the fine orange incandescence of neon appears and persists, and the purifying vessels can be removed. When other sources of light are absent, the eye readily becomes accustomed to this light, and there seems to be no doubt that it will prove useful not only for decorative purposes, but for illuminating workshops, halls, etc. The author has investigated the efficiency of this method of lighting, using a tube with a length of 6 metres between the electrodes, and a diameter of 45 mm. With a difference of potential of 1000 volts between the ends of the tube (with nitrogen under the same conditions, the P.D. would be about 3000 volts) and a current-strength of 0·94 ampère, the power effectively consumed in the tube is 850 watts, and the light emitted by the tube is 1320 candle-power. Hence the consumption of power is 0·64 watt per candle-power. If the loss due to the transformer, and the loss in the regulating coil inserted in the primary circuit, are taken into account, 0·80 watt is consumed per candle-power. A greater efficiency would be obtained with longer tubes, since a considerable part of the power expended is lost at the electrodes. With optimum conditions in respect of pressure of the gas, diameter of the tube, and current-strength, etc., the efficiency should be still further increased.—L. E.

Wood alcohol production of the United States. U.S. Census Bureau Rept. Oil, Paint, and Drug Rep., Dec. 19, 1910. [T.R.]

There was consumed in the United States during the year 1909 in the wood distillation industry 1,265,000 cords of wood, as against 978,000 cords in 1908 and 1,282,000 cords in 1907. The average cost per cord reported for the 1909 consumption was $3·21, which was an increase of 23 cents over that reported for 1908, and of 6 cents over that for 1907. While a substantial increase is noted in that branch of the industry using yellow pine, fir, and other soft woods as material, the revival of activity was more marked in hardwood distillation, due undoubtedly to the material advance in the average value per gallon of wood alcohol over the two preceding years. While the average value per unit has varied little for most of the products of hardwood distillation during the past three or four years, for alcohol it has fluctuated over a wide range, following the passage of the so-called denatured alcohol law, which became effective January 1, 1907. The average value per gallon reported for crude alcohol manufactured during 1906 was 34 cents. In 1907 it dropped to an average of 15 cents, increased to 17 cents during 1908, and reached an average of 24 cents in 1909. The use of sawdust and other mill waste as material in 1909 was substantially greater than in any preceding year, and the indications are that the industry will develop largely in future in the direction of utilising this class of material.

A comparative summary of the operations in 1909 of the 116 hardwood distillation plants, using 1,150,000 cords of beech, birch, maple, etc., and the 31 softwood distillation plants, using 116,000 cords of long-leaf pine, etc., follows:—

Product.	Hardwood.		Softwood.	
	Amount.	Value.	Amount.	Value.
Charcoal, bshls.	53,075,000	$3,299,000	2,403,000	$210,000
Crude alcohol, galls.	8,468,000	2,082,000	—	—
Gray acetate, lb.	148,769,000	2,203,000	—	—
Brown acetate, lb.	2,157,000	22,000	—	—
Iron acetate, galls.	303,000	28,000	—	—
Oil, galls.	38,000	3,000	323,000	770,000
Tar, galls. ...	—	—	1,365,000	105,000
Turpentine, galls.	—	—	683,000	243,000
All other	—	5,000	—	59,000
Total value ..	—	$7,642,000	—	$687,000

PATENTS.

Vertical retorts for the distillation of coal and other substances; Settings of ——. Gibbons Bros., R. Masters and M. Van Marle, Dudley. Eng. Pat. 27,291, Nov. 23, 1909.

Two retorts are arranged side by side with a central up-take from the gas-producer between them. Secondary air is admitted at the point where the gases from the producer enter this up-take, and the burnt gases are admitted through a series of dampers in the side walls of the up-take into superposed heating chambers which surround the retorts. The dividing walls of these chambers are formed by rebated tiles built into the outer walls of the setting, and these tiles act as struts for the vertical walls of the retorts. The flow of heating gases is further controlled by dampers between the heating-flues and the waste gas flue.—A. T. L.

Coal and other carbonaceous material; Carbonisation of ——. R. W. Pringle, Richmond, Surrey, and L. S. Richards, London. Eng. Pat. 27,828, Nov. 29, 1909.

A container for the coal, adapted to be introduced into a retort, comprises an open rectangular iron vessel with one or more removable side pieces and with partitions or conducting plates arranged so as to form compartments of tapering section. By this arrangement, heat is conducted to all parts of the charge, and a free escape is provided for the products of distillation.—A. T. L.

Coal; Distillation of ——. M. Ruthenburg, London. Eng. Pat. 29,328, Dec. 15, 1909.

The partly or completely coked charge is subjected (in the retorts) to the action of an electric current, by which means—it is claimed—sulphur and other impurities are more completely eliminated than by ordinary methods. (Reference is directed to Eng. Pats. 1890 of 1869 and 3466 of 1875.)—W. E. F. P.

Ammonia from the hot gases, free from tar, derived from the distillation of pit-coal, lignite, and analogous kinds of coal; Process for the direct extraction of ——. C. Otto and Co., Ges. m. b. H. Fr. Pat. 418,018, July 7, 1910. Under Int. Conv., Oct. 25, 1909.

The gases are treated in an injector fed with acid, and the liquor from the injector is allowed to accumulate in a receiver, in such a way that the gases, after leaving the injector, have to pass again through the liquid, which is maintained at a constant level, the solution leaving the receiver being mixed with fresh acid and pumped back to the injector. In order to prevent the condensation of water vapour in the receiver, the hot crude gases, before removal of the tar (which may be effected in an injector fed with tar), are made to pass through a sleeve surrounding this vessel.—F. Sodn.

Distillation gases; Process for separating tar and obtaining by-products from ——. C. Otto und Co. Ger. Pat. 228,871, July 28, 1909. Addition to Ger. Pat. 211,577, Oct. 8, 1908 (see this J., 1909, 830).

The separation of water from the hot gases, and the consequent increase of the volume of liquor in the saturator, is avoided, if the first portion of the distillation gases containing much steam (*e.g.*, those produced during the first hour's carbonisation) is collected separately, and passed through the hot coke in a retort the contents of which are completely or nearly carbonised: the steam is thus decomposed, and the gases are then mixed with the main volume of distillation gases, whereby their temperature is increased and their steam-content decreased.—T. F. B.

Incandescence bodies; Self-lighting ——. A. Eisner. Fr. Pat. 417,934, May 7, 1910.

A composition formed from an intimate mixture of glycerin, oxides or salts of the rare earths, and compounds of the platinum group is used for the purpose of automatically lighting gas mantles, etc. It is stated that the material becomes incandescent when brought into contact with a mixture of gas and air even if the air is moist.—H. H.

Electric incandescence lamps; Method of producing a vacuum in ——. Lichtwerke Ges. m. b. H. Fr. Pat. 417,952, June 8, 1910. Under Int. Conv., June 9, 1909.

A small quantity of phosphorus is placed in the small tube attached to the lamp globe and the pressure is reduced to 0·5 mm. of mercury. The temperature is then raised to about 250° C. and a small quantity of hydrogen admitted, after which the lamp is again exhausted. The filament is now raised to a dull red heat, and pure oxygen is admitted and exhausted three times in succession, after which the small tube is sealed below the point containing the phosphorus and the latter vapourised. The lamp is then sealed in the ordinary manner. Ammonia or a mixture of water vapour and carbon dioxide may be used instead of the hydrogen.—H. H.

Distilling coal and recovering the products; Apparatus for ——. R. S. Richards and R. W. Pringle. Fr. Pat. 417,553, June 27, 1910. Under Int. Conv., July 5, 1909.

See Eng. Pat. 15,643 of 1909: this J., 1910, 552.—T. F. B.

III.—TAR AND TAR PRODUCTS.

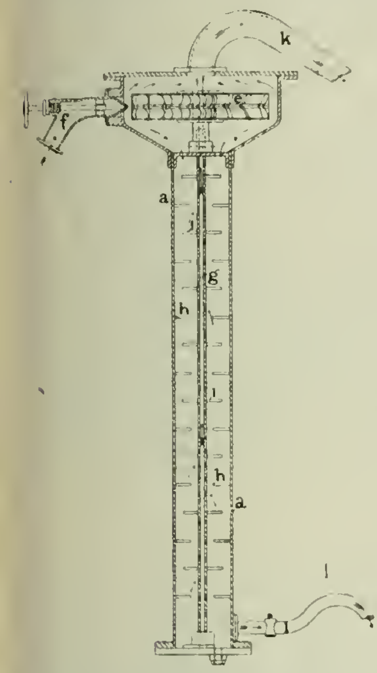
Halogens in benzene derivatives; Use of metallic potassium in determining ——. C. H. Maryott. Amer. J. Sci., 1910, **30**, 378—380.

Potassium is much more efficient than sodium in reducing haloid benzene derivatives. The substance is weighed into a conical flask, 10—15 c.c. of a mixture of 1 volume of absolute alcohol with 2 volumes of benzene free from thiophene are added, and a cork carrying a plain glass tube, 50 cm. long, to act as condenser fitted to the flask. The potassium, in quantity about ten times that needed for the reaction, is then gradually dropped in through the tube. When the action slackens, about 2 c.c. of alcohol are added, and the flask is warmed and shaken till all potassium is dissolved. The contents are then shaken with water, and the halogen in the aqueous layer determined as silver salt.—J. T. D.

PATENTS.

Dehydrating and evaporating liquids such as tar, petroleum, etc.; Process and apparatus for ——. C. H. Köhn and E. Münster. Fr. Pat. 417,209, June 16, 1910.

THE liquid is heatedl to a temperature above the boiling point of its more voatile constituents (in the case of coal tar, to about 110° C.) and projected against a turbine wheel or similar device to divide it into small drops, which are then subjected to a beating action to free them completely from their volatile portions. In the apparatus shown, the liquid is forced through *f* against the turbine wheel, c, and falls in the form of drops into the chamber, *a*; here it comes in contact with the blades, *i*, *i*, attached to the perforated tube, *g*, which is kept rotated by the turbine wheel, to which it is fixed. The liquid thus follows a zigzag course down the chamber, coming in contact also with the projections, *h*, *h*, on the sides of the chamber. The vapours generated in this chamber pass partly through the perforations in the tube, *g*, and partly through the orifices in the base of the upper chamber, and are led to the condenser through *k*. The dehydrated liquid runs off through *l*.—T. F. B.



Tarry and analogous products; Process for increasing the melting point and resistance to heat of ——. Akt.-Ges. f. Asphaltierung und Dachbedeckung vorm. J. Jeserich. Ger. Pat. 228,497, Nov. 25, 1909.

TARS, tarry or bituminous substances, etc., are rendered more resistant to heat, and of higher melting-point, by mixing them with an ester of an unsaturated fatty acid (linseed oil, rape oil, etc.) or other substance which will absorb chlorine, and then heating them with hexachloroethane. The following example is given:—About 20 parts of an ester of an unsaturated fatty acid are melted with 80 parts of bitumen, and hexachloro-ethane is added to the hot mass; chlorine is thus caused to combine with the unsaturated compound, whilst the carbon of the hexachloro-ethane remains mixed with the product. It is advisable to dehydrate the tarry substance before the treatment. In one case, a substance which originally melted at 60°—65° C., had a melting point of 170° C. after treatment with 5 per cent. of hexachloro-ethane as described above.—T. F. B.

Carboxylic acids of the anthraquinone series; Process for producing ——. F. Ullmann. Fr. Pat. 418,088, July 9, 1910. Under Int. Conv., July 19, 1909.

AMINO-ANTHRAQUINONES are diazotised, and the diazo compounds converted into the nitriles (*e.g.*, by means of copper-potassium cyanide), which are converted into the carboxylic acids by treatment with sulphuric acid or other suitable agent.—T. F. B.

Polynitrobenzoic acids; Process for preparing —— *from the corresponding nitrotoluenes.* G. Lüttgen. Ger. Pat. 226,225, July 27, 1909.

THE polynitrotoluenes can be oxidised to the corresponding nitrobenzoic acids by means of potassium chlorate in nitric acid solution; in this process the long heating at high temperatures, which is required when a mixture of nitric and sulphuric acids is used as oxidising agent, is unnecessary. Further, the absence of sulphuric acid renders the washing much more rapid, which is an advantage in view of the solubility of some of the products (*e.g.*, trinitrobenzoic acid).—T. F. B.

6-*Chloro-1-hydroxynaphthacenequinone and its -4-sulphonic acid; Process for preparing* ——. Anilinfarben- und Extract-fabr. vorm. J. R. Geigy. Ger. Pat. 226,230, July 7. 1909.

WHEN 4-chloro-1-hydroxynaphthoyl-*o*-benzoic acid or its -6-sulphonic acid is heated to 70°—100° C. with fuming sulphuric acid in presence of boric acid, 6-chloro-1-hydroxynaphthacenequinone (m. pt. 307° C.) or its -4-sulphonic acid is obtained. The products serve for the preparation of dyestuffs of the naphthacenequinone series.
—T. F. B.

Nitroso-arylhydroxylamines; Process for preparing alkali and ammonium salts of ——. O. Baudisch. Ger. Pat. 227,659, Dec. 25, 1908.

THE free nitroso-arylhydroxylamines are unstable, sometimes explosive compounds, but their salts are quite stable: these may be prepared by the action of alkyl nitrites on arylhydroxylamines in the nascent state. One method of carrying out the process is to reduce aromatic nitro-compounds by means of zinc dust, in alkaline or ammoniacal solution, in presence of alkyl esters of nitrous acid. Another method consists in treating aromatic amino-compounds with alkyl nitrites and sulphomonoperacid. in presence of alkali hydroxides or carbonates or ammonia. The salts are of value in the preparation of azo dyestuffs.—T. F. B.

Azoxy- and azo-benzene; Process for preparing ——. Chemikalienwerk Griesheim. Ger. Pat. 228,722, May 1, 1908. Addition to Ger. Pat. 225,245, April 24, 1908 (see this J., 1910, 1149).

NITROBENZENE is reduced to azoxybenzene and this in turn to azobenzene, by treatment with molasses and alkali, preferably in presence of an organic solvent. For example, 15 kilos. of nitrobenzene, 7·5 kilos. of molasses, 15 kilos. of caustic soda solution of 40° B., and 7·5 kilos. of solvent naphtha are heated in a closed vessel for 24 hours at 140°—150° C., and the mixture of azoxy- and azo-benzene (amounting to about 10 kilos.) is extracted from the melt by means of solvent naphtha, which is then removed from the solution by distillation with steam.—T. F. B.

Nitrothiophenols; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 228,868, Nov. 26, 1908.

THE dinitrophenyldisulphides, $NO_2.C_6H_4.S_2.C_6H_4.NO_2$, may be reduced to the corresponding nitrothiophenols by heating them in presence of alkali, with not more than one-half a molecular equivalent of an alkali hydrogen sulphide, or with the corresponding quantity of an alkali sulphide or disulphide.—T. F. B.

Halogen-anthraquinones; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 228,876, Feb. 4, 1910.

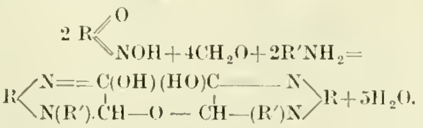
When the sulphonic acids of anthracene or its substitution products are treated with halogens or substances which liberate halogens, in presence of water, the sulphonic group is replaced by halogen, whilst the anthracene nucleus is oxidised to anthraquinone.—T. F. B.

Arylthioglycol-o-carboxylic acids and their esters; Process for preparing ——. R. Lesser. Ger. Pat. 229,067, July 20, 1906.

The arylthioglycol-*o*-carboxylic acids or their esters are obtained in good yield by the action of monohalogen-acetic acids or their esters on the corresponding xanthogenic esters of the type, $HOOC.Ar.S.CS.OC_2H_5$; the reaction may be carried out in aqueous alkaline solution, or the two substances may be heated together. The xanthogenic esters are obtained by the interaction of diazotised anthranilic acid (or a derivative) and potassium xanthogenate.—T. F. B.

Pyrazine derivatives; Process for preparing ——. M. Lange. Ger. Pat. 229,127, June 3, 1909.

When aromatic *o*-hydroxynitroso compounds are condensed with formaldehyde and aliphatic primary amines or other amino compounds which contain the amino group combined with an aliphatic radical (*e.g.*, amino-acetic acid), or with the condensation products of formaldehyde and such amines, pyrazine derivatives are obtained, in which two pyrazine nuclei appear to be united by means of an oxygen atom. Each mol. of the nitroso compound requires two mols. of formaldehyde and one of the amine for the reaction, which is represented as follows:—



$$2\,R\langle^{O}_{NOH}+4CH_2O+2R'NH_2=R\langle^{N=C(OH)(HO)C—N}_{N(R').CH—O—CH—(R')N}\rangle R+5H_2O.$$

—T. F. B.

Tar, pitch, mineral resins, and similar materials; Process for increasing the resistance of —— to heat. K. L. V. Zimmer. Eng. Pat. 9955, April 23, 1910.

See Ger. Pat. 228,497 of 1909; preceding.—T. F. B.

Tarry and similar substances; Process for reducing the fusibility of —— and increasing their resistance to heat. J. W. Löhmer. Fr. Pat. 417,749, June 4, 1910.

See Ger. Pat. 228,497 of 1909; preceding.—T. F. B.

Thio-derivatives of diarylamines; Manufacture of the so-called —— and of their derivatives. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 29,112, Dec. 13, 1909.

See Fr. Pat. 410,382 of 1909; this J., 1910, 808.—T. F. B.

Halogen-substituted anthraquinones; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4898, Feb. 26, 1910.

See Fr. Pat. 412,979 of 1910; this J., 1910, 1098.—T. F. B.

Anthraquinone series; New products of the ——, their production and industrial applications. F. Ullmann. Fr. Pat. 418,178, July 12, 1910. Under Int. Conv., July 19 and Dec. 13, 1909.

See Ger. Pats. 224,982 and 227,324 of 1909; this J., 1910, 1098 and 1368.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Azo-dyestuffs; Use of cold in the production of ——. D. Rittermann. Internat. Low Temperature Congress, Vienna, 1910. Z. angew. Chem., 1910, 23, 2269—2270.

Figures are given showing the annual consumption of ice at five of the largest German dyestuff factories. The Badische Anilin und Soda Fabrik, for instance, uses about 100 million kilos. of ice a year.—F. Sodn.

Patents.

Sulphonic acids and azo dyestuffs therefrom; Manufacture of new ——. R. B. Ransford, London. From L. Cassella und Co., Ges. m. b. H., Frankfort, Germany. Eng. Pat. 6153, March 11, 1910.

N-Formyl derivatives of arylaminonaphtholsulphonic acids are obtained by boiling the alkali salts of the latter with formic acid. The formyl derivative of phenyl-2 : 5-aminonaphthol-7-sulphonic acid is prepared by boiling 94·5 kilos. with 500 kilos. of 85 per cent. formic acid and 45 kilos. of sodium formate for about 2 hours. Part of the formic acid is then distilled off and the residue poured into concentrated salt solution. The formyl compound separates as a resin and turns soon to a whitish gray mass which may be filtered off. The formyl derivative of 2-phenylamino-8-naphthol-6-sulphonic acid is similarly prepared. Formylphenyl-2 : 8 : 6-aminonaphtholsulphonic acid gives with diazotised *α*-naphthylamine an azo dyestuff which produces bluish red shades on wool. Formylphenyl-2 : 5 : 7-aminonaphtholsulphonic acid gives with the following diazo-compounds dyes which produce the shades mentioned. With diazotised *α*-naphthylamine: reddish claret on wool and cotton; with diazotised *β*-naphthylamine: red on wool and bluish red on cotton; with diazotised *p*-sulphobenzeneazo-*p*-xylidine: violet on cotton; diazotised sulpho-xylene-azo-*p*-xylidine: violet on cotton; the diazoazo-compound produced from disulphonaphtholazo-amino-cresol methyl ether (from H acid and aminocresol methyl ether ($CH_3 : NH_2 : OCH_3 = 1:3:4$): reddish blue on cotton.—J. C. C.

Dyestuffs; Manufacture of ——. R. B. Ransford, London. From L. Cassella und Co., Ges. m. b. H. Frankfort, Germany. Eng. Pat. 7060, Mar. 21, 1910

Monoazo dyestuffs for wool are obtained by combinin an *o*-diazophenolic compound with monoalkyl- or monoaryl-aminonaphthols. Example 1: 21·1 kilos. of 2-nitro-6-amino-4-acetylaminophenol are diazotised and combine with 18·7 kilos. of 1 : 5-ethylaminonaphthol, in acid solution. The dyestuff gives violet shades on woo which become jet black on chroming. Example 2 The diazo-compound obtained from 120 kilos. of 1 : 2 : 4-aminonaphtholsulphonic acid is combined with 11 kilos. of 1-phenylamino-8-naphthol in sodium hydroxid solution. The product dyes wool in indigo-blue shade which become deep black on chroming.—J. C. C.

Substances for use in manufacture of dyes; Productio of new ——. H. R. Le Sueur, London. Eng. Pats 7404, Mar. 24, 1910, and 11,947, May 13, 1910.

The *α*-anilino- or *α*- or *β*-naphthylamino-derivatives o palmitic or stearic acid are heated above their meltin points, whereby carbon dioxide is evolved and the corresponding alkylamino-compounds are produced. The starting materials are prepared by heating the corresponding base with the corresponding *α*-bromo-fatty acid. The following new compounds are described and they ar used for the manufacture of dyes and paints. Pentadecylphenylamine, $C_{15}H_{31}.NH.C_6H_5$, m. pt. 32°—33° C Heptadecylphenylamine, $C_{17}H_{35}.NH.C_6H_5$, m. pt. 40·5—41·5° C. *α*-Naphthylpentadecylamine, $C_{10}H_7.NH.C_{15}H_{31}$ m. pt. 41°—43° C. *β*-Naphthylpentadecylamine, m. pt 52°—55° C. *α*-Naphthylheptadecylamine $C_{10}H_7.NH.C_{17}H_{3}$ m. pt. 48°—50° C.; and *β*-naphthylheptadecylamine m. pt. 57·5°—58·5° C.—J. C. C.

Acenaphthene; Manufacture of nitrogen compounds of —— and of colouring matters therefrom. G. W. Johnson, London. From Kalle und Co. A.-G., Biebrich on Rhine, Germany. Eng. Pat. 19,340, Aug. 17, 1910.

ACENAPHTHENEQUINONE mono-oxime, obtained by the action of nitrous esters on acenaphthene (Eng. Pat. 19,341 of 1910; this J., 1910, 1295), is frequently accompanied by an isomeride, the oxime being decomposed into acenaphthenequinone and hydroxylamine on hydrolysis, whilst the isomeride is converted into naphthalic anhydride and ammonia. The oxime may be removed from the mixture by treatment with an alkali sulphite, the isomeride remaining as a crystalline powder, soluble in dilute sodium carbonate solution. When condensed with indoxyl or 3-oxy-(1)-thionaphthene, or a derivative of either of these, in presence of formic or oxalic acid or other reducing agent, vat dyestuffs are obtained, identical with those described in Eng. Pats. 344 and 12,810 of 1908 (this J., 1908, 399 and 894). The mono-oxime of acenaphthenequinone can also be reduced to form the same substance as is obtained by the reduction of its isomeride, so that it is unnecessary to separate the products, it being possible to reduce the raw product of the action of nitrous esters on acenaphthene and to effect the condensation forthwith. —T. F. B.

Black dyestuffs and their production. Farbenfabr. vorm. F. Bayer und Co., Fifth Addition, dated June 6, 1910 (Under Int. Conv., Aug. 6, 1909) to Fr. Pat. 405,928, Aug. 11, 1909.

DYESTUFFS possessing similar properties to those described in the chief patent (this J., 1909, 1309) are obtained by replacing the ethers of 5-nitro-2-aminophenol by other amines of the benzene or naphthalene series which do not contain a nitro-group. The dyestuffs produced dye wool in red to violet shades. Example: The combination of diazotised aniline with 2-*m*-xylylamino-8-naphthol-6-sulphonic acid in acid solution dyes wool in fast yellowish red shades. The patent contains a list of similar dyestuffs produced in this way.—J. C. C.

Anthracene series; Dyestuffs of the ——. Badische Anilin und Soda Fabrik. Fr. Pat. 417,332, June 21, 1910. Under Int. Conv., April 8, 1910.

AMINOANTHRAQUINONES containing one or more methyl groups can be converted, by means already used in the case of the unsubstituted compounds, into methyl derivatives of indanthrene. Example 1: 1 kilo. of 2 : 3-aminomethylanthraquinone is boiled for 3 hours with 40 kilos. of glacial acetic acid and 3 kilos. of lead peroxide. The product is boiled with dilute hydrochloric acid to remove lead and the residue is crystallised from nitrobenzene. The 3 : 3′-dimethylindanthrene thus obtained is a greenish blue powder and gives a blue vat from which cotton is dyed in blue shades becoming greener on washing. An alternative method of preparation is given starting from 1-bromo-2-amino-3-methylanthraquinone. Example 2: 1 kilo. of 6-(or 7) methyl-2-aminoanthraquinone is mixed at 250° C. with 4 kilos. of potassium hydroxide and kept at 260° C. for half an hour. The 6 : 6′-(or 7 : 7′) dimethylindanthrene produced is similar in properties to the 3 : 3′-derivative. It produces a deep blue on cotton.—J. C. C.

Dyestuffs of the triphenylmethane group capable of being chromed; Production of violet to blue ——. Farbwerke vorm. Meister, Lucius, und Brüning. First Addition, dated July 7, 1910 (Under Int. Conv., Sept. 7, 1909) to Fr. Pat. 417,490, May 7, 1910.

IN the process described in the chief patent (compare this J., 1910, 1297) *p*-chlorobenzaldehyde may be replaced by its substitution products or by other *p*-halogenated benzaldehydes or their substitution products. Dyestuffs containing the alphylamino-group in place of halogen in the para-position dye wool from an acid bath and, when chromed, very fast violet to blue shades are produced. An example is given illustrating the condensation of aniline with the dyestuff produced from 4 : 6-dichloro-3-tolualdehyde and *o*-cresotinic acid.—J. C. C.

Dyestuffs of the thioindigo series; Preparation of bromo-derivatives of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 417,937, May 17, 1910. Under Int. Conv., May 18, 1909.

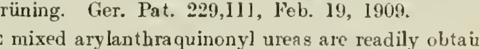
DYESTUFFS of the thioindigo series can be brominated by adding bromine to an aqueous suspension of the dyestuff. For example, 20 parts of bromine are added to 296 parts of a homogeneous paste containing about 10 per cent. of thioindigo and the mixture is stirred and warmed for several hours. The resulting monobromothioindigo dyes cotton in bluer shades than does thioindigo. The process may be applied to derivatives of thioindigo and halogen acids may be added to facilitate the solution of the bromine, or the latter may also be produced from its compounds in the mixture itself.—J. C. C.

Arylanthraquinonylureas or -thioureas; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 229,111, Feb. 19, 1909.

THE mixed arylanthraquinonyl ureas are readily obtained by the interaction of aminoanthraquinones and arylcarbonimides, preferably in presence of a neutral solvent; if the carbonimide is replaced by the corresponding thiocarbonimide (aryl mustard oil), arylanthraquinonylthioureas are produced. The products may be used in some cases as dyestuffs, and also for the preparation of dyestuffs. (See also this J., 1910, 750 and 1002.)—T. F. B.

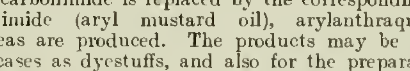
Vat dyestuffs of the anthraquinone series, Production of ——. F. Ullmann, Germany. Fr. Pat. 418,201, July 13, 1910. Under Int. Conv., July 19, 1909.

VAT dyestuffs are obtained by condensing chloroanthraquinones or their derivatives with the amides of anthraquinonecarboxylic acids or with their derivatives. The condensation is best effected in the presence of a catalyst and of a substance capable of combining with the hydrogen chloride formed. For example: 13 parts of 1 : 4-chloromethylanthraquinone, 13 parts of anthraquinone-β-carboxyamide, 7 parts of potassium carbonate, 1 part of copper acetate and 100 parts of nitrobenzene are heated to boiling under a reflux condenser. The resulting β-anthraquinonyl-1-amino-4-methylanthraquinone,



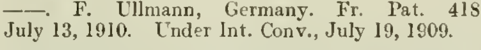
$$C_6H_4\genfrac{\langle}{\rangle}{0pt}{}{CO}{CO}C_6H_2(CH_3)\cdot NH\cdot CO\cdot C_6H_3\genfrac{\langle}{\rangle}{0pt}{}{CO}{CO}C_6H_4,$$

is obtained in yellow crystals. It dyes cotton from the vat in yellow shades. Similarly anthraquinonyl-1-aminoanthraquinone,



$$C_6H_4\genfrac{\langle}{\rangle}{0pt}{}{CO}{CO}C_6H_3\cdot CO\cdot NH\cdot C_6H_3\genfrac{\langle}{\rangle}{0pt}{}{CO}{CO}C_6H_4.$$

which dyes cotton from the vat in yellow shades and (from 1 : 5-dichloroanthraquinone) di-β-anthraquinonyl-1 : 5-diaminoanthraquinone,



$$C_{14}H_7O_2\cdot CO\cdot NH\cdot C_6H_3\genfrac{\langle}{\rangle}{0pt}{}{CO}{CO}C_6H_3\cdot NH\cdot CO\cdot C_{14}H_7O_2,$$

which dyes cotton in orange shades can be obtained.—J.C.C.

Azo dyestuff; Process for preparing a brown ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 228,258, Sept. 1, 1909.

A BROWN azo dyestuff, which is very fast to light, and easily soluble in water and alcohol, giving a dark brown colour to wood, is obtained by combining diazotised *p*-aminodiphenylamine with resorcinol. It is also suitable for printing fabrics and for making spirit-colours.—T. F. B.

Chrome residues containing dyestuffs; Process for working-up and utilising ——. J. Hertkorn. Ger. Pat. 228,294, April 7, 1910.

BOTH the chromium and the dyestuff in residues obtained in the manufacture of dyestuffs, are utilised by treating the residue with a concentrated mineral acid to render it soluble in water; the solution can then be used directly for dyeing silk, wool, or cotton, from acid, alkaline, or neutral baths, the chromium acting as mordant. For example, the residue is treated with 10 to 30 per cent. of concentrated sulphuric acid until soluble in water, and then diluted with 20—100 times its weight of water, and used for dyeing after adding 2·5 to 5 per cent. of sugar, starch, molasses, or glycerin.—T. F. B.

Leucogallocyanine dyestuffs; Process for preparing ——. Farbwerke vorm. L. Durand, Huguenin, und Co. Ger. Pat. 228,369, April 12, 1910.

Arylalkylamines are condensed with gallocyanine dyestuffs in presence of air or of an easily reducible substance, and the product reduced to the leuco-compound, with or without removal of the carboxyl group. The dyestuffs thus obtained are less violet in shade than those obtained from alkylamines and gallocyanines, and more readily reduced and more easily soluble, in the form of their leuco-compounds, than those from arylamines. —T. F. B.

Anthracene colouring matters; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 7632, March 29, 1910.

See Addition of April 2, 1910, to Fr. Pat. 365,920 of 1906; this J., 1910, 1197.—T. F. B.

Black [azo] dyestuffs and process for producing them. Farbenfabr. vorm. F. Bayer und Co. Fourth Addition, dated May 30, 1910, to Fr. Pat. 405,928, Aug. 11, 1909. Under Int. Conv., Aug. 6, 1909.

See Eng. Pat. 30,297 of 1909; this J., 1910, 1244.—T.F.B.

Disazo dyestuff; Process for producing a ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 417,463, June 24, 1910.

See Eng. Pat. 15,391 of 1910; this J., 1910, 1196.—T. F. B.

Triphenylmethane dyestuffs; Process for making violet to blue, chrome ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 417,490, May 7, 1910. Under Int. Conv., May 25, 1909.

See Eng. Pat. 12,130 of 1910; this J., 1910, 1297.—T. F. B.

Monoazo dyestuff, its manufacture and industrial applications. Act.-Ges. f. Anilinfabr. Fr. Pat. 417,601, June 28, 1910.

See Ger. Pat. 228,258 of 1909; preceding.—T. F. B.

Dyestuffs of the safranine series; Process for producing ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 417,669, Sept. 6, 1909.

See Eng. Pat. 20,029 of 1909; this J., 1910, 1050.—T. F. B.

Indoxyl, its derivatives and homologues; Process for making ——. Consortium f. Elektrochem. Ind., G. m. b. H. Fr. Pat. 418,167, July 12, 1910. Under Int. Conv., July 30, 1909.

See U.S. Pat. 960,671 of 1910; this J., 1910, 808.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Textile fibres; Importance and application of low temperatures for the obtaining, working up, and improvement of ——. F. Erban. Internat. Low Temperature Congress, Vienna, 1910. Z. angew. Chem., 1910, **23**, 2269.

Too low a temperature is harmful in the mechanical working up of textile fibres, though not directly damaging the fibre. The chilling of moist textiles has an unfavourable effect on the uniformity of the subsequent dyeing. Low temperatures play an important part in the production of artificial silk. With reference to the cooling of mercerising liquors, the use of ammonia, rather than of carbon dioxide, machines is recommended, so as to avoid the formation of a carbonate in the event of possible leakage. The use of cold is also very important in the loading of silk, and in this case carbon dioxide ice machines are regarded as the more suitable, since ammonia would decompose the tin bath.—F. Sodn.

Cellulose; Mercerised ——. O. Miller. Ber., 1910, **43**, 3430—3435.

The author gives reasons in support of his view that mercerised cellulose is not a cellulose hydrate. If the materials are dried at 95° C. before and after mercerisation, a slight loss of weight is recorded, instead of a gain, as the result of the treatment. The hygroscopic moisture of mercerised cellulose is the same whether the sample be dried at 95° C. in the oven or at 25° C. over calcium chloride; a hydrate stable between these extreme temperatures is hardly conceivable. When dried *in vacuo* over sulphuric acid, mercerised cellulose has the same percentage composition as the original cellulose. On the other hand, mercerised cellulose behaves differently from ordinary cellulose in certain ester reactions—nitration, benzoylation. It also shows an increased adsorption capacity, *e.g.*, for atmospheric moisture, dyestuffs, etc. Hence the author contends that in the process of mercerisation the sodium hydroxide enters into a state of solid solution in the cellulose (this J., 1909, 37), and that this process is accompanied by a partial conversion of the cellulose into an isomeride, the extent of this conversion depending on the concentration of the alkali. This degree of mercerisation may be measured colorimetrically by dyeing tests. Dyestuffs of different classes behave differently. For instance, an ethereal solution of Rosaniline base dyes mercerised cellulose more strongly than ordinary cellulose, and the increments show sharp differences in the lower degrees of mercerisation (1—9 per cent. of sodium hydroxide). Substantive dyestuffs (*e.g.*, Geranin and Chrysophenin) only begin to show an increased affinity for mercerised cellulose at about the stage corresponding to a concentration of 9 per cent. of sodium hydroxide, and the increments then rise gradually to a maximum corresponding to a concentration of about 25 per cent. of sodium hydroxide, no sudden break occurring in the curve at any point corresponding to stoichiometrical ratios.—J. F. B.

Sulphite wood pulp waste lyes; Utilisation of —— [*as fodder*]. A. Stutzer. Chem.-Zeit., 1910, **34**, 1352.

Continuing his investigations on the use of the waste lyes from sulphite wood pulp mills as fodder for cattle, the author remarks that the sulphurous acid must be eliminated, and that his formaldehyde process (this J., 1909, 1162) has proved in practice to be too costly. Substances which increase the ash of the product are also out of the question. The most satisfactory neutralising agent is ammonia, which converts the calcium bisulphite into the insoluble monosulphite, and if used in slight excess, liberates some of the sulphurous acid which is in combination with aldehydes; the ligninsulphonic acids are not decomposed. The ammonium sulphite produced is dissociated on heating, and ammonia and sulphur dioxide are volatilised during the evaporation of the lyes. Calcium salts are also precipitated if ammonium carbonate be employed. It has been stated by Kellner that ammonia in combination with organic acids can be assimilated by animals. Further, the bitter constituents of the lyes are so changed during the treatment that, in conjunction with beet molasses, the products are readily eaten by cattle. Suitable proportions are: 1 part of molasses, 4 parts of the prepared wood-extract and 5 parts of sliced potatoes. The product has not been tried on the large scale, but experimental results have been satisfactory. The ammonia from coke-ovens is too costly for the purpose, and the author recommends the use of calcium nitride. Experiments have also been made with satisfactory results on the use of the evaporated waste lyes in finishing textiles. For this purpose the colouring matters are first removed from the lyes.—J. F. B.

Sulphite wood pulp waste lyes; Evaporation and utilisation of —— for tanning. A. Kumpfmiller. Chem.-Zeit., 1910, 34, 1352—1353.

According to the process described by the author, the lyes are violently agitated whilst boiling, in order to eliminate a portion of the sulphurous acid, sodium carbonate is then added and the sodium sulphite formed is converted into chloride by hydrochloric acid; lastly lactic acid is added, since calcium lactate is not injurious in tanning. The purified lyes are evaporated in a vacuum circulation apparatus of the type used in the potash industry. It consists of an open boiler from which the lye circulates through a vacuum evaporating apparatus and back again to the boiler. The lyes contain 7—9 per cent. of organic solids, including 2—3 per cent. of tanning matter. In oak bark extract the ratio of tanning matters to soluble non-tannins is 3 : 2, whilst in quebracho it is 20 :1. By blending the wood extract with other tanning materials, it is possible to prepare an extract very similar to oak bark extract. The lyes must be thoroughly purified from lime and sulphurous acid, since these impurities would make the leather brittle and black. Spruce extract exerts a good mordanting action and yields a pale leather. It is particularly useful in the preparation of chrome leather, to which it imparts the necessary "handle," whilst the presence of the non-tannins gives body and weight. A combination of chrome and spruce-extract tanning promises to become of very considerable importance in the near future.—J. F. B.

Rosin substitutes. Klemm. *See* XIII.

Viscosity of solutions of nitrocellulose. Piest. *See* XXII.

Patents.

Fibres: Treatment of vegetable —— for the preparation of textile yarns. E. Nowitzki. Fr. Pat. 417,422, June 23, 1910.

The specification relates to the arrangement of machinery for preparing slivers direct from the stems of textile plants, such as flax and hemp straws. The bundles of stems are first passed between grooved breaking rolls and are delivered from these to another pair of grooved rolls across a space which is occupied by a stripping machine consisting of a number of scrapers or brushes carried on an endless chain, which press against the fibres as they travel across the space and remove the impurities. The operation is repeated, the stripping bars on the second arrangement being carried on a cylinder. The bundles of stems are always held at one end or the other by the grooved rolls whilst they are being beaten or brushed. By an alternative arrangement the bundles are held at the middle by reciprocating rolls and the scrapers or strippers act on both ends at once. Afterwards the fibres, separated from the stems, pass through a graduated series of combs and draw-rolls for the preparation of a sliver.—J. F. B.

Acidifying and neutralising wool and woollen fabrics before and after carbonising; Application of electrolysis to the operations of ——. Baudot et Cie. Fr. Pat. 417,847, July 4, 1910.

Negative and positive electrodes are so arranged in a vat that the material to be treated can be readily moved between them either mechanically or by hand.—P. F. C.

Cellulose esters; Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 417,274, June 18, 1910. Under Int. Conv., Aug. 14, 1909.

Cellulose esters (acetates) soluble in acetone are obtained by acetylating cellulose or its derivatives (oxycellulose, hydrocellulose) in presence of an acid sulphate of a primary aromatic amine. For example, 80 parts of *o*-toluidine bisulphate are dissolved in a mixture of 1200 parts of glacial acetic acid and 1000 parts of acetic anhydride, and 200 parts of cellulose are introduced into the liquid. The reaction is allowed to continue at a temperature below 70° C. until a sample precipitated with water and washed and dried is completely soluble in acetone.—A. S.

Cellulose esters; [Solvent for ——]. W. H. Walker. Fr. Pat. 417,319, June 21, 1910.

Acetylene tetrachloride is well known as a suitable solvent for the esters of cellulose, *e.g.* cellulose acetate. According to this specification, the solvent properties of this liquid may be further improved by the presence of a limited proportion of a "latent" solvent, such as methyl or ethyl alcohol. These media, whilst not being solvents themselves, indirectly favour solution by acetylene tetrachloride and increase the fluidity of the products. For instance: 1 part of cellulose acetate is dissolved in 10—12 parts of acetylene tetrachloride containing 2 parts of one of the above alcohols; the solution makes an excellent varnish or lacquer.—J. F. B.

Cellulose xanthate; Preparation of solutions of ——. A. Pellerin. Fr. Pat. 417,568, June 27, 1910.

The addition of glycerin, glucose or other similar substance with alcoholic functions to cellulose xanthate is claimed. The glycerin or glucose may either be incorporated with the alkali-cellulose before the sulphuration process or may be mixed with the finished xanthate before use. The mixed product is stated to yield filaments of superior flexibility and elasticity as compared with the ordinary xanthate.—J. F. B.

Cellulose articles; Process of finishing ——. Comp. Franç. des Applications de la Cellulose. Fr. Pat. 417,599, Sept. 3, 1909.

Articles made of artificial silk, or "crinol" filaments, suffer in the natural state from lack of rigidity. According to this invention, such articles: fabrics, trimmings, hat-shapes, etc., are finished by the application of a solution of nitrocellulose, which imparts to them rigidity and impermeability, without detracting from their lustre. A 10 per cent. solution of nitrocellulose in amyl acetate is stated to be suitable for the purpose.—J. F. B.

Paper-stock; Process for elimination of colouring matter from ——. M. H. Hubbard, Utica, N.Y. U.S. Pat. 977,013, Nov. 29, 1910.

The paper stock is reduced to a pulp, treated with a mixture of soap solution and whiting, then washed and finally bleached with a solution of bleaching powder. —P. F. C.

Artificial silk; Apparatus for the manufacture of ——. G. Guadagni, Pavia, Italy. U.S. Pat. 977,863, Dec. 6, 1910.

See Fr. Pat. 386,334 of 1908; this J., 1908, 682.—T. F. B.

Acetyl derivatives of cellulose; Manufacture of ——. V. J. A. Pauthonier, Paris. Eng. Pat. 27,102, Nov. 22, 1909.

See Fr. Pat. 409,465 of 1909; this J., 1910, 751.—T. F. B.

Acetylcellulose; Method of manufacturing brilliant, frosted or patterned layers or coatings from ——. A. Eichengrün, Berlin. Eng. Pat. 4959, Feb. 28, 1910. Under Int. Conv., April 15, 1909.

See Fr. Pat. 413,901 of 1910; this J., 1910, 1101.—T. F. B.

Cellulose; Process for producing shaped compounds of ——. Farbenfabr vorm. F. Bayer und Co. Fr. Pat. 417,250, June 17, 1910. Under Int. Conv., July 26, 1909.

See Eng. Pat. 14,364 of 1910; this J., 1910, 1152.—T. F. B.

Sugar-yielding products and process for obtaining them. Fr. Pat. 417,317. *See* XVII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Mercerisation; Influence and application of cold in ——. A. Kirchbacher. Internat. Low Temperature Congress, Vienna, 1910. Z. angew. Chem., 1910, **23**, 2269.

With lyes of less than 30° B., the best results are obtained at a low temperature, but with more concentrated solutions, the influence of temperature is small. The percentage shortening or shrinking of fibres in proportion to their original length, when immersed for different periods in lyes of various strengths, is shown in the following table.

Concentration of the caustic lye.	5° B.			10° B.			15° B.			25° B.			30° B.			35° B.		
Period of action.	1′	10′	30′	1′	10′	30′	1′	10′	30′	1′	10′	30′	1′	10′	30′	1′	10′	30′
Temp.																		
2° C.	0	0	0	1	1	1	12·2	15·2	15·8	19·2	19·8	21·5	22·7	22·7	22·7	24·2	24·5	24·7
18° C.	0	0	0	0	0	0	8	8·8	11·8	19·8	20·1	21	21·2	22	22·3	23·5	23·8	24·7
30° C.	0	0	0	0	0	0	4·6	4·6	6	19	19·5	19	18·5	19·5	19·8	20·7	21	21·1
80° C.	0	0	0	0	0	0	3·5	3·5	3·8	13·4	13·7	14·2	15	15·1	15·5	15	15·2	14·4

—F. Sodn.

Fastness to washing of dyed shades, and the testing of the same. P. Heermann. Mitt. Königl. Materialprüfungsamt, Ergänzungsheft 1, 1910, 1—18.

White linen garments for use in the tropics are preferably lined with red dyed material, as this colour is found to give the best protection against exposure (sunstroke, etc.) owing to the high degree of absorption of the light rays of short wave length. Some difficulty has been experienced in obtaining a dyed material which possessed the excellent fastness to washing of a high priced speciality already on the market, but it has been shown that Turkey Red (dyed by the "Old," not by the "New" process), may be dyed so as to satisfy all requirements. The author draws attention to the variation in the methods employed for determining the fastness of a shade to washing, especially in the matter of the strength of the solutions of soap and alkali, and the temperature at which the test is carried out. He points out that the degree of fastness should be interpreted differently according to the nature of the fibre (cotton, wool, or silk), and that in the interpretation of the results not only the diminution in the depth of shade, but the degree of staining of white contiguous fibre and the degree of colouration of the liquors should be taken into account. Lange's method (this J., 1903, 947) is criticised on account of the lack of working details given and the omission of any differentiation between the different classes of material. The author proposes the following method. Dyed cotton materials are treated (together with white cotton, wool, or silk) at 60° and 100° C. for 15 minutes in a solution containing 5 grms. of Marseilles soap and 3 grms. of calcined sodium carbonate per litre. The results are to be classified with respect to the shade itself, the effect upon white material, and the colouration of the bath. Thus :—(*a*) : I. The shade is not affected at 100° C. II. The shade is not affected at 60° C.; there is a slight loss of depth at 100°. III. The shade loses a little at 60° C.; appreciably at 100°. IV. Appreciable loss at 60° C. V. Very much affected at 60° C.: stripped at 100° C. (*b*) : I. Does not bleed into white contiguous fibre at 100° C. II. Does not bleed at 60°; bleeds a little at 100° C. III. Bleeds a little at 60°; bleeds very much at 100° C. IV. Bleeds appreciably at 60° C. V. Bleeds strongly at 60° C. (*c*) : I. Liquor remains uncoloured at 100° C. II. Liquor remains uncoloured at 60°; slightly coloured at 100° C. III. Liquor slightly coloured at 60°; strongly coloured at 100° C. IV. Liquor appreciably coloured at 60° C. (V). Liquor strongly coloured at 60° C. With respect to dyeings upon silk and wool the demands must be somewhat less exacting, and Fastness II. in the case of cotton is in their case looked upon as Fastness I. It must be remembered however that the fastness properties of individual dyestuffs depend very largely upon the method of dyeing, and the preliminary, or after-treatment employed; examples illustrating this are given. Details of the "Old" and "New" methods of dyeing Turkey Red are given and mention made of the better degree of fastness of the shades produced by the "Old" method. The article concludes with a list of dyestuffs with which shades upon cotton may be dyed fast to washing, also of dyestuffs which give fast dyeings upon wool.—F. M.

Coloured reserves on Aniline Black with the aid of viscose; Printing and fixing ——. M. Puaux. Sealed note dated March 8, 1899. Bull. Soc. Ind. Mulhouse, 1910, **80**, 281—282.

Viscose has the property of fixing mineral pigments and the alkali it contains is sufficient to reserve Aniline Black; kaolin (for whites), vermilion, barium chromate and ultramarine are amongst the pigments found suitable for this purpose. The padded material is printed with a mixture of viscose paste and the mineral colour, then steamed, passed through a solution of a silicate or chromate and afterwards washed and dried. The process is also applicable to some direct dyestuffs. E. Noelting in his report confirming the foregoing states that during the steaming process the viscose is decomposed into alkali and carbon bisulphide (which reserve the Aniline Black) and insoluble hydrated cellulose which fixes the colour.

—P. F. C.

Patents.

Wool and other analogous materials; Process for the treatment of ——. E. Elsaesser. Fr. Pat. 418,082, July 9, 1910.

Wool can be considerably improved, especially as regards lustre and affinity for dyestuffs by treating it with a bisulphite solution. The treatment can be effected—(*a*) by adding small quantities of bisulphite to the dye-bath, the dyestuffs employed being such as are not affected by the addition; (*b*) by subjecting wool whilst under tension to the action of a boiling solution containing 1 part by volume of sodium bisulphite solution of 40° B. to 5 parts of water. After a five minutes immersion, the wool still under tension, is treated with a boiling 2 per cent. solution of a mineral acid for an hour and is afterwards washed and dried.—P. F. C.

Bleaching and dyeing of yarns; Process and apparatus for ——. J. Oklitschek. Fr. Pat. 417,733, May 26, 1910.

This apparatus comprises a vat inside which are mounted a number of perforated cylinders carrying the yarn to be bleached or dyed. By means of pipes provided with stopcocks a pump is connected with the interior of the vat, with the interior of each cylinder and with a reservoir for preparing or storing the liquor used in the treatment. By this means the liquor can be circulated through the yarn either from the vat into the interior of the cylinder or in the opposite direction. The bleaching solution employed contains sodium hypochlorite, acetic acid, and an extract of quillaia bark.—P. F. C.

Perforated tubes through which pass the liquors used in the dyeing and bleaching operations; Process and apparatus for mounting, etc., bobbins of textile fibres on ——. A. Holle und Co. Fr. Pat. 417,276, June 18, 1910.

The yarn is wound on to perforated paper tubes and those parts of the tubes which project beyond the ends of the bobbins are then slit along their length in a number of places, so that when a conical instrument is pushed down the end of a tube, the separated sections open out transversely in the shape of a star and can be flattened down on the end of the bobbin. If desired the slits can be made by cutting edges which project from the surface of the conical instrument sufficiently far to cut into the inner wall of the paper tube but not to cut through it.—P. F. C.

Dyeing articles, such as fibres, sheets, plates, slabs, etc., made of fatty acid esters of cellulose; Process of ——. Fürst Guido Donnersmarck'sche Kunstseiden- u. Acetatwerke. Ger. Pat. 228,867, March 15, 1907.

Articles made from fatty acid esters of cellulose cannot be coloured by means of aqueous solutions of dyestuffs, on account of their water-repellent nature; it is found, however, that if acetin or other organic acid esters of glycerol, glycol, or their derivatives or homologues, be added to the aqueous solution of the dyestuff, the cellulose ester is readily dyed, the shade produced varying according to the amount of acetin, etc., present. If the solution of the fatty acid ester of cellulose is mixed with acetin or one of the above named esters, and then formed into sheets, fibres, etc., in the usual manner, the products can be dyed with aqueous solutions of dyestuffs.—T. F. B.

Discharges on vatted grounds and new sulphonated derivatives of organic ammonium bases. Badische Anilin und Soda Fabrik. First Addition, dated June 18, 1910, to Fr. Pat. 414,937, Apr. 19, 1910. Under Int. Conv., Mar. 24, Apr. 16, and June 11, 1910.

In the process described in the principal patent (this J., 1910, 1247) for directly obtaining coloured discharge effects, the depth of colour is not sufficiently intense when the ground to be discharged is light in shade. It is now found that satisfactory effects can be obtained even on light grounds by adding to the printing colour a soluble derivative of a vat dyestuff which is rendered insoluble by the action of the discharge colour. The bisulphite compounds of dehydro-derivatives of vat dyestuffs are specially suitable for the purpose. It is also found that white discharges can be obtained by using instead of ammonium bases containing a sulphonated alkaryl group, alkaryl compounds of the general formula, $RR^1CH.Ha^1$, which contain one or more salt-forming groups (Ha^1 represents a halogen atom, R, an atom of hydrogen or an alkyl, alkaryl, or aryl group and R^1 an aryl or alkaryl group). The processes described above and in the principal patent can be applied to the production of discharges on grounds dyed with sulphide dyestuffs.—P. F. C.

Steaming and cooling textile fabrics; Machine for ——. J. B. Whiteley, Huddersfield. Eng. Pat. 7503, Mar. 26, 1910.

The patent is a further improvement on the means described in Eng. Pat. 15,140 of 1909 (this J., 1910, 691) for preventing the blowing of condensed water into cloth, whilst it is being steamed on a perforated roller. In the end wall of the drainage chamber is located a cylinder having one end open and projecting into the perforated roller, the other end of the cylinder being solid and presenting a dished surface to the entering steam. A number of holes are bored through the peripheral wall of the cylinder to admit steam from the chamber to the roller by way of the open end of the cylinder, and in order to conduct the water of condensation away from these openings a number of grooves are formed in the periphery of the cylinder. The water drops from these grooves and drains away as described in the previous patent.—P. F. C.

Waterproofing linen or other textile articles and giving them a permanent glazed washable surface; Process for ——. A. A. A. Zimmer, London. Eng. Pat. 24,006, Oct. 19, 1909.

The article is subjected to such a degree of saturation in a waterproofing solution which is free from collodion (such as a 15 per cent. solution of stearic acid in alcohol) that the inner fibres of the material become thoroughly impregnated without the formation of a covering skin. The article is partially dried and then coated with a solution obtained by dissolving celluloid in dichlorhydrin or in a mixture of tetrachloroethane and acetone. The most satisfactory solution is one containing about 20 per cent. of nitrocellulose or its compounds to 80 per cent. of solvent. The article is next passed between heated rollers which make the outer glazed surface homogeneous with the waterproofed linen. Successive polishings with pumice powder, talcum and powdered chalk complete the process. —P. F. C.

Oiling product; Manufacture of a new ——. J. Capron fils. Fr. Pats. 417,554 and 417,555, Sept. 2, 1909.

Three buckets of a vegetable or animal oil are poured into a boiler and a sufficient quantity of soda lye is then run in to partially saponify the oil. After saponification 70 litres of oil are added, the well-stirred mixture is heated for a few minutes and then allowed to cool. A further 100 litres of oil are next added, the mass is stirred to keep it uniform and water is slowly run in until the mixture attains the necessary consistence. If desired a filtered extract of lichen can be added to the oils before saponification. Particulars are given of the filtering, stirring and other apparatus employed.—P. F. C.

Dyeing machines. J. T. Psarski, Cleveland, U.S.A. Eng. Pat. 13,740, June 7, 1910.

See Fr. Pat. 416,866 of 1910; this J., 1910, 1373.—T. F. B.

Grey dyeings and printings; Process for producing fast ——. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 417,667, Sept. 6, 1909.

See Eng. Pat. 20,312 of 1909; this J., 1909, 1246.—T. F. B.

Alizarin printing; Product for use in —— and the application thereof. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 7826, March 31, 1910. Under Int. Conv., April 3, 1909.

See Fr. Pat. 413,836 of 1910; this J., 1910, 1103.—T.F.B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Lead chamber process [of making sulphuric acid]; Theory of the ——. F. Raschig. Z. angew. Chem., 1910, 23, 2243—2250.

Replying to criticisms made by Wentzki (this J., 1910, 1247) and by Jurisch (this J., 1910, 1248), the author denies that dry sulphur dioxide can react with dry nitrogen peroxide and points out that in Wentzki's experiments, water was present; dry nitrous gases are found to have no effect on dry sulphur dioxide, with or without air, even after months of contact. Moreover, an excess of oxygen in the chamber, contrary to what would be expected if sulphurous acid is directly oxidised in the presence of a catalyst, has a harmful effect on the process, whereas this is quite in accordance with the author's views (this J., 1905, 923), according to which nitrous acid alone is required for the production of nitroso- and nitrosi-sulphonic acids, nitric acid being useless. Wentzki's statement that nitrosisulphonic acid is reduced by sulphur dioxide, is shown to be based on a misinterpretation of the facts observed; the decomposition of the acid is merely accelerated by the current of sulphur dioxide, as by any other gas. Referring to Wentzki's formula for nitrosisulphonic acid (*loc. cit.*), it is pointed out that copper sulphate (1 mol.), dissolved in sulphuric acid, should absorb 2 mols. of nitric oxide, whereas only 1 mol. is absorbed, as required by the author's formula, $OH.NO.SO_3H$. As regards the displacement of sulphuric acid by the labile blue acid, it is suggested that concentrated sulphuric acid, in view of its feeble electrical conductivity, is probably a very weak acid. Manchot's results (this J., 1910, 1374) are also discussed, and the opinion is expressed that the sulphate residue, in common with copper and iron compounds, has the power to unite with nitric oxide, which would explain why copper sulphate reacts with nitric oxide more readily than other copper salts. The contention that the purple acid obtained in the Gay Lussac tower owes its colour to the presence of iron is held to be incorrect; for the iron is always present in the ferric state, and ferric salts, dissolved in this dilute acid, cannot absorb nitric oxide.—F. Sodn.

Lead chamber process [of making sulphuric acid] and some notes on sulphur-nitrogen compounds; Theory of the ——. E. Berl. Z. angew. Chem., 1910, **23**, 2250—2253. (Compare preceding abstract.)

In agreement with Raschig, it is held that Wentzki's results may be explained by current theories (see Lunge and Berl; this J., 1906, 533). It is denied that direct oxidation can occur, and, referring to Wentzki's supposed reaction, $SO_2+NO_2=SO_3+NO$, it has been found that sulphur trioxide and nitric oxide themselves interact, according to the equation, $5SO_3+2NO=S_4O_{11}(ONO)_2+SO_2$, the dinitrosylsulphuric anhydride produced (a very hygroscopic solid) rapidly decomposing with the liberation of nitrous gases (which explains why very strong acid gives low results in the nitrometer). Wentzki's conclusions, based on the reduction of nitrous vitriol by alcohol, are held to be incorrect, because the reducing action of organic substances is largely dependent on the conditions and is probably quite different from that of inorganic reducing agents. Rose and Brüning's dinitrosylpyrosulphuric acid, $S_2O_5(ONO)_2$, (the anhydride of nitrosylsulphuric acid) is readily obtained by dissolving crystals of nitric anhydride in liquid sulphur dioxide in a sealed tube, when, after a few days, the compound separates in the form of very hygroscopic needles.—F. Sodn.

Sulphuric acid; Observations on G. Stolzenwald's article on the concentration of —— to 97—98 per cent. mono-hydrate. A. G. Duron. Z. angew. Chem., 1910, **23**, 2307—2308 (see this J., 1910, 1248).

The author does not agree with Stolzenwald as to the advantage of concentrating sulphuric acid in two stages, but contends that, with modern apparatus, 97—98 per cent. acid is readily obtained with a smaller consumption of fuel by the direct method than is required for the combined system, with which, moreover, it is impossible to obtain a pure acid. Direct concentration can be effected, without any difficulty, either with Gaillard or Kessler apparatus. A Gaillard apparatus, for instance, costs about M. 45,000—50,000 (£2200—£2450), for a production of 8000—9000 kilos. of 97—98 per cent. acid per 24 hours, and requires 15—17 per cent. of coke and 0·5—0·75 horse-power for driving the fan; the Kessler apparatus (Teisset-Prat system; this J., 1909, 937) costs M. 25,000—27,000 (£1220—£1320), for 4000 kilos of 97—98 per cent. acid, and requires 22 per cent. of coke and 10—12 horse-power; and, finally, with the improved Kessler apparatus devised by the author, in which strong plates of volvic lava replace the channels, in such a way that there is little space between these and the level of the acid, so that the hot gases pass over the acid more rapidly, the cost of installation, for 5000—6000 kilos. of 97—98 per cent. acid per 24 hours, is M. 21,000 (£1030), 16—18 per cent. of coke and 4 horse-power being required.—F. Sodn.

Metaboric and metaphosphoric acids; Behaviour of —— in fusions of their alkali salts. H. S. van Klooster. Z. anorg. Chem., 1910, **69**, 122—134.

The author has investigated the following binary systems, I. Potassium metaborate and potassium metaphosphate. The melting point curve shows a flat maximum corresponding to the compound, KBO_2,KPO_3, and two eutectic points. The compound can be identified in the fusions by its chemical and microscopical properties. II. Sodium metaphosphate and sodium metaborate. The tendency to form glassy bodies on cooling renders the measurements incomplete, but the existence of a compound, $NaBO_2.NaPO_3$, is probable. The chemical and microscopical properties lead more certainly to this conclusion. III. Sodium metaborate and potassium metaborate. The melting point curve is a typical mixed crystal diagram with no eutectic point. IV. Lithium metaborate and sodium metaborate. The curve shows a well-marked eutectic point and scarcely any tendency to form mixed crystals is indicated.—W. H. P.

Tartaric acid; The determination of total —— by the Goldenberg process. C. Ordonneau. Bull. Soc. Chim., 1910, **7**, 1034—1041.

In determining total tartaric acid in lees, tartars and commercial calcium tartrate by the Goldenberg process (this J., 1888, 349; 1907, 841; 1908, 245; 1910, 814) the author has studied the nature and magnitude of the errors caused by the various impurities usually present in these substances. These impurities embrace pectin substances, phosphates of iron and aluminium, calcium salts and clay. Commercial calcium tartrate may also contain alumina and silica as impurities derived from the lime used in its preparation, as well as malates and oxalates. For the tests pure potassium bitartrate and calcium tartrate were used; these were individually mixed with known quantities of the impurities mentioned above. They were also mixed together in proportions to simulate commercial cream of tartar. The relative merits of, and relations between the use of phenolphthalein and litmus as indicators for the titration were also studied. The results are tabulated.

Losses in the Goldenberg process, 1907.

Impurities added to the bitartrate.	Total tartaric acid.	Per cent. of impurity.	Loss of tartaric acid		Loss of tartaric acid per gram of impurity.	
			Litmus.	Phenol-phthalein.	Litmus.	Phenol-phthalein.
Calcium phosphate (trihasic)	75·80	5	2·35	1·60	0·47	0·32
Ferric phosphate	75·80	5	6·15	3·68	1·23	0·73
Ferrous phosphate	75·80	5	7·95	3·98	1·59	0·79
Aluminium phosphate	75·80	5	4·65	2·20	0·93	0·44
Alumina, pure, anhyd.	75·80	5	19·35	8·80	3·87	1·76
Ferric chloride, dry (equivalent to 4·92 grms. of Fe_2O_3)	71·81	10	13·38	7·21	2·71	1·46
Calcium tartrate	78·69	5	1·77	0·99	—	—
Calcium tartrate	77·57	10	1·85	1·04	—	—
Calcium tartrate, alone	57·69	—	2·08	2·00	—	—

Generally, the losses when using litmus are about double those observed with phenolphthalein. In a crude tartar the amount of the impurities, iron and aluminium phosphates, is nearly proportional to the difference between the two titrations and is obtained by multiplying this difference by a factor varying from 1·5 to 2·0. In presence of tartrates, alumina is basic to phenolphthalein when cold, and acidic when warm; the loss in this case is dependent on the temperature. From these observations the author is of the opinion that the best results are obtained by using phenolphthalein at 50° C. after boiling and cooling the liquid.—B. G. McL.

Soda crystals; Efflorescence of washing ——. A. C. Cumming. Chem. News, 1910, **102**, 311.

A specimen of washing soda crystals, weighing several pounds, which had been kept for at least twenty years in a glass case fitting tightly but not air-tight on a wooden floor, was found on analysis to have been converted almost completely into sodium sesquicarbonate, $Na_2CO_3,NaHCO_3,2H_2O$. Natural sodium sesquicarbonate, or trona, is wrongly described in some text-books as having the composition, $Na_2CO_3,2NaHCO_3,2H_2O$. (See also this J., 1910, 420.)—A. S.

"*Nitrolime*" [*crude calcium cyanamide*]. N. Caro, B. Schück, and R. Jacoby. Z. angew. Chem., 1910, **23**, 2405—2417.

I. Silver salts of cyanamide and of dicyandiamide. Pure silver cyanamide, CN_2Ag_2, can be obtained by treating an ammoniacal solution of freshly-prepared sodium cyanamide with silver nitrate solution, using very dilute solutions (1 : 150). If more concentrated solutions be used, precipitates of varying silver content, but containing the whole of the cyanamide are obtained; these are probably mixtures of silver cyanamide with double salts or basic salts. Normal silver cyanamide is easily soluble in alkali cyanide solution, and if excess of silver nitrate be added to the solution, a white crystalline double salt of silver cyanide and silver cyanamide is precipitated. Dicyandiamide when treated with silver nitrate solution, forms addition-compounds containing, according to the conditions, one, two, or three mols. respectively of dicyandiamide per mol. of silver nitrate. The compound, $AgNO_3,H_4C_2N_4$, on treatment with sodium hydroxide, yields silver dicyandiamide, $AgH_3C_2N_4$, which is slightly soluble in water, easily soluble in ammonia, and soluble in hot nitric acid. The compound, $AgNO_3,2H_4C_2N_4$, when treated in a similar manner, yields varying mixtures of silver dicyandiamide and silver oxide. On prolonged boiling with potassium hydroxide solution, or even in aqueous solution, silver dicyandiamide is converted into silver cyanamide and cyanamide itself, the latter undergoing polymerisation to dicyandiamide.

II. Separation and determination of cyanamide and dicyandiamide. The dilute solution of the substance (10 grms. of nitrolime to 500 c.c. of water) is rendered strongly ammoniacal and treated with excess of silver acetate solution (100 grms. of silver acetate and 40 c.c. of 10 per cent. ammonia solution per litre). The precipitated silver cyanamide is collected on a nitrogen-free filter, washed free from ammonium salts, dried, and its nitrogen-content determined by Kjeldahl's method. In an aliquot part of the filtrate from the silver cyanamide, the dicyandiamide is determined by adding excess of 10 per cent. potassium hydroxide solution and boiling until ammonia is no longer evolved. The precipitate, which consists of a compound of silver dicyandiamide with varying quantities of silver hydroxide, is filtered off, washed, and its nitrogen-content determined. This method has been in use, with good results, for more than two years.

III. Determination of urea in nitrolime. The authors confirm the statement of Ulpiani that nitrolime always contains small quantities of urea, although they were unable to isolate the latter by extraction with alcohol as described by Ulpiani. The urea can be determined in the solution obtained after precipitating the cyanamide and dicyandiamide as described above, by precipitating the silver with hydrogen sulphide, then expelling the excess of the latter by carbon dioxide, evaporating the solution to dryness, and determining the nitrogen-content of the residue. In four samples of nitrolime containing 20·51—20·60 per cent. of nitrogen, the soluble nitrogen consisted of 19·60—19·74 of cyanamide-nitrogen, 0·11—0·13 of dicyandiamide-nitrogen, and 0·72—0·80 of urea-nitrogen; and there was also present from 0·65—0·78 per cent. of insoluble nitrogen.

IV. Determination of cyanides in presence of cyanamide and dicyandiamide. In presence of much cyanamide, cyanide cannot be readily determined by Liebig's method, owing to the masking of the end-reaction. Feld's method (this J., 1903, 1068) is, however, satisfactory. 1—2 grms. of the substance are boiled with lead nitrate solution, and the distillate is collected in sodium hydroxide solution. The alkaline solution is titrated with $N/10$ silver nitrate solution, after addition of sodium iodide. In the case of nitrolime containing carbide, the alkaline solution must be treated with steam to expel acetylene before titrating. Experiments in the electric furnace at 900° C. showed that the product obtained by the action of nitrogen on calcium carbide alone was free from cyanide, but when small quantities of various compounds (sodium and potassium hydroxides, potassium carbonate, calcium chloride and fluoride) were added to the carbide, the products contained small proportions (0·03 to 0·14 per cent.) of cyanide.

V. Action of cyanides on carbides. Cyanide when heated with carbide in absence of air is converted almost completely into cyanamide. Acetylene also effects the conversion of cyanide into cyanamide. This reaction is of importance in that it shows the necessity of using nitrolime free from carbide in Frank and Caro's process for the production of cyanide by melting calcium cyanamide with suitable fluxes.

VI. Action of carbon dioxide on nitrolime. A study of the gaseous products of the action of carbon dioxide on nitrolime at 600°, 800° and 1000° C. showed that not only is any carbide present decomposed with formation of lime and carbon, but that the calcium cyanamide is also decomposed, with separation of carbon.

VII. Action of nitrogen and carbide on alumina. When a mixture of alumina and calcium carbide is heated to about 1000° C. in an inert atmosphere, the carbide is entirely decomposed, and no aluminium carbide is formed. Moreover, aluminium carbide absorbs no ammonia at temperatures of 1140°—1190° C., or at least only such small quantities as may be taken up by metallic aluminium produced by dissociation of the carbide.

VIII. Preparation of pure cyanamide from its salts. (1). *From commercial sodium cyanamide.* 25 grms. of the salt are gradually added to 37 grms. of hydrochloric acid (sp. gr. 1·19), with strong cooling, and water is removed from the solution by distillation *in vacuo*. The residue solidifies on cooling; it is extracted with ether, the ether distilled off from the solution, and the cyanamide caused to crystallise by cooling with running water. It is purified by crystallising from ether. Yield, 5·2 grms. (2). *From nitrolime.* The solution of calcium cyanamide obtained by extracting the nitrolime with water is treated with either oxalic acid or aluminium sulphate, to remove the calcium. The latter method is the best: the precipitate of calcium sulphate and alumina is separated, the filtrate evaporated *in vacuo*, and the cyanamide separated and purified by means of ether. In this way 18 grms. of cyanamide can be obtained from 300 grms. of nitrolime containing 18·3 per cent. of nitrogen. Cyanamide forms colourless crystals, which melt at 41°—42° C., are easily soluble in water, alcohol, and ether, and are volatile in steam. It is converted into dicyandiamide gradually on standing in the air, and immediately on heating. It attacks the skin just as caustic alkalis do, but nevertheless, like dicyandiamide, it is a perfectly neutral compound. The derivative, nitrocyandiamidine, $NO_2.NH.CO.NH.C(NH_2):NH$, which is used in the explosives industry, on the other hand behaves as a weak acid. Dicyandiamide can be converted into guanidine nitrate, with a good yield, by means of an acid mixture containing 25 per cent. of hydrochloric acid of sp. gr. 1·19 and 35 per cent. of nitric acid of 1·38.

IX. Action of nitrogen on a mixture of baryta and charcoal, and influence of additions on carbide-forming mixtures. Comparative experiments showed that the addition of calcium or barium fluoride caused a lowering of the temperature at which fixation of nitrogen by a mixture of baryta and charcoal begins. In presence of barium fluoride, for example, fixation of nitrogen begins below the melting point of the fluoride (1280° C.) whereas with baryta and charcoal alone, practically no nitrogen is fixed below 1320°—1350° C. The effect of the fluoride, as also the corresponding effect of calcium chloride in the case of a mixture of lime and charcoal, is due primarily to a lowering of the temperature at which carbide is produced, for the formation of carbide always precedes the fixation of the nitrogen.—A. S.

Lithium ; New compounds of nitrogen and hydrogen with ——. F. W. Dafert and R. Miklauz. Monats. Chem., 1910, **31**, 981—996.

Metallic lithium, in a current of pure dry nitrogen at the ordinary temperature, is gradually but completely converted into amorphous lithium nitride, Li_3N. At 400° C., the reaction is very rapid, the temperature rises to that of visible redness, and the product is semi-fused and partly crystalline. At this temperature, however, the substance attacks practically all materials of which the containing apparatus can be made, so that the final product is very impure ; and for the preparation of the nitride the reaction in the cold is to be preferred. Dry air in the cold has no action upon lithium ; and the addition to nitrogen of a much smaller proportion of oxygen than exists in air, or of an equally small proportion of hydrogen, entirely prevents its action on lithium. The nitride, heated to 220°—250° C. in a stream of hydrogen, absorbs the gas, forming a new compound, "trilithium-ammonium," of formula, Li_3NH_4. This, heated in hydrogen to 340° C., loses some of its hydrogen, to absorb it again when the temperature is lowered ; but if the temperature be raised to 480° C., the loss of hydrogen is permanent, and the substance "trilithiumamide," Li_3NH_2, is formed. The same substance is formed directly when hydrogen is passed over crystallised lithium nitride. Heated to 600°—800° C. in a stream of hydrogen it forms lithium hydride. All of these compounds of lithium with nitrogen, and with nitrogen and hydrogen, are decomposed by water with evolution of ammonia.

—J. T. D.

Nickel in presence of much cobalt ; A method for the detection of ——. *Compounds produced by the simultaneous action of nitrites and hyposulphites [hydrosulphites] on nickel salts. (Preliminary note.)* W. C. Ball. Chem. Soc. Proc. 1910, 329.

When solutions of sodium or potassium nitrite and nickel nitrate are mixed, and sodium hydrosulphite is gradually added, the liquid assumes the colour of a permanganate solution, and needle-shaped, dark purple crystals separate. This substance, of which the formula is possibly $Na_3NiNS_2O_8,4H_2O$, seems to be the sodium salt of a complex acid containing nickel. The potassium salt, similar in colour, but more soluble, may be obtained by a slight modification of the method. Both salts yield purple precipitates with barium and strontium solutions. Analogous complex cyanides, of an intense reddish-purple colour, may be obtained by treatment of the above substances with potassium cyanide, and also by the oxidation of ammoniacal solutions of hydroxylamine, containing a nickel salt and a cyanide. They are soluble in alcohol and other organic solvents, and afford a ready means of detecting nickel in presence of much cobalt. The compounds are all very unstable, and from their method of preparation would appear to be derived from some compound intermediate between nitrous acid and hydroxylamine, possibly from dihydroxylamine.

Catalysis by chromic acid and its salts. E. Spitalsky. Z. anorg. Chem., 1910, **69**, 179—208.

The analysis of very dilute chromic acid solutions is carried out by the author by adding excess of about 3*N*-hydrochloric acid, then excess of standard sodium arsenite solution, and titrating back with standard potassium bromate. With the help of this method it is shown that the extent to which a 0·00543 grm.-molecular chromic acid solution is reduced by hydrogen peroxide gradually increases as the initial concentration of hydrogen peroxide increases, until with about 0·2 grm.-mol. peroxide a constant amount, viz., 28·3 per cent., is reduced. After this no further reduction can take place even if the peroxide is originally over twice grm.-mol. concentration. A second addition of peroxide does not affect the amount reduced if this limiting value has been reached. The same value is obtained from the other side, *i.e.*, beginning with solutions in which more than 28·3 per cent. of the chromium is in the tervalent state. By means of ethyldiazoacetate it is found that, when a great excess of peroxide is used, only about 84·6 per cent. of the original hydrogen ions are used in the equation : $Cr_2O_7'' + 8H^{\cdot} \rightleftarrows 2Cr^{\cdot\cdot\cdot} + 4H_2O + 3O$. The author's results do not permit of any determination of the equilibrium constant of this reaction.—W. H. P.

Hydrogen peroxide ; New observations on the formation of ——. K. Charitschkow. J. Russ. Phys.-Chem. Ges., 1910, **42**, 900—904. Chem. Zentr., 1910, **2**, 1738.

By the use of paper impregnated with cobalt naphthenate (see this J., 1910, 210), 1 part of hydrogen peroxide in one million parts of water can be detected. A small increase of temperature causes great volatilisation of the peroxide. Water in contact with oxygen yields hydrogen peroxide on exposure to sunlight. On exposure to radium bromide, hydrogen peroxide is formed from water and oxygen even in the dark, and readily in sunlight ; the author is of the opinion that the radium emanation acts catalytically, and that the effect can be utilised for the determination of radioactivity. The cobalt naphthenate test-paper is decolourised almost instantaneously when held in contact with damp, porous substances (wood, asbestos, pumice).

—A. S.

Hydrogen peroxide ; Formation of —— *on burning oxy-hydrogen gas.* K. Charitschkow and Ambardanow. J. Russ. Phys.-Chem. Ges., 1910, **42**, 904. Chem. Zentr., 1910, **2**, 1738.

By the aid of cobalt naphthenate test-paper, hydrogen peroxide was detected in the combustion gases from a oxy-hydrogen flame, but not in the products of combustion of alcohol and petroleum spirit.—A. S.

Hydrogen peroxide ; Determination of the acid content of ——. L. Wohler and W. Frey. Z. angew. Chem., 1910, **23**, 2353—2354.

The observations made by Endemann (this J., 1909, 473) are not confirmed, the increase in the amount of acid found after heating with alkali being probably due to absorption of carbon dioxide during the process. The acid in hydrogen peroxide may, contrary to the statement of this writer, be quite accurately determined by direct titration with $N/10$ alkali, using methyl orange as indicator. Towards phenolphthalein, however, hydrogen peroxide behaves as a very weak acid, and, if the presence of organic acids, etc., necessitates the use of this indicator, either the hydrogen peroxide must be decomposed (*e.g.*, by warming with an excess of alkali, in the absence of carbon dioxide) before titration, or, in the case of weak solutions, a correction may be made, as indicated in the following table, using 25 c.c. of solution and titrating back with $N/10$ acid after adding 25 c.c. of $N/10$ alkali.

Per cent. of hydrogen peroxide.	c.c. of $N/10$ alkali.	Per cent. of hydrogen peroxide.	c.c. of $N/10$ alkali.
0·17	0·19	3	0·38
1	0·2	4	0·48
1·5	0·25	5	0·55
2	0·28	6	0·72

—F. Sodn.

Hydrogen peroxide ; Nature of the decomposition of —— by light. Tian. Comptes rend., 1910, **151**, 1040—1042.

The decomposition of hydrogen peroxide by heat is a bimolecular reaction, whereas the decomposition of this compound by various catalysts is unimolecular. The author shows that the decomposition of hydrogen peroxide by light (derived from a mercury vapour quartz lamp) is also unimolecular ; the course of the action may be represented as follows : $H_2O_2 = H_2O + O$; $2O = O_2$.—L. E.

Silicon ; Compounds of —— with bromine and with hydrogen and bromine. A. Besson and L. Fournier. Comptes rend., 1910, **151**, 1055—1057 (Cp. this J., 1909, 364).

On heating amorphous silicon in a current of dry hydrogen bromide, a product is obtained, about 90 per cent. of which consists of silicon tetrabromide. The remainder consists chiefly of silicon bromoform, and by fractionation, a liquid, which distils at about 75° C., and corresponds to the formula, SiH_2Br_2, can be separated. This liquid is colourless, and is spontaneously inflammable in air. The fractions distilling below 75° C., have compositions intermediate between those corresponding to the formulæ, SiH_2Br_2 and SiH_3Br ; the composition approaches that of the latter formula in proportion as the boiling point is lower. It is concluded that the boiling point of the compound, SiH_3Br, lies between 30° and 40° C. By the action of the electric discharge on the vapour of silicon bromoform, a product is obtained from which the following compounds can be isolated :—(1) Silicon tetrabromide. (2) A white, crystalline compound, Si_2Br_6, which melts at 95° C., and distils without decomposition at 265° C. under ordinary pressure. (3) A white compound, Si_3Br_8, which sublimes *in vacuo* in the form of small, very lustrous crystals, and melts at 133° C. (4) The compound, Si_4Br_{10}, which sublimes *in vacuo* ; it appears to fuse at about 185° C., and undergoes partial decomposition at this temperature.—L. E.

Sapphire ; Nature of the oxides which colour the oriental ——. A. Verneuil. Comptes rend., 1910, **151**, 1063—1066 (see this J., 1910, 210).

Hitherto, titanium has not been detected in the clear sapphire, and according to Morozewicz, the colour of this stone is due to iron oxide. The identity of the colour of the product obtained synthetically (*loc. cit.*) with that of the natural stone, indicates that titanic acid or the oxide plays an important part in the colouration. The author has analysed Australian, Burmese, and Montana sapphires, and has found that they contain, beside oxide of iron, an oxide of titanium in quantity equivalent to 0·031—0·058 per cent. of titanic acid. From this, and from the absence of other constituents capable of imparting colour to the stone (*e.g.*, Australian and Montana sapphires contain no phosphate), the author concludes that the oriental sapphire owes its fine blue colour to oxide of iron and an oxide of titanium.—L. E.

Tantalic acid from West Australian fergusonite ; Production of ——, and sodium tantalate. E. Wedekind and W. Maass. Z. angew. Chem., 1910, **23**, 2314—2316.

Australian fergusonite is found to be specially suitable for the preparation of tantalum compounds in a state of purity, since it contains a large proportion of tantalic acid and very little niobic acid (54·2 and 1·8 per cent. of the respective anhydrides in the sample examined). In the authors' experiments, the finely-powdered mineral was decomposed by fusion with potassium bisulphate, and the melt was thoroughly exhausted with cold water until the aqueous extract no longer gave a precipitate with ammonia. The colourless residue was successively boiled. twice with hydrochloric acid and once with ammonium sulphide, and was then again boiled with concentrated hydrochloric acid and washed with the same acid. After oxidising the separated sulphur with fuming nitric acid, the residual matter (tantalic, niobic and titanic acids) was washed and dried, 38 grms. being obtained from 74 grms. of the mineral. The acids were then separated by Weiss and Landecker's method (this J., 1909, 1169), as follows :—7·5 grms. were carefully introduced into 15 grms. of fused sodium carbonate, and then a further 4 grms. of carbonate and 1·6 grms. of sodium nitrate were added. After about 45 minutes, the melt was allowed to cool, and was then boiled for about an hour with 750 c.c. of water. After filtering and standing overnight, 6·4 grms. of the sparingly soluble sodium tantalate crystallised out, and this was dissolved in water and the solution treated with carbon dioxide to precipitate the tantalum as tantalic acid. The crystals of the sodium salt are colourless and their aqueous solution is distinctly alkaline ; the salt, which loses 12·5 molecules of water on ignition, is considered to have the formula,

$((OH)_2Ta(ONa)_2)_2Ta(OH)O,10H_2O$.—F. Sodn.

Mesothorium ; Characteristics of ——. W. Marckwald. Ber., 1910, **43**, 3420—3422.

Hahn (this J., 1907, 487, 949) found that thorium underwent spontaneous decomposition with the formation of *mesothorium*, and subsequently he showed (Z. physik. Chem., 1908, **9**, 246) that mesothorium was not directly changed into radiothorium, but that an unstable intermediate product, *mesothorium II.*, (half period of decay, 6·2 hours) was first produced. Still more recently (Vortrag. Deutsch. Chem. Ges., July 11, 1910), he has succeeded in concentrating this intermediate substance so that its activity was many times greater than that of an equal weight of pure radium salts. A sample of radium preparation derived from the residues from uranium and thorium ores has been examined by the author. It consisted, in the main, of barium chloride, and from a measurement of the γ-rays should have contained more than 1 per cent. of radium chloride. The quantity of radium emanation emitted, however, corresponded to not more than about 0·2 per cent. of radium, and further investigation showed that about 80 per cent. of the γ-rays originated from mesothorium II. When the aqueous solution of the salt was mixed with a trace of iron chloride, and rendered alkaline with ammonia, the mesothorium II. was precipitated simultaneously with the iron hydroxide. The precipitate emitted γ-rays in abundance, whilst the residue of barium chloride left on evaporating the filtrate had nearly lost its power of emitting γ-rays. But whereas the precipitate (with a half period of decay of about 6 hours) lost its emission capacity, the salt recovered most of its powers of emitting rays within a day. The ammoniacal precipitate must also have contained the radiothorium formed from the mesothorium. In fact, after the disappearance of the mesothorium II., there remained a residue which emitted α-rays and yielded thorium emanation. Apparently mesothorium is chemically identical with radium, and the author has not succeeded in finding a method of separating it from radium and barium, just as hitherto it has not been found possible to separate by chemical reactions the four substances thorium, radiothorium, ionium, and uranium X. It is probable that mesothorium preparations obtained from monazite will invariably contain radium, owing to the presence of uranium ; whilst, on the other hand, the radium prepared from thorium ores, still richer in uranium, *e.g.*, thorianite, will invariably contain mesothorium. Since radium has about 300 times as long a life as mesothorium, it is of the greatest importance to take into consideration the possibility of the presence of the latter in radium preparations. The simplest test is to heat the sample for a short time to expel the emanation, or to dissolve it in water and evaporate the solution. If, after expulsion of the radium emanation, and the subsequent disappearance within a few hours of radium C, there is still an emission of γ-rays, these must be due to mesothorium. The relationship of γ-rays before and after the treatment affords a measure of the relative proportions of radium and mesothorium in a mixture.—C. A. M.

Radioactive elements ; Chemical reactions of ——. B. Szilard. Int. Congr. of Radiology and Electricity, Brussels, Sept. 13-15, 1910. Z. angew. Chem., 1910, **23**, 2431—2432.

The reactions of radioactive elements with relatively short life-periods are not true chemical reactions. The particles of a precipitate produced in a solution become electrically charged by contact with the liquid and attract ions carrying charges of an opposite kind. If among those electrically-charged ions, those of a radioactive element are present, they also are attracted, and, in part, carried down with the precipitate. If such a solution be diluted and then precipitated, the particles are finer and more numerous: the total charge of the particles is hence greater and a larger number of foreign ions are carried down with the precipitate. Besides the physical and chemical character of the particles, the presence of some indifferent foreign substances, especially iron and uranium, also plays an important part. In absence of iron and uranium it is almost impossible to carry down uranium X in a precipitate of barium sulphate. The uranium X appears to be carried down together with iron by the precipitate. Radioactive substances giving intense radiation are very easily carried down by precipitates, but it is almost impossible to separate non-radiating radioactive substances (radium D, radio-uranium) in this way.—A. S.

Oxygen; Separation of —— by cold. J. Swinburne. Faraday Soc. Trans., Dec. 13, 1910. [Advance proof.]

CONSIDERATIONS of ideal apparatus for the separation of oxygen and nitrogen by rectification at low temperature show that, since the gases after separation have less entropy than when mixed at the same temperature and pressure, the apparatus must be fed with compressed air, and energy is therefore needed to separate the gases. The cost of thus separating oxygen on the large scale is calculated to be at least £50 per ton, and this figure is regarded as prohibiting the use of such oxygen in blast-furnaces.—F. SODN.

Sodium nitrate; Shipments, consumption, and stocks, from 1908 *to* 1910. W. Montgomery and Co., Dec. 31, 1910. [T.R.]

into pure concentrated sulphuric acid. The alkali aluminate also produced is extracted from the residue with water, and the solution is treated with carbon dioxide, in order to obtain an alkali carbonate, which may be further converted into an alkali hydroxide or salt, and a precipitate of alumina which is used again in the process or for the production of aluminium, or is converted into aluminium sulphate.—F. SODN.

Hydrocyanic acid; Process for the manufacture of ——. Soc. Anon. pour l'Industrie de l'Aluminium. Fr. Pat. 417,794, July 2, 1910. Under Int. Conv., Sept. 24, 1909.

A MIXTURE of nitrogen, hydrogen, and hydrocarbons is heated to a high temperature and subsequently cooled, and the hydrocyanic acid formed is eliminated and the gaseous residue regularly returned to the reaction chamber. The harmful excess of hydrogen which separates from the heated hydrocarbons is constantly eliminated by diffusion or oxidation, before or after the separation of the hydrocyanic acid; or part of the residual gaseous mixture may be separated from the rest and a corresponding quantity of nitrogen (or air) and hydrocarbon added in its place.—F. SODN.

Ammonia; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 417,940, May 23, 1910. Under Int. Conv., Sept. 13, 1909.

THE union of nitrogen and hydrogen is brought about catalytically, under very high pressures (preferably 150—250 atmos. or above), any or all of the materials being heated to a suitable temperature, such as an incipient red heat. The ammonia may be separated in the liquid state by cooling. (Compare Eng. Pat. 14,023 of 1910; this J., 1910, 1453.)—F. SODN.

		1908.	1909.	1910.
Shipments from South American Ports to all parts for the twelve months ending 31st December	Tons	2,017,000	2,100,000	2,285,000
Consumption in U.K. for the twelve months ending 31st December	„	103,000	111,000	120,000
Do. in Continent do. do.	„	1,275,000	1,354,000	1,531,000
Do. in United States do. do.	„	309,000	407,000	510,000
Do. in other Countries do. do.	„	45,000	66,000	89,000
Do. in the World do. do.	„	1,732,000	1,938,000	2,250,000

Chromium hydroxide; U.S. Customs Decision. Oil, Paint, and Drug Rep., Dec. 19, 1910. [T.R.]

THE substance in question was a paste containing chromium hydroxide, produced by precipitating with calcined magnesia the waste liquid obtained in the oxidation of anthracene to anthraquinone by means of chromic acid. The merchandise was returned by the appraiser as a chemical compound and duty assessed as such at the rate of 25 per cent. ad valorem. The importers claimed the merchandise to be entitled to free entry as an article in the crude state used in dyeing and tanning. The Government relied mainly on the evidence in the case (T.D. 29/01) covering chrome alum, but the Board of Appraisers decided in favour of the importers, the chrome alum having been crystallised before importation (which is equivalent to refining), whereas the goods in question were in the crudest form known in commerce.

PATENTS.

Sulphuric acid; Process of manufacture of —— by means of alkali sulphates and bisulphates, of industrial origin or contained in minerals of complex composition (glauberite, alunite, etc.), with the production of alkali hydroxides or salts and of aluminium sulphate or pure alumina. Soc. Dior Fils. Fr. Pat. 417,816, Sept. 11, 1909.

THE material (alkali sulphates and bisulphates) to which is added bauxite or aluminium sulphate, if alumina be not already present, is heated in a muffle at a suitable temperature, so as to effect the liberation of sulphur trioxide and sulphur dioxide, which are transformed by known methods

Ammonia [and aluminium compounds]; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 418,059, July 8, 1910. Under Int. Conv., July 9, Aug. 6, Sept. 15, and Dec. 28, 1909, and Jan. 24, and Feb. 18, 1910.

ALUMINIUM nitride, containing other nitrides or other substances, is treated with acids or acid salts or with salts capable of yielding acids (especially salts, like those of aluminium, from which the base may be precipitated by ammonia) or with bases, in such a way as to give ammonia or ammonium salts and soluble compounds of aluminium in a pure state. Just sufficient acid or base is used to transform the nitrogen, attached to the aluminium only, into ammonia, or an acid, such as carbonic acid, may be chosen which is incapable of forming a stable salt with aluminium; and, where bases are used, these may be of such a nature that the aluminium compound formed dissolves or that it remains partially or wholly undissolved, to be dissolved subsequently, or the treatment may be effected in the presence of soluble salts. The aluminium nitride may be decomposed by water or steam before being submitted to the above treatment, and it may undergo a preliminary purification by oxidising agents or other means. The following is an example:—50 kilos. of a nitride of silicon and aluminium, made in accordance with Fr. Pat. 405,712 (this J., 1910, 424), by heating a mixture of refractory clay and carbon in a current of nitrogen, and containing 18 per cent. of nitrogen combined with silicon and 8 per cent. combined with aluminium, is heated for some hours, to about 100° C., with 360 kilos. of sulphuric acid of 20° B.; the mixture is then filtered, and the aluminium salt in solution is decomposed in any known manner, or the solution is evaporated so as to give ammonium alum. The nitride may be purified before treatment by extraction with cold dilute sulphuric acid. Nine other examples are given.—F. Sodn.

Lead oxide ; Means for making ——. S. Pope, Manchester. Eng. Pat. 26,175, Nov. 12, 1909.

In the apparatus for the manufacture of lead oxide, described in Eng. Pats. 11,526, 24,768, and 25,203 of 1909 (this J., 1910. 1306), one or more chambers are placed in the structure of the lead oxide pot or separately secured thereto. Block lead is introduced into these chambers through suitable openings, and molten lead runs into the lead oxide pot through openings, which are controlled by sliding covers or rotating plates.—O. R.

Borax, soap, soap powder, soda crystals, soda-ash, carbosil, and similar articles ; Process of making —— *less hygroscopic and less liable to set into a hard mass.* W. R. Ormandy, Warrington, and W. Kay, Stretford, Lancs. Eng. Pat. 26,264, Nov. 12, 1909.

The addition of a very finely divided infusorial earth, to borax, soap, soap powders, and the like, is claimed to render these substances less hygroscopic, owing to the large amount of moisture which the earth can absorb without altering its appearance and physical properties.—O. R.

Chlorine and an alkali metal ; Apparatus for the manufacture of —— *by electrolysis of a fused alkali chloride.* Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 417,246, June 17, 1910. Under Int. Conv., Dec. 22, 1909.

The essential feature of the apparatus is that the products of electrolysis are kept separate from each other by means of partitions which are not attacked by the fused electrolyte, and do not interfere with the flow of the current ; the partitions near the cathode are constructed of a material not attacked by alkali metals, and those near the anode of a material not acted on by chlorine. Resistances and additional electrodes are disposed so as to melt the charge of alkali chlorides (which may, if desired, be mixed with other salts) by means of an alternating current, the additional electrodes coming into action as soon as a sufficient layer of molten salt has been formed and serving to maintain the salt in a fused state if the electrolysis be interrupted. The partitions between the electrodes may be vertical, or the electrodes may be superposed, in which case, an inverted roof-shaped diaphragm, insulated from the electrodes, may be attached to the partition around the upper electrode to form a closed chamber, so that the alkali metal or chlorine, as it rises from the lower electrode towards the surface, is diverted to the peripheral portion of the furnace.—F. Sodn.

Per-acids and peroxides ; Process for preparing ——. J. D'Ans. Ger. Pat. 228,665, March 27, 1910.

Per-acids and peroxides, both inorganic and organic, are obtained by the action of hydrogen peroxide on acid halides, particularly chlorides or fluorides ; a characteristic of the process is the fact that it is unnecessary to remove the hydro-halogen acid which is formed during the reaction. If one equivalent of an acid halide reacts with one equivalent of hydrogen peroxide, the per-acid is formed : for example, by using chlorosulphonic acid, Caro's acid may be obtained in a pure, crystalline form, thus, $HO.SO_2.Cl + H_2O_2 = HO.SO_2.O_2H + HCl$. Allowing two equivalents of the halide to react with one equivalent of hydrogen peroxide, the corresponding peroxide is formed ; acetyl peroxide is prepared from acetyl chloride in this manner. The per-acids obtained from the first reaction are also converted into peroxides by interaction with a further equivalent of the halide.—T. F. B.

Aluminium, chromium, and iron formates ; Process for preparing ——. G. Muth. Ger. Pat. 228,668, June 29, 1909.

The preparation of aluminium formate by dissolving aluminium hydroxide in formic acid, is unsatisfactory, owing to the necessity for isolating the alumina and the loss in preparing free formic acid. It is now proposed to prepare the formates of aluminium, chromium, and iron by decomposing the fluoride by means of an alkali formate (in presence of aluminium fluoride in the case of the iron and chromium compounds) in the cold. For example, bauxite is treated with sufficient concentrated hydrofluoric acid to produce aluminium fluoride, ferric fluoride, and aluminium fluosilicate and fluotitanate ; when this reaction is complete, alumina is added to precipitate the iron, silica, and titanic acid ; the solution of aluminium fluoride is then decomposed by the quantity of sodium formate required by the equation,

$$2Al_2F_6 + 6H.CO_2Na = Al_2F_6,6NaF + Al_2(CO_2H)_6.$$

The aluminium-sodium fluoride, which is precipitated, may be treated with lime to obtain calcium fluoride and sodium aluminate, from which the alumina is recovered. In the preparation of chromic and ferric formates from the fluorides, aluminium-alkali fluoride is also obtained as by-product, thus,

$$Cr_2F_6 + Al_2F_6 + 6H.CO_2Na = Al_2F_6,6NaF + Cr_2(CO_2H)_6.$$

—T. F. B.

Nitric acid ; Process for concentrating ——. E. Brauer, Leipzig, Germany. Eng. Pat. 14,381, June 14, 1910. Under Int. Conv., June 16, 1909.

See Ger. Pat. 222,680 of 1909 ; this J., 1910, 879.—T.F.B.

Chlorosulphonic acid ; Process for making ——. Saccharin-Fabr. A.-G. vorm. Fahlberg, List. und Co. Fr Pat. 418,179, July 12, 1910. Under Int. Conv., Sept. 4, 1909.

See Eng. Pat. 16,518 of 1910 ; this J., 1910, 1203.—T. F. B.

Formic acid from formates ; Process for making concentrated ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 417,815, Sept. 11, 1909.

See Eng. Pat. 20,893 of 1909 ; this J., 1910, 1133.—T. F. B.

Aluminium formate ; Production of water-soluble crystalline ——. H. Sefton-Jones, London. From F. Quade, Berlin. Eng. Pat. 16,169, July 6, 1910.

See Ger. Pat. 224,074 of 1909 ; this J., 1910, 976.—T. F. B.

Aluminium formate soluble in water ; Process for preparing a crystalline ——. J. A. Wülfing. Fr. Pat. 418,150, July 11, 1910. Under Int. Conv., Aug. 2, 1909.

See Ger. Pat. 227,074 of 1909 ; this J., 1910, 976.—T. F. B.

Radium and substances rich in radium ; Process for obtaining ——. F. Ulzer and R. Sommer. Fr. Pat. 417,482, Aug. 31, 1909.

See Eng. Pat. 19,820 of 1909 ; this J., 1910, 1156.—T. F. B.

Air ; Process and apparatus for splitting up atmospheric —— *into oxygen and nitrogen.* G. Röttger, Schafstädt, Germany. Eng. Pat. 7858, March 31, 1910. Under Int. Conv., April 7, 1909.

See Fr. Pat. 413,958 of 1910 ; this J., 1910, 1205.—T. F. B.

Hydrogen ; Process for making ——. O. Dieffenbach and W. Moldenhauer. Fr. Pat. 417,930, April 26, 1910. Under Int. Conv., Jan. 10, 1910.

See Eng. Pat. 8734 of 1910 ; this J., 1910, 1205.—T. F. B.

Oxygen ; Mixture evolving —— *under the influence of heat.* C. Zeiss. Fr. Pat. 418,122, July 11, 1910. Under Int. Conv., July 29, 1909.

See Eng. Pat. 17,809 of 1910 ; this J., 1910, 1205.—T. F. B.

VIII.—GLASS; CERAMICS.

Retort material; Institution of Gas Engineers' standard specification for the manufacture and testing of ——.

The following specification has been drawn up by a Joint Sub-committee formed of five representatives elected by the Retort and Fire-Brick Section of the Society of British Gas Industries, and an equal number of the Refractory Materials Committee of the Institution of Gas Engineers, with the assistance of J. W. Mellor, of the Staffordshire County Pottery Laboratory, Stoke-on-Trent.

Constituents. Clause 1.—The retorts or retort tiles shall be made of sufficiently seasoned raw clay and clean burnt clay or "grog." No "grog" shall be used which will pass through a test sieve having 16 meshes to the linear inch.

Chemical Analysis. Clause 2.—A complete chemical analysis of the material is to be provided when required by the engineer (or purchaser), for his personal information only.

Refractoriness. Clause 3.—A piece of the material shall show no signs of fusion when heated to a temperature of not less than Seger cone 28 (about 1630° C.); the heat being increased at the rate of about 50° C. per five minutes, in an oxidising atmosphere.

[Note.—The new scale of Seger cones printed herein is to be used.]

Surfaces and Texture. Clause 4.—All surfaces shall be reasonably true and free from flaws or winding; and, after burning, no "washing" shall be done without the consent of the engineer (or purchaser). The texture throughout shall be even and regular, containing no holes or flaws, and the "apparent porosity" shall not be less than 18 per cent.

Contraction. Clause 5.—The material shall be evenly burnt throughout, and contain no black core. A test-piece, when heated to a temperature of Seger cone 12, for two hours, shall not show, when cold, more than 1 per cent. contraction or expansion. The test-piece shall be 5 to 6 centimetres long; the ends being ground flat, and the contraction measured by means of Vernier callipers reading to 0.1 mm.—a suitable mark being made on the test-piece, so that the callipers may be placed in the same position before and after firing.

Inspection and Testing. Clause 6.—The engineer (or purchaser) or his agreed representative shall have access to the works of the maker at any reasonable time, and shall be at liberty to inspect the manufacture at any stage, and to reject any material which does not conform to the terms of this specification. Pieces may be selected for the purpose of testing, either before or after delivery; but in either case a representative of the maker shall, if he choose, be present when such selection is made, and shall be supplied with a similar piece of the retort material to that taken for the purpose of testing. If the engineer (or purchaser) and the maker are not prepared to accept each other's tests, they shall agree to submit the samples for testing to an independent authority to be mutually agreed upon; and the engineer (or purchaser) reserves to himself the right, if the material does not conform to the tests laid down in the specification, to reject any or all the material in the consignment from which the test-pieces were taken. The cost of these independent tests and of any retort lengths or tiles damaged before delivery for obtaining test-pieces, shall be equally divided between the purchaser and the maker if the test proves satisfactory; and if unsatisfactory, such cost, and that for all other subsequent tests required on this account from the same consignment, shall be borne by the makers. The cost of any tests or of any material damaged for the purpose of obtaining test-pieces after delivery shall be borne by the purchaser in the event of the test being satisfactory, and if unsatisfactory by the manufacturer, in a similar manner to that specified for the tests prior to delivery.

Appendix and Notes. Constituents. Clause 1.—The sieve to be used is the test-sieve specified by the Institute of Mining and Metallurgy (see this J., 1907, 1240).

Chemical Analysis. Clause 2.—The silica should be determined by two evaporations with an intervening filtration; and the alumina, lime, and magnesia, by two precipitations. The amount of titanic oxide should be indicated, and not confused with alumina and iron. The potash and soda should be separately determined.

Refractoriness. Clause 3.—The Deville furnace, although useful for comparative tests in refractoriness, is not altogether suitable for carrying out those specified in this clause, for which a compressed air-gas furnace of the Méker type, or Hirsch's electric furnace, is recommended. The gas-furnace will require an air-pressure of at least 10 lb. per square inch; and for the electric furnace a current of approximately 90 volts and 90 amps., with a slightly higher voltage at the start, has been found, by means of a carefully standardised Wanner pyrometer, to be sufficient. Two or more tests are generally required with an unknown material. A preliminary trial is first made with a piece of the material chipped into the approximate form of a cone. This should be cemented on to a refractory disc or slab with a mixture of alumina and best china clay, together with Seger cones 28, 30, and 32 (small size). These cones are selected because they cover the range of first-grade clays usually employed for retort material. Best china clay fuses between cones 35 and 36; and all British fire-clays fall below this point. If cones 28 and 30 fall, the furnace should be cooled, and the material under investigation examined. If it exhibits no sign of fusion, the trial should be repeated with cones 31, 32, and 33. When cone 32 squats, the piece should be again examined; and if it shows signs of fusion, the trial should be repeated with cones 30, 31, and 32. By this method of approximation, it is possible to decide whether the piece vitrified between cones 30 and 31 or between cones 31 and 32.

Softening Points of Seger Cones.

Cone No.	Cent.	Fahr.	Cone No.	Cent.	Fahr.
022	600	1112	9	1280	2336
021	650	1202	10	1300	2372
020	670	1238	11	1320	2408
019	690	1274	12	1350	2462
018	710	1310	13	1380	2516
017	730	1346	14	1410	2570
016	750	1382	15	1435	2615
015a	790	1454	16	1460	2660
014a	815	1499	17	1480	2696
013a	835	1535	18	1500	2732
012a	855	1571	19	1520	2768
011a	880	1616	20	1530	2786
010a	900	1652	26	1580	2876
09a	920	1688	27	1610	2930
08a	940	1724	28	1630	2966
07a	960	1760	29	1650	3002
06a	980	1796	30	1670	3038
05a	1000	1832	31	1690	3074
04a	1020	1868	32	1710	3110
03a	1040	1904	33	1730	3146
02a	1060	1940	34	1750	3182
01a	1080	1976	35	1770	3218
1a	1100	2012	36	1790	3254
2a	1120	2048	37	1825	3317
3a	1140	2084	38	1850	3362
4a	1160	2120	39	1880	3416
5a	1180	2156	40	1920	3488
6a	1200	2192	41	1960	3560
7	1230	2246	42	2000	3632
8	1250	2282	—	—	—

Apparent Porosity. Clause 4.—The "apparent porosity":

$$\frac{\text{Volume of pores} \times 100}{\text{Volume of piece (including pores)}},$$

can be determined in one of the numerous voluminometers working with the vacuum process.

Linear Contraction or Expansion. Clause 5.—The term "linear contraction or expansion" is expressed by:—

$$\frac{\text{Change in length} \times 100}{\text{Original length of piece.}}$$

A carborundum wheel may be used for grinding the ends of the test-pieces flat; and a mark should be made across the slab with a steel file. One of the Méker gas-furnaces, with blast if necessary, may be used for carrying out the test. The temperature is difficult to regulate without a pyrometer. The test-piece should be supported horizontally, and fired along with cones 11, 12, and 13.

IX.—BUILDING MATERIALS.

Mortars; Porosity to air of ——. Tätigkeitsber. des Kgl. Materialprüfungsamt der Techn. Hochschule zu Berlin (1 April, 1909 bis 31 März, 1910). Chem.-Zeit., 1910, **34**, 1344.

In determining the porosity of mortar to air, the sample is made into a disc about 3 cm. in thickness, and this is fixed with wax (to form an air-tight joint jound the edge) into a filter funnel. The stem of the funnel passes through the cork of a flask filled with water to a certain level, whilst through another opening in the cork passes a siphon tube the outer limb of which can be closed by a tap. The time required for a litre of water to flow from the flask affords a comparative measure of the porosity of the mortar. Thus in the case of a disc consisting of 1 part (by volume) of cement, I part of lime, and 6 parts of sand, the water took $8\frac{3}{5}$ hours to flow from the bottle; whilst in the case of a cement mortar (I part of cement to 3 parts of sand) it required only $1\frac{5}{6}$ hours. In the case of two building mortars made by a special process the test gave $8\frac{4}{5}$ and $4\frac{1}{2}$ hours respectively. In each instance the prepared discs were exposed to the air for 28 days before being tested.—C. A. M.

Hydraulic cements; Experiments on the alteration of the hardening processes of —— *at low temperatures.* B. Kirsch. Internat. Low Temperature Congress, Vienna, 1910. Z. angew. Chem., 1910, **23**, 2268.

The setting of cement is completely arrested by frost, and, if the conditions obtain from the first, hardening is likewise prevented. This is in accordance with expectations, since the hardening process depends on the formation of a solution of lime in the water present.—F. Sodn.

Ligno-concrete; Tests on ——. C. A. M. Smith. Engineering, 1910, **90**, 820—821.

Tests were made upon beams of ligno-concrete measuring $4\frac{1}{2}$ in. by $4\frac{1}{2}$ in. by 55 in. long; the reinforcements consisted of four $\frac{3}{4}$ in. square timber bars, $2\frac{1}{4}$ in. from centre to centre and 52 in. long. Six bands of iron ($\frac{1}{2}$ in. by $\frac{1}{8}$ in.) 3 in. from each end and 9 in. apart, were placed round and fastened to the timber rods by eight screws, the latter projecting $\frac{1}{4}$ in. The concrete used was composed of 1 part of granite chips, 2 of fine sea-sand, $\frac{1}{3}$ of course sea-sand and $\frac{1}{2}$ of English Portland cement (B.E.S.C. specification). The span in each test was 42 in., the beams being loaded in the centre. The following results were obtained:—

Test No.	Description of beam.	Age of beam (days)	Initial cracking load in pounds.	Maximum load in pounds.
2.	Plain concrete	—	—	425
3.	Oak reinforcement ..	—	1400	2240
4.	Ash ,,	—	1000	1800
5.	Teak ,,	—	1400	2500
6.	Mahogany ,,	—	1200	1595
7.	Deal ,,	—	—	2250
8.	Plain concrete	10	—	650
9.	Tallow wood reinforcement	10	1050	3150
10.	Jarrah wood ,,	10	850	3300
11.	$\frac{1}{2}$ in. steel ,,	14	900	1500
12.	$\frac{1}{4}$ in. steel ,,	15	500	1000
13.	Stringy bark ,,	—	—	300

In beam No. 9 the iron bands were replaced by bands of tallow wood. The concrete employed for beam No. 12 was composed of fine sandy beach and cement in the proportion of 2 to 1.—W. E. F. P.

Patents.

Refractory bricks and other ware; Manufacture of —— *cemented by means of spinel.* C. E. Mankau. Fr. Pat. 417,293, June 20, 1910.

The particles of refractory material are bound together by a more fusible spinel, which is made by adding the necessary amount of bauxite or corundum to dolomite, or of dolomite to ferrochrome.—H. H. S.

Porous stones; Manufacture of artificial ——. A. Petersen and C. Frank. Fr. Pat. 417,441, June 24, 1910.

Gypsum and sawdust, some steeped in acid and some in sodium carbonate solution, are mixed together with cinders and the whole worked into any desired shape. The bubbles of carbon dioxide cause the mass to assume a porous structure.—H. H. S.

Building materials obtained by milling of certain rocks after fusion and artificial reduction of density. F. dit C. Ribbe. Fr. Pat. 417,925, Sept. 14, 1909.

Basalts, phonolites, dolerites, lavas and similar rocks are too hard and too heavy to use as building material under ordinary circumstances. They are therefore fused, and a vesicular structure is induced in them by blowing air through the fused mass or simply by pouring from one vessel to another. This process also diminishes both the hardness and the density.—H. H. S.

Plaster; Treatment of ——. C. P. and A. W. Chamberlain. Fr. Pat. 418,204, July 13, 1910.

The revivification of old plaster is effected by powdering and heating it for about three minutes.—H. H. S.

Concrete; Manufacture of very fluid ——. H. J. Harms, jun., and G. E. Small. Fr. Pat. 417,652, June 30, 1910. Under Int. Conv., July 10, 1909.

Cement, sand and rubble are caused to remain suspended in water by adding finely-divided plastic clay, the proportion being determined by aid of a hydrometer.—H. H. S.

Artificial stone from slag; Manufacture of ——. W. Schumacher, Osnabrück, Germany. U.S. Pat. 977,681, Dec. 6, 1910.

See Eng. Pat. 18,806 of 1905; this J., 1906, 1148.—T. F. B.

Building materials with basis of pyrites. C. F. Mendez. Fr. Pat. 417,737, May 31, 1910.

See Eng. Pat. 11,926 of 1910; this J., 1910, 1455.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron ores; Direct reduction of —— *in the electric furnace.* M. G. Arnou. Rev. de Metallurgie, 1910, **7**, 1190—1200.

Hæmatite, magnetite, and clay ironstone were reduced with either wood charcoal, coke or anthracite in an electric furnace capable of producing fifteen tons of metal. Finely powdered mineral was reduced as easily as an agglomerate or briquettes. The analyses of seven consecutive castings are given, and very closely approximate to one containing 0·08 per cent. of carbon, 0·10 of manganese, 0·02 of silicon, 0·02 of sulphur with traces of phosphorus, and although the mechanical and microscopical properties of the metal have not yet been fully investigated, the author states that the metal, in so far as tests have been applied to it, shows a perfect similarity to Swedish iron. The cost of production and the possible applications of the process are discussed. —A. H. C.

Briquettes; Melting of —— *of pig iron and turnings in the cupola.* A. Messerschmitt. Stahl u. Eisen, 1910, **30**, 2063—2075.

After mentioning some old methods, a complete account is given of recent methods employed by various firms of briquetting pig iron with iron scrap, turnings and filings, and their fusion in the cupola furnace. The influence of the sulphur and phosphorus content on the quality of the casting produced is discussed. The most advantageous form of briquette appears to be 140 mm. in diameter and 100 mm. high, compressed to a density of from 5·0 to 5·8. —A. H. C.

Nickel steel; Use of —— in bridge-building. F. Bohny. Ver. deutsch. Eisenhüttenleute, Düsseldorf, Dec. 4, 1910. Chem.-Zeit., 1910, **34**, 1359.

Experiments made in America in the direction of using special steels for bridge construction date back to 1903 (compare Waddell, this J., 1909, 985). In Germany the *Gutehoffnungshütte* first proposed the use of nickel steel for bridges in the autumn of 1908, and immediately gained the support of the authorities. The first work undertaken was a small railway bridge near Oberhausen, of 31·5 m. length between the supports: this bridge was constructed entirely of nickel steel. Nickel steel has also been used in the construction of a suspension ferry over the harbour entrance at the Imperial dockyard of Kiel, and of a covered foot-bridge over the Rhine-Herne canal, near Oberhausen. The *Gutehoffnungshütte* make a steel containing 2—2½ per cent. of nickel with a strength of 56—65 kilos. per sq. mm. In some cases the nickel may be partly replaced by the somewhat cheaper chromium.—A. S.

Copper and iron and their alloys; Corrosion of —— by water containing salt and air, and the oxidation of copper at high temperatures. W. P. Jorissen. Z. angew. Chem., 1910, **23**, 2305—2306.

(1) Analysis of a piece of "delta metal," corroded by sea-water, showed the presence of 41·1 per cent. of cuprous oxide and 52·7 per cent. of metallic copper; the zinc had practically disappeared. Copper which had been partially immersed for two years in sea-water or in a solution of sodium chloride of equal chlorine content also showed the presence of cuprous oxide, and the same was observed with distilled water. (2) Samples of iron which had become corroded underground or in water were found to contain ferrous and ferric oxides, and 14—45 per cent. of substances insoluble in hydrochloric acid (50 per cent. or more being carbon), showing that much of the iron had been dissolved away; the specific gravity of the corroded samples varied from 2·0 to 2·53. (3) Copper is converted by prolonged heating at a sufficiently high temperature, in a limited supply of air, into cuprous oxide, the layer of cupric oxide first formed being completely dissociated.—F. Sodn.

Tailing pulp; Classification of ——, prior to cyaniding. E. H. Johnson. J. Chem., Met. and Min. Soc., S. Africa, 1910, **11**, 157—163.

The method of treatment devised by Caldecott (J. Chem., Met. and Min. Soc., S. Africa, Aug. 1909) has been adopted on the East Rand Proprietary Mines. The plants comprise four 20 ft. sand filter tables, each with its complement of four primary cones (9 ft. by 8 ft.), and two washing cones (8 ft. by 5 ft.), and are capable of handling the sand from about 4000 tons of tailings per day, effecting a separation of about 50 per cent. of the pulp as a slime containing only about 2 per cent. of material coarser than 200-mesh. The sand, containing under 1 per cent. of slime (as determined by elutriation) is easily leachable, and is collected in vats full of solution by means of Butter's distributors, the solution overflowing at the periphery and returning to the launder carrying the sand from the filter tables. The solution of the gold takes place rapidly and without transfer or other means of disintegration or aeration of the deposited sand. Grading and chemical analyses have indicated that this method of classification effects the retention of the bulk of the pyrites in the sand; that the size separation is efficient, nearly all the less than 200-mesh product in the tailing pulp going to the slime plant, while 88 per cent. of the sand is more than 200-mesh; and that efficient extraction is dependent on the fineness of crushing and not on the elimination of pyrites. The essential feature of this system being the maintenance of a large, steady under-flow containing a minimum of moisture, its effectiveness is shown in the low slime content of the sand, and the low pyritic content of the slime. The slime sampling apparatus employed in connection with the determination of moisture in the product is described by R. E. Sawyer.—W. E. F. P.

Cyanide solution; Precipitation of gold from —— by carbon in lime. E. H. Croghan. J. Chem., Met. and Min. Soc., S. Africa, 1910, **11**, 156—157 (see this J., 1910, 957).

The author, while fully recognising the injurious effects (precipitation of gold) arising from the presence of carbon in lime, is of opinion that under Witwatersrand conditions (*i.e.*, using 3 lb. of lime per ton of ore) existing lime specifications are in many instances unduly restrictive, since carbon is present in Rand ore itself, as much as 0·22 per cent. having been found in some samples.
—W. E. F. P.

Cyanide; Destruction of ——. J. Moir and J. Gray. J. Chem., Met. and Min. Soc., S. Africa, 1910, **11**, 152—156.

Replying to the discussion on their paper (this J., 1910, 1061) the authors state that their work was mainly confined to the ferrous sulphate process, as they considered this to be the only one economically possible for the rapid destruction of cyanide. They are, however, quite in agreement with H. A. White (*loc. cit.*) as to the efficacy of alkaline permanganate and of formalin for the purpose, but are of opinion that the reaction in the latter case requires further explanation than that afforded by White's equation; the reaction with picrates is considered too slow for practical application. Attempts to reduce the proportion of iron employed in the ferrous sulphate process have resulted in the ratio Fe : 4KCN being found satisfactory. The relative sensitiveness (towards hydrocyanic acid gas in air) of the hydrocœrulignone, tolidine, dianisidine and benzidine reagents (this J., 1910, 723) has since been determined, with the following results:—(*a*) 1 *part of hydrocyanic acid in* 30,000 *of air.*—The reactions are instantaneous, except in the case of benzidine, with which about 2 seconds are required. (*b*) 1 *in* 200,000 *of air.*—The reactions with hydrocœrulignone and tolidine are practically instantaneous; that with dianisidine requires about 20 seconds, and that with benzidine about 2 minutes. (*c*) 1 *in* 500,000 *of air.*—Results similar to (*b*), but the reaction with dianisidine takes about a minute, and benzidine does not react definitely. (*d*) 1 *in* 1,000,000 *of air.*—Hydrocœrulignone requires about 3 seconds, tolidine about 6 seconds, and the others are unreliable. (*e*) 1 *in* 2,000,000 *air.*—Hydrocœrulignone reacts in 10 seconds, and tolidine doubtfully in 20 seconds. As the result of experiments upon a mouse, the authors conclude that the use of the test-papers underground gives a margin of at least ten times for persons exposed to the gaseous products arising from the cyanide-extracted gold-ore residues employed in stope filling.
—W. E. F. P.

German silver and similar alloys [containing copper, nickel, and zinc]; Analysis of ——. R. Korte. Z. angew. Chem., 1910, **23**, 2354—2356.

The following method is recommended as being both rapid and accurate. About 0·8 grm. of the alloy is dissolved in *aqua regia*, the solution evaporated to dryness, and the residue taken up with dilute hydrochloric acid. Copper is then precipitated as sulphide from the hot solution, and, after dissolving the precipitate in nitric acid (sp. gr. 1·2), separated electrolytically. The filtrate is evaporated to about 50 c.c., and the nickel determined by Grossmann's method (this J., 1907, 718, 1067), about 2 grms. of dicyanodiamidine sulphate in 20 c.c. of water being introduced, and then, after cooling the solution and making it strongly ammoniacal, a 30 per cent. solution of potassium hydroxide, being added, whilst stirring, until the colour changes to yellow. After standing for some hours (preferably over-night) the precipitate is filtered off, and the nickel present determined electrolytically (*loc. cit.*), or the precipitate is dried at 115° C. and weighed as the compound, $(C_2H_5N_4O)_2Ni$. The filtrate from the nickel is acidified with hydrochloric acid and then made up to 500 c.c., and the zinc determined by titrating 100 c.c. with a standard solution of potassium ferrocyanide, using ammonium molybdate as indicator (on a tile). The ferrocyanide solution is made by dissolving rather more than the calculated quantity (21·63 grms.) of the pure crystallised salt and 7 grms. of dry sodium sulphite in 1 litre of water, and standardised with a 1 per cent. hydrochloric acid solution of zinc, the titration being carried out in hot hydrochloric acid solution, each indicator test being made some seconds after adding the ferrocyanide, shaking meanwhile; the indicator is prepared by dissolving 9 grms. of ammonium molybdate in 1 litre of water. The small quantities of manganese and iron generally present in the alloys are determined as follows:—About 2 grms. of the alloy are dissolved in a little strong nitric acid, and, after adding about 20 c.c. of nitric acid (sp. gr. 1·48), the boiling solution is treated with solid potassium chlorate; the boiling is continued for 3—5 minutes, a little more potassium chlorate being added, and the mixture then diluted to 150 c.c. and quickly filtered. The separated manganese dioxide is washed with hot water, dissolved in strong hydrochloric acid, and the manganese again precipitated as peroxide by adding solid ammonium persulphate to the boiling (ammoniacal) solution. Solid ammonium chloride is then added to the nitric acid filtrate, which is boiled with an excess of ammonia; the precipitate thus formed is washed and dissolved in the smallest possible quantity of dilute hydrochloric acid, and then, after adding about 150 c.c. of warm water, a few drops of a 5 per cent. hydrochloric acid solution of cupric chloride and 15—20 c.c. of a 10 per cent. solution of sodium salicylate are introduced, and the solution titrated with standard thiosulphate until the violet colour is discharged, the thiosulphate solution being standardised with a solution of ferric chloride.—F. Sodn.

Tin ores: Notes on the occurrence and concentration of ——. C. F. Thomas. J. Chem., Met. and Min. Soc., S. Africa, 1910, **11**, 164—168.

The world's production of tin is practically all derived from cassiterite, the bulk of which is obtained from alluvial workings; but the proportion of mined cassiterite is rapidly increasing, the mineral occurring in lodes, fissures, beds, pipes, stockwerks, contacts and "gash-veins," usually in the vicinity of granite. Of the minerals commonly associated with cassiterite, the most important commercially are wolfram, mispickel, copper pyrites and other cupriferous minerals, such copper ores from the Cornish mines being frequently rich in silver; tin pyrites or bell-metal ore (a sulphide of tin, copper and iron) is also occasionally found, but never in sufficient quantity to constitute an ore of tin. In Cornwall the Dolcoath ore from the deep levels (3000 ft.) is extremely hard and tough, the cassiterite being very finely disseminated throughout. The concentrate obtained averages 64 to 66 per cent. of tin, is almost free from objectionable impurities, and, as sold, contains 7 to 9 per cent. of moisture. The ore of the Carn Brea, East Pool and South Crofty mines is generally associated with wolfram. In the Transvaal, no tin mines have yet attained a depth of 400 ft.; the ore occurs in pipes in the granite, but impregnations of finely-disseminated cassiterite occur also in the shales, etc., where the latter have been intersected by narrow fissure veins: and the author is of opinion that these deposits have resulted from the upward infiltration of mineralising solutions. Bolivian tin ores often contain a considerable proportion of antimony and wolfram. With regard to the concentration of mined cassiterite, the average extraction obtained does not—in the author's opinion—exceed 80 per cent. Sliming accounts for the greater part of the loss, the proportion of slimes produced generally decreasing as the speed of the stamps increases. As a preliminary to the consideration of concentration plant, systematic testing with the vanning-shovel is recommended, the latter affording, in expert hands, a higher extraction than that attainable in any existing plant. Sizing being unsatisfactory for fine-grained cassiterite, hydraulic classification becomes a necessity, and for this purpose clear water must be employed and regularity of speed must be maintained for each concentrator—a separate drive for the concentration plant being desirable. Magnetic separation of wolfram from cassiterite, although successful with the coarser concentrates, has been found most unsatisfactory with concentrated slime; and the author is of opinion that it may be advisable to treat the latter product by roasting with sodium carbonate. Modern practice in concentration is exemplified by notes and working data in connection with two plants, the first being that of the South Crofty Mine in Cornwall for the treatment of complex ore containing cassiterite, wolfram, arsenic and copper, and the second a plant erected in South Africa for the treatment of ore in which the cassiterite is very fine grained. In reporting it is urged that, unless the reduction of the ore is conducted at the mine, all values be stated in terms of concentrates, since the value of the unsmelted metal varies according to the class of concentrate containing it.—W. E. F. P.

Radium lode in South Australia. D. Mawson. Pharm. J., 1910, **85**, 804.

Radio-active mineral is reported from the Yudna Mutana district, in the vicinity of Mount Pitt and Mount Paynter. An extensive lode is stated to exist, containing carnotite and torbernite. The latter mineral, which is a hydrated uranium copper phosphate, is a rare radium-bearing mineral, and its occurrence is practically unique in Australasia. The only other single specimen, which is in the New South Wales geological collection, purports to have come from the cobalt mines at Carcoar.

Pilbarite: a new [radio-active] mineral from the Pilbara Goldfields, W.A. E. S. Simpson. Chem. News, 1910, **102**, 283—284.

Pilbarite is the name given to a canary-yellow, brittle, earthy, amorphous mineral, of hardness, 2·5—3, and specific gravity, 4·4—4·7, recently found in small quantities at Wodgina, Pilbara Goldfield. The mineral, which is essentially a hydrated silicate of lead, uranium, and thorium, of the formula,

$$PbO,UO_3,ThO_2,2SiO_2,2H_2O+2H_2O,$$

is readily decomposed by hydrochloric, nitric, or sulphuric acid and is strongly radio-active.—F. Sodn.

Analysis of substances containing titanium. Bornemann and Schirmeister. *See* XXIII.

Separation of oxygen by cold. Swinburne. *See* VII.

Separation of alumina and ferric oxide. Barbier. *See* XXIII.

Iron ores in Norway; Electric smelting of ——. Board of Trade J., Dec. 15, 1910. [T.R.]

The four principal undertakings in Norway interested in the electrical smelting or iron ore are as follows:—

1. *The Tinfos Paper Mills*, near Notodden, in Telemarken. The process used here is stated on the one hand to be the invention of Messrs. Blakstad, Holta and Co., of Skien, and on the other of Bie-Lorentzen. Experiments having been successful, modern works are to be erected for electric smelting in connection with foundries and steelworks, employing up to 15,000 h.p. of energy from an electric power station now under construction at Hitterdal Lake, where quays and warehouses are also to be built; 5,000 h.p. are to be available by next summer, and the remainder by 1912.

2. *The "Aktieselskabet Hardanger Elektriske Jern-og Staalverk,"* at Odda, Hardanger. Here is employed the Swedish Grönwall method. The power for these works will be derived from the Tysse Falls. The estimates for the equipment of the works provide for two blast furnaces of 2,900 h.p. (one of these to be held in reserve), one steel furnace of 800 h.p., and rolling mills with a producing capacity of 6,800 tons of billets. These last, it is calculated, could be delivered at British ports at a price of about £8 per ton.

3. *The "Nordenfjeldske Grubecompagni," Trondhjem.* This company intends to employ the Lyons method used at Heroult, California. The company intend next spring to erect, probably in the north of Norway, a furnace similar to the Heroult furnaces. The company is understood to have acquired large iron deposits and waterfalls in the Tromsö district, and it is thought that the furnace will be erected in that neighbourhood, if not near Trondhjem.

4. *The Ulefos Ironworks.* Here the methods and patents of the Tinfos Paper Mills and of Bie-Lorentzen, and also the patents of the Norwegian Electro Metal Company may be used. Satisfactory trials are said to have been made, and plant for a second electric smelting furnace has been ordered and is expected to be at work shortly. The electric furnace now being used is supplied with power from the Fehn Mines power station. In future, power is to be derived from a new reservoir near the works which is now approaching completion. The water power of the Eidsfos and the Vrangfos Falls has been acquired for the same purpose, and is being kept in reserve for future extensions of the works.

Mineral production of Western Australia. Board of Trade J., Dec. 29, 1910. [T.R.]

THE following table, showing the quantity and value of all the minerals produced in Western Australia during the years 1908 and 1909, is taken from the Report of the Department of Mines of that State for the year 1909, page 4 :—

		1908.		1909.	
		Quantity.	Value.	Quantity.	Value.
			£		£
Asbestos*	statute tons	40	1,600	3	154
Coal*	,,	175,248	75,694	214,302	90,965
Copper ore†	,,	2,503	29,272	6,959	59,541
Copper, ingot, matte, etc.†	,,	479	27,819	833	45,103
Gold‡	fine ozs.	1,647,911	6,999,882	1,595,269	6,776,274
Mica†		—	10	—	—
Silver†	fine ozs.	168,455	18,877	176,843	18,775
Silver lead ore†	statute tons	518	5,006	211	1,199
Tantalite†		—	400	—	—
Tin, ore and ingot†	statute tons	1,093	83,595	698	65,959
Wolfram†	,,	—	—	1	100
Zinc, spelter, etc.†	,,	11	98	19	244
Unenumerated†		—	2,750	—	735
Total values		—	7,245,003	—	7,059,052

* Raised. † Exported. ‡ Exported and minted.

PATENTS.

Iron from ores ; Method of recovering —— and preparing iron alloys. A. S. Ramage, Buffalo, N.Y., U.S.A. Eng. Pat. 27,806, Nov. 29, 1909.

SEE U.S. Pat. 949,004 of 1910 ; this J., 1910, 360. When treating titaniferous iron ores, the electrolytically deposited iron is melted in presence of a quantity of the reduced iron sponge containing titanium oxide.—T. F. B.

Alloys suitable for obtaining chilled castings. R. C. Totten, Pittsburgh, Pa., U.S.A. Eng. Pat. 30,428, Dec. 29, 1909.

IN order to obtain a casting metal, a coke or coal cast-iron containing a large proportion of graphitic carbon but only a very small proportion of combined carbon, is smelted in a cupola furnace with ferro-chrome and nickel, or an alloy of the two, employed in such proportions that the resulting metal will contain 0·35 to 0·70 per cent. of nickel and 0·15 to 0·30 of chromium. The ferro-chrome usually contains a large proportion of combined carbon, up to 10 or 12 per cent., which gives the necessary chilling qualities to the metal, whilst the nickel increases the strength and controls the depth of chill. A small proportion of chilling cast iron (iron containing 0·5 to 1·5 per cent. of combined carbon) may also be added and, in some cases, such as the manufacture of car-wheels, steel may be employed, the amount of the latter ranging from 5 to 30 per cent., according to the increased content of nickel.—C. A. W.

Phosphatic slag and iron ; Process of making ——. H. Mehner, Velten, Germany. U.S. Pat. 977,819, Dec. 6, 1910.

MATERIAL containing tri-calcium phosphate is heated with carbon for the production of tetra-calcium phosphate ; or with carbon and metallic iron (or metallic ores) to form tetra-calcium phosphate and a phosphorised metallic product.—W. E. F. P.

Steels ; Refining of liquid —— obtained in a furnace with non-electric heating. Soc. Anon. Electrométallurgique (Procédés P. Girod). Third Addition, dated June 15, 1910, to Fr. Pat. 402,758, May 6, 1909 (this J., 1910, 361 and 827).

IN the original specification and subsequent additions, it was stated that the oxidation of the liquid steel in the Thomas, Bessemer or Martin furnace before introduction into the electric furnace, should not be carried too far. It is now proposed to interrupt prematurely the oxidation in the first furnace in order to continue it afterwards in the electric furnace : in this way it will be made certain that the operation is not carried too far before the transference of the metal. The oxidation in the electric furnace being effected at a low temperature, the carbon, manganese, silicon and phosphorus will be oxidised more rapidly than the iron. Moreover, in the absence of an air-blast, which in the case of the Thomas furnace always contains water vapour, there will be a notable diminution in the production of occluded gases. It has been found also that the oxide of iron dissolved in the metal is very easily reduced at the low temperature by the carbon, silicon and manganese, the artificial cooling in the electric furnace facilitating the reaction, so that it is not only disadvantageous to eliminate these bodies entirely in the preliminary heating but it may even be desirable to add further quantities of them before transferring the metal. Finally, since it is well known that the presence of carbon and silicon diminishes the absorption of hydrogen by the iron, it is therefore possible to accelerate the disengagement of the occluded gases.—C. A. W.

Steel ; Process and arrangement for the electrical manufacture of ——. T. Levoz. Fr. Pat. 417,597, Sept. 4, 1909.

THE material to be treated is introduced in the liquid state, and submitted to the electric current at the surface only, where it is in contact with the slag. The negative electrodes are arranged in the lateral walls of the furnace, at the height of the normal level of the bath, and one or more positive electrodes are arranged above the level of the slag. The preliminary heating of the material may be accomplished by resistance, by means of electrodes disposed in the walls of the furnace, the size and number of these electrodes varying with the capacity of the furnace. —B. N.

Iron ores ; Treatment of —— in blast-furnaces. G. Grégoire. Fr. Pat. 417,272, June 18, 1910.

THE ore is smelted in blast-furnaces of diminished capacity, but hydrogen is employed in place of coke as a reducing agent. The charge consists of alternate layers of ore, flux and briquettes, the last being composed of a mixture of ore and wood charcoal agglomerated with wood tar. The hydrogen, introduced through tuyères at the lower part of the furnace, combines with the oxygen of the air and produces a very great heat at that point, the excess ascending to the upper part and effecting the reduction of the ore. The metal as it flows from the furnace is equal in quality to ordinary remelted cast iron. It is collected immediately in a series of pockets of refractory material provided with tuyères, and there exposed to a series of jets of hydrogen mixed with air or oxygen. By this means, provided the hydrogen be in excess, the sulphur and phosphorus are eliminated, and the degree of carbonisation can be regulated until a steel of the desired quality is obtained. The method is intended for the treatment of ores where there is a scarcity of coal and where sufficient water power is available for the electrolytic production of the hydrogen.—C. A. W.

Iron and steel or pieces formed of these metals; Partial cementation of ——. G. Daebritz. Fr. Pat. 418,029, July 7, 1910.

The object having received a protective coating of varnish upon those portions which are to be carbonised subsequently, the unvarnished parts are covered with a thin layer of copper, brass or nickel, which may be deposited electrolytically. Alternatively the thin layer may be deposited over the whole surface and subsequently partially removed, in any case a protection is formed on certain portions against the carbonising action in the subsequent cementation, and for this purpose copper is preferable. The object is finally introduced into a cementation box, surrounded with the carbonising material and heated to 900° C. in the ordinary manner.—C. A. W.

Homogeneous mixture of a pulverised material and a gas; Method of obtaining a —— *and apparatus therefor.* Soc. Anon. Métallurgique Proc. de Laval, Stockholm, Sweden. Eng. Pat. 26,938, Nov. 19, 1909. Under Int. Conv., Nov. 21, 1908.

The patent relates to metallurgical furnaces in which the charge, in a powdered condition, is introduced continuously, and is given a rapid, rotary motion within the furnace by a current of air or gas introduced tangentially. The finely divided solid materials composing the furnace charge are first intimately mixed and a small proportion of the gas is allowed to intermingle with the mixture. The mixture thus obtained is introduced either at right angles or tangentially into the current of reducing or oxidising gas to which a rotary motion has been previously imparted. The result is that the gas and solids are intimately mixed and receive a rotary motion before they enter the furnace.
—W. H. C.

Furnaces; Electrical induction ——. O. Mulacek and F. Hatlanek, Kladno, Bohemia. Eng. Pat. 674, Jan. 10, 1910. Under Int. Conv., March 2, 1909.

One or more specially rammed or pressed layers of fireproof material are placed close alongside the parts of the furnace in direct contact with the fluid metal, in order to prevent the latter in the secondary channel from breaking through the walls. The layers may be connected, below the level of the melting bath, with the part of the furnace in contact with the fluid metal, and the various layers may be separated from each other by paper or the like placed between them.—B. N.

Furnaces; Electrical induction ——. F. J. Brougham, London. From Poldihütte Tiegelguszstahlfabrik, Vienna. Eng. Pat. 5266, March 2, 1910.

The walls of the melting channel, containing the metal forming the secondary of the induction furnace, are formed by ramming or pressing fireproof material, so that the thickness is approximately the same all over, with the exception of the part adjacent to the pouring spout, or of any raised parts on the bottom for the purpose of heating the slag, or other arrangements necessitating local strengthening or weakening of the portion of the lining in contact with the metallic bath. One or more expansion spaces may be provided, which may be filled with readily compressible material, thus forming buffer layers allowing of a sufficient expansion of the whole of the lining of the inner smelting vessel. Alternative forms are described in which the inner wall of the secondary channel is less steep than the outer wall, and in which loosely arranged fireproof stones are placed at the sides of the part of the fireproof lining, which is in contact with the fluid metal. The joints of the fireproof stones may be filled with suitable fireproof material in the form of sand or fine powder.
—B. N.

Furnace; Electric ——. Soc. Anon. Electrométallurgique (Proc. P. Girod). Third Addition, dated June 24, 1910, to Fr. Pat. 350,524, Jan. 4, 1905 (this J., 1905, 739, 1179, and 1907, 535).

The metallic poles, sunk in the sole of the furnace, are placed at the extreme periphery of the sole, so as to remove them horizontally as far as possible from the upper electrodes.—B. N.

Alkali metals and alloys of alkali metals; Electrolytic manufacture of ——. G. W. Johnson, London. From R. J. McNitt, Niagara Falls, U.S.A. Eng. Pat. 20,519, Sept. 2, 1910.

Fused alkali chlorides are electrolysed in presence of a fused cathode metal, *e.g.*, lead, capable of alloying with the alkali metal produced, and an "exchange of temperature" is effected between the cathode and agents of other temperatures. The cathode is thus maintained at the most suitable temperature for the production of a good yield, without reference to the temperature of the electrolyte. For example the lead-sodium (or other similar) alloy may be decomposed in a distilling apparatus connected with the electrolytic cell, and the lead left behind in the still may be heated or cooled before returning it to the electrolytic cell.—B. N.

Metals and acid; Process and apparatus for the production by electrolysis of ——. J. Passama. Fr. Pat. 417,623, June 29, 1910.

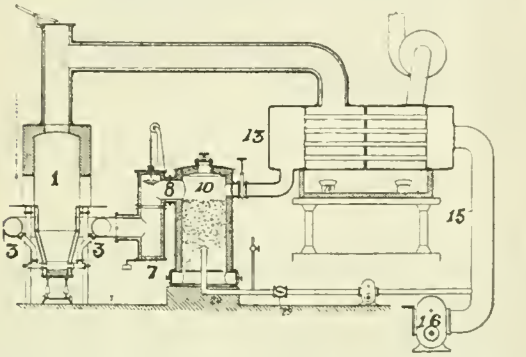
The outer electrolytic vessel is provided, at its interior surface, with carbon anodes completely surrounded by granular carbon, forming an enveloping mass at the base of which is arranged a tube pierced with holes, through which is passed sulphur dioxide gas. The mass of granular carbon surrounds a perforated cylinder covered by a strong sheet of asbestos or other diaphragm, at the interior of which is disposed the cathode, and the electrolyte is supplied at the top and interior of the cathode. The latter consists of a vertical metallic cylinder which is rotated, or it may be stationary, in which case the electrolyte is agitated so as to keep it in movement. With an electric current of low tension and high intensity, a rapid and economic extraction of the metal in the electrolyte, such as copper sulphate, is obtained, with deposits which are pure and compact. The granular carbon offers a resistance to the ascending sulphur dioxide, with the result that the gas is completely absorbed and converted into sulphuric acid, which may be again used for the lixiviation of the ore, at the same time preventing the attack of the anode by oxygen.—B. N.

Converter, and method of smelting and refining copper ores and compounds. R. Baggaley, Pittsburg, Pa. U.S. Pats. 977,922 and 977,996, Dec. 6, 1910.

(1). The converter is circular in horizontal cross-section, of relatively small depth and has an outer shell comprising a series of metal ribs, each with one or more water channels cast in it. The water supply to the different channels is under separate control, so that the cooling action may be regulated at any desired place. Except at the nose or spout, which is of solid metal, the converter is lined with basic refractory material. The apparatus is primarily intended for the purpose of dissolving ores in low-grade, corrosive matte. (2). The ore is submerged in a bath of molten matte through which air is then forced, resulting in the elimination of the silica, alumina and lime as slag. After removal of the latter, the low-grade matte is transferred to a converter, mixed with value-bearing silicious ore and then blown: silicate of iron slags are thus produced and air is forced into the bath until the residual oxidisable impurities are eliminated from the metal. The resulting blister copper is afterwards refined in the usual manner.—W. E. F. P.

Air [for furnaces]; Method and apparatus for heating ——. G. Westinghouse, Pittsburg, and A. M. Gow, Edgewood Park, Pa. U.S. Pats. 976,966 and 976,967, Nov. 29, 1910.

THE air, required for the blast of a furnace, 1, is delivered by the fan, 16, and the pipe, 15, into the regenerator, 13, where it is heated by means of a portion of the waste gases of the furnace. The heated air is thence passed into the top of a gas producer, 10, where a portion of its oxygen is employed in supporting the combustion of the producer gases; when, finally, the whole mixture containing the products of combustion and an excess of oxygen is swept through the outlet, 8, and the tuyères, 3, into the furnace, 1. The delivery of air to the producer through the pipe, 20, is made to depend upon the temperature of the gases supplied to the furnace, an electrical device connected with the valve, 29, being employed to that end. —C. A. W.



Zinc blende and other metalliferous constituents; Separation of —— from concentrated ores and slimes. E. J. Horwood. First Addition, dated June 24, 1910, to Fr. Pat. 399,272, Feb. 9, 1909 (this J., 1909, 942).

THE original specification related to the preliminary treatment of a mineral containing the three sulphides blende, pyrites and galena, in which the pyrites was transformed into iron oxide and the galena into lead sulphate whilst the blende remained unchanged, the subsequent separation being effected by a method of flotation or granulation. It is now found that when iron pyrites is present, the treatment which consisted in heating the ore to a temperature of 300° C. to 400° C. in a reverberatory furnace is more advantageous. In the absence of pyrites, however, the oxidation may be effected by the alternative method, the ore being digested with nitric and sulphuric acids.—C. A. W.

Ores; Extraction of metals from their ——. W. Hommel and H. T. Durant. Fr. Pat. 417,208, June 16, 1910. Under Int. Conv., Dec. 7, 1909.

THE method is more particularly applicable to the extraction of zinc and copper from their sulphide ores, but it can also be employed in the case of oxidised materials such as malachite. The roasted ore is mixed with water and introduced into a "solution column" where it is brought into contact with the sulphurous acid gases which have been passed from the roasting furnace through a cooling column. In this way a solution of zinc (or copper) bisulphite is obtained, the liquid being separated from the insoluble residue containing lead by decantation into a second vessel. It is thence pumped up into the cooling column and there submitted to the action of the hot gases proceeding from the roasting. By this means, the excess of sulphur dioxide is eliminated from the liquid with precipitation of zinc monosulphite (or, in the case of copper, the metal itself), whilst the hot gases are enriched in sulphurous acid and cooled by the descending stream of liquid. —C. A. W.

Copper, nickel or alloys of these metals; Welding of ——. W. Schieber. Fr. Pat. 417,446, June 21, 1910.

THE pieces of metal to be united are heated to the necessary temperature by means of the oxyhydrogen flame or the like, and a salt—preferably of the metal in question, such as copper nitrate—is applied in the form of a 50 per cent. solution to the welding surface. The heating is then continued by means of a reducing flame of hydrogen or water-gas, when the salt is reduced to metal which fills the line of weld. The escape of heat from the weld must be prevented as far as possible by providing the surfaces on which the pieces are supported with a covering of asbestos. Finally the joint is completed by forging in the ordinary manner. In the burner employed, the two gases are made to pass through separate inlet pipes provided with screens of wire gauze, layers of asbestos, and cylindrical blocks perforated with small holes. The two inlet pipes open into a common mixing chamber and are provided with branches, the outer ends of which are fitted with screw valves by which the mixture of the gases may be exactly regulated.—C. A. W.

Gold; Method of amalgamation permitting the complete extraction of even very finely divided —— from its ores. L. F. R. de Segovia. Fr. Pat. 417,751, June 3, 1910.

IN the extraction of gold by amalgamation, where the crushed ore mixed with water is brought into contact with mercury, it has been found that the very fine particles of metal show a tendency to float upon the surface of the water, or remain in suspension in the liquid, so that their amalgamation is rendered difficult. It is therefore proposed to add to the water a caustic alkali such as potash or ammonia, which not only cleans the fine particles and causes them to deposit, but, in addition, removes the suboxide formed on the surface of the mercury by its contact with the air.—C. A. W.

Roasting-furnace. E. W. Kauffmann. Ger. Pat. 227,621, May 28, 1909.

IN furnaces of the type having superposed hearths, with toothed arms moving over them, the teeth of successive arms on each hearth act in opposite directions and at a different angle, so that whilst they effect a rapid turning-over of the material, the latter is moved forward only slowly in a radial direction. In this way either a larger quantity of ore can be roasted in a given time with a given number of hearths, or for a given quantity of ore, the number of hearths can be reduced.—A. S.

Roasting furnaces. J. Ettlinger, Cologne, Germany. Eng. Pat. 14,823, June 20, 1910.

SEE Fr. Pat. 415,672 of 1910; this J., 1910, 1316.—T. F. B.

Metallurgical furnaces. L. A. Smallwood. Fr. Pat. 417,420, June 23, 1910. Under Int. Conv., June 24, 1909.

SEE Eng. Pat. 14,812 of 1909; this J., 1910, 958.—T. F. B.

Pyrophoric metal alloys. H. Beck. First Addition, dated June 27, 1910, to Fr. Pat. 414,057, Feb. 1, 1910. Under Int. Conv., July 1, 1909.

SEE Eng. Pat. 15,507 of 1910; this J., 1910, 1392.—T.F.B.

Alloys. A. L. Brooke and R. D. Mackintosh. Fr. Pat. 417,616, June 28, 1910.

SEE Eng. Pat. 15,384 of 1909; this J., 1910, 1015.—T. F. B.

Ores; Treatment of ——. E. B. Parnell. Fr. Pat. 417,277, June 18, 1910. Under Int. Conv., June 19, 1909.

SEE Eng. Pat. 14,372 of 1909; this J., 1910, 884.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Electric arc; Method for effecting the reaction of two substances in the ——. E. A. Salmon. Comptes rend., 1910, **151**, 1057—1058.

The apparatus includes a quartz tube, 3—4 cm. in diameter and 0·2 cm. in length, each end of which is fitted with a quartz stopper luted on to the tube with plaster. Each stopper is perforated with a hole 1·8 cm. in diameter, and carries a tubular electrode 1·7 cm. in diameter. The electrodes are held in position in the stoppers by asbestos sheeting, so that they may be readily shifted in the direction of their axes. The gas constituting one of the reacting substances is introduced through one of the tubular electrodes, and the reaction-products escape through the other. The author has effected a number of reactions with this apparatus, and amongst them, the direct combination of carbon and nitrogen. For this, tubular carbon electrodes were first heated in a current of chlorine and then in a current of carbon dioxide; the electrodes were then placed in the quartz tube, an electric current was passed between them, and, after about a quarter of an hour, a stream of dry nitrogen was passed into the apparatus, the electric current being continued. The reaction-products were passed into a dilute solution of potassium hydroxide; subsequent examination of the latter showed that it contained cyanide. The author has also succeeded in decomposing water by the action of copper; on introducing steam into the apparatus fitted with tubular copper electrodes, 10 c.c. of hydrogen, together with fused copper oxide, were obtained in a few minutes, the current-strength employed being 6 ampères.
—L. E.

Silver deposits from various electrolytes; Character of ——. J. S. Hughes and J. R. Withrow. J. Amer. Chem. Soc., 1910, **32**, 1571—1576.

In the authors' experiments, the dish cathode described previously (J. Amer. Chem. Soc., 1908, **30**, 381) was used, with an anode shaped as a spiral of 5 cm. diam. and held 2 cm. above the bottom of the dish so as to be nearly equidistant from all parts of the cathode. The quantity of electrolyte (125 c.c.) was such that there was an effective cathode surface of about 110 sq. cm. The electrolyte was not agitated. Quantitative experiments were made with electrolytes of nitric acid, ammonia and ammonium sulphate, ammonia and di-ammonium phosphate, ammonia and sodium pyrophosphate, nitric acid and ammonium acetate, and potassium cyanide. In all cases, with the exception of potassium cyanide, the deposits became spongy when a voltage of about 1·4 was exceeded. The conditions under which the most satisfactory results were obtained are shown in the following table:—

Silver present.	Electrolyte.		Current.		Temp.	Silver found.	Character of deposit.
	Reagent.	Amount.	Ampère.	Volts.			
grm.					° C.	grm.	
0·2505	HNO_3	4 c.c.	0·04—0·001	1·2—1·35	25	0·2503	Crystalline
0·2505	HNO_3	4 c.c.	0·03—0·001	1·1—1·4	25	0·2506	,,
0·2505	NH_4OH $(NH_4)_2SO_4$	25 c.c. 12 grms.	0·04—0·001	1·0—1·3	25	0·2504	Good, crystalline
0·2505	NH_4OH[*] $(NH_4)_2HPO_4$	— 10 grms.	0·07—0·002	1·0—1·7	60—70	0·2502	Crystalline
0·2505	NH_4OH $(NH_4)_2HPO_4$	3 c.c. 25 grms.	0·1—0·001	1·2—1·8	25	0·2508	,,
0·2505	NH_4OH $Na_4P_2O_7$	5 c.c. 5 grms.	0·05—0·002	1·2—1·9	25	0·2509	,,
0·2505	NH_4OH $Na_4P_2O_7$	10 c.c. 5 grms.	0·05—0·001	1·2—1·9	25	0·2506	,,
0·2505	HNO_3 $NH_4C_2H_3O_2$	5 c.c. 25 grms.	0·07—0·001	1·0—1·7	60	0·2506	Good, crystalline
0·2505	KCN	2 grms.	0·02—0·03	2·0—2·5	25	0·2506	White
0·2505	KCN	2 grms.	0·07	2·5—3·0	60	0·2507	White, good
0·2505	KCN	2 grms.	0·07	2·5	65—70	0·2504	White

[*] Sufficient to dissolve the precipitate first formed.
Note:—The nitric acid used was of sp. gr. 1·42, and the ammonia, sp. gr. 0·00.

Qualitative tests were also made with electrolytes of hydrofluosilicic acid, ammonia and perchloric acid, sulphuric acid, sulphuric acid and glycerol, ammonium thiocyanate, sodium hydroxide and ammonia, and potassium fluoride, and under certain conditions satisfactory, adherent, crystalline deposits were obtained with the two first mentioned.—A. S.

Patents.

Electric furnaces with triphase currents; Method of supplying ——. Soc. Anon. Electrométallurgique (Proc. P. Girod). Eng. Pat. 3421, Feb. 11, 1910. Under Int. Conv., Aug. 26, 1909.

The furnace is provided with two upper electrodes of different polarity, and a sole (hearth) electrode, the feeding being effected by two monophase transformers, the primaries of which are connected with the phases 1, 2, and 1, 3 respectively. The secondary terminals are connected, one with the lower electrodes, and the other with one or the other of the upper electrodes, with the terminals of the one inverted relatively to the terminals of the other, so as to increase the tension between the two upper electrodes or sets of electrodes.—B. N.

Furnace; Electric ——. F. A. J. FitzGerald, Niagara Falls, U.S.A. Eng. Pat. 11,718, May 11, 1910. Under Int. Conv., May 13, 1909.

It is known that, in an electric furnace, the electric energy is employed most efficiently when the load is approaching a maximum. To this end, a furnace may be provided with combined fuel and electric heating, so that, at the commencement, it can be raised to a relatively high temperature in the most efficient manner by means of a gaseous combustible, when, subsequently, the current may be switched on and the higher temperature attained by means of electrical energy. The furnace is provided with a cover and a melting chamber, the latter being composed of a number of refractory U-shaped sections provided with flanges which impinge upon the outer brickwork. These flanges contain a series of openings through which a continuous passage for the gases is provided. Above the melting chamber, but separated from it by a refractory plate of some such heat non-conducting material as carborundum, the carbon resistance for the electrical heating is placed. This resistance may consist of a number of carbon rods extended in a pile along the length of the furnace, a contact for the passage of the current being arranged at each end. In the working of the furnace, the gaseous fuel, introduced through a hole near the top, is carried over the resistance and thence into the melting chamber below, where it is mixed with a current of cold or heated air. The flame, sweeping over the charge, passes out at the end of the chamber through two holes at the side and is thence carried back through the outer space to the furnace outlet. By regulating the supply of air, the character of the flame may be controlled so that an oxidising, reducing or neutral atmosphere is produced in the melting chamber. At the conclusion, when the electric current is switched on, the inlet tubes for the gas and air are closed; but, in order to prevent as far as possible the loss of heat by conduction and radiation, a mixture of gas and air may be introduced through the original outlet hole and allowed to pass away through supplementary openings at the side.—C. A. W.

Furnace; Electric resistance —— with great concentration of energy and continuous working. V. Popp. Second Addition, dated May 6, 1910, to Fr. Pat. 409,244, Oct. 15, 1909 (this J., 1910, 766 and 1212).

The resister of granular material is insulated from the interior vessel, and in case of need from the walls of the furnace, by guard plates, the latter being either conductive, of lesser, equal, or greater resistance than the resister, or insulating. The plates, which may be either solid or perforated, are made of carbon combined with alumina, magnesia, lime and carborundum if they are to be conductive and play the part of a secondary resister, but if they are to be insulating in character, they are composed of refractory oxides containing alumina, bauxite, magnesia, and silica.—B. N.

Furnaces; Feeding of electric ——. A. Frantzen. Fr. Pat. 417,933, May 4, 1910. Under Int. Conv., May 5, 1909.

Several electric furnaces, or conductors with negative temperature coefficients, are fed from a common generator, in such a way that each furnace or conductor receives energy from a section of the generator, which, electrically, is independent of the other sections. Each furnace is connected with the generator in a manner so that the variations in intensity of the current in one section exercise an influence as feeble as possible on the fields of lines of force, and on the tension, of the other sections.—B. N.

Furnaces; Electric ——. A. Helfenstein, Vienna. Eng. Pat. 26,844, Nov. 18, 1909.

See Fr. Pat. 402,652 of 1909; this J., 1909, 1206.—T. F. B.

Metal wires or bands; Process for the production of electric insulating layers of oxide on ——. Specialfabrik f. Aluminium-Spulen und -Leitungen, Berlin. Eng. Pat. 2711, Feb. 3, 1910. Under Int. Conv., Feb. 5, 1909.

See Fr. Pat. 403,234 of 1909; this J., 1909, 1317.—T. F. B.

Electrodes for accumulators; Manufacture of ——. A. T. K. Estelle, Fliseryd, Sweden. Eng. Pat. 9964, April 23, 1910. Under Int. Conv., May 13, 1909.

See Fr. Pat. 414,713 of 1910; this J., 1910, 1212.—T. F. B.

Acidifying and neutralising wool and woollen fabrics by electrolysis. Fr. Pat. 417,847. *See* V.

Manufacture of chlorine and an alkali metal by electrolysis. Fr. Pat. 417,246. *See* VII.

XII.—FATS; OILS; WAXES.

Menhaden oil in cod liver oil; Detection of ——. A. W. Hoppenstedt. J. Amer. Leather Chem. Assoc., 1910, **12**, 553—557.

When menhaden oil is shaken with hydrochloric acid, it acquires a greenish colour, which is not given by any other oil. The test is carried out as follows:—5 c.c. of the oil are dissolved in 5 c.c. of acetone in a test-tube of about $\frac{5}{8}$ in. diameter, 1 c.c. of concentrated hydrochloric acid is added, and the whole shaken vigorously. 5 c.c. of petroleum ether are next added, and after mixing and allowing to separate, the colour of the acid layer is observed. With pure menhaden oil an intense bluish green is produced; with pure cod liver oil the layer assumes a yellow or brown colour, with no trace of green or blue. With a mixture of equal parts of menhaden oil and cod liver oil the green colour is apparent, but is partially masked by the brown colour. The green colour can be observed when the quantity of menhaden oil is not less than 20 per cent., but below that point the green colour is almost completely masked by the brown due to the cod oil.—J. R. B.

Elaïdin reaction; The ——. Preliminary communication. S. Fokin. J. Russ. Phys.-Chem. Ges., 1910, **42**, 1068—1073. Chem. Zentr., 1910, **2**, 1747.

In accordance with his view that the elaïdin reaction is caused by compounds such as sulphurous and nitrous acids, capable of existing in two modifications, the author finds that phosphorous acid, which can also exist in two forms, likewise produces the reaction. Oleic acid when heated with phosphorous acid yields a product melting at 28°—29° C. Hypophosphorous acid, phosphorus trichloride, tetranitromethane, and ethyl nitrite act in a similar manner. The author states that he has obtained a third modification of oleic acid by heating elaïdic acid with phosphorous acid for 30—40 hours at 180° C. The liquid acid thus obtained no longer gives the elaïdin reaction with phosphorous acid, but yields stearic acid when reduced with hydrogen in presence of platinum as catalyst.—A. S.

Soya beans and their utilisation. Honcamp. *See* XIXa.

Measurement of viscosity of lubricants and other liquids. Scarpa. *See* XXIII.

Patents.

Fats, oils, paraffin, etc.; Process for obtaining the solid constituents of ——. F. Winterstein and S. Nitsch. Ger. Pat. 226,137, Feb. 14, 1909.

The substance, at a temperature a little above its melting point, is mixed with water at a temperature just below its solidifying point. The portion of the fat which does not solidify is drawn off with the water, and the solid residue is treated again in a similar manner, until its solidifying point is raised to the desired extent. In carrying out the process, the melted substance may be passed through the inner, and the water through the outer, tube of a double jet, in order to effect intimate mixing of the two.—A. S.

Plastic compositions [from fats and oils]; Manufacture of ——. L. Lilienfeld. Fr. Pat. 417,392, June 23, 1910. Under Int. Conv., June 23, 1909.

Fats or fatty acids, or drying oils (especially tung oil or its fatty acids), or their derivatives, or esters of fatty acids with alcohols, are treated with amino- or hydroxy-derivatives of aromatic hydrocarbons (or with their transformation products), and with a suitable condensing agent, to obtain plastic products which may be used as rubber substitutes, in the manufacture of linoleum, etc. Products of greater elasticity and solubility may be obtained by carrying out the reaction in the presence of glycerin or its derivatives.—C. A. M.

Soap and similar materials liable to damage from extraneous moisture, or liable in themselves to lose moisture; Packages for ——. W. R. Ormandy, Warrington, and E. Higgins, Wallasey. Eng. Pat. 27,464, Nov. 25, 1909.

Conical or nearly cylindrical boxes of cardboard or wood are coated with a solution of pitch in a readily volatile solvent, which is then allowed to evaporate. If required, a further coating of the pitch (which must be incapable of injuriously affecting the goods) is applied to the closed package so as to seal it hermetically.—C. A. M.

Soap; Method and apparatus for the manufacture of ——. A. S. Grant. Fr. Pat. 417,547, June 27, 1910.

A soap containing a large proportion of glyceryl borate is obtained by first mixing the ingredients (caustic soda, fat and oil) in a converter before the introduction of the coarse materials containing the borate. The latter are subjected to a preliminary mixing in a machine and are then introduced in definite quantities at regular intervals into the converter. To effect more intimate admixture and more complete combination, the substances projected into the converter may be carried outwards by means of centrifugal force and the converter may be provided with a series of central stirring arms turning in one direction and with other arms outside these, turning in the opposite direction, whilst the heating may be effected by means of a steam jacket round the lower part. In another modification of the apparatus the coarsest ingredients are first mixed in a mixing machine and then driven by means of compressed air into a receptacle whence they are forced, also by compressed air, at definite intervals, into the converter, where the caustic soda, fat, and oil have already been stirred by the agitators.—C. A. M.

Waxes, fats, and oils; Process for extracting and refining ——. S. Wynberg. Fr. Pat. 418,044, July 8, 1910. Under Int. Conv., July 10, 1909.

See Eng. Pat. 16,148 of 1909: this J., 1910, 576.—T. F. B.

Manufacture of a new oiling product. Fr. Pats. 417,554 and 417,555. *See* VI.

Making borax, soap, soap powder, etc. less hygroscopic. Eng. Pat. 26,264. *See* VII.

Rubber substitute from soya-bean oil. Ger. Pat. 228,887. *See* XIV.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

White lead; Production of —— *by Wultze's method.* O. Wentzki. Z. angew. Chem., 1910, 23, 2253—2257.

Wultze's method of preparing white lead (this J., 1905, 892, 898) is now being employed by four German factories and gives a product identical with that produced by the chamber process. Finely divided lead (in the form of thread) is employed, and, with an apparatus of about 20 cb. m. capacity, 1200 kilos. of lead are dissolved in 4—5 hours, the precipitation of 1500 kilos. of white lead from the solution obtained being complete in 2—3 hours. The precipitation is interrupted when the solution becomes acid to litmus, and the lead acetate liquor remaining is then used for dissolving more lead, the process being continuous. A comparison of Wultze's process with the Dutch method and the German chamber process shows that, for a daily output of 5000 kilos., the reaction space required is respectively 40, 3240, and 2800 cb. m., the corresponding times necessary for completing the process by the two latter methods being 63 and 49 days. Wultze's method is also claimed to be superior from a hygienic point of view, on account of the fact that the material is dealt with largely by mechanical means.—F. Sodn.

Red lead; Physico-chemical and technical studies on —— *IV.* J. Milbauer. Chem.-Zeit., 1910, 34, 1341—1342. (See also this J., 1909, 1049; 1910, 282.)

The oxidation of technical lead oxide by means of atmospheric oxygen takes place very slowly, as is shown by the following results obtained with the products from the roasting furnace of an Austrian works:—After one hour's roasting the product contained 0·4 per cent. of Pb_3O_4; after 3 hours, 3·7; 5 hours, 3·7; 7 hours, 41·9; 9 hours, 56·8; 11 hours, 64·3; and after 25 hours, 83·6 per cent. In comparative experiments with technical litharge and with the so-called "nitrite litharge" obtained from the residues in the manufacture of nitrites, the oxygen was supplied under constant pressure and the temperature maintained within +2° of 460° C., as described in the previous communications (*loc. cit.*). The behaviour of technical litharge in a current of oxygen and of air is seen in the following results:—

Time. minutes.	In oxygen. Pb_3O_4	In air. Pb_3O_4	Time, minutes.	In oxygen. Pb_3O_4	In air. Pb_3O_4
	per cent.	per cent.		per cent.	per cent.
30	13·1	—	420	84·29	—
60	38·9	—	480	—	44·83
90	—	1·5	660	—	48·52
120	70·23	—	780	89·76	—
180	79·29	7·58	900	—	52·36
300	—	13·34	—	—	—

In the case of the "nitrite litharge" the oxidation was effected much more rapidly at 500° C., the same result being then obtained in one hour as after 15 hours in the case of ordinary litharge at 460° C. Hence the application of a temperature higher than the optimum appears to accelerate the speed of formation of red lead. The following results show that the "nitrite litharge" is preferable to technical litharge for the purpose. In each case the oxides were heated for three hours in a current of air in the experimental furnace previously described:—

Temperature. ° C.	Technical litharge yielded. Pb_3O_4	"Nitrite litharge" yielded. Pb_3O_4	Temperature.	Technical litharge yielded. Pb_3O_4	"Nitrite litharge" yielded. Pb_3O_4
	per cent.	per cent.		per cent.	per cent.
300	—	23·4	500	—	46·52
400	5·9	30·9	530	—	—
440	—	50·8	550	5·2	—
460	—	74·0	570	0·2	0·2
490	11·22	—	—	—	—

Preparations of different origin required different lengths of time to reach a certain state of equilibrium when heated in a current of oxygen under constant conditions, as is shown by the following results:—Pure lead oxide (PbO), 16 hours; PbO from lead carbonate, 3 hours; PbO from PbO_2, 4 hours; technical litharge, 13 hours; chemically pure lead oxide (PbO), 2½ hours; and "nitrite litharge," 6 hours. Experiments upon "nitrite litharge" the particles of which were separated into four grades of different size showed that the speed of oxidation was not affected by this factor. Partial pressure of oxygen plays a part in the reaction; as may be seen in the following results of experiments in which technical litharge was heated for 3 hours at 450° C. in mixtures of air with varying proportions of oxygen:—With 20 per cent. of oxygen the product contained 7·4 per cent. of red lead; with 40 per cent., 25·88 of red lead; with 60 per cent., 39·60 per cent.; with 80 per cent., 61·48 per cent.; and with 100 per cent., 79·80 per cent. of red lead. Under no conditions was it found possible in these experiments to obtain a product containing 100 per cent. of red lead. The technical litharge used contained 93·0 per cent. of lead monoxide; 6·4 per cent. of lead; 0·2 per cent. of red lead; 0·23 per cent. of carbon dioxide and 0·03 per cent. of insoluble residue. The "nitrite litharge" had the following composition:—Lead monoxide, 93·52; red lead, 5·96; carbon dioxide, 0·21; nitric acid (N_2O_5),0·12; insoluble residue, 0·12 per cent., with traces of silver oxide, iron oxide, lime and sodium oxide.—C. A. M.

Rosin substitutes. P. Klemm. Chem.-Zeit., 1910, **34**, 1353.

During the past year no important advance has been made towards the discovery of substitutes for rosin. Most of the proposals relate not to substitutes, but to mixtures of ordinary rosin with colloids. The author has examined a sample of liquid oil-resin obtained as a by-product from sulphate wood pulp mills, which is capable of serving as a partial substitute for colophony. Palm resin is not saponifiable but can be emulsified in soap solution; it might find an application in the sizing of wrapping papers. A readily saponifiable resin obtained from *Daniella thurifera*, of the family of *Cæsalpinaceæ*, would appear to be capable of future development; it is obtained from Togo (this J., 1908, 1129).—J. F. B.

Patents.

Pigments; Method of preparing ——. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro-Metallurgical Co., New York. U.S. Pat. 976,337, Nov. 22, 1910.

Refractory bodies capable of yielding pigments when heated in contact with a gas, are finely ground up and heated in presence of that gas, the supply of the latter and the temperature being regulated according to the colour required.—C. A. M.

Zinc sulphide unaffected by light, and product prepared therefrom; Manufacture of ——. H. W. de Stucklé. Fr. Pat. 418,124, July 11, 1910. Under Int. Conv., Sept. 6, 1909.

The method of partial dehydration claimed in Fr. Pat. 386,061 of 1908 (this J., 1908, 512) gives a less stable product than one that has been completely dehydrated. The yellow discolouration that takes place on heating zinc sulphide above 250° C. to remove the whole of the moisture has been found to be due to the presence of oxysulphide, and may be obviated: (*a*) by heating the zinc oxysulphide precipitated from alkaline or alkaline-earth solutions to about 155° C. under pressure in the presence of a slight excess of ammonium hydrosulphide; (*b*) by treating the precipitate before dehydration with hydrogen sulphide in the presence of hydrofluoric or hydrochloric acid; (*c*) by mixing the precipitate with sulphur and an alkali silicofluoride. The zinc oxysulphide is thus converted into zinc sulphide, which may be heated to incandescence without turning yellow.—C. A. M.

Floor coverings, insulating materials and the like; Production of preparations for use in the manufacture of ——. H. Ingle, Kirkcaldy. Eng. Pat. 1021, Jan. 14, 1910.

A mixture of linseed oil, rosin or resinous pitch, with a suitable proportion of a non-drying or semi-drying oil to counteract the brittleness of the oxidised rosin or resinous compound, is oxidised in the usual way, to obtain a linoleum cement, etc., to which, if desired, further quantities of rosin, gum, etc., may be added.—C. A M.

Lakes [from azo dyestuffs]; Manufacture of colouring matter ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 7922, April 1, 1910.

See Addition of April 1, 1910, to Fr. Pat. 297,330 of 1900; this J., 1910, 1215.—T. F. B.

Lakes; Process for making greenish-blue ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 418,039, July 7, 1910. Under Int. Conv., July 27, 1909.

See Ger. Pat. 224,442 of 1909; this J., 1910, 1120.—T. F.B.

Production of carbon black together with combustible gas. U.S. Pat., 977,000. *See* IIa.

Cellulose esters [; Solvent for ——]. Fr. Pat. 417,319. *See* V.

Plastic compositions [from fats and oils]. Fr. Pat. 417,392. *See* XII.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber industry; Use of cold in the ——. J. Boutaric. Internat. Low Temperature Congress, Vienna, 1910. Z. angew. Chem., 1910, 23, 2271.

Cooling arrangements are employed in the freezing of the rubber before cutting the blocks into sheets, and in the recovery of the naphtha. The process has thus been made independent of the external temperature.—F. Sodn.

Patents.

Indiarubber; Method of purifying vulcanised ——. P. J. Leemans, Vieux-Turnhout-lez-Turnhout, Belgium. Eng. Pat., 16,456, July 9, 1910.

The waste rubber is dissolved in terpinolene and (preferably) treated with a solvent for sulphur, after which rubber substitutes or filling materials are removed by treating the solution with a dilute solution of soda, and the rubber itself precipitated by means of alcohol, acetone, etc., and purified by dissolving it in one of the usual solvents and reprecipitating it.—C. A. M.

β-γ-Dimethyl-α-γ-butadiene; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 417,275, June 18, 1910. Under Int. Conv., Feb. 11, 1910.

Pinacone and pinacoline can be converted into β-γ-dimethyl-α-γ-butadiene by heating in presence of catalytic dehydrating agents (*e.g.*, alumina). By passing the vapours of pinacone or pinacoline over fragments of alumina heated to 400° C., yields of 70 per cent. of the theoretical yield of the dimethylbutadiene, of b. pt. 69° C., were obtained.—T. F. B.

Caoutchouc; Process for producing substances having the properties of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 417,768, June 11, 1910. Under Int. Conv., April 16 and 26, 1910.

Substances possessing all the properties of natural caoutchouc are obtained when β-γ-dimethyl-α-γ-butadiene (see preceding abstract) is heated alone, or preferably in presence of some indifferent liquid, such as water or a solution of common salt. The same result is obtained by effecting the polymerisation by means of alkali hydroxides or carbonates, alkaline-earth hydroxides, potassium cyanide, etc., in solution or suspension in water or diluted alcohol. For example, equal weights of the dimethylbutadiene and water are heated for 60 hours in a closed vessel at 100° C., and the unpolymerised substance is removed by a current of steam; the residue consists of a white, elastic mass, which is precipitated by alcohol from its solutions in benzene.—T. F. B.

Rubber substitute from soya-bean oil; Process for preparing a ——. F. Gössel and A. Sauer. Ger. Pat. 228,887, June 10, 1909.

Soya bean oil (100 parts) is mixed with nitric acid (30—50 parts) of sp. gr. 1·14 to 1·4, and the emulsion is heated to 75°—100° C.; after a short time a reaction commences, and the temperature is raised to 130° C. At the end of the reaction (in which no nitration occurs), the homogeneous, frothy mass is washed with cold water and treated with a 5 per cent. aqueous solution of ammonia (200 parts) until the product has dissolved: this treatment may with advantage be at a temperature of 75°—150° C., and preferably under pressure. The solution is now made neutral or slightly acid by addition of dilute acid, and the precipitated mass washed with water until the washings are colourless. The water is then removed from the product by pressure, and the mass heated at 150° C. until it can be mechanically worked in the usual manner. A tough, elastic substance resembling rubber is obtained in this way, which can be vulcanised by means of sulphur if desired.—T. F. B.

Plastic compositions [from fats and oils]. Fr. Pat. 417,392. *See* XII.

Waterproofing leather [with rubber]. Eng. Pat. 27,583. *See* XV.

XV.—LEATHER; BONE; HORN; GLUE.

Acidity of one-bath chrome liquors; Method for the determination of the ——. M. Bateson. Leather, 1910, 2, 263.

Ammonia is added to 50 c.c. of the chrome liquor (containing 0·5—1·0 per cent. of chromic oxide) in a 100 c.c.

flask until phenolphthalein is reddened. The liquor is made up to the mark and the chromium hydroxide filtered off. 10 c.c. of neutral formaldehyde solution (40 per cent.) are added to 50 c.c. of the filtrate and the solution titrated with $N/2$ caustic soda till a pink colour is obtained. Each c.c. of $N/2$ caustic soda is equivalent to 0·024 grm. of SO_4 or 0·01775 grm. of Cl and hence the amount of acid in the original chrome liquor can be calculated and, the percentage of chromium being known, its basicity. Good agreement is obtained by this method with that of Procter and McCandlish (this J., 1907, 458). Old chrome liquors show an acidity, by this method, higher than the correct value owing to the acid compounds produced by the addition of formaldehyde to the amino-acids produced by the hydrolysis of hide substance. The presence of ammonium salts will also cause high results to be obtained.—D. J. L.

Leather; Extraction of —— by various solvents. G. A. Riker. J. Amer. Leather Chem. Assoc., 1910, 12, 539—545.

The present American methods for the extraction of the water-soluble matter, are found not to give concordant results. This is due to the fact that in the case of water extraction there is no definite end point, and that at a temperature of 55° C. to 60° C., after the first or second extraction, the leather coagulates to a sticky mass and decomposes. The author finds that 95 per cent. alcohol gives better results than water. Sugars, Epsom salts (magnesium sulphate) and combined tannin are not dissolved by 95 per cent. alcohol, and the end point is definite, thus enabling duplicate tests to agree. 15 grms. of the ground fat-free leather are placed in an S. and S. thimble and extracted with 95 per cent. alcohol in a Soxhlet for 8 hours. 250 c.c. of water are now added to the extract and the whole placed on a steam-bath to evaporate the alcohol. The solution is made up to 1000 c.c. and analysed according to the official method of the Amer. Leather Chem. Assoc. The disadvantage of the method is that a further water extraction must be made for the estimation of sugars and soluble sulphates, but the author claims that is useful because the soluble extracted material will contain nothing which was not present in the tanning material used to tan the leather, and thus it is possible to distinguish between added and natural non-tannins.—J. R. B.

Leather industry; Employment of low temperatures in the ——. W. Eitner. Internat. Low Temperature Congress, Vienna, 1910. Z. angew. Chem., 1910, 23, 2268—2269.

Although temperatures below zero are harmful, the cooling of hides, before preservation with salt, and storage of the salted hides at temperatures below 10° C. is advantageous. Unhairing by the sweating process is also best regulated by means of artificial cooling.—F. Sodn.

Gelatin; Methylation of ——. Z. H. Skraup and B. Böttcher. Monats. Chem., 1910, 31, 1035—1050.

By the action of methyl iodide on gelatin, it was found that methoxyl groups entered the molecule, and also that methyl groups attached themselves directly to the nitrogen. On hydrolysing the methyl derivative no lysine, and only small proportions of histidine and arginine were found; amongst the other products were glycocoll in greater amount than from the original gelatin, alanine, leucine, pyrrolidine-carboxylic acid and phenylalanine. In these respects gelatin and casein behave similarly; but whilst the hydrolysis of methyl-casein yields glutamic acid in quantity as great as from the original casein, the hydrolysis of methyl-gelatin yields practically none. The reactions of methyl-gelatin are similar to those of gelatin: the biuret reaction, and the reactions with α-naphthol and with thymol, are identical in both cases, but in the xanthoprotein test methyl-gelatin gives a brighter yellow colour and a sharper change with ammonia to red than does gelatin.—J. T. D.

Evaporation and utilisation of sulphite wood pulp waste lyes for tanning. Kumpfmiller. *See* V.

Patents.

Tanning products from vegetable materials; Batteries for the extraction and concentration of ——. C. Bourdon. First Addition, dated July 5, 1910, to Fr. Pat. 407,504, Oct. 1, 1909 (this J., 1910, 504).

The extraction vessel is connected with a battery of concentration vessels, each of which can be filled with liquor independently of the others, the extractor thus being worked continuously and discharged into one or other of the evaporators when they have finished the concentration of the previous charge. The concentration vats consist of vessels completely closed and heated by means of low-pressure or exhaust steam through a coil, the temperature thus being comparatively low.—D. J. L.

Waterproofing leather [with rubber]; Process for ——. E. Lapisse, Arcueil, France. Eng. Pat. 27,583, Nov. 26, 1909.

Leather, previously freed from grease if necessary by a treatment with boiling carbon tetrachloride, is placed in a closed vessel in which a vacuum is then produced in order to remove all the air from the pores of the leather. A hot solution of rubber to which a small proportion of tar has been added is then run into the vessel, and readily penetrates into the material. The impregnated leather is afterwards dried and vulcanised. Excellent penetration is obtainable with a solution containing two per cent. of tar on the weight of the rubber. If desired the tar can be subsequently removed from the leather by brushing it with benzine.—P. F. C.

Grease for rendering leather impermeable; Method of preparation of a ——. F. Fölsch. Fr. Pat. 417,810, July 2, 1910.

A mixture of yellow wax, hard paraffin and solution of Para rubber is added to vaseline oil which has been submitted to prolonged boiling.—D. J. L.

Leather, especially boots; Process for waterproofing ——. F. Fölsch. Fr. Pat. 417,811, July 2, 1910.

A mixture of equal parts of yellow wax, ceresin and paraffin is melted together or dissolved in ether, petroleum, or benzene, and applied to the leather or boot. After solidification it is caused to penetrate the leather by treatment with a hot iron. A sole, thus treated, may be inserted between the inner and outer soles of the boot.—D. J. L.

Chrome sole-leather; Method of manufacture of impermeable and non-slipping ——. A. Wigand. Fr. Pat. 418,162, July 12, 1910. Under Int. Conv., Oct. 8, 1909.

Chrome-tanned leather is impregnated at high temperatures with hydrocarbons or fatty matters and resins or resinous materials, and then treated with aqueous solutions of the acid salts of aluminium, manganese, chromium, iron or nickel, or of aluminium or chrome alum.—D. J. L.

Tannic extracts; Process for making ——. Nitritfabrik A.-G. First Addition, dated June 20, 1910, to Fr. Pat. 405,110, July 15, 1909.

See Eng. Pat. 14,861 of 1910; this J., 1910, 1322.—T. F. B.

Calcium or barium salts of fatty acids from glue boiler residues; Process for obtaining ——. G. Napp, Rolsdorf-Düren, Germany. Eng. Pat. 7734, March 30, 1910.

See Fr. Pat. 413,509 of 1910; this J., 1910, 1122.—T. F. B.

Gelatinous or colloidal liquids or products; Process and apparatus for clarifying and decolorising ——. J. H. Utley. First Addition, dated June 14, 1910, to Fr. Pat. 410,111, Dec. 7, 1909.

See U.S. Pat. 961,180 of 1910; this J., 1910, 892.—T. F. B.

Grease and glue from bones; Process for obtaining —— and apparatus therefor. A. Meiro. Fr. Pat. 417,336, Aug. 27, 1909.

See Eng. Pat. 18,468 of 1909; this J., 1910, 1213.—T.F.B.

Thermoplastic [albuminoid] compounds and process for producing them. B. B. Goldsmith. Fr. Pat. 418,060, July 8, 1910.

See Eng. Pat. 412 of 1909 and U.S. Pat. 965,137; this J., 1910, 227 and 1025.—T. F. B.

XVI.—SOILS; FERTILISERS.

Soil humus; Some acid constituents of ——. O. Schreiner and E. C. Shorey. J. Amer. Chem. Soc., 1910, **32**, 1674—1680.

The isolation of picoline-carboxylic acid, dihydroxystearic acid, and agroceric acid from soil has been previously described (this J., 1908, 912, 1075; also U.S. Dept. Agric., Bull. No. 53, 1909). A sample of Elkton silt loam soil from Maryland was treated with 2 per cent. sodium hydroxide solution, and the dark-coloured extract acidified with sulphuric acid. The brown flocculent precipitate was filtered off, washed, and treated with boiling 95 per cent. alcohol. The solution was evaporated to expel alcohol, water being added to keep the volume constant, and the precipitate thus produced was filtered off, washed, and dried. From the brown substance thus obtained, a compound was isolated by extraction with petroleum ether, and after purifying by repeated crystallisation from alcohol, was identified as α-monohydroxystearic acid, $CH_3(CH_2)_6CH.OH(CH_2)_9COOH$, m.pt. 84°—85° C. From the alcoholic mother-liquor by precipitation with lead acetate, and treatment of the precipitate with hydrogen sulphide, a substance was obtained, which after purification was found to be identical with the paraffinic acid, $C_{24}H_{48}O_2$, m.pt. 45°—48° C., prepared by Pouchet (Bull. Soc. Chim., 1875, **23**, 111) by the action of fuming nitric acid on paraffin. From a peat soil containing 27 per cent. of organic carbon, it was found possible both by distillation and by extraction with alcohol, to isolate lignoceric acid, $C_{24}H_{48}O_2$, m.pt. 80°—81° C., first obtained by Hell and Hermanns (Ber., 1880, **13**, 1713) from the solid residue of beechwood tar, and which occurs as a glyceride in peanut (arachis) oil (Kreiling, Ber., 1888, **21**, 880). The probable origin of these acid constituents of soils is discussed.—A. S.

Soil constituent [dihydroxystearic acid]; Some effects of a harmful organic ——. O. Schreiner and J. J. Skinner. U.S. Dept. Agric., Bureau of Soils, Bull. No. 70, 1910. Pp. 98.

Dihydroxystearic acid, an organic constituent of the soil, hinders the growth of wheat plants when it is present in pure aqueous solution. It is also harmful in presence of nutrient salts, irrespective of the ratio of the valuable elements of these, *viz.*, phosphoric acid, ammonia, and potash. It is, however, least harmful when the ratio of the fertiliser elements is that most favourable to growth and most harmful when this ratio is that least suited for plant growth. In particular it is least harmful in presence of nitrogenous fertilisers. The presence of dihydroxystearic acid causes less phosphate and potash to be removed from solution, and it also modifies both the amount and ratio of the three fertiliser elements removed. Towards the plant it has the additional effect of darkening the root tips, stunting root development, causing enlarged root ends, and strongly inhibiting the oxidising power of the roots. The fertilisers which tend to increase root oxidation are those which best combat the poison. A study of the relationship between plant growth and fertiliser action showed that the strongest growth occurred when all three nutrient elements were present and was best in mixtures containing from 10—30 per cent. of phosphate, from 30—60 per cent. of nitrate, and from 30—60 per cent. of potash. Solutions containing only one constituent gave the least growth, those with three constituents the most. The greatest growth occurred when the solutions suffered the least change in ratio as the materials were removed, although these showed the greatest change in concentration. There is a tendency of the plant to remove from any solution nutrients in the ratio corresponding to greatest growth, but it is hindered in doing so when the solution is unbalanced. Such solutions were most altered during growth. The more any one constituent is present the more it is taken up by the plant, though it is not used economically.—E. F. A.

Plants; Influence of various volatile substances on higher ——. H. Coupin. Comptes rend., 1910, **151**, 1066—1067.

Wheat grains were steeped in water for 24 hours, and then allowed to germinate (*e.g.*, in wet sawdust) until the aerial part of the plant was about 2 cm. in length. The young plants, beside the volatile substance, were then placed under bell-jars of 3 litres capacity, and kept under observation for a fortnight. On the basis of his investigations, the author groups the substances examined, as follows:—1. *The young plants are killed at once.*—Acetone, acetic, hydrochloric, formic, and sulphurous acids, amyl, ethyl, and methyl alcohols, benzaldehyde, ammonia, benzene, bromine, bromoform, chloroform, ether, ammonium bisulphide, carbon bisulphide, carbon tetrachloride. 2. *The young plants are killed after having grown very slightly.*—The essential oils of thyme, wild thyme, and eucalyptus, petroleum ether, nitrobenzene, toluene, xylene. 3. *The young plants are killed after having grown considerably.*—Formaldehyde, chlorine, turpentine oil, rosemary oil, furfural, iodine, menthol, petroleum. 4. *The young plants are not killed, but their growth is diminished.*—Essential oils of citronella and lavender, mineral oil, thymol. 5. *The young plants are not affected.*—Phenol, camphor, o-cresol, creosote, essential oils of cloves and patchouli, gas-tar, mercury, naphthalene.—Further experiments have shown that most of the volatile substances are more harmful to the very young plant than to the plant when its aerial part has attained a length of 2 cm., and that the volatile substances are not always equally toxic towards different plants.—L. E.

Kainite and carnallite; Protective action of —— against frost. E. Grohmann. Fühlings landwirtsch. Zeit., 1910, 341. Biedermann's Zentr., 1910, **39**, 767—769.

Boxes of sand containing 5 per cent. of water were manured on the surface with increasing quantities of kainite or carnallite and exposed throughout the winter. The temperature was determined by thermometers placed 4 cm. deep in the sand so that the bulbs were covered completely. It was found that the potassium salts prevent the penetration of the frost into the ground, since they quickly absorb moisture from the soil and so keep the surface moister. Large quantities of the potassium salts are only effective during the first and second frosts; subsequently a crust is formed, and the frost penetrates more deeply than with sand alone. In no case did any hoar frost form. Since frost penetrates most easily into sand, it is to be expected that the potassium salts would be even more effective in a more binding soil.—E. F. A.

Ammonium sulphate; Fertilising power of —— with the addition of sodium chloride. B. Schulze. Mitt. deuts. Landw. Ges., 1910, 452—458. Biedermann's Zentr., 1910, **39**, 731—733.

A comparison of the manurial value of sodium nitrate and of ammonium sulphate with and without the addition of common salt, made with a variety of crops showed that ammonium sulphate alone is irregular in its action, but on the average it is about 85 per cent. as effective as sodium nitrate. When salt is added, corresponding in amount to the sodium of the nitrate, the combined manure is often more valuable than nitrate.—E. F. A.

Insecticidal treatments in viticulture. L. Moreau and E. Vinet. Comptes rend., 1910, **151**, 1068—1070. (See this J., 1910, 514.)

The authors have investigated the proportion of lead arsenate retained by the grapes, 1, after one and two treatments (on May 31 and June 14, respectively, both dates being prior to the flowering stage) as a preventive from the first generation of *Cochylis*; 2, after a third treatment (on Aug. 6, some time after the flowering stage) as a preventive from the second generation of this insect. The amount of insecticide retained by the grapes, as compared with the quantity employed, is very small after the first treatment (less than 1 per cent. in the authors' experiment). Owing to the development of the grape, the proportion retained after the second treatment is larger; the second treatment is necessary, and the more so because in the climate of Western France, it often happens that the development of the larvæ of *Cochylis* does not take place simultaneously. It is shown also that the amount of insecticide retained by the grapes after the third treatment is only about one-third of that retained by the stalks of the vine.—L. E.

Lead arsenate in viticulture, and the consumption of fresh and dried grapes. L. Moreau and E. Vinet. Comptes rend., 1910, **151**, 1147—1148. (See this J., 1910, 514, and preceding abstract.)

The grapes were treated with insecticide (200 grms. of sodium arsenate and 600 grms. of lead acetate per hectolitre) on May 31, and again with insecticide (of 50 per cent. greater concentration) on June 14 and Aug. 6. The authors show that if the grapes are treated before the flowering stage (*i.e.*, on May 31 and June 14), only a small quantity of lead arsenate is found on the grapes on Aug. 6, and none at the time of gathering (Oct. 15). If, however, the grapes are treated with insecticide after the flowering stage (*i.e.*, on Aug. 6), some of the poison (*e.g.*, 0·4 mgrm. per 100 grms. of grapes) is left on the grapes at the time of gathering; hence it would be dangerous to eat grapes that had been treated with insecticide after the flowering stage. If, in spite of the fact that the insecticide has not been used after the flowering stage, traces of lead arsenate are found on the dried grapes, the presence of the poison must be due to contact of the grapes with the stalks during handling (especially in packing).—L. E.

Lime-sulphur-salt wash and its substitutes. J. K. Haywood. U.S. Dept. Agric., Bureau of Chemistry, Bull. No. 101, 1907. Pp. 29.

A close study has been made of the composition of the lime-sulphur-salt wash and its substitutes. The wash is prepared by boiling together 30 lb. of lime, 20 lb. of sulphur, 15 lb. of salt, and 60 galls. of water in a closed enamel boiler. To get a maximum amount of sulphur in solution 45—60 minutes' boiling is required: more prolonged boiling increases the thiosulphates and also the combined sulphates and sulphites. The finished wash contains comparatively large quantities of pentasulphide and thiosulphate and extremely small quantities of sulphates and sulphites. The salt has practically no influence on the composition of the wash, so far as the sulphur compounds are concerned. The time of boiling necessary to dissolve all the sulphur is not altered by a slight change in formula: to obtain at a minimum cost a wash with the maximum amount of sulphur, 50 galls. of water, 20—22·5 lb. of lime and 22·5 lb. of sulphur should be used. There is no difference in washes prepared with flowers of sulphur and flour sulphur, but crystallised sulphur even when ground to a fine powder dissolves more slowly. The wash sprayed upon trees in a dry climate undergoes the following changes. First, the excess of lime loosens the scales from the trees and exposes insects; the pentasulphide on decomposing deposits finely divided sulphur having insecticidal value. Next, thiosulphate decomposes and sets free sulphite and more sulphur. In a wet climate, thiosulphate is washed away and the free sulphur remaining on the tree is the only compound having insecticidal properties. The lime-sulphur-soda wash contains a little more sulphur than when either lime or soda are omitted and the sulphur acids are present partly as sodium salts: it is advisable to mix the ingredients in the order sulphur, caustic soda, lime. It decomposes more slowly than the lime-sulphur-salt wash. A new wash is suggested containing water, 50 galls.; powdered sulphur, 19 lb.; caustic soda, 10 lb.—E. F. A.

Patents.

Superphosphate chambers; Means for automatically emptying ——. E. C. R. Marks, London. From H. Freudenthal, Hamburg, Germany. Eng. Pat. 15,940, July 4, 1910.

The apparatus comprises a superphosphate chamber, in which the entire bottom plate, upon which the solid mass rests, can be lowered and then withdrawn laterally, the walls of the chamber being constructed either cylindrically or tapering slightly downwards, so as to support the mass of superphosphate when the bottom plate is removed. A series of rotating knives are arranged to act on the exposed block of superphosphate from underneath, thus disintegrating it and allowing the particles to fall clear of all obstructions.—O. R.

Manures; Manufacture of —— *containing carbonophosphates and potassium and calcium-potassium phosphates.* G. E. Jacquemin. Fr. Pat. 417,416, June 23, 1910.

A concentrated solution of potassium carbonate, or concentrated vinasse, or a solution of the saline residues from distilleries, is treated with a natural phosphate (preferably phosphatic chalk) or with precipitated phosphate (bicalcic phosphate), either at the ordinary temperature, or with the aid of heat. The product is calcined at a temperature not exceeding that at which fusion just begins; if phosphatic sand is used as source of phosphate, a high calcining temperature must not be used since, otherwise, the silica would vitrify in presence of the potassium salts and thus diminish the value of the product. If desired, the phosphate- and potash-containing materials may be mixed in the dry state. Claim is also made for the application of the product, which contains a high proportion of soluble phosphoric acid and potassium salts, as a fertiliser.—L. E.

Vines; Process for destroying parasites on ——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 417,885, Sept. 13, 1909.

The vines are treated with copper formate prepared by mixing a formate with a soluble copper salt. The copper formate may be used in a dry powdered state or in solution, and adhesive substances may be added.—W. P. S.

Fertilisers; Production of ——. L. R. Coates, Baltimore, U.S.A. Eng. Pat. 9258, April 16, 1910. Under Int. Conv., April 26, 1909.

See U.S. Pat. 947,795 of 1910; this J., 1910, 442.—T. F. B.

Antitoxins; Production of —— *and their application to the soil to increase its fertility.* L. R. Coates. Fr. Pat. 417,716, April 25, 1910. Under Int. Conv., April 26, 1909.

See U.S. Pat. 947,797 of 1910; this J., 1910, 442.—T. F. B.

Process of making phosphatic slag and iron. U.S. Pat. 977,819. *See* X.

XVII.—SUGARS; STARCHES; GUMS.

Sugar cane; Relation between the potash and sugar contents of the ——. H. C. Prinsen Geerligs. Archief Suikerind., Nederl.-Ind. (Java), 1910, **18**, 108—117.

It has been shown by Saillard (this J., 1909, 725) and by Andrlik and Urban (Z. Zuckerind. Böhm., 1906, 208) that in the beet there is a distinct correlation between the sugar content and the percentage of potash and soda, the sugar increasing in inverse proportion to the alkalis. An attempt was made to discover a similar relationship in the case of the sugar cane, figures for the sucrose, Brix, purity, and potash values of a considerable number of

Javan juices being collated. It was found, however, that although a general tendency for a high potash content to concur with low sucrose and purity values is apparently indicated, there are a large proportion of contradictory instances. The author concludes that there are other important factors exerting more influence than the potash content on the purity of cane juices.—J. P. O.

Sugar cane; Manufacture of sugar from desiccated ——. S. G. Ruegg. La. Planter, 1910, **45**, 291.

Some particulars are given of the experiments on the extraction of sugar from desiccated sugar cane, which are being conducted at a beet factory at Madison, Wis., U.S.A. (*cf.* also this J., 1910, 1027). On arrival from Cuba the material was passed to the top of the factory by compressed air, and conveyed to the diffusers. During the extraction of the sugar considerable difficulty was experienced in effecting a proper circulation of the juice through the cells, owing to the presence of the pith; and it is probable that a special substitute for the diffusion battery will have to be devised. It is suggested that an open vessel with a suitable stirrer may give the desired results. The raw juice was treated in a similar manner to beet diffusion juice, but owing to the low purity of the clarified liquor thus obtained, operations were not continued further than evaporation. From the analytical details available it appears that the pith of the desiccated cane contained 52 and the fibre 30 per cent. of sugar; and that some samples of juice indicated sugar 9·7, Brix 11·8°, and purity 82·3°. It is intended ultimately to utilise the exhausted pith as a raw material for the manufacture of guncotton, and the exhausted fibre for paper pulp.
—J. P. O.

Bagasse; Determination of the sucrose content of ——. J. S. de Haan. Archief Suikerind., Nederl.-Ind. (Java), 1910, **18**, 118—138.

The degree of fineness to which the bagasse is divided has but a slight influence on the polarisation. It is possible to obtain reliable results for the true sucrose content of bagasse by an alcoholic digestion method, such as is employed for beetroot analysis, but this necessitates making a correction for the volume of fibre. Geerligs' aqueous digestion method gives values that are higher than the truth, but if the basic lead acetate be added after, instead of before, boiling, correct sucrose values are then obtainable. On this observation the author bases his modification of Geerligs' aqueous method, claiming for it that it gives the true sucrose content of the bagasse because no dextro-rotatory non-sugar is formed, and further because the polarisation of the liquid inside and outside the tissue of the bagasse is the same. The modification is further recommended on account of its simplicity. An average sample from the mills is passed through a 7 mm. sieve, and well mixed; 20 grms. are immediately transferred to a tared flask, 250 c.c. of water added, and the liquid boiled for 15 minutes, water being added to compensate for that lost by evaporation. "The contents of the flask are then cooled, 3 c.c. of basic lead acetate added, the whole weighed, then the liquid filtered and polarised in a 400-mm. tube." The author has isolated and examined the optically-active body, to which the high polarisation obtained by Geerligs' method is attributed, and has found that it has a specific rotatory power twice that of sucrose, but practically no cupric-reducing power, until treated with acids. On extracting bagasse with alcohol, then boiling the residue with water and basic lead acetate, under the ordinary conditions of analysis, it was found that even after an hour's boiling the liquid was optically-inactive (*cf.* Pellet, Bull. Assoc. Chim. Sucr., 1909, **26**, 201), whereas sugar-free bagasse boiled with water alone yields a distinctly optically-active solution.—J. P. O.

Sugar industry of Austria-Hungary. British Cons. Report, No. 4599, 1910.

The following tables show the total exports of sugar during the last five years, and also the quantities sent to the United Kingdom and India in the same period:—

	Total sugar.	Raw sugar.	Refined sugar.
	tons.	tons.	tons.
1905	569,400	88,700	480,700
1906	727,450	53,050	674.400
1907	734,423	108,546	625,877
1908	801,176	194,740	606,436
1909	797,317	157,956	639,361

Exports to the United Kingdom:—

	Total sugar.	Raw sugar.	Refined sugar.
	tons.	tons.	tons.
1905	241,300	68,800	172,500
1906	323,050	35,450	287,600
1907	350,152	74,949	275,203
1908	409,763	138,940	270,823
1909	422,837	126,638	296,199

Exports to British India:—

	Refined sugar.
	tons.
1905...............	103,800
1906...............	141,500
1907...............	65,913
1908...............	101,280
1909...............	87,614

The decline in the total exports of raw sugar of 36,800 tons is accompanied by one of only 12,000 tons in the exports to the United Kingdom, which now takes nearly all the raw sugar exported. On the other hand the increase in the export of refined sugar to the United Kingdom, which now takes nearly half the total export, together with the rise in price, caused the value of all the sugar sent last year to this country to rise by nearly £500,000.
—J. P. O.

Sugar industry in Japan. British Cons. Reports, Nos. 4511 and 4519, 1910.

At present the greatest efforts are being made to advance the Formosan sugar industry, and in a few years Japan will probably be able to supply all her requirements for sugar from her own dominions, the exports from Formosa having been 121,000 tons in 1909, compared with only 46,000 tons in 1908. The exports of refined sugar for the same period have been in quantity and value as follows:—

	1907.	1908.	1909.
Tons	14,685	17,008	29,017
£	264,600	352,000	518,900

From Yokohama it is reported that there was a considerable falling-off in the import of sugar during 1909, a decline that was shared by the whole country. There was, however, at the same time a considerable recovery of the export trade from the disastrous declines of 1907 and 1908, consequent on the sugar scandal. The difference is an indication of the expansion of the sugar growing industry within the bounds of the Empire. The relative positions of Japanese and Formosan sugars, referred to in last year's report, continue to be the subject of unfavourable comment, and indeed the whole matter of taxation, both customs and excise, of sugar is one which has received much criticism from merchants. Prices for brown Java during the year were steady between 17s. and 18s. 9d. per cwt., and for white Java £1 4s. 8d. and £1 9s. 10d. per cwt. The former represented some 73 per cent. of the whole import.
—J. P. O.

Lactose; Determination of —— in the presence of the commonly-occurring sugars. J. L. Baker and H. F. E. Hulton. Analyst, 1910, **35**, 512—514.

The authors have investigated the extent to which lactose is acted on by brewers' yeast and propose a method for the determination of this sugar in the presence of other sugars. The method is the outcome of a number of experiments in which lactose alone and lactose mixed with dextrose, invert sugar, dextrose and maltose, flour, etc., was submitted to the action of brewers' yeast. Each 100 c.c. of a 2 to 3 per cent. solution of the sugars received the addition of 0·5 grm. of washed yeast, and fermentation was allowed to proceed for from 60 to 70 hours at a temperature of 27° C. The solutions were then filtered, boiled to remove alcohol, diluted to a suitable volume, and titrated with Fehling's solution. When the solution contained lactose alone, from 90 to 95 per cent. of this sugar remained unfermented, but when other sugars were also present, the lactose was attacked to a less degree, an average of about 97·5 per cent. of the quantity originally present being found on titration. The other sugars were fermented completely. The fermentation must not be allowed to proceed for more than 72 hours; after this time, bacteria develop, the solution becomes acid, and the lactose rapidly diminishes in quantity. The presence of other sugars, however, prevents this action of the bacteria to a certain extent. The results obtained in the case of mixtures of lactose with flour are of interest, as they show that lactose may be determined by this process in such articles as infants' and invalids' foods; the food should be extracted with water for 2 or 3 hours, the solution then filtered, inverted with invertase or nitric acid if sucrose be present, and fermented under the conditions mentioned. In dealing with sugar solutions which are free from nitrogenous matters, a small quantity of sterile yeast water or asparagine should be added. Pure cultures of yeast were found to yield similar results with sugar solutions as did brewers' yeast, but such pure yeasts are not at the disposal of all analysts. The method cannot, of course, be applied to the determination of lactose when this sugar is associated with commercial glucose, dextrin-maltose, etc., which even after fermentation in the presence of diastase leave a residue capable of reducing Fehling's solution.—W. P. S.

Ley's reaction [for honey]; The chemistry of ——. C. Amberger. Z. Unters. Nahr. Genussm., 1910, **20**, 665—676.

The characteristic colouration and fluorescence which is obtained when natural honey is heated with an ammoniacal solution of silver oxide (Ley's reaction) is due to the formation of a colloidal compound of silver and a constituent of the honey. The author has isolated this compound and finds that the constituent which absorbs the silver is an albumin. The compound does not contain dextrins or sugars, but the latter may have some influence on the reduction of the silver oxide. With the albumin separated from honey the author has prepared colloidal compounds of silver, gold, and palladium similar to those described by Paal (this J., 1902, 994).—W. P. S.

Polarimetric determination of lactose. Richmond. *See* XIXa.

Patents.

Sugar-yielding products and process for obtaining them. G. B. McMullen. Fr. Pat. 417,317, June 21, 1910.

Sugar-cane in a state of maturity and undried, is cut up so as to convert it into a mass composed of finely divided parenchymatous tissue, and fine, woody fibres. The material thus cut up, is then passed over a series of sieves of increasing fineness, which are kept in lateral agitation. The mass of parenchymatous tissue, which contains most of the sugar, falls through, whilst the fibre is retained, and is discharged at the end of the series. Claim is made for the products thus separated: either or both products are dried in such a way that no invert sugar is formed; for this, a temperature between 37° and 100° C. is best, and the vapour should be removed as rapidly as it is formed. The dried products should contain less than 30 per cent. of water. The sugar is readily extracted from the dried products; the exhausted residue from the parenchymatous tissue is of value in various ways, *e.g.*, for the manufacture of artificial silk, and the residue from the fibre can be made into very good paper.—L. E.

Diffusion battery; Process and apparatus for progressively and uniformly heating the fresh cossettes in the first diffuser of a continuous —— to the most favourable temperature for hot diffusion, with a view to obtaining concentrated diffusion juice. P. Emmrich. Fr. Pat. 417,890, Dec. 13, 1909.

The first diffusion vessel of the continuous diffusion battery, is divided vertically into two, three, or more zones of maceration. Each of the annular chambers surrounding the zones is divided into two halves. The fresh cossettes enter the top zone at a temperature of say 12° C.; an equal quantity of juice from the preceding diffusion vessel, heated to say 96° C., enters this zone through one part of the corresponding annular chamber, traverses the cossettes and heats them to 54° C., and passes out by the other part of the annular chamber to a vessel in which it is mixed with the juice similarly drawn off from the second zone of the diffuser; from this vessel, the juice is pumped to a re-heater wherein it is heated to 96° C., after which it is returned to the three zones of the diffuser. The cossettes are carried through the diffuser by a screw-conveyor and are heated in the second and third zones to say 75° and 85·5° C. respectively, by contact with the hot juice. After passing through the third zone, the juice is sent to the measuring back. A modification of the process is also claimed in which the cossettes are heated in the first zone with low-pressure steam instead of with hot juice.—L. E.

[Sugar] solutions; Purification of ——. F. Tiemann, Berlin. Eng. Pat. 30,080, Dec. 23, 1909.

See Addition of Dec. 23, 1909, to Fr. Pat. 395,752 of 1908; this J., 1910, 969.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Nitrogen content of wort; Influence of addition of chit-malt, barley and rice to the malt grist on the ——. W. Windisch and G. Daus. Woch. Brau., 1910, **27**, 621—623.

In the experiments the malt and chit-malt were made from the parcel of barley of which a part was used as such. The grist in every case consisted of 65 per cent. of malt and 35 per cent. of either chit-malt, barley or rice. The malt was mashed cold. The other ingredient of the grist was mashed with water at 45° C., warmed in 20 minutes to 70° C., after 15 minutes raised to boiling in 10 minutes and boiled for a little while. The boiled mash was remashed with the malt mash at 45° C., held at this temperature for 20 minutes, heated to 70° C. in 25 minutes and maintained at this for 30 minutes, heated to boiling in 10 minutes and boiled for 5 minutes, cooled and further saccharified by addition of cold water malt extract. The nitrogen was estimated in the worts unboiled and after one hour's boiling with and without hops. The following values were obtained:—

	Malt.	Do. + chit-malt.	Do. + barley.	Do. + rice.
Protein per cent. of the extract:—				
Unboiled	4·49	4·22	4·08	3·12
Boiled..............	4·47	4·07	4·03	2·99
Boiled with hops ..	4·46	4·14	3·99	2·84

The results show that the chit-malt did not differ greatly from the ordinary malt, while the barley and particularly the rice worts lost notable quantities of nitrogen on boiling. The several ingredients of the grists separately and the worts were analysed. The results show that the malt alone gave 76·9 per cent. of extract and 34 per cent. of the total nitrogen was soluble, the chit-malt gave nearly similar values, 73·5 and 29·3 respectively, the barley gave only 45·3 of extract and 15·6 of soluble nitrogen, while the rice yielded only 4 per cent. of its nitrogen. The authors thus confirm Wyatt and Schlichting (this J., 1909, 733) and consider rice a most useful diluent of highly nitrogenous barley malt. They regard the prohibition of the use of such diluents in brewing as retrograde and to be deplored.—R. L. S.

Beef and yeast extracts of known origin ; A comparison of ——. *See* XIXA.

Determining total tartaric acid by the Goldenberg process. Ordonneau. *See* VII.

PATENTS.

Mashing process. A. J. M. Lasché, Milwaukee, Wis. U.S. Pat. 977,200, Nov. 29, 1910.

FILTERED distillery slop is sterilised and neutralised, and is then inoculated or infected with a micro-organism (a mould) capable of secreting liquefying and saccharifying enzymes. The micro-organism is allowed to develop in the liquid for a certain length of time, the liquid being then separated from the micro-organism, and added to the grain mash.—W. P. S.

Extracts ; Process of manufacturing concentrated, non-alcoholic —— *for the preparation of liqueurs.* R. Paulini und Co. Fr. Pat. 418,196, July 13, 1910. Under Int. Conv., July 14, 1909.

ALCOHOLIC extracts, prepared in the usual way, are evaporated under reduced pressure in order to remove the alcohol and produce a syrupy or solid residue. To the latter are then added volatile oils to replace those which have been removed during the evaporation ; the volatile oils employed are, preferably, those which are soluble in 40 per cent. alcohol.—W. P. S.

Distillery vinasses ; Treatment of ——. A. and E. Lederer. Fr. Pat. 417,950, June 8, 1910.

THE concentrated vinasse is treated with an absorbent, preferably with lignocellulose that has been decorticated and partly or completely carbonised by the action of acids. The product, containing about 50—60 per cent of water, is dried, and treated with more vinasse, the process being repeated until the final, dried mass contains the desired proportion of the solid constituents of the vinasse. The mass is then treated with one or more solvents, preferably crude alcohol ; the residue, after removal of the solvent, consists of a nearly dry product, and may be converted into briquettes. The briquettes may be burnt with a view to extracting potash from the residue, or they may be distilled in a closed vessel, in which case methyl alcohol, acetic acid, etc., are obtained, besides a carbonaceous residue ; this residue may be extracted with a view to obtaining the soluble constituents such as oxalic acid and cyanides, and the final residue of charcoal may be used as a fuel, or, after ignition, as a clarifying agent for alcohol, etc. The extract from the mixture of absorbent and vinasse constituents, is distilled, a rectification of the crude alcohol used for extraction, being effected simultaneously ; the residue which contains crude glycerol and other vinasse-constituents, including succinic acid, is purified by treating it in the same way as the original vinasse, the separation of the glycerol and succinic acid being subsequently effected by any suitable method. The residue from this second extraction, after removal of the solvent, is added to the residue (also freed from solvent) obtained in the first operation.—L. E.

Cassava ; Process of treating —— *and producing alcohol therefrom.* C. C. Moore, Lexington, Ky., Assignor to The Tropical Products Co., Washington. U.S. Pat. 977,465, Dec. 6, 1910.

SEE Eng. Pat. 22,655 of 1909 ; this J., 1910, 1123.—T.F.B.

Sterilisation of water and other liquids, and cultivation of ferments. Eng. Pat. 27,798. *See* XIXB.

XIXA.—FOODS.

Beef and yeast extracts of known origin ; A comparison of [the composition of] ——. F. C. Cook. U.S. Dept. of Agric., Bureau of Chem., Circular No. 62, 1910, 1—7.

THE results obtained on the analysis of various beef and yeast extracts may be summarised as follows :—Yeast extracts contain approximately 1 per cent. of ether-soluble substances, whilst beef extracts contain larger amounts ; cholesterol is not present in the ether extracts. Sarcolactic acid was found in the beef extracts but not in the yeast extracts. The phosphorus of beef is largely water-soluble, and, consequently, the ash of beef extract contains a considerable quantity of this constituent. Approximately one-half of the sulphur of beef is water-soluble. Yeast extracts prepared from yeast rich in phosphorus also yield an ash containing large quantities of phosphorus compounds, but the total amount of phosphorus present is larger than that found in the ash, showing that some phosphorus compound is volatilised during the incineration. The organic phosphorus, determined by the Siegfried-Singewald process (this J., 1905, 1258), was approximately one-tenth of the total phosphorus present. The beef extracts contained, on the average, 11·82 per cent. of nitrogen, calculated on the dry, fat-free substance, whilst the yeast extracts contained 7·44 per cent. The amide-nitrogen present in the beef preparations amounted to nearly double of that of the yeast extracts. Although the water-soluble nitrogen of beef, which constitutes 25 per cent. of the total nitrogen, consists of about two-thirds protein and one-third amide-nitrogen, the beef extracts contained 28 per cent. of protein-nitrogen and 72 per cent. of amide-nitrogen. As a food both varieties of extract are very limited in value ; the beef extracts contain more of the nitrogenous extractives than the yeast preparations, otherwise their general composition is much the same.—W. P. S.

Milk ; Detection and determination of nitrates in —— *by means of the diphenylamine-sulphuric acid test.* J. Tillmans. Z. Unters. Nahr. Genussm., 1910, **20**, 676—707.

THE author has investigated this reaction and gives the details of procedure and conditions necessary to enable very small quantities of nitrates to be detected by means of the test. The reagent is prepared by treating 0·085 grm. of diphenylamine with 190 c.c. of dilute sulphuric acid (1:3) and adding a quantity of concentrated sulphuric acid ; the mixture becomes heated and the diphenylamine dissolves. After the addition of a further quantity of concentrated acid, the solution is cooled and the volume is made up to 500 c.c. with concentrated sulphuric acid. Two c.c. of this reagent are then placed in a test-tube, a few c.c. of the water or milk serum to be tested are added, and, after being shaken, the mixture is cooled. The characteristic blue colouration obtained when nitric acid is present reaches its full intensity after the lapse of 1 hour. The presence of small quantities of chlorides appears to be essential to the development of the colouration when only a very small amount of nitric acid is present ; water containing a relatively large amount of nitrates but free from chlorides does not yield a colouration with the reagent. Proteins, especially peptones, and milk-fat prevent the formation of the blue colour, and in testing milk it is necessary to treat the calcium chloride serum with ether and calcium hydroxide before applying the test. Milk serum containing as little as 0·25 mgrm. of nitric acid (N_2O_5) per litre yields a distinct blue colouration. Nitrous acid acts similarly to nitric acid, but the colouration appears almost at once and the presence of chlorides is unnecessary. The test may be rendered quantitative by comparing the colouration obtained with those yielded by quantities of milk serum containing known amounts of nitrate. The test enables the presence of 5 per cent. of added water in milk to be detected if the water contains not less than 10 mgrms. of nitric acid (N_2O_5) per litre. If the nitrate-content of the water be known, it is possible to deduce the quantity of added water in a sample of milk from the amount of nitric acid found in the same. Milk which contains an abnormal quantity of dirt may yield a faint colouration with the reagent, but the presence of a small amount of extraneous matter is without influence on the test.—W. P. S.

Lactose [in milk and milk products]; Polarimetric determination of ——. H. D. Richmond. Analyst, 1910, **35**, 516—517.

Owing to the laevo-rotation of proteins, the polarimetric method of determining lactose in milk and milk products yields too low results unless the proteins have been removed completely. Various substances have been proposed for the removal of proteins. The use of acid mercuric nitrate solution, proposed by Wiley, is the most convenient for this purpose, its employment involving but a small dilution, but it still leaves traces of the proteins present. If phosphotungstic acid be added to the clear filtrate obtained from milk which has been treated with mercuric nitrate, a somewhat voluminous precipitate is formed, and, after filtration, the polarimeter reading becomes higher. With whole milks the difference in the readings, before and after treatment with phosphotungstic acid is but small, but in the case of dried milks the difference may amount to several units per cent. It is therefore recommended that the milk be treated with mercuric nitrate as usual and that 5 per cent. of phosphotungstic acid and 5 per cent. of sulphuric acid (1 : 1) be then added. After filtration, the solution is polarised, and the reading multiplied by 1·1.—W. P. S.

Butter; Influence of the alkalinity of the washing water on the water-content of ——. W. Meijeringh. Chem. Weekblad, 1910, 7, 951—953. Chem. Zentr., 1910, 2, 1833.

The size of the globules of water in butter-fat decreases with increasing alkalinity of the water. Seeing that with larger globules of water, these would not emulsify so well with the butter-fat, not so much water would be retained by butter washed with acid water as by butter washed with alkaline water.—A. S.

Soya beans and their utilisation. F. Honcamp. Tropenpflanzer, 1910, **14**, 613—634.

According to English consular reports the total production of soya beans in China amounted in 1907 to 580,000 tons, rising in the following year to 850,000 tons. During the year 1909 no less than 35,000,000 kilos. of the beans passed through the Suez canal. Harz classified the varieties of *Soja hispida* into two main groups, one containing those of strongly compressed form and of olive green to brownish-black colour, and the other swollen varieties more or less sickle-shaped, and of yellowish-brown to deep brown colour. An analysis of the inorganic constituents of the beans by Schwackhöfer gave the following results:—Potassium oxide, 44·56; sodium oxide, 0·98; lime, 5·32; magnesia, 8·92; iron oxide, trace; silica, trace; phosphoric acid, 36·89; sulphuric acid, 2·70; and chlorine, 0·27 per cent. Both in China and Japan the black varieties are boiled and roasted and eaten with rice, whilst the green and white varieties are ground to meal and baked into cakes, etc. The soy sauce, which is now largely exported to England and America, and used in the manufacture of other sauces, is prepared from wheat and a small light yellow variety of the bean, with the addition of salt and water, the prepared mass being fermented in open vessels at as low a temperature as possible for a period of 8 months to 5 years, and the sauce then separated from the residue. The finished *shoyu* has the following composition (Kellner):—Sp. gr. 1·182 to 1·193; total solids, 287·5 to 319·2; organic constituents, 136·3 to 164·7; free acid (as acetic acid) 5·3 to 6·5; and nitrogen, 7·2 to 14·5 grms. per litre. The nitrogen is present entirely in the form of decomposition products of proteins (leucine, tyrosine, etc.), and soy sauce is comparable with meat extract in its stimulative properties. Another product made from the beans in Japan, and used in the preparation of soups and flavours for cooking, is known as *miso*. It is made from a mixture of the crushed beans, with rice or barley *koji*, salt, and water. Five samples examined by Kellner had the following composition:—water, 48·45 to 59·27; protein, 10·18 to 14·34; fibre, 1·79 to 2·68; ether extract, 5·10 to 7·87; ash, 7·78 to 15·62; sodium chloride, 5·99 to 12·91; dextrose, 4·38 to 11·63; soluble in cold water, 22·13 to 34·25; and alcohol, 0·95 to 1·92 per cent. In addition to these, a so-called bean cheese (*tofu*), and a similar product from which the bulk of the water has been removed (*kori-tofu*), are prepared from soya beans in Japan. The use of the beans for the preparation of bread for diabetic subjects has recently been proposed by Villon, the low proportion of carbohydrates rendering them particularly suitable for this purpose. It has been asserted that soya bean oil has purgative properties similar to those of castor oil, but this has been negatived by the experiments of Korentschewski and Zimmermann. Experiments made by Kellner and Ogasawara upon the digestibility of soya beans and soya hay by cattle are also described at length. It is stated that attempts to acclimatise the plant in Germany have not yet proved successful, although it may be possible to introduce an early-ripening variety with a short vegetation period (see this J., 1910, 1394).—C. A. M.

Utilisation of sulphite wood pulp lyes [as fodder]. Stutzer. *See* V.

Determination of lactose in presence of the commonly occurring sugars. Baker and Hulton. *See* XVII.

Patents.

Coffee extract; Process for roasting ——. C. A. Fischer, Berlin. Eng. Pat. 3031, Feb. 8, 1910. Under Int. Conv., Feb. 9, 1909.

The extract, obtained by treating raw ground coffee with hot water, is delivered in the form of a thin layer upon plates, revolving drums, endless cloths, or the like, the temperature of which is maintained at 200°—220° C. The extract is thus instantly dried and roasted.—W. P. S.

Milk; Process for desiccating ——. Techno-Chemical Laboratories, Ltd. Fr. Pat. 417,450, June 24, 1910. Under Int. Conv., July 13, 1909.

See Eng. Pat. 16,375 of 1909; this J., 1910, 1175.—T. F. B.

XIXb—WATER PURIFICATION; SANITATION.

Water; Determination of nitrates in —— *by a sulphosalicylic reagent.* H. Caron and D. Raquet. Bull. Soc. Chim., 1910, 7, 1025—1027.

In the Grandval and Lajoux process (this J., 1909, 740), the authors propose the replacement of phenol by salicylic acid. The intensity of the yellow colour produced is relatively greater than with phenol, and is not influenced by the age of the reagent. In presence of chlorides, freshly prepared solutions should be used, as the reagent becomes sensitive to chlorides after being kept for 5 or 6 days; the phenol reagent becomes sensitive in less than one day. Both reagents are sensitive to the presence of bromides and iodides. In order to avoid the necessity of preparing fresh solutions the following procedure is recommended:—10 c.c. of the water to be examined are evaporated with 1 c.c. of a 1 per cent. solution of sodium salicylate, the residue cooled in a desiccator and 1 c.c. of pure sulphuric acid added. After thoroughly mixing and standing for several minutes, 10 c.c. of water are added. and finally 10 c.c. of ammonia solution. The colourations are compared against a standard prepared under the same conditions.—B. G. McL.

Tarring roads; Effect of —— on adjacent vegetation. E. Griffon. Comptes rend., 1910, **151**, 1070—1073.

Experiments made under laboratory conditions show that the vapours emitted by tar kill the cells of plant tissues. Under practical conditions in the open air, however, the vapour emitted by tarred road surfaces does not injure vegetation at a distance of several metres from the road surface. The dust from tarred road surfaces is injurious to some delicate plants, but is harmless to many plants. So far as they go, the author's investigations lead to the conclusion that the advantages derived from tarring roads outweigh the disadvantages.—L. E.

Destruction of cyanide. Moir and Gray. *See* X.

Patents.

Water and other liquids; Sterilisation of —— and the cultivation of ferments. V. Henri and A. Helbronner. Paris, and M. von Recklinghausen, Bas Meudon, France. Eng. Pat. 27,798, Nov. 29, 1909.

The water or other liquid is subjected to the influence of ultra-violet rays for a period of time which is sufficiently long to kill harmful bacteria, but which is not long enough to destroy harmless organisms. For instance, pathogenic organisms may be destroyed by subjecting water containing them to the action of the rays for a period of 20 seconds, whilst the harmless bacteria usually found in drinking water are only destroyed when the rays are allowed to act on the water for about 2 minutes. In the production of fermented liquids by means of alcoholic, lactic or acetic fermentation, the liquid may be subjected, when fermentation is nearly complete, to the action of the rays for 30 seconds; the development of bacteria (usually very marked at this period of the process) is thus inhibited, whilst the enzymes are not affected. The treatment may also be used in the preparation of pure yeast, etc. —W. P. S.

Sewage, waste-water, etc.; Apparatus for the purification of ——. J. E. Jerôme. Fr. Pat. 418,207, July 13, 1910.

The sewage is delivered into a tank divided into two compartments by means of a partition which is perforated at its lower part; after passing through these two compartments, the liquid flows through holes in one of the sides of the tank into a septic tank, which is also divided into a number of compartments by means of perforated plates. On leaving the last of the septic tanks, the liquid is passed through a series of aerating and filtering chambers. —W. P. S.

Sewage waters; Apparatus for purifying ——. P. Koch. First Addition, dated April 9, 1910, to Fr. Pat. 396,606, Nov. 23, 1908.

See Eng. Pat. 13,877 of 1910; this J., 1910, 1471.—T.F.B.

Furnace for incinerating refuse. H. N. Leask. Fr. Pat. 417,414, June 23, 1910. Under Int. Conv., Sept. 29, 1909.

See Eng. Pat. 22,137 of 1909; this J., 1910, 1267.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Cinchona and its alkaloidal content; Tincture of ——. H. Frerichs. Apoth. Zeit., 1910, **86**, 836.

The methods for the preparation of tincture of cinchona have been investigated by the author, and their efficiency compared. For the determination of the total alkaloid in cinchona the following method, due to Fromme, is considered the most trustworthy:—2·5 grms. of the powdered bark are placed in a 200-c.c. flask with 20 c.c. of water and 2 c.c. of 25 per cent. hydrochloric acid, and heated in a boiling water-bath for ten minutes. After cooling, 25 grms. of chloroform and 50 grms. of ether are added, then 5 c.c. of 15 per cent. sodium hydroxide solution, with vigorous shaking. The mixture is shaken for ten minutes, 1·5 grms. of powdered tragacanth are added, and the whole again well shaken until the ethereal layer is clear. 60 grms. of the ethereal layer (representing 2 grms. of the bark) is strained into a separator, and the alkaloids extracted with three successive quantities of 1 per cent. hydrochloric acid. The hydrochloric acid solutions are mixed, made alkaline with ammonia and extracted with three successive quantities of chloroform. The mixed chloroform solutions are filtered and evaporated to dryness. The residue is dried at 100° C. until of constant weight. Tinctures were prepared by (1) the single maceration method of the German Pharmacopœia; (2) the double maceration process of the Italian Pharmacopœia; (3) a percolation method devised by the writer. It was found that by the percolation process a larger proportion of the total alkaloid was extracted from the drug than by either of the other two methods. The author recommends percolation for the preparation of tinctures of cinchona and similar hard drugs which are rich in extractive matter. Some experiments were also made on the titration of the alkaloidal residue obtained in the above process of estimation. Lower results were obtained by titration of the residue after drying at 100° C. than by weighing. Titration of the residue immediately after evaporation of the ether-chloroform solution gave results which agreed with the gravimetric figures. The author supposes that during the heating at 100° some decomposition of the alkaloids takes place. The titrations may be made directly using hæmatoxylin as indicator or indirectly with methyl-red as indicator, the former method being preferred by the author.

Strychnine salts; Solubility of ——. D. B. Dott. Pharm. J., 1910, **85**, 795.

Strychnine nitrate.—Although this salt is not official in the British Pharmacopœia, it is described in several of the foreign pharmacopœias, and must be recognised as one of the more important salts of strychnine. The statements regarding its solubility vary considerably. The author's figure for solubility in water, is 1 in 71 at 15° C. In 90 per cent. alcohol in the cold he finds the solubility 1 in 108·4 by weight, or 1 grm. in 130 c.c. In boiling spirit, it was 1 in 24 by weight.

Strychnine acid tartrate.—It is frequently the case that the acid tartrate of an alkaloid exhibits a sparing solubility in water, like the corresponding salts of ammonium and potassium. Strychnine is no exception to the rule. 15·57 grms. of the solution left 0·070 grm. of dry salt. Allowing for the 9·27 per cent. of water of hydration lost on heating on the water-bath, this result indicates a solubility of 1 in 200 of water.

Strychnine acid oxalate.—18·20 grms. of solution left 0·207 grm. of dry salt. Correcting for the 6·06 per cent. lost on drying the crystallised salt, the solubility in cold water is 1 in 82.

Ipomœa Bona nox. Peckolt. Chem. and Drug., 1910, **77**, 57.

The author, writing on Brazilian drugs, devotes considerable space to the seeds of *Ipomœa Bona nox*, preparations of which are largely employed as a remedy against snake-bites. The seeds have the following composition: Water, 9·00 per cent.; crystalline resin, 0·50 per cent.; amorphous bitter substance, 0·015 per cent.; carbohydrates, 17·28 per cent.; tannoids, 0·81 per cent.; fatty oil, 9·35 per cent.; resin acids, 1·25 per cent.; proteins, 2·70 per cent.; organic acids, 0·095 per cent.; ash, 5·00 per cent. In the leaves of the plant the author found a small quantity of a crystalline glucoside. Several other species of *Ipomœa* were also reported on.

Ergot assay. G. Fromme. Chem. and Drug., 1910, **77**, 57.

The author states that many difficulties are encountered in determining the amount of cornutine in ergot. One which has not received sufficient attention is its slow rate of solution in ether, which he finds is facilitated by adding sufficient magnesia and water mixture to the de-fatted powdered ergot to form a thick paste, so that on shaking with ether intimate mixing occurs. The ether can then be easily separated by means of tragacanth powder. The varying results obtained by different investigators in ergot assays render it advisable to draw attention to this point. It is also stated that ergot stored in a dry condition and protected from light for two years showed no loss in its cornutine content, this being on August 25, 1908, 0·3 per cent., and on August 3, 1910, 0·295 per cent., an immaterial diminution. It would thus appear that the removal of moisture at the proper time prevents further changes. The following is a *résumé* of the Keller-Fromme method for determining cornutine in ergot :—

Place 25 grms. of finely powdered ergot in a small percolator closed with a plug of cotton-wool, and slowly extract with petroleum ether until a drop on evaporation does not leave any oily stain on filter-paper. The whole of the powder is then removed from the percolator and the petroleum ether allowed to evaporate off before introducing the powder into a bottle with a capacity of about 250 c.c. Ether (125 c.c.) and magnesia mixture (1 gram of light magnesia and 40 grams of water) are then added, and the mixture shaken repeatedly during thirty minutes. Next 3 grams of powdered tragacanth are added, and the mixture well shaken prior to passing 100 grams (or as much as possible) of the ethereal solvent through a plug of cotton-wool in a covered funnel. The liquid (of which each 5 grams represents 1 gram of powder) is next shaken out with 25, 20, and 15 c.c. of dilute hydrochloric acid (1 per cent.) until the acid liquor gives no cloudiness with Mayer's reagent. The bulked acid liquors are shaken up with 0·3 gram of kieselguhr and again filtered, washing the bottle and filter with a little water. The filtrate is then made alkaline with ammonia and shaken out with 25, 10, and 10 c.c. of ether, the ethereal solution being filtered into a tared Erlenmeyer flask. The solvent is removed by distillation and the residue dried till of constant weight. If 100 grams of ether solution were shaken out, this weight, multiplied by 5, is equal to the percentage of cornutine.

Morphine ; New reaction of ——. G. Denigès. Comptes rend., 1910, **151**, 1062—1063.

Ten c.c. of a solution containing morphine hydrochloride are treated with 1 c.c. of hydrogen peroxide (5—12 volumes) and 1 c.c. of ammonia. The mixture is thoroughly shaken, treated with 1 drop of a solution of copper sulphate (containing 1—4 per cent. of the crystallised salt according to the less or greater concentration of the solution under investigation), and well shaken again. A rose to intense red colouration, according to the concentration of the alkaloid, soon appears. With aqueous solutions containing at least 1 grm. of morphine per litre, the colouration appears at once. Other solutions of morphine, provided that they are colourless or only slightly coloured, are treated in the same way. When the morphine-containing substance (*e.g.*, morphine itself) is insoluble in water, it is dissolved with a few drops of hydrochloric acid (1 : 3) and then diluted with water before addition of the reagents. In the case of syrup of morphine, 10 c.c. of the sample are mixed with 1 c.c. of hydrogen peroxide and 1 c.c. of ammonia ; the mixture is shaken, treated with 1 drop of a 3—4 per cent. solution of copper sulphate, and shaken again. In the course of a few minutes, the rose colour acquires its maximum intensity and may be compared with the colour of similarly treated, standardised solutions of morphine hydrochloride in sugar syrup with a view to colourimetric determination. The reaction is negative with codeine, thebaine, papaverine, narceine, and narcotine ; positive (though different) results are obtained with the direct derivatives of morphine—oxymorphine and apomorphine—as well as with its readily hydrolysable phenolic ethers.—L. E.

Ceylon grass oils. Chem. and Drug., 1910, Dec. 17th, 49. (See also this J., 1910, 1079.) [T.R.]

Otto Stapf, of the Royal Gardens, Kew, undertook a botanical revision of the aromatic grasses assigned to the genus *Andropogon* and renamed this portion of the genus *Cymbopogon* ; so that citronella grass became *Cymbopogon Nardus*, and the lemon-grasses were separated into two species, the one yielding the "soluble lemon-grass oil" of the East Indies being *Cymbopogon flexuosus*, while that furnishing the "insoluble lemon-grass oil" of the West Indies was named *Cymbopogon citratus*. It gave a fresh stimulus to the chemical examination of the oils furnished by these grasses, and in 1908 J. F. Jowitt, of Craig, Bandarawela, Ceylon, sent to the Imperial Institute for examination a series of oils prepared from the wild and cultivated citronella grasses of that island for examination. The oils are classified botanically according to Stapf's identifications of the grasses yielding them, and in many cases the figures quoted represent the first analyses of oils from thoroughly authenticated sources. It is well known that the citronella grasses of Ceylon are of three types :

(*a*) Mana, or wild grass.

(*b*) Lena-batu, the variety cultivated by natives and yielding the typical citronella oil of Ceylon.

(*c*) Maha-pengiri, or Winter's grass, yielding the finest Ceylon oil, which approximates to Java and some Malay States oils in character and composition.

The Mana grasses show considerable variation in habit, but, according to Stapf's identifications, they all belong to two varieties of *Cymbopogon Nardus*—viz. : (1) *Cymbopogon Nardus* var. *Linnæi*, (2) *Cymbopogon Nardus* var. *Confertiflorus*. The oils from these Mana grasses show great variation in composition and quality ; thus the "total alcohols" range from 26 to 64 per cent., citronellal from 17 to 33 per cent., and geraniol from 6·3 to 44 per cent., though the variation is due in part to distillation of grass at varying periods of growth. Thus, to quote only one instance, *C. Nardus* var. *Linnæi*, from one plot, distilled on three different occasions, yielded oils containing 51·6, 63·2, and 57·2 per cent. respectively of "total alcohols." From a commercial point of view, however, the most interesting fact is that these Mana grasses give only, as a rule, 0·1 to 0·26 per cent. of oil, as compared with the 0·42 to 0·56 per cent. got from Lena-batu grass and 0·59 to 0·77 per cent. obtained from Maha-pengiri grass. An interesting point in connection with these Mana-grass oils is that certain of them approximate in type to Lena-batu oil and others to Maha-pengiri oils ; but this chemical classification of the oils into two groups does not fall into line with Stapf's division of the grasses yielding them.

Stapf regards Lena-batu grass as a distinct variety, which he names *Cymbopogon Nardus, Lena-batu*. The Imperial Institute analyses of the oils from the carefully selected and cultivated samples of this grass show that they contain from 57 to 62 per cent. of "total alcohols," 24·2 to 33·6 per cent. of citronellal, and 26·3 to 34·5 per cent. of geraniol, which agreed fairly well with the results already on record for good Ceylon oil of the ordinary type. The oils are described as giving clear solutions with their own volume of 80 per cent. alcohol, but becoming slightly opalescent on dilution with ten volumes of the alcohol. Maha-pengiri grass, which yields the best citronella oil of Ceylon, such as Winter's, is now named *Cymbopogon Winterianus*, Jowitt. This grass gives a very high yield of good quality oil rich in citronellal, but unfortunately it does not seem to grow in the island without attention, and for that reason has never recommended itself to native cultivators. The three authentic samples of this oil examined gave 79 to 84·8 per cent. of "total alcohols," 24·1 to 32·5 per cent. of geraniol, and 46·5 to 60·7 per cent. of citronellal, and showed great similarity to Java oils. A number of samples of lemon-grass oil were also examined, and the results confirmed Stapf's view that the "good soluble oil" is the product of *C. flexuosus*, while the "insoluble oil" comes from *C. citratus* ; but the *C. flexuosus* oil exhibits certain peculiarities which further cultivation-work will be needed to explain.

Essential oils; Constituents of ——. *Regeneration of "caryophyllene."* F. W. Semmler and E. W. Mayer. Ber., 1910, **43**, 3451—3455.

THE removal of hydrogen chloride from caryophyllene dihydrochloride, m. pt. 69°—70° C., can take place with or without the formation of a ring. This substance was treated with sodium methoxide at a temperature not above 60° C. when a bicyclic caryophyllene was obtained with the following constants:—b. pt. 121°—122·5° C. at 12 mm., sp. gr. 0·8996 at 20°/4° C., $a_D = +19°$ in a 1 dem. tube, $n_D = 1·4990$ at 20° C. On treatment with hydrogen chloride in ethereal solution, the hydrocarbon yielded the same dihydrochloride, m. pt. 69°—70° C. as is obtained from clove oil. The hydrochlorides prepared from either substance have, moreover, the same optical rotation, $[a]_D$ at 20° C. being about 50°. When the dihydrochloride is boiled with quinoline, tricyclic caryophyllene is produced. This boils at 122°—123° C. at 13 mm., has the sp. gr. 0·927 at 20°/4° C., $n_D = 1·50246$ at 20° C., $a_D = -57°$ in a 1 dem. tube at 20° C. Formulæ are given for these two hydrocarbons and the dihydrochloride.—F. SHDN.

Formaldehyde solutions; Simple method for the valuation of ——. W. Braeutigam. Pharm. Zentralh., 1910, **51**, 916; Pharm. J., 1910, **85**, 729.

THE method is based on the reactions which take place between calcium hypochlorite and formaldehyde resulting in the ultimate formation of calcium carbonate, one molecule of which is equivalent to one molecule of formaldehyde as expressed in the following equations:—

$$CH_2O + CaOCl_2 = HCO_2H + CaCl_2.$$
$$HCO_2H + CaOCl_2 = CO_2 + H_2O + CaCl_2.$$
$$2CaOCl_2 + CO_2 + H_2O = CaCO_3 + CaCl_2 + 2HClO.$$

About 300 c.c. of freshly prepared chlorinated lime solution is treated with 10 grms. of a 1 : 10 dilution of the formaldehyde solution to be tested, and set aside in a loosely-stoppered flask: at normal temperatures and under the influence of daylight, reaction speedily takes place, as indicated by the appearance of precipitate. When this is complete the supernatant liquid will be clear. The calcium carbonate is then collected on a tared filter, and the filtrate is heated to boiling to ensure completion of the reaction. Should any further precipitate be formed, this should be added to that first collected. The whole is then washed free from chlorides dried at 100° C. and weighed. Each 1 grm. of calcium carbonate so obtained is equivalent to 0·3 grm. of formaldehyde. Good commercial formaldehyde solutions were found to give from 1·15 to 1·2 grms. of calcium carbonate, equivalent to 35 to 36 per cent. of formaldehyde, when treated by this method.

ERRATUM.

This J. 1910, page 1472, col. 1, line 7 from top, line 9 from top, and line 12 from top, *for* "methylhydrastine" *read* "methylhydrasteine" in each case.

PATENTS.

Hydrocarbon bodies [pentenes, pentines, dipentenes, etc.]; Process for preparing certain ——. E. Wassmer, Geneva. Eng. Pat. 26,936, Nov. 19, 1909.

A SUBSTANCE or substances containing the hydrocarbon body which it is desired to obtain "or constituents thereof," is passed in the form of vapour or spray through a vessel in which it is subjected to the action of an electrically heated conductor, by which it is decomposed: the vapours are then condensed and the liquid fractionated. The process may be applied, for example, to the preparation of pentenes, pentines, and dipentenes, and particularly of isoprene, which is prepared by heating "naphtha vapour" to 800°—1000° C. by means of the electrically heated conductor. In addition to the above treatment, the vapours may be submitted to the action of platinum-black or other catalytic substance, or to the influence of light.—T. F. B.

Isoprene; Production of ——. H. C. Woltereck, London. Eng. Pat. 27,908, Nov. 30, 1909.

THE vapours of spirit of turpentine are passed through an iron tube, filled with contact material such as wire gauze, perforated discs, etc., and heated at a temperature not exceeding 550° C.; the resulting gases are condensed and fractionated, the fraction boiling between 35° and 45° C. representing the isoprene. The turpentine vapours may also with advantage be mixed with nitrogen or other inert gas; in this case the temperature may be raised to 600° C. with satisfactory results. The yields are said to be much higher than those (250 c.c. from 4 litres) obtained by passing the vapours through an iron tube at a low red heat.—T. F. B.

[Mercury] compounds; Manufacture of pharmaceutical ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 29,751, Dec. 20, 1909. Addition to Eng. Pat. 27,030, Nov. 20, 1909.

COMPOUNDS having similar properties to those described in the principal patent (see Ger. Pat. 224,435 of 1909; this J., 1910, 1037) are obtained by treating other oxymercuric carboxylic acids (*e.g.*, oxymercuric benzoic acid anhydride or oxymercuric naphthol-carboxylic anhydride) with alkalis and amino-acids or with the alkali salts of amino-acids.—T. F. B.

Mercury derivatives of carboxylic acid esters and their saponification products; Process for producing ——. W. Schoeller and W. Schrauth. Ger. Pat. 228,877, Dec. 3, 1909.

MERCURY derivatives of unsaturated fatty acids and their esters are obtained by treating esters of the general formula, $A.CH:CHA_1.COOR$ (where A and A_1 are radicals attached to the carbons, and R an alkyl or aryl radical) in solvents containing alcohols, with mercury salts (mercuric acetate or chloride); suitable solvents are either alcohols alone, or mixtures of an alcohol with water or ether. When the mercurised esters are required, the glyceryl esters of unsaturated fatty acids, or oils containing them, may be used; if the free acids are to be prepared, the methyl or ethyl esters are more convenient to use, as the glyceryl esters are usually somewhat difficult to saponify: the methyl or ethyl esters of the mercurised acids are saponified by treatment with sodium hydroxide solution. The products do not contain mercury in an ionised condition, but combined to carbon, since it is not precipitated by alkalis nor by ammonium sulphide at the ordinary temperature.—T. F. B.

Acetic anhydride; Manufacture of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 23,924, Oct. 15, 1910. Under Int. Conv., Oct. 19, 1909.

THE solutions of sulphuryl chloride in acetic anhydride, obtained by passing sulphur dioxide and chlorine into acetic anhydride, are utilised to convert anhydrous sodium acetate into acetic anhydride. The use of acetic anhydride as solvent and diluent facilitates the mixing of the reacting substances. For example, the solution of sulphuryl chloride obtained by passing 256 parts (by weight) of sulphur dioxide and 284 parts of chlorine into 100 parts of acetic anhydride, is mixed, with cooling, with 1312 parts of anhydrous sodium acetate. When the reaction is complete the anhydride is distilled.—T. F. B.

Amino-oxyarylarsenoxides; Manufacturing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Eng. Pat. 24,480, Oct. 21, 1910. Under Int. Conv., Nov. 2, 1909. Addition to Eng. Pat. 9855, May 6, 1908.

THE therapeutic action of the amino derivatives of the hydroxyarylarsenoxides is stated to be considerably greater than that of the hydroxy-compounds themselves (see Ger. Pats. 206,057 and 206,456; this J., 1909, 328). The amino compounds are obtained by treating amino derivatives of *p*-hydroxyarylarsinic acids with feeble reducing agents, such as hydriodic acid, sulphurous acid, etc. For example, 234 grms. of aminohydroxyphenylarsinic acid (see Ger. Pat. 224,953; this J., 1910, 1178) are dissolved in 1·5 litres of water and 1·3 litres of diluted (1 : 5) sulphuric acid, 50 grms. of potassium iodide are added, and the whole is saturated with sulphur dioxide; concentrated aqueous ammonia is then added (with cooling) until the solution is strongly alkaline, when the amino-hydroxyphenylarsenoxide separates; the precipitation may be completed by addition of common salt.—T. F. B.

Allyl sulphocarbonate bismuth tri-iodide. F. S. Mason, New York. U.S. Pat. 976,669, Nov. 22, 1910.

A double compound of bismuth tri-iodide and allylthiourea, of the formula, $C_3H_5N_2H_3CS,BiI_3$, is obtained by the action of potassium iodide and bismuth subnitrate on allylthiourea; at ordinary temperatures it is an orange-red, semi-fluid substance, insoluble in dilute acids, but decomposed by dilute alkalis.—T. F. B.

Silver and albumose; Process for preparing alkali compounds of ——. Chem. Fabr. auf Actien, vorm. E. Schering. First Addition, dated June 20, 1910, to Fr. Pat. 400,627, March 8, 1909. Under Int. Conv., June 21, 1909 (see this J., 1909, 1062).

Compounds of silver, albumose, and ammonia are prepared (1) by treating albumose or a solution of albumose with a compound of silver and ammonia, and isolating the product either by precipitation or evaporation; (2) by dissolving albumose in ammonia, adding a silver salt, and precipitating or evaporating the solution. For example, 1·8 kilos. of silver sulphate are dissolved in 46 litres of *N*/1 ammonia solution, 15 kilos. of albumose are dissolved in the solution, and the resulting solution is filtered and evaporated to dryness in a vacuum at a low temperature. —T. F. B.

Tricyclene carboxylic acid; Process for preparing ——. J. Bredt and R. May. Ger. Pat. 225,709, Nov. 26, 1909.

Camphenyl nitrite, $C_{10}H_{15}NO_2$, of m. pt. 67° C., is treated with concentrated mineral acid in the cold, and the product is converted into tricyclenecarboxylic acid by boiling with water.—T. F. B.

Urea and alkaline-earth bromides; Process for producing double compounds of ——. Gehe und Co., A.-G. Ger. Pat. 226,224, July 10, 1909.

Double compounds of urea with alkaline-earth bromides, suitable for use in medicine, are obtained by heating 4 mols. of urea with one mol. of the bromide for some hours, in a suitable solvent.—T. F. B.

1-*Phenyl*-2.3-*dimethyl*-4-*isovalerylamino*-5-*pyrazolone and* 1-*phenyl*-2.3-*dimethyl*-4-*a*-*bromo*-*isovalerylamino*-5-*pyrazolone; Process for preparing* ——. Knoll und Co. Ger. Pat. 227,013, Jan. 19, 1908.

The above compounds are obtained from 1-phenyl-2.3-dimethyl-4-amino-5-pyrazolone by introducing the isovaleryl or *a*-bromoisovaleryl group into the amino group by the usual methods: the products melt at 203° C. and 206° C. (with decomposition), respectively, and are applicable to medicine.—T. F. B.

Amino-acids; Process for preparing derivatives of esters of aromatic ——. P. Runge. Ger. Pat. 228,666, July 31, 1910.

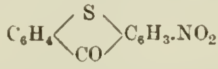
Compounds of esters of aromatic amino-acids with aromatic hydroxy-aldehydes (vanillin, salicylic aldehyde, etc.) may be obtained by simply fusing the components together in molecular proportions, or by allowing them to interact in presence of water, alcohol, or other suitable solvent; their formation is accelerated by heat, and also by the presence of small quantities of hydrochloric or sulphuric acid. The anil from *p*-aminobenzoic acid ethyl ester and vanillin is a yellowish substance of m. pt. 149° C., soluble in alcohol, ether, and toluene: that from *p*-aminobenzoic acid ethyl ester and salicylic aldehyde exists in two modifications; the yellow form, of m. pt. 85·5° C., is best obtained by the interaction of concentrated solutions of the components and rapid crystallisation, whilst the red form is obtained by slow crystallisation from dilute solutions: it commences to melt at 83° C., changes to the yellow variety and solidifies, and finally melts at 87·5° C. Both modifications are soluble in alcohol, ether, toluene, and xylene, the yellow being more readily soluble. All the above substances possess antiseptic properties, and may be used in medicine as antiseptics, and for treating blood and skin complaints.—T. F. B.

Formaldehyde; Process for the preparation of ——. O. Blank. Ger. Pat. 228,697, Sept. 27, 1908.

A mixture of air and methyl alcohol vapour is led over heated silver, *e.g.*, silver deposited on asbestos. By the use of silver as contact substance, the methyl alcohol is converted almost quantitatively into formaldehyde, the amount of undecomposed alcohol passing over being so small as to be negligible, whereas when copper is employed, the product has to be fractionated in order to remove methyl alcohol.—A. S.

Nitrothioxanthones and their derivatives; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 228,756, Dec. 3, 1909.

The nitrophenylsulphide-2′-carboxylic acids can be converted into the corresponding nitrothioxanthones,



$$C_6H_4\left\langle\begin{matrix}S\\CO\end{matrix}\right\rangle C_6H_3.NO_2,$$

by treatment with sulphuric acid containing anhydride. Fifty parts of 2-nitrophenylsulphide-2′-carboxylic acid are dissolved in four times the weight of 20 per cent. "oleum," the solution is poured into ice-water, and the 2-nitrothioxanthone treated with dilute caustic soda solution to remove the unaltered carboxylic acid, and recrystallised from xylene; it forms small yellow prisms, of m. pt. 216°—218° C., soluble with difficulty in xylene and alcohol, easily in glacial acetic acid. The 4-nitrothioxanthone and its -2-sulphonic acid, and 2-nitrothioxanthone-4-sulphonic acid can also be obtained from the carboxylic acids by this process.—T. F. B.

Amino-acetyl-p-phenetidine; Process for preparing bromo-fatty acid compounds of ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 228,835, April 4, 1908.

When the amino-group of amino-acetyl-*p*-phenetidine is substituted by bromo-fatty acids, compounds possessing antipyretic, antirheumatic, sedative, and hypnotic properties are obtained: the active dose does not exceed 0·5—0·75 grm. *a*-Bromo-isovalerylamino-acet-*p*-phenetidine, prepared by treating the base with *a*-bromoisovaleryl chloride or bromide in benzene solution, is a white crystalline substance, of m.pt. 155°—156° C., readily soluble in alcohol, ether, and hot benzene, and insoluble in petroleum spirit.—T. F. B.

Isoborneol; Process for preparing fatty acid esters of ——. J. R. Schindelmeiser. Ger. Pat. 229,190, March 4, 1909.

Camphene and fatty acids can be made to react quantitatively to form isoborneol esters, if phosphoric anhydride is employed as the condensing agent, the presence of water being avoided: no solvent is required. Isobornyl acetate, for example, is obtained by mixing 100 kilos. of camphene, 70 kilos. of 98—99 per cent. acetic acid, and 5 kilos. of phosphoric anhydride, allowing to stand some hours, and then heating at 40°—50° C. for five to six hours.—T. F. B.

Aloïn; Process for producing derivatives of ——. Verein. Chininfabr. Zimmer und Co. Ger. Pat. 229,191, Sept. 18, 1908.

New derivatives of aloïn, suitable for therapeutic purposes, are obtained by converting it into its carbonic acid esters or into a substituted carbonate, by the known methods for preparing such compounds.—T. F. B.

Santalol compounds; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4539, Feb. 23, 1910.

See Ger. Pat. 226,229 of 1909; this J., 1910, 1474.—T. F. B.

Octendione and its homologues; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 7057, March 21, 1910.

See Ger. Pat. 227,176 of 1909; this J., 1910, 1332.—T. F. B.

Octadionol and its homologues; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 9358, April 18, 1910.

See Ger Pat. 227,177 of 1909; this J., 1910, 1332.—T. F. B.

Anhydrides of organic acids; Manufacture of ——. F. W. de Jahn. Fr. Pat 417,710, March 17, 1910. Under Int. Conv., March 27, 1909.

See Eng. Pat. 5939 of 1910; this J., 1910, 1227.—T. F. B.

Bromo-diethylacetylurea; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 417,803, July 2, 1910. Under Int. Conv., July 9, 1909.

See Eng. Pat. 2888 of 1910; this J., 1910, 1332.—T. F. B.

Preparing per-acids and peroxides. Ger. Pat. 228,665. *See* VII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Screen-plates for half-tone process printing. H. W. H. Palmer, Tunbridge Wells. Eng. Pats. 27,665 and 27,906, Nov. 27 and 30, 1909.

A photographic plate carrying a sensitive emulsion on one side, is provided on the opposite side with a screen of any suitable form consisting of lines, dots, etc.; the plate is exposed with the screen towards the lens, and the screen removed before development, so that the resulting negative can be printed directly on to the sensitised metal plate to form the half-tone plate, thus avoiding the preparation of a print and photographing this through a ruled screen.—T. F. B.

Polychrome screens for the photography of colours; Process for producing ——. R. Ruth. Fr. Pat. 417,382, June 22, 1910.

See Eng. Pat. 16,273 of 1910; this J., 1910, 1272. The solutions may also contain silver bromide and other sensitive substances.—T. F. B.

Colour photography; Process for making polychrome screens for —— by melting a layer of coloured glass grains on a glass plate. E. Gistl. Ger. Pat. 228,597, Dec. 24, 1908.

Polychrome screens formed by melting a number of suitably coloured grains of glass on to a glass plate, have a more or less irregular surface, and therefore do not transmit the rays with the requisite accuracy. It is therefore proposed to grind and polish the surfaces of these screens.—T. F. B.

Papers and other fabrics sensitive to light; Preparation of —— for use in reproduction. Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pat. 226,982, July 17, 1909.

Highly sensitive surfaces, the prints on which can be easily coloured or retouched, are obtained by coating paper or other fabric with a silver bromide emulsion in the usual manner, and mechanically removing the emulsion which has not penetrated into the fabric. When the emulsion is prepared with agar-agar or gelatin, it is preferable to add to it a solution of a mucilaginous substance.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

French service powder. E. Neumann. Z. ges. Schiess- und Sprengstoffw., 1910, 5, 449—451, 472—474.

The author traces the development of the French service powder from 1866. From this date up to 1884 considerable alterations were made in the composition and form of black powder, and also in the nature of the charcoal used. In 1884 Vieille introduced into the French service, a smokeless powder known as "B" powder, which has, with various modifications, been retained as the French service powder. It originally consisted of:—Insoluble nitrocellulose 68·21 per cent., soluble nitrocellulose 20·79 per cent., and paraffin 2·0 per cent. The nitrocellulose was gelatinised with ethyl acetate and finished in the form of flakes. Somewhat later a powder of another composition was introduced, consisting of:—Insoluble nitrocellulose 29·13 per cent., soluble nitrocellulose 41·31 per cent., barium nitrate 19·0 per cent., potassium nitrate 8·0 per cent., and sodium carbonate 2·0 per cent. Ether-alcohol was used for the purpose of gelatinising the powder and, later, methyl alcohol was also used. More recently a pure nitrocellulose powder, with various ingredients added as stabilisers, has been in use. The author deals with the French powders used for guns of various calibre, giving details as to the size of the grains and the ballistics obtained. —G. W. McD.

Nitrocellulose; The viscosity of solutions of ——. C. Piest, Z. ges. Schiess- und Sprengstoffw., 1910, 5, 409—413.

The viscosity of solutions of nitrocellulose was investigated in the apparatus designed by Cochius, and also by Engler's method. It was found that the latter method was preferable when using, as was the case throughout, 2 grms. of the nitrocellulose dissolved in 100 c.c. of either acetone or ether-alcohol. The figures quoted for viscosity readings refer to the ratio of the times of flow, from Engler's apparatus at 20° C., of 200 c.c. of the nitrocellulose solutions, compared with the time of flow of water at the same temperature. The solutions always stood for 2 days before testing and a comparison was generally made between such solutions and those which had been standing for 21 days. Using the same mixed acid, at a temperature of 20°—25°C., and with the same time of nitration (30 mins.) mercerised cotton produced a stabilised nitrocotton of higher viscosity (2·3) than strongly bleached cotton (1·2). The nitrogen content of the former was 12·96 per cent., and the solubility 21·8 per cent., whilst for the latter the figures were 12·71 per cent. and 40·9 per cent., respectively. Samples of soluble nitrocellulose were prepared using an acid mixture of the following composition:—Sulphuric acid (57·7), nitric acid (22·5), and water (19·8). The nitrocellulose produced by immersing cotton in this acid mixture at 50° C. for 10 mins, had, when stabilised, a viscosity reading of 1·38. That produced by immersing cotton at 34°—40° C. had a higher viscosity (2·09). The effect of the addition of nitrating acid (2 drops), to 250 c.c. of a solution of unstabilised nitrocellulose in acetone was also investigated. Without the addition of acid the viscosity readings were as follows, after standing for the periods mentioned:—2 days (14·51), 6 days (13·53), 21 days (13·49). The corresponding figures after the addition of acid were 12·6, 12·95, and 12·47 respectively. The viscosity of the acetone solution of stabilised collodion cotton fell from 24 to 18 on standing for 21 days. Similar results were obtained when acetic acid was added to the solutions of nitrocellulose in either acetone or ether-alcohol.—G. W. McD.

XXIII.—ANALYTICAL PROCESSES.

Titanous chloride; Use of —— in volumetric analysis. IV. Determination of quinones. E. Knecht and E. Hibbert. Ber., 1910, 43, 3455—3457.

The method is based upon the quantitative reduction of the quinone, in the cold, by means of titanous chloride,

—$C_6H_4O_2 + 2TiCl_3 + 2HCl = C_6H_6O_2 + 2TiCl_4$. A cold aqueous solution of the quinone is treated with an excess of standardised titanous chloride solution, and the excess titrated with iron ammonium sulphate, with potassium thiocyanate as indicator. Or the titration may be done directly in the presence of methylene blue as indicator, the quinone being quantitatively reduced before reduction and decolourisation of the methylene blue take place. Methylene blue may also be used as an indicator in place of potassium thiocyanate in the titration of ferric salts, which are quantitatively reduced by titanous chloride before decolourisation of the indicator occurs. The quantity of methylene blue employed should be such as to be decolourised by one drop of the titanous chloride solution, and for rapid working it is preferable to heat the solution of the ferric salt to 35°—40° C.—C. A. M.

Alumina and ferric oxide; Separation of ——. P. Barbier. Bull. Soc. Chim., 1910, 7, 1027—1028.

A solution of the material in which the aluminium and iron are to be determined is treated with a slight excess of a solution of sodium acetate followed by a gradual addition of a 10 per cent. solution of sodium hydrosulphite until the reddish colour has been discharged. On boiling the liquid the aluminium is precipitated quantitatively in a dense form easy to filter and wash. The incineration of the precipitate is carried out with the aid of nitric acid. The iron remains entirely in solution and is determined in the usual way. With ores containing beryllium, this metal is precipitated along with the aluminium, from which it may be separated by digestion for 36 hours with a concentrated solution of ammonium carbonate. The beryllium is dissolved and is reprecipitated from the solution by prolonged boiling. The method is stated to be both rapid and accurate.—B. G. McL.

Titanium; Analysis of substances containing ——. K. Bornemann and H. Schirmeister. Metallurgie, 1910, 7, 711—716. 724—729.

In order to completely oxidise the titanium it is necessary to fuse about 0·5 gram of the substance for at least half an hour with fifteen grams of potassium hydroxide and five grams of potassium nitrate in a nickel crucible at a dull red heat. After cooling, the melt is evaporated to dryness with hydrochloric acid in order to remove the silica before proceeding to separate the titanic acid (this J., 1910, 1304.) A number of analyses are given by which it is shown that in order to get exact values for the titanic acid, the ammoniacal precipitate obtained as given (this J., 1910, 1304) should be heated with a mixture of sulphuric and nitric acids (the presence of alkalis does not interfere), or by repeated precipitation before the final ignition, which should be at a temperature of at least 1000° C. In the case of titanium steels, 0·3 to 0·5 gram of the substance should be employed, and to the solution, warmed to 50° C., 30 c.c. of a concentrated solution of sodium bisulphite added until all the iron is reduced. To obtain a white titanic acid precipitate 70 c.c. of concentrated ammonia solution containing some potassium cyanide (about 7 to 8 times as much as the steel originally taken) is added all at once while stirring. The solution is then heated for ten minutes, filtered, and the precipitate washed with a solution of ammonium bisulphite and with hot water. The authors also discuss the titration of iron in the presence of titanic acid.—A. H. C.

Niobium and tantalum; Indirect method for determining —[*in mixtures of the two*]. H. W. Foote and R. W. Langley. Amer. J. Sci., 1910, 30, 393—400.

The oxides of the two metals are precipitated together, ignited, and weighed. The specific gravity of the mixture is then determined, and the proportion of niobium to tantalum deduced from previous careful determinations of the specific gravities of known mixtures. The mixed oxides obtained in the course of analysis are dissolved in hydrofluoric acid (if they will not dissolve they are fused with acid potassium fluoride, the fusion dissolved in water and hydrofluoric acid, the oxides precipitated with ammonia, filtered and washed with ammonia water, then re-dissolved in hydrofluoric acid), the solution evaporated to dryness, the residue moistened with concentrated sulphuric acid, and heated till all hydrofluoric acid is expelled. Water is added, the solution made alkaline with ammonia, filtered, and the precipitate washed, ignited, and weighed. It is then heated over a blast lamp for an hour, and the density determined. The density of the mixed oxides is not a linear function of the percentage of either, but the curve drawn from the figures seems to indicate the existence of solid solutions of either in the other. The authors' figures for the densities are as follows :—

Ta_2O_5	Specific gravity.	Ta_2O_5	Specific gravity.	Ta_2O_5	Specific gravity.
per cent.		per cent.		per cent.	
0	4·552	50	5·850	—	—
5	4·650	60	6·434	85	7·961
10	4·746	65	6·737	90	8·098
20	4·929	70	7·083	95	8·243
30	5·200	75	7·441	100	8·716
40	5·474	80	7·654	—	—

—J. T. D.

Tantalum and niobium; Note on a recent method for separating ——. H. W. Foote and R. W. Langley. Amer. J. Sci., 1910, 30, 401—402.

The authors have endeavoured to use the method of Weiss and Landecker (this J., 1909, 1169) to separate tantalum from niobium. In whatever way they varied the quantities of reagents used and the concentrations of the solutions, however, they invariably found that nearly all the niobium was precipitated by the carbon dioxide along with the tantalum; moreover, some alkali seemed to be precipitated too, for the weight of the tantalum oxide found was frequently greater than the sum of the weights of the two oxides taken.—J. T. D.

Viscosity of lubricants and other liquids; Measurement of ——. O. Scarpa. Gazz. chim. ital., 1910, 40, II., 261—285.

In the apparatus devised by the author the principles of the two types of apparatus hitherto used are embodied, and final corrections are eliminated as far as possible. The viscosimeter tube consists of a pipette with a long capillary (5 to 10 cm. long by about 0·2 mm. in diameter) above which is a bulb, *a*, holding about 1 c.c., a second bulb, *b*, (capacity about 5 c.c.), a third, *c*, of about 10 c.c. capacity, and a fourth, *c'*, of about 1 c.c. capacity. Between these are the marks *s*, *s'*, and *s''*. In one form of the apparatus (Fig. 1) the capillary tube opens into a curved tube, about 2 cm. in diameter and 30 cm. in length, which serves as the reservoir for the liquid; whilst in the other form (Fig. 2), which is more practical, the viscosimeter tube is fixed in a large test tube by means of a cork with two openings. The top of the viscosimeter tube is connected with an apparatus for creating reduced pressure, and this in turn communicates with a pressure regulator and a manometer. From 20 to 25 c.c. of the liquid under examination are placed in the reservoir tube and the time, t_1, in seconds, required for it to be drawn into the bulb *a*, *b*, or *c* (according to the viscosity) is ascertained. Then, without touching the viscosimeter, the pressure apparatus is disconnected, and a further determination made of the time, t_2, taken by the liquid to flow by its own weight from the same bulb. The value of the function, $\frac{t_1 t_2}{t_1+t_2}$ of the times of influx and efflux of the same volume of liquid, is proportional to the viscosity of that liquid, and the proportionality does not depend upon the surface tension, the specific gravity, or the quantity of liquid in the viscosimeter. Moreover, if the pressure, P, be kept constant, this proportionality is a value characteristic for all measurements made with the same apparatus. If η represent the coefficient of viscosity of the liquid; t_1 and t_2 the respective times of influx and efflux of the volume V; R the radius of the capillary tube of length L; P the value of the external pressure during the influx; p the value of the pressure

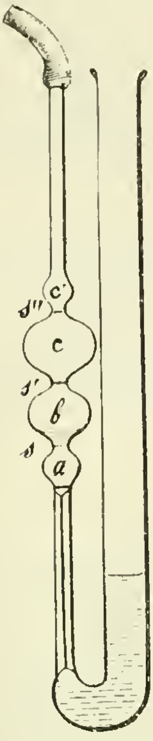


Fig. 1.

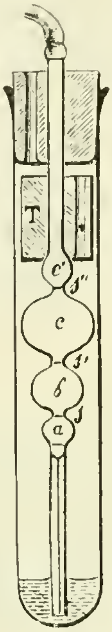


Fig. 2

exercised by the liquid during its efflux—tho value of η may be calculated by means of the equation—

$$\eta = \frac{\pi R^4 P}{8VL} \cdot \frac{t_1 t_2}{t_1+t_2} - \frac{\partial V}{10\pi L} \cdot \frac{2}{t_1+t_2},$$

and, applying Hagenbach's correction,—

$$\frac{\pi . R^4 P}{8VL} = 0{\cdot}01005\left(\frac{1}{t_1}+\frac{1}{t_2}\right) + \frac{\partial V}{0\pi L}\left(\frac{1}{t_1^2}+\frac{1}{t_2^2}\right)$$

If it is required to refer the viscosity of the liquid to that of water at a fixed temperature the value of the function $\frac{t_1 t_2}{t_1+t_2}$ of the time of influx and efflux of that given volume of water at that fixed temperature, must be determined. The following results obtained with Engler's viscosimeter and with the author's apparatus are quoted (among others) to show the errors that may result from the use of a viscosimeter in which (as in the case of Engler's) the efflux of the liquid does not take place in accordance with tho laws of Poiseuille :—

Coefficient of viscosity, η, compared with water at 20° C.
Turbine Oil.

Engler's viscosimeter.		Scarpa's viscosimeter.	
° C.	η.	°C.	η.
91·2	1·14	93·4	3·17
80·0	1·25	81·2	3·91
56·2	1·59	57·7	7·09
45·0	1·86	45·6	10·39
17·8	6·53	—	—

Hence, in the author's opinion, deductions as to the viscosity of lubricants at high temperatures based upon the curves of viscosity obtained with Engler's apparatus must certainly be erroneous. A further advantage claimed for the new viscosimeter is that it is possible to examine therewith lubricants so viscous as not to be capable of examination in Engler's apparatus. In the latter case not only is the efflux time excessively long (over half an hour) but, in addition to this, drops are formed at the end of the tube, and the results are thus rendered illusory.—C. A. M.

Extracting cyanogen from coal gas. Mueller. *See* IIa.

Use of metallic potassium in determining halogens in benzene derivatives. Maryott. *See* III.

Determining total tartaric acid by the Goldenberg process. Ordonneau. *See* VII.

Nitrolime [*crude calcium cyanamide*]. Caro and others. *See* VII.

Detection of nickel in presence of much cobalt. Ball. *See* VII.

Determination of the acid content of hydrogen peroxide. Wöhler and Frey. *See* VII.

Destruction of cyanide. Moir and Gray. *See* X.

Analysis of German silver and similar alloys. Korte. *See* X.

Character of silver deposits from various electrolytes. Hughes and Withrow. *See* XI.

Detection of menhaden oil in cod liver oil. Hoppenstedt. *See* XII.

Elaïdin reaction. Fokin. *See* XII.

Determination of the acidity of one-bath chrome-liquors. Bateson. *See* XV.

Extraction of leather by various solvents. Riker. *See* XV.

Insecticidal treatments in viticulture. Moreau and Vinet. *See* XVI.

Determining the sucrose content of bagasse. De Haan. *See* XVII.

Chemistry of Ley's reaction [*for honey*]. Amberger. *See* XVII.

Determination of lactose in presence of the commonly occurring sugars. Baker and Hulton. *See* XVII.

Polarimetric determination of lactose [*in milk and milk products*]. Richmond. *See* XIXa.

Detection and determination of nitrates in milk. Tillmans. *See* XIXa.

Determining nitrates in water by a sulphosalicylic reagent. Caron and Raquet. *See* XIXb.

Tincture of cinchona and its alkaloidal content. Frerichs. *See* XX.

New reaction of morphine. Denigès. *See* XX.

Valuation of formaldehyde solutions. Braeutigam. *See* XX.

Patent.

Indicating and recording the calorific value of gases. U.S. Pat. 977,970. *See* IIa.

XXIV.—MISCELLANEOUS ABSTRACTS.

Reduction of unsaturated compounds ; Catalytic ——. *Preliminary communication.* S. Fokin. J. Russ. Phys.-Chem. Ges., 1910, **42**, 1074—1077. Chem. Zentr., 1910, **2**, 1743—1744.

On passing hydrogen through an unsaturated compound of the type, $R_1CH:CH.R_2$, holding a metallic hydroxide in suspension, the author observed the production of complex compounds of the hydroxide and the unsaturated compound, in the form of sols. These complex compounds appear to play a part in the reduction of the unsaturated compounds, acting as hydrogen-carriers. —A. S.

Cellase ; Influence of temperature on the activity of ——. G. Bertrand and A. Compton. Comptes rend., 1910, **151**, 1076—1079. (See this J., 1910, 102, 292, 1075.)

It is found that the optimum temperature for the action of cellase lies between 45° and 47° C. ; the enzyme is very rapidly destroyed when its solution is heated at 75° C. The authors propose to show that the optimum temperature for the action of cellase serves to distinguish this enzyme from the other soluble enzymes which accompany it in almonds, and which decompose amygdalin.—L. E.

Books Received.

Chemiker-Kalendar, 1911. Ein Hilfsbuch für Chemiker, Physiker, Mineralogen, Industrielle, Pharmazeuten, Hüttenmänner, u. s. w. Von Dr. Rudolf Biedermann. In zwei Bänden. Zweiunddreissigster Jahrgang. Julius Springer's Verlag, Monbijouplatz 3, Berlin, 1911. Price M. 4. Bound in leather, M. 4.50.

Part I.—Arranged as a pocketbook and strongly bound in waterproof cloth or in leather. It contains an almanack for 1911, together with a table of the frequently used atomic weights and their multiples. The general text refers principally to matters of purely chemical interest. I. Atomic and molecular weights. II. Different properties of chemical substances. III. Gas and vapour densities. Specific gravities, (i.) Alkalis. (ii.) Acids. (iii.) Salts. (iv.) Alcohols, etc. IV. Solubilities. V. Analysis. VI. Volumetric analysis. VII. Electrochemical analysis. VIII. Gas analysis. IX. Spectrum analysis. The matter in these various groups is chiefly arranged in tables described as "Hilfstabellen." A notebook calendar with blank pages for notes, is arranged for the different days of the year. The subject matter, exclusive of the calendar and the blank pages for notes, fills 389 pages. A tabular arrangement of the relative coinage values of the world now follows. One side of the external cover of the little volume is utilised as a centimetre scale measure.

Part II.—Supplementary volume in size similar to the pocket book, but unbound, and more directly concerned with chemical technology. It contains tables relating to :—I. Physics and physical-chemistry. II. Mineralogy. III. Technical chemical analysis and investigation. IV. Special items, recipes, etc. Besides the tabulated matter, however, there are concise descriptive paragraphs of introductory character, with descriptions of analytical methods. The subdivisions are as follows :—(1) Water. (2) Assaying. (3) Fuels. (4) Sulphuric acid. (5) Alkali. (6) Bleaching powder. (7) Nitre and explosives. (8) Ceramics. (9) Glass. (10) Mortar and cement. (11) Illuminants. (12) Starch and sugar. (15) Essential oils and perfumery. (16) Tanning agents. (17) Textile fibres and paper. (18) Photography. (19) Dyestuffs and colours. (20) Physiological chemical analysis. (21) Appendix. The subject matter fills 608 pages.

Sprechsaal-Kalender, 1911, für die keramischen, Glas- und verwandten Industrien. Herausgegeben von Dr. J. Koerner. Verlag von Müller und Schmidt, Coburg, 1910, III Jahrgang. Price, M. 2.50.

Small volume in pocket book form, bound in waterproof linen. It contains a calendar with blank pages subdivided for each day of the year, and 46 blank pages for additional notes. The subject matter fills 137 pages, devoted to the usual purely scientific data and tables to begin with, followed by carefully arranged tabulated and other matter relating to fuel, clays, etc., and likely to be of service to those engaged in the ceramic, glass, pottery and earthenware industries.

Abstract of the Reports on the French Coal-dust Experiments, conducted at the Liévin Experimental Station, 1907—1910. By J. Taffanel, Director of the Experimental Station. (Abstracted and translated by the "Colliery Guardian" from the original French, by permission of the Comité Central des Houillères de France.) The Colliery Guardian Company, Limited, 30 and 31, Furnival Street, Holborn, London, E.C. 1910. Price 1s. net.

An abridged translation of a series of six reports by M. Taffanel on the above subject (82 pages), with a final concise chapter of general conclusions (9 pages).

The Explosibility of Coal Dust. United States Geological Survey. Department of the Interior. Bulletin 425. George S. Rice, with chapters by J. C. W. Frazer, A. Larsen, F. Haas and C. Scholz. Washington Govt. Printing Office, 1910.

8vo volume, containing 167 pages of subject matter, a selected bibliography from earlier years up to date, and an alphabetical index. There are 29 illustrations. The subject matter is classified as follows :—I. Historical review of the coal-dust question in Europe. II. Historical review in the United States. III. Coal-dust and its origin and distribution. IV. Explosible coal-dusts. V. Effect of coarseness of dust. VI. Effect of chemical composition. VII. Humidity of mine air. VIII. Remedies for coal-dust ignition. IX. Tentative conclusions on the coal-dust problem. X. Laboratory investigations of the ignition of coal dust. XI. Exhaust steam as a preventative of dust explosions, and moisture in coal-dust. XII. Use of steam and water sprays in Oklahoma mines.

Report on Colors : The solubility and extraction of colors and the color reactions of dyed fiber and of aqueous and sulphuric acid solutions. United States Department of Agriculture. Bureau of Chemistry. Circular No. 35. Jan. 10, 1910. H. M. Loomis, Chemist, Pennsylvania Department of Agric. Washington, D.C., U.S. America.

This reprint in pamphlet form, contains 51 pages of subject matter, commencing with I. Introduction. II. Plan of experiments. III. Solubility. IV. Extraction with immiscible solvents. V. Colour reactions of dyed fibre. VI. Reaction of colours in aqueous solution and with concentrated sulphuric acid. The rest of the work (pp. 4 to 51) is made up of tables :—Table I. "Solubility of colours, with colours of solution." Table II. "Extraction of colours with immiscible solvents from aqueous solutions." Table III. "Colour reactions of dyed fibre (wool)." Table IV. "Appearance and reactions of colours in aqueous solution and with concentrated sulphuric acid."

Inorganic Chemistry for Advanced Students. By the Right Hon. Sir H. Roscoe, F.R.S., and Dr. A. Harden, F.R.S. (2nd Edit. completely revised.) Macmillan and Co., Ltd., St. Martin's Street, London. 1910. Price 4s. 6d.

Designed as supplementary to the volume of *Inorganic Chemistry for Beginners.* It contains subject matter filling 466 pages, illustrated with 53 engravings, and an alphabetical index of subjects. The work is divided into chapters, at the close of most of which are summaries of the gist of the contents, and at the close of all of which, are selections of appropriate exercises. The contents are as follows :— 1. Molecular and atomic weights. 2. Determination of the molecular weights of gases and volatile liquids and solids. 3. Solution and crystallisation. 4, 5, and 6. The halogen elements. 7. Action of alkalis on the halogens. 8. General properties of the halogen elements. 9. Equivalents. 10. Metals and non-metals. 11, 12, 13 and 14. Nitrogen group and its elements.

15. Determination of atomic weight from the specfic heat of the solid element. 16. Crystals. Isomorphism. 17. Alkali metals. 18. The alkali manufacture. 19. Alkali metals cont. 20. Constitutional formulæ, etc. 21. Ammonium compounds. Dissociation. 22. The alkaline earth metals. 23 and 24. Zinc group of metals. 25 and 26. Copper group of metals 27. Thermo-chemistry. 28. Electro-chemistry. 29. Aluminium group of elements. 30, 31 and 32. Carbon group. 33 and 34. Iron group. 35. Chromium. 36. Manganese. 37. Platinum, and gases of helium group. 38. Periodic system. 39. Determination of the molecular weights of dissolved substances. 40. Spectrum analysis. 41. The radio-active elements.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London. W.C., from whom all the works in the preceding list can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

Applications.

28,833. Chesebrough. Methods of filtration practice.* Dec. 12.

28,892. Moore and Hall. *See under* VII.

28,899. Phillips and Phillips. Simultaneous desiccation and consolidation of pulps. Dec. 13.

28,925. Studer. Evaporating apparatus. Dec. 13.

28,927. Reid. Settling tanks for separating liquids and solids. [Comprised in No. 7109, March 22, 1910.] Dec. 13.

28,941 and 28,942. Bolz. *See under* II.

28,982. Bernhardt. Regenerative furnaces.*. Dec. 13.

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29,933. Boeking et Cie., and Stumm-Halberg. Filtration of furnace gases. [Ger. Appl., May 30, 1910.]* Dec. 23.

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30,267. Sellars. Centrifugal machines for separating substances contained in liquids. Dec. 30.

Complete Specifications Accepted.

25,807 (1909). Nagle. Direct heat rotary drying apparatus. Dec. 21.

29,360 (1909). Wilfley Mining Machinery Co., and Roberts. Filtering apparatus for separating liquid from solids. Dec. 21.

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29,698 (1909). Scott and Co., and Pooley. Evaporating apparatus. Dec. 30.

29,789 (1909). Krüger. Production of crystals. Dec. 21.

30,092 (1909). Hannay. Furnaces. Dec. 30.

30,586 (1909). Breakell. Filtering apparatus for separating liquids from materials and for washing and saturating materials with liquids. Dec. 31.

2522 (1910). Bratkowski. Drying materials by hot air. Dec. 30.

5145 (1910). Lovekin. Exchanging heat between fluids. Dec. 21.

21,820 (1910). Forsberg. Centrifugal liquid separators. Dec. 21.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

28,855. Glasgow. Manufacture of water-gas. Dec. 12.

28,929. Wainwright and Cooke. Manufacture of fuel. Dec. 13.

28,941 and 28,942. Bolz. Upright distilling retorts. [Comprised in No. 17,949, July 28, 1910.]* Dec. 13.

29,019. Moore. Retort for treating coal and other carbonaceous substances. Dec. 14.

29,189. Allen and Gibson. Manufacture or treatment of coke or like fuel. Dec. 15.

29,194. Johnston and Clark. Gas manufacture. Dec. 15.

29,196. Brassert and Witting. Methods and apparatus for cleaning gas. [U.S. Appl., April 4, 1910.]* Dec. 15.

29,247. Wetter (Naamlooze Vennootschap Briquet Co.). Manufacture of fuel blocks or briquettes.* Dec. 16.

29,306. Von Groeling and Smith-Rewse. Apparatus for treating paraffin wax. Dec. 16.

29,367. Reynolds. Production of gaseous fuel for metallurgical and other purposes. Dec. 17.

29,431. Hartness. Suction gas producers. Dec. 19.

29,501. Southey. Production of gaseous fuel. Dec. 19.

29,673. Evans. Purification of coal gas and like gases. Dec. 21.

29,705. Von Groeling and Smith-Rewse. Apparatus for distilling petroleum oil or other hydrocarbons or for condensing natural gases. Dec. 21.

29,894. Phillips and Bulteel. Cracking or decomposition of hydrocarbon oils. Dec. 23.

29,935. Coke Oven Construction Co., Ltd., and Marr. Recovery of by-products formed in gasifying coal.* Dec. 23.

30,374. Jones. Vertical coke ovens. Dec. 31.

Complete Specifications Accepted.

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Applications.

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Complete Specifications Accepted.

28,868 (1909). Radcliffe. *See under* II.

29,138 (1909). Newton (Bayer und Co.). Manufacture of anthracene derivatives. Dec. 21.

30,504 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of anthracene compounds. Dec. 21.

9213 (1910). Barlen. Upright retorts for distilling tar, oils, etc. Dec. 30.

IV.—COLOURING MATTERS AND DYES.

Applications.

28,862. Redlich and Deutsch. Manufacture of sulphur colouring matters. [Austrian Appl., Jan. 12, 1910.]* Dec. 12.

28,872. Meister, Lucius, und Brüning. Manufacture of trisulphonic acids of the safranine series. [Ger. Appl., Feb. 8, 1910.]* Dec. 12.

29,143. Newton (Bayer und Co.). Manufacture of pentachlorobenzaldehyde and dyestuffs therefrom. Dec. 15.

29,352. Newton (Bayer und Co.). Manufacture of vat dyes of the anthracene series. Dec. 17.

29,368. Imray (Soc. Chem. Ind. in Basle). Manufacture of condensation products and dyestuffs from indigo or its substitution products.* Dec. 17.

29,567. Ullmann. *See under* III.

29,722. Johnson (Badische Anilin und Soda Fabrik). *See under* III.

29,918. Johnson (Badische Anilin und Soda Fabrik). Reduction of vat colouring matters. Dec. 23.

30,104. Newton (Bayer und Co.). Manufacture of sulphur dyestuffs. Dec. 28.

30,105 and 30,106. Newton (Bayer und Co.). Manufacture of mordant dyestuffs of the triphenylmethane series. Dec. 28.

30,284. Bayer und Co. Manufacture of dyestuffs which are derivatives of diaminodiphenylurea. [Ger. Appl., April 20, 1910.]* Dec. 30.

Complete Specifications Accepted.

369 (1910). Newton (Bayer und Co.). Manufacture of azo dyestuffs. Dec. 21.

2393 (1910). Newton (Bayer und Co.). Manufacture of azo dyestuffs. Dec. 31.

17,087 (1910). Meister, Lucius und Brüning. Manufacture of dyestuffs of the triphenylmethane series. Dec. 30.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

28,848. Seaton-Snowdon and Young. Manufacture or treatment of cellulose acetate or acetylcellulose to render it fireproof. Dec. 12.

29,046. Verein. Glanzstoff-Fabr. Manufacture of cellulose fibres or threads. [Ger. Appl., Oct. 20, 1910.]* Dec. 14.

29,087. Stanley. Manufacture of wood pulp. [U.S. Appl., Dec. 14, 1909.]* Dec. 14.

29,246. Verein. Glanzstoff-Fabr. Manufacture of non-inflammable materials similar to celluloid. [Ger. Appl., Nov. 1, 1910.]* Dec. 16.

29,442. Peters. Non-inflammable celluloid. Dec. 19.

29,553. Barat. Preparation of milk of resin for sizing paper.* Dec. 20.

29,582. Boult (Rebello Faria et Cie.). Manufacture of products from cellulose.* Dec. 20.

Complete Specifications Accepted.

29,118 (1909). Sparre. Manufacture of paper from sawdust. Dec. 21.

30,510 (1909). Gebauer. Manufacture of artificial silk and fabrics thereof. Dec. 31.

17,263 (1910). Seignol. Destruction of hairs and other foreign substances in floss and other waste silk. Dec. 31.

24,707 (1910). Morane. Machines for spinning artificial silks. Dec. 30.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Application.

29,381. Bradford Dyers' Assoc., Ltd., Whitaker, and Graham. Treatment of textile fabrics with liquids. Dec. 17.

COMPLETE SPECIFICATIONS ACCEPTED.

26,025 and 26,026 (1909). Daniell and Hebden. Dyeing yarn or the like. Dec. 21.

26,029 (1909). Daniell and Hebden. Dyeing apparatus. Dec. 21.

29,957 (1910). Johnson (Badische Anilin und Soda Fabrik). Production of discharge effects on fibre. Dec. 30.

30,505 (1909). and 13,911 (1910). Johnson (Badische Anilin und Soda Fabrik). Production of discharge or printing effects on fibre. Dec. 31.

7120 (1910). Calico Printers' Assoc., and Kenyon. Block printing on textile fabrics. Dec. 21.

9369 (1910). Müller. Bleaching process. Dec. 21.

5871 (1910). Gibbins. Washing, dyeing, and softening machines. Dec. 30.

VII.—ACIDS: ALKALIS: SALTS; NON-METALLIC ELEMENTS.

APPLICATIONS.

28,839. Behrens. Manufacture of concentrated acetic acid.* Dec. 12.

28,892. Moore and Hall. Condenser for acid vapour.* Dec. 12.

28,933 and 28,952. Nitrogène Soc. Anon. Recovery of oxides of nitrogen diluted with indifferent gases. [Swiss Applns., Dec. 16, 1909, and Sept. 23, 1910.]* Dec. 13.

29,094. Pollitt. Manufacture of zinc chloride from zinc ores or zinc oxide. Dec. 14.

29,165. Dubosc, Luttringer, and Denis. Manufacture of formates. [Fr. Appl., Dec. 15, 1909.]* Dec. 15.

29,282. Schlaugk. Preventing the decomposition of aqueous solutions of hydrogen peroxide.* Dec. 16.

29,385. Collett and Eckardt. Process of burning iron pyrites. [Appl. in Norway, Dec. 20, 1909.]* Dec. 17.

29,386. Collett and Eckardt. Manufacture of sulphates. [Appl. in Norway, Dec. 20, 1909.]* Dec. 17.

29,893. Phillips and Bulteel. Obtaining oxides of nitrogen. Dec. 23.

29,906. Hale and Scott. Recovery of corrosive acids from absorbents. Dec. 23.

29,989. Paul. Production of sulphur phosphides suitable for preparing non-poisonous priming materials.* Dec. 24.

29,997. Scheitlin. Rendering alkali superoxides harmless for use in the laundry, bleaching, etc. [Ger. Appl., Dec. 24, 1909.]* Dec. 24.

30,185. Thomann. Manufacture of a hard and dense composition containing alkali peroxide.* Dec. 29.

30,280. Gerlache. Manufacture of metallic ammoniates. Dec. 30.

30,354 and 30,355. Eckford. Manufacture of lead oxide and apparatus therefor. Dec. 31.

COMPLETE SPECIFICATIONS ACCEPTED.

26,696 (1909). and 14,268 (1910). Rollin, and Hedworth Barium Co. Manufacture of amorphous, anhydrous barium hydrate. Dec. 30.

28,868 (1909). Radcliffe. *See under* II.

29,989 (1909). Percival and Lee. Apparatus for supplying oxygen or other gas or mixture of gases. Dec. 21.

30,386 (1909). Herve. Manufacture of soda crystals. Dec. 31.

30,503 (1909). Johnson (Badische Anilin und Soda Fabrik). Removal of nitrous acid from solutions. Dec. 21.

4976 (1910). Swinton. *See under* XX.

10,441 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia. Dec. 21.

19,602 (1910). Magnesite Co. Freeing liquefied carbon dioxide from air. Dec. 31.

VIII.—GLASS; CERAMICS.

APPLICATIONS.

29,349. Chamberlin. Enamelled ware. Dec. 17.

29,387. Kruse. Enamel or like compositions.* Dec. 17.

29,521. Tidy. Kilns for burning pottery, earthenware glazed or enamelled bricks, tiles, etc.* Dec. 20.

COMPLETE SPECIFICATIONS ACCEPTED.

30,233 (1909) and 14,989 (1910). Helliwell and Helliwell. Manufacture of abrading or polishing powders. Dec. 21.

16,441 (1910). Bloxam (Siemens und Halske A.-G.). Manufacture of glass. Dec. 30.

18,301 (1910). Smythe. Glass pot heating furnaces. Dec. 30.

IX.—BUILDING MATERIALS.

APPLICATIONS.

30,035. Hippe. Manufacture of artificial stone.* Dec. 24.

30,091. Deuts. Rekord Cement Werke, and J. Krümpelmann. Manufacture of a substance for rendering cement waterproof.* Dec. 28.

COMPLETE SPECIFICATIONS ACCEPTED.

7585 (1910). Hurll. Hoffmann kiln for burning bricks and other clay goods. Dec. 31.

16,028 (1910). Harms and Small. Manufacture of liquid concrete. Dec. 31.

X.—METALS: METALLURGY, INCLUDING ELECTRO-METALLURGY.

APPLICATIONS.

28,953. Wintle. Recovery of metals from ores, residues, etc. Dec. 13.

29,084. Seligman, and A.-G. f. Autogene Aluminium Schweissung. Welding aluminium. Dec. 14.

29,184. Durville. Aluminium bronze. [Fr. Appl., Dec. 31, 1909.]* Dec. 15.

29,261. Cowper-Coles. Apparatus for use in electroplating. Dec. 16.

29,367. Reynolds. *See under* II.

29,469. Duke. Alloys. Dec. 19.

29,473. Pucklitzsch. Electroplating apparatus.* Dec. 19.

29,504. Heathcote, and Rudge-Whitworth, Ltd. Treatment of iron or steel to prevent oxidation or rust. Dec. 19.

29,723. Johnson (Heraeus). Alloys of platinum.* Dec. 21.

29,778. Cowper-Coles. Apparatus for use in electroplating. Dec. 22.

29,830. Boucher. Manufacture of iron and steel. [Fr. Appl., Nov. 7, 1910.]* Dec. 22.

29,839. Pescatore. Production of zinc and the like.* Dec. 22.

29,904. Weiss. Manufacture of alloys. [Hungarian Appl., Dec. 23, 1909.]* Dec. 23.

30,198. Baraduc-Muller. Treatment of melted metals, alloys, and steels. Dec. 29.

30,222. Naulty and Scanlin. Alloy. [U.S. Appl., Jan. 4, 1910.]* Dec. 29.

COMPLETE SPECIFICATIONS ACCEPTED.

26,019, 28,612, and 29,616 (1909). Sulman and Picard. Treatment of oxidised ores, concentrates, slimes, etc. Dec. 21.

26,588 and 27,003 (1909). Soc. Anon. Electrométallurgique. Process of refining steel. Dec. 30.

29,795 (1909). Johnson (Chem. Fabr. Griesheim Elektron). Manufacture of alkali metals. Dec. 21.

30,377 (1910). Cito. Extraction of metals from ores containing silver, nickel, cobalt, and arsenic. Dec. 31.

3965 (1910). Gadomsky. Extraction of copper from ores and slags. Dec. 31.

6035 (1910). Petersson. Charging electric resistance furnaces. Dec. 21.

7225 (1910). Smith and Deakin. Apparatus for the electrodeposition of metals. Dec. 21.
7226 (1910). Smith and Deakin. Electroplating barrel apparatus. Dec. 30.
8711 (1910). Petersson. Electric resistance furnaces. Dec. 21.

XI.—ELECTRO-CHEMISTRY.

Applications.

28,834. Rasmussen. Composition for use in electric insulating, etc.* Dec. 12.
29,299. Serpek. Revolving electric furnaces. [Fr. Appl., Aug. 11, 1910.]* Dec. 16.
29,715. Serpek. Revolving electric furnaces.* Dec. 21..
30,194. Johnson (Badische Anilin und Soda Fabrik). Apparatus for the electrical purification of gases. Dec. 29.
30,390. Popp. Electric furnaces. [Fr. Appl., May 6, 1910.]* Dec. 31.

Complete Specifications Accepted.

6035 and 8711 (1910). Petersson. *See under* X.
9459 (1910). Reid. Electric induction furnaces. Dec. 31.
11,837 1910). Estelle. Depolarising agents for electric batteries. Dec. 31.
15,169 (1910). Thomson. Electric furnaces. Dec. 21.
23,671 (1910). Peterson. Manufacture of electric insulating material. Dec. 31.

XII.—FATS; OILS; WAXES.

Applications.

28,871. Ges. f. Chem. Ind. in Basel. Manufacture of salts of halogenised fatty acids of high molecular weight. [Ger. Appl., Dec. 24, 1909.]* Dec. 12.
29,612. Bedford and Williams. Conversion of unsaturated fatty acids, esters and glycerides, into the corresponding saturated compounds. Dec. 20.
29,831. Rasmussen. *See under* XIX.
30,014. Wilbuschewitsch. Converting fats, oils, and fish oils into like bodies of higher melting point.* Dec. 24.
30,218. Kenney. Lubricants.* Dec. 29.
30,275. Li. *See under* XIX.
30,282. Crosfield and Sons, Ltd., and Markel. Conversion of unsaturated fatty acids and their glycerides into saturated compounds. [Addition to No. 1515 of 1903.] Dec. 30.

Complete Specifications Accepted.

29,438 (1909). MacDonald. *See under* XIX.
5009 (1910). Huilerie et Savonnerie de Lurian. Extracting the oil from hydrosilicates, fuller's earth, etc., used for decolouring oils. Dec. 30.
13,008 (1910). Patent Borax Co., and Bradford. Soap. Dec. 21.

XIII.—PAINTS; PIGMENTS; VARNISHES, RESINS.

Applications.

29,373. Pigments, Ltd., and Thompson. Manufacture of pigments. Dec. 17.
29,389. Rüter. Quickly-drying ink. [Belg. Appl., Dec. 18, 1909.]* Dec. 17.
29,485. Withers (Blum). Manufacture of zinc white oxide.* Dec. 19.
29,553. Barat. *See under* V.
29,594. Pigments, Ltd., and Thompson. Manufacture of pigments. Dec. 20.
30,354 and 30,355. Eckford. *See under* VII.

Complete Specifications Accepted.

29,675 (1909). Bloxam (Act. -Ges. f. Anilinfabr.). Manufacture of colour lakes. Dec. 30.
22,130 (1910). Munro and Ewart. Manufacture of paint, enamel, etc. Dec. 30.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

29,403. Ingle. Manufacture of rubber substitutes. Dec. 19.
29,647. Nicholson and Cochrane. Drying or other preliminary treatment of rubber, etc. Dec. 21.
29,718. Herzenstein. Manufacture of artificial rubber. Dec. 21.

Complete Specifications Accepted.

27,398 (1909). Black and Morton. Artificial production of indiarubber, etc. Dec. 31.
4904 (1910). Zu Aichlburg. Manufacture of a caoutchouc-like mass. Dec. 21.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

29,075. Cox. Manufacture of horn, ivory, or like substance. Dec. 14.
29,509. Soc. des Colles et Gélatines Françaises. Treatment of gelatin. [Fr. Appl., Dec. 20, 1909.]* Dec. 19.
30,311. Kohn. Process for making a liquor for bating hides.* Dec. 30.

Complete Specifications Accepted.

6268 (1910). Manns. Process for detanning leather. Dec. 30.
18,930 (1910). Forel. Manufacture of artificial leather. Dec. 30.

XVI.—SOILS; FERTILISERS.

Complete Specification Accepted

9279 (1910). Coates. Production of fertilisers. Dec. 30.

XVII.—SUGARS; STARCHES; GUMS; &c.

Applications.

28,958. Browne. Treatment of sugar. Dec. 13.
29,384. Duarte. Treatment of the root of the cassava plant. Dec. 17.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

29,071. Winde. Manufacture of malt. [Comprised in No. 7166, March 22, 1910.]* Dec. 14.
30,124. Grass. Increasing the output in processes of fermentation in which malt is employed.* Dec. 28.

Complete Specifications Accepted.

29,379 (1909). Sureties. Process for solidifying brewer's yeast. Dec. 21.
30,476 (1909). Whitaker. Process of brewing and apparatus therefor. Dec. 31.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

APPLICATIONS.

29,267. Maw, Salamon, and Riley. Disinfectants. Dec. 16.

29,831. Rasmussen. Cooling margarine emulsions and other liquids or semi-liquids. Dec. 22.

29,956. Adams. Sewage purification plant. Dec. 24.

29,964. Smith. Water or fluid filter for sewage works, etc. Dec. 24.

30,247. Pearson. Apparatus for producing pure water. Dec. 30.

30,275. Li. Manufacture of products from soja.* Dec. 30.

30,350. Li. Soja flour and its derivatives.* Dec. 31.

30,351. Li. Alimentary products made from soja grains.* Dec. 31.

30,378. Savary-Carlier. Purification of water. [Fr. Appl., Jan. 6, 1910.]* Dec. 31.

COMPLETE SPECIFICATIONS ACCEPTED.

29,032 (1909). Guy, and Farnley Iron Co. Bacteria beds or filter beds for treating sewage or other foul waters. Dec. 21.

29,438 (1909). MacDonald. Manufacture of feeding cakes for animals, and extraction of oil from the seeds used. Dec. 30.

30,397 (1909). Henri and others. Sterilising liquids. Dec. 30.

2027 (1910). Lebreil and Desgeorge. Process for rendering casein plastic. Dec. 31.

3034 (1910). Hirst and Jones. Apparatus for filtering and purifying water and other liquids. Dec. 21.

14,128 (1910). Henri, Helbronner, and von Recklinghausen. Sterilisation of liquids. Dec. 21.

18,315 (1910). Chavassieu. Dissolution and subsequent coagulation of proteids. Dec. 21.

19,621 (1910). Wiener. Sterilising milk and milk products. Dec. 30.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

APPLICATIONS.

28,831. Wellcome and Ewins. Synthesis of organic substances. Dec. 12.

28,871. Ges. f. Chem. Ind. in Basel. *See under* XII.

29,073. Johnson (Chem. Fabr. Griesheim-Elektron). Manufacture from acetylene of acetaldehyde and condensation and polymerisation products thereof.* Dec. 14.

29,559. Kalle und Co. Manufacture of therapeutic preparations. [Ger. Appl., Jan. 3, 1910.]* Dec. 20.

29,720. Johnson (Badische Anilin und Soda Fabrik). Manufacture of chlor-alkylsulphonic acids. Dec. 21.

29,721. Johnson (Badische Anilin und Soda Fabrik). Manufacture of chlor-aralkyl carboxylic acids. Dec. 21.

29,901. Newton (Bayer und Co.). Manufacture of salts of hydrastine. Dec. 23.

29,907. Von Wülfing. Therapeutic preparations containing formaldehyde. [Addition to No. 2682 of 1906.]* Dec. 23.

30,129. Busch and von Wülfing. Preparation of salts of guaiacol acids. [Addition to No. 29,787 of 1909.]* Dec. 28.

COMPLETE SPECIFICATIONS ACCEPTED.

27,397 (1909). Black and Morton. Production of substances of the terpene series. Dec. 31.

4976 (1910). Swinton. Manufacture of volatile organic acids from their calcium salts. Dec. 31.

13,485 (1910). Meister, Lucius, und Brüning. Manufacture of derivatives of *p*-oxyarylarsinic acids. Dec. 30.

14,094 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of 2·3-dimethyl-1·3-butadiene. Dec. 21.

15,722 and 17,099 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of aromatic ammonium compounds. Dec. 31.

19,350 (1910). Ges. f. Chem. Ind. in Basel. Manufacture of alkyl esters of di-iodo fatty acids of high molecular weight. Dec. 30.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

COMPLETE SPECIFICATION ACCEPTED.

23,138 (1910). Späth. Manufacture of colour screens on celluloid films or coatings. Dec. 21.

XXII.—EXPLOSIVES; MATCHES.

APPLICATION.

29,989. Paul. *See under* VII.

COMPLETE SPECIFICATION ACCEPTED.

29,882 (1909). Claessen. Manufacture of smokeless gunpowder. Dec. 30.

XXIII.—ANALYTICAL PROCESSES.

APPLICATION.

29,416. Jones. Instrument for obtaining great sensitiveness and accuracy in recording densities. Dec. 19.

COMPLETE SPECIFICATION ACCEPTED.

14,926 (1910). Lovibond. Apparatus for use in determining the colour of liquids. Dec. 21.

Journal of the Society of Chemical Industry.

No. 2, Vol. XXX. JANUARY 31, 1911. No. 2, Vol. XXX.

Birmingham Section.

Meeting held at Birmingham University on Thursday, December 15th, 1910.

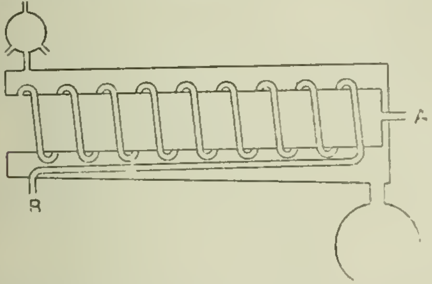
DR. T. SLATER PRICE IN THE CHAIR.

A NEW FORM OF CONSTANT TEMPERATURE DRYING OVEN.

BY R. L. SIAU.

The oven is an adaptation of Archbutt's vaporimeter (this J., 1896, 328) by which the drying chamber and the air, or other gas, passing through it are maintained at a constant temperature by means of the vapour of a suitable liquid boiling under atmospheric or, if necessary, other pressure. The drying chamber, or oven proper, consists of a long and narrow copper tube, either square or round in section, closed at one end with a plate through which passes a short length of pipe, and is wrapped round by a coil of copper tube of small, $\frac{1}{8}$—$\frac{1}{4}$ inch, diameter of which one end opens into the oven near its mouth and the other is brought, in any convenient position, through the jacket with which the oven is surrounded. A copper jacket of similar section to the oven proper fits loosely over the coil, and is supplied at its lower side near one end with a tubulure to which a copper flask is connected by means of a ground-in union, and at its upper side near the other end with a Soxhlet ball condenser. The space between the mouth of the oven and the jacket is closed by a thick planed gun-metal casting against which the gun-metal door is screwed tight by suitable swing bolts and fly nuts.

The accompanying diagram sufficiently represents the apparatus.



When in use the orifice, A, is connected with a water pump or other exhausting apparatus and a gentle current of air is sucked through the oven. It is as well to connect the tube, B, with a bubble counter so as to be sure that the door is closed tightly and that only air heated by passing through the coil is allowed to enter the drying chamber. If desired A and B can be fitted with trains of drying apparatus so that the moisture can be estimated by the gain in weight of the train connected with A, as well as by the loss in weight of the substance in the oven. Obviously, also, B can be connected to a gas supply if it is desired. The substances to be dried, contained in shallow dishes, are placed in a wire gauze tray which slides easily into the oven. If desired thermometers may be fitted in the oven near to the back and in the jacket near to the front, but they are hardly necessary.

The oven in use, made for me by Messrs. Baird and Tatlock, London, is 18 inches long by 3 inches wide and $1\frac{1}{2}$ inches high inside, with a 250 c.c. boiling flask which is half filled with distilled water (for 100° C.) or toluol (for 110° C.) and when in daily use only needs to be examined once a week.

With this oven the moisture present in barley or malt can be determined by one and a half to two hours heating at 100° C. instead of the four to six hours which are necessary when the ordinary water jacketted oven is used.

Discussion.

Mr. F. **Shedden** said the method of drying, as explained, was very interesting because the same substance dried in two particular ovens did not give the same weight. The one was the ordinary water oven; the other, an electrically heated oven. In one of the ovens there was a slight leakage due to corrosion, and damp air was admitted. For standard purposes, for getting things really dry, it was not only necessary to heat to 100° C., but also to use a current of dry air. That made quite an appreciable difference in accurate work. Mr. Siau's apparatus might easily be adapted, he thought, by connecting the inlet to some drying arrangement.

Dr. H. W. **Brownsdon** stated that a method had been adopted for drying the Mansbridge condensers as used by the General Post Office, which consisted in vigorously churning the heated air inside a closed drying oven by means of a fan, instead of leaving the air stagnant in the oven. By such treatment it was found that desiccation was completed in less than one third of the time required in a stagnant atmosphere. The percentage of moisture to be removed was of course small.

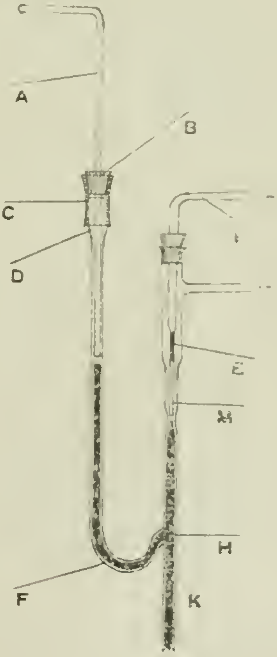
Mr. E. C. **Rossiter** said he had come to the conclusion that it was impossible to determine differences between 0·1 and 0·2 per cent. by direct weighing of the substance, and before and after drying an effective way of dealing with this small quantity of moisture was to heat the substance and to pass over it dry hydrogen or other gas, and then collect the moisture in a sulphuric acid weighing tube.

Mr. **Siau** replied that it was essential to use a current of dry air in the apparatus. The normal moisture content of malt was 0·5 to 5 per cent., but barley this year contained an average of 20 per cent. The apparatus lent itself well to the method described by Mr. Rossiter.

A NOTE ON GAS REGULATORS FOR THERMOSTATS.

BY ARTHUR SLATOR, PH.D., D.SC., F.I.C.

The ordinary toluene gas-regulators used in connection with thermostats are often so constructed, that they can be



readily adjusted to maintain any desired temperature. For this purpose the stem of the regulator has a side-piece attached, by means of which the amount of mercury in the apparatus can be decreased or increased according to whether a high or a low temperature is desired.

A modification of this part of the regulator has been in use some time and found to work satisfactorily. It consists of a side-piece having the construction indicated in the accompanying figure. The figure shows the upper part of the regulator and does not include the toluene bulb. The glass rod plunger, A, passes through the rubber bung, B, and forces the desired amount of mercury into the stem, K, of the apparatus. The cup, D, is filled to the exclusion of all air by a mixture of about two parts of glycerin and one of water. The bung, B, rests on the cup and is held in position by the rubber tubing, C, which overlaps the bung and the cup. The plunger readily slides through the bung owing to the efficient lubrication by the glycerin and water and to the fact that the tubing, C, whilst making a tight joint, does not unduly compress the bung. The bend, F, insures the mercury remaining in the side piece, even if the level in the stem falls below the joint, H. By means of this arrangement the regulator can be adjusted accurately to any desired temperature over a wide range of temperatures. It has also been noticed that the fragile end, M, of the tube, N, is rendered less liable to breakage if the two are connected by means of narrow rubber tubing, E (bicycle valve tubing), instead of being rigidly attached.

London Section.

Meeting held at Burlington House, on Monday, 2nd January, 1911.

MR. E. GRANT HOOPER IN THE CHAIR.

THE DETERMINATION OF SUCROSE IN BEET SUGAR FACTORY PRODUCTS BY CLERGET'S PROCESS, USING INVERTASE AS HYDROLYST.

BY JAMES P. OGILVIE.

Introduction.—In determining the percentage of sucrose in sugar factory products by the Clerget process, it has been recognised for some time past that other bodies than sucrose (and raffinose, if present), such as the "gums," vegetable acids, and certain nitrogenous compounds and decomposition products, may be affected by the action of the concentrated acid, and that the actual value which the determination is intended to express may thus to a more or less extent be vitiated. For this reason several well-known investigators have proposed to replace the use of acid by that of the invertase enzyme of yeast, as a hydrolyst capable of acting selectively upon the sucrose in the presence of impurities of the nature indicated.

Previous work.—Although Kjeldahl (Res. Compt. rend., Lab. Carlsberg, 1881, **1**, 192), and later C. O'Sullivan and Tompson (J. Chem. Soc. Trans., 1891, **59**, 46), conclusively demonstrated that accurate results were obtainable by the use of invertase as the hydrolytic agent, the highest percentage of sucrose estimated in this way was about 10 per cent. in a so-called "treacle."* Heron had pointed out (Thorpe's Dictionary of Applied Chemistry, vol. iii., p. 656) that in the Clerget process "instead of carrying out the inversion of cane sugar by acid O'Sullivan and Tompson's yeast process may be employed"; but it was left to Ling and Baker (this J., 1898, **17**, 111) to indicate the possible value of inversion with invertase in the analysis of molasses and other low products of the sugar factory. Working with both cane and beet molasses, these authors showed that the figures for Clerget by invertase differed appreciably from those found in the ordinary way, and they contended that this fact was *a priori* to be accounted for by defects in connection with acid hydrolysis. Hudson (U.S. Dept. Agric., Bur. Chem., Circ. 50; this J., 1910, 443) quite recently used a specially prepared solution of invertase for the examination of a variety of sugar products, estimating the invert sugar by the copper reduction method as well as polarimetrically, and the conclusion drawn by this investigator, so far as cane syrup and bagasse are concerned, was that "the invertase method of hydrolysis gives percentages which agree with those obtained by acid hydrolysis," a conclusion contrary to that arrived at by Ling and Baker.

Methods of defecation.—In now taking up this line of investigation, which is one of considerable importance to the sugar factory chemist, the present author found that the principal difficulty to be contended against when operating with invertase on very dark molasses was that of suitable clarification. It is well known that enzymes are extremely sensitive towards acids and alkalis, and it was soon observed that the action of invertase is entirely prevented by the presence of a reagent like basic lead acetate. To act upon the undefecated molasses with invertase and afterwards clarify with basic lead acetate, certainly does not yield accurate results, owing to precipitation of levulose and dextrose, although such results may be of some comparative value; whilst to use the solution defecated with basic lead acetate for the direct polarization, and then to eliminate the lead in solution by means of sodium carbonate, potassium oxalate, etc., likewise introduces an error, owing either to precipitation of the reducing sugars, or to the influence of these reagents or the product of their reaction with the lead salt, on the rotatory power of the sucrose. After a number of preliminary experiments, the method of clarification chosen, as being free from sources of error, was to defecate with basic lead acetate, to eliminate this reagent as lead sulphite by sulphur dioxide (in the way first proposed by Pellet for the ordinary Clerget process), and then to neutralise the excess of acidity, a procedure which has been found to work well, being easily carried out, and giving constant and satisfactory results.

Defecation for the invertase inversion.—As finally modified this method for the clarification of molasses solutions for invertase inversion stands as follows: Four times the normal sugar-weight of the sample are transferred to a standardised 200 c.c. flask, defecated with the minimum amount of basic lead acetate solution (sp. gr. 1·26), a little alumina cream added, then the liquid adjusted to bulk at standard temperature, well shaken, and filtered. 100 c.c. of the filtrate are measured by a standard pipette into a small beaker, sulphur dioxide passed in from a syphon of the liquefied gas till a faint smell is perceptible (the indication that all the lead is precipitated), then the liquid transferred to a 200 c.c. flask, made up to the mark, and well mixed. Sufficient calcium carbonate (dried) in fine powder to neutralise the excess of acidity, and a little recently ignited kieselguhr, are added, after which filtration follows.* In this way a normal solution is obtained which is sufficiently clarified to give a distinct polarimetric reading, is free from lead and excess of acidity, and is therefore well suited for the invertase inversion.

Invertase inversion.—The method employed for the inversion was essentially that devised by O'Sullivan and Tompson (*loc. cit.*), the exact procedure being as follows: 50 c.c. of the molasses solution, prepared in the manner just described, contained in a 100 c.c. flask, are raised in a constant temperature bath to 50—55° C., when 0·5 grm. of washed brewery yeast (top-fermentation), and 2 drops of acetic acid, are added, and the temperature maintained as near 55° C. as possible for 4½ to 5 hours. At the end of this time the liquid is cooled, alumina cream or a little kieselguhr added to assist filtration, and made up to bulk at standard temperature. The clear filtrate is then polarised in a lateral-branched water-jacketed tube, at exactly 20·0° C., the temperature being determined by a thermometer reading to 0·1° C.

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* A diluted syrup, which called for no special treatment in defecation.

* Lead sulphite is a very troublesome precipitate to filter. Pellet advises the addition of paper pulp; whilst Watts and Tempany (this J., 1908, **27**, 55), who have also used the sulphurous acid process, advocate the addition of kaolin in small amount; but the present author, using a special close filter paper and a little kieselguhr, found that a bright filtrate was obtainable almost at once.

Acid inversion.—The ordinary acid inversion was carried out exactly in the manner prescribed by Herzfeld (Zeitsch. Ver. deut. Zuckerind., **38**, 699), the precautions indicated by Pellet (Ann. Chim. Anal., 1909, **14**, 243) for the avoidance of possible errors being carefully observed. It may be mentioned here that all polarimetric readings, both direct and inversion, were made at 20·0° C., the necessity of making a temperature correction thus being obviated. The acid inversions in some of the determinations were rendered uncertain on account of the dark colour developed by the action of the acid during inversion, and it was then found necessary to decolorize with a small quantity of animal charcoal. The material used was prepared from a finely ground refinery char of high decolorizing power by boiling with hydrochloric acid, washing until free from acid, and then well drying. Extracted charcoal cannot be used for decolorising for the direct reading, since it then adsorbs sucrose; but it may be used for decolorizing for the inversion reading, provided that it is not in excess, and the liquid is acid, facts that have been pointed out by Pellet, Beaudet, and other chemists (Bull. Assoc. Chim. Sucr. et Dist., 1891, **9**, 439 and 624), and are now confirmed by the author.

Constants.—When carrying out Clerget determinations a frequent source of error is the selection of an incorrect constant for the calculation of the sucrose value. Herzfeld (Zeitsch. Ver. deut. Zuckerind., **40**, 194) has drawn up a table of constants by means of which account may be taken of the change in the rotatory power of the levulose with varying dilution, and his values have been confirmed by Ling (this J., 1898, **17**, 110); but as Pellet has pointed out from time to time, it is very advisable in accurate work for the chemist to re-determine the constant to be applied, for the purpose of checking the individual method of operating (the standardisation of flasks, pipettes, etc.), as well as with the object of verifying the dextro- and levo-rotatory graduation of the polarimetric scale of the instrument employed. Since in the present research only beet molasses polarising 48—54° V. was used, the procedure adopted in establishing the constants was to take 50 c.c. of a ½-normal sugar-weight solution of the purest refined sugar* (carefully dried), to invert with invertase and acid, to dilute to 100 c.c., and to polarize at 20·0° C. The results obtained, as the mean of several determinations, were 131·6 for the invertase inversion, and 132·0 for the hydrochloric acid inversion. It may be stated that in some of these determinations the procedure followed was exactly parallel to that used in analysing the molasses, *i.e.*, to the pure sugar solution basic lead acetate solution was added (half the amount used for the molasses), and this eliminated in the manner described above, after which the invertase and acid inversions were carried out. The figures thus obtained corroborated those found with pure sugar solutions to which lead solution had not been added, thus showing that the sulphur dioxide treatment causes no inversion of the sucrose whatever, and thus generally establishing the accuracy of the process.

Experiments with beet molasses.—On then carefully carrying out a series of determinations with beet molasses, comparing the invertase method with the ordinary Herzfeld modification of the Clerget process, some interesting results were obtained. The generally accepted assumption is that the more powerful acid hydrolyst should yield the higher results. Quite contrary, however, to this expectation, it was found that the invertase method gave distinctly higher results, and this invariably so in each of the samples of beet molasses examined. Blank experiments showed conclusively that these higher results were not caused by the formation of optically active bodies from the yeast during the period of inversion at 55° C., or by the influence of the small amount of solid matter introduced with the yeast or the alumina used for clarification.

Explanation of the higher invertase results.—While considering the reason of these higher results given by the invertase method, the author's attention was drawn to the valuable work of Ehrlich, Andrlik and Stanek, Pellet, and others upon the optically active non-sugars of the sugar beet. Briefly summarised, the investigations of these well-known chemists show that the rotation of the optically active amino-acids in very low beet products varies considerably according to whether the reaction be alkaline, neutral, or acid, so that in the ordinary Clerget determination a source of error exists in taking the direct reading in an alkaline solution (due to basic lead acetate) and the inversion reading in an acid solution (due to the hydrochloric acid used to effect inversion). Andrlik and Stanek (Zeitsch. Zuckerind. Böhm., 1906, **31**, 417) demonstrated that a 1·0 per cent. solution of glutamic acid indicates the following polarizations in Ventzke degrees according to the reaction of the solution: alkaline (15 c.c. of basic lead acetate in 100 c.c.), −1·45; neutral, −0·35; and acid (5 c.c. in 100 c.c.), +1·77; whilst in the case of aspartic acid the figures are for the same concentration, +12·25, −1·00, and +1·40 respectively. With an osmose water the direct readings taken in alkaline, neutral, and acid solutions were 14·75, 14·85, and 15·80; and with a molasses, 22·4, 22·5, and 23·2 respectively. As the result of these observations, Andrlik and Stanek (*loc. cit.*) concluded that "the optical determination of sucrose in syrups, molasses, and osmose waters, in presence of optically active amino-acids, cannot yield accurate results, and therefore the Clerget process as ordinarily carried out is untrustworthy."

The Andrlik polarisation.—Andrlik and Stanek, however, devised a modification of the ordinary Clerget process for the purpose of obviating the influence of these optically active bodies, which simply consisted in taking the direct polarimetric reading, not in an alkaline (to basic lead acetate) medium, but in a solution containing the same amount of acid as that used for the inversion reading, betaïne or urea* being added to inhibit the inversion of the sucrose during the time of reading. On applying this method to the analysis of osmose waters and molasses they found that values are thus obtainable that are higher than those given by the ordinary Clerget procedure (in which the direct reading is taken in the alkaline solution defecated by basic lead acetate) by 0·9 to 3·2 per cent.; and it was concluded that this method involving the direct polarisation in an acid solution gives the truest sucrose values.

Alkaline, neutral, and acid polarisations.—The next step was to apply these considerations to the problem under investigation. In so doing, determinations were made of the alkaline or basic lead acetate, the neutral, and the acid direct polarisations, by working in the following manner: 5 times the normal sugar-weight of the molasses were weighed out, washed into a 250 c.c. flask with a little warm water, cooled, defecated with the minimum amount of basic lead acetate (50 to 60 c.c. of a solution of sp. gr. 1·26), a little alumina cream added, then the solution made up to bulk at standard temperature, and filtered. For the direct alkaline polarisation, 25 c.c. were diluted with water to 50 c.c., being adjusted to bulk at the temperature at which flask and pipette were standardised, then read at 20·0° C. 100 c.c. of the double normal weight solution were next treated with sulphurous acid as previously described, made up to 200 c.c., excess of calcium carbonate and a little kieselguhr added, then filtered. By reading this liquid, the neutral direct polarisation was obtained. For the Andrlik or acid direct polarisation, 25 c.c. of the neutral solution were placed in a 50 c.c. flask (using the same pipette and flask as before), made up to about 49·5 c.c. with a solution containing 10 c.c. of concentrated hydrochloric acid (of the same density as the acid used in effecting the Herzfeld acid inversions) and 10 grms. of pure urea in 100 c.c., then adjusted to bulk at standard temperature with water, mixed, and quickly read in the water-jacketed tube at 20·0° C. From experiments with pure sugar solutions the author is satisfied that the urea does not modify the polarisation of the sucrose, neither does the polarisation change and inversion occur until after the lapse of 7 to 10 minutes. After this the invertase and acid inversions were carried out, using the neutral solution, and following the procedures already indicated.

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* Containing, water, 0·030; and ash, 0·025 per cent., after drying.

* Many other substances in addition to betaine and urea retard the rapidity of the hydrolysis of sucrose by acids, as *e.g.*, neutral organic salts, alcohol, and acetone. For further information reference should be made to Prof. von. Lippmann's "Chemie der Zuckerarten."

Results obtained.—The results for the Clerget values for four different samples of beet molasses then obtained, summarised in the following table, are very interesting.

Sample.	1	2	3	4
Direct alkaline (basic lead acetate) polarisation	48·8	—	48·6	47·0
Direct neutral polarisation ...	49·2	52·0	49·0	47·6
Direct acid (Andrlik) polarisation	50·4	53·25	50·0	48·4
Direct acid (Pellet) polarisation	50·3	53·3	—	48·3
Invertase inversion polarisation	−14·6	−16·0	−15·0	−14·4
Acid inversion polarisation ..	−13·2	−14·6	−13·6	−13·8
Clerget value by invertase ...	48·5	51·7	48·6	47·1
Clerget valne by acid, using alkaline direct polarisation .	47·0	—	47·1	46·1
Clerget value by acid, using neutral direct polarisation..	47·3	50·5	47·4	46·5
Clerget value by acid, using acid (Andrlik) direct polarisation	48·2	51·4	48·2	47·1
Clerget value by acid, using acid (Pellet) direct polarisation	48·1	51·4	—	47·0

On comparing these results, it is seen that the invertase method gives values that are higher than the ordinary Herzfeld method (as used by Ling and Baker, and by Hudson) by 1 to 1·5 per cent. differences that are much beyond the permissible limit of error attendant on the process;* but it is also seen that the invertase method gives results which approximate very closely with those obtained by acid inversion if the influence of the optically active non-sugars be obviated by using the Andrlik polarisation. Assuming that by the use of the Andrlik polarisation the results given indicate the true sucrose value, or at any rate the truest hitherto obtainable, an hypothesis that is probably quite valid, then the fact would appear to be established that *invertase is a selective hydrolyst, i.e.*, that it inverts only the sucrose without affecting the non-sugar bodies present, either by hydrolysing them, or by modifying their rotatory power. It is needless to point out that such a hydrolyst would be of the greatest value in investigating the problem of obtaining correct results in the case of complex and impure sugar factory products, like osmose waters and waste molasses, whether the optical (Clerget) or gravimetric (copper test) methods be used. For practical purposes, the author's procedure, as it stands at present, is perhaps too lengthy and involved. There is, however, a method due to Pellet which not only eliminates the error caused by the non-sugars, but is also comparatively simple, and has other very apparent values.

Pellet's sulphurous acid process.—In a letter to the author, M. Pellet describes this method as follows: Make up 200 c.c. of a normal sugar-weight solution of the molasses, add to it 10—15 c.c. of basic lead acetate solution, complete the volume to exactly 220 c.c., mix well, and filter. Take 100 c.c. of the filtrate, add to it 10—15 c.c. of a saturated solution of sulphurous acid and some paper pulp, make up to 200 c.c., mix, filter, and polarise at 20° C. in the 400 mm. tube, using the necessary correction for the dilution. This gives the direct polarisation. Take 50 c.c. of the solution and invert according either to the original Clerget routine, or the Herzfeld modification, and read at 20° C. This gives the inversion polarisation.†

Now the most important advantage of this process from the point of view of the present investigation is that the direct polarisation of the solution acidified by sulphurous acid gives the same figure as the Andrlik polarisation, in which concentrated hydrochloric acid is used, and that therefore the error due to the optically active non-sugars is thereby eliminated. That at any rate is what the author has proved in the case of the samples of beet molasses under examination, as the following comparative readings show:

Sample of molasses.	Andrlik acid polarization.	Pellet acid polarization.
1	50·40	50·30
2	53·25	53·30
4	48·40	48·30

Other advantages of the process are: (1) The liquid is appreciably decolorised for the direct reading, and during inversion the development of colour by the hydrochloric acid is effectually prevented, considerations which are certainly important, especially when dealing with very dark cane molasses, like Cuban or Egyptian. (2) Since the liquid used for inversion is free from lead, the 5 c.c. of acid added to effect hydrolysis is all utilised; none is removed from reaction as lead chloride, thus rendering the inversion quite certain. The latter is indeed quite an important point, for an error is introduced by using more or less acid than the amount employed in establishing the constant, owing to the influence of hydrochloric acid upon the rotatory power of the levulose, a point which has been studied by Tolman (J. Amer. Chem. Soc., 1902, 24, 515) and several others. (3) Yet another advantage noticed by the author when working with the Pellet process is that inversion by the sulphurous acid does not occur for some time after treatment, for an hour at any rate; whereas in the Andrlik polarisation inversion by the hydrochloric acid in the presence of urea sets in after only 7 minutes, so that the observation must be made almost immediately after the addition of the acid.

Considerable help has been received from M. Pellet in carrying out this investigation, especially in connection with the consideration of the higher results obtained by means on invertase, and the influence of the optically active non-sugars. There is no greater authority on this complicated branch of analytical work than M. Pellet, and the author takes this opportunity of thanking him for much valuable advice, so courteously and willingly given.

Conclusions.—(1) If in determining the sucrose in beet molasses by Clerget's process invertase be used as hydrolyst, distinctly higher results are then obtained than with the ordinary Herzfeld modification in which concentrated hydrochloric acid is used as hydrolyst.

(2) But if in operating the Herzfeld process the error due to the influence of the optically active non-sugar substances be obviated, by using the direct acid polarisation, instead of the usual alkaline (basic lead acetate) polarisation, then the results do not differ appreciably from those obtained by means of invertase. From this the fact would appear to be established that invertase is a selective hydrolyst, inverting only the sucrose (and raffinose also, if present), without at all affecting the non-sugar bodies.

(3) The Pellet method of obviating the error due to the influence of the optically active non-sugars, by taking the direct polarisation in a solution made acid by sulphurous acid, gives the same results as the method proposed by Andrlik and Stanek in which concentrated hydrochloric acid and urea are used, besides having certain other apparent advantages. As a practical method, Pellet's sulphurous process is now recommended as preferable to the Andrlik and Stanek procedure, by reason of its greater ease of manipulation and several other apparent advantages.

Discussion.

Mr. C. **Proctor** said that he had made many determinations by means of invertase, but principally on worts and similar liquids. He had found that for complete inversion at the ordinary temperature a much longer time was required than that mentioned by the author, and that in order to prevent loss of sugar by fermentation the addition of a small quantity of salicylic acid was desirable. Working in that way, he had added weighed quantities of sugar to sugar-free worts and the amount found after inversion agreed with that added.

Mr. L. J. **de Whalley** said the temperature of 50° C. to 55° at which this solution was kept quite precluded the possibility of fermentation occurring. He thought if salicylic acid alone were applied it would be found that the sugar was not quite stable.

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* Since the same solution was used for both acid and invertase inversions only one direct reading was necessary, and the error of observation was consequently diminished. The author's experimental error should therefore be less than 0·5 per cent., the permissible limit of error between two independent workers.

† Full details of this method are given in Bull. Assoc. Chem. Sucr. et Dist., 1891, 9, 439 and 624, together with some interesting results.

THE TESTING OF INCANDESCENT MANTLES.

BY J. H. COSTE AND W. E. F. POWNEY.

Very little information as to the comparative testing of incandescent mantles appears to be available.

The Photometry Committee of the "Deutscher Verein von Gas und Wasserfachmännern" (this J., 1901, 1098) recommended a consumption of gas varying between 4·0 and 4·6 cubic feet per hour at a pressure of 1·4 to 1·6 inches of water. From this it appears probable that the ordinary "C" pattern burners were referred to, especially as chimneys 25 cm. long were to be used. The air supply seems to have been fixed and the amount of gas adjusted until the highest illumination of the mantles was obtained. The durability of the mantles was to be judged by the alteration in illuminating power after 24, 100, and 300 hours burning, and at least 4 were to be tested. This method would necessitate the expenditure of 13 days over a single test and, if many mantles were to be tested, would involve the use of a very large installation of burners placed in a large special room, as an unpleasant amount of heat is radiated.

After trying various methods, the following have been adopted as requiring only a reasonable time and giving a fair idea of the way in which mantles may be expected to behave in use.

I. Durability Tests.

Various appliances have been devised for subjecting mantles to a series of regular mechanical shocks. The authors were considering the question of designing one, when they found that the Metropolitan Gas Companies were using one which appeared to be of a suitable kind for their purposes. In the Woodall-Moon machine a mantle, fixed on its proper burner, which is screwed on an upright stem is, after having been "hardened" by "burning off" for about 5 minutes, subjected to a series of shocks administered by a miniature stamp mill driven by a water motor. The impacts occur on the lower part of the machine and impart to the upright and the mantle on it vibrations which are probably not dissimilar to those occurring as the result of the passage of heavy traffic or of persons moving in rooms overhead. Varying weights can be used to load the rising and falling rods which give the shock. A counting apparatus for registering the number of shocks is provided, also an automatic extinguishing and re-lighting device.

It appears to us desirable to apply a durability test of this kind before "burning" mantles over a prolonged period as, obviously, a mantle which is not strong is less useful than one which, though strong, gives an inferior light. From each batch of 12 mantles, three are tested for durability on the Woodall-Moon machine. If any of the three fail to survive 1000 shocks administered at the rate of 300 a minute using 2 oz. weights (or 3000 at 600 a minute with 3 oz. weights for inverted mantles) three more are tested; and if the average strength of the six is represented by a figure less than 1000 (or 3000 for inverted mantles) no further tests of any kind are made. No upright mantle is tested above 1200 shocks, and no inverted mantle above 3600 shocks. This test allows one mantle in six to fail absolutely if the other five survive 1200 or 3600 shocks each. As some mantles will stand over 10,000 shocks it is obviously undesirable to allow one unusually strong one to compensate for the entire or partial failure of the rest, hence the limit of 1200 or 3600 shocks. This serves as a weeding-out test as well as an indication of the strength of survivors; and, as showing the advisability of applying a test of this kind, it may be mentioned that we have on many occasions obtained figures much below 100 as the average of 6 mantles from a single batch; while individual mantles have frequently broken down after only 3 or 4 shocks.

From those batches which have passed the shock test, 3 fresh mantles are tested photometrically. The three or more which remain are available in case a mantle is accidentally injured.

II. Photometric Tests.

The mantles for photometric tests are fitted on suitable burners; for the "C" pattern we use Bray's "1906 C" burner which has the advantage of an air adjustment; but any other "C" pattern could be used. After the mantles have been properly burnt off, gas is allowed to burn for 100 hours, and the mantles, on their burners, are then removed to the photometer room which is close to that in which the burning is conducted. A 10 candle Harcourt Pentane lamp is used as the standard of light and a Leeson star disc, as modified by Dibdin, has been found satisfactory for purposes of comparison. We have found that new workers on seeing the different colours of the lights on either side of the disc, have declared accurate comparison impossible and have forthwith proceeded to obtain readings which agreed well within themselves and with those of other workers. A secondary incandescent standard as designed by Carpenter and Helps is considered more satisfactory, but we have no reason to abandon the direct use of the pentane lamp.

The calorific power of the gas used by us, which is regulated by statute, is fairly constant (about 120—125 calories net per c. ft.).

We usually test mantles at the following rates of consumption, which approximately correspond to the working pressures indicated, and are normal for the respective burners.

Burner and Mantle.	"C."	Kern.				Inverted large size.
		1.	2.	3.	4.	
Cubic feet of gas per hour ...	3·5	2	3	4	5·5	4
Pressure in in. of water at nipple of burner	1·2	1·8	1·1	1·6	2·1	2·3

The horizontal value is taken for all upright mantles on a 60 in. Letheby Bar Photometer, four readings being taken at equal angular intervals round the burner. For inverted mantles, Sugg's radial photometer is employed, three readings at each of the vertical angles 0°, 45° and 90° being taken.

Some doubt having been felt as to whether tests made at a fixed rate of consumption, even when the air supply was adjusted, would give the same results as tests made at the maximum illumination attainable at ordinary pressures, a series of experiments was carried out with five different brands of "C" mantles. The results are summarised below:—

Duty, i.e., candles per cubic foot of gas burnt.

			At 3½ feet per hour.	At 5 feet per hour.
I	3	mantles	18·30 ± ·36	18·04 ± ·22
II	3	do.	16·79 ± ·36	16·59 ± ·16
III	3	do.	17·08 ± ·34	18·79 ± ·46
IV	2	do.	19·30 ± ·50	15·53 ± ·73
V	3	do.	18·03 ± ·54	18·36 ± ·06

The averages of the two series are respectively 17·9 and 17·46, or, correcting for the weight of each series, 18·05 and 17·8. If IV were to be omitted, as the mantles were not of the usual shape, the averages would become 17·55 and 17·94 and the corrected means 17·5 and 18·6. As, however, mantles do at times vary in shape, and as those in question gave a very good efficiency at the lower rate and not a very bad efficiency at the higher, it appears fair to adopt the lower rate, more especially as from 3½ to 4 feet per hour is the recognised normal rate of consumption for "C" burners under ordinary domestic conditions.

In considering the results of a series of testings on mantles of different makes, it is useful to decide on some numerical expression which shall indicate the relative merits of different batches. It will probably be found that there are several sets having high average illuminating power with little variation between individual mantles. Others will have an equally high average illuminating power but greater variation between individuals; and others quite low illuminating power.

It is not fair in such a case to take the average as the figure of merit, since to do this would be to disregard uniformity of lighting. If, however, the minimum is taken, difficulties of another kind occur. Various formulae based on a desire to give weight to both average and uniformity break down in some cases. Two plans can be adopted with satisfactory results. (1) To eliminate all with an average below a certain figure, and then all above this with a greater variation between individuals than is considered desirable, and to judge these remaining on average only; or (2) to calculate for each set, or at any rate for all those which are obviously worth considering, the mean variation (V) by means of the formula,

$$v = \pm \sqrt{\frac{v_1^2 + v_2^2 + \ldots \; v_n^2}{n(n-1)}}$$

where $V_1 \ldots V_n$ represent the variation of each mantle from the average, and n is the number of mantles examined. The comparison figure is obtained by subtracting the mean variation from the average; when three mantles are examined $\sqrt{n(n-1)} = 2{\cdot}45$. This method gives very useful figures for comparing all the members of a long series.

In applying either or both of these methods, it must be borne in mind that the number of mantles tested is not, and in practice cannot be, great and that the experiments are not very exact. The relative prices of the members of a series will naturally have a great weight in the final choice.

Sometimes changing a mantle from one burner to another very materially alters its performance, since the efficiency of a mantle depends very much on the coincidence of its outline with that of the cone of highest temperature of the flame, which will vary in shape in different burners of the same pattern; and it is advisable, when abnormal variation is shown, to re-test such mantles on other burners if possible.

Some experimental figures are appended with the figures of merit calculated as above. In most of the results quoted, the mantles passed the shock test; the exceptions are those examined prior to our adoption of the Woodall-Moon machine, but these results are also included as showing the variations occurring in the illuminating power. In all cases the mantles were in good condition (*i.e.* undamaged) after the 100 hours burning, the results given for illuminating power being the best obtainable under ordinary working conditions, at the gas-consumption stated:—

"C" Mantles.

	Illuminating power.	Mean of set.	Figure of merit.	Duty, i.e., candles per cu. ft. of gas burnt.
A	67·3 60·4 63·3	63·7 ± 2·0	61·7	18·2
B	58·9 60·6 59·4	59·6 ± 0·5	59·1	17 0
C	56·8 57·3 61·8	58·6 ± 1.6	57·0	16 7
D	67·5 63·5 67·5	66·2 ± 1·3	64·9	18 9
E	65·5 67·5 60·5	64·5 ± 2·1	62·4	18·4
F	57·3 65·3 59·5	60·7 ± 2·3	58·4	17·3
G	59·3 59·0 54·3	57·5 ± 1·6	55·9	16·4
H	64·0 52·5 58·0	58·2 ± 3·3	54·9	16·6
I	48·8 63·5 62·3	58·2 ± 4·7	53·5	16·6
J	63·1 52·9 67·1	61·0 ± 4·2	55·8	17·4
K	68·3 63·7 54·6	62·2 ± 4·0	58·2	17·8
L	67·3 63·8 58·8	63·3 ± 2·4	60·9	18·1
M	65·3 59·5 50·8	58·5 ± 4·2	54·3	16·7

No. 2 Kern.

	Illuminating power.	Mean of set.	Figure of merit.	Duty, i.e., candles per cu. ft. of gas burnt.
A	61·0 63·0 60·5	61·5 ± 0·8	60·7	20·5
B	56·8 50·9 54·4	54·0 ± 1·7	52·3	18·0
C	57·9 46·9 43·4	49·4 ± 4·4	45·0	16·5
D	60·3 57·1 48·6	55·3 ± 3·5	51·8	18·4
E	52·0 42·5 25·0	39·8 ± 7·9	31·9	13·3
F	58·3 48·8 58·0	55·0 ± 3·1	51·9	18·3
G	43·8 48·0 41·3	44·4 ± 2·0	42·4	14·8
H	39·5 44·0 49·5	44·3 ± 2·9	41·4	14 8

No. 3 Kern.

	Illuminating power.	Mean of set.	Figure of merit.	Duty, i.e., candles per cu. ft. of gas burnt.
A	76·3 77·9 75·0	76·4 ± 0·8	75·6	19·1
B	79·5 72·8 78·0	76·8 ± 2·0	74·8	19·2
C	78·1 80·4 75·1	77·9 ± 1·5	76·4	19·5
D	74·0 71·5 76·0	73·8 ± 1·3	72·5	18·5
E	82·5 79·0 78·3	79·9 ± 1·3	78·6	20·0
F	72·0 72·0 71·0	71·7 ± 0·3	71·4	17·9
G	77·0 74·8 74·5	75·4 ± 0·8	74·6	18·9

No. 4 Kern.

	Illuminating power.	Mean of set.	Figure of merit.	Duty, i.e., candles per cu. ft. of gas burnt.
A	112·9 107·9 116·5	112·4 ± 2·5	109·9	20·4
B	112·9 107·8 114·6	111·8 ± 2·0	109·8	20·3
C	103·8 98·0 101·3	101·0 ± 1·7	99·3	18·4
D	108·8 120·0 115 3	114·7 ± 3·2	111·5	20·9
E	105·3 102·3 109·8	105·8 ± 2·2	103·6	19·2
F	107·5 103·0 102·5	104·3 ± 1·6	102·7	19·0
G	102·5 113·8 107·3	107·9 ± 3·2	104·7	19·6
H	104·5 106·0 105·5	105·3 ± 0·4	104·9	19·2

DISCUSSION.

The CHAIRMAN said this paper introduced a development which so far as he knew had not made much progress in

England. The general user of mantles was not accustomed to buy them under any guarantee of efficiency or durability; but it seemed to him that this paper indicated to manufacturers that at least the larger purchasers were on the look out for articles which on as accurate a comparison as circumstances permitted were the best. If they were not already doing so it would be necessary for manufacturers to see that their products were up to certain standards.

Mr. W. J. **Dibdin** said he had come to the conclusion that, as far as his experience went, there was no proper test for mantles. He did not wonder that Mr. Coste had tried to get some mean figure when he saw the table of duties, as they used to call it, the mean values or "candles per cubic foot" deduced from a series of experiments; and he thought he had got remarkably consistent results, for the ordinary gas mantle was most variable. One figure he should have liked to have seen added, and that was the number of hours the mantle had been burning, and the number of shocks it had received, before the photometric tests were made and the mean duty arrived at. He was glad that the authors were able to make some definite statements, his experience being that it was most difficult to give a fair opinion as to the value of a gas mantle. One point had not been touched upon; a mantle would start at 70 or 80 candles, giving a beautiful light; but after a time it decreased to, perhaps, 30 candles or less. Then if it could be subjected to a series of vibrations, it might in a way be revivified, probably by breaking away some of the oxides which formed on the mantle and tended to retard the illuminating power, and it would give a very much brighter light. It would be one of the most valuable tests if it could be shown how many times and to what extent a mantle could be revivified and brought back to a useful illuminating quality. The apparatus, which was quite new to him, was most ingenious and should be useful if it could be applied to show how a mantle which had lost in great part its illuminating power, could be revivified and brought into use again.

The **Chairman** asked the authors whether they had made any observation with reference to the effect of the mantle on the burner? Mr. Dibdin suggested that in certain instances there appeared to be some revivification of the mantle. The speaker suggested that any such effect was due to action on the burner rather than on the mantle. When the mantle had run down if it were taken off, and the burner well blown out and cleansed, a great improvement in luminosity at once resulted. Certain mantles might more readily choke the burner than others; and in such a case there would be a much more rapid running down.

Mr. C. S. **Garland** asked whether the authors had made experiments as to the speed at which shocks were administered, as it was believed that this affected the behaviour of mantles when tested in this manner. At least one firm of mantle makers carried out the long series of tests alluded to by the authors. He had not found that the results of the shock test always agreed with those of actual use. From twenty to thirty mantles should be tested to obtain a good mean value.

Dr. C. A. **Keane** asked whether, in connection with the machine for testing the durability, it was found that mantles of a similar character gave fairly equal results. In the tables of the illuminating power it was striking how near the results were, the difference between the three observations of the same mantle being almost as great as that between any two mantles in the whole table; that seemed to indicate that mantles of the same type working under those conditions were approximately similar. He accordingly would be interested to know whether a similar conclusion had been arrived at with regard to durability. Had Mr. Coste studied any motion other than a vertical motion in regard to durability, because a mantle when in use received shocks from various directions.

Mr. **Coste** said they had had the views of different makers on the Woodall-Moon machine; one firm thought the test was too drastic, another thought the machine did not test the mantles sufficiently thoroughly, and that a more efficient machine was required. The mantles tested photometrically had not been subjected to shock, although others of the same batch had been, but they had been burning for 100 hours before the test. They originally tested after 5 hours burning and then after 100 hours; but in most cases the alteration in the illuminating power was not such as to render this necessary. They had not been carrying out a research where time was of no importance; but had tried to made a practical test which would be of assistance in making a choice. Mantles could be revivified to some extent by removing from the fork with a piece of wire, and dipping in cold water while hot and putting on again. A good mantle would stand several treatments of that kind; it was most unusual for it to break under those conditions. The Chairman's suggestion that burners required very frequent attention was doubtless correct. In testing for durability they adopted a rate of about 300 shocks a minute, which was recommended to them, but they had not made much investigation on that point. One could understand that makers who were desirous of turning out standard products made much more elaborate tests than people did who had to compare rapidly many different kinds of mantles. The results shewn were for "C" mantles; which were the kind of upright mantles most in use, and it seemed to them that the makers had, wisely, concentrated their attention on that type and had consequently been more successful with them than with others; probably that was the reason for the relative uniformity of quality that was noticed. They did not suppose that the formula gave the true variation in quality of the mantle when so few were tested; but it seemed to be fair to use it to obtain a comparative figure. Mr. Powney had pointed out, that in a series of imaginary sets, all having the same average illuminating power, the figure of merit calculated by that formula was confirmed by the careful inspection of the individual figures and it was very useful when comparing a large number of sets. In this matter, as in many other matters, the question of price very strongly influenced the final choice. The testing of mantles was not yet very satisfactory; but they might hope that, in time, something more definite might be obtained. The shock test, was considered useful by a number of very large consumers; and so was the photometrical test. What users wanted was a strong mantle which would give a reasonable amount of light.

Mr. W. E. F. **Powney** said the formula was only used for the purpose of obtaining a comparison figure when considering the results of a number of different mantles; they did not suggest that the testing of three mantles was adequate for calculating the true average illuminating power of a large batch.

RADIATION ERRORS IN FLOW CALORIMETERS.

BY J. H. COSTE AND B. R. JAMES.

The assumption usually made that losses or gains due to heat exchanges between a gas calorimeter of the flow type and its surroundings are negligible is correct only when the temperature of the water supply approximates closely to that of the surroundings. If this is not the case, it will be found that when water is allowed to circulate through the instrument without lighting the gas the temperature of the outlet water will be different from that of the inlet. If the water supply, as is usual, is of a lower temperature than the surroundings of the calorimeter, heat will be absorbed by the latter and the outlet thermometer will record a higher temperature than the inlet thermometer. The following examples show this:—

	1.	2.	3.	4.	5.	6.	7.	8.
Temperature of room	16·0	16·0	18·0	15·0	15·0	15·0	16·5	16·0
Temperature of inlet	5·70	5·57	6·51	8·60	9·40	10·65	10·70	9·50
Temperature of outlet...............	5·91	5·75	6·83	8·66	9·50	10·81	10·80	9·70
Excess of outlet temperature	·21	·18	·32	·06	·10	·16	·10	·20

Tests with smouldering phosphorus showed that there was practically no passage of air through the instrument so that changes were due to radiation rather than to convection. This was confirmed by observations of the differences noted between inlet and outlet temperatures when the air outlet holes were all opened and when they were closed. No alteration was produced by closing the holes.*

When gas is passing through the calorimeter, the question of convection comes into consideration and can be provided for as described by one of us (this Journal, 1909, p. 1233).

The error due to absorption or radiation of heat could conceivably be corrected in three ways :—

(1) By considering the thermometer readings when water is flowing at the desired rate, but no gas burning, as index or zero errors and using the observed increased difference between inlet and outlet.

(2) By raising the water to the temperature of the room. This may be done by having a water tank in the room and working from this with the ball-cock or other inlet from main closed during an experiment. Another method is to pass the water through coils of piping heated either by gas or by chemical action. The Committee on Calorimetry of the American Gas Institute have used this method, the electrolysis of a solution of sodium sulphate furnishing the heat for the coils. We have used a gas heater somewhat similar to that supplied for the Zeiss refractometer (actually a short coil of "compo" piping in a canister heated by a Bunsen burner) followed by long coils of similar piping painted black and hung up in the room; we have found this very efficient.

(3) By surrounding the instrument with an annular metal vessel through which water circulates before reaching the inlet thermometer. The jacket which has been constructed is concentric with the outer casing of the calorimeter and is separated from it by an air space of about $\frac{3}{4}$ in. By this means the calorimeter, or the greater part of it, is surrounded by a vessel between which and it perfectly free heat exchanges are allowed and which by being always at practically the same temperature as the inlet of water reduces these exchanges to a very small minimum.

This method is simple and has the special advantage that it places the calorimeter in a position where it is not affected by fluctuations of external temperature. This is important when a suitable room of a constant temperature and free from draughts is not available.

The best arrangement is doubtless to combine this method with that of heating the inlet water to the temperature of the room.

All three methods are open to the objection that during a calorimetric experiment the temperature of the exterior of the calorimeter, which is the final radiating surface of the system, is not necessarily the same all over and that in fact it is *e.g.* in Boys' Calorimeter, higher at the bottom than at the top. The difference between the temperatures of the top and bottom of the portion above the level of the water pool in the instrument can only be very small as the temperature of this pool is not high (very little above that of the surroundings) and the outer coil of water piping above this level is subject to very little heating indeed. Still it is possible that an exchange from the calorimeter to its surroundings tends to minimise the gain of heat which nearly always occurs during an experiment.

It will be readily understood that the fact that flow calorimeters do not present a homogeneous temperature system renders the computation of errors due to radiation most difficult and that a reduction of them is the most practical method of minimising their effect.

Temperatures of				Corrections for		Gross calorific power.		Correction for initial difference between thermometers, calculated as calories per foot of gas.	Difference caused by equalizing temperature of inlet water and surroundings of calorimeter.
Inlet water.	Outlet water.	Inlet air.	Outlet air.	Humidity.	Sensible heat of exit gases.	(Official method.)	Corrected for humidity, etc.		
8·95	22·41	16·0	18·5	+0·29	+0·14	136·5	136·2		−1·9
H 16·70	37·33	17·0	22·0	+0·69	+0·28		134·3		
7·89	32·39	15·5	21·0	+0·75	+0·30	141·6	141·1		−2·0
H 16·26	38·55	17·0	24·0	+1·17	+0·39		139·1		
5·66	29·78	16·5	17·0	+0·29	+0·03	138·6	138·2		−1·1
H 12·51	35·16	14·0	20·0	+0·62	+0·33		137·1		
10·70	33·83	18·0	22·0	+0·86	+0·22	141·7	141·2	−0·6	−2·1
H 18·09	39·02	19·5	25·0	+1·32	+0·30		139·1		
10·68	33·68	18·0	22·0	+0·60	+0·22	142·8	142·1	−1·0	−1·4
H 18·49	39·56	20·0	25·0	+1·06	+0·28		140·7		
8·89	30·09	17·0	19·5	+0·20	+0·14	139·5	138·6	−0·6	−0·6
H 17·93	29·01	18·0	24·0	+0·81	+0·33		138·0		
5·46	28·76	16·0	17·0	+0·23	+0·06	137·9	137·5	−1·3	−1·3
J 6·29	29·85	16·5	17·0	+0·23	+0·03		136·2		
9·05	29·87	17·0	19·0	+0·25	+0·11	140·0	139·4	−1·2	−0·7
J 9·73	30·65	17·0	19·0	+0·25	+0·11		138·7		
5·68	29·35	19·0	18·0	+0·35	+0·05	138·9	138·8		−1·3
J 6·84	29·91	19·0	16·5	+0·18	−0·14		137·5		
5·39	29·86	18·0	18·0	+0·18	0·00	140·9	140·5	−1·1	0·0
J 6·55	30·55	17·5	17·5	+0·18	0·00		140·5		
5·78	30·25	19·0	18·5	+0·20	−0·03	141·2	141·1		−1·4
J 6·84	31·37	17·0	17·7	+0·20	−0·03		139·7		

The mark H indicates experiments in which the inlet water was raised to the temperature of the surroundings of the calorimeter.

The mark J indicates that the water jacket was used.

In the unmarked experiments the temperatures were not equalised. All the comparisons were made with figures corrected for humidity, etc.

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* It has been suggested that this difference was due to the condensation of water from the air contained in the calorimeter. With the gas exit holes closed, the rise of temperature of the system *with no water flowing* would be below ·023° C., supposing that the coils and water pool are full of water 10° below the temperature of the air which is saturated with moisture. This rise would not occur to an appreciable extent with water flowing through the instrument as the whole increment of sensible heat is at the most 0·027 calorie.

In the foregoing table results obtained under ordinary winter conditions and by the methods indicated are compared. The gas for each pair of testings was collected from the main in a small holder so that possible variations of quality should not influence the results. Hence it has been found better to give the gross calorific power only since owing to the relatively short time of burning the net results are not entirely satisfactory. It will be seen that the uncorrected or partially corrected results are in each case higher than those in which the temperature of the surroundings of the calorimeter and the inlet water have been made to approximate closely. The average difference is about 1 calorie. In summer this would be less.

A Boys' Calorimeter was used for these experiments. The American Committee have done useful work in this direction with Junker's Calorimeter. They advise that attention should be paid to this point in all accurate work; with this advice we concur.

We may remark that the correction of $\pm\frac{1}{6}$ the difference of temperature of inlet and outlet air used in official testing appears to correct fairly well errors due to other causes than radiation when the outlet water is weighed, as was done in all these experiments, and not measured as is directed (see this Journal, 1909, p. 1234). The tendency is for results so corrected usually to be above the truth. This is not, from a testing point of view, of great importance since any standards based on such testing would be equally affected by such errors. It is, however, in our opinion, desirable to put on record both the nature and amount of errors due to radiation and the above simple means of reducing them.

Discussion.

The Chairman said it was of importance that in determinations of this character the utmost accuracy should be aimed at and a most useful purpose was served by pointing out the exact amount of difference resulting where no account was taken of variations such as those dealt with in the paper.

Mr. G. N. Huntly said it occurred to him that the chief difficulty in the flow calorimeter in regard to the question of radiation was that the external temperature of the radiating surface was not uniform; and, that being so, it was impossible to apply any correction based on calculation; it must be empirical. That, he took it, was the main result of the paper; but he did not quite see how even now, *a priori* these results were more likely to be correct than the uncorrected ones. Taking the first case, if the water were passed through without the gas, the change of temperature due to radiation in the instrument had no relation to the figure obtained when the gas was alight. In the latter case there was a much higher temperature, and unequal distribution; in the first case, there was a practically uniform temperature. It seemed to him that with a flow calorimeter radiation was always present, and that an accuracy greater than from one-half to one per cent. could not be expected.

Mr. Coste, in reply, said he agreed with Mr. Huntly that the method of taking the two thermometer readings as a zero error was not altogether satisfactory; but he did not know that the effect on the outer surface of the calorimeter of heating in the centre was very great in any standard pattern. When working with cold water in a warm room heat was registered that should not be credited to the gas; and if either the water raised was to the temperature of the room or the surroundings cooled to the temperature of the water, more correct results should be obtained. No doubt the best plan was to raise the water as near as might be to the temperature of the room, and then to surround the calorimeter with a large mass of water, in order that the radiation from the body in making the readings might not affect the result. He thought it was a point against flow calorimeters that there was no satisfactory way of computing their errors.

Mr. James said that their object had been all along rather to minimise the radiation, than to determine its amount.

Nottingham Section.

Meeting held at Nottingham on Wednesday, December 21st, 1910.

MR. S. J. PENTECOST IN THE CHAIR.

THE WATERS OF BURTON-ON-TRENT.

BY FRANK E. LOTT, A.R.S.M., F.I.C., AND
C. G. MATTHEWS, F.I.C.

The position of Burton-on-Trent in the valley of the Trent at a point where it is entirely cut into the red gypseous marls of the New Red Sandstone, has resulted in its becoming the recognized centre of the brewing industry, the reason being that the water in the valley gravels underlying the town consists largely of spring water from these same gypseous marl beds, and water of this quality produces the best-flavoured soundest pale ales. The water supplies of Burton-on-Trent may be divided into the following groups:—

I. *Shallow wells or tubes in the Gravel beds*, 20 to 32 ft.—Water of varying but considerable hardness, used chiefly for brewing. Formerly the drinking water of the town.

The water in these wells is derived in part from the rainfall collected in the Trent Valley and in part from springs in the marl beds underlying the Gravel; the hardness increases proportionately with the amount of this very hard spring water. Cases have been met where tubes driven to the same depth within ten yards of each other have yielded waters with total solids differing as much as 76 and 130 parts per 100,000, a ridge of marl being between the lower ends of the two tubes.

At Branston two miles above Burton there are salt springs; and waters containing as much as 940 parts per 100,000 of chlorine have been met with a few feet below the surface.

The temperature of these shallow wells is very variable, ranging from 46° to 60° F. according to position and time of year.

II. *Bore tubes in the Marl beds*, 70 to 200 ft.—Very hard gypseous waters, used for brewing, blended with Nos. I. and IV.

In the tubes first driven, some 40 years ago, the supply was frequently sufficient to project the water several feet above the surface, now the water level in the same tubes is not usually less than 16 feet from the surface.

Bores in the marl beds have in some cases proved unproductive, no supply of water being met with.

These waters are usually at a constant temperature of 52° F.

III. *Bore tubes in the Lower Keuper Sandstone beds*, 350 to 525 ft.—Very hard gypseous and saline waters, not used for brewing. Usually about 55° to 56° F.

IV. *Bore tubes in the Bunter Conglomerate*, at the N.E. end of the town, 180 to 400 ft. A moderately hard saline water, not used for brewing. Temperature about 55° F.

V. *South Staffordshire Water Works Supply* from bore hole at Fradley, 8 miles up the valley above Burton, pumped to reservoir above the town. A hard drinking water. Temperature variable. Blended with Nos. I and II. for brewing.

VI. *River Trent Water.*—A somewhat impure hard water. Temperature variable.

This water is much too impure for brewing purposes but is used occasionally with ice for cooling purposes in summer.

The organic impurity of this water at Drakelow, a mile above the town, is markedly greater than immediately below the town, the two weirs and other causes producing a very appreciable amount of purification. The samples analysed were taken with the river at an average height, not in flood.

Although all these waters must be classed as hard waters, it will be seen from the table of analyses that there is a great difference in their degrees of hardness and in their general composition. The following table of analyses gives the average composition of these various supplies and also an average of the analytical data from which the composition was calculated.

Exhibits :—

Geological Survey's Section, Trent Valley and Needwood Forest.

Worthington and Co.'s bore tube section.

Rough section of strata below Burton.

Bore samples, Park House bore near Burton.

Bore samples from Marl beds below Burton.

Residues from (1) Soft water, Vyrnwy;
(2) South Staffordshire Water Works supply;
(3) Deep bore, Burton.

Crystals from Condenser.

2 Geological Maps.

GEOLOGICAL CONDITIONS OF THE NOTTINGHAMSHIRE WATER SUPPLY.

(ABSTRACT).

BY G. W. LAMPLUGH, F.R.S., OF H.M. GEOLOGICAL SURVEY.

A memoir dealing with the water supply of Nottinghamshire is in course of preparation by the Geological Survey, in which an attempt will be made to embody all the available information respecting the sources and quality of the waters. All the main supplies are at present pumped from underground and are therefore primarily dependent upon the geological conditions. The rocks of the county have a general easterly dip and pass downward in succession in this direction. The oldest rocks belong to the carboniferous formation and are exposed only in the west of the county; though otherwise important, they are of little consequence in respect to the water supply. The overlying magnesian limestone series (Permian) holds much water, but allows the too-ready passage of surface-waters along open joints and fissures, so that there is always danger of contamination of the underground supply. A thin impermeable belt of permian marl usually intervenes between the magnesian limestones and the sandstones of the Bunter formation which constitute the main reservoir of the county. The Bunter beds retain and filter a large portion of the annual precipitation, so that these porous sandstones become saturated up to a certain level, known as the "water-table"; and they yield their content freely when wells are sunk below this level. An attempt is being made to map out the underground contours of the water-table, which reflect the contours of the land in a modified form. Where the Bunter formation sinks eastward beneath its impervious cover of Keuper beds, it is entirely waterlogged; but the water, having long been stagnant or nearly so, shows a high increase of dissolved solids when tapped by wells. The attention of analysts is particularly called to the desirability of fuller information respecting the composition of these deep-seated waters, as the present results are in some cases anomalous, and the effect of continued pumping and consequent inflow requires further study. There is known to be progressive depreciation of quality as the depth to the Bunter increases, but the rate of change appears to be variable and irregular. The Keuper waterstones and marls yield small and uncertain quantities of water, usually containing rather a high percentage of dissolved solids, so that they are useless for a large supply. Similar conditions rule in respect to the Rhætic and Lias, which are the newest "solid" rocks of the county. The river-gravels of the Trent flat are generally waterlogged in their lower portion and have often an independent water-table of their own; but their supply is always shallow and subject to contamination. In all the waters of the county it is essential that the geological source should be taken into consideration in interpreting the results of analysis.

TABLE OF ANALYSES.

Approximate composition in parts per 100,000.	I. Shallow wells and tubes. 20 to 32 ft. in the gravel beds.			II.	III.	IV.	V.	VI.
	Average of 25 wells with total solids below 100.	Average of 25 wells with total solids above 100.	Average of 250 analyses.	20 Bores in the Upper Keuper, 70 to 200 ft., average of 60 analyses.	3 Bores in the Lower Keuper, 350 to 525 ft., average of 10 analyses.	2 Bores in the Bunter Conglomerate 180 to 400 ft. N.E. of town, average of 2.	South Staffordshire Water Works, 1892 to 1910, average of 12 analyses.	Trent River Water, 1884 to 1910, average of 16 analyses.
Carbonate of magnesia	4·9	4·7	4·9	3·1	3·6	9·0	2·7	4·0
Carbonate of lime	17·1	22·5	20·2	20·0	17·8	16·0	11·5	12·5
Sulphate of lime	29·3	60·6	46·1	147·0	89·5	14·0	22·6	28·7
Sulphate of magnesia	9·7	23·9	17·4	32·0	19·5	—	5·7	7·5
Sulphate of soda	—	—	—	1·0	23·5	10·0	3·3	—
Nitrate of magnesia	5·6	11·2	8·7	5·2	·3	—	·7	1·0
Chloride of magnesium	2·0	1·8	1·9	—	—	—	—	—
Chlorides of sodium and potassium	10·8	12·9	12·0	11·2	37·8	19·0	3·9	16·5
Difference—Iron, silica, alumina, etc.	1·1	1·4	1·3	·7	2·0	—	1·3	1·0
Total solids dried at 180° C	80·5	139·0	112·5	220·2	194·0	68·0	51·7	71·2
Free ammonia	·007	·004	·006	·003	·024	·025	·003	·167
Albuminoid ammonia	·007	·009	·008	·004	·004	·005	·003	·032
Lime (CaO)	21·64	37·55	30·29	71·72	36·81	14·72	15·75	18·82
Magnesia (MgO)	7·92	13·99	11·28	13·55	8·29	4·28	3·37	4·67
Soda (Na_2O)	5·72	6·84	6·36	6·37	30·29	14·43	3·51	8·74
Sulphuric anhydride (SO_3)	23·70	51·58	38·72	108·37	88·90	13·87	18·96	21·88
Nitric anhydride (N_2O_5)	4·09	8·17	6·35	3·80	·22	—	·51	·73
Carbonic anhydride (CO_2)	10·10	9·90	11·46	10·42	9·72	11·76	6·47	7·60
Chlorine (Cl)	8·05	9·18	8·70	6·80	22·95	11·53	2·37	10·02

Prof. LAMPLUGH, replying to questions, said the locality of the analyses was of course essential for the purposes of the Survey. They had already a large number of the records of wells. The one in the Midland Goods yard was quite well known to them. With regard to the shallow wells of the Trent Valley they had collected a considerable amount of information. The Trent Valley was different from most river valleys, and the fact was an interesting one from a geological point. When the water table was higher than the river there was no danger of the water soaking through. He presumed there must be always be a danger of pollution, but yet there were many parts of the county where the condition of things was worse than in others. With due care there should not be much danger in the waters. Wells should be made to a certain depth, and they should be watertight nearly to the bottom. The weakness generally of water analyses was that they were rot continuous. It was hardly fair for water to be judged on one particular analysis, and especially so with regard to deep well waters.

WATER ANALYSES FROM NOTTINGHAMSHIRE.

BY J. GOLDING.

ANALYSES OF NOTTINGHAMSHIRE WATERS.

BY L. ARCHBUTT.

TABLE OF WATER ANALYSES.

BY G. J. WARD.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Heat-conductivity of powdered substances. M. Smoluchowski. Anz. Akad. Wiss. Krakau, 1910, Reihe A., 129—153. Chem. Zentr., 1910, 2, 1860.

The author determined experimentally the heat-conductivity of quartz sand, zinc dust, iron powder, zinc powder, rice flour, lycopodium seeds, cupric oxide, lampblack, and kieselguhr, and ascertained the influence of the nature and pressure of the gases filling the spaces between the grains of the powders. The results show that the heat-conductivity of powdered solid substances is mainly determined by the nature and pressure of the gas filling the interstices, being very small if the gas is completely removed.—A. S.

Patents.

Grinding and pulverising ores, cement, phosphates, colours, chemicals and the like. T. Breakell, Wirksworth. Eng. Pat. 28,798, Dec. 9, 1909.

The claim is for a fixed mortar having one or more mullers with convex surfaces adapted to fit close and to be rotated in contact with the periphery of the mortar and about its centre. Each muller is also so arranged that it can not only rotate on its own axis but is free to move vertically.—W. H. C.

Filters for separating liquids from materials and for washing and saturating materials with liquids; Rotary ——. T. Breakell, Wirksworth. Eng. Pat. 28,945, Dec. 10. 1909.

The filter is of the ordinary drum type having the interior connected with the suction of a vacuum pump which draws off the liquid. The improvements claimed consist in providing a longitudinally reciprocally moving, perforated feed pipe to supply the wash water, so that it is not always sprayed on at the same point. The liquid or mud to be filtered is contained in a tank in which the drum rotates whilst partially immersed and which is provided with a perforated air-pipe for agitation. The dried cake is stripped off the drum by a scraper of the usual type, which however is placed at some little distance from the point at which the surface of the drum again enters the liquid. In order to prevent loss of vacuum by air passing through the filter in this interval, a flexible flap is provided which is held against the face of the filter by the suction.—W. H. C.

Filtering or separating solids from liquids or semi-liquids; Method of and means for ——. J. H. Brownson, Cheadle Hulme, Cheshire. Eng. Pat. 3171, Feb. 9. 1910.

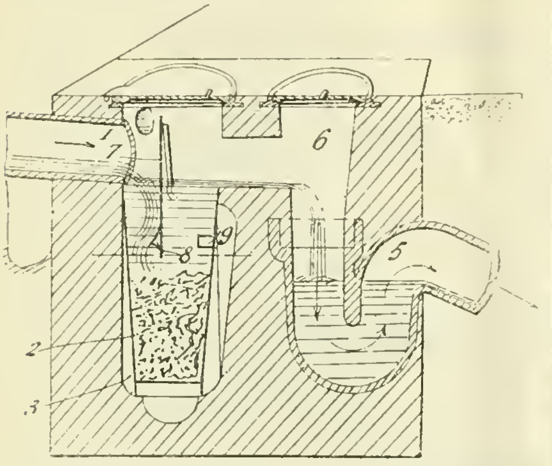
The filter consists of a cylinder having a perforated wall covered with filter-cloth. The material to be filtered is introduced through a valve into the upper end of the cylinder and the liquid passes through the perforations. A screw or reciprocating scraper or conveyor pushes forward the solids to the lower end of the cylinder so that only a definite thickness of solid cake accumulates on the surface of the wall. The solids are pushed down into a solids exit-chamber from which they are discharged through a valve.—W. H. C.

Suction-filter. H. E. Kier, Colorado Springs, Colo. U.S. Pat. 978,381, Dec. 13, 1910.

The apparatus comprises a horizontal rotatory frame provided with a filtering-tray to the bottom of which a conduit, for the withdrawal of the filtered liquid by suction, is attached. The conduit communicates with two suction-pipes controlled by valves, the operation of which regulates the period of filtration and allows of the solution and the washings being collected separately. During each revolution of the frame, the filtering-tray is automatically tilted for discharging purposes and returned to its normal horizontal position; the discharging operation is facilitated by the use of compressed air which is conveyed by a third pipe communicating with the conduit beneath the tray.—W. E. F. P.

Separation of solids from liquids. J. W. Madeley, From E. P. Richards, Madras, India. Eng. Pat. 17,899, July 27, 1910.

The mixture to be separated enters by the channel, 1, and flows into the bucket, 2, placed in the hole, 3, and provided with a non-perforated diaphragm, 7, having a projecting deflector plate, 8, on the inlet side. The deflection of the current causes the deposition of the solid matter on the bottom of the bucket, and the clear liquid overflows by the channel, 6, into the siphon trap, 5. When a sufficient quantity of solid matter has accumulated, the bucket is lifted out and emptied. The excess of liquid drains off through the aperture, 9, which also allows any sludge that has collected in the hole, 3, whilst the bucket was removed, to re-enter the bucket.—W. H. C.



Centrifugal separating washing apparatus. L. C. Trent, East Auburn, Cal. U.S. Pat. 978,238, Dec. 13, 1910.

The apparatus comprises an outer pressure-chamber containing a rotatable vessel, the latter being provided with a series of peripheral outlets at the base, above which a diaphragm extends nearly to the sides. Above the pressure-chamber, and connected with the inner vessel by means of a wide pipe, a cylindrical box or drum of relatively small depth is situated, provided with peripheral outlets opening into a circular launder for the reception of the separated liquid. The inlet pipe of the inner vessel is centrally disposed therein, its lower end supporting the diaphragm, and its upper part extending through and above the drum, thus forming an annular space by which the latter communicates with the inner vessel. In operation the fluid material enters the inner vessel, flowing between the diaphragm and the base; suction and centrifugal action cause the separated liquid to flow upwards, through the annular space surrounding the inlet pipe, into the drum above; the separated solids are ejected from the base of the inner vessel by means of a current pressure acting in a direction opposite to that of rotation. —W. E. F. P.

Abrading or polishing powders; Manufacture of ——. R. B. Helliwell, Waterloo, Lancs., and J. S. Helliwell, Lydiate, Lancs. Eng. Pats. 30,233, Dec. 24, 1909, and 14,989, June 22, 1910.

The powders consist of calcined cannel coke. The coke is subjected to slow combustion in a tank or furnace to which only a very restricted amount of air has access. Any hard lumps are separated from the mass, and the residue is reduced to powder which is graded and collected according to the degree of fineness. This process is effected by passing the calcined material through an inclined rotating cylinder, provided with disintegrating bars, and through which a current of air is passed, which carries the powder to collecting and grading shelves, set at varying distances from the end of the cylinder. As an alternative, the material may be fed on to a vibrating sieve, over which the hard lumps pass, and through which the powder falls on to a travelling belt, arranged to project the powder into a settling chamber where it falls into collecting and grading receptacles placed at varying distances from the end of the belt.—W. C. H.

Separating a single gas from a mixture of gases and apparatus for use therewith; Process of ——. A. Sinding-Larsen and O. J. Storm, Kristiania, Norway. Eng. Pat. 12,748, May 25, 1910. Under Int. Conv., Sept. 10, 1909. Addition to Eng. Pat. 8211 of 1910, dated April 7, 1909 (this J., 1910, 1092).

In the process described in the original patent, in order to reduce the power required, the circulation of the absorbing liquid between the pressure and the vacuum vessels is arranged to take place as nearly as possible in a horizontal plane. Also, in order to prevent the destruction of the blood or hæmoglobin by the action of bacteria or ferments, the solution is exposed to the action of natural or artificial light or is mixed with such substances as sugar, glycerin, molasses, saccharate of iron or other organic iron compounds which tend to prevent fermentation. The gases to be treated are also first filtered through sterilised cotton.—W. H. C.

Distillation system for ice plants. A. Faget, Assignor to Pacific Engineering Co., San Francisco, Cal. U.S. Pat. 978,279, Dec. 13, 1910.

In a water distillation system, suitable steam connections with the boiler are provided, whereby the steam used in the power plant is re-heated during its passage. By means of steam connections from the re-heater to other heaters, the temperature of the feed-water is raised nearly to that of the boiler itself, the steam from the various heaters discharging into a vacuum re-boiler.—W. E. F. P.

Bone-black furnace. O. P. Nichols, Warren, Pa. U.S. Pat. 978,625, Dec. 13, 1910.

The furnace, which is for the purpose of burning bone, fullers' earth and other filtering material, has a series of burning shafts each provided with a burner and an outlet for the burned material at its bottom, and a feed hopper at the side of the furnace having a series of openings corresponding with the number of shafts and adapted to feed the material into the upper portion of the shafts, the feed being capable of variation by means of controlling devices. The shafts are provided with internal baffle-projections, with inclined upper surfaces extending partly across the shafts, alternately from opposite sides thereof. Above the feed openings in the shaft rises a stack portion.—E. W. L.

Regenerative reversing-furnace. L. L. Knox, Avalon, Pa., Assignor to Keystone Furnace Construction Co., Pittsburg, Pa. U.S. Pat. 978,822, Dec. 13, 1910.

In a regenerative reversing-furnace the gas and air uptakes, provided with separate refractory walls, are surrounded on all sides by hollow cooling-plates. The gas uptake extends centrally between the air uptakes, the refractory walls being protected by the adjacent cooling-plates. Alternatively, a port cooler, provided with a suitable internal spraying arrangement, may be employed, its upper part extending within the arch separating the gas and air ports in such a manner as to enclose the sides of the gas port and the upper portion of the gas uptake.—W. E. F. P.

Evaporator. J. E. Dunn, Assignor to American Evaporator Co., Philadelphia, Pa. U.S. Pat. 978,993, Dec. 20, 1910.

The evaporator comprises a liquor chamber at the bottom, a vapour chamber at the top, and an intermediate heating chamber through which vertical evaporating-tubes pass from one to the other. The number of tubes in action is varied proportionally to the volume of vapour required, suitable valves being provided for the purpose.—H. H.

Concentrating comminuted material; Process of ——. H. M. Sutton, and W. L. and E. G. Steele, Dallas, Tex. U.S. Pat. 979,046, Dec. 20, 1910.

The material is fed by gravity across an unobstructed surface and supported thereon by air pressure applied in separated parallel areas, a propelling movement in the direction of such parallelism and crossing the feed by gravity being thereby imparted to a portion of the material of different specific gravity to the rest.—H. H.

Colloidal or other substances; Method and apparatus for drying —— with recovery of the solvent. Soc. Anon. de Travaux Dyle et Bacalan. Fr. Pat. 418,785, July 30, 1910.

The colloidal substances, etc., are placed in a hermetically closed vessel, in which they can be moved about by means of any suitable device so as to be subjected to the uniform action of a current of air or other gas. This is introduced through a series of valves and carries forward into a suitable condensing chamber the volatile solvent (alcohol, etc.) which it removes from the substances being dried. C. A. M.

Distillation furnaces; Process and apparatus for drawing off the gases from ——. W. Wielandt. Ger. Pat. 228,220, Oct. 22, 1909.

In order to facilitate the withdrawal of gases from distillation furnaces, the cooling of the gases is effected exclusively in pipes or vessels in which the gases flow vertically downwards, and those pipes or vessels in which the gases do not follow this downward direction are not only not cooled, but are protected by insulating material in order to prevent cooling. Further the pipes and cooling vessels are made of progressively decreasing size, corresponding with the contraction of the gases by cooling, so that as far as possible the velocity of the gases is the same throughout the system. It is claimed that by these means not only are the inner friction of the gases and the friction between the gases and the pipes, etc., diminished, but the descent of the heavier cooled gases in the cooling arrangements augments the natural draught due to the gases escaping from the furnace.—A. S.

Mixing operations and chemical reactions; Apparatus for continuously carrying on ——. Chem. Fabr. vorm. Weiler-ter-Meer. Ger. Pat. 228,544, July 24, 1909.

Up to the present the chief aim in the construction of stirring and mixing apparatus, has been to secure intimate mixing of the contents of the apparatus, and no regard has been paid to the fact that the efficiency of such apparatus is reduced by the presence together, in one and the same space, of the fresh ingredients, the partially mixed ingredients, and the final product or products. Claim is now made for an apparatus divided into compartments so that the products of the different stages of the mixing or of the chemical reaction are kept separate. It consists of a cylindrical vessel provided with a rotating central shaft having stirring blades, and with discs which extend alternately nearly to the wall of the vessel and nearly to the central shaft, so that liquids which are forced into the vessel under pressure, are intimately mixed by the stirring blades and caused to take a tortuous path through the compartments formed by the discs.—A. S.

Liquids of all kinds, extracts, balsams, fats, waxes, and hygroscopic substances; Process of converting —— into impalpable powder. G. Fendler. Ger. Pat. 229,141, July 25, 1909.

The substances are mixed with amorphous silicic acid prepared from alkali silicate solution. The silicic acid has a strong absorptive power for the substances mentioned in the title, and the products do not ball together as is the case when kieselguhr is used as absorbent.—A. S.

Disintegrating and subdividing into fine particles, insoluble bodies [graphite, etc.]; Method of ——. E. G. Acheson, Stamford Township, Canada. Eng. Pat. 6463, March 15, 1910.

See U.S. Pat. 964,478 of 1910; this J., 1910, 1047.—T. F. B.

Separating solids from liquids; Vats, tanks, or vessels for ——. A. J. Arbuckle, Belgravia, Transvaal. Eng. Pat. 12,062, May 14, 1910.

See Fr. Pat. 416,193 of 1910; this J., 1910, 1391.—T. F. B.

Evaporator. R. Sauerbrey, Assignor to G. Sauerbrey Maschinenfabrik A.-G., Stassfurt, Germany. U.S. Pat. 978,490, Dec. 13, 1910.

See Ger. Pat. 207,478 of 1908; this J., 1909, 465.—T. F. B.

Extracts; Apparatus for making ——. W. Wiegand, Merseburg, Assignor to R. Rieder, Frankfort on Maine, Germany. U.S. Pat. 979,362, Dec. 20, 1910.

See Fr. Pat. 386,829 of 1908; this J., 1908, 760.—T. F. B.

Retorts for distilling gases and vapours. H. Lage. Fr. Pat. 418,762, July 29, 1910.

See U.S. Pat. 922,407 of 1909; this J., 1909, 646.—T. F. B.

Pyrometers; Radiation ——. The Cambridge Scientific Instrument Co., Ltd., and R. S. Whipple. Fr. Pat. 419,142, Aug. 10, 1910. Under Int. Conv., Sept. 18, 1909.

See Eng. Pat. 21,369 of 1909; this J., 1910, 1239.—T. F. B

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Water-gas plant; Utilising waste heat in ——. J. H. Taussig. J. Gas Lighting, 1910, 112, 933—934.

The author discusses the economies which can be effected in carburetted water-gas plants by raising steam by means of the waste heat in (1) the blast gases from the oil superheater, and (2) the illuminating gas itself. For boilers utilising both gases, 70 lb. of water at 212° F. can be converted into steam per 1000 cb. ft. of illuminating gas produced in the plant. It is estimated that the installation, if applied to an existing water-gas plant and run at its full capacity of 22 working hours per day for 300 days in the year, would effect a saving of 56 per cent. of the outlay in one year, while in the case of an entirely new plant the installation would be paid for in a year. The lowering of the outlet temperature of the illuminating gas in the waste-heat boiler enables a smaller washbox be used for to washing and cooling the gas.—H. H.

Cyanogen compounds in coke oven gases; Determination of ——. E. Lecocq. Bull. Soc. Chim. Belg., 1910, 24, 439—445.

It is to be expected that coke oven gases will be used to an increasing extent as fuel in gas engines, and for this purpose, a purification of the gas is indispensable. In recovering the cyanogen compounds in the purification process, it is important to know their nature and quantity. The author proposes the following method of investigation which is applicable to the gas previously freed from tar and ammonia, and also to the crude gas provided that the ammoniacal liquor, condensed at the time of taking the sample, is collected and added, after filtration, to the alkaline liquid referred to below:—To a cock, which is soldered to the gas conduit, is attached a rubber tube, the further end of which is provided with a screw-clip. The gas is drawn through the tube until the latter is filled with the gas, when it is closed by the screw-clip. The tube is then connected with two 200 c.c. flasks arranged in series: each flask is half-filled with an absorbent liquid prepared by dissolving 2·5 grms. of lead acetate in 200 c.c. of a 10 per cent. solution of potassium hydroxide. A measured volume of the gas is then drawn through the solutions at such a rate that in two periods of 6 hours (on consecutive days). 50—100 litres pass through the solutions. The liquids in the flasks are then united, and filtered from the lead sulphide, which is rapidly washed with a few c.c. of 10 per cent. solution of potassium hydroxide. The filtrate is rendered distinctly acid with dilute sulphuric acid (1 : 5), added gradually and with cooling, to prevent loss of hydrocyanic acid. The liquid is made up to 500 c.c., shaken, left to stand for some time, and then filtered from the lead sulphate. Four hundred c.c. of the filtrate are treated with 10 c.c. of a solution containing 10 per cent. of a mixture of equal parts of ferrous and ferric sulphates (quite free from chlorides, and slightly acidified with sulphuric acid). A solution of potassium hydroxide is then added, little by little, in quantity sufficient to precipitate a considerable part of the iron salts, without rendering the solution alkaline. Under these conditions, Prussian blue is formed from the hydrocyanic acid, and ferric thiocyanate from the thiocyanic acid. The liquid is then left for at least an hour in a fairly warm place, after which it is acidified with 10—20 c.c. of sulphuric acid (1 : 5), heated on the water-bath for 15 minutes, and left to stand for some hours. The supernatant red solution is then decanted into a 500 c.c. flask, the precipitate of Prussian blue is transferred to a small filter of fine texture, and washed, the filtrate and washings being transferred to the 500 c.c. flask. *Determination of hydrocyanic acid.*—If the quantity of Prussian blue is sufficient, it may be redissolved in a few c.c. of potassium hydroxide, and titrated according to the well-known method of Knublauch; otherwise, it should be dissolved in a small quantity of sodium hydroxide, and determined by Feld's method (this J., 1903, 1068, section 2). *Determination of thiocyanic acid.*—The solution, freed from Prussian blue by filtration, may be titrated directly by Volhardt's method with N/10 silver nitrate. If, however, the solution contains chlorides, the following colourimetric method should be used:—A solution of potassium plumbate, prepared in exactly the same manner as that used for absorbing the cyanogen compounds, is treated with the same quantity of sulphuric acid as that previously used, and filtered from the lead sulphate; 400 c.c. of the filtrate are treated with 10 c.c. of the solution of iron sulphates, rendered neutral by gradual addition of potassium hydroxide, and then acidified with 10—20 c.c. of sulphuric acid (1 : 5). To this solution is added an aliquot part (10—50 c.c.) of a suitably dilute solution of potassium thiocyanate standardised by Volhardt's method. The red solution thus obtained is heated on the water-bath for an hour, cooled, and made up to 500 c.c. The colour of this solution is then compared with that of the solution (also made up to 500 c.c.) freed from the Prussian blue as described above. The author finds that the gas from horizontal, regenerative coke ovens, with Belgian, or mixtures of Belgian and English coals, contains, on the average 0·093 grm. of cyanogen and 0·189 grm. of "sulphocyanogen" (SCN) per cubic metre.—L. E.

Gas-oils; Rapid method for the identification of——. F. E. Park and L. E. Worthing. Chem. Engineer, **11**, No. 4. Chem. News, 1911, **103**, 3—7.

For distinguishing gas oils the authors rely upon the bromine absorption value found by treatment with bromine dissolved in carbon tetrachloride, together with the determination of the percentage of hydrobromic acid formed (see this J., 1900, 176). This process is expeditious and stated to be sufficiently accurate for the requirements of water-gas manufacture. (See also this J., 1888, 64; 1902, 676).—A. Sbld.

Gas-volumetric determination of hydrogen. Brunck. *See* XXIII.

Oil resources of California. M. L. Requa. Mining Mag., 1911, 4, 47—52.

Oil bearing area of California contrasted with that of other parts of the United States.

State.	Square Miles.
Alaska	100
Alabama	50
California	850
Colorado	200
Idaho	10
Illinois	200
Indiana	1,000
Kansas	200
Kentucky	400
Louisiana	60
Michigan	80
Missouri	30
New Mexico	80
New York	300
Ohio	650
Oklahoma	400
Pennsylvania	2,000
Tennessee	80
Texas	400
Utah	40
West Virginia	570
Wyoming	750
Total	8,450

According to this table the total area of oil-land in the United States is 8450 square miles. In other words, California is credited with slightly more than one-tenth of the total area, but is also credited with a quantity of oil equal to from one-half to one-third of the total. Analysis of the two tables gives, excluding California, a yield of approximately 1000 barrels per acre as a minmium and something slightly over 3200 as a maximum. [1 barrel = 42 American gallons or 35 Imperial gallons.] Contrasting this with the estimated California production of a minimum of 9000 to a maximum of over 15,000 bbl. per acre, we have a fairly satisfactory comprehension of the relative productivity, acre for acre, of the California land as contrasted with similar land in other parts of the United States.

The quantity of oil produced in California from year to year has increased with startling rapidity, as is shown herewith:—

Total California Production.

Year	Barrels.	Year.	Barrels.
1875	3,000	1893	470,179
1876	12,000	1894	705,969
1877	13,000	1895	1,208,482
1878	15,227	1896	1,252,777
1879	13,543	1897	1,903,411
1880	40,552	1898	2,257,207
1881	99,862	1899	2,642,095
1882	128,636	1900	4,324,484
1883	142,857	1901	8,786,330
1884	262,000	1902	13,984,268
1885	325,000	1903	24,382,472
1886	377,145	1904	29,649,434
1887	678,572	1905	33,427,473
1888	690,333	1906	33,098,598
1889	303,220	1907	39,748,375
1890	307,360	1908	48,300,758
1891	232,600	1909	58,191,000
1892	385,049	1910 (estimated)	75,000,000

Patents.

[Fuel] briquettes and process of making same. E. J. Callahan, Salt Lake City, Utah. U.S. Pat. 979,258, Dec. 20, 1910.

The process consists in heating coal dust, adding to it while hot a hot liquid composition containing mineral oil and a substance which forms a solid compound with said oil on cooling, and forming the mixture into briquettes while hot. The solidifying agent may consist of resin, caustic alkali, and soap stock. Soot may be added to the material.—H. H.

Fuel; Manufacture of artificial ——. J. Leach. Fr. Pat. 418,525, July 23, 1910.

Colliery waste is treated by washing and then sprinkling with a solution of potassium hydroxide. From 4·5 to 6·35 kilos. of potash are used for 1015 kilos. of fuel.—A. T. L.

Coke ovens: Horizontal or inclined —— in which the direction of the draught is constant. R. Fabry, Sheffield. Eng. Pat. 19,104, Aug. 15, 1910.

The system of gas-heating for coke ovens described in Eng. Pat. 6813 of 1910 (this J., 1910, 1148) is applied to coke ovens in which the direction of the draught is constant. Before the air is allowed to enter the vertical heating flues containing the gas jets, it is heated (1) by passing it through a flue in proximity to the waste heat flue, and (2) by burning a regulated amount of gas in it sufficient to raise the temperature to the desired extent.—H. H.

Coke-breeze; Process of utilising ——. H. A. Tobelmann, Warren, Ariz. U.S. Pat. 978,236, Dec. 13, 1910.

The coke-breeze is pulverised, separated from ash, and mixed with a suitable proportion of clean, coking slack. The mixture is then subjected to a temperature sufficient to coke the slack.—W. E. F. P.

Gas from hydrocarbon oils; Manufacture of ——. W. E. Lake, London. From Hydrocarbon Converter Co., New York. Eng. Pat. 29,029, Dec. 11, 1909.

A mixture of finely divided heavy hydrocarbon oil and air in the form of a mist is passed over the surface of a porous material heated to a moderate temperature, and the warm vapourised mixture so produced is then passed through an extended passage lined on one or both sides with porous material where partial spontaneous combustion occurs to a sufficient extent to supply the heat necessary for fixing the gas. The apparatus is provided with (1) an external jacket through which hot gases, such as the exhaust gases from a gas engine, are passed for heating the apparatus initially and for maintaining the temperature, (2) means for projecting a flame into the jacket at starting, (3) means for introducing highly combustible liquids such as alcohol for supplying combustible gas while the apparatus is relatively cold, (4) jackets for heating the air supply provided with check valves for preventing back-firing into them, and (5) means for heating a further current of air to be finally mixed with the gas produced in the apparatus. In a convenient form the apparatus is arranged as a cylindrical drum with a number of concentric drums within it arranged to form a zig-zag passage.—H. H.

Gas; Method of and apparatus for making ——. W. T. Cutter, East Lyme, Conn., Assignor to Hydrocarbon Converter Co., New York. U.S. Pat. 978,853, Dec. 20, 1910.

The method of making a fixed gas consists in saturating hydrocarbon oil with carbon dioxide under pressure, and decomposing the mixture by passing it along the face, or through the pores of porous material, heated to approximately 1400° F. After being washed, the resulting gas is collected in a suitable receiver at substantially the initial pressure.—W. C. H.

Gas; Process of producing ——. G. J. Weber, Assignor to L. M. Weber, Kansas City, Mo. U.S. Pat. 978,970, Dec. 20, 1910.

Air and steam are forced through burning fuel, and the resulting gaseous products are passed into contact with a fresh supply of air and steam, and this mixture is then passed through burning fuel, into which a fresh supply of steam is simultaneously discharged.—W. C. H.

Water-gas; Conversion of carbon monoxide in —— into methane. L. Vignon. First Addition, dated Oct. 6, 1909, to Fr. Pat. 416,699, Aug. 12, 1909 (this J., 1910, 1366).

Water-gas is passed through a mixture of quicklime and slaked lime, as in the principal patent, but under a pressure of 2 to 5 atmospheres, instead of at atmospheric pressure. In this way, methane is formed at lower temperatures, and the secondary reaction:

$$CO+Ca(OH)_2=CaCO_3+H_2,$$

which proceeds more rapidly at higher temperatures can be avoided. The lime need be heated only to 100°—200° C. —A. T. L.

Hydrogen; Process and apparatus for the extraction of the free —— contained in fuel gases. G. F. Jaubert. Fr. Pat. 418,312, Sept. 23, 1909.

Lighting gas, water-gas, or other gas containing free hydrogen is passed through retorts packed with briquettes formed of iron oxide with a refractory substance and a catalytic agent, the retorts being heated to 800°—900° C. Steam is afterwards passed through the retorts at the same temperature, yielding pure hydrogen in amount equal to that contained in the gas. The briquettes are preferably composed of a mixture of 30—60 kilos of iron oxide (Fe_2O_3 or Fe_3O_4), 15—25 kilos. of fireclay or pumice, 15—25 kilos. of calcined magnesia, and 5—15 kilos. of the oxide of lead, copper, chromium or manganese. —A. T. L.

Gas producer with recuperation of waste heat. R. E. Mathot. Fr. Pat. 419,177, Aug. 11, 1910.

The producer is of the suction type, and in order to permit of working with an open ash-pit, the steam from a boiler forming the roof of the producer is delivered at a slight pressure to the ash-pit, where it mixes with the entering air. The steam is superheated by passing through vertical downtakes arranged in an annular gas-outlet chamber surrounding the producer chamber. The grate comprises horizontal ring-shaped bars arranged at suitable distances one above the other, with the smallest ring at the bottom, and the fuel column extends down through this bottom ring and rests upon the bottom of the ash-pit.—A. T. L.

Gas; Apparatus for use in making —— by the dry distillation of coal, and for preventing the formation of thick tar. J. Y. Johnson, London. From Maschinen und Armaturenfabr. vorm. H. Breuer und Co., Höchst-on-Maine, Germany. Eng. Pat. 29,125, Dec. 13, 1909.

Communication between the ascension-pipe of the retort and the hydraulic main is made by means of a connection-piece into which a nozzle opens. A liquid, such as tar water or thin tar, is projected through the nozzle, under pressure, against the bottom of the hydraulic main, which is provided with an outlet-pipe at its lowest part for the exit of the mixed tar and added liquid. By means of a device attached to the mouth of the connecting-piece, the effective cross-sectional area of the latter may be controlled, thus regulating the suction action of the jet of liquid.—W. E. F. P.

Tar from gases; Separating ——. The Otto-Hilgenstock Coke-Oven Co., Ltd., Wakefield, Yorks. From Dr. C. Otto und Co., Ges. m. b. H., Dahlhausen, Germany. Eng. Pat. 17,548, July 23 1910.

The separation is effected by means of a spray from an injector which, while normally passing only sufficient liquid for the treatment of a minimum quantity of gas, is so constructed that additional liquid may pass through an adjustable annular orifice concentric with that of the nozzle. Thus the quantity of liquid employed may be adjusted to suit the volume of gas passing at any time, the velocity of the liquid, and consequently the character of the spray, remaining practically unaffected.—W. E. F. P.

Gas purifier. Berlin Anhaltische Maschinenbau- A.-G. Abteilung Köln-Bayenthal. Fr. Pat. 418,272, July 15, 1910. Under Int. Conv., April 20, 1910.

To permit the use of a great depth of purifying material without excessive back-pressure, the material is supported by horizontal or inclined bars arranged one above the other on vertical rods or bars which are suspended from the top of the purifier. These vertical bars are free to move laterally. The vertical bars are divided into sets by pairs of perforated plates, the gas entering and leaving the purifying material through these plates.—A. T. L.

Hydrocarbons obtained by distillation with steam; Process for dehydrating and simultaneously saturating with ammonia ——. K. Baumgärtel. Ger. Pat. 228,260, Sept. 28, 1909.

The distillate, consisting of hydrocarbons and steam, is first passed through several fine sieves and then through a mixture of caustic alkali and an ammonium salt. Petroleum benzine obtained in this way, and hence saturated with ammonia, is stated to possess detergent properties superior to those of the ordinary product.—A. S.

Producer gas; Manufacture of ——. H. L. Doherty, New York. Eng. Pat. 7786, March 31, 1910. Under Int. Conv., March 31, 1909.

See U.S. Pat. 964,901 of 1910; this J., 1910, 998.—T. F. B.

Gas-producing oven. H. A. R. Bröker, Hamburg, Assignor to Ofenbau-Ges. m. b. H., Munich, Germany. U.S. Pat. 978,354, Dec. 13, 1910.

See Eng. Pat. 19,419 of 1909; this J., 1910, 479.—T. F. B.

Hydrogen; Process for making ——. F. Sauer. Fr. Pat. 418,459, July 20, 1910.

See Ger. Pat. 224,862 of 1907; this J., 1910, 1148.—T. F. B.

Gas and ammonia from peat; Production of —— in a gas producer. A. H. Lymn. Fr. Pat. 418,484, July 21, 1910. Under Int. Conv., July 22, 1909.

See Eng. Pat. 17,074 of 1909; this J., 1910, 935.—T. F. B.

Distillation gases; Process and apparatus for separating tar from hot ——, by means of tar, washing water impregnated with tar, or both these means. C. Otto und Co. Ges. m. b. H. First Addition, dated July 19, 1910, to Fr. Pat. 390,470, May 22, 1908. Under Int. Conv., April 29, 1910.

See Eng. Pat. 17,548 of 1910; preceding.—T. F. B.

Separating ammonia from industrial gases. Fr. Pat. 417,505. *See* VII.

Manufacture of ammonium sulphate from coal gas or coke oven gases. Fr. Pat. 417,782. *See* VII.

Viscosity meters. Eng. Pat. 22,961. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Acetic anhydride; Behaviour of —— at a high temperature. [*Formation of acetone from calcium acetate.*] E. Bamberger. Ber., 1910, 43, 3517—3520.

The author is of the opinion that the preparation of acetone from calcium acetate consists first in the formation of lime and acetic anhydride and that the latter then decomposes into acetone and carbon dioxide. In confirmation of this it was found that when acetic anhydride is heated in a sealed tube to about 295° C., small amounts of acetone and still smaller amounts of acetylacetone are produced. The reaction is probably a reversible one and the large yield of acetone obtained in the ordinary process of manufacture is accounted for by the fact that the carbon dioxide produced is continually fixed by the lime, thus allowing the reaction to proceed in one direction only.
—J. C. C.

Patents.

Distillation gases; Process and apparatus for the recovery of tar, tar-vapour, and ammonia from ——. J. Radcliffe, East Barnet, Herts. Eng. Pat. 28,868, Dec. 10, 1909.

The gases are passed (1) through one or more scrubbers in contact with oil or tar or both at such a temperature that the water vapour contained in the gases is not condensed while the tar is separated, and (2) through a saturator for the recovery of ammonia without condensation of water vapour, the conditions being such that no external heating is necessary.—H. H.

Tar; Process of removing —— in recovering ammonia. E. Wagener, Dahlhausen-on-the-Ruhr, Germany. U.S. Pat. 977,909, Dec. 6, 1910.

In the preparation of ammonium sulphate from the products of distillation of coal and the like, the gases are passed over the surface of the acid bath which is used for absorbing the ammonia. Tar condenses on the surface and is drawn off together with the upper layer of the liquid. The tar is then seperated from the liquid and the latter returned into the absorbing vessel.—O. R.

Incandescence mantles; Manufacture of ——. J. Visseaux. First Addition, dated Sept. 27, 1909, to Fr. Pat. 408,807, Jan. 30, 1909 (this J., 1910, 618).

In carrying out the process described in the principal patent, if commercial thorium nitrate is used, containing 48 per cent. of thorium oxide in combination, the solution is always acid. The solution should be neutralised by the addition of thorium hydroxide, $Th(OH)_4$, before the fabric is impregnated. It is also found best to treat the mantle with the cerium salt separately, after the thorium has been precipitated on the fabric by sodium hypochlorite and the mantle has been washed and dried.—A. T. L.

Incandescent bodies with automatic igniting. A. Eisner. First Addition, dated July 27, 1910, to Fr. Pat. 417,934, May 7, 1910 (this J., 1911, 14).

The catalytic igniter consists of a pellet containing $\frac{1}{15}$ gram of metals of the platinum group mixed with oxides or salts of the rare earth metals. The materials are mixed with glycerin in order to form the pellet.—A. T. L.

Mercury-carbon filament incandescent lamp. C. H. Weber, Berlin. Eng. Pat. 9250, April 16, 1910. Under Int. Conv., Oct. 9, 1909.

For the purpose of removing the last traces of oxygen from a mercury carbon filament lamp, a metal which will readily oxidise but will not decompose again is added to the mercury in a proportion not exceeding 20 per cent. Either a metal which will form an amalgam, such as sodium, potassium, barium, calcium, strontium, or rubidium, or a powdered metal such as reduced iron, wolfram, molybdenum, or zirconium may be used, but preferably zirconium hydride is employed which gives off hydrogen and so produces the necessary pressure of inert gas. The carbon filament is thickened in that part which is in the immediate vicinity of the mercury.—H. H.

Oxygen; Process of removing —— from vessels [*incandesence lamp bulbs*]. R. Hopfelt, Cologne-Klettenberg, Germany. U.S. Pat. 975,040, Nov. 8, 1910.

In exhausting incandescent lamp bulbs or other containers, it is not sufficient to rinse out the vessel with hydrogen or other gas, as a considerable quantity of oxygen remains through adherence. Malignani obtained good results for small vessels by using amorphous phosphorus to absorb the gas, but the process is not adequate for larger containers. The vessel is therefore exhausted and phosphorus trichloride, or other gaseous phosphorus halide, mixed with hydrogen is introduced and ignited by an incandescent wire.—H. H. S.

Electrodes for arc lamps ; Use of metallic tungsten and uranium for ——. F. A. M. V. Michotte. Fr. Pat. 418,280, July 15, 1910.

Electrodes of metallic tungsten and uranium are used in a non-oxidising atmosphere.—A. T. L.

Electrically conducting filaments ; Processes of and apparatus for the preparation of ——. H. de F. Madden, Bloomfield, N.J., and W. G. Housekeeper, Philadelphia, U.S.A. Eng. Pat. 7331, March 23, 1910. Under Int. Conv., March 31, 1909.

See Fr. Pat. 414,257 of 1910 ; this J., 1910, 1195.—T. F. B.

Separating ammonia from distillation gases. Ger. Pat. 227,946. *See* VII.

III.—TAR AND TAR PRODUCTS.

Indole in coal-tar. R. Weissgerber. Ber., 1910, 43, 3520—3528.

From the fraction of coal-tar distillate boiling at 240°—260° C., after removal of phenols and bases, indole can be obtained and isolated by means of its potassium derivative (compare Ger. Pats. 205,465 and 209,694; this J., 1909, 84, 649). 7·5 kilos. of the oil are heated with 500 grms. of potassium hydroxide for 5 hours at 190°—200° C. After cooling, the unattacked oil is drawn off and the potassium compound of indole remains at the bottom of the pan as an amorphous, brownish red mass. It is washed with a little benzene, decomposed with 2—3 litres of water, and the indole extracted by means of ether. After removing the solvent and distilling once in a vacuum, about 200 grms. of technically pure indole are obtained. The sodium compound may also be prepared by means of sodium amide or sodium (*loc. cit.*). From indole thus obtained the author has prepared the hitherto unknown N-benzoyl derivative, and the carboxylic acid of indole can be prepared by heating 300 grms. of indole with 50 grms. of sodium for 2 hours at 190°—200° C., and then leading in carbon dioxide until the whole becomes stiff. The carboxylic acid is extracted with water and precipitated with hydrochloric acid. The purification of technical indole can advantageously be effected by means of the bisulphite compound.—J. C. C.

Hydrogenations in presence of palladium. Application to phenanthrene. P. Breteau. Comptes rend., 1910, **151**, 1368—1369.

By passing a mixture of hydrogen and phenanthrene vapour over spongy palladium heated to about 160° C., a mixture of the tetra- and octo-hydrides of phenanthrene is produced. Only the tetra-hydride is produced by hydrogenation in presence of palladium black or precipitated palladium. In these cases: (1), hydrogen is passed into a solution of phenanthrene in cyclohexane, to which palladium black, obtained by the reduction of palladous chloride by formaldehyde, has been added; and (2), a solution of palladous chloride in hydrochloric acid is added to a solution of phenanthrene in 95 per cent. alcohol or ether, mixed with metallic zinc, and when the palladium is precipitated, hydrochloric acid gas is passed into the solution until the zinc is dissolved.—A. S.

Case of poisoning by dinitrobenzene. *See* XIXb.

Patents.

Hydrocarbons [tar, etc.] ; Process for treating liquid ——. G. L. Davies and W. E. Windsor-Richards. Fr. Pat. 418,330, July 18, 1910. Under Int. Conv., July 20 and Aug. 19, 1909.

See Eng. Pats. 16,908 and 19,081 of 1909; this J., 1910, 1368.—T. F. B.

Obtaining oils rich in bitumen from tar, etc., and their utilisation for impregnating wood. Fr. Pat. 418,520. *See* IX.

IV.—COLOURING MATTERS AND DYES.

Indirubin ; Constitution of ——. A. Wahl and P. Bagard. Bull. Soc. Chim., 1910, 7, 1090—1101.

It is shown that oxindole and indoxyl behave differently under similar conditions. When isatin chloride is allowed to act upon oxindole, indirubin is formed. With the same reagent indoxyl yields indigotin. The formulæ of Baeyer for these substances gives a satisfactory explanation of the authors' results. (See this J., 1909, 420.)—F. Shdn.

Patents.

Vat dyestuffs ; Halogenated —— dyeing like indigo. Soc. pour l'Ind. Chim. à Bâle. Ninth Addition, dated Oct. 11, 1909, to Fr. Pat. 372,627 Dec. 17, 1906. (See U.S. Pats. 848,354—848,356 of 1907; this J., 1907, 466—467.)

Halogenation of dyestuffs of the thioindigo or indirubin series can be effected in the presence of chlorosulphonic acid ($OH.SO_2Cl$). Example: 10 parts of the product of condensation of oxythionaphthene with α-isatinanilide are introduced gradually at 16°—18° C. into a mixture of 100 parts of chlorosulphonic acid and 38 parts of bromine. The mass is stirred for about 24 hours, when it is thrown on ice and the precipitated dyestuff collected. The product is a hexabromo-derivative and dyes textile fibres from an alkaline vat in blue shades which on soaping become violet blue.—J. C. C.

Vat dyestuffs of the anthracene series. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 418,937, Oct. 13, 1909.

Vat dyestuffs of the anthracene series are produced by treating aminoanthraquinones, their derivatives, analogues or homologues, with agents capable of introducing the radical of an unsaturated monobasic acid of the aliphatic-aromatic series into the amino-group. Example: 15 parts of cinnamoyl chloride are added to a warm solution of 10 parts of 1-aminoanthraquinone in 150 parts of xylene and the mixture is boiled for 15 minutes. The product, which crystallises out, dyes cotton from an alkaline vat in pure yellow shades. Similar condensation of cinnamoyl chloride with 1-amino-4-hydroxyanthraquinone furnishes a clear red dyestuff; with 1-amino-4-methoxyanthraquinone a dyestuff giving reddish orange shades turning to yellowish scarlet on soaping; with a mixture of 1 : 5- and 1 : 8-diaminoanthraquinone a dyestuff producing olive green shades turning to intense orange on exposure to the air; and with 2-aminoanthraquinone a dyestuff is obtained which gives pure greenish yellow shades. The condensation of 1 : 5-diaminoanthraquinone and phenylpropiolyl chloride in nitrobenzene solution leads to the production of a dyestuff which gives orange shades on animal and vegetable fibres. —J. C. C.

Azo dyestuffs dyeing cotton direct ; Process for the production of ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated July 15, 1910 (Under Int. Conv., July 30, 1909) to Fr. Pat. 402,126, April 16, 1909 (this J., 1909, 1191).

The dyestuffs described in the chief patent can also be obtained from the unsubstituted amino-acids there mentioned by first combining them with the respective diazo-compounds and then treating the products with the appropriate acylating agents.—J. C. C.

Azo dyestuffs : Production of new —— and their intermediate products. Farbenfabr. vorm. F. Bayer und Co. Second Addition, dated July 30, 1910 (Under Int. Conv., Dec. 30, 1909), to Fr. Pat. 414,294, March 11, 1910 (see Eng. Pat. 15,847, this J., 1910, 938).

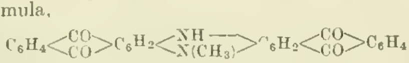
Azo dyestuffs possessing similar properties to those mentioned in the chief patent are obtained by combining the same diazo-compounds with naphtholsulphonic acids. Example: The diazo-derivative of 4-toluidine-2-sulphanilide ($C_6H_5.CH_3 : NH_2 : SO_2.NH.C_6H_5 = 1 : 4 : 2$) is combined in alkaline solution with 2-naphthol-6-sulphonic acid. The product dyes wool from an acid bath in orange shades.—J. C. C.

Azo dyestuffs; Production of new —— dyeing on a mordant. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 418,733, July 27, 1910. Under Int. Conv., Sept. 3, 1909.

Mordant azo dyestuffs are obtained by combining the diazo-compounds of derivatives of o-aminophenol or o-aminocresol containing nitro- or halogen groups or both, but no sulphonic or carboxylic groups, with carboxylic acids of diaminodiphenyl ethers. Example: diazotised 4-nitro-6-chloro-2-aminophenol is combined in alkaline solution with 2:4-diaminophenol ether-4′-carboxylic acid. The product dyes wool yellowish brown from an acid bath to which potassium bichromate may be added. —J. C. C.

Anthracene series; Dyestuffs of the —— and their intermediate products Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 418,908. May 13, 1910. Under Int. Conv., Sept. 10, Oct. 6, and Nov. 10, 1909.

Vat dyestuffs are obtained by heating in the presence of a metallic salt mixtures of o-halogenated aminoanthraquinones or of o-halogenated alkylaminoanthraquinones or their derivatives. Example: A mixture of 10 kilos. of 1-amino-2-bromoanthraquinone, 10·5 kilos. of 1-methylamino-2-bromoanthraquinone, 10 kilos. of anhydrous sodium acetate, 500 grms. of copper sulphate and 200 kilos. of naphthalene is heated to boiling until the formation of the dyestuff is complete. The latter is filtered off and washed with naphtha, alcohol and warm water. It has the formula,



$$C_6H_4<\substack{CO\\CO}>C_6H_2<\substack{NH\text{ —— }\\N(CH_3)}>C_6H_2<\substack{CO\\CO}>C_6H_4$$

and dyes textile fibres from the hydrosulphite vat in blue shades.—J. C. C.

Dyestuffs of the triphenylmethane series; Preparation of acid chrome ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 228,838, Dec. 9. 1908. Addition to Ger. Pat. 216,305, Oct. 22. 1908 (see this J., 1909, 1309).

Instead of using aldehydo-hydroxybenzoic acids, as in Ger. Pat. 216,924 (this J., 1910, 207), *o*- or *p*-hydroxybenzaldehydes or their derivatives are condensed with salicylic or *o*-cresotinic acid, and the leuco-compounds oxidised.—T. F. B.

Benzanthrone and its derivatives; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 418,435, July 7, 1910. Under Int. Conv., May 23, 1910.

Mono- and poly-ketones of the aromatic series, which contain a peri-position with respect to the carbonyl group, can be converted into benzanthrone or its derivatives by heating or by treatment with condensing agents such as aluminium chloride or by oxidising agents. Thus phenyl *a*-naphthyl ketone furnishes benzanthrone, 1:1′-dinaphthyl ketone gives naphthobenzanthrone, dibenzoylpyrene yields pyranthrone, tri-*a*-naphthoylpyrene yields naphthopyranthrone which gives a blue vat, dibenzoyl-*a*-dinaphthyl gives violanthrone, and anthraquinonyl naphthyl ketone furnishes a phthaloylbenzanthrone which gives a vat dyeing in green shades which are oxidised to yellow.—J. C. C.

Vat dyestuffs; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 418,843, Aug. 2, 1910, Under Int. Conv., Sept. 28, 1909.

Amino- or chloro-anthraquinothioxanthones are condensed with chloro- or amino- anthraquinones yielding vat dyestuffs. Example: A mixture of 6 parts of *a*-chloroanthraquinone, 7 parts of 1-amino-5:6-anthraquinothioxanthone, 3 parts of anhydrous sodium acetate, 1 part of copper chloride and 150 parts of nitrobenzene is boiled under a reflux condenser for 4—5 hours. The product, which can be freed from copper by boiling with dilute nitric acid, gives, with hydrosulphite a brownish violet vat from which cotton is dyed in Bordeaux red shades.—J. C. C.

Vat dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld. Germany. Eng. Pat. 28.043. Dec. 1. 1909. Addition to Eng. Pat. 7819. April 1, 1909.

See Addition of June 1, 1910, to Fr. Pat. 407,507 of 1909; this J., 1910, 1369.—T. F. B.

Vat dyestuffs and process for producing them. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 418.344, July 18, 1910. Under Int. Conv., Oct. 28, 1909.

See Eng. Pat. 27.029 of 1909; this J., 1910, 1098.—T. F.B.

Polyazo dyes: Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,718, Dec. 8, 1909.

See Fr. Pat. 416,021 of 1910; this J., 1910. 1296.—T. F. B.

Trisazo dye. A. Blank and W. Bergdolt, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld. Germany. U.S. Pat. 971,112, Sept. 27, 1910.

See Eng. Pat. 8144 of 1909; this J., 1910. 207.—T. F. B.

Azo dyestuffs: Manufacture of ——. P. A. Newton, London. From Farbenfabr vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 369. Jan. 6, 1910.

See Addition of June 6. 1910, to Fr. Pat. 405.928 of 1909; this J., 1911, 17.—T. F. B.

Azo dye; Green ——. W. Bergdolt. Leverkusen. Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 974,346, Nov. 1, 1910.

See Fr. Pat. 415,662 of 1910; this J., 1910, 1296.—T. F. B.

Anthracene derivatives; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 29,138, Dec. 13, 1909. Addition to Eng. Pat. 2702, Feb. 4, 1909.

See Addition of April 6, 1910, to Fr. Pat. 400,653 of 1909; this J., 1910, 1197.—T. F B.

Dyes. O. Dressel. Elberfeld, and R. Kothe and H. Hoerlein, Vohwinkel. Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld. Germany. U.S. Pats. 978,438 and 978,439, Dec. 13. 1910

See Eng. Pat. 15,847 of 1909; this J., 1910, 938.—T. F. B.

Dye. O. Günther and L. Hesse. Elberfeld. and A. Zart, Vohwinkel. Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 978,580, Dec. 13, 1910.

See Eng. Pat. 13,727 of 1909; this J., 1910, 938.—T. F. B.

Aurin dyes. M. Weiler, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld. Germany U.S. Pats. 978.799, 978,800, 978,801. and 978,802, Dec. 13, 1910.

See Fr. Pats. 411,709 and 415,229 of 1910; this J., 1910, 937 and 1296.—T. F. B.

Compounds of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 30,504, Dec. 30, 1909.

See Addition of April 2, 1910, to Fr. Pat. 365,920 of 1906, this J., 1910, 1197.—T. F. B.

Colouring matters of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 7923, April 1, 1910.

See Addition of April 2, 1910, to Fr. Pat. 408,787 of 1909; this J., 1910, 1197.—T. F. B.

Monoazo dye and process of making. O. Ernst and H. Eichwede, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 978,865, Dec. 20, 1910.

See Eng. Pat. 9497 of 1910; this J., 1910, 1051.—T. F. B.

Disazo dyestuffs; Process for producing substantive ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 418,362, July 18, 1910.

See Eng. Pat. 17,088 of 1910; this J., 1910, 1297.—T. F. B.

Monoazo dyestuff particularly suitable for the preparation of lakes; Process for making a ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 418,975, Aug. 1, 1910.

See Eng. Pat. 19,000 of 1910; this J., 1910, 1450.—T. F. B.

Monoazo dyestuffs for wool; Process for producing chrome ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 419,120, Oct. 18, 1909.

See Eng. Pat. 23,738 of 1909; this J., 1910, 686.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Sulphite wood-pulp: Determination of lignin in ——. P. Klason. Papierfabr., 1910, 8, 1285—1286.

All commercial sulphite pulps contain greater or smaller quantities of lignin, according to the degree of resolution effected in the digestion process, and the elasticity and bleaching properties of the fibre are influenced thereby. The author describes a colourimetric method for the determination of the residual traces of lignin in sulphite cellulose, based on the fact that pure cellulose is soluble in concentrated sulhpuric acid without colouration, at any rate at first, whereas the slightest trace of lignin immediately causes a dark brown colouration. The procedure is as follows: 22 mgrms. of air-dry cellulose (equal to 20 mgrms. of dry substance) are placed in a graduated glass-stoppered cylinder of 50 c.c. capacity and dissolved in 20 c.c. of sulphuric acid. A standard sample is treated in the same way in another cylinder, and the colour of the solutions is compared after shaking. The comparison is best made by holding the cylinders between the eye and daylight, and it is essential that both solutions should have been prepared at the same time. The darker solution is then diluted with sulphuric acid until the two are equal, and the proportion of lignin is calculated from the relative volumes. It is advisable to have two types of standard, one for low-boiled pulps and another for high-boiled, in which the percentage of lignin has been determined by chemical methods. This simple and rapid method is particularly useful in pulp-mill control.—J. F. B.

Patents.

Jute; Process of rendering —— woolly. Gebrüder Schmid, Basel, Switzerland. Eng. Pat. 18,479, Aug. 4, 1910. Under Int. Conv., Aug. 4, 1909.

Jute which has been treated with strong caustic lye with or without an accessory treatment with hypochlorite, is treated with a solution of soap in the form of soap-foam, prepared with about 10 grms. of soap per litre of water. After this, the material is washed with warm water or, if a special finish be required, with acidulated water. By this treatment with soap-foam, a softer and more wool-like touch is imparted to the material.—J. F. B.

Wool; Manufacture of artificial —— [from jute] E. Baunach. Fr. Pat. 418,608, Oct. 2, 1909.

Raw jute instead of being "batched" with oil, is steeped for 24 hours in a mixture of sodium hydroxide and soap solution. For 200 kilos. of jute, the following proportions are employed: 2000 litres of water, 2 kilos. of caustic soda and 1 kilo. of common soap. The fibres are washed and then bleached in a special bath made up as follows: 500 litres of hot water, 9 kilos. of bleaching powder and 1 kilo. of magnesium sulphate, to which mixture is added a solution of 50 litres of hydrochloric acid in 1500 litres of water. The goods are entered at a temperature of about 100° C., and remain in the bath for about 1½ hours. They are then treated with a mixture of 50 per cent. of sulphurous acid and 50 per cent. of water for half an hour. The bleached fibres are washed, dried and carded or otherwise prepared for spinning.—J. F. B.

Floss and waste silk; Destruction of hair, nails, horny and gelatinous matters in ——. C. Seignol. First Addition, dated Sept. 23, 1909, to Fr. Pat. 416,063, July 28, 1909. (See U.S. Pat. 974,440, this J., 1910, 1371.)

To the alkali sulphide which is employed for destroying extraneous animal matters in silk wastes, a little oil, such as linseed, cotton or olive oil, is added to mitigate the corrosive action of the free alkali, thereby making it possible to employ stronger solutions of the sulphide. The temperature of the bath whilst in use may be lowered to 50°—70° C., and its action may be prolonged for about an hour. An extremely good clearing effect may be obtained by increasing the concentration of the sulphide up to 5—10 per cent. and working entirely in the cold, with an immersion of 12—48 hours; in this way chrysalides and dead silkworms may be entirely eliminated.—J. F. B.

Actinium or other radio-active substances; Preparation of fibres impregnated with ——. Soc. anon. Banque du Radium. Fr. Pat. 418,455, Sept. 28, 1909.

Fibres in the form of yarns or cloths are impregnated with actinium or other radio-active element by combining the latter with a large excess of bismuth subnitrate. This substance is dissolved in a minimum quantity of nitric acid and the fibres are steeped in the solution. They are then placed in a boiling solution of ammonium chloride, whereby the bismuth is precipitated in the fibres in the form of the insoluble oxychloride, still retaining all the radio-active properties of the original substance. After treatment, the goods may be passed through a fixing bath of tannin or other colloidal solution. —J. F. B.

Artificial threads and the like: Process of manufacturing masses for use in making ——. R. Linkmeyer, Bremen, Germany. U.S. Pat. 979,013. Dec. 20, 1910.

Those parts of young plants which contain hemicellulose and other carbohydrates are treated with a weak alkaline solution, insufficient to remove carbohydrates, and then bleached by a process, which will not decompose the hemicellulose. The product, which contains cellulose, hemicellulose and carbohydrates, is then dissolved in a cuprammonium solution.—P. F. C.

Plastic material [from cellulose acetate] capable of being stamped; Manufacture of a ——. A. Eichengrün. Fr. Pat. 418,744, July 28, 1910. Under Int. Conv., Aug. 15, 1909.

A plastic material possessing the hardness and strength of celluloid and capable of being moulded by stamping, is prepared by incorporating cellulose acetate with large proportions of loading materials (inert powders) in presence of softening agents. Example: 1 kilo. of cellulose acetate is mixed with 300 grms. of "manol" (methyl acetanilide) and 300 grms. of ethyl lactate; 1 kilo. of alcohol and 1 kilo. of benzene are added, and solution is effected by heating at 70° C. Two kilos. of zinc white are then incorporated with the mass and the product is poured on to a level support. After drying, the product is obtained in the form of a sheet which is capable of being stamped at a temperature of about 75° C.—J. F. B.

Sulphate cellulose manufacture; Method of preventing the escape of the offensive odours produced in the furnace process in ——. M. Müller. Ger. Pat. 226,658, May 26, 1909.

In the manufacture of cellulose by the sulphate process the black lyes from the digester are evaporated, then concentrated further in a rotary furnace and the residue fused in a furnace supplied with an air blast. According to the present specification the gases from the melting furnace are circulated continuously, fresh air being added as required, and thus any escape of offensive odours is prevented. The gases from the melting furnace after passing through the concentrating and evaporating apparatus are led in succession through a dust chamber, a condensing apparatus fed with water or with the lye to be subsequently used in the digestion process, and then through a scrubber or scrubbers in which they are treated with alkali or lime in order to remove in part the carbonic acid and sulphur compounds (hydrogen sulphide, methyl sulphide, methylmercaptan, etc.). After this treatment the gases are mixed with air and used for the blast in the melting furnace.—A. S.

Cellulose from wood; Process for the manufacture of ——. W. Burton. Ger. Pat. 226,912, April 1. 1909.

In the process of preparing cellulose from wood by digestion with a chemical solution, it is proposed to subject the wood simultaneously to mechanical disintegration. The digestion is effected in a rotating drum provided with a heating jacket and mounted on a horizontal axis. Inside the drum are loose rollers (steel rollers or steel tubes filled with lead) which effect the disintegration.—A. S.

Paper from sawdust; Manufacture of ——. P. A. Sparre, Paris. Eng. Pat. 29,118, Dec. 13, 1909.

The sawdust is treated in an open vessel with a 5—10 per cent. solution of an alkali or acid at a temperature not exceeding 80° C. until it has lost half its weight. The product thus obtained can then undergo the usual operation of digesting under high pressure to convert it into pulp. —P. F. C.

Paper or cardboard out of the husks of cotton seeds; Making ——. M. W. Wilbuschewitsch, Canavin, Nishny-Novgorod, Russia. Eng. Pat. 27,950, Nov. 30, 1909.

The husks [hulls] are freed from colouring matter by heating in rotary autoclaves, with a solution of alkali. They are then beaten in the hollander and the pulp is bleached by means of sodium hypochlorite, after which it is washed neutral. The chief action of the sodium hypochlorite is the disintegration of the woody tissue of the husk.—F. M.

Paper pulp material and fibres for spinning; Treatment of wood, etc., for the manufacture of ——. R. Kron, Thalheim, Saxony. Eng. Pat. 2560, Feb. 1, 1910.

The wood whilst in the sap, or if dry after previous treatment with water or suitable solutions, is passed transversely to the run of the fibres between heavy rollers until the material is reduced to the condition of a "fleece." By the treatment, the fibre bundles are separated without the fibres themselves being broken and powdered. The material so obtained is in a suitable form for conversion into pulp, and by the treatment of hard reed plants such as bamboo and the like, fibres which can be spun are obtainable.—F. M.

Paper pulp; Process and apparatus for treatment of ——. H. Arledter. Fr. Pat. 418,584, July 26, 1910.

The process consists in beating the pulp in a hermetically closed beating engine, in which it can be subjected to a vacuum or to increased pressure, or both successively, all the operations of bleaching, colouring, sizing and loading being performed in the same engine. The type of engine employed may conveniently be that known as the vertical tower type with centrifugal circulating pump. The upper part is closed by a lid through which chemicals may be injected and which is connected with an air pump; the lower part may be steam-jacketed. After charging, the contents of the beater are placed under vacuum and all the air is drawn out of the fibres, thereby facilitating the entry of water and the hydration of the fibres. Subsequently pressure is applied which facilitates the combination between the fibres and the colouring, sizing and loading matters. It is claimed that by this process, mechanical wood pulp acquires many of the characteristics of pure cellulose.—J. F. B.

Proteids; Process for the dissolution and subsequent coagulation of ——, *and the application of the products to industrial purposes* [*making threads, etc.*]. H. L. J. Chavassieu, Lyons, France. Eng. Pat. 18,315, Aug. 2, 1910. Under Int. Conv., July 31, 1909. Addition to Eng. Pat. 26,155, Dec. 3, 1908.

See Addition of July 31, 1909, to Fr. Pat. 395,402 of 1907; this J., 1910, 1371.—T. F. B.

Artificial silk; Manufacture of ——. G. Guadagni, Pavia, Italy. U.S. Pat. 978,878, Dec. 20, 1910.

See Fr. Pat. 386,339 of 1908; this J., 1908, 682.—T. F. B.

Cellulose acetates; Process for preparing solutions of —— Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 418,309 July 16, 1910. Under Int. Conv., July 22, 1909.

See Eng. Pat. 16,932 of 1910; this J., 1910, 1299.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Adsorption [*of dyestuffs*]; "*Anomalous*" ——. W. M. Bayliss. Z. Chem. Ind. Kolloide, 1910, 8, 2—4.

The author considers that the results obtained by Biltz and Steiner (this J., 1910, 1152) on the adsorption of Night Blue by cotton and wood charcoal may be explained by means of the conception of "electrical adsorption," as set forth by him in a paper published in 1906 (Biochem. J., 1906, 1, 178), but which appears to have been generally overlooked. In this paper experiments on the adsorption of dyestuffs by filter-paper were described, and also the effect of electrolytes on such adsorption. Paper, in contact with water is negatively charged, and dyestuffs were adsorbed or not according to the electrical charge carried by them, whilst the influence of neutral salts on the adsorption depended upon the effect of the cation of the salt on the potential difference between the paper and the dyestuffs.—A. S.

Relative quantities of arsenic in seaweeds and in products derived therefrom. Tassilly and Leroide. *See* VII.

Patents.

Union cotton and wool goods; Process of bleaching ——. J. S. Armstrong, Assignor to Farnsworth Co., Lisbon, Me. U.S. Pat. 977,848, Dec. 6, 1910.

The process consists in saturating the material with a neutral soap solution, transferring to a washer, and while in the lather adding a mixture of bleaching powder, alkali and dilute sulphuric acid. The goods are finally stoved. —F. M.

Baths for weighting silk; Process for revivifying sodium phosphate ——. T. Goldschmidt. Fr. Pat. 418,870, Aug. 3, 1910. Under Int. Conv., April 7, 1910.

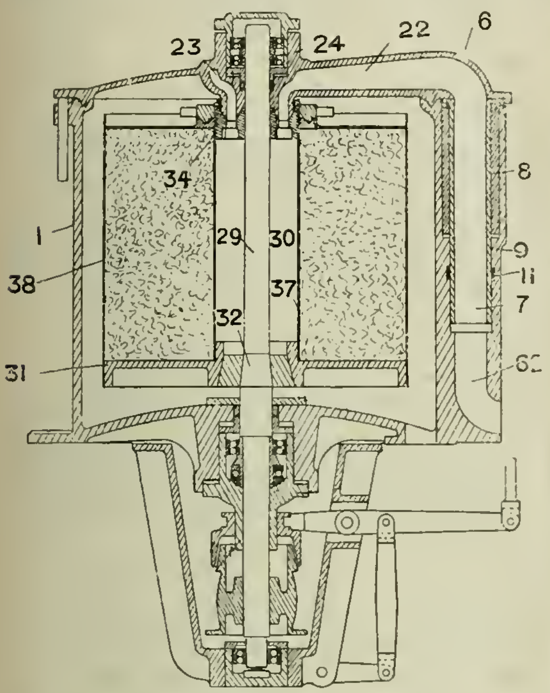
Sodium phosphate weighting baths are rendered unfit for use after a time by the tin compounds which accumulate in them. It is found that these compounds can be eliminated by adding to the baths small quantities of soluble salts of metals (such as calcium or magnesium) which form insoluble phosphates. On warming the baths after the addition, a precipitate is thrown down which carries with it the whole of the tin present in the solutions.—P. F. C.

Yarn; Machinery employed in washing, steaming, bleaching, dyeing and drying ——. R. S. Heap, Burnley. Eng. Pat. 27,731, Nov. 29, 1909.

In the usual method of treatment of yarn upon beams, the beams are taken to separate frames for the various operations of washing, dyeing, etc. In the machine described, the treatment from washing to drying is carried out in one frame, the perforated beam being tightly connected to the supply pipe through which, by an arrangement of valves and stopcocks, the necessary liquids are forced. The beam is rotated during the treatment, and the arrangements for effecting this are described.—F. M.

Dyeing, bleaching and the like of textile fibres or goods; Machine for ——. A. Schiffers, Aix-la-Chapelle. Germany. Eng. Pat. 28,126, Dec. 2, 1909.

A dye-vat, 1, has an air-tight fitting cover, 6, which can be raised and swung away from the machine. This cover, 6, is provided with a tubular trunnion, 7, seated in a sleeve, 8, and having teeth arranged on one side of it to form a rack for raising the cover. This sleeve, 8, in turn is seated in a tubular lateral projection of the dye-vat, 1, and carries ball-bearings on its top face to enable the cover to be swung easily. The trunnion, 7, is made air-tight and water-tight in the projection, 9, by means of hydraulic packing, 11. The boring of the trunnion, 7, is continued by the channel, 22, of the cover and ends in the centre of it as a ring channel, 23, the inner wall of which forms part of the stuffing-box, 24. The main shaft, 29, which can be raised or lowered by means of a system of levers, carries an annular receiver, 30, which has its walls, 37 and 38, perforated to permit the passage of fluids through the material contained in it. The bottom, 31, of the receiver, 30, is seated upon the conical part, 32, of the shaft, 29, and opposite to it is situated a perforated spacing-ring, 34, provided with a V-shaped tightening groove into which the correspondingly shaped faces of the ring-channel, 23, enter. By means of the pipe, 62, which is a continuation of the trunnion, 7, the interior of the dye-vat can be put in connection with a water supply, a reservoir containing dye or bleach liquor, a blower for hot or cold air and a pump. Means are also provided for lifting the receiver out of the vat. When the machine is working, the charged receiver is inserted and the parts, 23 and 34, are brought into air-tight contact. By means of a blower, the air is then exhausted from the dye-vat and when a high vacuum is attained, the dye-liquor is run in through the pipe, 62, and is kept in continuous circulation through the material in the receiver by means of the pump. As soon as the dyeing operation is completed, the dye-liquor is pumped back into the reservoir and the excess still remaining in the material is expelled by lowering the shaft so as to break the contact of parts, 23 and 34, and then setting the shaft in rotation. This converts the receiver into a centrifugal cage and the speed at which it rotates expels the excess of liquor from the material. If an oxidising or fixing process is necessary, the shaft is again raised to make the air-tight contact and air is driven through the material by the blower. After rinsing and hydro-extracting as described above, the material is finally dried by blowing hot dry air through it. The cover is then raised and the receiver is lifted out of the machine.—P. F. C.

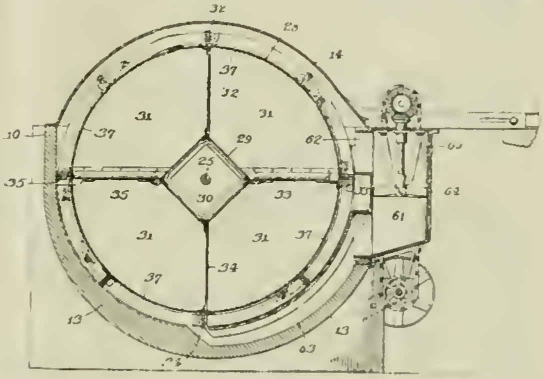


Vegetable silk and like fibres; Process for preparing —— for dyeing and spinning. E. G. Stark, Chemnitz, Saxony. Eng. Pats. 28,701, Dec. 8, 1909, and 3757, Feb. 15, 1910.

See U.S. Pat. 962,173 of 1910; this J., 1910, 940. The treatments with liquids are carried out at 60°—100° C. Colouring or bleaching agents may be added to the aqueous solutions used, and small quantities of hydrochloric or sulphuric acid may in some cases be added to the water used for the maceration of the fibres.—T. F. B.

Dyeing machine. G. E. Drum and J. H. Skitt. Assignors to G. E. Drum and R. P. Smith, Philadelphia, Pa. U.S. Pat. 973,487, Oct. 25, 1910.

This machine comprises a vat, 10, provided with a cover, 14, which can be raised at will by means of a system of levers. Inside the vat is mounted a rotatable cylindrical carrier, 28, containing an inner rectangular chamber, 30, through the middle of which the horizontal axle, 25, of the carrier extends. The space between the outer and inner walls, 28 and 29, is divided into four compartments, 31, by partitions, 32, 33, 34, 35, which extend beyond the outer wall, and make projections which engage with the curved wall, 13, of the vat, when the carrier is rotated. Each compartment is provided with a door, 37, extending the whole length of the carrier. The walls, 28 and 29, are perforated but the partitions are not. By the side of the vat are arranged two casings, 60, each enclosing a vertical chamber, 61, and the upper part of each chamber communicates with the vat by a channel, 62, arranged higher than the axle of the carrier. The lower part of each chamber communicates with the lower part of the vat by means of a wide channel, 63. A propeller, 64, situated inside each chamber circulates dye-liquor through the apparatus. During the dyeing operation the carrier, which has been previously lifted out of the vat and charged, is slowly rotated, and as the compartments, 31, successively pass the channels, 62 and 63, the dye-liquor flows through them outwards and inwards respectively, thus producing a reversible flow without reversing the pump.—P. F. C.



Damask and similar effects upon fabrics; Process fc producing ——. A. Oppenheim, Berlin. Eng. Pat 26,253, Nov. 12, 1909. Under Int. Conv., Nov. 12 1908.

If sulphuric acid is brought into contact with cotton for a short time, and then completely removed by a thorough washing, an increased transparency and different dyeing properties are imparted to the cotton without impairing its strength. This effect can be localised in the form of a design either by directly printing sulphuric acid of 30—100 per cent. concentration on to the material or by printing a chemically or mechanically protective coating on to certain parts of the material and then treating the whole fabric with acid. The length of the acid treatment varies from a fraction of a

second to a few seconds, according to the material to be treated and the effect desired. It is also found that if a material which has been treated by any of the above processes is calendered, a permanent finish is imparted to the treated portions. Varying colour effects can be obtained by dyeing treated fabrics with suitable dyestuffs; direct or basic dyestuffs for example have a much greater affinity for the treated parts than for ordinary cotton.
—P. F. C.

Block printing upon textile fabrics. The Calico Printers' Assoc., Ltd., Manchester, and J. Kenyon, Blackburn. Eng. Pat. 7120, Mar. 22, 1910.

THE lighter shades of all colours are obtained by first block printing those parts of the pattern where the light shades must appear with a suitable semi-resist printing mixture and then printing with another block those parts of the pattern where the dark shades must appear and simultaneously over-printing the portions already printed with the semi-resist. The colours are subsequently fixed in the ordinary way. A suitable semi-resist consists of a mixture of one part of a 10 per cent. solution of gum tragacanth and two parts of a gum senegal solution containing 4½ lb. of gum to a gallon of water.—P. F. C.

Printing paste. J. Deinet, Assignor to Farbenfabr. vorm F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 978,138 and 978,139, Dec. 13, 1910.

A PRINTING paste is prepared by mixing thickening agents with the leuco-compound obtained by treating dibenzoyl—1·8- or -1·5-diaminoanthraquinone with reducing agents such as tin crystals, copperas powder and tartar powder. This paste produces on the fibre, after oxidation, a yellow shade which is reduced by a dilute alkaline hydrosulphite solution to an olive-brown, which can be readily re-oxidised to the original shade.—P. F. C.

Plate printing on fabrics or analogous materials; Machine for ——. A. Svoboda. Fr. Pat. 418,690, Apr. 25, 1910.

THE table on which the cloth to be printed is spread out, is provided with wooden joists carrying two sets of rails, the narrow pair being placed inside and parallel to the wider set. A carriage framework which holds the printing plates horizontally runs on the wider rails, whilst on the narrow rails, a low carriage carrying colour plates runs underneath the first one. Means are provided for moving the printing plates vertically to apply the colour to them from the colour plates and to effect the printing process.
—P. F. C.

Plastic products such as pastes for printing rollers; Manufacture of ——. A. H. Lemoine. Fr. Pat. 419,044, Oct. 15, 1909.

THE glycerin usually employed in the preparation of these pastes as ordinarily prepared is replaced by sulphoricinic acid or an alkali sulphoricinate. Example: 1050 grms. of gelatin are softened in 330 c.c. of water and then removed. 1620 grms. of ammonium sulphoricinate are next mixed with the water and warmed to 60° C., and the swollen gelatin is then added.—P. F. C.

Cameo or varying shade effects on one or both sides of a fabric; Process for obtaining ——. A. Borrel. Fr. Pat. 419,050, Oct. 16, 1909.

THE scoured material is impregnated or printed in the dark with a 1—5 per cent. solution of sodium or ammonium bichromate to which may be added small quantities of an alkali metavanadate and a "non-actinic" substance, like Tartrazine for example, for the purpose of regulating the action of the light and preventing its too rapid penetration through the tissue. After drying in the dark at a temperature not exceeding 25° C. the material is exposed to light for a few minutes, the exposure being regulated as described, according to the effect desired. If, for example, different shades are required on the back and face of the material, only one side is exposed to light. Varying effects can be obtained by using light-shields. After exposure the material is washed to remove unfixed bichromate and then dyed with mordant dyestuffs. The dyestuff is only absorbed by those parts of the cloth which have been exposed to light and thus become mordanted. The non-actinic body is added to the impregnating liquor to moderate the action of light during exposure and is specially necessary with thin materials.—P. F. C.

Black printing inks which can be bleached; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 225,275, Nov. 24, 1908.

PRINTING inks which can be discharged by chlorine, are obtained by intimately mixing black or blue-black sulphide dyestuffs or black substantive cotton dyestuffs, with printer's varnish.—T. F. B.

Bleaching process. R. Müller, Eilenburg, Germany. Eng. Pat. 9369, April 18, 1910.

SEE Fr. Pat. 414,821 of 1910; this J., 1910, 1200.—T. F. B.

Mercerising textile fabrics; Apparatus for ——. E. Heberlein, Assignor to Heberlein und Co., Wattwil, Switzerland. U.S. Pat. 978,883, Dec. 20, 1910.

SEE Fr. Pat. 399,904 of 1909; this J., 1909, 935.—T. F. B.

Mercerising, dyeing, bleaching, or otherwise treating cotton or other vegetable fibre in the roving, sliver, or loose state, in hanks, or woven; Machine for ——. J. H. Robson. Fr. Pat. 418,643, July 27, 1910. Under Int. Conv., Nov. 13, 1909.

SEE Eng. Pat. 26,317 of 1909; this J., 1910, 1300.—T.F.B.

Cop-tubes for supporting and retaining yarn or similar material. F. H. Daniell, Franklin, N.H., U.S.A. Eng. Pat. 26,024, Nov. 10, 1909.

SEE Fr. Pat. 408,400 of 1909: this J., 1910, 623.—T. F. B.

Dyeing yarn or the like. F. H. Daniell, Franklin, N.H., and J. C. Hebden, Providence, R.I., U.S.A. Eng. Pat. 26,025, Nov. 10, 1909.

SEE Fr. Pat. 408,424 of 1909; this J., 1910, 623.—T. F. B.

Dyeing yarn or the like. F. H. Daniell, Franklin, N.H., and J. C. Hebden, Providence, R.I., U.S.A. Eng. Pat. 26,027, Nov. 10, 1909.

SEE U.S. Pat. 942,166 of 1909; this J., 1910, 209.—T. F. B.

Dyeing apparatus. F. H. Daniell, Franklin, N.H., and J. C. Hebden, Providence, R.I., U.S.A. Eng. Pat. 26,029, Nov. 10, 1909.

SEE Fr. Pat. 410,551 of 1909; this J., 1910, 812.—T. F. B.

Wool, silk, and hair; Use of oxidation products of phenols, especially quinones, for the treatment of ——. L. Meunier. Fr. Pat. 418,797, Oct. 9, 1909.

SEE Eng. Pat. 4557 of 1910; this J., 1910, 1199.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Formic acid in glacial acetic acid. H. Fincke. Apoth. Zeit., Sept. 21, 1910; 727. Pharm. J., 1911, 9.

IT was pointed out by Ost and Klein in 1908 that commercial glacial acetic acid commonly contained formic acid, different samples showing various proportions up to 0·6 per cent., and Pikos showed that it was quite easy to produce acetic acid perfectly free from this impurity. Recent examination of samples of the acid supplied for pharmaceutical use show that there has been no improvement in this respect. Five specimens all contained formic acid, in quantity from 0·018 to 0·806 per cent. To determine the amount present in a sample, 5 c.c. of the glacial acid, 5 grms. of sodium acetate, 40 c.c. of 1 in 20 solution of mercuric chloride, and 30 c.c. of water should be heated in an Erlenmeyer flask for two hours in a boiling water-bath under a reflux condenser, the part of the flask containing the liquid being fully immersed; the precipitated calomel is collected in a Gooch crucible, dried, and weighed; its weight multiplied by 0·0977 gives the weight of formic acid.

Calcium cyanamide; The formation and decomposition of ——. M. Le Blanc and M. Eschmann. Z. Elektrochem., 1911, **17**, 20—34.

The authors have studied the equilibrium of the reaction: $CaC_2+N_2 \rightleftharpoons CaN_2C+C$ at temperatures from 1100° to 1300° C. At high temperatures it is often found that the cyanamide sublimes slowly from the hotter to the cooler parts of the reaction vessel and thus escapes from contact with the carbon. It is also possible that there is a gradual inactivation of the carbon, the result being that the equilibrium values are not exactly reproducible, and that the reaction gradually becomes irreversible. This effect could not be avoided entirely by causing rapid absorption and evolution of the nitrogen, some of the solid material being often mechanically removed from the nickel boats in which it was contained. When these disturbing influences are avoided as far as possible, the figures suggest that the system is probably bivariant, *i.e.*, the pressure of gaseous nitrogen is a function of the concentration of nitrogen in the solid phase. The fact that the system is bivariant demands two solid phases, which are probably a carbide-cyanamide solution and suspended carbon. Under favourable circumstances, using a finely powdered carbide (75 per cent. pure), without adding calcium chloride, the amount of nitrogen absorbed at 1300° C. and one atmosphere pressure is about 85 per cent. of the total theoretically possible, whilst at 1200° C. it rises to about 90 per cent. To obtain a relatively large absorption in a short time it is suggested that the temperature should be first raised to 1300° C. and then allowed to fall very slowly, particularly when nearing 1100° C.—W. H. P.

Barium salts industry in Italy. E. Asbrand. Chem.-Zeit., 1910, **34**, 1324.

Of the two raw materials of the industry, viz. heavy spar and witherite, only the former occurs in Italy. That found at Albenga on the Riviera di Ponente is of a dazzling whiteness; huge deposits of a lower quality are worked at Valsassina and not inconsiderable quantities in Sardinia. Other smaller deposits occur at Pietrasanta on the Gulf of Spezia, the product being worked up locally in the colour industry. The most interesting of the uses of heavy spar in Italy is in connection with the manufacture of gorgonzola cheese in Valsassina. The cheeses receive a covering in the form of a thick heavy crust of the finely ground spar, which has the property of affording just sufficient protection from aeration. The fact that in spite of the large home supplies, very large quantities of barium salts have still to be imported is due, in the first place, to the circumstance that the foreigner has cheap fuel. Only one Italian factory makes the chloride from the sulphide and hydrochloric acid produced on the spot, the sulphuretted hydrogen being lost. Barium nitrate is imported, mainly from Germany, although subject to an import duty of L.10 per 100 kilos (£4 per ton). Barium peroxide is imported, mainly from England. The consumption of this product is great, especially in the neighbourhood of Florence where the straw-hat industry flourishes. Barium hydroxide is extensively used in desaccharifying molasses. It was produced by one large sugar factory for some time for its own consumption by heating the carbonate in electric ovens. But carbonate cannot be obtained at reasonable prices in Italy, and the manufacture of the hydroxide is being given up, the product being imported. Efforts are being made towards the removal of the duty L.2 (16s. per ton) on this article. *Blanc-fixe*, although the Italian product is of high quality, is largely imported from Germany. Lithopone is not made in Italy and is not much used. It is suggested that a factory for the manufacture of barium compounds might pay if situated near one of the northern ports in order to obtain raw material at relatively low prices.—E. W. L.

Ammonia production of Great Britain in 1910. Bradbury and Hirsch, Liverpool. [T.R.]

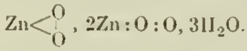
The total production of ammonia from all sources, calculated as sulphate, in the United Kingdom (including that used in making ammonia-soda and other chemical processes) in 1909 and 1910, was as follows:—

	1909.	1910.
	Tons.	Tons.
Gas works	164,000	168,000
Iron works	20,000	21,000
Shale works	57,000	60,000
Coke and carbonising works and producer gas	107,500	120,000
	348,500	369,000

Of last year's production it is estimated that England contributed 248,500 tons, Scotland 117,500 tons, and Wales 3000 tons. The stock brought forward from 1909 was 14,000 tons, making the supply for 1910 383,000 tons; exports during 1910 amounted to 284,000 tons, and home consumption to 87,000 tons, leaving a stock of 12,000 tons to carry forward to 1911.

Zinc peroxide. P. Kazanezky. J. Russ. Phys.-Chem. Soc., 1910, **42**, 1452—1458.

The action of 30 per cent. hydrogen peroxide solution on potassium, sodium, or ammonium zincate results in the formation of a white, micro-crystalline precipitate which is found to consist of a zinc peroxide, ZnO_2,H_2O, containing an admixture of zinc carbonate, the presence of the latter being due to the strong alkalinity of the solution in which the reaction takes place. When treated with dilute sulphuric acid, zinc peroxide yields hydrogen peroxide, whilst, with concentrated hydrochloric acid, chlorine is evolved. The peroxide must, indeed, be regarded as consisting of three molecules of ZnO_2, one of which is the dioxide corresponding with an acid anhydride, the other two representing true zinc peroxide:—



$$Zn{<}\genfrac{}{}{0pt}{}{O}{O},\ 2Zn:O:O,\ 3H_2O.$$

The three molecules form a salt-like compound. These zinc peroxides which have been previously described by various authors consist either of mixtures of zinc peroxide and oxide or of compounds between the two oxides. —T. H. P.

Seaweeds and products derived therefrom; Relative quantities of arsenic in ——. E. Tassilly and J. Leroide. Bull. Sci. Pharmacol., 1910, **17**, 580—583. Chem. Zentr., 1910, **2**, 1933.

The quantities of arsenic contained in 100 grms. of different seaweeds and products derived therefrom were as follow:—*Chondrus crispus*, 0·070 mgrm.; *Fucus vesiculosus*, 0·010; *Mousse de Corse*, 0·025; *Laminaria digitata*, 0·050; *L. saccharina*, 0·010; *L. flexicaulis*, 0·010; norgine (a sizing preparation from *Laminaria*; see this J., 1910, 1300), 0·030; gelose, 0·025 and 0·020 mgrm. Crude sodium carbonate prepared from *Laminaria* contains 1 mgrm. of arsenic per 100 grms., the whole of the arsenic present in the raw material remaining in the crude carbonate. —A. S.

Silicon monosulphide. I. L. Cambi. Atti R. Accad. dei Lincei Roma, 1910 [5], **19**, II., 294—300. Chem. Zentr., 1910, **2**, 1863.

Ferrosilicon containing 90 per cent. of silicon was mixed with 2 parts of powdered sulphur and an electric current of about 80 ampères passed through the mass. After cooling in a current of carbon dioxide, the grey product was treated with water, and then evaporated. The non-volatile residue consisted of iron sulphide and undecomposed ferrosilicon, and sometimes contained small quantities of silicon disulphide. The monosulphide, SiS, was obtained in two forms, a compact, black substance and a yellow powder. The former has the sp. gr. 1·853 at 15°/4° C. and sublimes at 940°—980° at 20—30 mm. pressure. On treatment with a 30 per cent. solution of potassium hydroxide it decomposes according to the equation: $SiS+2KOH=SiO_2+K_2S+H_2$. Some of the yellow monosulphide is always formed when the black modification is sublimed. It is much less stable than the latter, rapidly absorbing moisture from the air and evolving hydrogen sulphide, and at the same time becoming white. It dissolves in alkalis, with evolution of hydrogen.—A. S.

Mesothorium; The chemistry of ——. F. Soddy. Chem. Soc. Proc. 1910, **26**, 336—337.

Experiments on the mixture of radium and mesothorium with barium sulphate, obtained by adding a barium salt and sulphuric acid to a solution of thorianite in nitric acid, have shown that the separation of mesothorium is not due, as previously has been supposed, to its adsorption by the barium sulphate, but depends on a true chemical analogy between mesothorium and barium of the same kind as exists between barium and radium. The mesothorium could not be concentrated from the barium by chemical methods. By fractional crystallisation of the chlorides, the mesothorium remains with the radium, and can thus be separated from the barium. The proportion between mesothorium and radium is completely unchanged by fractional crystallisation of the chlorides. In the ordinary method used in the manufacture of thorium compounds for dissolving monazite sand, by heating it with excess of sulphuric acid and agitating the product with water, some of the mesothorium remains in the insoluble residue, but the greater part passes into solution. If a small quantity of a barium compound is mixed with the monazite sand before treatment, practically the whole of the mesothorium is separated with the insoluble residue, none passing into the solution. The part of the residue containing the mesothorium can readily be separated from the heavy unattacked sand by decantation. From this part the mesothorium can be separated by methods similar to those employed in the working up of pitchblende residues for radium. The cases of complete chemical identity between groups of radio-active elements, differing presumably in atomic weight, which now appear to include all the radioactive elements of period of average life longer than a year, are in direct conflict with the principle of the periodic law.

Colloids; Coagulation of ——. W. Wolshin. J. Russ. Phys.-Chem. Ges., 1910, **42**, 863—876. Chem. Zentr., 1910, **2**, 1853—1854.

The author determined the quantities of different salts (potassium, sodium, and ammonium chlorides) required to coagulate colloidal solutions of Prussian blue of different concentrations. Two different preparations of Prussian blue were used, viz., a peptised Prussian blue, obtained by precipitating a solution of potassium ferrocyanide with excess of ferric chloride, washing the precipitate with water, and dissolving it in dilute oxalic acid; and soluble Prussian blue prepared by treating a solution of potassium ferrocyanide with a quantity of ferric chloride insufficient to cause precipitation. Curves were drawn by using as abscissæ the concentrations of the colloidal solutions and as ordinates the number of gram-molecules of the salts necessary for coagulation. Each of the curves obtained in this way consisted of three branches, indicating that the composition of the Prussian blue gel produced by coagulation differs according to the concentration of the colloid solution. The points of intersection of the three branches of the different curves are on the same vertical line, showing that for a given colloidal solution of Prussian blue the quantities of the three salts mentioned above necessary for coagulation stand in simple molecular relations to one another. For the peptised Prussian blue the ratios are: $NaCl : NH_4Cl : KCl=4 : 2 : 1$ and for the soluble Prussian blue, $NaCl : NH_4Cl : KCl=4 : \frac{4}{3} : 1$.—A. S.

Colloids; Action of radium rays on ——. W. P. Jorissen and H. W. Woudstra. Z. Chem. Ind. Kolloide, 1910, **8**, 8—11.

On exposing a ferric oxide sol prepared by digesting ferric oxide with ferric chloride solution, and subsequent dialysis, to the radiation from radium bromide contained in thin glass tubes, the authors were able to confirm the statement of Henri and Mayer (Comptes rend., 1904, **138**, 521; Comptes rend. Soc. Biol., 1904, **57**, 33) that the ferric oxide sol in presence of a quantity of sodium nitrate insufficient alone to cause coagulation, is coagulated when exposed to the radium preparation. Although the ferric oxide sol alone apparently remains unaffected by exposure to the radium bromide, it is in fact rendered more sensitive, for it is, in general, coagulated by quantities of electrolytes insufficient to cause coagulation of a similar sol which has not been so exposed. No similar effect of radium rays on a silver sol could be observed.—A. S.

Patents.

Nitric acid; Treating [concentrating] aqueous —— *and the like with sulphuric acid and other hygroscopic substances.* H. Pauling, Gelsenkirchen, Germany. Eng. Pat. 22,320, Sept. 26, 1910.

Aqueous nitric acid, or the like, and a hygroscopic substance such as sulphuric acid, are allowed to trickle down a vertical column through an ascending stream of steam or hot gases. The dehydrating agent is introduced at a point above the entry of the liquid to be concentrated, so that the vapours generated by the heat are acted on by undiluted hygroscopic material.—O. R.

Nitric acid; Method of concentrating aqueous solutions of ——. H. Pauling, Gelsenkirchen, Germany. Eng. Pat. 22,322, Sept. 26, 1910.

A mixture of dilute nitric acid and sulphuric acid, or other hygroscopic substance, is subjected to the action of a counter-current of steam, or gases mixed with steam.—O. R.

Nitric acid; Process for obtaining concentrated —— *from concentrated nitrous gases, air and water.* O. Engels and F. Dürre. Ger. Pat. 229,096, Dec. 25, 1908.

In the preparation of nitric acid from nitrous gases containing at least 50 per cent. of oxides of nitrogen, *e.g.*, the gases produced in the manufacture of oxalic acid from sugar and nitric acid, nitric acid of higher concentration can be obtained if the air necessary for the oxidation is added gradually instead of all at once. The gases are passed through a series of towers fed with water or dilute nitric acid, on the counter-current principle, and the air is added in portions, one portion before the gases enter the first tower, and successive portions between the towers. The acid flowing down the towers becomes more and more concentrated and is withdrawn from the first tower at a concentration of 60—65 per cent. of nitric acid.—A. S.

Hydrochloric or hydrobromic acid; Process for the preparation of —— *with chlorine or bromine respectively.* E. Hoppe. Fr. Pat. 418,731, July 27, 1910.

The process depends on the alternate hydrolysis of stannous chloride, or other chloride (or bromide) readily decomposed by water, and re-formation of the normal salt, together with hydrochloric (or hydrobromic) acid and oxygen, by the action of chlorine (or bromine) on the basic chloride (or bromide) produced. In practice, the reactions are made to take place simultaneously, and the process consists, therefore, in the catalytic decomposition of water with the production of the halogen hydracid,

$$SnCl_2+H_2O=Sn(OH)Cl+HCl;$$
$$Sn(OH)Cl+2Cl=SnCl_2+HCl+O.$$

For example, chlorine, obtained electrolytically, is allowed to react with a saturated solution of stannic chloride.

at 50°—70° C., and, from the mixture of hydrogen chloride, chlorine, and oxygen, leaving the apparatus, part of the acid is recovered on cooling, by condensation with the water vapour present, and the remainder is recovered in the usual way, the residual chlorine being then absorbed by alkali.—F. Sodn.

Sulphuric acid; Manufacture of —— according to the principle of the chamber process. J. Fels. Ger. Pat. 228,696, May 15, 1909.

The process is carried on in chambers not containing filling material but provided with rapidly rotating devices (stirring blades, etc.), which effect not only a thorough mixing of the different gaseous constituents but also intimate mixing of the gases with the acid on the floors of the chambers, which acid flows from chamber to chamber in a direction opposed to that of the gases. By this method it is possible to work with an excess of nitrous gases, which was not feasible by the process described in Eng. Pat. 12,070 of 1886 (this J., 1887, 597).—A. S.

Sulphurous acid: Apparatus for the manufacture of ——. J. Edmunds, Waltham, Mass., U.S.A. Eng. Pat. 8006, April 2, 1910.

In an apparatus for dissolving sulphur dioxide in water, a trap is interposed between the outlet port of the absorption tank and the discharge pipe, so as to seal the discharge port and prevent air from entering into it. The discharge side of the trap is provided with a neck fitted with a perforated cap, which allows air to enter and relieve any vacuum, which might be formed at the outlet of the trap, thereby allowing the liquid to be discharged freely, when required.—O. R.

Persulphuric acid and its salts; Manufacture of ——. A. Pietzsch and G. Adolph, Munich, Germany. Eng. Pat. 23,252, Oct. 7, 1910. Under Int. Conv., Oct. 11, 1909.

In the preparation of persulphates and persulphuric acid by electrolysis, using anodes of 99 per cent. platinum, the yields of ammonium persulphate, potassium persulphate, sodium persulphate, and persulphuric acid obtained, are 85, 30—35, 10, and 30—60 per cent. respectively. By using platinum anodes, which contain more than 99 per cent. of platinum, the yields of persulphates are greatly increased, amounting, in the case of chemically pure platinum, to 95 per cent. of ammonium persulphate, and 90 per cent. in the case of persulphuric acid and its sodium and potassium salts.—O. R.

Potassium persulphate and sodium persulphate; Manufacture of ——. A. Pietzsch and G. Adolph, Munich, Germany. Eng. Pat. 23,551, Oct. 11, 1910. Under Int. Conv., Feb. 16, 1910. Addition to Eng. Pat. 23,157 of 1910 (this J., 1910, 1454).

The modification consists in carrying out the double decomposition of ammonium persulphate with potassium sulphate or bisulphate in the electrolytic cell itself, by electrolysing a solution of ammonium sulphate or bisulphate and potassium sulphate or bisulphate.—G. W. McD.

Ammonia; Process of separating —— from industrial gases. Gewerkschaft des Steinkohlen-Bergwerks Lothringen, and F. Uhde. Fr. Pat. 417,505, June 6, 1910.

The gases from coke ovens, gas retorts, or the like, mixed with carbon dioxide, if necessary, are absorbed by a solution of an alkaline-earth metal nitrate, especially calcium nitrate, with formation of ammonium nitrate and precipitation of an alkaline-earth metal carbonate, especially calcium carbonate.—O. R.

Ammonium sulphate; Manufacture of —— from coal gas or coke oven gases, after the tarry matter has been separated from the gases but without reheating them. Solvay et Cie. Fr. Pat. 417,782, June 18, 1910.

The ammoniacal gases are absorbed in a saturator containing sulphuric acid, and the ammonium sulphate liquor passes from the saturator through a decanting vessel, which collects the last traces of tarry matter, into an evaporator, in which the heat of the burnt gases from the furnaces is utilised for the evaporation.—O. R.

Ammonia; Process for separating —— from distillation gases by means of sulphuric acid. E. Henss. Ger. Pat. 227,946, Sept. 9, 1909.

The hot gases after passing the tar extractor are forced into a bath of sulphuric acid by means of an acid jet injector. The greater portion of the ammonia is absorbed by the acid in the injector, so that the pipe leading the gases into the sulphuric acid bath needs to dip only a short distance below the surface, and hence the gases rising from the acid are still under such pressure that they pass onwards to the gas-holder without the use of special appliances.—A. S.

Ammonia; Process for the production of —— from its elements. Badische Anilin und Soda Fabrik. Fr. Pat. 418,287, July 15, 1910. Under Int. Conv., July 31, 1909 and June 27, 1910.

The catalytic production of ammonia from its elements, under pressure, is effected in a vessel constructed of metal (steel, for instance), which is heated externally or from within to a suitable temperature, preferably not above 700° C. The metal may, if desired, be protected by plating or enamel.—F. Sodn.

Ammonia; Process for the production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 418,434, July 7, 1910. Under Int. Conv., July 31, 1909.

The essential feature of the process, which concerns the catalytic preparation of ammonia from its elements, under pressure, is that the ammonia formed is condensed to the solid or liquid state in the reaction vessel itself; for example, by cooling the walls of the vessel.—F. Sodn.

Lime-burning and lime gas-producing kilns; Method of constructing ——. W. Laverty, Belfast. Eng. Pat. 28,665, Dec. 8, 1909.

The outer and inner shells of a vertical, shaft lime-kiln are so constructed as to form a continuous, annular chamber above the draw-off doors, thereby leaving a large reservoir of air to be heated by the waste heat from the kiln. This chamber is supplied with air through inlets at the top, and the heated air is delivered into the kiln through ducts at the bottom, which are arranged in between the several draw-off doors. It is claimed that this construction produces high-grade lime with considerable saving of fuel. —O. R.

Calcium phosphide; Process of producing ——. W. Doerbecker, Hanover, Germany. Eng. Pat. 22,029, Sept. 22, 1910.

Alternate layers of red phosphorus and lime are heated to a red heat in a closed receptacle.—O. R.

Lead oxide (litharge); Process of transforming metallic lead into ——. Bergmann und Simons, Ges. m. b. H., and Lindgens und Söhne. First Addition, dated July 21, 1910, to Fr. Pat. 409,944, Dec. 4, 1909 (this J., 1910, 816).

The height of the vessel in which the oxidation takes place is made considerably greater than its width, so that there is sufficient room above the surface of the molten lead to ensure complete oxidation of the pulverised metal or to allow unoxidised particles to fall back into the bottom of the vessel, thus preventing metallic lead from being carried forward into the depositing chambers.—F. Sodn.

Lead oxide; Process for the manufacture of ——. Lindgens und Söhne and Bergmann und Simons Ges. m. b. H. Ger. Pat. 228,729, March 2, 1909.

Lead oxide free from fused particles and from metallic lead is obtained by treating molten lead in a closed chamber with a mixture of steam and air, with agitation, and then heating the mixture of lead, lead oxide, air, and gases, which is evolved from the chamber, to a temperature below the melting point of lead oxide before leading it to the settling chamber or to a muffle-furnace. The oxidation chamber is provided with a siphon for the introduction of molten lead and a vertical outlet pipe for the reaction products, means being provided for heating both the siphon and the outlet pipe. The outlet pipe of the muffle-furnace is furnished with a gas-filter.—A. S.

Atmospheric air ; Process and apparatus for separating by fractional distillation [liquefied] gaseous mixtures, especially ——. G. Hildebrandt. Fr. Pat. 417,537, June 25, 1910.

The fractional distillation is carried out in such a manner that the nitrogen, which separates in the course of distillation, immediately escapes outside the region where it is evolved, so that it cannot be re-absorbed by the liquid, when the latter is subjected to further cooling. The distillation takes place in a system of gutta-percha or rubber tubes furnished with fine apertures, the tubes forming a spiral column, the anterior section of which is warmed by the more volatile gases issuing from the lower warmer layers.—O. R.

Hydrogen ; Process of manufacturing ——. O. Dieffenbach and W. Moldenhauer. Fr. Pat. 417,929, April 25, 1910. Under Int. Conv., Sept. 27, 1909.

Granulated coal or coke is treated with a solution of an alkali silicate, alkali carbonate, or other suitable alkaline material, and the mixture is briquetted and subjected to the action of superheated steam at temperatures from 550° to 750° C.—O. R.

Hydrogen ; Process of liquefying ——. Heylandt Ges. m. b. H. Fr. Pat. 418,138, July 11, 1910. Under Int. Conv., July 12, 1909.

Hydrogen, previously purified and compressed, is cooled by a current of air or hydrogen, which has been reduced to a temperature of −150° to −190° C. by doing external work, to such a degree as to allow of its liquefaction by sudden expansion, without the intermediary of a previously liquefied gas.—O. R.

Hydrogen ; Process for the production of —— by the employment of silicon and of alkaline solutions. Consortium für Elektrochem. Ind., Ges. m. b. H. Fr. Pat. 418,946, July 18, 1910.

The reaction vessel, used for the interaction of silicon and the solution of an alkali, as described, for instance, in Fr. Pat. 406,930 of 1909 (see Eng. Pat. 21,032 of 1909 ; this J., 1909, 1314), is provided with an inner compartment, so that the heat of the reaction in the outer vessel may be utilised in preparing a fresh quantity of the hot alkali solution required for recharging.—F. Sodn.

Hydrogen ; Process for the manufacture of a durable preparation for the evolution of ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 229,162, Jan 17, 1909.

The preparation consists of finely-divided aluminium (98 parts) mixed with small quantities of mercuric oxide (1 part) and caustic soda (1 part). On treatment with water, hydrogen is evolved steadily and uniformly, 1—1·2 cb. m. (calculated at 0° C. and 760 mm.) being obtained from 1 kilo. of the product. The mass can be kept unaltered for a long time if protected from moisture, and can be easily transported, 1 kilo. only occupying a volume of 0·8 litre.—A. S.

Aluminium and nitrogen ; Process for the production of compounds of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 418,425, June 24, 1910. Under Int. Conv., July 9, 1909.

The known process of heating a mixture of alumina and carbon in an atmosphere of nitrogen is modified by the addition of oxides or "oxidic compounds," capable of giving stable nitrides under like conditions ; the formation of aluminium nitride is thus accelerated and effected at a relatively low temperature. Special mention is made of silica for the purpose, but the oxides of titanium, zirconium, etc., or mixtures of oxides, or compounds or minerals containing them, such as silicates, may also be employed. A mixture, given as an example, contains 48 per cent. of anhydrous alumina, 24 per cent. of pure quartz, and 28 per cent. of carbon ; it is heated in a current of nitrogen for 15 hours at about 1500° C. The specification contains three other examples, and claim is further made for the application of the products obtained by the process to the manufacture of ammonia, cyanides, etc.—F. Sodn.

Cyanogen ; Process for the production of ——. Soc. Française des Produits Azotés. Fr. Pat. 418,793, Oct. 8, 1909.

Nitrogen is made to react with the carbide of an alkali or alkaline-earth metal, under one or more of the following conditions :—(1) Under increased pressure, (2) in the presence of an excess of nitrogen in active circulation, (3) at a higher temperature than that employed in the production of cyanamide, secured either by more intense heating or by preventing loss of heat, by suitable insulation, (4) by more intimate and prolonged contact with the nitrogen, preferably in apparatus arranged in series. The cyanogen is separated from the treated gas by cooling or by compression, or it may be made to combine with sodium or other appropriate substance or be converted into hydrocyanic acid. The reaction takes place in accordance with the equation, $n\text{MC}_2+3n\text{N}=n\text{MCN}_2+x\text{CN}+y\text{C}+y\text{N}$, in which M is the metal and $x+y=n$; under the most favourable conditions, y becomes zero.—F. Sodn.

Hydrocyanic acid ; Process and furnace for carrying on gas reactions, especially for the manufacture of ——. O. Dieffenbach, W. Moldenhauer and Chem. Fabr. Griesheim-Elektron. Ger. Pat. 228,539, Feb. 27, 1908.

In the manufacture of hydrocyanic acid from nitrogen and hydrogen (or hydrocarbons) in the electric arc, and in similar processes, the lower electrode is formed of a heap of pieces of coke, which become incandescent, and the gases are led through this heap, and thus become strongly heated, before entering the arc. The upper electrode is preferably a carbon tube serving as outlet for the reaction products. It is best to use continuous current with the heap of pieces of coke as anode, and the other, upper electrode as cathode. The upper electrode is enclosed in a chamber of carbon or other refractory material, the lower electrode forming the floor of the chamber, and during the process, fresh coke is allowed to fall down the outside of the chamber to replace that consumed by the arc.—A. S.

Hydrocyanic acid ; Process for the manufacture of —— from highly heated hydrogen, carbon, and nitrogen. Chem. Fabr. Griesheim-Elektron, O. Dieffenbach, and W. Moldenhauer. Ger. Pat. 229,057, June 12, 1908.

In the production of hydrocyanic acid in the electric arc, it is proposed to introduce finely-divided carbon into the arc together with the hydrogen and nitrogen, instead of utilising only the carbon of the electrodes.—A. S.

Tablets of acids mixed with alkali carbonates ; Process for the preparation of durable ——. Chem. Fabr. Helfenberg, Akt.-Ges. vorm. E. Dieterich. Ger. Pat. 228,841, May 19, 1909.

The acid (citric or tartaric) and alkali carbonate are mixed with from 2—4 per cent. of an anhydrous, hygroscopic salt, preferably a chloride (*e.g.*, sodium chloride), before being compressed into tablets.—A. S.

Oxides of nitrogen from air ; Process for obtaining ——. Dynamit-Act.-Ges. vorm. A. Nobel und Co. Ger. Pat. 228,849, Sept. 3, 1909.

The process is an improvement on that described in U.S. Pat. 948,372 this J., 1910, 353), several rotating magnetic fields, instead of one, being disposed around the tube or containing vessel in which the arc is produced, in such a manner that the arc is not only caused to rotate, but travels along the wall of the tube, and repeatedly crosses the inner space.—A. S.

Nitrous acid; Effecting the removal of —— from solutions containing it. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 30,503, Dec. 30, 1909.

See Fr. Pat. 411,674 of 1910; this J., 1910, 949.—T. F. B.

Ammonia; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 10,441, April 28, 1910.

See Fr. Pat. 416,877 of 1910; this J., 1910, 1378.—T. F. B.

Evaporating brine apparatus. J. Hodgkinson, Pendleton. U.S. Pat. 979,301, Dec. 20, 1910.

See Eng. Pat. 26,068 of 1908; this J., 1910, 24.—T. F. B.

Ammoniacal copper solution; Process for preparing ——. H. Bernstein. Fr. Pat. 418,282, July 15, 1910.

See U.S. Pats. 965,273 and 965,557 of 1910; this J., 1910, 1105.—T. F. B.

Sodium aluminate; Processes for making ——. H. Lage. Fr. Pat. 419,169, Aug. 11, 1910. Under Int. Conv., Sept. 29, 1909.

See U.S. Pat. 957,848 of 1910; this J., 1910, 756.—T. F. B.

VIII.—GLASS; CERAMICS.

Kaolins and clays; Influence of soluble sulphates on ——. R. Rieke. Sprechsaal, 1910, 43, 709—711, 723—725, 739—741, 755—757.

The soda-slip casting process has now attained such general recognition that the rival theories of plasticity—the one attributing it to the presence of colloids, the other to soluble salts, in the clay—become of commercial importance. The influence of soluble sulphates on the fluidity of slip, and their adsorption by clay, have been examined accordingly, and the following conclusions drawn. Most soluble sulphates increase the viscosity of a slip and barium hydroxide should therefore be added to the slip. The sulphates with the most harmful influence are those of calcium, aluminium and the heavy metals. Alkali sulphates stiffen the slip at first when only about 0·1 per cent. is present, then render it more fluid till the slip contains over 1 per cent. of sulphates, and lastly stiffen it again. Zinc and copper sulphates also exhibit this phenomenon of varying influence. The curve representing the degree of activity of the salts, *i.e.*, the increase of viscosity divided by the original viscosity, rises rapidly on small addition of sulphates, but more slowly on greater additions. It is also dependent to some extent on the proportion of clay to water in the slip. The use of water free from sulphates is better than trying to rectify one that contains salts detrimental to fluidity. Clays absorb sulphates in small quantities though sometimes, as in the case of iron and aluminium, when a sulphate solution is in contact with a clay, the clay absorbs the metallic ion leaving the sulphate in the solution to withdraw an alkali metal from the clay, double decomposition taking place. —H. H. S.

Patents.

Glass furnace. P. Bourdu. Fr. Pat. 418,482, July 21, 1910.

In the centre of the furnace is a vertical flue for providing the secondary air, which it draws partly from the regenerators and partly from supplementary air from the interior. This flue is furnished at the top with tuyères to project the air perpendicularly into the jets of gas which are forced from a circular passage around the central flue. Wells, heated by the escape gases, are situated under the glass pots to recover any glass that may be spilt from broken pots.—H. H. S.

Glass-drawing furnace. G. H. Baillie. Fr. Pat. 418,555, July 25, 1910. (See also this J., 1910, 1311.)

To prevent tar and other deposits from falling on to the glass from the exit flues for the combustion gases, it has been necessary to use purified gas or water-gas for firing. But ordinary producer gas may be safely used by reversing the tuyères when a deposit accumulates, so that the exit tuyère now becomes the entrance, the process being repeated every ten minutes or as often as experience proves necessary.—H. H. S.

Carborundum abrasive article. F. J. Tone, Assignor to Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 978,679, Dec. 13, 1910.

Carborundum and a vitrified binder formed of a lime-bearing material, kaolinite and flint, are moulded together. —H. H. S.

Abrasive article. F. W. Higgins, Assignor to Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 978,747, Dec. 13, 1910.

The article is composed of carborundum held together by a vitrified aluminium silicate containing fluorine, such as a fused mixture of ferrous kaolin, fluorspar and cryolite. —H. H. S.

Enamelling metals; Art of ——. C. L. Rice and B. W. Gilchrist, Woodhaven, N.Y. U.S. Pat. 971,641, Oct. 4, 1910.

A coating of a magnetic material and sulphur is electrolytically deposited on the metallic article by immersing it in an electrolyte consisting of sulphur and a salt of a magnetic metal, and the enamel is then applied on the top of it.—H. H. S.

Silica glass; Manufacture of ——. The Silica Syndicate, Ltd. Fr. Pat. 419,157, Aug. 10, 1910.

See Eng. Pat. 10,930 of 1910; this J., 1910, 1382.—T. F. B.

IX.—BUILDING MATERIALS.

Lime in clay; Rendering —— harmless. R. Loebe. Sonderabdruck aus dem Protokoll des Deutsch. Ver. für Ton-, Zement- und Kalkind., E.V. Chem. Zentr. 1910, 2, 1958—1959.

The danger of destruction of bricks due to inclusions of marl depends upon the size and shape of the particles of marl, the strength of the burnt clay, the composition (calcium carbonate content) of the marl, and the temperature and duration of burning. Chemical reactions also play an important part, however, since during the burning, a portion of the lime reacts with the clay to form easily fusible silicates which penetrate the pores of the brick, leaving spaces capable of accommodating the expansion due to the hydration of the free lime. It is stated that the minimum limit for safety corresponds with a conversion of 30 per cent. of the lime present as carbonate into silicates. The author made experiments with mixtures of clay and marl, test-bricks being prepared and burnt in an electrically heated muffle-furnace, and then the free lime in the brick determined by powdering, boiling with distilled water, and titrating the solution with hydrochloric acid, using phenolphthalein as indicator. It was found that with marl ground to 2 mm. size, no danger was to be apprehended after burning for 2 hours, when the temperature in the coolest part of the furnace was 1020° C., whilst the same result was attained after only a few hours burning at a temperature slightly above the melting point of silver (about 960° C.). Instead of the usual method of immersion in water for the slaking of any free lime in the bricks, storing in a moist atmosphere proved equally satisfactory.—A. S.

Paving bricks ; Imperfect ——. J. C. Lawrence and C. J. Boner. J. Ind. Eng. Chem., 1910, **2**, 524—525.

An examination of certain brittle and distorted paving bricks, made from shale, showed that vitrification of the outer portion of the brick had occurred before the interior was dry. During the further burning, therefore, steam was prevented from escaping and set up a pressure within the vitrified shell, producing distortion and a scoriaceous appearance of the interior ; the inner core was also dark in colour owing to the presence of a large proportion of ferrous iron.—F. Sodn.

Mortars and stones ; Cause of efflorescences on ——. P. Rohland. Z. Chem. Ind. Kolloide, 1910, **8**, 48—49.

According to the author efflorescence on mortars, bricks, etc., can be caused only by substances (salts, acids, bases) in the crystalloid condition and not by substances in the colloidal condition. The extent of the efflorescence depends partly upon the porosity of the mortar, etc., for in a very porous material the soluble salts may crystallise partly in the interior of the mortar, whereas with material of closer structure, the water (and dissolved salts) is forced to the surface. It is pointed out that soluble salts may separate quantitatively on the surface of mortar, etc., after hardening. For example, if plaster of Paris (calcium sulphate hemihydrate) be ganged with water containing in solution, 0·05 grm. of copper sulphate, the plaster remains pure white during setting and hardening, but after several hours, the blue copper sulphate crystallises out quantitatively on the surface.—A. S.

Portland cement ; Calcium silicates and calcium aluminates contained in ——. O. Schott. Cement and Eng. News, 1910, **22**, 372—377, 415—420, 463—470, 508—515.

The various silicates and aluminates which might be present in Portland cement were investigated by heating the theoretical quantities of fused pure lime and silica or alumina in an electric furnace. The furnace was arranged to heat the materials by radiation, and special precautions were taken to prevent contamination with carbon from the electrodes. The experiments proved the non-existence of the hypothetical compound tricalcium silicate, $3CaO,SiO_2$, in Portland cement. Dicalcium silicate, $2CaO,SiO_2$, was obtained in two forms. One form, of sp. gr. 3·15, disintegrates, does not set under water, and sets very slowly in air. The other form, of sp. gr. 3·40, is stable and sets in 6 to 8 hours under water. The conditions determining the formation of the stable form could not be ascertained, but the product usually contained about one-third part of the stable form which could be separated from the disintegrated powder by sifting. All lime-silica mixtures containing over 2 molecular proportions of lime give a product which disintegrates. With 2·5 molecular proportions and upwards, the product swells and cracks after setting, as in the "blowing" of Portland cement. Lime-silica mixtures with 2 molecular proportions of lime and over, fuse only at temperatures above the melting point of platinum. The corresponding aluminates and ferrites fuse at lower temperatures. Monocalcium silicate, CaO,SiO_2, fuses at 1300° C.—A. T. L.

Patents.

Oils rich in bitumen from tar or similar materials ; Process for obtaining ——, *and their utilisation for impregnating wood.* G. Krojanker. Fr. Pat. 418,520, July 22, 1910. Under Int. Conv., July 27, 1909.

See Ger. Pat. 227,492 of 1909 ; this J., 1910, 1368. When dissolved in mineral oils, the bituminous oils obtained according to this process are well suited for use in impregnating wood or other porous substances.—T. F. B.

Volcanic rocks ; Utilisation of ——. F. Ribbe. Fr. Pat. 418,624, July 27, 1910.

The rocks are melted and rendered less dense by blowing air through or by adding lighter materials to the melt. They can then be used for mill-stones, paving-stones, and the like.—H. H. S.

Artificial stone made from melted slags. B. Neumann. Fr. Pat. 418,862, Aug. 3, 1910.

Slag from furnaces is moulded in the usual way, and is capable of taking a high degree of finish, the best slags for the purpose being the dense and homogeneous varieties found at the bottom of a melt.—H. H. S.

Artificial stone from carbonic acid and lime ; Process for the manufacture of ——. J. Rawitzer. Ger. Pats. 229,010 and 229,011, Oct. 27, 1908 and July 4, 1909.

Quicklime or slaked lime, or a mixture of the two, is intimately mixed with "carbonic acid snow" and with water and the mixture is compressed in moulds, preferably lined with a layer of an easily fusible alloy, which can be subsequently melted to allow of the ready removal of the hardened mass. The water is used in the form of a spray which is mixed with the carbonic acid snow, or in the form of snow or powdered ice. The products are very dense and hard, similar to natural marble. Colouring matters, etc., may be added to the mass before compression ; by the addition of argillaceous substances, stones suitable for lithographic purposes are obtained.—A. S.

Cement kilns ; Fuel burner for ——. M. F. Mangelsdorff, Assignor to Combustion Utilities Co., New York. U.S. Pat. 977,113, Nov. 29, 1910.

The burner comprises a source of compressed air, a flattened nozzle chamber constricted near its centre but having a flattened, unrestricted flame outlet, and a coal-jet conduit connected with the source of compressed air and terminating behind the constriction of the nozzle chamber. Means are provided for feeding powdered coal into the conduit, and a separate, parallel air conduit is also provided, connected with the source of compressed air and ending behind the constriction of the nozzle chamber. —O. R.

Portland cement ; Method of making ——. J. M. Carrère, Assignor to Blanc Stainless Cement Co., Allentown, Pa. U.S. Pat. 978,848, Dec. 20, 1910.

The raw mixture from which the cement is made consists of approximately 76 per cent. of limestone and 24 per cent. of natural alkaline clay, containing about 3 per cent. of alkali. The mixture, which is substantially free from iron, is subjected first to a relatively low and gradually increased heat in order to drive off the carbon dioxide and a portion of the alkalis, and afterwards to a higher and clinkering heat produced by a short intense "singeing flame," the resulting clinker being discharged as soon as formed. The process is carried out in a rotary kiln, heated close to its discharge end by a burner composed of two nozzles, arranged one above the other ; a current of fuel, atomised by a small volume of fluid under high pressure, is discharged through the upper nozzle, and a current of air, from a low-pressure source, through the lower nozzle. This burner gives the short intense "singeing flame" for clinkering, and by the passage of the products of combustion through the kiln towards the charging end, the mixture of raw materials is subjected to the gradually increased heat treatment above mentioned.—W. G. H.

Artificial stone from lime and carbon dioxide ; Process for making ——. J. Rawitzer. Fr. Pat. 418,969, Aug. 1, 1910.

See Ger. Pats. 229,010 and 229,011 ; preceding.—T. F. B.

Cement ; Manufacture of hydraulic —— *or like material.* H. Kühl, Berlin. Eng. Pat. 3119, Feb. 8, 1910.

See Fr. Pat. 411,016 of 1909 and Addition thereto ; this J., 1910, 952.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Troostite; Constitution of —— and the tempering of steel. A. McCance. Engineering, 1910, 90, 905—908.

The author uses the term "troostite" for the micrographic constituent of steels discovered and described by Osmond, and gives twelve microphotographs of steels showing its characteristics when produced under various conditions. These show that the carbon content of troostite may vary, and that it should not be considered as finely divided pearlite, although, being a transition product, it is a stage in the development of pearlite in the same sense as martensite is, and pearlite may be obtained ultimately from both martensite and troostite. From a detailed discussion of the curves, which are given, for the expansion of a bar of steel, for the residual magnetism, and for the changes in magnetic intensity on reheating as well as for the variation in density on tempering, it is concluded that troostite is amorphous and uncrystallised α-iron which has not yet attained its crystalline state of ferrite. On reheating a quenched steel the first effect is to change the iron to the uncrystallised α-form (troostite) from which the carbon, since it is insoluble in α-iron, is deposited *in situ* as $(Fe_3C)_2$. This is unable to polymerise into $(Fe_3C)_4$ (the constitution of massive cementite, as stated by Campbell), and will remain in suspension, and hence it is concluded that troostite contains carbon in suspension and not in solution. Above 450° C. the α-iron crystallises as ferrite in low carbon steels, and with increasing polymerisation of the carbon compound the remaining complex mass becomes sorbitic and finally pearlite. In an appendix the author states that in the paper martensite was assumed to be a solid solution of carbon in β-iron, and that the carbon goes into solution at the Ar2 point, but that there are many experimental and theoretical supports for the view that solution does not take place at the Ar2 point but at the Ar3 point, and that carbon is quite incapable of dissolving in any form in β-iron.—A. H. C.

Magnets; Some alloys for permanent ——. C. F. Burgess and J. Aston. Met. and Chem. Eng., 1910, 8, 673—676.

A large number of iron alloys, mostly without carbon, in the form of bars were examined in a permeameter with reference to their suitability for use as permanent magnets. They were tested in the forged state and also, after quenching from 1000° C. In addition they were tested in order to determine their ability to retain their residual magnetism after shock. The addition of *chromium* alone to iron free from carbon does not give a suitable material for magnets, but an alloy containing 5 to 6 per cent. of chromium with either 0·75 to 1·0 per cent. of silicon, or 0·3 to 0·5 per cent. of carbon is very suitable. For every increase of *manganese* content the coercive force increased with a corresponding decrease of retentivity up to an alloy with 10·41 per cent. of manganese, which was non-magnetic. Of the *molybdenum* alloys only one bar was magnetically hard in the forged condition, and this contained 8·0 per cent. of molybdenum, 0·3 of vanadium, and 0·6 of carbon, and in all cases where carbon was present they became on quenching very fine magnetic materials. In the *nickel* alloys there was a decrease in retentivity up to that containing 26 per cent. of nickel, which was non-magnetic. The addition of *vanadium* increased the magnetic hardness which was again increased by quenching. The binary alloys of *tungsten* and iron were all unsuitable, but one containing 4·0 per cent. of tungsten and 0·4 of vanadium was an exceptionally good permanent magnet. Among the ternary alloys the detrimental effect of the additions of nickel with its non-magnetic tendency is particularly noted, and the various combinations of chromium with molybdenum or tungsten either alone or with additions of silicon, vanadium, or carbon gave satisfactory results. The results of the tests on bars after subjecting to a series of shocks are tabulated, the decrease in residual magnetism averaging fifty per cent.—A. H. C.

Chromium; Determination of —— in chromium-tungsten steels. H. Wdowiszewski. Chem.-Zeit., 1910, 34, 1365.

A simple and rapid modification of Von Knorre's method (this J., 1907, 1010) is carried out as follows: 1 grm. of the sample is placed in a 500 c.c. flask with 10—15 c.c. of sodium phosphate solution; 7—8 c.c. of sulphuric acid (sp. gr. 1·65), and 5 c.c. of water are added, and the flask is gently warmed until the steel is dissolved. The heating is continued, and 2 c.c. of nitric acid (sp. gr. 1·4) are added, in order to convert the tungsten into soluble phosphotungstic acid. The clear solution is diluted with 300—500 c.c. of hot water, and boiled gently with 3—5 grms. of ammonium persulphate. The solution is finally cooled and titrated with permanganate after addition of excess of ferrous-ammonium sulphate.—A. T. L.

Brown gold. Hanriot. Comptes rend., 1910, 151, 1355—1357.

When a gold-silver alloy composed of about 4 parts of silver to 1 of gold is attacked by nitric acid as in the ordinary gold assay, a spongy brownish residue is left, which the author terms brown gold. It always contains a small quantity of silver and traces of other metals (copper, lead), and also a notable quantity of nitric acid which it loses only at 175°—200° C. On heating to a still higher temperature it changes colour and shrinks considerably; at about 900° C. gas is evolved, whilst at about 1040° C. the metal melts and acquires the properties of ordinary gold. The author has studied the effect of nitric acid and of annealing on different alloys. The alloys were used in the form of thin plates on which two parallel lines were marked, the distance between which was measured before and after each treatment, and the percentage contraction calculated. The alloys were treated successively in nitric acid of 22° B. (sp. gr. 1·18) and of 32° B. (sp. gr. 1·285), in each case until silver was no longer dissolved. Alloys containing more than 3·5 parts of silver to 1 of gold were disintegrated by the action of the acid. Some results obtained by the acid treatments are shown in the following table:—

Parts of silver to 1 of gold in the alloy.	Contraction in the acid.		Silver content of the brown gold.	
	per cent.	per cent.	per cent.	per cent.
3·5	24	23·7	0·00007	0·00006
3·0	20·7	19·2	0·00015	0·0001
2·5	13·2	12·6	0·00037	0·00036
2·0	9·05	7·2	0·0005	0·0006
1·5	1·4	1·6	0·0107	0·011
1·0	0·3	0·4	0·020	0·0199

The test-pieces used in the above experiments were annealed twice, once after the first rolling and again after a second rolling, before the treatment with acid. The annealing has a considerable influence. Three test-pieces of the same composition and subjected to the same treatment, except with respect to annealing, gave the following results:—

Parts of silver to 1 of gold.	No. of annealings.	Contraction.		Silver content.	
		per cent.	per cent.	per cent.	per cent.
3	2	20·7	19·2	0·00015	0·0001
3	1	19·5	18	0·00028	0·00037
3	0	5·8	5·4	0·0035	0·0045

—A. S.

Copper and lead smelting; An improvement in hot blast ——. C. H. Mace. Met. and Chem. Eng., 1910, 8, 671—673.

The Partridge furnace which has been erected in the Alamos district, Sonora, Mexico, is described and illustrated by photographs. In place of the bustle pipe and tuyères is a crucible furnace with a complete open space of 360° in circumference and 2·5 in. in height between the top of the crucible and the bottom of the bosh where the water-jacket terminates; the crucible is on a jack-plate by means of which it is raised into position beneath the bosh. The slag overflows by a spout (it is never tapped), while the matte tap is on the outside of the chamber. The slag is carried by small cars which travel beneath the slag tap and then around the slag box and discharge automatically. The blast enters the slag box above the point where the cars discharge, passes over the molten slag and thence up into the crucible chamber, reaching the smelting zone at a high temperature. This obviates the necessity for an external stove to heat the blast, and the furnace has shown that the introduction of a high pressure blast through tuyères is erroneous. In order to smelt correctly, it is essential that the blast should enter the zone of fusion at a speed just sufficient to maintain an active combustion and that the blast forge effect is wrong in that it causes a heavy flue dust, an increase in the height of the smelting zone and volatilisation of metals. The furnace described has an ore shaft 22 in. in diameter, and is boshed to a diameter of 18 in. with a capacity of 25 tons per day, and a minimum smelting capacity of 8·5 tons per sq. ft. of furnace area as against 6·5 tons obtained by the standard smelter. Using metallic iron to flux the ore, a matte containing 14·4 per cent. of copper, 1·51 oz. of gold, and 11·98 oz. of silver was obtained from an ore containing 2·73 per cent. of copper, 0·29 oz. of gold, and 2·6 oz. of silver.—A. H. C.

Output of iron ore, pig iron, steel, and manganese ore in principal countries. Board of Trade J., Jan. 12, 1911. [T.R.]

THE following particulars of the output of iron ore, pig iron, steel, and manganese ore in the principal producing countries of the world are extracted from a Return ("Iron and Steel, 1908–9"), relating to iron and steel recently issued by the Board of Trade:—

Iron ore.—The total output of iron ore in the world is estimated to have amounted in 1909 to about 133 million tons, the principal producers being the United States, Germany, the United Kingdom, France, and Spain, in the order given, these five countries accounting for about seven-eighths of the total output of the world. The following statement shows the total output of iron ore in the principal countries, in each of the years 1907–9:—

Country.	1907.	1908.	1909.
	Tons.	Tons.	Tons.
United States	51,721,000	35,983,000	53,034,000*
Germany (including Luxemburg.	27,252,000	23,888,000	25,095,000
United Kingdom	15,732,000	15,031,000	14,980,000
France	9,847,000	9,895,000	12,254,000*
Spain	9,738,000	9,123,000	9,056,000

* Provisional figures, in some cases partly estimated.

The actual resources of the principal ore-producing countries are estimated to be, in the United States, 4258 million tons, the equivalent in metallic iron being 2305 million tons; in Germany, 3877 million tons (1360 million tons of iron); in the United Kingdom, 1300 million tons (455 million tons of metal); in France, 3300 million tons (1140 million tons of metal); and in Spain, 711 million tons (349 million tons of metal). In addition to these, the potential resources of the world not yet developed are estimated to amount to 123,377 million tons of ore, representing 53.136 million tons of iron, the principal deposits being in Russia, the United Kingdom, and the United States.

Pig iron.—The total quantity of pig iron produced in the world in 1909 is estimated at about 60 million tons, the principal countries of production being the United States, Germany, and the United Kingdom in the order named, these three countries together accounting for about four-fifths of the total output of the world.

The following statement shows the total output of pig-iron in the principal producing countries in each of the years 1907 to 1909:—

Country.	1907.	1908.	1909.
	Tons.	Tons.	Tons.
United States	25,781,000	15,936,000	25,795,000
Germany (including Luxemburg)	12,668,000	11,615,000	12,442,000
United Kingdom	10,114,000	9,057,000	9,532,000

Steel.—The combined output of steel in the United Kingdom, Germany, and the United States in 1909 is estimated at nearly 42½ million tons, and the world's output at somewhat more than 53 million tons. The following statement shows the quantity of steel produced in the years 1907–9, inclusive, in the three principal countries:—

Country.	1907.	1908.	1909.
	Tons.	Tons.	Tons.
United States	23,363,000	14,023,000	23,955,000
Germany (including Luxemburg)	11,870,000	11,007,000	11,856,000
United Kingdom	6,522,000	5,341,000	6,610,000

Manganese ore.—Of the principal steel-producing countries, only Russia and Germany produce manganese ore in important quantities, though even in Germany the home supply has to be supplemented by large importations from other countries. The other principal sources of supply are British India, Brazil, and Spain.

The following statement shows the production (or exports) of these countries in 1907, 1908, and 1909:—

Country.	1907.	1908.	1909.
	Tons.	Tons.	Tons.
Russia	907,905	438,000†	609,000†
British India *	899,040	674,315	642,675
Brazil (exports)	232,973	163,452	‡
Germany	71,930	66,604	‡
Spain	40,837	16,672	14,500†

* Approximate figures. † Exports.
‡ Figures not yet available.

Mercury statistics for the United Kingdom. A. J. Pickering. Chem. and Drug., Jan. 14, 1911. [T.R.]

Year.	Imports.	Exports.	Price.					
			Highest.			Lowest.		
	Bottles.	Bottles.	£	s.	d.	£	s.	d.
1901	35,341	26,863	9	2	6	8	17	6
1902	33,192	19,519	8	17	6	8	14	6
1903	34,886	18,846	8	15	0	8	5	0
1904	33,218	27,277	8	5	0	7	14	0
1905	34,034	21,330	7	15	0	7	1	0
1906	38,823	27,712	7	7	6	6	17	0
1907	39,448	29,465	8	5	0	6	15	0
1908	43,605	22,348	8	10	0	7	12	6
1909	43,163	22,050	9	17	6	7	19	0
1910	44,595	24,748	9	15	0	7	9	0

The estimated consumption in the United Kingdom is 13,000 bottles per annum.

Slags; Role of alumina in copper blast-furnace ——. L. G. Smith. Eng. and Min. J., 1910, 90, 1260—1261.

THE author remarks upon the directly opposed conclusions of C. F. Shelby (this J., 1908, 903) and C. A. Heberlein (this J., 1909, 941) as to the role of alumina in copper blast-furnace slags, and refers to the researches of J. H. L. Vogt upon the constitution of igneous rocks (***Studien über***

Schlacken, Silikotschmelzlösungen) for the purpose of interpreting some of the facts observed by the first-named worker. Vogt showed that in all slags containing less than 43 per cent. of silica, with a moderate amount of alumina, and in which the ratio 3 (Ca,R) : Al_2 is greater than one, all the alumina is present in the form of a double silicate; and that alumina can only act as a real acid when it preponderates largely over the other bases present—a condition which never obtains in slags rich in alumina. Since the oxygen ratios given by Vogt are in agreement with those obtained by Shelby in the analyses of actual copper blast-furnace slags from all over the world, and the ratio 3 (Ca,R) : Al_2 in these slags is always greater than one, the author—in opposition to Shelby—concludes that the alumina cannot possibly act as an acid.—W. E. F. P.

Castings [*of aluminium-bronze*] *to withstand high pressures; Production of* ——. H. C. H. Carpenter and C. A. Edwards. Inst. of Mech. Eng.; through Engineer, 1910, **110**, 701—703.

The authors have found that castings capable of withstanding high pressures can be made with copper-rich aluminium-bronzes. These alloys have so small a freezing interval that no segregation takes place even if they be cast in sand. They are easily prepared, are very resistant to corrosion by fresh and sea water, and possess considerable tenacity and ductility, the former rising and the latter falling with increased content of aluminium (see this J., 1907, 153, 206). Preliminary experiments with alloys containing from 9 to 11·5 per cent. of aluminium showed that simple cylinders could be cast, in both chill and sand moulds, capable of holding pressures of 15—20 tons per sq. inch. Leakage at the valve joint generally occurred at somewhat lower pressures owing to stretching of the casting, but after screwing up the valve so as to tighten the joint, further pressure could be applied.

On next attempting to make a casting of more complicated form, viz., a hydraulic valve-block, consisting of a lug, a barrel, and a base-plate (lug, 2⅝ in. diam., 2 in. high; barrel, 8½ in. high, 2⅝ in. diam. at wide and 2 in. at narrow end; base plate, 5⅝ by 4 by ¾ in.; bore ¾ in.), such as is used in high-pressure pumps, it was found necessary to observe the following precautions in order to obtain sound castings. The molten metal should remain in the crucible as long as possible before pouring, which should be performed at about 1100° C. (2012° F.). The metal should be poured very slowly and should enter the mould at the lowest possible point. The mould is preferably faced with a somewhat coarse sand, and the surface of the lower part of the mould should be dried. With these precautions an average of four good castings out of six can be obtained, yielding results similar to those given in the following table:—

Aluminium.	Gauge pressure at which valve-joint began to leak.	Maximum pressure to which casting was subjected.
per cent.	tons per sq. in.	tons per sq. in.
10·0	11-12	17
9·75	10-11	15
9·5	9-10	14

Test-cylinders of about the same dimensions as the barrel of the valve-block had the following mechanical properties.

Aluminium.	Ultimate stress.	Elongation on 2 in.
per cent.	tons per sq. in.	per cent.
9·0	18·12	26·0
9·5	21·60	14·5
10·0	20·32	7·0

Several castings have been kept for one or two years without deterioration, and two have been tested for a long period with high-pressure steam under "service" conditions with satisfactory results.—A. S.

Ore dressing; Application of electrostatic separation in ——. F. S. MacGregor. Amer. Electrochem. Soc., Oct., 1910. J. Ind. Eng. Chem., 1910, 2, 517—522. (Compare this J., 1906, 1054; 1910, 29.)

The Huff electrostatic separator has been successfully applied to the solving of many problems connected with the concentration of ores, and the accompanying table shows some of the results obtained:—

Material.	Product.	Per cent.					Oz.	
		Copper.	Iron.	Lead.	Zinc.	Silica.	Gold.	Silver.
Low-grade copper pyrites in quartz	Original	2·56	17·8		—	—	0·01	2·6
	Concentrates	5·63	37·0	—	—	—	0·02	5·5
	Tails	0·10	2·0	—	—	—	trace	0·4
Pyrites and copper pyrites in various gangues	Original	6·37	25·0	—	—	—	—	—
	Concentrates	9·33	36·3	—	—	—	—	—
	Tails	0·14	1·9	—	—	—	—	—
Copper pyrites and bornite in garnet	Original	3·60	18·6	—	—	32·3	—	—
	Concentrates	19·10	25·7	—	—	14·4	—	—
	Tails	0·34	17·6	—	—	36·7	—	—
Zinc, iron, and silver ore	Original	2·61	23·8	13·9	19·4	—	—	52·8
	Concentrates	3·33	30·7	16·4	6·4	—	—	69·0
	Tails	0·91	3·4	2·7	51·8	—	—	4·6
Zinc, lead, and iron middlings	Original	—	20·2	12·6	23·1	5·2	—	—
	Concentrates	—	31·2	21·0	4·0	3·2	—	—
	Tails	—	2·4	0·5	53·8	8·5	—	—

		Per cent.					
		Copper.	Iron.	Lead.	Zinc.	Sulphur.	Silica.
New Mexico concentrates	Original	2·11	16·2	—	29·9	—	12·9
	Concentrates	5·65	37·2	—	4·9	—	6·6
	Tails	0·13	4·2	—	44·9	—	15·9
Zinc from above tailings	Original	—	—	—	—	—	—
	Concentrates	—	—	—	57·1	—	—
	Tails	—	—	—	1·3	—	—
Native copper in sandstone	Original	2·68	—	—	—	—	—
	Concentrates	38·70	—	—	—	—	—
	Tails	0·27	—	—	—	—	—
Pyrites concentration for sulphur	Original	—	—	—	—	30·1	—
	Concentrates	—	—	—	—	44·8	—
	Tails	—	—	—	—	3·0	—
Middlings from Joplin, Mo.	Original	—	10·8	2·5	49·5	—	—
	Concentrates	—	37·4	9·9	2·9	—	—
	Tails	—	1·6	trace	62·3	—	—

—F. Sodn.

Calcium; Efficiency in the electrolytic production of metallic ——. F. C. Frary, H. R. Bicknell, and C. A. Tronson. Amer. Electrochem. Soc., Oct., 1910. J. Ind. Eng. Chem., 1910, 2, 522—524.

The following table shows the efficiency obtained in a series of experiments on the electrolysis of fused calcium chloride with the production of a cathode rod of metallic calcium about 1 cm. in diameter.

Time.	Ampères.	Volts.	Weight.	Efficiency.
Min.			grms.	per cent.
60	74·45	18·3	30·8	55·3
60	73·9	21·4	25·0	45·2
60	74 2	21·0	43·5	78·4
38	73·2	26·0	27·0	77·8
32	73·1	24·4	26·5	90·7
30	71·5	25·5	24·0	89·8
27	70·4	33·0	21·5	90·5
30	69·66	28·0	26·0	100·0
34	52·54	34·0	21·6	97·0
36	68·75	31·0	31·0	100·5

The chloride alone was found to be rather more satisfactory, as to efficiency, than a mixture of chloride and fluoride and to be decidedly easier to manipulate. It is important that the cathode be kept at the proper level, just penetrating the surface of the electrolyte, and that there be no irregularity in the raising of the cathode or in the adding of fresh portions of the electrolyte.—F. Sodn.

Corrosion of metallic food containers. Gudeman. *See* XIXa.

Patents.

Steel; Method of making ——. H. W. Lash, Cleveland, Ohio. U.S. Pat. 978,905, Dec. 20, 1910.

A charge, composed of finely ground iron oxide, carbon, cast iron and possibly manganese dioxide, is smelted with an iron product of high carbon and manganese content. The iron product, which should be low in silicon, may contain 3 to 4 per cent. of combined carbon and about 1 per cent. of manganese.—C. A. W.

Cast-iron waste; Treatment of ——. H. W. Lash, Cleveland, Ohio. U.S. Pat. 978,906, Dec. 20, 1910.

A mixture of cast-iron waste, carbon and manganese dioxide is fused together, the heating being continued until the molten iron is rendered high in carbon and manganese and low in silicon, phosphorus and sulphur.—C. A. W.

Steel; Heat treatment of ——. S. S. Wales, Munhall, Pa., Assignor to Carnegie Steel Co., Pittsburg, Pa. U.S. Pat. 979,113, Dec. 20, 1910.

The steel plate containing different proportions of metalloids in its different parts is heated unevenly, those portions containing the greater proportion being raised to the higher temperature. The plate may be heated to a hardening temperature, quenched and heated at different portions along the length to temperatures ranging between 500° and 700° C., according to the difference in composition produced by segregation.—C. A. W.

Thomas converters; Preparation of bottoms for ——. Soc. Anon. des Forges et Fonderies de Montataire. Fr. Pat. 418,449, July 19, 1910.

A mixture of crushed dolomite with from 4 to 5 per cent. of tar is employed, the bottoms being gradually heated to a temperature of from 300° to 400° C. before use.
—W. E. F. P.

Iron and steel; Process and furnace for the manufacture of ——. M. Davidsen. Fr. Pat. 418,851. Aug. 3, 1910.

In a modified Siemens-Martin process, the regenerative reverberatory furnace comprises two or more separate compartments which are, in turn, traversed by the charge in a direction opposite to that of the flame. Finely pulverised charcoal is employed as the combustible, an intensely hot flame being thereby freely developed above the metallic bath.—W. E. F. P.

Iron, steel, etc., from waste enamelled ware; Process and apparatus for the recovery of ——. T. Goldschmidt. Fr. Pat. 418,971, Aug. 1, 1910. Under Int. Conv., Feb. 11, 1910.

The articles (or scrap) are first subjected to compression for the purpose of cracking the enamel, and cut into strips. By means of appropriately constructed cleavers, the strips are then opened sufficiently to allow of the broken enamel falling away from between the layers.—W. E. F. P.

Rusting or oxidation; Treatment of iron or steel to prevent ——. T. W. Coslett, Birmingham. Eng. Pat. 28,131, Dec. 2, 1909.

The iron or steel is subjected to the action of phosphoric acid in the presence of zinc or a zinc compound. Preferably a dilute acidulated solution of zinc phosphate is employed. In some cases iron phosphate may also be added to the solution. The formation of the protective covering or deposit is hastened by the passage of an electric current through the solution.—H. H.

Filtering apparatus particularly adapted for use in the cyanide process. W. W. Robacher, Rochester, N.Y., U.S.A. Eng. Pat. 16,156, July 6, 1910. Under Int. Conv., May 13, 1910.

A hollow rotary filtering wheel having the sides formed of a rigid porous filtering material is partly immersed in the liquid to be filtered, scrapers being arranged in contact with the walls, above the liquid, to remove the semi-solid material which collects thereon. Radial partitions within the wheel serve to raise the filtrate to the central outlet opening, or a pipe hanging downwards from the axis of the wheel may be employed for the purpose. The material removed by the scrapers may be treated with fresh liquid in an auxiliary tank and refiltered, a series of rotary filters being arranged in steps if prolonged treatment is necessary.—H. H.

Ores; Concentration of oxidised ——. H. L. Sulman and H. F. K. Picard, London. Eng. Pats. 26,019, Nov. 10, 1909; 28,612, Dec. 7, 1909; 29,616, Dec. 17, 1909.

The ore or slime, containing oxidised metallic compounds which are not capable of separation by flotation directly, is treated with a soluble sulphide or with sulphuretted hydrogen. The oxidised particles are thereby coated with a thin layer of sulphide and can now be separated from the gangue by flotation. Similarly, employing a suitable amount of acid, a mixture of oxidised lead and zinc compounds can be separated, the lead only being converted into sulphide whilst the zinc is left behind with the pulp in the subsequent flotation. Moreover, in the absence of acids, the compounds of certain metals (such as copper and lead) appear to be affected before those of others such as zinc. Alternatively, the ore may be heated with a suitable sulphide such as iron pyrites, or with sulphur, and afterwards cooled out of contact with the air, the object in any case being to obtain a superficial sulphidising of the oxidised particles. Finally, it is found that, in order to form the necessary coherent froth, where there is not sufficient finely divided mineral, the presence of some freshly precipitated sulphide (say 5 per cent.) is advantageous, the scum obtained picking up and retaining the particles of natural sulphide ore. Thus in treating a lead ore, a soluble lead salt may be introduced into the pulp together with the soluble sulphide. Carbon in the form of lampblack or finely ground charcoal (2 to 20 per cent.) may be employed to the same end, but the sulphide is usually preferable.—C. A. W.

Concentration of ores. H. L. Sulman, A. H. Higgins, and J. Ballot, London. Eng. Pat. 28,933, Dec. 10, 1909.

The crushed ore is introduced into water, with or without a small percentage of sulphuric acid, and a very small quantity of a terpene product such as spirit of turpentine added. Upon thorough agitation of the mixture, the metalliferous matter floats to the surface in the form of froth. Small quantities of resins, alcohols, phenols, oils, or other frothing agents may be used in conjunction with the turpentine.—H. H.

Metallurgical furnaces; Drying of air supply to ——. J. Bliss, Manchester. Eng. Pat. 28,099, Dec. 2, 1909.

The air is passed through one or more chambers containing revolving plates or discs which dip into a liquid such as brine and so become coated with a film of the liquid. The air is thereby cooled and caused to deposit moisture. —H. H.

Crucible furnaces; Gas-fired and like ——. Fletcher Russell and Co., Ltd., and T. W. Fletcher, Warrington. Eng. Pat. 9940, Apr. 23, 1910.

An annular baffle is arranged between the crucible and the wall of the furnace, the flames being caused to pass in a circuitous course around the crucible, over the top of the baffle, and down through the space between the baffle and the wall of the furnace to the outlet.—H. H.

Electrolytic refining of metals; Arrangement of electrodes for the ——. F. M. Köhler, St. Petersburg. Eng. Pat. 2364, Jan. 31, 1910.

The electrolytic cells are built up of two anode plates of the metal to be refined clamped against two intermediate insulating frames so as to form a box-like structure, the cathode plate being held in a recess between the intermediate frames. Inlet and outlet pipes for the electrolyte enter the frames and are connected to supply and collecting vessels, which are maintained under vacuum if necessary, so that the electrolyte can be kept out of contact with air, thus avoiding difficulties due to oxidation. The cells are placed upon platforms having inlaid conductors arranged in such a manner that the anode and cathode plates make contact therewith. The walls of the intermediate frames may be made transparent or provided with windows so that the colour and appearance of the electrolyte can be observed continuously.—H. H.

Metals; Extracting —— electrolytically. J. H. Robertson, New York. U.S. Pat. 978,211, Dec. 13, 1910.

The powdered ore is subjected, whilst in suspension in an electrolyte, to the agitating effect of a heated vapour or gas, and the metal is simultaneously deposited by means of an electric current upon an electrode capable of being disintegrated or fused by heat.—B. N.

Smelting; Apparatus for electric ——. F. Creelman, New York, Assignor to The Willson Carbide Works Co. of St. Catharines, Ltd., St. Catharines, Canada. U.S. Pat. 978,137, Dec. 13, 1910.

The electric arc furnace is provided with a pair of stationary electrodes, arranged to permit the passage of material between them from above. An outlet is arranged directly beneath the electrodes, and below the opening is a transversely movable receptacle for the molten product. The receptacle comprises a series of conveyer sections, adapted to pass successively beneath the electrodes close to the opening, so as to form a continuous pig from the product. Being immediately beneath the zone of fusion, the product in the receptacle immediately beneath the electrodes is molten, and serves to support the material undergoing reduction in the opening. The actuating mechanism for the receptacle, for withdrawing the product progressively as it is formed, is controlled by the variations in the voltage, and consists of a "pusher" advanced by short steps continuously in one direction, the pusher being adapted to be quickly returned to its starting point. Means are provided for supplying a current of constant amperage, notwithstanding variations in the internal resistance of the furnace.—B. N.

Furnace; Electrometallurgical ——. F. Louvrier, Mexico. U.S. Pats. 978,464 and 978,465, Dec. 13, 1910.

(1). The furnace comprises a furnace body, within which is built up a refining chamber in such a manner as to divide the body into two separate and distinct reduction chambers. Openings are provided in the lower parts of the walls, so as to allow of the flow of reduced metal directly from the bottoms of the reducing chambers to the interior of the refining chamber. A reducing current is passed through the material in the reduction and refining chambers, whilst the passages in the refining chambers are open. Means are provided for closing the openings, and for bridging the closures so that the current may pass thereabout. Suitable arrangements are provided for feeding material to the reduction chambers. (2). The furnace comprises a number of reduction chambers electrically arranged in series, and provided with floors made of a non-electrically conductive material. A "preliminary crucible" communicates with the reduction chambers, and connects them electrically by means of the contained metal. One or more refining crucibles, isolated from the reduction chambers, communicate with the preliminary crucible, and an electric current is passed through the reducing chambers and the preliminary crucible, whilst a separate current is passed through the refining crucibles. Means are also provided for conducting a separate electric current through the preliminary crucible. The material is fed to the reduction chambers, and an arrangement is provided for cutting off the feed of material from one or more of the chambers.—B. N.

Copper; Process of refining ——. W. S. Rockey and H. Eldridge, New York. U.S. Pat. 978,212, Dec. 13, 1910.

The crucible or hearth is constructed of material, such as magnesite, which is refractory to heat and neutral to the flux employed. A predetermined quantity of boron trioxide is fused in the crucible, and a sufficient quantity of silica is added to neutralise the action of the boron trioxide that may be contained in the crucible or hearth. The cathode copper, previously immersed in a hydrocarbon oil, is then added to the fused flux of boron trioxide, and heated in order to melt the metal. The oxides of copper contained in the metal are thus reduced by the action of the hydrogen and carbon in the oil, the impurities in the copper being thus eliminated. The metal is cooled beneath the flux in order to prevent oxidation and the absorption of gases during the cooling period.—B. N.

Metals [copper, etc.]; Process of expelling gases from ——. W. S. Rockey and H. Eldridge, New York. U.S. Pat. 979,204, Dec. 20, 1910.

The copper or copper alloy having been freed from oxide and other impurities, is heated repeatedly above its melting point beneath a molten flux containing boron trioxide. The metal is then cooled to a temperature in the neighbourhood of its melting point and there retained whilst the occluded gases are expelled into the flux. —C. A. W.

Ores; Treatment of fine ——. J. N. Whitman, Philadelphia, Pa., Assignor to M. T. Reynolds, Albany, N.Y. U.S. Pat. 978,971, Dec. 20, 1910.

The fine ore or residue to be agglomerated is moistened and heated until its particles are fused sufficiently to become sticky by reason of the impurities which they contain. The mass in the semi-plastic state is then agitated by rolling.—C. A. W.

Chemical [reduction] process. W. C. Arsem, Schenectady, Assignor to General Electric Co., New York, N.Y. U.S. Pat. 979,363, Dec. 20, 1910.

Pure graphite, obtained in a finely divided condition by heating a carbonaceous deposit from a volatile carbon compound, is mixed with a refractory metallic oxide, such as an oxide of tungsten, which is reduced by heating the mixture in a vacuum, by means of radiant heat or by a resistance conductor insulated from the mixture. —W. C. H.

Alloys of zinc (or tin) and titanium and process for their production. A. J. Rossi, Niagara Falls, N.Y., Assignor to The Titanium Alloy Manufacturing Co., New York. U.S. Pats. 979,393 and 979,394, Dec. 20, 1910.

A zinc-titanium alloy is produced by adding titanic acid, alone or together with zinc oxide, to a molten mixture of zinc and aluminium and subjecting the mass to a temperature sufficient to ensure reduction by means of the aluminium. Similarly, by the employment of tin and tin oxide in place of the zinc, a tin-titanium alloy can be obtained.—C. A. W.

Zinc ; Treatment of sulphurised minerals containing ——. Comp. des Mines d'Aïn-Barbar. Fr. Pat. 418,996, Aug. 5, 1910.

The patent relates more particularly to certain complex sulphide ores containing zinc, copper and precious metals, and consists in treating the raw or partly roasted mineral in a converter having an additional lining of coke dust or other combustible, the quantity of the latter being proportional to the amount of zinc present. The bessemerisation proceeds without the addition of flux and results in the production of zinc oxide and a matte containing the bulk of the copper and precious metals. Before tapping, iron pyrites is added for the purpose of cleaning the slag. —W. E. F. P.

Manganese minerals : Process for the preparation of ——, and new products resulting therefrom. Cöln-Müsener Bergwerks-Actien-Verein. Fr. Pat. 419,144, Aug. 10, 1910.

The minerals are heated, by means of blast-furnace gases, in closed vessels (such as retorts or rotatory pipes), the oxygen evolved being collected and compressed. The residue may be smelted as usual for the production of ferro-manganese, or made into briquettes constituting the new products for which claim is made.—W. E. F. P.

Alloys of low specific weight ; Manufacture of ——. W. Rübel, Berlin. Eng. Pat. 28,608, Dec. 7, 1909.

See Fr. Pat. 407,814 of 1909 ; this J., 1910, 636.—T. F. B.

Metals ; Extraction of —— from their ores. W. Hommel and H. T. Durant, London. Eng. Pat. 28,611, Dec. 7, 1909.

See Fr. Pat. 417,208 of 1910 ; this J., 1911, 34.—T. F. B.

Alkali metals ; Manufacture of ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 29,795, Dec. 20, 1909.

See Fr. Pat. 416,926 of 1910 ; this J., 1910, 1393.—T. F. B.

Sodium ; Apparatus for carrying out the electrolytic production of ——. P. L. Hulin, Grenoble. Assignor to Soc. d'Electro-Chimie, Paris. U.S. Pat. 978,888, Dec. 20, 1910.

See Eng. Pat. 6063 of 1910 ; this J., 1910, 885.—T. F. B.

Smelting furnaces ; Electric induction ——. A. Hiorth, Christiania. Eng. Pat. 12,214, May 18, 1910. Under Int. Conv., May 22, 1909.

See Fr. Pat. 416,079 of 1910 ; this J., 1910, 1394.—T. F. B.

Furnaces ; Tilting ——. L. Canda, Paris. Eng. Pat. 13,317, June 1, 1910. Under Int. Conv., Dec. 21, 1909.

See Fr. Pat. 410,478 of 1909 ; this J., 1910, 828.—T. F. B.

Furnace for roasting ores. X. de Spirlet, Brussels. U.S. Pat. 979,349, Dec. 20, 1910.

See Fr. Pat. 415,338 of 1910 ; this J., 1910, 1392.—T. F. B.

Iron and steel ; The hardening of ——. G. Daehritz, Niederwalluf, Germany. Eng. Pat. 15,984, July 4, 1910.

See Fr. Pat. 418,029 of 1910 ; this J., 1911, 33.—T. F. B.

Steel ; Manufacture of ——. A. Reynolds, London. U.S. Pat. 979,337, Dec. 20, 1910.

See Eng. Pat. 28,030 of 1906 ; this J., 1908, 26.—T. F. B.

Liquid amalgam ; Process for making a ——. H. P. Ewell. Fr. Pat. 418,371, July 19, 1910.

See U.S. Pat. 969,853 of 1910 ; this J., 1910, 1210.—T.F.B.

Metallic compounds ; Process for separating —— from complex ores, mattes, residues, and other metalliferous substances. A. McKechnie and F. G. Beasley. Fr. Pat. 418,381, July 19, 1910. Under Int. Conv., Dec. 14, 1909.

See Eng. Pat. 29,287 of 1909 ; this J., 1910, 1391.—T. F. B.

Zirconium, titanium, thorium, cerium, vanadium, uranium, chromium, tungsten, and molybdenum ; Process for extracting pure —— from their oxides by means of metallic calcium. H. Kuzel and E. Wedekind. Fr. Pat. 419,043, Oct. 15, 1909.

See Eng. Pat. 23,215 of 1909 ; this J., 1910, 1255.—T. F. B.

Artificial stone from melted slags. Fr. Pat. 418,862. *See* IX.

XI.—ELECTRO-CHEMISTRY.

Patents.

Furnace ; Electric ——. F. von Kügelgen, Holcombs Rock, Va., and G. O. Seward, East Orange, N.J., Assignors to Virginia Laboratory Co., New York. U.S. Pat. 978,171, Dec. 13, 1910.

The reverberatory electric furnace comprises a furnace chamber, provided with electrodes, and a removable closed top, consisting of a hollow hood covering the chamber. The hood contains a non-conducting lining having a cavity extending upwards and of sufficient height to enclose and retain a substantially inert gaseous body, the latter being of sufficient thickness to serve as a heat shield and thus protect the lining of the cavity from fusion.—B. N.

Furnace ; Electric —— with recharger mounted on the chamber. A. Helfenstein. Fr. Pat. 418,567. July 25, 1910. Under Int. Conv., July 27, 1909.

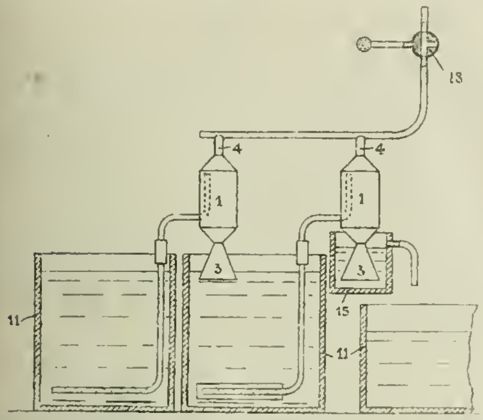
The charging arrangement is mounted on the chamber of the furnace, the outfall of the recharger occupying the whole of the length or breadth of the chamber. Breast-walls are disposed along the length of this outfall, these being carried by the walls of the furnace, and serve as supports to the arches of the chamber and the recharger. The material as it sinks down from each breast-wall forms a cone, and at each side a collecting chamber for the gas. The escape pipes for the gas are placed at the extremities of these chambers, and the latter may be enlarged in the direction of the escape pipes.—B. N.

Furnace for carrying on chemical reactions, especially in gaseous mixtures, by the use of an arc moving in a magnetic field. H. Albihn. Ger. Pat. 228,755, Jan. 14, 1908.

The electrodes have the form of closed geometrical lines, *e.g.*, they are ring-shaped, enclosing an axial hollow space, in which the magnet coil is placed, whereby a uniform distribution of the magnetic field is obtained with very short paths for the lines of force. It is claimed that with this arrangement, very small furnaces of large capacity can be constructed.—A. S.

Electrolytic baths ; Apparatus for the circulation of the liquid in ——. C. Gabrielli. Ger. Pat. 224,907, Oct. 22, 1909.

The apparatus which is for the purpose of transferring the electrolyte from each cell to the next of a series is shown in the accompanying figure. The receptacle, 1, can be connected, by means of the three-way tap, 18, either with a suction device, or with the air. When it is connected with the suction device, liquid is drawn from the cell, 11, into 1, a valve in 3 becoming automatically closed. When 1 is full, a valve in 4 closes; the tap, 18, is then turned so as to open communication with the air, whereupon the valve in 3 opens, and the liquid in 1 flows either into the next cell, 11, or into an intermediate receptacle, 15.—A. S.



Electric resistance furnaces; Methods of and means for charging ——. A. Petersson, Odda, Norway. Eng. Pat. 6035, March 10, 1910. Under Int. Conv., June 2, 1909.

See Fr. Pat. 414,296 of 1910; this J., 1910, 1212.—T. F. B.

Furnaces; Electric ——. J. Thomson, New York. Eng. Pat. 15,169, June 23, 1910. Under Int. Conv., Sept. 1, 1909.

See U.S. Pat. 950,882 of 1910; this J., 1910, 436.—T. F. B.

Furnace: Electric ——. C. Féry and C. Langlet, Paris. U.S. Pat. 978,146, Dec. 13, 1910.

See Fr. Pat. 363,437 of 1906; this J., 1906, 854.—T. F. B.

Furnaces; Electric ——. Imbert Process Co. Fr. Pat. 418,693, May 11, 1910. Under Int. Conv., May 13 and Sept. 1, 1909.

See U.S. Pats. 950,877 to 950,882, 950,904, 950,905, and 951,086; this J., 1910, 436.—T. F. B.

Electrolysis of aqueous solutions; Process for the continuous ——. A. Pietzsch, Triberg, Germany, and E. Steinbuch, Monthey, Assignors to Soc. of Chem. Industry in Basle, Switzerland. U.S. Pat. 978,934, Dec. 20, 1910.

See Fr. Pat. 408,565 of 1909; this J., 1910, 638.—T. F. B.

Electrical element. A. T. K. Estelle and K. W. H. Evers, Assignors to Nya Ackumulator Aktiebolaget Jungner, Fliseryd, Sweden. U.S. Pat. 979,064, Dec. 20, 1910.

See Eng. Pat. 7338 of 1909; this J., 1910, 98.—T. F. B.

Electric arcs; Process for producing ——. Badische Anilin und Soda Fabrik. Fr. Pat. 418,892, Aug. 4, 1910. Under Int. Conv., Aug. 6, 1909.

See Eng. Pat. 22,715 of 1909; this J., 1910, 1167.—T. F. B.

Obtaining oxides of nitrogen from the air. Ger. Pat. 228,849. *See* VII.

Electrolytic process for preventing the fermentation of wines, musts, etc. Fr. Pat. 418,486. *See* XVIII.

Improving wines, spirits, and liqueurs. Fr. Pat. 419,143. *See* XVIII.

XII.—FATS; OILS; WAXES.

Tomato-seed oil. P. Accomazzo. L'Ind. Chimica, 1910, 10, 360—361. (See also this J., 1908, 1072; 1910, 1031.)

The manufacture of tomato preserves is an important industry in Italy, and the author discusses the question of utilising the residue for the manufacture of tomato-seed oil. The exports of tomato preserves from Italy have a value of more than Lire 13,000,000 (£516,000) per annum, whilst the domestic consumption is probably twice as great. According to statistics published by the Chamber of Commerce of Parma, in this province alone, about 850,000 quintals (83,660 tons) of tomatoes are treated per annum, yielding a residue of 120,000—130,000 quintals (11,810—12,795 tons), composed of skins and seeds and a large proportion of water (up to 80 per cent.). The water-content can be reduced to 30—35 per cent. by simple pressing, or to 10—12 per cent. by utilising waste heat available in the preserve-factory. After removal of the greater part of the water, the residue amounts to 40,000—42,000 quintals (3940—4140 tons), of which 10,000—12,000 quintals (985—1180 tons) correspond to skins and the remainder to seeds. Special tests showed that tomato-seeds yield 18 per cent. of oil on cold pressing and 20 per cent. by extraction, so that it would be possible to recover 5000—6000 quintals (490—590 tons) of oil from the residue mentioned. The oil has the sp. gr. 0·920, saponification value, 184; iodine value, 118. It has rather pronounced drying properties and would probably be useful as an ingredient of oil varnishes, and as a burning oil.—A. S.

Tung oil; Drying properties of ——. Meister. Chem. Rev. Fett-Ind., 1911, 18, 1—2.

The maximum absorption of oxygen in the drying of tung oil takes place at a later period than in the case of linseed oil, and the rapid formation of a skin upon the former must be attributed, not to the drying process, but in all probability to a polymerisation process similar to that which occurs in the well-known "gelatinisation" of the oil. Although a skin is formed upon raw tung oil within one or two days, it is soft and non-elastic, and not until after 5 or 6 days does it become firm like linoxyn. It is, therefore, incorrect to regard tung oil as possessing more rapid drying powers than linseed oil. From 125 to 145 hours are required for tung oil to absorb its maximum amount of oxygen, whereas from 80 to 120 hours may be regarded as the normal period for the drying of raw linseed oil.—C. A. M.

Poisonous substances in vegetable butters and fats. Hertkorn. *See* XIXa.

Patents.

Emulsions in water; Process of transforming substances soluble in alcohol into ——. S. Knopf, Vienna. U.S. Pat. 978,307, Dec. 13, 1910.

See Eng. Pat. 17,523 of 1907; this J., 1908, 693. A solution of naphthalene in petroleum is employed in place of the petroleum alone.—T. F. B.

Medicinal soap: Manufacture of ——. F. Fattinger, Treibach, Austria. Eng. Pat. 11,953, May 13, 1910.

Lithium compounds are used to replace either partially or entirely the potassium or sodium compounds used for the saponification, or lithium soaps or salts, such as the chloride, may be added to the soap produced in the usual way. The formation of the lithium soaps may be promoted by the addition of a solvent for fats (*e.g.* alcohol) as in the case of other soaps.—C. A. M.

Glycerin [polyglycerin]; Method of treating ——. S. H. Fleming, Camden, N.J., Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. N.J. U.S. Pat. 978,443, Dec. 13, 1910.

The glycerin is mixed with a condensing agent and heated under a pressure less than that of the atmosphere in order to effect polymerisation or condensation.—C. A. M.

Catalytic reduction of organic substances [*oleic acid, etc.*]. F. Bedford and C. E. Williams. Fr. Pat. 418,385, July 18, 1910. Under Int. Conv., July 21, 1909.

See Eng. Pat. 3752 of 1910 : this J., 1910, 1396.—T. F. B.

Washing [*soap*] *tablets and processes for making the same.* F. Boehm, Offenbach on Maine, Germany. Eng. Pat. 14,285, June 13, 1910.

See Fr. Pat. 417,139 of 1910 ; this J., 1910, 1397.—T.F.B.

Converting liquids of all kinds, extracts, balsams, fats waxes, etc., into impalpable powder. Ger. Pat. 229,141. *See* I.

Viscosity meters. Eng. Pat. 22,961. *See* XXIII.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Patents.

White lead ; Apparatus for making —— . F. H. Ludington, J. P. Marshall and L. C. Besson, St. Louis, Mo. U.S. Pat. 978,122, Dec. 6, 1910.

Metallic lead is atomised and converted into a sludge, which is passed through a hopper into a rotary oxidising chamber containing air and water, where the lead is oxidised. The oxide sludge is conveyed into a storage tank, the unoxidised lead being removed in transit, and thence to a carbonating tank in which it is agitated in contact with carbon dioxide. The carbonate passes through a screening device into a heated drying mechanism, from which, when dry, it is removed by scrapers, and passed through a cooling apparatus into the case or other receptacle in which it is placed on the market.—E. W. L.

Paints ; Preservative ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated July 13, 1910 (Under Int. Conv., July 19, 1909), to Fr. Pat. 403,103, May 17, 1909 (this J., 1910, 33).

Oxymercuric salts or anhydrides of phenols or arylamines or their sulphonic acids may be used in the preparation of these paints.—C. A. M.

Zinc ores ; Direct treatment of poor ——, *by a wet process, for the production of zinc white* (*oxide or sulphide*). J. Dantin and A. Thibal. Fr. Pat. 418,464, July 20, 1910.

The roasted ore, mixed with water, is treated with sufficient hydrochloric acid to dissolve all the zinc present. The solution is then decanted and allowed to remain in contact with a new charge of roasted ore for several hours, to effect the precipitation of the bulk of the iron by means of the excess of zinc oxide ; after decantation of the solution, the residue is treated with fresh hydrochloric acid, as above. The iron remaining in the solution is precipitated (together with a little of the zinc) by the addition of a small quantity of water saturated with hydrogen sulphide ; and, after filtration, the liquid is further treated with this reagent, in the gaseous form, in vessels connected in series and each containing a quantity of chalk for the purpose of neutralising the acid liberated by the reaction. The precipitated zinc sulphide is separated by ordinary means and converted to oxide by roasting, if required. The hydrogen sulphide employed is generated from sulphide ores and hydrochloric acid, the zinc being ultimately recovered from the solutions in the manner described.—W. E. F. P.

Non-oxidisable paint ; Manufacture of ——. The Universal Smoke Separating Co. Fr. Pat. 418,898, July 30, 1910.

Lampblack, or other form of carbon produced by incomplete combustion, is incorporated with boiled oil, a varnish or other drying agent, and a non-volatile solvent.—C. A. M.

Compositions for coating hulls of ships. Fabr. de Vernis et Prod. Chim. Fr. Pats. 419,005 and 419,006, Oct. 14, 1909.

(1). Anhydrous copper sulphate and metallic copper powder are incorporated with a waterproof varnish in the proportions calculated to yield cuprous chloride, which will have a destructive action upon marine fauna and flora. Or the copper sulphate may be replaced by cupric chloride, and the latter should be used in compositions for ships sailing in fresh water. (2). In the production of waterproof varnish for the hulls of ships, an amalgam of zinc, tin or other metal may take the place of the copper amalgam claimed in Fr. Pat. 396,764 of 1908 (this J., 1910, 577). Or the amalgams may be replaced by two metals in the form of powder, which are suspended in the varnish in such a manner that when liberated by the action of molluscs, etc., they form a galvanic couple. Metals that may be used for this purpose include copper and zinc, copper and tin, zinc and iron, etc.—C. A. M.

Artificial shellac ; Manufacture of ——. E. Noa. Fr. Pat. 419,061, Aug. 8, 1910.

A material which can take the place of shellac for polishes and can be employed in the production of plastic objects is obtained by heating together phenol and starch paste, boiling the mixture with dilute nitric acid, and adding to the solution stearine, resin, formaldehyde, and a mineral acid. The liquid is boiled until thickened, and the resulting solid product is treated with chlorine, washed with water containing ammonia, dried, and fused, or moulded in hot water into various shapes.—C. A. M.

Varnish ; Infusible insulating —— *for electrical construction, the wrapping of conducting wires and cables and other applications.* Debauge et Cie. Fr. Pat. 418,347, Sept. 24, 1909.

Cellulose acetate is dissolved in tetrachloro-ethane and pyridine, the latter, though indifferent as a solvent, neutralising the acetic acid which may be formed from the cellulose ester. The proportions of the latter may be varied according to the viscosity to be obtained, with a greater amount of cellulose acetate, the varnish being suitable for replacing gum-lac in the windings of motors, dynamos, etc. The viscosity may be increased by the addition of hexachloro-ethane or of aldehydes of the terpene series to the solvent. The varnish may be used for the impregnation of various textile materials used for wrapping wires and cables, and for separating the sheets of tin foil in the making of electric condensers.—B. N.

Zinc sulphide ; Method of manufacturing dehydrated ——. H. W. de Stucklé, Dieuze, Germany. Eng. Pat. 9391, April 18, 1910. Under Int. Conv., Sept. 6, 1909.

See Fr. Pat. 418,124 of 1910 ; this J., 1911, 38.—T. F. B.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Rubber latex : Experiments with a new —— [*Cacaloxuchitl*]. F. Kaye. India-Rubber J., 1910, **40**, 903—907. (See also this J., 1910, 288.)

Three species of *Plumeria*, viz. *rubra*, *acutifolia*, and *mexicana* are probably included under the name *cacaloxuchitl*. The plants occur in Central and Southern Mexico at elevations of 500—7000 ft., flourish best in sandy loam full of rocks and pebbles, number from 20 to 175 per acre, and have an average height of about 12 feet and a girth of 6 to 18 inches at 3 feet from the ground. Tapping would therefore be practically impossible, but rubber might readily be obtained by suitable mechanical and other treatment of the young, soft branches. The sample of latex examined (two days' journey from its source) contained about 12 per cent. of spontaneously coagulated rubber, which when dry was soft, somewhat resinous, and deficient in strength. When boiled with water 29 per cent. of soluble resins, nitrogenous and other substances was removed. The acetone extract of the unboiled rubber amounted to 9 per cent. When boiled with alcoholic potash it lost 40 per cent. The latex was white and did not darken on exposure to air. The rubber obtained from it was very pale in colour. The acidity of the latex expressed as acetic acid was 0·352 grm. per 100 c.c.; ash 2·54 grms. per 100 c.c.; sp. gr. 1·030 (1·0234—1·0344). The author finds that for a given tree the higher the sp. gr. of the latex, the more rubber is obtainable from it. The dried coagulated rubber having a lower specific gravity than water, it follows either that the rubber in the latex must be in a different state of aggregation from that of the coagulated product, or that there is a quantitative relationship between rubber content and the amount of nitrogenous and other constituents present in the latex. The latex is readily coagulated by boiling with ten times its volume of water; not quite so readily when the dilution is only 5 : 1. Coagulation is accelerated by addition of small quantities of acids (*e.g.*, tannic, acetic and sulphuric acids), mercuric chloride, sodium chloride, magnesium sulphate and lead acetate. The tannic acid coagulum is pale violet and darkens considerably on drying. Experiments were made to determine the amount of acid absorbed on coagulation, by titrating the serum after removal of the clot; it was found that the amount of sulphuric acid used up is proportional to the amount of latex coagulated, and also that acetic acid has about twice the coagulative power of sulphuric acid in this particular latex. The amount of resin in the rubber varies somewhat with the nature of the coagulant employed, as indicated in the following:—

Coagulant.	Character of rubber.	Resins in dry rubber.
		per cent.
1. Acetic acid........	Glass clear—fairly good	22·9
2. Tannic acid	Violet-coloured, darker by reflected light. Rather stronger than No. 1...............	20·5
3. Sulphuric acid	Glass clear—good..	18·0
4. Mercuric chloride ..	Pale-brown colour .	21·1

In a second series of experiments the rubber prepared with acetic acid contained 30, that with tannic acid 27, and that with sulphuric acid 24·5 per cent. of resin. Generally speaking while cacaloxuchitl rubber is remarkably clean and often colourless, it is deficient in strength and elasticity.—E. W. L.

Castilloa latex; Colouration and tackiness of ——. F. Kaye. India-Rubber J., 1910, 40, 755—756, 831—833.

The sample of latex employed was light-brown in colour, strongly acid to litmus, and its acidity, with phenolphthalein as indicator, was equivalent to 0·384 grm. of acetic acid per 100 c.c. of latex; ash, 1·14 grm. per 100 c.c., and sp. gr. 1·01347. The coagulum, produced by addition of alcohol or acetone, when filtered off and allowed to dry till the following day, was very dark on the outside, but grey inside. Most of the colouring matter was soluble in water, and the solution gave a dirty greenish colouration with ferric chloride. When sodium carbonate was added to the greenish solution, violent effervescence occurred, a precipitate was formed and a faintly reddish violet solution produced. From these and other facts the author concludes that the oxidation, or the hydrolysis, of a substance, present in the latex of *Castilloa elastica*, which in alkaline solution gives dark colourations, effects the coagulation either by its hydrolysis or by its oxidation modifying its chemical association with the caoutchouc globules, or by, or together with, the acidity produced by its own oxidation as well as the oxidation of other components of the latex. The conclusion is also drawn that many of the colouration effects in latices and in the rubber produced from them are due to phenolic derivatives from the proteins. Although peroxydase has been found in *Castilloa* latex, the darkening of the raw rubber is not due entirely to enzymic action. The colouration is often probably due to the fact that there are several different basic constituents of the nitrogen compounds of the latex which are so readily oxidisable that, if free, darkening immediately results when in contact with air or with oxidising substances, and that these may be incorporated in the rubber by coagulation. The author also finds that a minimum percentage of resins (9·3 per cent.), in the rubber is obtained by diluting *Castilloa* latex with 5 parts of boiling distilled water, and then boiling, and concludes that complete hot-water cleansing is the key to the solution of the problems of coloured rubber and high resin-content in *Castilloa*.—E. W. L.

Latex of Ficus elastica; Coagulation of ——. E de Wildeman. Caout. et Gutta-percha, 1910, 7, 4665—4666.

The author gives an account of work by C. W. Weijs ("Cultuurgids," 1910, June 15) on the coagulation of the latex of *F. elastica* on Java plantations. The methods of heating, beating, and churning have not given very satisfactory results, and this is true, also, of the methods of evaporation to dryness, and the addition of "purub." All the methods tried are slow, some of the more dilute latices requiring two days for complete coagulation. It has been found, however, that by working at first with a very small quantity of latex, ¾ to 1 litre, stirring it rapidly in a zinc vessel with a wooden paddle, and rubbing it against the walls of the vessel, a much more rapid coagulation is effected, and that once this small quantity of latex has been coagulated, the addition of a portion of it to fresh latex brings about a much more rapid coagulation than would otherwise be the case. For the preliminary beating process the thickest latex is selected; coagulation is complete in from 2 to 15 minutes; this coagulum is called "Mintah Bibit" by the natives. By the use of this method it is possible to coagulate in half a day a quantity of latex which, working under the older conditions, would have required a day's beating, followed by the application of heat on the second day. The product, after passing the washing rolls, forms whitish, translucent, highly elastic sheets, which develop a brownish tinge on drying. —E W. L.

Rubber; The so-called coagulation of ——. E. Fickendey. Z. Chem. Ind. Kolloide, 1910, 8, 43—47.

The separation of rubber from the latex is not a process of coagulation in the usual sense of the word, and the author favours the adoption of the term coalescence ("*Koalisation*"). Rubber latices are emulsions, the stability of which is due to the presence of protective colloids (proteins or peptones). Coalescence of the rubber globules can be induced by mere dilution with water, by which the concentration of the protective colloids is reduced to such an extent, that they can no longer prevent the coalescence of the globules of rubber (compare Kinzelbach and Zimmermann, this J., 1909, 945); or by addition of substances which precipitate the protective colloids or otherwise render them inactive. The author has previously shown (this J., 1909, 1148) that the protective substances in *Kickxia* latex are peptones, and if freshly separated rubber cream from *Kickxia* latex be shaken vigorously with peptone solution, a stable emulsion can be produced. An analogous result is obtained by shaking rubber cream from *Castilloa* latex with a solution of albumin. These facts show that the separation of the rubber cream (the first phase of coalescence) is a reversible process. That the stability of rubber latices is due to the protective colloids they contain is borne out by the fact that substances which cause the separation of rubber in latices containing proteins, are all protein-precipitants, whereas in the case of latices, such as *Kickxia* latex, where the protective colloids are peptones, peptone-precipitants and not protein-precipitants are effective. Formalin for example acts as a preservative of latices containing proteins, because it hinders the precipitation of the latter, whilst in the case of *Kickxia* latex it precipitates the peptones and hence causes separation of the rubber. The second phase of the coalescence, the conversion of the liquid globules into elastic rubber, is generally regarded as a process of polymerisation although this has not been demonstrated experimentally. The transformation proceeds without any evolution of heat, and with no appreciable change of volume. The author is unable to confirm Schidrowitz's statement (this J., 1909, 6) that the globular form persists even in the elastic rubber. It appears that liquefaction, or destruction of the globular form precedes the transformation of the liquid rubber into the elastic modification.—A. S.

Rubber ; Direct determination of —— in vulcanised rubber articles. G. Hübener. Chem.-Zeit., 1910, 34. 1307—1308, 1315—1316.

Experiments are described which show that, in carrying out a rubber determination according to the author's bromide process (this J., 1910, 364 ; 1909, 803), (1) the presence of substitutes does not affect the bromine-titration owing to the formation of an insoluble bromine derivative, neither does it interfere with the estimation of the sulphur of vulcanisation, since the whole of the sulphur present in the substitute passes into the filtrate from the rubber bromide, and is estimated as "free" sulphur ; (2) gutta-percha and balata do not form insoluble bromides under the conditions of the experiment, and are therefore not estimated as rubber ; (3) the sulphur of sulphides and sulphates, with the sole exception of barium sulphate, is estimated as "free" sulphur and the presence of these compounds does not appreciably affect the determination of the sulphur of vulcanisation. By employing a method of total sulphur determination which leaves the barium sulphate unaltered (*e.g.*, oxidation with nitric acid followed by oxidation with bromine and water), the presence of barium sulphate may be ignored as affecting the determination of vulcanisation sulphur ; (4) the rubber present in the form of reclaimed rubber and ground waste is estimated with the fresh rubber. (1) *Influence of substitutes.* The mixing employed was composed of fine Para, 35 ; substitute, 55 ; sulphur, 6·5 ; and barium sulphate, 3·5 per cent. The material was subdivided on a sharp file, and 0·1 grm. was heated with a little water in a 400 c.c. Erlenmeyer flask until thoroughly wetted ; the volume was then made up to 150—200 c.c. with cold water, about 5 c.c. of bromine were added, and the flask was gently heated until most of the bromine was volatilised, the last traces being driven off by heating more strongly. The clear liquid was decanted through a filter, and the solid in the flask crushed in order to ascertain whether the whole of the original sample had been acted upon. If not, the treatment with bromine was repeated. The solid matter was then rinsed on to the filter, washed with hot water, transferred again to the flask with the filter paper and decomposed by heating with 20 c.c. of nitric acid (sp. gr. 1·48) and 25 c.c. of $N/10$ silver nitrate solution. The excess of nitrate was titrated back with ammonium thiocyanate, using iron alum as indicator. The rubber corresponding with the amount of bromine liberated under these conditions was calculated in the usual way and amounted to 31·28 per cent. on the original. The "free" sulphur, determined in the filtrate from the rubber bromide, was 5·22 per cent. and the total sulphur including sulphur in substitute, but not the sulphur in barytes, was 7·30 per cent. The sulphur combined with rubber was therefore 2·08 per cent., and the rubber corresponding with this—from the formula $C_{10}H_{16}S_2$—was 4·40 per cent. Hence the total rubber found was 35·68 per cent. (2) *Influence of gutta-percha and balata.* The mixing employed consisted of fine Para, 40 ; balata, 20 ; gutta-percha, 10 ; sulphur, 5 ; and magnesia usta 25 per cent. The rubber found as bromide was 36·04 per cent. and as sulphide 4·95 per cent., giving a total of 40·99 per cent. (3) *Influence of sulphur-containing compounds.* Three mixings were employed in this connection :—(*a*) fine Para, 40 ; substitute, 20 ; lithopone, 20 ; sulphur 4, ; litharge, 5 ; golden sulphide, 8 ; and rosin oil, 3 per cent. Rubber found as bromide, 35·36 per cent., as sulphide 4·35 ; total 39·71 per cent. In this case, also, the sulphur present as barium sulphate in the lithopone employed was subtracted from the total sulphur as found by Henrique's method before subtracting "free" sulphur in order to obtain sulphur of vulcanisation. The sulphur in the substitute, the lead sulphide, and the antimony sulphide, is all included under the heading "free" sulphur, determined in the filtrate from the bromination. (*b*) Rubber, 15 ; whiting, 32 ; sulphur, 5 ; gutta-percha, 10 ; balata, 5 ; substitute, 10 ; asbestos powder, 10 ; litharge, 10 ; and *magnesia usta*, 3 per cent. Rubber found as bromide, 12·92 per cent., as sulphide, 2·46 per cent. ; total, 15·38 per cent. (*c*) Para, 50 ; gypsum, 10 ; sulphur, 10 ; substitute, 30 per cent. Rubber found as bromide 46·58 per cent., as sulphide 4·5 per cent. ; total, 51·08 per cent. In this case the calcium sulphate passed almost if not quite quantitatively into the bromination filtrate. (4) *Influence of reclaimed rubber.* The mixing employed was as follows :—rubber, 20 ; reclaimed, 13 ; sulphur, 5 per cent., the other ingredients being balata, substitute, tar, French chalk, litharge, magnesia usta, lime, and lampblack. Rubber found as bromide, 25·50 per cent. To determine the rubber in the reclaimed employed, a mixing of reclaimed, 60 ; sulphur, 10 ; and substitute, 30 per cent. was made and vulcanised. The rubber found in this as bromide was 28·56 per cent. ; as sulphide, 4·5 per cent. ; total, 33·06 per cent. Hence the reclaimed rubber contains 55·10 per cent. of rubber, and 13 parts contain 7·16 parts of rubber. Subtracting this from the 25·50 per cent. found in the original mixing we have 18·34 per cent. rubber present apart from the reclaimed rubber used, and without estimating the "sulphide" rubber, a result which is quite comparable with those obtained in the other cases. The influence of rubber resins has not yet been fully studied, all the mixings being made with Para rubber.—E. W. L.

Cold vulcanisation. B. Bysow. Z. Chem. Ind. Kolloide, 1910, 8. 47—48.

Three sulphur chloride preparations were made by distilling the commercial product, collecting the fraction coming over at 136°—138° C., and dissolving different quantities of sulphur in portions of this. The three preparations contained : (1). 51·09 per cent. of chlorine and 48·91 of sulphur ; (2), 46·40 of chlorine and 53·60 of sulphur ; and (3). 34·35 of chlorine and 65·65 of sulphur. Solutions of 5 grms. of each in 1 litre of dry petroleum spirit were then used for vulcanising pieces of sheet Para rubber (see this J., 1910, 770), and the vulcanised samples extracted with acetone and analysed. The results were as follow :—

	I.	II.	III.
	per cent.	per cent.	per cent.
Sulphur	0·88	1·12	1·22
Chlorine	0·63	0·50	0·39

They show that Weber's theory according to which, in cold vulcanisation, the fixation of sulphur is dependent upon the extent to which the chlorine combines with the rubber, and the quantity of sulphur fixed is governed by the amount of heat generated by the combination of chlorine with the rubber, is untenable.—A. S.

Indiarubber production in 1910. S. Figgis and Co., London. Jan. 3, 1911. [T. R.]

The world's supply of rubber in 1910 amounted to 70,000 tons (all of which was consumed) against 69,000 tons in 1909. About 750,000 acres are now under rubber cultivation in the East, and about 100,000 in Mexico, Nicaragua, and Honduras. Exports of rubber from Brazil and Bolivia were 40,500 tons in 1910, against 42,000 tons in 1909 ; about 8000 tons of guayule rubber was exported from Mexico last year. Exports from Ceylon and India amounted to 1430 tons, from Malaya to 6800 tons, and from the West African coast about 14,800 tons.

Imports, etc., of all kinds of rubber into England were :—

	Imports.	Deliveries.	Stock, Dec. 31.
	Tons.	Tons.	Tons
1910	32,659	29,980	5231
1909	24,563	24,225	1848
1908	21,611	23,369	1510

Imports of Parà (Manaos) rubber into England were 12,433 tons in 1910, 10,179 tons in 1909, and 11,006 ton in 1908; and of Peru (cauchu), 5577 tons in 1910, 4630 in 1909, and 4310 in 1908. 6598 tons of East India and Malay plantation rubber were imported into England last year, against 3607 tons in 1909 and 1668 tons in 1908.

PATENTS.

Rubber; Artificial production of ——. A. A. W. Grist, London. Eng. Pat. 28,613, Dec. 7, 1909.

THE process consists in subjecting "pure tar" to the action of a ferment obtained from virgin rubber. The ferment is prepared by cutting up virgin rubber, unsmoked and unvulcanised, into small pieces, heating it with about five times its weight of an animal or vegetable oil (*e.g.*, cod-liver oil) for some days on a water-bath at 40°—50° C., mixing the product with water (equal in amount to half the quantity of oil taken) agitating the mixture and heating it for a further 10 hours if necessary, then allowing it to stand in an upright vessel for a week or a fortnight, when the ferment is precipitated at the junction of the liquids, and can be separated from them. The tar is freed from ammonia by agitation with dilute acetic acid, and may be further treated with a mixture of an extract of Panama (*Quillaya Sap.*) wood and an alcoholic solution of phosphoric acid mixed with benzine. The tar thus treated is placed in a shallow dish, and left in a stove in contact with oxygen for at least 10 hours. The ferment, emulsified in benzine, is then added, the stove closed, a slow current of oxygen passed through it, and the temperature kept at 45° C. until the mass begins to liquefy slightly. It is then removed, and the liquid portion is poured off, and mixed with carbon bisulphide. The rubber is recovered from this solution either by distillation, or by diluting it with its own weight of benzine, and adding a similar quantity of pure alcohol, when the rubber is precipitated as a whitish coagulum which is stated to have industrial properties not inferior to those of the best natural rubber.—E. W. L.

Rubber and the like; Substitute for ——. A. R. van der Burg, Schiedam, Holland. Eng. Pat. 16,758, July 13, 1910.

100 parts by weight of Chinese or Japanese wood-oil, and 15 parts by weight of rosin oil are heated together until a temperature of about 260° C. is attained, and the mixture is kept at that temperature until a plastic mass—which when cooled has the elasticity and resiliency of rubber—is formed. The time necessary is generally about half-an-hour. During cooling air is excluded from the mass as far as practicable. The proportions of the two oils may be varied, in order to obtain a harder or a softer product. —E. W. L.

Vulcanised rubber waste; Apparatus for use in and process for reclaiming ——. C. S. Heller, Barberton, Ohio, Assignor to the Moore Architectural and Engineering Co., Akron, Ohio. U.S. Pats. 978,583 and 978,584, Dec., 13, 1910.

THE apparatus consists of a vertical jacketed heater, with a conical bottom, inside which is suspended, at a short distance from the bottom, a smaller conical vessel open at the top, and the sides of which are approximately parallel with the inside walls of the conical bottom of the heater. From the conical end of the heater a pipe leads downwards, and then bending upwards, passes again into the heater through the side wall, and downwards into the hollow conical inner vessel. In the circuit of this pipe is provided a means for producing a current of liquid upwards from the smaller conical vessel, through the pipe, and back to the heater at the conical end, where it passes between the inner walls of the heater and the outer walls of the conical vessel, flowing into the latter again. By this means the liquid contents of the vessel are kept in continuous motion between the two conical surfaces, which serve as electrodes for the passage of an electric current through the liquid. The vulcanised rubber waste in a comminuted condition (100 lb.) is introduced into the apparatus together with caustic alkali (21 lb.), water (600 lb.), and ferric sulphate (1 lb.). The solution is heated, the heater being sealed so as to generate a pressure, and the liquid is then caused to circulate in the manner described, while a current is passed between the electrodes. The waste is afterwards withdrawn from the heater, and washed in order to remove the reclaiming agents from it.—E. W. L.

Rubber or rubber-like substances; Process for separating —— *and resin from materials containing them.* L. H. Chanut, Aubervilliers, France, Assignor to Asia Rubber Co. of America. U.S. Pat. 978,696, Dec. 13, 1910.

THE process consists in the extraction of (*e.g.*) "dead Borneo" with carbon bisulphide and acetone in the cold, and is conducted as follows:—The dead Borneo (100 kilos.) is placed in a kneading machine, and 50 litres of carbon bisulphide are added, and allowed to act for five minutes; the machine is then started and 97·5 litres of carbon bisulphide are added and allowed to act for 20 minutes; then 40 litres of acetone are added and allowed to act for 15 minutes. The machine is then stopped, the liquid removed, the machine re-started, 40 litres of carbon bisulphide being added and allowed to act for 20 minutes, after which 50 litres of acetone are added and the machine kept in motion for 20 minutes longer. The machine is then stopped, the liquid removed, the machine restarted after the addition of 40 litres of carbon bisulphide, and 20 litres of acetone and kept running for 20 minutes. The liquid is again removed after stopping the machine, and finally the residue is extracted with four successive quantities of 56 litres of acetones, each addition being allowed to act for 20 minutes.—E. W. L.

Caoutchouc; Process and apparatus for separating —— *from resinous products.* General Caoutchouc Co., Ltd., Paris. Eng. Pat. 7139, March 22, 1910. Under Int. Conv., June 22, 1909.

SEE Fr. Pat. 404,307 of 1909; this J., 1910, 225.—T. F. B.

Caoutchouc-like mass; Manufacture of ——. F. zu Aichlburg, Villach, Austria. Eng. Pat. 4904, Feb. 26, 1910. Under Int. Conv., March 6, 1910.

SEE Fr. Pat. 415,542 of 1910; this J., 1910, 1322.—T. F. B.

Caoutchouc; Process for producing a substance resembling ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 418,544, July 23, 1910. Under Int. Conv., Sept. 29, 1909.

SEE Eng. Pat. 15,254 of 1910; this J., 1910, 1215.—T.F.B.

XV.—LEATHER; BONE; HORN; GLUE.

Kermes root (*Statice Gmelini*). G. Powarnin and A. Ssekretow. J. Russ. Phys.-Chem., Ges., 1910, 42, 1024—1034. Chem. Zentr., 1910, 2, 1935.

ANALYSIS of roots from the Dons district gave the following results:—Soluble matter, 30·15; non-tannins, 14·45; tannides (compare this J., 1909, 844), 15·70; water, 10·76; sugars, 2·03; ash, 4·23; and resin, 0·37 per cent.; the presence of ellagic acid or ellagitannic acid could not be detected. The tannins are readily oxidised, and consist of at least two kinds, representing different stages of oxidation of one and the same tannide. The tannides contain gallic acid and yield red and brown phlobaphenes on oxidation.—A. S.

Colloid chemistry and tanning. H. R. Procter. "Gedenkboek—van Bemmelen" 1910.

HIDE-FIBRES are an organised colloid jelly, and both the tannins and the basic mineral salts used in tanning possess marked colloid character. The hide-fibre consists of bundles of extremely tenuous fibrils of about 1μ diameter and the cementing material, which, in the unaltered hide, binds these together probably differs from them in composition only in its degree of hydration, and is almost entirely removed in the acid or alkaline liquors previous to tanning. The other constituents, such as elastic fibre and albumins play a very subordinate part in the tanning process. Hide-fibre swells in cold water to a fixed maximum, and the swelling is accompanied, in the early stages, by considerable mechanical pressure and the evolution of heat, though the latter has not been experimentally determined. The swelling action is a case of osmotic pressure of an ordinary character in which the attraction of fibre-matter for water is balanced against that of its own cohesion, and both forces must diminish as swelling proceeds. In order that there may be a maximum, the attraction for water must diminish more rapidly than the cohesion, and when, at higher temperatures, this ceases to be the case, the swelling proceeds to complete colloid solution. The author has shown that the value of the maximum for gelatin is partially dependent on its original setting volume. Gelatin, which will absorb 7—8 times its weight of water, may swell to over 50 times in very dilute acid, and in hydrochloric acid a maximum swelling is obtained at a dilution of below 0·01 millimolecular concentration and diminishes with increasing concentration till solution begins. In these cases two separate kinds of absorption are concerned, firstly, the direct attraction of the fibre for acid, and secondly, the mechanical absorption of the acid by osmosis. That they are of different character may be proved by the fact that, while the whole of the absorbed acid can be estimated by titration with caustic alkali using phenolphthalein as indicator, a considerable part is no longer capable of reddening methyl orange, showing that its ionisation is less than 10^{-6} millimolecular hydrion concentration. The quantity of hydrochloric acid fixed in this way increases with increasing concentration, at first rapidly and then more slowly, tending to a maximum of about 1·25 mols. per 1000 of dry gelatin. The swelling is almost wholly inhibited by concentrated alkali chloride solutions (though with neutral gelatin such solutions slightly increase swelling) and under these conditions the total maximum absorption is somewhat greater than that not indicated by methyl orange. The assumption that the acid solution absorbed osmotically is of the same concentration as the exterior solution is only approximately correct, as the fact that chloride solutions exert an external osmotic pressure on the gelatin when acidified with hydrochloric acid proves that the acid gelatin must inversely expel chlorides (including hydrogen chloride) from the absorbed solution, and consequently the latter must be weaker, and the amount of fixed acid larger than that shown by calculation. The results of alkaline swelling are similar, suggesting a definite hydrolysable compound of a weak (amphoteric) acid with a strong base, and the evidence in both cases points to ionic chemical combination. Swelling with acid, in general terms, is dependent on hydrion concentration, and with alkalis, on that of hydroxyl ions, though it is evident that with acids the anions and with alkalis the cations have their share in the reaction. Investigations on the absorption of vegetable tannins point to adsorption rather than to chemical combination as the leading factor, at least in the earlier stages. The tanning action of salts of chromium and aluminium is a complex one, in which both effects are involved, the acid combining chemically, and the colloid physically, with the hide-fibre. In tanning with alum the resulting leather is partly a true aluminium tannage and partly a mere physical product of the action of the acid and salt, which, by dehydrating the individual fibres, prevents their adhesion on drying, so that, while the washed leather dries hard and horny it does not completely return to the condition of untanned pelt. All practical tanning operations must be carried out under acid conditions, except tanning with formaldehyde which acts best in alkaline solution. Neutral gelatin free from electrolytes has no electric charge and does not precipitate pure tannin, but in acid solution takes a positive charge as compared with the liquid, and travels to the cathode, while tannin particles are negative. Knapp's theory that all tanning was due merely to surface coating of the hide-fibres which prevented their adhesion has proved insufficient to explain all the known facts; there is little doubt that not only chemical changes occur, but also, that physical absorption, which is rather molecular than merely mechanical, takes place. While Knapp's original dictum that the essential condition of making leather is the isolation and non-adhesion of the fibres is true, there are many ways in which this can be brought about.—D. J. L.

Colloids; Studies on organic ——. S. Levites. Z. Chem. Ind. Kolloide, 1910, **8**, 4—8.

Glutin is insoluble in cold water but dissolves tolerably easily in solutions of iodides and thiocyanates. Casein, which is insoluble in warm water, yields a stable opalescent solution, which can be readily filtered, when it is triturated with saline solutions (potassium iodide, sodium thiocyanate, sodium phosphate, potassium nitrate) and the mixture warmed. The casein is precipitated from the solution on addition of acid. Gliadin does not behave in an analogous manner. Glutin and casein are both insoluble in pyridine, but in aqueous pyridine the solubility increases with the pyridine content up to a maximum for the mixture, $C_5H_5N+2H_2O$. The casein solutions are precipitated by addition of more pyridine or by strongly diluting with water, but the glutin solutions are unaffected by such treatment. The solutions in aqueous pyridine are very viscous. Glutin and Witte peptone are readily soluble in formamide, giving transparent, very viscous solutions, which are unaffected by dilution with water; the glutin shows no tendency to gelatinise even in concentrated solutions. Casein dissolves only in traces, and gliadin is quite insoluble, in formamide. The precipitation of proteins by tannin is a more sensitive reaction than the biuret reaction; glutin can be detected at a dilution of 1 : 15,000, egg albumin at 1 : 800, and Witte peptone at 1 : 5000. In a series of tests in which pieces of gelatin were swollen in water and then placed in contact with tannic acid solution, it was found that more tannic acid was adsorbed the longer the gelatin was previously soaked in water. Gelatin which had not been soaked adsorbed very little tannic acid. Considerably more tannic acid was adsorbed in presence of an electrolyte. By using a sufficient excess of tannic acid, gelatin can be quantitatively precipitated; the precipitation is favoured by hydrogen ions, but hydroxyl ions act injuriously. The tripeptide, leucyl-glycyl-glycine, in 3 per cent. aqueous solution, is not precipitated even by a considerable excess of alcohol, but is precipitated immediately on addition of $\frac{1}{40}$ vol. of ether.—A. S.

Physical constants and analyses of some commercial peptones. Pépin. *See* XIXa.

Patent.

Tanniferous material; Process of preparing —— *for extraction.* H. Mechlenburg, Assignor to Nitritfabrik A.-G., Köpenick, Germany. U.S. Pat. 979,080, Dec. 20, 1910.

See Eng. Pat. 14,861 of 1910; this J., 1910, 1322.—T. F. B.

XVI.—SOILS; FERTILISERS.

Soil oxidation; Studies in ——. O. Schreiner, M. X. Sullivan, and F. R. Reid. U.S. Dept. Agric., Bureau of Soils, Bull. No. 73, 1910, pp. 57.

Oxidations play an important part in the changes which take place in the mineral and organic constituents of soils. The rootlets of wheat seedlings possess the power of reduction as shown by the precipitation of selenium and tellurium from dilute solutions of sodium selenite and tellurite. The reducing power increases from the time of germination to the sixth or eighth day and then decreases. The oxidising power of the roots was shown by means of organic compounds which on oxidation yield colouring matters which either colour the solution or are deposited on the root surface. Such compounds are *a*-naphthylamine, vanillin, aesculin, phenolphthalein and in particular aloïn. This last reagent is particularly useful in the case of soil, the yellow aqueous solution being changed to a claret red by oxidation. The depth of colour can be measured and is taken as an indication of the extent of the oxidation. The oxidising power of the wheat seedlings increases with age; it is greater in darkness than in light. The two opposite properties of reduction and oxidation may occur separately or concurrently, depending upon the reaction of the medium. Soil oxidation does not appear to be due to enzyme action but to be the result of interaction between inorganic constituents and certain types of organic matter. It is also brought about by autoxidisable organic matter and by inorganic oxygen carriers such as manganese and iron. Both processes activate oxygen. The addition of substances such as silver nitrate, mercuric chloride and carbon bisulphide which destroy enzymes had no particular influence on the oxidising power of the soil. The oxidation in soils was increased by the addition of salts of manganese, iron, aluminium, calcium and magnesium, especially in the presence of simple hydroxy-acids such as citric, tartaric, malic, and glycollic acids and their salts. The addition of manganese gave the best result and the value of manganese as a fertiliser is attributed to its oxidising power rather than to its function as a plant nutrient. Fertiliser salts augment the oxidising power of roots and the manured soil has an increased oxidising power after cropping. Fertiliser salts effect changes in the soil constituents, more particularly in the organic matter, and in consequence they sometimes increase, sometimes diminish the oxidising functions of the soil. Dihydroxystearic acid inhibits oxidation but as a rule a plentiful supply of organic matter augments oxidation. Excessive oxidation is harmful to vegetation. Oxidation in soils is parallel to that in plants and animals, and soils oxidise in a manner analogous to an oxydase, but the oxidation is considered not to be due to enzyme action. The oxidising power of the soil is a symbol of the condition of the soil. A decrease in the oxidation in the soil decreases growth and *vice versa*, factors which favour oxidation are those which favour soil productivity.—E. F. A.

Cyanamide; Decomposition of —— by mineral constituents of soil. H. Kappen. Fühlings Landw. Zeit., **59**, Heft, 19. Biedermanns Zentr., 1911, **40**, 17—30. (Compare this J., 1909, 153.)

THE decomposition of calcium cyanamide in the soil can be brought about by inorganic catalysts, though the co-operation of micro-organisms is also possible; it is impossible at present to distinguish between the action of the two factors. Different soils behave in a very varying manner towards cyanamide, doubtless because, in one soil the decomposition is mainly caused by chemical agents, in another soil, mainly by biological means. Extensive experimental studies have shown that certain metallic hydroxide gels, in particular those of manganese and iron, have the power of acting catalytically in promoting the conversion of cyanamide into carbamide. Silica and alumina gels and the other silicate gels, which are assumed to exist in earth, are without influence. The decomposition of cyanamide in the soil is no mere surface action but is dependent on the specific nature of the substances present. The rate of change is influenced by the amount of catalyst present. The exposure of ferric hydroxide to heat decreases its activity on account of the lessening of the effective surface. Ferric hydroxide as a soil is also active but less so than the gel.—E. F. A.

Manganese sulphate; Manurial value of ——. A. Carlier. Ann. de Gembloux, 1910, 423. Biedermanns Zentr., 1910, **39**, 859.

MANGANESE sulphate was added in the proportion of 50 kilos. and 100 kilos. per hectare (44·5 and 89 lb. per acre) to grass land. In the first case an increase of 0·9 per cent. and in the second one of 9·5 per cent. in the hay crop was recorded. The action of the fertiliser became evident a few days after its addition, in that the plot appeared vivid green. In the case of potatoes and turnips, actually a diminution in the amount of the crop resulted, amounting for potatoes in the first case to 9 per cent. and in the second to 0·6 per cent.; with turnips the roots showed 2·5 and 1·0 per cent. respectively less and the leaves 25 and 20 per cent. respectively less. The results are interpreted as showing that manganese sulphate does not possess the high manurial value often attributed to it.—E. F. A.

Cereals; Influence of some artificial oxydases and some metallic compounds on the growth of ——. V. Nazari. Atti. R. Accad. dei Lincei. Roma, 1910, [5], **19**, II., 361—367. Chem. Centr., 1910, **2**, 1936. (See also this J., 1908, 823; 1909, 666, 724, 919.)

THE author concludes from his experiments that the effect of manganese, whether as a constituent of an artificial oxydase, or used for the treatment of seeds or as a fertiliser, is different according to the compound employed (sulphate, dioxide, carbonate). Ferric sulphate in many cases causes an increased yield of grain. Ferrous sulphate is useful as a rust preventive. Copper and aluminium salts have an unfavourable effect on the growth of cereals. —A. S.

PATENT.

Fertiliser; Process of making ——. S. B. Newberry, Sandusky, Ohio, Assignor to G. R. Fishburne, Charleston, S.C. U.S. Pat. 978,193, Dec. 13, 1910.

INSOLUBLE phosphate is converted into a citrate-soluble form by calcination with an amount of lime approximately equal to the phosphoric acid and an amount of sodium carbonate approximately equal to one-half of the phosphoric acid, contained in the phosphate treated.—E. W. L.

XVII.—SUGARS; STARCHES; GUMS.

Sugar beet; Non-protein nitrogenous substances of the ——. K. Smolenski. Z. Ver. deut. Zuckerind., 1910, 1215—1261.

HAVING observed the considerable influence exerted by a high nitrogen content on the amount of molasses produced in the beet sugar factory, the author has been led to study the nature and amount of the nitrogenous compounds present in the beet and in the diffusion juice, especially the so-called "objectionable nitrogen" (cf. this J., 1910, 1122), which is of much importance from the practical point of view. He finds in a Russian beet factory that 70 per cent. of the total nitrogen, 30 per cent. of the protein nitrogen, and 93 per cent. of the "objectionable nitrogen" contained in the root passes into the diffusion juice, and that of the total nitrogen in the diffusion juice about 54 per cent. is "objectionable nitrogen." Amongst the non-protein nitrogenous compounds contained in the diffusion juice of the same factory it was possible to identify the following: vernine, allantoine, asparagine, glutamine, and betaine; but tyrosine and choline were absent. The question of the presence of asparagine and aspartic acid in the root itself requires further investigation.—J. P. O.

Dextrose; Normal weight of ——. C. A. Browne. J. Ind. Eng. Chem., 1910, **2**, 526—527.

THE author suggests that in the case of dextrose, as with all sugars, a fixed value should be given to the normal weight, this value being the weight of pure sugar which, dissolved to 100 true c.c. and polarised at 20° C., in a 200 mm. tube, will give a constant reading of exactly 100 (Ventzke scale) upon the saccharimeter. Making use of Tollens' formula (recalculated to a concentration basis) for the specific rotation of dextrose, $[a]^{20}_{D} = 52{\cdot}50 + 0{\cdot}0227c + 0{\cdot}00022c^2$ and taking the value of 1° Ventzke, in circular degrees, as 0·3448, the normal weight of dextrose is calculated to be 32·25 grms., and a table is given showing the correction to be added to the scale reading of the saccharimeter when using this figure, in consequence of the variation of the specific rotation with the concentration; the percentage of dextrose (D), corresponding to any scale reading (s), is also almost exactly expressed by the formula,

$$D = s + 0{\cdot}02s - 0{\cdot}0002s^2.$$—F. SODN.

d-Galactose; Instance of the occurrence of ——. E. O. von Lippmann. Ber., 1910, **43**, 3611—3612.

AFTER a sudden night-frost (during dry weather) harder than had been experienced for many years, and following an unusually and continuously warm autumn, it was observed that the most exposed berries on an ivy-covered wall were coated with a substance resembling hoar-frost. This substance, which had a slight, but pure, sweet flavour, yielded much mucic acid on oxidation, and was found to contain galactose which was isolated in the anhydrous, crystalline condition. As to the genesis of the sugar, there is no evidence; no other sugar was found to accompany it, and the contents of the berries did not yield appreciable quantities of mucic acid on oxidation. Many writers have ascribed the occurrence of abnormal quantities of raffinose in sugar beet to the influence of cold weather, but definite knowledge is wanting, and the source of the galactose has not been ascertained. According to Tollens, a glucoside isolated from ivy by Vernet, contains galactose, but this sugar does not appear to have been present in the juice of the berries referred to by the author since, otherwise, more mucic acid must have been obtained on oxidation.—L. E.

Honey formation: The chemistry of ——. M. Küstenmacher. Biochem. Zeits., 1910, **30**, 237—254.

The author has investigated the processes taking place in the body of the bee during the formation of honey; a full description of the physiology of the insect is given and also of the changes which take place when the nectar of flowers is converted into honey. This nectar consists essentially of an aqueous solution of sucrose containing tannin, organic acids, mineral constituents, flavouring substances, and colouring matters; enzymes are also present, and the author shows that invertase, the principal enzyme, is derived from the pollen and that the saliva of bees does not introduce this enzyme into the honey. —W. P. S.

Honey; Analysis of ——. G. Curtel, F. Muttelet, and E. Moreau. Ann. Falsif., 1910, **3**, 497—502, 503—513, 513—515.

Results of analyses of honey are recorded in these papers, limiting values are given, and certain tests are recommended. Curtel fixes the following limits for pure honey:—Protein, 0·25—0·65; invert sugar, 64—75; sucrose, 0·8—9·6; water, 14—20; acidity (as formic acid), 0·022—0·069; ash, 0·08—0·25 per cent. The albumin-tannin precipitate obtained in Lund's test should not exceed 2 c.c. in volume; the tests proposed by Fiehe (this J., 1908, 1127) and Ley (see this J., 1911, 43) afford useful information as to the purity of a sample of honey. Muttelet recommends that the chemical examination of honey should comprise determinations of the water, acidity, ash, dextrins, and albumins; Fiehe's and Ley's tests should be applied to the sample, and the sugars should be determined polarimetrically. Honey does not contain more than 25 per cent. of water and the acidity (as formic acid) lies between 0·05 and 0·25 per cent.; if chlorides or sulphates be present in notable quantity the honey is probably adulterated. Moreau suggests the following limits within which the various values for pure honey should fall:—water, less than 25; ash, less than 0·40; acidity (as formic acid), 0·32—0·124 per cent. All three authors draw attention to the importance of the microscopical examination of honey.—W. P. S.

Patents.

Sugar-juice; Apparatus for separating scum and precipitates from, and process for separating scum from ——. J. J. Homans, Samarang, Java. U.S. Pats. 978,450 and 978,750, Dec. 13, 1910.

(1). The apparatus for the clarification of sugar-juices consists of a stationary vessel surrounded by a heating chamber, also means for supplying sugar-juice into the vessel so as to keep the latter completely filled with the juice. Inside the vessel is situated a rotatable device for subjecting the juice to centrifugal action, whereby the scum or precipitate is thrown out to form a peripheral layer, whilst the clarified juice remains near the axis. A plate is secured to the wall of the vessel, closed along one edge and open along one edge, so as to receive the matters driven out to it by the rotatable device. A chamber is provided for the clarified juice and means, controlled by a valve, for leading the juice to the chamber.

(2). The process for separating scum from sugar-juice consists in subjecting the mixture to centrifugal action, thereby separating the scum and juice according to their respective specific gravities, into two cylindrical layers, the scum forming an outer layer and the remaining juice forming an inner layer, all while heating and maintaining the material at a temperature not lower than that of the "cracking point" of the defecation process, and removing the scum and the separated juice each separately. —J. F. B.

Sugar-cane or beet: Extracting juice from ——. J. J. Homans, Samarang, Java. U.S. Pat. 978,451, Dec. 13, 1910.

The process for extracting sugar-juice from sugar-producing vegetable materials consists in squeezing the material, then adding thereto scum separated from sugar-juice (see preceding abstract), heating the mass to a temperature not lower than that of the "cracking point" of the defecation process and squeezing the mass for extraction of juice and to incorporate precipitates of the added scum with the squeezed material. Diluted juice from following squeezings is then added to the mass and the latter is squeezed, lastly water is added and squeezed out, the mass being maintained always at the above-mentioned temperature.—J. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Hops: Valuation of the antiseptic properties of ——. A. J. Brown and G. B. Ward. J. Inst. Brew., 1910, **16**, 641—656.

During an investigation of the micro-organisms present in an acid beer, a bacterium was isolated having many of the morphological characteristics of van Laer's *Saccharobacillus Pastorianus*. Attention was specially attracted to this organism by its very remarkable power of multiplication in suitable liquid media, and its extreme susceptibility to the toxic influence of hop extract. These properties suggested the possibility of the bacterium being utilised as a means of measuring the antiseptic properties of hops. Tentative experiments having yielded encouraging results the work was proceeded with until the following method was developed: Standard hop extract is prepared by infusing 5 grms. of an average sample of the hops under examination with 500 c.c. of distilled water in a steam steriliser at 100° C. for one hour. As culture medium "cold water malt extract" prepared as follows is employed. Equal measures of ground pale malt and distilled water are digested at room temperature for two hours, and then filtered. The filtered extract is boiled for one hour, cooled, re-filtered, and diluted with water to a specific gravity of 1030°. If the solution is not perfectly brilliant, a condition of much importance, it is treated with algin and isinglass finings and again filtered. A volume of 10 c.c. of the clear extract is measured into each of a series of test-tubes, which are plugged and sterilised in the usual way for not more than 10 minutes. In conducting an experiment, varying amounts of the standard hop extract (*e.g.* 0·25, 0·5, 0·75, 1·0, 1·25, 1·5 c.c.) are measured into a series of tubes of culture medium which are then steam sterilised for 10 minutes. After cooling, each tube is inoculated with a drop of a freshly grown vigorous culture of the bacterium and incubated at 30° C. for 18 hours. The toxic, or antiseptic, power of a hop is expressed on the basis of 100 representing a toxicity such that 0·25 c.c. of extract inhibits the growth of the organism. The following are typical examples of the results obtained.

Growth and year.		Toxicity.
Oregons	1909	90
Marzills	,,	83
Columbians	,,	50
E. Kents	,,	33
E. Kent goldings	,,	28
Mid-Kents	,,	19
E. Kent "old-olds"	,,	6

Experiments were also made using solutions of soft and hard hop resins and an infusion of the hops from which these had been extracted, when it was found that the soft resins had a toxicity 50 times greater than that of the hard resins and that the infusion of the extracted hops had no toxicity at all. It is suggested that the toxicity of the hard resins may be due to the presence in the preparation of a trace of soft resin remaining from the extraction with petroleum spirit. It was further found that prolonged exposure of the organism to the influence of strong hop extract did not destroy the life of the organism, which developed normally on subsequent inoculation in unhopped culture medium, showing that the hop extract only arrests the development of the organism.—R. L. S.

Yeast; Influence of alkalis and acids on the autodigestion of ——. E. Navassart. Z. physiol. Chem., 1910, **70**, 189—197.

Fresh pressed yeast suspended in saturated chloroform-water, with or without addition of alkali or acid, was allowed to undergo autodigestion at a temperature of 39°—40° C., for 68—69½ hours. The products were then neutralised if necessary, treated with potassium dihydrogen phosphate until perceptibly acid, and boiled in order to throw down unchanged protein. The degrees of proteolysis and nucleolysis were ascertained by determining the percentages of total nitrogen and purine bases in the filtrates. It was found that alkalis (sodium and potassium carbonates) decrease the autodigestion of yeast, and to an increasing degree with increasing concentration; their influence on the autodigestion of yeast bears a striking resemblance to their influence on the autodigestion of animal tissue. A concentration of 0·2 per cent. of sodium carbonate causes a considerable decrease in the autodigestion of yeast, and a concentration of 0·4 per cent. arrests it completely; potassium carbonate is less effective, a concentration of 0·4 per cent. being required to lessen the autodigestion considerably. Hydrochloric acid, at a concentration of 0·1374 per cent. (equivalent to 0·2 per cent. of sodium carbonate) arrests the autodigestion of yeast practically completely, and very small quantities of hydrochloric acid do not accelerate it. It was also found that the nuclease of yeast is influenced to a greater extent than the proteolytic enzyme by change in the reaction of the medium.—L. E.

Tin haze in pale beers. F. Schönfeld and W. Hirt. Woch. f. Brau., 1910, **27**, 633—635, 653—656.

Twenty-three beers and the waters and worts from which many of them were prepared have been investigated. The general conclusions arrived at are as follows: The sensitiveness to tin varies in different beers from almost complete insensitiveness to great susceptibility. Beers from any particular brewery usually show similar behaviour, but marked exceptions to this are found. The hazes are more marked in beer rich in carbon dioxide than in those which contain little gas. There is a connection between the acidity of the beer and the susceptibility to haze, which is most marked in the more acid samples, and is decreased or even entirely checked by reducing the acidity. It would appear that the acidity of the finished beer is conditioned by that of the wort from which it is prepared, and that beer from wort neutralised by being boiled with chalk, or even simply boiled after removal of the cooler-sludge, is much less sensitive than that yielded by the wort without special treatment. Water containing carbonates produces beers that are insensitive to tin, while sulphate waters give sensitive ones.—R. L. S.

Koumiss and kephir fermentation; The chemistry of ——. A. Ginzberg. Biochem. Zeits., 1910, **30**, 1—37.

Koumiss and kephir are products prepared by subjecting milk to alcoholic and lactic fermentation, these two processes being allowed to proceed simultaneously. The fermentation not only converts the lactose into lactic acid, alcohol and carbon dioxide, but considerably alters the composition of the casein, this protein being hydrolysed and mineral constituents removed from its molecule. The character of the changes taking place in the constituents of the milk is dependent on the proportion of the micro-organisms to the quantity of milk, on the temperature, time of action, etc.; the course of the two fermentations may be followed by a chemical examination of the liquid, whilst a bacteriological examination yields information regarding the quality of the micro-organisms but does not give any evidence as to the ripeness of the beverages. Koumiss and kephir may be prepared from mares' and cows' milks, respectively, by inoculating the milks with a suitable culture: brewers' yeast may be added to produce the alcoholic fermentation and Grigoroff-Metschnikoff's *Bacillus Bulgaricus* to produce the lactic fermentation. Slight differences in composition characterise the two products. The casein of cows' milk tends to form clots or lumps, and kephir may be termed a food; whilst koumiss, prepared from mares' milk, is always fluid and is a true beverage. If it be desired to prepare koumiss from cows' milk, the latter must be diluted with water and the casein subjected to the action of pepsin, before the milk is fermented. Koumiss may also be made from asses' milk. There is no evidence that the milk obtained from mares which have been pastured on the Russian steppes is of better quality than that produced by animals in other parts of the country. The author concludes with remarks on the physiological action of koumiss and kephir. (See also this J., 1910, 1469.)—W. P. S.

Enzymes; Method of determining whether a liquid contains one or several ——. Achalme and Bresson. Comptes rend., 1910, **151**, 1369—1372.

The authors describe experiments from the results of which they conclude that the following method will serve to prove whether an enzymic preparation which acts on several different substances contains one or more enzymes. A small quantity of the enzymic preparation is allowed to act, under identical conditions, on two of the substances separately and on a mixture of the two. If the effect on the mixture is about the same as the sum of the effects on the two substances separately, in a given time, then there are two different enzymes present, but if it is less, then only one enzyme is present. If, instead of determining the extent of the action in a given time, the time required for complete hydrolysis of the substance or substances be determined, it is found that this time is about the same in all three cases (with each substance separately and with the mixture of the two) if two enzymes are present, but is appreciably longer for the mixture of the two substances when only one enzyme is present. —A. S.

Patents.

Hop extraction process. A. Nilson, Assignor to Wahl-Henius Inst. of Fermentology, Chicago, Ill. U.S. Pat. 978,476, Dec. 13, 1910.

The bitter principles and resins are extracted from hops by infusing the material with a dilute solution of ammonium hydroxide in the proportion of about 100 lb. of hops to 250 gallons of the liquid. The resulting extract is separated from the hops and is acidified with lactic acid to precipitate the products. The precipitate is then separated and recovered.—J. F. B.

Beer of low alcoholic contents; Process of brewing ——. H. E. Deckebach, Cincinnati, Ohio. U.S. Pat. 977,603, Dec. 6, 1910.

The wort is placed in a closed vessel, yeast is added, and fermentation is allowed to proceed while cooled oxygen under pressure is admitted above the surface of the liquid. When the wort has been partially fermented, oxygen at a higher temperature is admitted, and subsequently, the fermentation is carried to completion while oxygen "of a degree lower than the first" is introduced into the vessel. Means are provided for continually withdrawing the gases from the vessel.—W. P. S.

Wines, musts and other fermentable liquids; Electrolytic process for preventing the fermentation of ——. A. M. Castaing. Fr. Pat. 418,486, July 18, 1910.

The process consists in subjecting the wine or other liquid to an electrolytic current, by passing it in a layer more or less thick between two electrodes, composed of metals or alloys which are not readily oxidisable. The surface of the positive electrode is very large and that of the negative electrode very small. The strength of the current varies according to circumstances. After treatment, the wine should be refrigerated almost to its freezing point; the dead yeast cells and precipitated matters are then allowed to settle for a few days, and the liquid is finally filtered.—J. F. B.

Wines, spirits and liqueurs; Process and apparatus for improving ——. A. Jarraud. Fr. Pat. 419,143, Aug. 10, 1910.

The process for improving wines, etc., consists in producing, in the body of the liquid to be treated, a molecular disturbance by means of Hertzian waves coming from a wave-producing apparatus preferably submerged in the liquid. This apparatus consists of a vessel composed of insulating material (ebonite) containing a dielectric liquid (petroleum) into which dips an oscillator such as a Hertz doublet. The vessel, which is completely immersed in the liquid, has a thick glass lid, pierced with two holes, through which the two high tension wires pass into the petroleum. From these holes two ebonite tubes extend upwards above the level of the wine, and are perforated at their upper ends to allow the escape of the vapours of petroleum produced by the discharge. The wires passing down these tubes to the oscillator are insulated in porcelain tubes, to avoid discharge of current in the vapours.—J. F. B.

Fermentation; Process of —— *for use in manufacture of yeast and spirit.* D. Forster and P. Finitzer, Budapest. U.S. Pat. 978,282, Dec. 13, 1910.

See Fr. Pat. 415,022 of 1910; this J., 1910, 1266.—T. F. B.

XIXa.—FOODS.

Vegetable butters and fats; Poisonous substances in ——. J. Hertkorn. Chem.-Zeit., 1910, 34, 1381—1382.

Recent cases of poisoning by "backa-margarine" (vegetable butter) have called attention to the possibility of poisonous substances being present in other butter substitutes. Such are the amyl esters of the lower unsaturated fatty acids, recently put upon the market and used to improve the aroma and flavour. These esters are stated to be prepared from alkyl haloids, ketones, etc., by interaction with potassium cyanide, with the formation of nitriles (cyanides, oxycyanides) as intermediate products. The toxic properties of some of the commercial vegetable fats are as a rule to be attributed to impurities derived from other parts of the plant or from foreign seed. In any case crude vegetable fats should always be examined with reference to their physiological action before being employed in the manufacture of butter substitutes. Heating the fat by means of dry heat or steam to a high temperature is usually sufficient to eliminate or destroy all toxic compounds. Cases of poisoning with fats thus heated are unknown. There should also be a treatment with alkali and washing with water, followed, if necessary, by treatment with acid and washing to remove basic poisonous substances. The substances permissible for the production of the butter aroma should also be scheduled, and their preparation from toxic intermediate products such as cyanogen compounds should be proscribed. —C. A. M.

Butter; Supposed less of soluble, volatile acids during the storage of ——. D. Crispo. Bull. Soc. Chim. Belg., 1910, 24, 436—438.

Using the method of Leffman and Beam, the author has determined the content of volatile acids in butter, both directly and after the lapse of months or years. It is found that unclarified butters, wrapped in parchment paper and enclosed in tin boxes, are rapidly invaded by moulds, become dry, and suffer a loss of volatile acids. It would appear that this loss of acidity ceases when the butter becomes dry. After the lapse of 7 months, the butters are quite dry, and generally, the amount of volatile acids does not further diminish. Refined butters (melted and strained) when kept in ordinary, corked sample bottles, do not alter in respect of volatile acid-content, during 3 years, to an extent exceeding the limits of analytical errors; in most cases, the content of volatile acids undergoes a slight increase.—L. E.

Corrosion of metallic food containers. E. Gudeman. Met. and Chem. Eng., 1910, 8, 680—681.

Instances are quoted where food inspectors have condemned food products containing 0·00003 per cent. of lead, and 0·000001 of sulphur dioxide, while recently the maximum amount of tin to be allowed in foods is to be 0·03 per cent. A perfect container is one which will withstand the action of acids or alkalis or both, as well as the oxidation or reduction reactions which are due to the character of the food itself or the normal changes in it on ageing. Perfect continuity between the tin and the iron in tin plate is essential and the coating must be perfectly homogeneous. An amalgam containing 0·5 per cent. of gold will perfectly coat iron and steel giving all the resisting qualities of gold itself and using about two ounces of gold per ton of iron, but costing about 12 to 15 times the cost of tin plate. In discussing enamelled cans mention is made of the costly method of impregnating the plate at a pressure of 50,000 lb. per sq. in. and then baking in order to fuse the enamel. It is suggested that lead glass might be utilised in a similar manner instead of enamel, such impregnated plates resisting the corroding action of food juices, as well as the glass itself, but the amount of lead that will go into solution has not yet been determined.—A. H. C.

Tetrodon poison. Y. Tahara. Biochem. Zeits., 1910, 30, 255—275.

Tetrodonæ abound in the Japanese seas and many of the species are used as food, but only after the ovaries have been carefully removed from the fish, as these organs contain a poisonous substance; the latter is not, however, present in the flesh. It may be isolated by grinding the well-washed ovaries to a paste with water, evaporating the mixture, precipitating the albumin with acetic acid, and removing phosphates by means of lead acetate. The residual solution is then rendered ammoniacal, when the substance is precipitated in an impure state. The precipitate is next washed with dilute ammonia, the lead present is removed as sulphide, and the residue obtained on evaporating the solution is extracted with alcohol, in which the poisonous substance is only partially insoluble. The treatment with lead acetate and ammonia may be repeated in order to further purify the substance. The portion which is soluble in alcohol appears to be of the same nature as the insoluble portion. The name "tetrodo-toxin" is suggested for the substance instead of "tetrodonic acid," a term applied to the substance by previous investigators; it appears to be a neutral substance and is neither an alkaloid nor a protein, but it is precipitated from its aqueous solution by metallic hydroxides. When pure, tetrodo-toxin is a white, hygroscopic powder; it is only slighty soluble in water and is insoluble in practically all organic solvents. The formula $C_{16}H_{31}NO_{16}$ is given to it, provisionally. Dilute hydrochloric acid converts it into a new base and a nitrogen-free, crystalline substance. Physiological experiments show that the fatal dose (by subcutaneous injection) is 4 mgrms. per kilo. of body-weight.—W. P. S.

Hydrocyanic acid; Formation of —— *in the germination of seeds.* C. Ravenna and M. Zamorani. Atti R. Accad. dei Lincei, Roma, 1910, [5], 19, II., 356—361. Chem. Zentr., 1910, 2, 1935—1936.

Seeds of *Sorghum vulgare* (Indian millet) which contain at most traces of hydrocyanic acid were allowed to germinate, in the light and in the dark, on washed and ignited sand moistened with distilled water. The sand was contained in two metal boxes divided into compartments. It was found that both in the light and in the dark hydrocyanic acid was formed, the quantity produced increasing with the duration of germination up to a certain limit, and then decreasing. Less hydrocyanic acid was produced in the plants grown in the dark than in those grown in the light. For example, seeds (seven for each test) were sown on Nov. 24, 1908: the percentages of hydrocyanic acid in those grown in the light and in the dark respectively were as follow, on the dates mentioned :—Oct. 7, 1909, 0·0462, 0·0308 ; Oct. 13, 0·1041, 0·0694 ; Oct. 16, 0·0848, 0·0655 ; Oct. 17, 0·0848, 0·0771 ; Oct. 18, 0·0540, 0·0540 ; Oct. 21, 0·0540, 0·0385 ; Jan. 3, 1910, 0·0501, 0·0424. Experiments with flax seed (*Linum usitatissimum*) containing hydrocyanic acid equivalent to 0·027 grm. per 100 seeds gave analogous results, thus confirming Soave's view (Staz. sperim. agrar. ital., 1906, **39**, 428) that hydrocyanic acid may be formed under conditions in which absorption of nitrogenous compounds from the soil is excluded (compare Guignard, this J., 1909, 38). The authors express the view that the hydrocyanic acid is formed in the seeds, just as in the developed plants, directly from carbohydrates and inorganic nitrogen compounds. In accord with this view are the facts : (1), flax seeds allowed to germinate in air free from carbon dioxide, *i.e.*, with less opportunity for the formation of carbohydrates, yielded less hydrocyanic acid than those allowed to germinate in ordinary air : (2), larger quantities of hydrocyanic acid were yielded by seeds moistened with a 2 per cent. solution of dextrose than by those moistened with pure water, the seeds being kept in the dark in both cases.—A. S.

Peptones ; Physical constants and analyses of some commercial ——. G. Pépin. Bull. Sci. Pharmacol., 1910, **17**, 594—599. Chem. Zentr., 1910, **2**, 1932—1933.

Experiments were made with eleven different peptones, including products obtained by the action of pepsin on gelatin, flesh, and fibrin, and of trypsin on flesh and fibrin. In the eleven products examined, the nitrogen-content of the ash-free material varied from 12·58 to 17·56 per cent. and the ratio of the total nitrogen to the amino-nitrogen varied between 3·92 and 36·44. The tryptic peptones contained much more amino-nitrogen than the peptic peptones, and of the latter, those prepared from gelatin were poorest in amino-nitrogen. The peptic peptones from flesh gave the highest yield of ash (up to 20 per cent. in some cases), whilst the peptones from gelatin resembled more nearly the tryptic peptones in this respect. The ash from the peptic peptones consisted chiefly of sodium chloride or calcium chloride, and invariably effervesced on treatment with nitric acid. The ash of the tryptic peptones contained a considerable quantity of carbonate. The peptic peptones rarely contained phosphorus, magnesium, and iron, and then only in traces. Of the eleven peptones examined, five contained considerable quantities of calcium, probably due to the use of lime or calcium carbonate for neutralising the acid employed in their preparation. Data are also given, with regard to the specific gravity, electrical conductivity, and optical rotation of, and freezing-point depression caused by, the different peptones.—A. S.

Relative quantities of arsenic in seaweeds and in products derived therefrom. Tassilly and Leroide. *See* VII.

Patents.

Flour, bread, and similar foodstuffs ; Manufacture of —— *from leguminous seeds.* O. C. Hexamer and H. H. Cuthbert, London. Eng. Pat. 28,033, Dec. 1, 1909.

The process consists in producing flour for use in the manufacture of bread, etc., from pulse or leguminous seeds by the removal of starch or carbohydrates therefrom. For instance, soya beans are dried by heating and then ground. After the husks have been removed by sifting, the flour is mixed with water and boiled for a period of time sufficient to burst the starch cells. The liquid portion is then drained off, and the residual paste is washed with cold water until all starch has been removed. The paste is now dried and the cake or coarse powder is ground. A small quantity of pancreatin may be added to the resulting flour.—W. P. S.

Trimethylxanthine in plants ; Process for diminishing the quantity of —— [*removal of caffeine from coffee*]. G. Desnot. Fr. Pat. 418,213, May 9, 1910.

The process may be applied to the removal of alkaloid from coffee, tea, etc. In the case of coffee, the raw berries are steeped in hot water and then extracted for 30 minutes with acetone containing 0·1 per cent. of hydrochloric acid. The berries are subsequently dried and roasted. The caffeine extracted by the solvent may be recovered by distilling the latter.—W. P. S.

Margarine emulsifier. Altonaer Margarine-Werke Mohr und Co., Ges. m. b. H. Fr. Pat. 418,869, Aug. 3, 1910.

The apparatus consists of a cylindrical vessel through which passes a central revolving shaft ; mixing blades are fixed on this shaft one above the other, whilst stationary blades attached to the sides of the cylinder are fitted between the moving blades. The latter are so shaped that the upper ones remove the margarine from the upper parts of the cylinder and cause it to move downwards, whilst the lower blades force the material upwards. —W. P. S.

Coffee ; Method of eliminating the active toxic agent from ——. H. Evers, Zürich, Assignor to Gerster et Cie., Clarens-Montreux, Switzerland. U.S. Pat. 978,866, Dec. 20, 1910.

See Eng. Pat. 20,215 of 1909 ; this J., 1910, 778.—T. F. B.

XIXB.—WATER PURIFICATION ; SANITATION.

Phenol ; Oxidation of —— *by certain bacteria in pure culture.* G. J. Fowler, E. Ardern, and W. T. Lockett. Proc. Roy. Soc., 1910, B **83**, 149—156.

Solutions of pure phenol can be oxidised on bacterial sewage filters. At the same time a selective action is exerted on the bacteria present, so that the filtrate contains only three or four types of organism. Of these the chief are *B. liquefaciens fluorescens* and a chromogenic organism, probably *B. Helvolus*. Pure cultures of the former do not act on phenol, but in contact with pure cultures of the chromogenic organism, dilute solutions of phenol remain unaffected for two or three days, and are then rapidly oxidised. When a broth culture of the chromogenic organism is added to a dilute phenolic solution which has been previously unacted upon by a culture of *B. liquefaciens*, almost complete oxidation occurs within four days.—R. V. S.

Dinitrobenzene ; A case of poisoning by ——. Chem. Zeit., 1910, **34**, 1387.

The directors of a chemical factory in Neu-Erlaa have been prosecuted for carrying on an operation dangerous to life. They produce a preparation of glue to which dinitrobenzene is added as an antiseptic agent. In the early part of the year 120 kilos. of this preparation were finely divided and ground in a mill, with the result that two workpeople who had attended to the mill were taken ill the following day with symptoms of poisoning, and one of them died. For the defence it was urged that directions had been given that the preparation was to be finely-divided, but was not to be ground ; that the toxic nature of dinitrobenzene was unknown to them ; that it could be obtained from any druggist without signing a register ; and that for the last 50 years it had been sent about in wagon-loads without any precautions. The defendants were acquitted.—C. A. M.

Patents.

Water ; Purification of —— [*for use in boilers, etc.*]. V. Lamy. Fr. Pat. 418,727, July 18, 1910. Under Int. Conv., July 19, 1909.

The process relates to the removal of bicarbonates of potassium or sodium from certain waters containing them. For this purpose the water is treated with predetermined quantities of calcium chloride and calcium hydroxide; these reagents are thoroughly mixed with the water and, after sedimentation, the clear water is decanted from the precipitated calcium carbonate. When it is convenient to boil the water during treatment, calcium chloride alone may be used.—W. P. S.

Sterilisation of liquids by ultra-violet rays; Apparatus for ——. V. Henri and A. Helbronner, Paris; and M. von Recklinghausen, Bas Meudon, France. Eng. Pats. 28,067, Dec. 1, 1909, and 25,883, Jan. 24, 1910.

The source of the ultra-violet rays is supported by float mechanism (*e.g.*, floats operating in chambers connected with the main conduit), so that a constant distance between the surface of the liquid and the source of the rays is automatically maintained. Or the lamp may be mounted in a closed container fixed in a constant position above the liquid, the surface of which is automatically maintained at a definite level by means of a float valve capable of admitting atmospheric air or air under compression.
—C. A. M.

Liquids; Sterilisation of ——. V. Henri and A. Helbronner, Paris, and M. von Recklinghausen, Bas Meudon, France. Eng. Pat. 14,129, June 10, 1910. Under Int. Conv., June 11, 1909.

A mercury vapour lamp for use in the sterilisation of liquids by means of ultra-violet rays is described. The lamp itself may be of any suitable shape, and it is surrounded by a quartz or silica envelope; the air is completely exhausted from the space between the lamp and the outer tube or envelope so that, when the apparatus is immersed in a liquid, radiation of heat from the lamp is prevented, whilst the normal working of the lamp is not affected. The wires conducting the current to the lamp pass through the walls of the envelope. If desired, only the straight tube between the two bulbs may be surrounded by an outer tube.—W. P. S.

Hyper-ultra violet rays of short wave-length; Method of producing and utilising —— for the sterilisation of liquids. A. L. Billon-Daguerre. Fr. Pat. 419,117, Oct. 18, 1909.

Geissler tubes constructed of silica and containing more or less rarefied gases are employed for the production of the rays used. Several forms of lamp are described, and they may be provided with a vacuum jacket. The liquid to be sterilised is passed in a thin layer over the surface of the lamp or is conducted through tubes where it is subjected to the action of the rays proceeding from the lamp.—W. P. S.

Sewage disposal by filtration and aeration. J. B. Paul, Pittsburg, Pa. U.S. Pat. 977,965, Dec. 6, 1910.

The apparatus consists of a septic tank provided with partitions and a number of filters. The liquid leaving the septic tank flows by gravity through the series of filters. The latter are connected with one another by means of suitable pipes and each filter consists of a chamber in which is fitted a removable cage containing filtering material. The chambers are provided with inlet pipes for the introduction of air, and the flow of the sewage from the septic tank is regulated by suitable means.—W. P. S.

Waste waters; Process for treating ——. T. Williams. Fr. Pat. 418,424, June 18, 1910.

See Eng. Pat. 14,439 of 1909; this J., 1910, 974.—T. F. B.

Sewage; Treating ——. K. Imhoff. Bredeney, Germany. U.S. Pat. 978,889. Dec. 20, 1910.

See Ger. Pat. 219,992 of 1909; this J., 1910, 588.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Alkaloidal constituents of Strychnos Kipapa. Vinci. Pharm. Zentralh. 1910, 51, 828; Pharm. J., 1911, 86, 37.

The root bark of *Strychnos Kipapa* contains 5 per cent. of strychnine; the root wood 0·1 per cent., the stem bark yields 2 per cent., and the true wood 0·16 per cent. The amount of brucine present is smaller, except in the leaves, where it reaches 0·5 per cent.

Alkaloids from the roots of Sanguinaria Canadensis. T. Kózniewski. Anz. Akad. Wiss. Krakau, 1910, Reihe A., 235—246. Chem. Zentr., 1910, 2, 1932.

For the purification and separation of the chelerythrine, sanguinarine, and protopine contained in the roots of *Sanguinaria Canadensis* (blood-root), the author made use of the slight solubility of the sulphates of the first two alkaloids. The greater part of the sanguinarine is present in the root not in the form of a salt of the free base, but in the form of a more stable compound, the salts of which have a red colour, and which yields sanguinarine on hydrolysis. Sanguinarine, $C_{20}H_{15}NO_4$, separates from alcohol or a mixture of chloroform and alcohol in crystals containing $\frac{1}{2}$ mol. of alcohol; m.pt., 212° C. It forms a periodide, $C_{20}H_{15}NO_4,I_2,HI$, which separates in needles, m. pt. 205° C., from aqueous solution. Chelerythrine periodide, $C_{21}H_{17}NO_4,I_2,HI$, obtained by treating a solution of the alkaloid in 95 per cent. alcohol or a mixture of chloroform and alcohol with a solution of iodine in carbon bisulphide, forms ruby-red needles, m.pt. 225° C., very slightly soluble in organic solvents, with the exception of acetone, in which it is easily soluble. (See also this J., 1894, 836; 1901, 1016.)—A. S.

Hydroxycodeine; A new alkaloid from opium ——. J. J. Dobbie and A. Lauder. Chem. Soc. Proc., 1910, 26, 339.

This alkaloid was discovered by Messrs. T. and H. Smith, Edinburgh, in the mother liquors obtained in the working up of the opium alkaloids after the ordinary alkaloids have been eliminated. It has the formula $C_{18}H_{21}O_4N$, and is a tertiary base. It is soluble in water and the usual organic solvents. So far it has not been obtained in the crystalline condition. On heating, it softens about 40°, and is completely melted at 51° C. It is slightly dextrorotatory, and contains one methoxyl group. The hydrobromide, $C_{18}H_{21}O_4N,HBr$, crystallises readily from water in large, hard, prismatic crystals. The platinichloride has the formula $(C_{18}H_{21}O_4N)_2,H_2PtCl_6$. The alkaloid appears to be a hydroxy-derivative of codeine; its absorption spectra agree very closely with those of codeine, and the colour reactions of the two alkaloids are practically identical.

Caffeine-containing plants; Present position of our knowledge of ——. A. Goris and G. Fluteaux. Bull. Sci. Pharmacol., 1910, 17, 599—615. Chem. Zentr., 1910, 2, 1933—1934.

The authors give a review of our knowledge of coffee, kola nuts, guarana, tea, maté, and cocoa. Kolatin, the crystalline principle isolated from kola nuts (this J., 1907, 713) can be purified by treatment with a large quantity of ether in which it slowly dissolves, the impurities being insoluble. The pure substance forms white microscopic needles, m. pt. 148° C., slightly soluble in water, very slightly in ether, easily in alcohol, methyl alcohol, glacial acetic acid, and acetone, and insoluble in benzene and chloroform. It is optically inactive, reduces ammoniacal silver solution, and, on warming, also Fehling's solution. If guarana (see this J., 1910, 1226) be treated in the same way as kola nuts (*loc. cit.*), but using for the extraction 5 litres of cold 80 per cent. alcohol for 1000 grms. of material, and evaporating the alcoholic solution in a current of hydrogen, *guaranatin-coffeine* is obtained. This yields only traces of caffeine to chloroform, but is decomposed into *guaranatin* and caffeine on treatment with hot water. Guaranatin crystallises from aqueous solutions and is probably identical with the paullinia-catechin of Scheer. No compound analogous to kolatin or guaranatin could be isolated from cocoa.—A. S.

Active hydrogen in organic compounds [*alkaloids, etc.*]; *Quantitative determination of —— by means of magnesium methyl iodide.* Th. Zerewitinoff. Ber. 1910, 43, 3590—3595.

The method for the determination of the active hydrogen of hydroxyl, amino and other groups by the action of magnesium methyl iodide in amyl ether upon a solution of the substance in the same solvent has been extended to certain alkaloids (see this J., 1908, 839). Correct results were obtained with atropine, quinine, and morphine; the figures showed rather more divergence for cocaine hydrochloride, cinchonine, cinchonidine, and quinidine. Brucine and narcotine gave no reaction. Nitromethane, nitroethane, primary and secondary, nitropropane, and phenylnitromethane gave, at the ordinary temperature, a quantity of methane corresponding to less than one atom of active hydrogen. The full quantity was evolved at 100° C. Xylene, mesitylene and anisol have been found to be suitable solvents.—F. Shdn.

Antiaris toxicaria; Milky juice of ——. H. Kiliani. Ber., 1910, 43, 3574—3579.

According to the author's earlier investigations (this J., 1896, 683), antiarin—the most important constituent of the milky juice of *Antiaris toxicaria*—— has the formula, $C_{27}H_{42}O_{10}+4H_2O$, and may be decomposed into antiarigenin, $C_{21}H_{30}O_5$, and antiarose, $C_6H_{12}O_5$, a sugar metameric with rhamnose. From a sample of the juice collected in Sarawak, Seligmann has obtained an antiarin differing in some important respects (especially in physiological action) from the long-known glucoside of the same name. The author has now examined another sample of the milky juice, and finds that it contains, besides the antiarin (α-antiarin) previously described by him (*loc. cit.*), a much larger quantity of a second antiarin (β-antiarin); the juice previously examined gave no indication of the presence of such a compound. The two antiarins are found by Straub to present no difference in respect of toxicity, and, contrary to Seligmann's view that antiarin in aqueous solution soon loses its toxic action, Straub finds that an aqueous solution of antiarin (0·04 mgrm. per c.c.) retains its activity quite unchanged after 3 days storage in a loosely stoppered flask. *α-Antiarin.*—The compound forms tabular crystals, and melts at 220°—225° C. Its hydrogen-content is less than that previously found, but provisionally there is no occasion to alter the formula, $C_{27}H_{42}O_{10}+4H_2O$, which, however, requires more exact confirmation. The compound undergoes alteration on heating with $N/10$ sodium hydroxide (1 mol. equiv.); it is not affected by treatment with emulsin for 20 hours at 33°—35° C.; it is only slowly decomposed on heating with dilute hydrochloric acid; it is attacked by potassium permanganate, readily at the ordinary temperature, and very vigorously on heating, a crystalline product being obtainable. *β-Antiarin.*—Small quantities of this compound crystallise in needles, whilst larger quantities generally crystallise in prisms and often in prismatic tufts. The substance melts at 206°—207° C., is neutral, free from nitrogen and mineral matter, and is a glucoside. Analysis shows that it may possess the formula $C_{27}H_{38}O_{10}+3H_2O$, or $C_{28}H_{38}O_{10}+3H_2O$. It does not appear to be decomposed more easily than the α-compound.—L. E.

Java grass oils. de Jong. Chem. and Drugg., Jan. 7, 1911, 52. (See also this J., 1911, 47.)

The source of citronella oil in Java is the grass known in Ceylon as "Mahapengiri," whilst the bulk of the Ceylon oil is obtained from "Lena-batu" grass. It is proposed to call these grasses *Andropogon Nardus, Java*, and *A. Nardus, Ceylon*, respectively. These names correspond to *Cymbopogon Winterianus* and *C. Nardus, Lena Batu.* With rich soil and careful cultivation, the former gives a better yield of the oil. The author recommends cutting when the fifth leaf is well developed. Distilling with steam under a pressure of 3—4 atmospheres, the yield of oil is 0·5 to 0·9 per cent. of the weight of the fresh leaves. The first fraction is richest in geraniol and citronellal. *A. Nardus, Ceylon*, is recommended for planters having a poor soil. Lemongrass plants should be cropped when the fifth leaf is well developed. The author uses the following method for the determination of citral. 35 grms. of crystallised sodium bisulphite are dissolved in 50 c.c. of water in a "cassia flask," and 12 grms. of sodium bicarbonate and 10 c.c. of the oil are then added. The flask is shaken for an hour, heated on the water-bath for 30 minutes, water added to the mark, and the flask set aside for 12 hours. The quantity of unattacked oil is then read off, giving the citral content of 10 c.c. of oil. The Java oil is derived from a variety of *Andropogon citratus*, and belongs to the group of "insoluble lemongrass oils," since it does not form a clear solution with two parts of 70 per cent. alcohol. The yield of oil (palmarosa oil) from the fresh leaves and stems of Rusa grass is generally about 80—90 per cent. An unidentified *Andropogon sp.* is known in Java and yields an oil rich in geraniol. The yield from the plant, which is similar to citronella grass in habit, is 0·2 to 0·3 per cent., and the geraniol content of the oil is 40—60 per cent. Two varieties of Vetiver or Cuscus grass (*A. muriaticus*) are known in Java. The oil is obtained from the roots to the extent of 0·4 to 0·9 per cent. —F. Shdn.

Essential oils; Oil of orange flowers. G. Laloue. Bull. Soc. Chim., 1910, 7, 1101—1107.

During the present year a sufficient amount of orange flowers was obtained in October and the oil extracted by light petroleum. Flowers gathered in May were extracted in the same way. 1000 kilos. of the flowers gave 2·272 kilos. of extract in May, and 1·795 kilos. in October. The oils obtained were subjected to steam-distillation, and thereby separated into portions insoluble and soluble in the condensed water. The soluble oil was removed by extracting with ether and mixed with the insoluble oil. The constants of the oil obtained in May were determined and compared with those of the October oils. All the oils were lævo-rotatory, whilst oils produced by the steam-distillation of the flowers are dextro-rotatory. Oil obtained by steam-distillation under reduced pressure is also lævo-rotatory. The optical rotation of the oils produced in May was higher than that of oils produced in October. The amount of methyl anthranilate was greater in the May oils than the October oils. The amount of terpenic esters and alcohols was smaller in the May oils than in the October oils.—F. Shdn.

Essential oils; Oil of Schinus Molle L. G. Laloue. Bull. Soc. Chim., 1910, 7, 1107—1109.

The plant, *Schinus Molle* L. or American pear, is abundant in Provence, the neighbourhood of Nice, and Algeria. Oil was obtained from this plant grown at Grasse and compared with oil from the same species grown in Algeria. The following characters were observed :—

	Algeria.		Grasse.
	Leaves.	Branches.	Branches.
Sp. gr. at 15° C.	0·8658	0·8634	0·8696
Optical rotation, 100 mm. tube	+ 65°20′	+ 50°54′	+ 46°13′
Solubility in 90 per cent. alcohol	3 vols.	5 vols.	10 vols. turbid.
Acid value	0·7	0	2·1
Total saponification value ..	4·1	5·5	10·3
True saponification value ..	3·4	5·5	8·2
Esters calculated as linalyl acetate, per cent.	1·2	1·9	2·8
Saponification value after acetylation	40·4	29·4	43·4

After fractionating by distillation, evidence was obtained of the presence of pinene, phellandrene and a sesquiterpene. Pinene appears to be present in larger amount in the French oil.—F. Shdn.

Catalytic reactions at high temperatures and pressures. XXII. Hydrogenation of terpenes. W. Ipatiew. Ber., 1910, **43**, 3546—3553.

LIMONENE was heated with copper oxide or copper in an iron tube at about 300° C., whilst hydrogen gas was pumped in, the pressure being kept at 110—130 atmospheres. Copper oxide was found to require a lower temperature than copper for the hydrogenation. Under these circumstances limonene gave a satisfactory yield of menthane. Pinene, from French oil of turpentine, was subjected to the same reaction but using different catalysers. In the presence of iron the tetramethylene ring is broken, with the formation of dipentene and polymerisation products. Using copper oxide hydrogenation takes place. At 265° C. a product, $C_{10}H_{18}$, is formed, whilst at 240° C. dipentene is produced. If the temperature is between 280° and 290° C. a hydrocarbon having the composition of menthane is formed. This has the sp. gr. 0·7949 at 20° C., boils at 163°—170° C., and is mixed with some unsaturated by-products. By fractionation and further hydrogenation, the amount of the latter can be reduced. A hydrocarbon, $C_{10}H_{18}$, is obtained when copper is used. With copper oxide at 300° C., a hydrocarbon, $C_{10}H_{20}$, was produced, boiling at 166°—169°, and with the sp. gr. 0·7970 at 20° C. Menthane (b. pt. 163°—169° C., sp. gr. 0·8028 at 20° C.) can be obtained from pinene by using nickel oxide as a catalyser at temperatures below 280° C. The product became warm on the addition of a nitrating mixture whereas the hydrocarbon, $C_{10}H_{20}$, (b. pt. 167°—170° C. sp. gr. 0·8038 at 20° C.) produced in the same way from cymene, was not attacked by this reagent.—F. SHDN.

d-Pinene-chloroxime; Action of piperidine on ——. L. V. Buschujew. J. Russ. Phys.-Chem. Soc., 1910, 42, 1447—1448.

IN Schimmel's Report (Oct., 1910, 171) it is stated that the results of the author's investigations on the action of piperidine on *d*-pinene-chloroxime (this J., 1910, 516) confirm those of Wallach (Annalen, 1888, **245**, 252). The author points out, however, that he obtained *d*-nitrosopinene and *d*-pinenenitrolpiperidide as the result of this reaction (compare also Golubew, this J., 1909, 40), whilst Wallach obtained *d*-pinenenitrolpiperidide only. —T. H. P.

Iodoform; Dimorphism of ——. B. Bardach. Chem.-Zeit., 1911, **35**, 11—12.

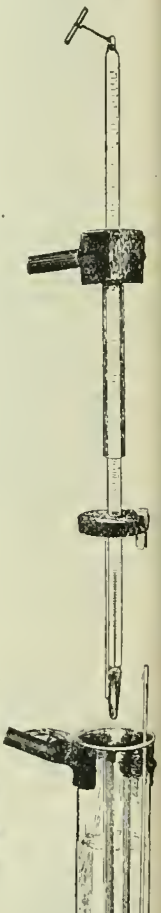
THE author has obtained iodoform in fine needle shaped crystals instead of the usual hexagonal plates. The simplest method of preparation is as follows:—0·1 grm. of coumarin is dissolved by heating with 3 c.c. of alcohol and the solution poured into 97 c.c. of hot water. After cooling 4 c.c. of iodo-potassium iodide solution and 6 c.c. of 10 per cent. ammonia are added, and the mixture filtered after 1 hour. To the clear light yellow or greenish filtrate, about 30 c.c. of a 2 per cent. alcoholic solution of iodoform are added drop by drop with stirring; needle shaped crystals separate at once, and are filtered off and washed with water until free from the odour of coumarin. The crystals melt at 121° C.; on recrystallising from alcohol or on distillation with steam, they yield the ordinary hexagonal plates melting at 119° C. Analysis gave 96·09 per cent. of iodine (calculated 96·68). These crystals are also formed in the author's modification of Lieben's acetone test (this J., 1909, 673).—A. SBLD.

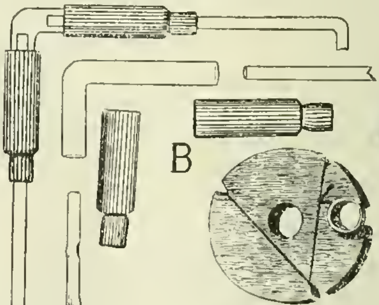
Photolysis of organic compounds by ultra-violet rays; Principal types of ——. D. Berthelot and H. Gaudechon. Comptes rend., 1910, **151**, 1349—1352.

THE authors have previously (this J., 1910, 724, 725, 904, 1080, 1081) described the decomposition of different organic compounds on exposure to ultra-violet rays and now classify the modes of decomposition according to the constitution of the compounds (alcohols, aldehydes, ketones, and acids).—A. S.

Melting point determinations; A study of ——, *with special reference to the melting-point requirements of the U.S. Pharmacopœia.* G. A. Menge. Public Health and Marine Hospital Service, U.S.A., Hygienic Laboratory. Bull. No. 70, Oct. 1909. (Compare also Tyrer and Levy, this J., 1899, 1048; 1900, 845, 926.)

IN connection with the forthcoming revision of the U.S. Pharmacopœia an investigation has been made of the different methods which have been proposed for the determination of melting points, and also of the causes of the varying results obtained by different workers. It was found that in the case of substances which decompose at or below the melting point, the latter is of little value as an indication of purity. It is recommended that a melting interval instead of a melting point be specified and that the following method be adopted as official in the next U.S. Pharmacopœia. The apparatus is shown in the accompanying figure. The substance, powdered so as to pass a 100-mesh sieve and dried for 24 hours over sulphuric acid in a desiccator, is introduced into a thin-walled capillary tube (internal diam. 0·8—1·25 mm.) so as to form a column 3 mm. high after tapping down. The capillary tube is attached to the thermometer so that the column of substance is opposite the middle of the bulb. Thermometers of uniform construction, preferably official, should be used, and corrections for calibration and for emergent stem applied. The heating bath recommended is concentrated sulphuric acid for temperatures up to 150° C., and a mixture of 70 parts of concentrated sulphuric acid and 30 parts of potassium sulphate (or 55 of acid to 45 of sulphate) for higher temperatures. This is placed in a round-bottom tube (30 mm. internal diam. and 100 mm. long) to such a depth that when the bulb of the thermometer is immersed so that its upper end is 2—3 cm. below the surface, its lower end will then be the same distance from the bottom of the tube. The tube is closed by a cork of the form shown at A, which is covered on its underside with a disc of asbestos. The glass stirrer is made in two parts which are joined as shown at B. The tube is heated by direct application of a small Bunsen flame; from a point about 25° below the melting point, the temperature is raised at the rate of 3° per minute up to the beginning of the melting interval (when a portion of the column of substance collapses against the side of the capillary tube) and then at the rate of 0·5° per minute until melting is complete. The bath is stirred constantly during the determination.—A. S.





Behaviour of acetic anhydride at a high temperature. Bamberger. *See* IIB.

Patents.

Tobacco; Method of removing nicotine from ——. J. Sartig, Nikolassee, Germany. Eng. Pat. 11,460, May 10, 1910.

The process consists essentially in treating the tobacco with steam at a temperature of about 50° C. and under a pressure of about 92 mm. The tobacco leaves, either in their original condition or after treatment with ammonia, are arranged in a closed vessel which is surrounded by a water-jacket at the desired temperature. Low-pressure steam is admitted into this vessel at the bottom and leaves at the top, carrying with it the nicotine vapours extracted from the tobacco. The steam and nicotine vapours are conducted through a condenser into a chamber surrounded by cold water; this chamber is in connection with an exhaust pump by means of which a reduced pressure is maintained in all the parts of the apparatus. The nicotine may be recovered by the use of suitable methods. —W. P. S.

Olefine or saturated acids; Process for obtaining ——. J. K. Phelps, New Haven, Conn. U.S. Pat. 974,182, Nov. 1, 1910.

Alcoholic and ketonic acids are reduced to acids containing fewer oxygen atoms, by treatment with hydriodic acid (or phosphorus and iodine) in presence of a substantially anhydrous organic solvent; the presence of a catalytic agent, such as zinc chloride or a salt of copper or iron, increases the rate of the reduction and the yield of the product. As an example is given the reduction of tartaric acid to succinic acid: 60 grms. of tartaric acid, 15 grms. of iodine, and 2 grms. of zinc chloride are dissolved in 100 c.c. of glacial acetic acid; 14 grms. of red phosphorus are added, and the mixture is heated for about two hours under a reflux condenser; on turning the condenser, the acetic acid and iodine distil over, leaving the succinic acid in the flask. To produce fumaric acid from tartaric acid, the same method is employed, using less phosphorus (*e.g.* 6·5 grms.).—T.F.B.

Quinine ester. H. Thron, Assignor to Verein. Chininfabr. Zimmer und Co., Frankfort on Maine, Germany. U.S. Pat. 978,792, Dec. 13, 1910.

When esters of quinine with organic acids are "coupled" with hydro-halogen acids, addition products are obtained, the halogen in which is not acted on in the cold by silver nitrate nor by ammonia. The general formula of the products is, $C_{20}H_{24}N_2O_2.x.y$, where x is a halogen and y an organic acid radical. The salicylic ester of hydrobromoquinine, $C_{20}H_{24}N_2O_2.Br.CO.C_6H_4OH$, is easily soluble in benzene, acetone, hot alcohol, and chloroform, but insoluble in petroleum spirit and water. It is precipitated by acids from its solutions in alkali.—T. F. B.

Radioactive elements; Method of obtaining the gaseous emanations of ——. E. Sommer and F. L. Kohlrausch. Ger. Pat. 226,804, March 24, 1909.

In the preparation of radium emanation for therapeutic purposes, the liquid containing the emanation is heated under a reflux condenser, so that the steam evolved along with the emanation is more or less completely condensed. It is stated that the condensed water retains but little of the emanation, and the more or less dry emanation collected is well suited for therapeutic purposes.—A. S.

2.3-*Dimethyl*-1.3-*butadiene; Manufacture of* ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 14,094, June 10, 1910.

See Fr. Pat. 417,275 of 1910; this J., 1911, 38.—T. F. B.

Organic mercury compound. M. Engelmann, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 978,145, Dec. 13, 1910.

See Ger. Pat. 224,435 of 1909; this J., 1910, 1037.—T.F.B.

Borneol; Process of oxidising —— *to camphor.* G. Austerweil, Neuilly, France. U.S. Pat. 979,247, Dec. 20, 1910.

See Fr. Pat. 392,011 of 1908; this J., 1908, 1222.—T.F.B.

Converting liquids of all kinds, extracts, balsams, fats, waxes, etc., into impalpable powder. Ger. Pat. 229,141. *See* I.

Diminution of the quantity of trimethylxanthine in plants. [*Removal of caffeine from cocoa*]. Fr. Pat. 418,213. *See* XIXa.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Colour screens on celluloid films or coatings; Process for the manufacture of ——. C. Späth, Steglitz-Berlin, Germany. Eng. Pat. 23,138, Oct. 6, 1910. Under Int. Conv., Oct. 29, 1909.

In the preparation of colour screens by successively staining portions of a celluloid surface with solutions of different dyestuffs, it is proposed to dilute the solvent used for making the solution, more and more for each successive staining; in this way, the previously stained surfaces are not affected by the more dilute solutions. A celluloid film may be coated on each side with a thin layer of rubber, and on one of these layers a series of lines is scratched to expose the celluloid surface; the film is now dipped in a solution of 2 grms. of Victoria Blue in 100 c.c. of absolute alcohol, washed, and dried; a second series of lines is scratched on the surface, preferably perpendicular to the first, and the film is immersed in a solution of 2 grms. of Auramine and 1 grm. of Ethyl Green in 150 c.c. of 80 per cent. alcohol, washed, and dried. The rubber coating remaining is now washed off the one side of the celluloid, and the film is immersed in a solution of 2 grms. of Rubin and 1 grm. of Auramine in 150 c.c. of 60 per cent. alcohol. The resulting screen will consist of blue lines and green and red squares.—T. F. B.

Gelatin composition [*for photographic films*]. E. F. Felsing, Assignor to M. W. Felsing, Munich, Germany. U.S. Pat. 974,131, Nov. 1, 1910.

The durability of gelatin films used for photographic purposes, is greatly increased by adding an uranium salt to the gelatin solution. For example, 200 grms. of hard gelatin are dissolved in 1000 c.c. of water and then melted in water at not more than 38° C.; to this solution are added about 5 grms. of alcohol or other hardening medium, 20 grms. of colouring matter, and 25 to 30 c.c. of a 5 per cent. solution of uranium acetate: after filtration the solution is spread on paper in the usual manner, and sensitised with bichromate.—T. F. B.

Photographic paper. G. W. Leighton and C. S. Babcock. Fr. Pat. 418,906, May 4, 1910. Under Int. Conv., May 10, 1909.

Photographic papers similar to platinotype paper, are obtained by coating a suitable paper or other basis with a solution containing ferrous oxalate, a soluble silver salt, and a soluble mercury salt: the solution may have the following composition:—Ferrous oxalate, 12 grms., silver nitrate, 5 grms.; mercuric nitrate, 1·2 grms.; oxalic acid, 1 grm.; water, 75 c.c. Decreasing the quantity of mercury tends to give brownish-black prints, and increasing it, bluish-black prints. The paper is printed, developed with potassium oxalate, and cleared with hydrochloric acid in the same way as with platinotype paper, but it must be fixed by means of 5 per cent. sodium thiosulphate solution before washing and drying. The finished prints do not appear to contain mercury. In place of the mercury salts soluble in water. those soluble in ferrous oxalate solution (*e.g.*, yellow mercuric oxide) may be used, whilst the mercury salt may be partially replaced by potassium oxalate, stannous citrate, and certain other salts.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

PATENTS.

Explosives. Nobel's Explosives Co., Ltd., Glasgow and J. M. Wilson, Beloeil Station, Canada. Eng. Pat. 8769, April 12, 1910.

THE explosive is a granular gelatinous dynamite, in which there is no cohesion of the inert material, which exists, practically, as separated grains. The active substances are nitroglycerin (62 parts), nitrocotton (3·5), pulp (6·13) and potassium nitrate (21·5). The inert substances are kieselguhr (4·87), magnesium carbonate (1) and red oxide of iron (1 part). The nitroglycerin, nitrocotton, and kieselguhr (3 parts) are mixed together and allowed to stand overnight. This mixture is placed in the gelatinising pan (50° C.), and, after incorporating for 5 minutes the potassium nitrate is added. After mixing for another 5 minutes the pulp, magnesium carbonate, red oxide, and the remainder of the kieselguhr (1·87 parts) are added. The incorporation should be stopped when the explosive presents a uniformly coloured mealy appearance. Further incorporation would result in cohesion and thus prevent the formation of a granular explosive. The advantages claimed are as follows. There is little liability of any unexploded part of the charge being found. If, in the granular form, the charge has partially miss-fired the remainder is disseminated. It is easier to see whether the explosive is properly thawed. The explosive is less inert and, thus, explosion is more complete than in the ordinary gelatinous explosive in the plastic form.
—G. W. McD.

Explosive. G. M. Peters, Cincinnati, and M. F. Lindsley, Kings Mills, Ohio, Assignor to The King Powder Co., Cincinnati, Ohio. U.S. Pat. 977,545, Dec, 6, 1910.

THE explosive consists of sodium nitrate, about 48; ammonium nitrate, about 24; calcium carbonate, about 4; brimstone, about 12, and charcoal, about 12 per cent.—E. W. L.

Explosives: Chlorate and nitrate ——. E. Louis. Fr. Pat. 418,675, July 28, 1910. Under Int. Conv., May 20, 1910.

A MIXTURE of petroleum derivatives with the physical characteristics of ordinary beef fat is used in place of the animal fats claimed in Fr. Pat. 340,913 of 1904 (this J., 1904, 837), with the object of obtaining greater stability. Thus from 85 to 95 parts of powdered potassium chlorate or sodium chlorate may be incorporated at about 80° C. with 15 to 5 parts of a mixture of, say, 201 parts of petroleum oil, 42 parts of vaseline, and 867 parts of paraffin wax. The chlorate may be mixed with a nitrate before incorporation with the other ingredients.—C. A. M.

XXIII.—ANALYTICAL PROCESSES.

Extraction of aqueous liquids with organic solvents of lower specific gravity. R. Kempf. Chem.-Zeit., 1910, 34, 1365.

AN extraction apparatus in which the use of corks or rubber stoppers is avoided comprises a wide vertical glass cylinder fitted, by means of ground joints, to the neck of a flask and to a Soxhlet condenser, at its lower and upper ends respectively. The aqueous liquid to be extracted is placed in a glass tube within the cylinder. The solvent is boiled in the flask, and drops from the condenser into a funnel-tube which leads it to the bottom of the aqueous liquid, the bubbles of solvent liberated at the lower end of the funnel-tube ascending by the under-surface of a glass helix. The solvent which collects above the aqueous liquid flows through holes in the side-walls of the tube, and so back into the flask.—A. T. L.

Determining cyanogen compounds in coke-oven gases. Lecocq. *See* IIA.

Rapid method for the identification of gas oils. Park and Worthing. *See* IIA.

Determining chromium in chromium-tungsten steels. Wdowiszewski. *See* X.

Direct determination of rubber in vulcanised rubber articles. Huebener. *See* XIV.

Normal weight of dextrose. Browne. *See* XVII.

Analysis of honey. Curtel, Muttelet, and Moreau. *See* XVII.

Valuation of antiseptic properties of hops. Brown and Ward. *See* XVIII.

Determining whether a liquid contains one or several enzymes. Achalme and Bresson. *See* XVIII

Determining active hydrogen in organic compounds [*alkaloids, etc.*]. Zerewitinoff. *See* XX.

Java grass oils. de Jong. *See* XX.

Melting point determinations. Menge. *See* XX.

Hydrogen; Gas-volumetric determination of ——. O. Brunck. Chem.-Zeit. 1910, 34, 1313—1314, 1332—1333.

THE author strongly recommends the method proposed by Paal and Hartmann (this J., 1910, 236) for the determination of hydrogen in presence of saturated hydrocarbons by absorption with a solution of colloidal palladium and sodium picrate. The palladium adsorbs the hydrogen which then converts the picric acid into triaminophenol. A solution containing 2 grms. of colloidal palladium in 100—110 c.c., with the addition of 5 grms. of picric acid neutralised by 22 c.c. of $N/1$ sodium hydroxide, is recommended. An ordinary tubulated gas pipette is used as absorption vessel and a number of glass balls of 5—7 mm. diameter as filling material, whereby less of the expensive palladium solution is required. The gas is left in contact with the absorbing solution for 5 mins., then returned to the measuring burette, and its volume noted, and these operations are repeated until no further decrease in volume takes place. According to Paal, the palladium solution when it loses its activity can be revivified in the following manner. Dilute sulphuric acid is added carefully, drop by drop, as long as a precipitate forms, but avoiding excess. The precipitate is removed, washed, suspended in a small quantity of water, dissolved by the gradual addition of sodium hydroxide solution, and the requisite quantity of sodium picrate added.—A. S.

PATENTS.

Viscosity meters. A. Baldus, Frankfort a/M., Germany. Eng. Pat. 22,961, Oct. 4, 1910. Under Int. Conv., Oct. 4, 1909.

THE fluid under examination is placed in a tube which is closed, leaving a bubble of air inside, and placed in one of a series of grooves upon a metal plate mounted upon pivots in a frame or box. Means are provided for heating this plate from beneath, whilst a thermometer can be placed in a groove near the tube. The metal plate is then tilted to a suitable angle and held in position by one of a series

of fixed stops, and the time required for the air bubble to traverse the fluid, or a measured portion thereof, is determined. The velocity of the air bubble in cm. or mm. per second affords a measure of the viscosity of the oil, etc. The viscosity meter may also be provided with adjustable legs, so that the zero mark may be made level even when the apparatus rests upon an uneven surface.
—C. A. M.

Colorimeter. A. M. Parks, Philadelphia, Pa. U.S. Pat. 977,964, Dec. 6, 1910.

The apparatus consists of a series of tubes held in position by two perforated horizontal partitions placed across a box. Only the middle portions of the tubes are visible and the back of the box is "of a contrasting colour with the material in the tubes." The back of the box and the lid are hinged, so that the tubes can be removed.—W. P. S.

XXIV.—MISCELLANEOUS ABSTRACTS.

Colloidal combinations; Capacity of saturation of ——. W. Spring. Bull. Soc. Chim. Belg., 1910, **24**, 446—453. (See this J., 1909, 430; 1910, 99, 363.)

The author has previously shown that the detergent action of soap belongs to the domain of colloidal chemistry, and his explanation of this action is chiefly based on the assumption that the force which determines the adsorption of the two substances (soap and dirt) should be limited, not only in intensity, but also in capacity, thus bearing a resemblance to chemical affinity. To simplify the conditions in the experiments now described, saponin, which is not hydrolysed so readily as soap, was used instead of the latter substance. It is shown that a solution of saponin in water is not absolutely colloidal, but that it occupies an intermediate position. A suspension of lampblack (freed from fatty or resinous substances) subsides much more slowly from a 2—3·5 per cent. solution of saponin in water than from pure water; solutions of saponin of greater or less concentration are less effective, and if even a trace of acid or alkali is added, the lampblack subsides from all the saponin solutions (0·0045—7·5 per cent. concentration) in a few hours, no optimum-region of saponin-concentration being exhibited. If an electric current is passed through a solution of saponin, the latter travels in a direction opposed to that of the current, whereas, with a suspension of lampblack, the opposite is the case. This difference supports the view that adsorption occurs between lampblack and saponin, and that such is the case, is proved by the fact that if a current is passed through a solution of saponin (of optimum concentration) containing lampblack in suspension, the liquid becomes quite clear in the neighbourhood of the cathode, *i.e.*, the direction of motion of the lampblack is reversed (owing to adsorption by the saponin); the concentration of the saponin decreases in the neighbourhood of the cathode. Hence, not only do the saponin and the lampblack form an adsorption compound, but the former is displaced more readily than the latter under the influence of the current. The author quotes various experiments which show that lampblack loses its property of being adsorbed by paper, when it, itself, has adsorbed saponin. If a suspension of lampblack in pure water is shaken for some time with filter paper pulp, the pulp then being removed and dried, and the residual liquid treated with fresh pulp several times, the liquid finally becomes nearly clear. The dried pulps, however, (with the exception of the last portion, treated with liquid containing very little lampblack) are darkened to nearly the same degree, *i.e.*, the colour of the dried pulp is not proportional to the amount of lampblack in the water; this indicates that the capacity of saturation of cellulose for lampblack (or inversely) is limited. The phenomenon constitutes a further proof that the properties exhibited by solutions of true colloids are also exhibited, though to a less degree, by suspensions.—L. E.

Books Received.

The Chemical Trade Directory of Chemical Manufacturers, Merchants, Brokers, and Agents and makers of Chemical Plant in Great Britain and Ireland. Fourth Edition. Davis Bros., 265, Strand, London, W.C. 1911. Price 10s.

8vo volume, containing 454 pages of matter. The contents are in three sections. The first, an alphabetical list of names of chemical manufacturers, merchants, brokers and agents, also makers of chemical plant and materials, in Great Britain and Ireland, with full addresses. The second, classified lists of chemical products, etc., with names and locations of the makers, such, that at a glance, the reader can discern how many makers there are of any particular product. The third section, an entirely new one, contains much information useful to those in the chemical trade. Opening with the text of the Alkali Act of 1906, an abstract follows of the last report of the Chief Alkali Inspector. Next follow abstracts of legal decisions, the "Census of Production" returns for 1908, and a series of price diagrams; one showing the fluctuations in the price of coal tar, etc. Then follow tables showing exports and imports of chemicals, etc., for the years 1907—1909, the section closing with an abstract of the Factory and Workshop Act of 1901.

Qualitative Chemical Analysis from the Standpoint of Solubilities, Ionization and Mass Action. By J. I. D. Hinds, Ph.D., LL.D., Professor of Chemistry, University of Nashville, etc., Tennessee. The Chemical Publishing Co., Easton, Pa. U.S. America. 1910. Price $2. Williams and Norgate, 14, Henrietta Street, Covent Garden, London, W.C.

8vo volume, containing 259 pages of subject matter, and an alphabetical index of subjects. The subject matter is divided into five sections, as follows:—I. Principles and methods of qualitative analysis. II. Basic analysis. III. Acidic analysis. IV. Complete analysis of an unknown substance. V. Reagents and tables.

A Text Book of Organic Chemistry. By A. F. Holleman, Ph.D. Professor ord University of Amsterdam. Edited by A. J. Walker, Ph.D., and O. E. Mott, Ph.D., with the co-operation of the author. Third English edition, partly re-written. John Wiley and Sons, New York, U.S.A. Chapman and Hall, Ltd., London. 1910. Price $2.50.

8vo volume containing 570 pages of subject matter, with 83 illustrations, and an alphabetical index of subjects. The text is subdivided as follows:—I. Introduction II. The fatty compounds, divided into twenty-six subsections. III. The aromatic compounds and substances related to them, including (i) the polymethylene derivatives. (ii) Properties characteristic of the aromatic compounds. (iii) Benzene and the aromatic hydrocarbons with saturated side chains. (iv) Mono substitution-products of the aromatic hydrocarbons. (v) Benzoic acid. Its derivatives and homologues, etc. (vi) Diazo-compounds and hydrazines. (vii) Compounds containing an unsaturated side-chain. (viii) Polysubstituted derivatives containing similar substituents. (ix) Derivatives with two or more dissimilar substituents. (x) Orientation of aromatic compounds. (xi) Hydrocylic or hydroaromatic compounds. (xii) Benzene-nuclei directly linked together, or indirectly by carbon. (xiii) Condensed benzene rings. (xiv) Heterocyclic compounds. (xv) Condensation products of benzene and heterocyclic nuclei (xvi) Alkaloids.

The Art of Roadmaking. Treating of the various problems and operations in the construction and maintenance of roads, streets and pavements. Written in non-technical language, suitable for the general reader; with an extensive bibliography and a descriptive list of reliable current books and pamphlets on these subjects. By Harwood Frost, B.A Sc. The Engineering News Publishing Co. New York. 1910. Price 12s. net. Constable and Co., Ltd., London.

8vo volume, containing 533 pages of subject matter, with 254 engravings, and 5 in the appendix. There is an alphabetical index of subjects. The text is subdivided as follows :—I. Resistances to traction. II. Road and pavement economics. III. Principles underlying the selection of pavements for different purposes. IV. Location of country roads. V. Construction and protective works. VI. Materials used in road construction. VII. Earth, gravel, sand, and clay roads. VIII. Broken-stone roads. IX. Roads in mountainous districts. X. Improvement and maintenance of country roads. XI. Control and prevention of road dust. XII. State and laws. XIII. Design of city streets. XIV. Stone block pavements. XV. Brick pavements. XVI. Wood block pavements. XVII. Asphalt pavements. XVIII. Concrete pavements. XIX. Cleaning and sanitation of city streets. XX. Side walks, curbs, and gutters. XXI. Miscellaneous roads and pavements. XXII. The roadside.

Einzelschriften zur Chemischen Technologie herausgegeben von Dr. Th. Weyl. Privatdozent a. d. tech. Hochschule zu. Berlin. Vol. I. (Erste Lieferung) Papier, von G. Dalén. J. Ambrosius Barth's Verlag, Dorrienstrasse 16, Leipzig. 1911. Price M. 4.

8vo pamphlet-volume, containing 120 pages of subject matter with 40 illustrations. The text is arranged as follows :—I. Preparation of Paper. (i.) The fibre materials: its origin and methods of working up. II. The additional processes and materials, mixtures, etc, used. III. Manufacture of paper. IV. Paper testing.

Vol. I. (Part II.) Glass. Bernhard Müller. Price M. 4.

Contains 103 pages of subject matter with 19 illustrations. The text is subdivided as follows :—I. Definition of glass. II. Its history. III. Exports and imports. Glass in Germany. Statistics. IV. Composition. V. Properties. VI. Materials and mixtures. Melting vessels and furnaces. VII. Fusion process. VIII. Preparing the glass melt, etc. IX. Glass colouring, etc. X. Mechanical processes. a. Cutting and polishing, etc. b. Etching. XI. Water-glass.

Leather. Johannes Paessler.

Forms part of the same issue as preceding, and contains 13 pages of subject matter, with 2 illustrations, and deals with the following subjects :—I. Introduction. II. Crude materials and adjuncts of the tanning industry. II. The tanning process, and its details.

Vol. I. (Part III.). Fats, Oils, Waxes, etc. C. Stiepel. Price M. 5.

This, part III. of the series, contains 138 pages of subject matter, with 22 illustrations, and an alphabetical index of subjects in all the three preceding issues, *i.e.* Parts I. to III. The subject matter of the present part III., is sub-divided as follows :—I. Occurrence of fats, oils, and waxes. II. Methods of extracting fats, oil, and waxes. III. Their purification. IV. The commercially most important fats, oils, and waxes and the technical methods of extracting and preparing them ; Their properties, and valuation. V. The commercial valuation, and final purification of fats and oils. VI. Soap manufacture. VII. Glycerin manufacture.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT ; MACHINERY.

Applications.

137. Ault, Collins, and Travis. Apparatus for separating and grading solids from liquids by centrifugal action. Jan. 3.

146. Paterson. Filtering apparatus. Jan. 3.

608. Drage. Filtering machines [Australian Appl., Feb. 21, 1910.]* Jan. 9.

623. Khur, George, and Jobling. Production of a vacuum with the liberation of free liquid hydrogen. Jan. 10.

748. Beeton. Vacuum pans, evaporators, or condensers. Jan. 11.

Complete Specifications Accepted.

22,728 (1909). Ogle. Machinery for separating materials of different specific gravity. Jan. 18.

581 (1910). Chambers, and H. B. Watson, Ltd. Means for the continuous discharge of solids from liquids. Jan. 18.

1033 (1910). Averine. Filtering apparatus. Jan. 18.

1353 (1910). Burgess and Muir. High-pressure filter. Jan. 11.

1960 (1910). Scherf. Drying apparatus. Jan. 18.

3452 (1910). Brownson. Filtering liquids, syrups, etc. Jan. 11.

10,753 (1910). Mathys (Kalb). Method and apparatus for evaporating liquids to dryness. Jan. 18.

19,473 (1910). De Guide and Briart. *See under* XVI.

II.—FUEL ; GAS ; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Applications.

78. Bussey (Evans). Manufacture of gas. Jan. 2.

132. Lüdecke, and Imperial Lamp Works, Ltd. Electric furnaces used in making metal filaments.* Jan. 3.

199. Woodroffe. *See under* XXIII.

298. Moeller. Production of producer gas from oil. Jan. 5.

475. Hellmann. Treatment of petroleum. Jan. 7.

595. Schweiz Flussigas-Fabr. L. Wolf. Manufacture of liquid gas. [Ger. Appl., Jan. 13, 1910.]* Jan. 9.

686. Edmundson. Manufacture of filaments for electric incandescent lamps. Jan. 10.

690. Koppers. Combined gas generators and coke ovens.* Jan. 10.

710. British Thomson-Houston Co. (General Electric Co.). Arc lamp electrodes. Jan. 10.

868 to 871. Armstrong and Mordau. Solidification of hydrocarbon oils. Jan. 12.

948. Jones. Vertical coke ovens. Jan. 13.

1073. Kupferberg. Gas producers. Jan. 14.

Complete Specifications Accepted.

4125 (1910). Hall-Brown. Gas producers of the rising grate type. Jan. 11.

4592 (1910). Kruskopf. Preventing explosions of coa dust in coal mines. Jan. 18.

7049 (1910). Summers. Coking processes. Jan. 18.

17,359 (1910). Burkheiser. Production of ammonium sulphate in the manufacture of gas. Jan. 18.

17,949 (1910). Bolz. Upright distilling retorts. Jan. 18.

III.—TAR AND TAR PRODUCTS.

Application.

411. Bayer und Co. *See under* XX.

IV.—COLOURING MATTERS AND DYES.

Applications.

73. Act.-Ges. f. Anilinfabr. Manufacture of azo dyestuffs [Ger. Appl., Aug. 18. 1910.]* Jan. 2.

222. Meister, Lucius, und Bruning. Manufacture of vat dyestuffs. [Ger. Appl., Feb. 9, 1910.]* Jan. 4.

316.* Newton (Bayer und Co.). Manufacture of azo dyestuffs. Jan. 5.

404. Act.-Ges. f. Anilinfabr. Manufacture of vat dyestuffs of the anthraquinone series. [Ger. Appl., May 12, 1910.]* Jan. 6.

488. Ransford (Cassella und Co.). Dyestuffs. Jan. 7.

894. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds and colouring matters of the anthracene series. Jan. 12.

974. Bayer und Co. Manufacture of trisazo dyestuffs. [Ger. Appl., April 20, 1910.]* Jan. 13.

COMPLETE SPECIFICATIONS ACCEPTED.

368 (1910). Newton (Bayer und Co.). Manufacture of dyestuffs of the triphenylmethane series. Jan. 11.

12,321 (1910). Meister, Lucius, und Brüning. Bromination of dyestuffs of the thioindigo series. Jan. 11.

15,390 (1910). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of an azo colouring matter. Jan. 18.

25,292 (1910). Bayer und Co. Manufacture of diazotisable dyestuffs. Jan. 18.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

APPLICATIONS.

309. Verein. Glanzstoff-Fabr. Manufacture of stable viscous cellulose solutions. [Ger. Appl., Sept. 13, 1910.]* Jan. 5.

406. Courtauld and Co., Ltd., and Napper. Manufacture of threads, filaments, strips, or films of cellulose. Jan. 6.

849. Bernstein. Manufacture of artificial threads. Jan. 12.

880. Norton. Production of pulp from papyrus and other Egyptian and Syrian semi-aquatic plants for papermaking, etc. Jan. 12.

1022. Fox and Myers. Apparatus for treating artificial threads. Jan. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

496 (1910). Milne. Apparatus for reclaiming fibre, loading, etc., from waste waters from paper making and similar machines. Jan. 18.

2018 (1910). Arledter. Manufacture or treatment of pulp for use in making paper. Jan. 18.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

APPLICATIONS.

82. Simpson. Bleaching fibres or textile fabrics. Jan. 2.

412. Bayer und Co. Production of brown to olive shades on the fibre. [Ger. Appl., May 30, 1910.]* Jan. 6.

489. Ransford (Cassella und Co.). Manufacture of bisulphite compounds of carbazole dyestuffs and their use for printing. Jan. 7.

572. Boult (Eddystone Manufacturing Co.). Fabric printing machines.* Jan. 9.

669. Meister, Lucius, und Brüning. Production on cotton of dyeings capable of being discharged. [Ger. Appl., Feb. 4, 1910.]* Jan. 10.

833. Melling. Apparatus for washing or other treatment of cloth in rope form in bleachworks, etc. Jan. 12.

867. Dürr. Process for dyeing mixed textile materials.* Jan. 12.

876. Lesser. Process of dyeing with benzoquinone and α-naphthoquinone dyestuffs . [Ger. Appl., March 3, 1910.]* Jan. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

870 (1910). Peters. Production of waterproof linen. Jan. 18.

953 and 12,741 (1910). Turnbull. Dyeing and washing machines. Jan. 11.

4985 (1910). Masurel. Cylindrical drying mechanism for sized yarn and the like. Jan. 18.

12,406 (1910). Zimmer. Treatment of starched linen articles. Jan. 18.

21,411 (1910). Deutsche Solvay Werke. Manufacture of bleaching liquids. Jan. 18.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

APPLICATIONS.

61. Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia. Jan. 2.

153. Jaubert. Preparation of hydrogen. [Fr. Appl., Jan. 14, 1910.]* Jan. 3.

297. Moeller. Manufacture of ozone. Jan. 5.

319. Friedrich. Manufacture of nitric acid. [Swiss Appl., Jan. 6, 1910.]* Jan. 5.

401. Saubermann. Process for generating hydrogen.* Jan. 6.

403. Friedrich. Manufacture of nitric acid. [Swiss Appl., Sept. 24, 1910.]* Jan. 6.

534. Goldschmidt. Manufacture and use of ferrosoferric oxide.* Jan. 9.

561. McCowan. Manufacture of zinc sulphate. [Divided Appl., on No. 3357 of 1910. Sept. 12.]* Jan. 9.

807. Gerlache. Manufacture of metallic ammoniates. Jan. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

10,066 (1910). Sarason. Process for developing oxygen. Jan. 11.

17,359 (1910). Burkheiser. *See under* II.

19,677 (1910). Wedekind und Co. Production of granular sodium bichromate. Jan. 18.

19,679 (1910). Deiss and Fournier. Manufacture of oxalic acid and other organic acids and oxygenated products of carbon. Jan. 18.

21,411 (1910). Deutsche Solvay Werke. *See under* VI.

VIII.—GLASS; CERAMICS.

COMPLETE SPECIFICATION ACCEPTED.

4316 (1910). Baillie. Glass furnaces. Jan. 11.

IX.—BUILDING MATERIALS.

APPLICATION.

556. Thom. Method for indurating lime blocks or compositions containing lime. Jan. 9.

COMPLETE SPECIFICATION ACCEPTED.

27,568 (1910). Thompson (Amme, Giesecke und Konegen A.-G.). Wet process for treating rock material, particularly raw materials for cement. Jan. 18.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

APPLICATIONS.

18. Thorp. Alloy and its manufacture. Jan. 2.

41. Naulty and Scanlin. Copper alloys. [U.S. Appl., July 23, 1910.]* Jan. 2.

47. Tonet. Oxidation of metals.* Jan. 2.

48. Wemyss-Just. Metallic alloys. Jan. 2.

100. Bussey (Evans). Extraction of copper from its ores. Jan. 2.

138. Duke. Metallic alloy. Jan. 3.

169. Vautin. Treatment of zinc. Jan. 3.

299. Moeller. Manufacture of heat and acid resisting metal goods. Jan. 5.

570. Hughes. Volatilisation of ores.* Jan. 9.

580. Reid. Apparatus for electroplating.* Jan. 9.

655. Cowper-Coles. Electro-galvanising. Jan. 10.

672 to 674. Stobie. Electric metallurgical furnaces.* Jan. 10.

721. Barron and Barron. Electro-deposition of metals. Jan. 11.

873. Duke. Metallic alloy. Jan. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

28,829 (1909). Glass. Process for briquetting fine ore and other materials. Jan. 18.

684 (1910). Goldberg. Pyrophoric alloys. Jan. 18.

7224 (1910). Smith and Deakin. Apparatus for the electro-deposition of metals. Jan. 18.

12,430 (1910). Aktiebolaget Elektrometall. Means for regulating the electrodes in electric smelting furnaces. Jan. 11.

XI.—ELECTRO-CHEMISTRY.

APPLICATIONS.

60 and 142. Johnson (Badische Anilin und Soda Fabrik). Electrical purification of gases. Jan. 2 and 3.

132. Lüdecke, and Imperial Lamp Works, Ltd. *See under* II.

176. British Thomson-Houston Co., Ltd. (General Electric Co.). Insulating compounds.* Jan. 3.

335. British Thomson-Houston Co., Ltd. (General Electric Co.). Insulating material. Jan. 5.

419. Helberger. Electric furnaces.* Jan. 6.

Complete Specifications Accepted.

1189 (1910). Reid. Electric furnaces. Jan. 18.

20,404 (1910). Ruthenburg. Electric furnaces. Jan. 18.

XII.—FATS; OILS; WAXES.

Applications.

261. Van der Capellen. Manufacture of soap.* Jan. 4.

372. Jones. Fat and oil extractor. Jan. 6.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

420. Linoleum Manufacturing Co., Ltd., and Godfrey. Manufacture of linoleum. Jan. 6.

1071. Freymuth. Manufacture of lac.* Jan. 14.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

20. Clarkson. Treatment of latex obtained from rubber and analogous trees. Jan. 2.

434. Silberrad. Manufacture of hydrocarbons analogous to rubber. Jan. 6.

435. Silberrad. Manufacture of a product analogous to vulcanised rubber. Jan. 6.

1045. Matthews and Strange. *See under* XX.

1069. Leemans. Purifying vulcanised indiarubber. [Addition to No. 16,456 of 1910.]* Jan. 14.

Complete Specifications Accepted.

341 (1910). Cockerill. Drying and otherwise treating indiarubber. Jan. 18.

14,281 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of substances resembling caoutchouc. Jan. 11.

26,173 (1910). Pahl. Coagulating the latex of caoutchouc producing plants. Jan. 18.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

491. Thompson (Hide-Ite Leather Co.). Manufacture of leather-board.* Jan. 7.

564. Grobe. Manufacture of imitation leather.* Jan. 9.

XVI.—SOILS; FERTILISERS.

Complete Specifications Accepted.

10,511 (1910). Stock. Fertiliser, insecticide, and fungicide. Jan. 18.

19,473 (1910). De Guide and Briart. Treatment of bags for holding and conveying chemical manure and the like. Jan 11.

19,706 (1910). Forbes and Macfarlane. Fertilisers. Jan 18

XVII.—SUGARS; STARCHES; GUMS.

Application.

133. Bébien. Continuous manufacture of sugar syrup by a cold process.* Jan. 3.

Complete Specification Accepted.

4855 (1910). Kestner. Sugar crystallising process. Jan. 11.

XVIII.—FERMENTATION INDUSTRIES.

Application.

115. Blair. Selection and culture of yeasts. Jan. 3.

Complete Specifications Accepted.

772 (1910). Kuhn. Manufacture of beer. Jan. 18.

4800 and 7188 (1910). Nance. Manufacture of fermented beverages containing low percentages of alcohol. Jan. 11.

XIX.—FOODS: WATER PURIFICATION; SANITATION.

Applications.

614. Loring. Manufacture of wheaten flour. Jan. 10.

842. Oetker. Manufacture of baking powder.* Jan. 12.

887. Swiss Dry Milk Co. Manufacture of dry milk. [Swiss Appl., Dec. 26, 1910.]* Jan. 12.

Complete Specifications Accepted.

28,516 (1909). Grossmann. Method and apparatus for drying sewage sludge. Jan. 18.

12,432 (1910). Wallis, and Wallis, Ltd. Treatment of germ of wheat to obtain a preparation for mixing with flour and meal. Jan. 18.

16,508 (1910). Commin. Treatment of sewage. Jan. 18.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

158. Heinemann. Manufacture or artificial production of essential oils. Jan. 3.

411. Bayer und Co. Production of pinacone. [Ger. Appl., June 2, 1910.]* Jan. 6.

568. Bart. Manufacture of organic derivatives of arsenic acid. [Ger. Appl., Jan. 7, 1910.]* Jan. 9.

569. Verein. Chininfabr. Zimmer und Co. Manufacture of hydro-cinchona-alkaloids. [Ger. Appl., March 26, 1910.]* Jan. 9.

611. Goldschmidt. Manufacture of acetic anhydride from salts of acetic acid. [Ger. Appl., Dec. 10, 1910. Addition to No. 25,433 of 1908.]* Jan. 9.

736. Silberrad. Manufacture of isoprene. Jan. 11.

877. Müller Manufacture of products from yohimbine. [Addition to No. 14,576 of 1910.]* Jan. 12.

975. Newton (Bayer und Co.). Manufacture of divinyl and its homologues. Jan. 13.

1045. Matthews and Strange. Manufacture of divinyl and its homologues and derivatives and of caoutchouc-like substances therefrom. Jan. 14.

Complete Specifications Accepted.

816 (1910). Gelhaar. Production of salts of urea. Jan. 18.

7721 (1910). Mason. Production of a compound of santalol and lactic acid. Jan. 18.

19,679 (1910). Deiss and Fournier. *See under* VII.

XXII.—EXPLOSIVES; MATCHES.

Complete Specification Accepted.

555 (1910). Van Pittius. Explosives. Jan. 11.

XXIII.—ANALYTICAL PROCESSES.

Applications.

199. Woodroffe. Apparatus for determining the quantity of carbon dioxide in furnace flue gases, producer gases, etc. Jan. 4.

659. Borchers. Apparatus for testing gases, steam, or other vapours, and recording same. [Ger. Appl., Jan. 14, 1910.]* Jan. 10.

1059. Presser. Selenium photometer.* Jan. 14.

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Yorkshire Section.

Meeting held at Leeds on Monday, December 12th, 1910.

MR. F. W. BRANSON IN THE CHAIR.

THE ANALYSIS OF OILS OF TURPENTINE.

Part II.

BY F. W. RICHARDSON AND J. E. F. WHITAKER.

In this Journal, 1908, June 30th, F. W. Richardson and J. L. Bowen showed that with mixtures of hydrocarbons occurring in American and Russian petroleums with turpentine one could get good results by simply determining the refractive indices of the various fractions. It was also stated that Armstrong's polymerisation method had given very unsatisfactory results.

J. H. Coste reaffirmed (Analyst, 1910, p. 112) his reliance on the Armstrong method, and criticised the procedure of Richardson and Bowen, pointing out the indisputable fact that certain petroleums contain very appreciable amounts of benzene homologues ("probably *m*-xylene, mesitylene, and cumene"). No doubt Mr. Coste had Borneo petroleum well in mind, petroleum rich in hexacarbocyclic ("aromatic") hydrocarbons. This petroleum differs widely from American petroleum, the products of which are by far the most extensively used for adulterating turpentine; indeed we are assured that for over a year no Borneo spirit has been imported into Europe. We have not met with any turpentine substitute or turpentine adulterant composed of Borneo spirit.

Samples of Borneo and American "daylight petroleum" gave us:

	Borneo.	American.
Specific gravity at 15½° C.	0·81364	0·80192
Refractive index at 15½° C.	1·4549	1·44474
Iodine (Hübl) 16 hrs.............	1·65	—

The differences are much accentuated upon fractional distillation:

Fraction at °C.	Volume per cent.		Sp. gr. at 15½° C.		Ref. Index at 15½° C.	
	Borneo.	American.	Borneo.	American.	Borneo.	American.
1. 126—149	8·0	9·8	0·8090	0·7500	1·4533	1·4180
2. —154	21·2	3·6	0·8104	0·7548	1·4541	1·4211
3. —161	28·5	3·4	0·8114	0·7580	1·4545	1·4229
4. —165·5	13·4	3·0	0·8130	0·7618	1·4546	1·4255
5. —171	10·6	2·8	0·8134	0·7652	1·4547	1·4286
6. —177	8·2	2·4	0·8142	0·7713	1·4547	1·4286
Residue	10·1	75·0	0·8236	—	1·4586	—
	100·0	100·0	—	—	—	—

As it is fairly easy to convert benzene and its homologues into sulphonates we made the attempt with the two petroleums and with pure benzene. 5 c.c. of the liquid are placed in a round-bottomed Jena glass flask of about 250 c.c. capacity with 8 c.c. of a mixture of equal parts of ordinary 1·82 sp. gr., and fuming sulphuric acids with precautions as to cooling. After thorough admixture and after connecting with a reflux condenser, the flask is heated with occasional vigorous shaking on a boiling water bath for an hour. After cooling and dilution the liquid is poured upon 30 grms. of powdered barium carbonate placed in a large porcelain dish. The mixture is made up to mark in a 500 c.c. flask and 100 c.c. are filtered off (corresponding to 1 c.c. of the original sample), and well boiled to decompose barium bicarbonate, and in the filtered solution the barium is determined as sulphate by precipitation with dilute sulphuric acid. The number of milligrams of barium sulphate thus found less 5 mgrms. for barium sulphite caused by reduction of sulphuric to sulphurous acid, represent the barium sulphate coefficient.

The following average figures were obtained:

Benzene (commercial)..................	1083
Borneo petroleum	533
American petroleum	99
American motor spirit	90
American turpentine	98

These results show that Borneo petroleum undoubtedly contains a considerable proportion of aromatic hydrocarbons. As benzol is very cheap, it is quite possible that it may be used as a turpentine adulterant.

The barium factor would give an approximation of the amount present, and it would also be of service in proving the absence or presence of aromatic hydrocarbons generally. If the figure were low (not more than 100 or 120) then the Richardson-Bowen method would be applicable. In the remote possibility of Borneo spirit ever being used for the adulteration of turpentine, we would recommend reliance upon the iodine number (Hübl) and the barium factor. The former to give an approximation of the amount of turpentine; the latter to indicate the nature of the adulterant. Distillation and fractionation would only be of subsidiary advantage.

Benzene can be readily separated from turpentine by the use of a Young's still-head. Over 90 per cent. of the ordinary commercial "benzene" (really benzol) distils over below 82° C. and the various distillates at 15½° C. show uniformly a specific gravity of 0·884 and a refractive index of 1·499.

A mixture of equal volumes of turpentine and benzol gave the following results on fractional distillation.

	Found.	Present.	Error.
Turpentine	47·8	50·0	− 2·2
Benzol	51·8	50·0	+ 1·8

When the benzol has come over the temperature in the distilling flask rapidly rises.

In our experience petroleum spirit and not crude petroleum is used to adulterate turpentine.

A mixture of constitution unknown to one of us gave the following data:—Sp. gr. at 15½° C., 0·76772; Ref. index at 15½° C., 1·43750. Barium sulphate factor, 263. Using a Young's still-head, 100 c.c. gave 70 c.c. of distillate at 25° C. to 85° C., having a sp. gr. at 15½° C. of 0·70884, refractive index (15½° C.), 1·4034, and barium sulphate factor, 287.

Using the figures, refractive index at 15½° C. benzol, 1·4993 ; gasolene, 1·3670, the 70 per cent. fraction consists of :

Benzol .	19·2	—15·6 (actual)	—3·6 error
Gasolene	50·8	—56·0 ,,	+5·2 ,,
	70·0		
Turpentine (diff.) ..	30·0	—28·4 ,,	—1·6 ,,
	100·0	—100·0	

With the barium sulphate factor, assuming for the non-benzol portions a value of 94, and the figure for the original mixture of 263, the results are :

	Found	Actual.	Error.
Benzol	17·1	15·8	+1·5
Gasolene and turpentine	82·9	84·4	—1·5

If we take the barium sulphate factor for the distillate the result is 14·0 per cent. benzol, or an error of 1·6 per cent.

Another mixture unknown to the analyst was submitted to our own methods, and to the Armstrong process carried out according to the details given in the original paper (this J., 1882, 478).

Armstrong operates upon 500 c.c. of the turpentine, and uses acids increasing in strength as the terpenes become reduced in quantity, and in the third treatment he advises that the mixture shall be violently agitated in a well stoppered bottle with several times its volume of strong sulphuric acid at 50° to 60° C.

If necessary the hydrocarbons must be shaken a fourth time with strong acid, to remove any terpenes.

100 c.c. with Young's still-head gave 30·5 c.c. fraction coming over from 25° to 85° C., and both the odour and the nitrobenzol reaction showed much benzol. The data were : sp. gr. at 15½° C., ·7204 ; ref. index at 15½° C., 1·4078 ; representing 21·0 c.c. of gasolene and 9·5 c.c. of benzol. The 69·5 c.c. residue in the distilling flask had a "bloom," and gave sp. gr. at 15½° C., 0·8548 ; ref. index at 15½° C., 1·4662. 65 c.c. of this on fractionation yielded :

	°C.	Vol. c.c.	c.c. $\frac{69·5}{65}$	Ref. ind. at 15½° C.
(1)	159	17·4	18·6	1·4640
(2)	171	25·6	27·4	1·4664
Residue over	171	22·0	23·5	1·4683
		65·0	69·5	

From Richardson and Bowen's data from petroleum and turpentine distillates the composition of the 69·5 c.c. was calculated :

(1) Distillate	2·2	c.c. petroleum
(2) ,, ...	3·1	,, ,,
Residue	14·3	,, ,,
	19·6	,, ,,
	49·9	c.c. turpentine by difference.
	69·5	

The results finally are :

	Present.	R. & W.'s method.	Errors.	Armstrong.
Turpentine	47·60	49·9	+ 2·3	67·2 (diff.)
Petroleum......	20·00	19·6	— ·4	32·8
Gasolene	21·65	21·0	— ·65	
Benzol	10·75	9·5	— 1·25	
	100·00	100·00	—	100·00

The results of the methods we have described are exceptionally good in the case of this complex mixture, while the original Armstrong process shows a loss of nearly half, viz., 19·6 c.c. of the petroleum, gasolene and benzol.

Recently Morrell (this J., 1910, 241) modified Armstrong's polymerisation method to this small extent ; instead of separating the unpolymerised portions, the mobile liquid from the dark sulphuric acid lower layer, he distils directly in a current of steam. Morrell is right in his contention that it is unnecessary to separate before distillation ; but the results we obtain by his modification are no better than those given by the original Armstrong process.

A further mixture of unknown composition gave :

	Present.	R. & W.'s methods.	Errors.	Armstrong's original.	Morrell's modif.
Turpentine ..	80·0	76·2	— 3·8	88	88·6
Petroleum....	10·0	13·8	+ 3·8	12	11·4
Gasolene	10·0	10·0	Nil.		
	100·0	100·0		100	100·0

In another mixture containing 18 per cent. of petroleum Armstrong's method gave 9·4 and Morrell's modification 10·2 per cent. a serious loss of adulterant in both cases.

On the other hand, the sulphuric polymerisation process is of considerable value for *qualitative* purposes, *i.e.*, when it is necessary definitely to prove the presence or absence of petroleum products when mixed with turpentine.

A turpentine gave sp. gr. at 15½° C., 0·84292 ; ref. index (15½° C.) 1·4630 ; iodine value (Hübl), 257. By the distillation method as described in the original paper, by Richardson and Bowen, the petroleums found amounted to 19·6 per cent.

A portion of a genuine turpentine and of the sample in question were submitted to the Armstrong process ; both gave a small amount of unpolymerised liquid, which furnished the following data :

	Genuine turpentine.	Suspected sample.
Sp. gr. at 15½° C. ...	0·8594	0·7994
Ref. index at 15½° C.	1·4760	1·4482

Polymerisation therefore furnished the strongest possible confirmatory evidence of the presence of petroleum products.

The constant manner in which the refractive indices and gravities of the unpolymerised portions increase as one applies further treatments with sulphuric acid shows that finality is not easy to obtain by the Armstrong method ; meanwhile serious losses are steadily occurring.

The following are our data from turpentines recently obtained :

	Turpentines.			
	American.	French.	Russian.	Swedish.
Specific gravity at 15½° C.	0·87224	0·86908	0·86608	0·8650
	0·86864	0·86805	—	0·86776
	0·86632	—	—	—
	0·87070	—	—	—
	0·86836	—	—	—
Refractive indices at 15½° C.	1·4695	1·4705	1·4710	1·4740
	1·4722	1·4706	—	1·4772
	1·4718	—	—	—
	1·4706	—	—	—
	1·4710	—	—	—
	1·4703	—	—	—
Iodine values (16 hrs.) Hübl	353 %	402 %	276 %	315 %
	358 %	402 %	—	255 %
	440 %	—	—	—
	425 %	—	—	—
	405 %	—	—	—
Barium sulphate factors	90	103	139	—
	98	113	—	140
				—
Polarimetry $[\alpha]_D$ ..	+ 78°	— 32·3°	+ 12·6	
	—	— 31·5	—	+ 12·75°

Discussion.

Mr. F. W. **Branson** asked if it would be possible to apply a correction scale so as to get more accurate results, if errors in the specific gravities and refractive indices were uniform.

Mr. T. **Fairley** said there was a difference in turpentine from different countries owing to the varying species of pines culvivated. What particular countries had the turpentine used come from? What attempts had been made to identify the different constituents of turpentine from various sources?

Mr. G. A. **Bracewell** asked what excess of iodine was used in determining Hübl's iodine value. He had found 30 per cent. excess insufficient especially in examining linseed oil. Much depended on how the solutions were made up. The alcoholic mercuric chloride solution kept quite well, but the iodine solution tended to oxidise. He considered at least 12 hours was required for the time of mixing. The iodine solution should be regularly standardised.

Dr. H. **Ingle** said that distillation in a current of steam was recommended in some text books for the separation of turpentine from petroleum products. He found, however, that many of these latter came over almost completely on distillation. Wijs' or Hübl's method (as modified by him, this J., 1902, 587), were best for the determination of the iodine values of turpentine. The main thing was the purity of the reagents used. He recommended doing a blank test in Hübl's method with the iodine solution alone leaving out the mercury solution. The calculated iodine value of pinene was 374 and under the above conditions pure American turpentine gave numbers closely approximating (this J., 1908, 314). In Hübl's method the time of action was best 18 hours or overnight. In Wijs' four hours were ample. On titrating, the liquid should be diluted with water first to separate the turpentine iodochloride in the chloroformic layer. If potassium iodide was first added, there was a danger of the reduction of the iodo-chloride, giving too low results. He had tried a rough polymerisation method for ascertaining the suitability of turpentine for paints, etc. To 10 c.c. of the sample 20 c.c. of pure coal tar benzol and 20 c.c. of conc. sulphuric acid were added in a measuring cylinder and after shaking allowed to stand half an hour. The increase in volume of the acid layer was read off, and afforded a rough and ready measure of the turpentine present. Different varieties of turpentine he found to give different iodine values. Russian turpentine often prepared from old wood (stumps of trees, etc.), gave lower results than American. Russian 230—280; American 350—374. He had never tried the barium sulphate method, but it seemed likely that it might give useful results where petroleum products other than shale spirit were present.

Mr. F. W. **Richardson**, in reply, said that he had used several varieties of turpentine for his experiments, including Swedish and Mexican. All were very much alike in specific gravity (usually 0·858—0·868) and refractive index (about 1·47), but the polarimeter could not be relied upon. Thus French turpentine was lævo-rotatory, while American was dextro-rotatory. Considerable differences also occurred in the iodine values, which could not be taken as satisfactory data unless supported by other factors. It was, however, useful in distinguishing between turpentine and such adulterants as benzene. He found it best to use quite double the amount of iodine necessary, and usually allowed 16 hours for the absorption. It was said that some substitutes for turpentine answered remarkably well and therefore it was surprising that there was so much objection to them. On the other hand, as petroleum cost about one-sixth as much as turpentine, it should not be sold at turpentine price.

Obituary.

ALBERT WERNER CRONQUIST.

A. W. Cronquist, one of the greatest authorities of his time on explosives, and artificial fuels, was born at Malmö in Sweden on June 26th, 1846. He was trained as a chemist at the Technical High School in Stockholm in the Sessions 1863—1866, and held the post of chemist to the Geological Survey of Sweden, during 1866—1871, at the same time acting as teacher in a school of technology. Towards the close of the above period, he obtained the "Byzantine grant" from the Swedish Academy of Science, and travelled in Germany, Belgium, and Holland, studying artificial fuels and their modes of production. With the experience thus gained, he undertook an investigation concerning the utilisation of the Swedish national peat supply. He also founded in 1872 a Bureau of Technology in Stockholm, which he maintained until 1884. When the position of Chemist of Commerce was instituted in Sweden, in 1877, Cronquist was appointed to it. In 1884, he was engaged as Chemist to the Torpedo Department of the Swedish navy, and in 1891, to the Navy itself, in the same capacity. Following these distinctions, he was made Inspector of Explosives for Sweden, a post he retained until his death. His professorial chair he obtained in 1893, and lectured in chemistry in connection with the Technical School, as well as in chemistry and mineralogy for the Agricultural Survey Department. He lectured in chemistry also in the Torpedo School, and in the Naval High School.

The manufacture of spirits was a subject largely investigated by Cronquist, though during the latter part of his life, he was mostly occupied by his investigations in explosives.

Cronquist took a leading part in founding the Swedish Chemical Society, and he acted as the representative of Sweden at foreign Congresses.

It was through his investigations as to the formation of hydrogen phosphide from ferrosilicon on board the s.s. "Olof Wijh," which led to fatal results, that legislation resulted in several countries besides Sweden, on the subject of carrying this compound on board ship.

A. W. Cronquist has been a member of this Society since 1890, and in 1889 he contributed a paper on "The behaviour of certain explosives under percussion" (see this J., 1889, 969—970). He died in Stockholm on November 22nd, 1910.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

English.—8*d.* each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1*s.* each, to the Secretary of the Society.

French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs Bourgeois, Paris (3e.).

German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Drying apparatus; Direct heat rotary ——. J. Nagle, London. Eng. Pat. 25,807, Nov. 9, 1909.

The material to be dried is fed into one end of the lowest of a series of two or more steel tubes placed parallel, one above the other, over a furnace and heated by the gases from the latter, which are caused to circulate through flues surrounding the tubes. Each tube is inclined slightly towards the outlet and is provided with internal, longitudinal, straight or curved vanes or deflectors spaced around the interior of the tube. The tubes are rotated from the ends and as the material is discharged from the

end of one tube it is elevated to the inlet of the next above. The dried product is discharged from the end of the uppermost tube. The vapours given off are withdrawn from the inlet ends of the tubes and conducted to suitable condensers where any solid particles that may have been carried away by the vapour are recovered.
—W. H. C.

Drying machines; Centrifugal ——. J. W. Macfarlane, Cathcart, N.B. Eng. Pats. 29,549, Dec. 17, 1909, and 10,146, April 26, 1910.

The head or boss from which the basket is supported by a spindle, and which is rotated in a hemispherical cup or seating, is controlled by a series of springs so arranged that they are in compression when the machine is at rest or rotating normally, but are prevented from following up the movement of the collar when the machine gyrates.
—W. H. C.

Drying apparatus; Vacuum ——. O. S. Sleeper, Assignor to Buffalo Foundry Co., Buffalo, N.Y. U.S. Pat. 980,444, Jan. 3, 1911.

A suitably heated drum is rotated within a chamber connected with a vacuum-pump. The material to be dried is supplied to the inner side of the drum simultaneously along its whole length and the dried material is removed by a scraper which also acts simultaneously along the whole length of the drum.—W. H. C.

Drying-oven; Vertical, continuous ——. Soc. de Constructions Mécaniques d'Alais. Fr. Pat. 419,034, Aug. 6, 1910.

A cylindrical casing has a number of superposed, radially slotted shelves arranged parallel to the ends of the cylinder, the slots of one shelf being immediately below the solid parts of the shelf above. The material to be dried is fed on to the top shelf and is agitated and caused to fall from shelf to shelf by arms or rakes attached to and rotated with a central vertical shaft. The drying is effected by a current of hot air or gas which enters the bottom of the cylinder, passes upwards and is withdrawn by a fan placed near the top.—W. H. C.

Separating liquid from solid material: Filtering apparatus for ——. The Wilfley Mining Machinery Co., Ltd., and J. F. M. Roberts, London. Eng. Pat. 29,360, Dec. 15, 1909.

A perforated drum is caused to rotate round a fixed support, and an endless band of perforated material forming a support for an endless band of filter cloth passes round the drum and round another drum fixed below. The upper part of the fixed support is hollow and is divided into radial chambers connected with a vacuum pump, and the lower part of the support is also hollow and connected with a supply of air or water under pressure. The filtering band is pressed against the drum to make a tight joint and the material to be filtered is fed on to the moving band at the point at which it comes into contact with the upper fixed support. The liquid is sucked through and a thin layer of solid deposit is left on the band. As the band comes into contact with the lower support, air and/or water under pressure are forced through the cloth from the inside to clear the pores. A scraper may be provided to assist in stripping off the solid deposit.—W. H. C.

Filtering apparatus for separating liquids from materials and for washing and saturating materials with liquid. T. Breakell, Wirksworth, Derby. Eng. Pat. 30,586, Dec. 31, 1909.

A horizontal, rotatory cylinder, externally covered with a suitable filtering medium, and internally provided with suction means for maintaining a reduced pressure and withdrawing the filtered solution, is partly immersed in—or is otherwise continuously supplied with—the material (slime, etc.) under treatment; the separated solid matter is removed, during the rotation of the cylinder, by means of an adjustable scraper or knife. By means of radial partitions fixed to the axis of the cylinder, the interior of the latter is divided into a number of segmental compartments, each of which is provided with a separate suction-pipe. Alternatively, when a side feed is adopted, a fixed trough, divided into two compartments by a vertical partition, extends through the interior (at a short distance below the axis) for the purpose of catching the filtered liquid; the passage of the latter to the trough being facilitated, and its flow to the lower part of the cylinder being largely prevented, by a series of projections on the inside of the cylinder wall. The washing of the filtered residue is effected by means of one or more water pipes adapted to oscillate along the whole length of the cylinder; and in either construction the arrangement is such that the filtered liquor and wash-waters may be collected separately, if desired.—W. E. F. P.

Filter-press; Centrifugal ——. F. K. and E. F. Atkins, Denver, Colo. U.S. Pat. 980,859, Jan. 3, 1911.

Prepared filter-elements covered with filter-cloth are radially disposed within the bowl of the centrifugal machine. The material to be filtered is fed under pressure through a central feed channel and is distributed by pipes to the bowl. The liquid passes through the filter-cloth into the interior of the radial filters and is discharged through pipes passing through the periphery of the bowl.
—W. H. C.

Filter-press; Continuous ——. C. C. Leclaire. Second Addition, dated July 21, 1910, to Fr. Pat. 394,450, Nov. 26, 1907. (See this J., 1909, 236 and 691.)

The filter-body is provided with a tapering core for the purpose of diminishing the volume of material under treatment, while retaining the same filtering area; independent arrangements are provided for operating the various parts of the apparatus, the mechanism for administering the shock being increased for the purpose of multiplying the periodic vibrations; and the solid deposit is evacuated tangentially to the lower conical portion in which the screw is situated.—W. E. F. P.

Filtering apparatus; Continuous ——. M. Denis. Fr. Pat. 419,279, Aug. 3, 1910.

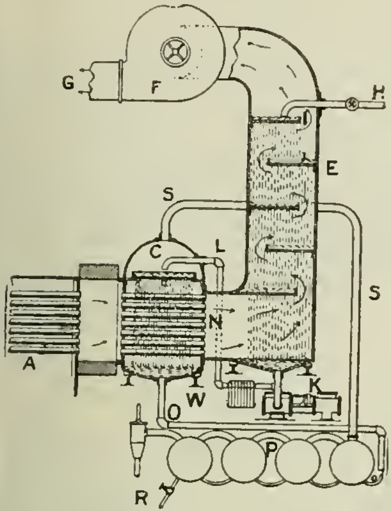
The apparatus comprises at least two elements, each consisting of a filtering chamber, containing a removable, conical filtering partition, and provided with a feed-pipe and an exit-pipe. These pipes are controlled by suitable cocks; and by means of a cock provided in the cover of the chamber, communication between the interior of the chamber and the outer air is made when required. To permit of the removal of the conical filtering partition from any chamber without disturbing the equilibrium of pressure in the system, the feed-pipe to each chamber is provided with a separately controlled by-pass.—W. E. F. P.

Evaporating apparatus. E. Scott and Co., Ltd., and H. J. Pooley, London. Eng. Pat. 29,698, Dec. 18, 1909.

In order to utilise the latent heat of the vapour from an evaporator or from the last effect of a multiple effect system, the liquid which is destined to be eventually evaporated in the apparatus proper, is sprayed over a tubular heater, through which the vapours from the last effect are caused to circulate. The cool liquid condenses the vapours and becomes heated. A current of air is drawn by a fan through the liquid spray either in the heat interchanging vessel, or in a subsidiary vessel, into which the heated liquid is sprayed, in order to carry away some of the liquid as vapour and to cool the remainder sufficiently to enable it to be fed directly into the last effect of the system, or to be used over again to condense the vapour from the last effect.—W. H. C.

Evaporating solutions; Apparatus for ——. S. M. Lillie, Philadelphia, Pa. U.S. Pat. 980,108, Dec. 27, 1910.

The liquid to be evaporated is fed by the pipe, H, into the top of the tower, E, provided with baffle-plates, I, and up which the hot gases from the furnace, A, pass to the exhaust fan, F. The liquid passes from the bottom of the tower, E, through the filter-press, W, to the pump, K, which delivers it by the pipe, L, to the heater, C, where it is further heated by the gases from A, which pass through the tubes, N, to the tower, E. The vapour given off in the vessel, C, passes by the pipe, S, to the multiple effect evaporator, P, to which the hot liquid from C, flows by the pipe, O. The liquid finally escapes in a concentrated condition from the pipe, R.—W. H. C.



Evaporator; Closed-cycle ——. J. Dinckels. Fr. Pat. 419,373, Aug. 16, 1910.

In a circulatory system, the liquid issuing from a tubular boiler passes into a chamber above, wherein the rapid escape of vapour is promoted by causing it to flow over horizontal or inclined plates, the liquid being thereby sufficiently cooled for the maintenance of the circulation. It is claimed that frothing is thus prevented, and that the vapour produced is free from particles of liquid. —W. E. F. P.

Exchanging heat between two fluids of different temperatures; Method of —— and apparatus therefor. L. D. Lovekin, Philadelphia, U.S.A. Eng. Pat. 5145, March 1, 1910.

One of the liquids is caused to pass rapidly through a narrow annular space between two concentric tubes in one direction and the other liquid is caused to pass in the contrary direction within the inner and without the outer tube. The flow of the liquid in the space between the tubes takes place as a more or less broken film. Both tubes are corrugated, the corrugations taking the form of a screw thread or helix, so that the two tubes may be loosely threaded together, leaving a very narrow helical annular space between them.—W. H. C.

Heating and cooling liquids more especially applicable for pasteurising purposes; Apparatus for ——. W. J. McKee, Detroit, Mich., U.S.A. Eng. Pat. 29,767, Dec. 20, 1909.

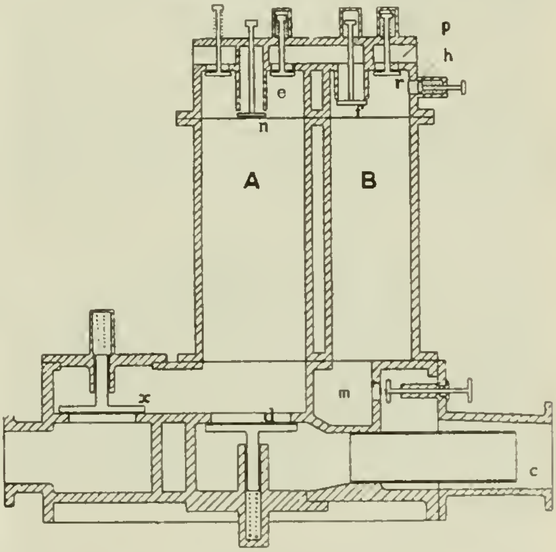
The apparatus consists of three vessels similar to ordinary multitubular condensers but having the usual tubes replaced by radially disposed, flattened tubes suitably attached to upper and lower tube-plates. The liquid to be treated enters the lower part of the first vessel, passes round the outside of the radial flattened tubes to the top and passes on to the second vessel. It passes up through the tubes of this vessel and is heated by steam which is circulated through the space surrounding the tubes. From the top of the second vessel, the now hot liquid passes downwards through the tubes of the first vessel, where it gives up part of its heat to the incoming liquid flowing round the tubes. The partially cooled liquid passes from the bottom of the first vessel to the top of the third, down the tubes of which it flows, being thus cooled by water which is circulated through the space surrounding the tubes.—W. H. C.

Mixing, blending and grinding machines. H. G. Boughton, Cleveland, Ohio, U.S.A. Eng. Pat. 9524, April 19, 1910.

By means of appropriate conveyors the materials are delivered, at a uniform rate and in the required proportions, to the boot of an elevator, whence the mixture is dumped regularly upon a vibrating screen. The stones, etc., being thus removed, the material falls into a mixing-trough provided with revolving paddles, and is thence conducted to the upper end of the blender—an inclined, rotatable, cylindrical vessel provided with buckets on its inner walls, and containing a system (two pairs) of rolls centrally disposed throughout its length. In the blender the material passes through each pair of rolls in succession, and, being carried up by the buckets during rotation, is repeatedly delivered to the rolls at successively lower points until finally discharged.—W. E. F. P.

Raising and forcing liquids; Method of —— and apparatus therefor. H. Davey, Ewell, Surrey. Eng. Pat. 7529, March 26, 1910.

The apparatus consists of two chambers, A, B, connected by valves and pipes as shown. A is the explosion chamber and B the compression chamber. Supposing the chamber, A, to be nearly filled with the liquid to be raised, confining a charge of explosive gaseous mixture above the liquid, and the chamber, B, to be full of liquid; when the explosion takes place the expansion forces the liquid through the non-return valve, *d*, into the rising main, C, and the velocity of the moving column of liquid draws with it, the liquid from the chamber, B, through the opening, *m*, and a fresh charge of gas enters B, through the valve, p. As soon as the gas in A, has expanded sufficiently, the valve, *n*, drops by its own weight and water enters the chamber, A, through the non-return valve, *x*, from the supply tank, and rises until it closes the valve, *n*. When the outward flow of the liquid in the main, C, ceases and the return or back flow begins, the valve, *d*, is closed, and water enters the chamber, B, the valve, *p*, closes and the gas in B, is compressed and driven through *f*, which is now open, and the non-return valve, *e*, into the space above the liquid in A. As soon as the liquid rises in B, to the level of the valve, *f*, it closes the latter but continues to rise and compress the remaining gas in the space, *r*, until the pressure is sufficient to force



the plunger, *h;* back against the spring; this closes the firing circuit and the charge in A, is exploded. — W. H. C.

Pumps; Centrifugal —— for pumping sands, ballast, minerals, sludges and the like. F. M. Lush, Roche, Cornwall. Eng. Pat. 18,857, Aug. 10, 1910.

IN centrifugal pumps having a runner or rotor attached on one side to the shaft for driving, and provided with a bearer plate on the other side near the inlet, in order to facilitate the taking up of the wear, a thickened flange is formed round the inlet. Further in order that no block may occur in the pump the runner is provided with three rearwardly curved hollow blades the openings in which are large enough to allow anything which enters the inlet of the runner to be discharged through the outlet. —W. H. C.

Refrigerating plants; Ammonia purifiers for ——. L. Wagner, Sedalia, Mo., U.S.A. Eng. Pat. 8567, April 8, 1910.

THE compressed ammonia passes from the compressor into the ammonia purifier before it enters the ammonia refrigerator and liquefier. The purifier consists of a series of steel drums set stepwise and cooled by interior cooling chambers through which water is circulated. In at least one of the drums the water must circulate in a direction contrary to that taken by the compressed ammonia. The compressed ammonia is cooled and any vapours of oil, water or other easily liquefied impurities are condensed. These flow to the lowest part of the lowest drum and are discharged through a suitable valve.—W. H. C.

Liquid separators; Centrifugal ——. E. A. Forsberg, Stockholm, Sweden. Eng. Pat. 21,820, Sept. 20, 1910.

THE liquid (*e.g.*, milk) to be separated is delivered into the bowl of the machine through several vertical gutters or channels which are spaced apart around the central feed pipe. The vertical gutters are connected together by suitable horizontal pipes and channels, and passages are formed in these connecting pipes to allow the lighter liquid to rise vertically past them to the outlet.—W. H. C.

Crystallisation; Arrangement for ——. F. Krüger. Fr. Pat. 418,215, May 20, 1910.

IN order to obtain large and perfectly homogeneous crystals suitable for optical work, the dissolving tank in which the circulating solution is saturated with the solid is provided with a heater capable of very exact adjustment. A cooler also provided with very fine adjustment is interposed in the circulating main between the heater and the crystallising vessel. By these means it is possible to arrange that the solution entering the crystallising vessel has an exact strength and temperature. By keeping the saturation and the temperature low, it is easy to obtain very fine and large crystals without any lamellar markings or structure.—W. H. C.

Still for double distillation. J. J. Joya. Fr. Pat. 418,723, July 7, 1910.

THE apparatus consists of a double set of stills, rectifying columns, and condensers, so arranged and connected that a simultaneous distillation can be carried on. The liquid to be distilled, after receiving a preliminary heating in the condenser, passes into the outer still heated by fire or by steam coils, and the product of this first distillation flows back from the condenser into the second still. This is placed within the primary still and is heated by the hot residual liquid supplemented, if necessary, by steam coils. The vapours from this second distillation pass into the second condenser.—W. H. C.

Separation of solid bodies of different densities by means of liquids. F. I. Du Pont. Fr. Pats. 419,072—419,078, Aug. 8, 1910. Under Int. Conv., Dec. 1, 1909 and Feb. 2, June 17 and 27, and July 13, 1910.

THE seven patents all refer to a process for separating solid bodies of differing densities by means of a liquid having a density intermediate between the two. The mixture of solids is fed into a vessel containing the liquid, and the lighter particles float and the denser ones sink to the bottom. By means of a suitable push-plate or screw conveyor the floating particles are carried to one end of the vessel and the heavier ones to the other end and discharged. The separated particles, with some of the liquid still adhering to them, are treated separately to free them from the liquid. If the liquid is volatile the particles are either passed through a heated tube or into a vessel containing a non-volatile heated liquid and the volatile liquid distilled off, condensed and used again. If the liquid used is not volatile, the particles are washed by a volatile liquid and the washings are distilled to recover the volatile washing liquid. Solid bodies which become liquid on heating may be used as separating liquids if the whole apparatus is heated. In the case of a mixture of oxides of iron which possess different densities on heating, they are separated by means of melted antimony bromide. —W. H. C.

Separation of solids by suspension in a liquid. F. I. Du Pont. Fr. Pat. 419,752, Aug. 8, 1910. Under Int. Conv., Dec. 1, 1909.

THE patent relates to processes in which a volatile metallic haloid (such as antimony chloride) is employed for the separation of minerals, etc., by gravity, the said haloid being finally removed from the separated mineral by volatilisation. Owing to the formation of non-volatile oxy-haloids during the process, minerals so separated are always contaminated; according to the present invention, this is obviated by the addition (to the liquid containing the separated mineral in suspension) of from 1 to 2 per cent. of an ammonium haloid (such as ammonium chloride) before the volatilisation is commenced.—W. E. F. P.

Gases; Purification and refrigeration of —— C. Bayer. Fr. Pat. 419,697, Aug. 26, 1910. Under Int. Conv., Sept. 22, 1909.

THE apparatus comprises a disintegrator and a fan, centrally connected by a wide, horizontal pipe. The former is provided with a rotatory system of baffles, fixed to the central shaft by which the fan is operated; and also with two pipes from which vertical streams of water are injected from the centre towards the periphery. In operation, the gas enters the disintegrator at the periphery, and, after being scrubbed by the combined action of the water jets and baffles, passes out by the central pipe to the fan, where the excess of water is removed from it by centrifugal action.—W. E. F. P.

Separation of liquid and solid substances from gases, vapours, air, etc.; Apparatus for the ——. C. Heine. Fr. Pat. 419,933, Dec. 1, 1910.

A VERTICAL, cylindrical vessel is divided into several annular compartments, communicating in series, by means of vertical partitions; and suitably curved bands or baffles—some of which are attached to the partitions—are disposed longitudinally in each compartment. The horizontal feed- and exit-pipes (situated one on either side of the cylinder) are on the same level, the former communicating with the outermost, and the latter with the innermost, compartment. In operation, the gas (under pressure or suction) passes through adjacent compartments in relatively opposite directions, the solid or liquid material being deposited in the curves or folds of the baffles. —W. E. F. P.

Crystals; Method of and means for producing ——. F. Krüger, Danzig-Langfuhr, Germany. Eng. Pat. 29,780. Dec. 20, 1909.

SEE Fr. Pat. 418,215 of 1910; preceding.—T. F. B.

Drying materials by hot air; Means for ——. W. Bratkowski, Berlin. Eng. Pat. 2522, Feb. 1, 1910. Under Int. Conv., Feb. 2, 1909.

SEE Fr. Pat. 412,040 of 1910; this J., 1910, 997.—T. F. B.

Drying apparatus. G. H. May, Newburgh, N.Y., and W. M. Grosvenor, Grantwood, N.J. U.S. Pat. 979,781, Dec. 27, 1910.

See Fr. Pat. 403,520 of 1909; this J., 1910, 84.—T. F. B.

Pulveriser. R. Luckenbach, Colwyn, Pa., Assignor to S. L. Garretson, San Francisco. U.S. Pat. 980,978, Jan. 10, 1911.

See Eng. Pat. 20,664 of 1910; this J., 1911, 10.—T. F. B.

Separation of liquids from gases or vapours; Apparatus for the ——. O. Bühring, Mannheim, Germany. U.S. Pat. 981,058, Jan. 10, 1911.

See Eng. Pat. 12,542 of 1910; this J., 1911, 10.—T. F. B.

Kiln; Continuous —— with travelling hearth. J. Rappold, Allswil, Switzerland. U.S. Pat. 981,109, Jan. 10, 1911.

See Eng. Pat. 13,720 of 1907; this J., 1908, 794.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal; Spontaneous ignition of ——. E. Galle. Zentralbl. Bakter. u. Parasitenk., 2. Abt., 1910, **28**, 461—473. Chem. Zentr., 1911, **1**, 48.

The author has made a bacteriological study of different kinds of coal under both aërobic and anaërobic conditions. Of seven kinds of bacteria isolated, four (*Bac. nacraceus, subtilis, mesentericus*, and *pseudosubtilis*), when grown on suitable media in presence of coal, produced a combustible mixture containing from 5·4 to 27·3 per cent. of carbon dioxide and 71·5—84·8 per cent. of methane; oxygen, heavy hydrocarbons, and carbon monoxide could be detected only in the gases produced by *Bac. nacraceus* and *pseudosubtilis*, and the total quantity never exceeded 3 per cent. The combustible gas mixture is produced by the bacteria even under conditions approaching those which prevail in nature, so that its formation in large coal deposits is probable. Although bacteria cannot be regarded as the sole cause of the spontaneous ignition of coal, it is possible that by their vital activity, especially by the production of combustible gas, they play a more or less important part in the process.—A. S.

Tar and tar-constituents; New method for the determination of —— in gas. W. Feld. J. Gasbeleucht., 1911, **54**, 33—35.

The amount of tarry matter which can be separated from the gas by cooling to any given temperature, or the amount held in suspension in the gas, is determined by passing the gas through a weighed U-tube packed with wadding. In carrying out the determination, the absorption tube packed with wadding is first dried till of constant weight by means of a current of the gas under examination, which has been passed through U-tubes packed with wadding and calcium chloride respectively, in order to free it from tar and moisture. All three U-tubes are supported in a water-bath at the required temperature. The absorption tube is next connected directly with the gas inlet, and a measured quantity of the moist tarry gas is passed through, after which it is replaced in its original position, and dried and brought to a constant weight as before. The current of gas used for drying being thus saturated with tar vapour at the temperature of the bath, it does not take up any tar in passing through the absorption tube. The method gives higher results than the methods commonly used, in which the tar is absorbed by wadding and dried by a current of air, or absorbed by alcohol which is afterwards evaporated.—A. T. L.

Hydrocarbons; Formation of —— from carbon monoxide. L. Vignon. Bull. Soc. Chim., 1911, **9**, 18—20.

The author has investigated the changes which occur when carbon monoxide is passed through a porcelain tube containing powdered lime (a mixture of oxide and hydroxide) at various temperatures. No appreciable change takes place below 350° C., but at 400° there is formed, together with hydrogen, a considerable quantity of methane and some ethylene. The proportion of hydrocarbons to hydrogen diminishes as the temperature is further raised, until at 600° C. the only reaction occurring is one discovered many years ago by Merz and Weith, viz.,

$$CO + Ca(OH)_2 = CaCO_3 + H_2.$$

The production of hydrocarbons at lower temperatures is probably preceded by the formation of calcium formate and oxalate, but the net results may be represented by the following equations—

$$4CO + 2Ca(OH)_2 + CaO = 3CaCO_3 + CH_4;$$
$$8CO + 4Ca(OH)_2 + 2CaO = 6CaCO_3 + C_2H_4 + 2H_2.$$

By passing pure (98·5 per cent.) carbon monoxide over heated lime three times in succession, the author obtained a gas consisting wholly of hydrogen and hydrocarbons. These reactions make possible the complete elimination of carbon monoxide from illuminating gas and water-gas, hydrogen and hydrocarbons being produced at the same time. The gases so treated are no longer toxic.

—J. H. L.

Petroleum; Catalytic and chemico-capillary processes in the formation of ——. N. C. Hviid. Petroleum, 1911, **6**, 429—436.

Experiments are described which illustrate the possible mode of formation of petroleum from animal and vegetable fats and waxes, as suggested by the theory of Engler and Hefer. In these experiments a silicious earth, known commercially as "frankonite" and sold for decolourising oils and fats, was used. This had the following average composition:—Amorphous silica, 70·32; titanic acid, 0·44; alumina, 13·30; iron oxide, 1·24; manganous oxide, 0·18; calcium oxide, 0·88; magnesium oxide, 0·44; potassium oxide, 4·11; sodium oxide, 1·57; and loss on ignition, 6·52 per cent. On distilling 50 grms. of lard with and without the addition of 100 grms. of this earth under comparable conditions, the distillate obtained from the mixture of lard and earth yielded, on treatment with concentrated sulphuric acid, about 40 per cent., and on treatment with fuming sulphuric acid an additional 20 per cent. of a liquid with an odour of petroleum. In similar experiments with oleic acid it was found that the decomposition effected by heat in the presence of the earth was accompanied by a liberation of water, and that the fluorescence of the distillate increased with the fall in the neutralisation value of the oleic acid. Up to a temperature of 350° C., 79 per cent. of fluid decomposition products (mainly hydrocarbons, etc.) with strong fluorescence were obtained. In the experiment with oleic acid by itself, only 23·4 per cent. of distillate was obtained below 350° C., whilst the fractions distilling between 350° and 360° C. amounted to 43 per cent. These fractions differed from those obtained from the mixture of oleic acid and earth, being solid products harder than the lard, whilst water was only split off in traces, if at all, during the distillation. On the other hand, only the first fractions of the distillate from the mixture contained traces of solid bodies. There was also a pronounced difference in the refractive indices (at 23° C.) of the two distillates, the fractions from the oleic acid ranging from 1·4542 to 1·4559, whilst those from the mixture gave the following readings: Below 250° C., 1·4502; 250° to 275° C., 1·4600; 275° to 300° C., 1·4590; 300° to 321° C., 1·4584; 321° to 340° C., 1·4645; and 340° to 350° C., 1·4705. From the results of these experiments the author concludes that under ordinary conditions there is no appreciable formation of hydrocarbons from oleic acid at 375° to 380° C., and that catalysis and adsorption must have played a part in their formation from the mixture of earth and oleic acid. The temperature at which evolution of gas took place was much lower when the fat was mixed with the earth (previously dried at 130° C.). Thus 196 c.c. of gas were liberated from a mixture of 10 grms. of lard with 50 grms. of "frankonite" after 45 minutes at 250° C., whereas from 10 grms. of the lard by itself the first evolution of gas only took place after 100 minutes at 365° C. The gases (excluding air calculated from the oxygen) contained, in the case of pure lard, 16·3 per cent. of carbon dioxide, 6·1 per cent. of olefines, and 26·1 per cent. of carbon monoxide, whilst the gases from the mixture of lard and earth contained 7·6 per cent. of carbon dioxide, 19·4 per cent. of olefines, and 19·4 per cent. of carbon monoxide. Hence it would seem that the presence of the earth had a restrictive influence upon the development of the carbon dioxide and carbon monoxide, this being probably due to the effect of capillary pressure. The distillate in this case consisted of 3·4 c.c. of water and 5·2 c.c. of a green fluorescent liquid (free from solid particles) consisting in the main of saturated and unsaturated hydrocarbons. Hence the larger proportion of earth in the mixture had a favourable influence upon the formation of fluid products. The receiver connected with the tube with the pure lard contained only about 6 grms. of a hard solid mass. The general conclusion drawn from all the experiments was that hydrolysis of the fats was first brought about by the catalytic action of the earth, and that this was followed, at a higher temperature, by decomposition, with the liberation of water, the process being retarded or modified by the capillary pressure of the porous material.—C. A. M.

Lamp oils from the principal crude Roumanian petroleums. L. Edeleanu, D. G. Many, G. Pfeiffer and Gané. Petroleum, 1911, **6**, 385—386.

THE crude petroleums of Roumania may be classified into two groups in accordance with the characteristics of the lamp oil fractions yielded by them, viz., those with fractions of low sp. gr. (Glodeni, Campina-Parjol, Policiori, and Campina, containing paraffin wax), and those with fractions of high sp. gr. (Campina, not containing paraffin wax, Bustenari, Moreni and Gura Ocnitei). Thus the hydrocarbons of crude Policiori oil distilling at 320° C. had a sp. gr. of 0·839, whereas the fractions of Bustenari oil distilling at about 300° C. had a sp. gr. of 0·887. Speaking generally, the distillation temperatures of the various fractions of the oils included in the second group are higher than in the case of the first group, with the exception of Campina-Parjol oil. The lamp oils from the petroleums in the first group contain solid hydrocarbons in their final fractions on distillation. Thus the fraction boiling above 300° C. solidified at +3° C., and the fraction 270° to 300° C. at −15° C., whereas the corresponding fraction from the oils in the other group remained completely fluid at −15° C. The lamp oils in the second group had a lighting capacity of 5·74 to 8·10 candle power (Hefner units), whilst those of the first group gave values of 10·17 to 12·97 (Campina oil, containing paraffin wax = 9·70). To ascertain the effect of different methods of refining upon the properties of the lamp oils, the following processes were tried :—(1) Treatment for 30 minutes with 2 per cent. of concentrated sulphuric acid at 20° C. ; (2) with 2 per cent. of fuming sulphuric acid (sp. gr. 1·92) at 70° C., added in one portion ; (3) with 2 per cent. of fuming sulphuric acid (sp. gr. 1·92) at 70° C., added in four equal portions ; (4) with liquid sulphur dioxide as in the method of Edeleanu (this J., 1910, 143). The last method was found to yield particularly favourable results, all hydrocarbons and other compounds with an injurious influence upon the light-giving capacity being eliminated but not decomposed by the liquid sulphur dioxide. These injurious constituents consisted of aromatic and cyclic unsaturated hydrocarbons, together with resinous and asphaltic bodies of unknown nature.—C. A. M.

Petroleum ; Refractive index of ——. G. A. Le Roy. Ann. Chim. Analyt., 1911, **16**, 12—13.

WITH the Zeiss-Abbé refractometer, at the temperature of 15° C., the author has found the following values, which may be of value for purposes of comparison : American oils : crude 1·4540, petroleum spirit (sp. gr. 0·720) 1·3995, white burning oil 1·4430. Russian oils : crude 1.4595, petroleum spirit (sp. gr. 0·720) 1·4105, white burning oil 1·4530. Roumanian oils : crude 1·4639, petroleum spirit (sp. gr. 0·720) 1·4055, white burning oil 1·4560.—R. W. N.

Dielectric strength of oil. Tobey. *See* XI.

PATENTS.

Coke-ovens : Preparation of charges of coal for ——. C. C. Ellison and W. Fletcher, Barnsley. Eng. Pat. 10,329, April 27, 1910.

LIGHT wooden frames are inserted into the forward end of the mass of coal in the stamping box, in order to give stability to the charge at that end so that it may be pushed into the oven without falling away. In this way the oven is more completely filled.—W. H. C.

Retort furnaces and the like ; Method of constructing ——. Stettiner Chamotte-Fabrik Akt.-Ges., vorm. Didier, Stettin, Germany. Eng. Pat. 21,789, Sept. 20, 1910. Under Int. Conv., Sept. 30, 1909.

To prevent the formation of cracks in the masonry of large furnace sets when these are heated for the first time, gaps are formed between the furnace units by means of yielding packing layers which may consist either of plates which can be withdrawn, or of a material such as compressed cork which can be carbonised by the heat of the furnace.—H. H.

Gas producers primarily for use with bituminous fuel. F. Fielden, New Ferry, Cheshire. Eng. Pat. 1500, Jan. 20, 1910.

IN gas producers for bituminous fuel of the class in which the coking of the fuel is effected in a short vertical distillation or coking retort situated at the base of the fire bed within the gas producer, (1) radial openings leading into the coking retort are provided through which hot air from an air jacket surrounding the producer is passed for the purpose of consuming the tar and other hydrocarbons given off, and (2) the piston for feeding the fuel from below into the vertical retort, and the valve-plate for preventing the return of the fuel during the downstroke of the piston, are operated by independent cams which can be adjusted so as to vary the fuel supply.—H. H.

Gas-producers. E. Hall-Brown, Glasgow. Eng. Pat. 4124, Feb. 19, 1910.

THE gas from the upper end of the producer passes down through a vertical pipe having gills cast on the exterior and surrounded by another pipe and placed adjacent to the producer. The air for the producer is caused to pass downwards through the annular space between the two pipes to the ash-pit. Water heated by passing through an annular chamber formed round the feed hopper on the top of the producer, is discharged from an annular perforated pipe surrounding the upper end of the gilled pipe into an annular gutter placed just below. The water overflows from the side of the gutter next to the pipe and trickles down over the gills, saturating the air with aqueous vapour.—W. H. C.

Producer gas ; Method of making ——. W. O. Amsler, Pittsburg, Pa. U.S. Pat. 979,818, Dec. 27, 1910.

AIR is passed through a highly heated bed of carbonaceous material and a body of "green" bituminous material in a gas producer, and the gas thus generated is oxidised in a chamber adjacent to the gas producer and passed into a second producer containing a highly heated bed of carbonaceous residue resulting from a previous production of gas from "green" bituminous material. The flow of gases is then reversed, a tar-containing fuel being introduced into the second gas producer, and the gas so generated in the second producer is passed back through the carbonaceous residue which has been formed in the first producer.—H. H.

Gas-producer. C. F. Miller, Pittsburg, Pa., Assignor to The Westinghouse Machine Co. U.S. Pat. 980,660, Jan. 3, 1911.

THE suction producer consists of an up-draught section and a down-draught section, the outside diameter of which is less than the greatest inside diameter of the other section. Between the sections is a vaporising top, provided with an interior vaporising chamber and air admission port, air and vapour delivery ports, a gas off-take port, and a number of poke-holes through which a "slice-bar" can be passed along the inner walls of the up-draught section. The down-draught section communicates with the up-draught section below it, by means of a suitable opening in the centre of the vaporising top, and is provided with an air-cooled top, the air-cooled chamber of which is connected with the air admission port of the vaporising top. Valves are provided on the pipes connecting the vaporiser with the respective sections, between the air inlets on the pipes and the vaporiser.—W. C. H.

Condensation products from gas; Arrangement for using —— in the hydraulic seal. Dessauer Vertikal-Ofen-Ges. m. b. H. Fr. Pat. 419,658, Aug. 25, 1910. Under Int. Conv., Mar. 14, 1910.

The gas main leading from the hydraulic seal is provided with an enlarged portion forming a chamber in which the condensation products collect, and these products are led back through a valved pipe to the seal-box.—A. T. L.

Hydrogen gas; Vertical retort-furnace for the production of ——. G. F. Jaubert. Fr. Pat. 419,667, Oct. 30, 1909.

The furnace comprises two retort chambers arranged at opposite sides of a central combustion chamber, which is directly above a gas producer. The air for combustion is heated in flues in the side walls of the gas producer, and mixing with the gas, passes through burner orifices in the floor of the combustion chamber. Baffles are provided so that no flame can enter the retort chambers. The retorts are tapered, and provided with flanges at each end. To permit of free expansion, the retorts are suspended from the top by means of the flange, which rests upon a ledge in the roof of the retort chamber, and the retorts are merely guided at the lower end. The ends of the retorts are closed by covers held in place by bolts, a tight joint being made by means of a copper ring. The lower end of the retorts is fitted with a central inlet-pipe for steam or other gas. This pipe is held in place by cast-iron rings, and is provided with a cap or hood to protect the open end. A horizontal retort arranged in a small heating chamber above the combustion chamber is used for annealing the cylinders into which the hydrogen is compressed.—A. T. L.

Natural gases or petroleum distillation gases; Utilisation of ——. A. J. Boult, London. From A. von Groeling, Vienna. Eng. Pat. 30,229, Dec. 24, 1909.

The gases are caused to bubble in a finely divided state and under suitably controlled conditions of progressively reduced temperature and increased pressure through a solvent, for example, heavy benzine, contained in a series of absorbing vessels. The unabsorbed gas is subsequently liquefied by high pressure at a low temperature. The reduction of temperature during absorption may be effected by expanding the compressed or liquefied gas in a chamber surrounding the absorbing vessel, and the condensed liquid itself may be used as the absorbent.—W. H. C.

Petroleum spirit; Emulsifying or solidifying ——, and raising the flash point of the product. F. Seaton-Snowdon and D. A. Young, London. Eng. Pat. 207, Jan. 4, 1910.

The emulsifying solution is formed by dissolving boric acid in an equal weight of water, adding $2\frac{1}{2}$ per cent. by weight of casein in free or combined form, and finally incorporating 5 per cent. of vaseline oil and 1 per cent. of hard soap. One part of this solution serves to emulsify 20 parts of petrol, etc., but when a solid product is required the proportion of petrol is reduced and a solution of formaldehyde added. The vaseline oil may be replaced by glycerin containing about half its weight of borax in solution.—H. H.

Oils for lighting, heating, and other purposes, and petrol for use in explosion engines; Treatment of ——. E. J. Roesch, London. From A. H. Burchard, Martinsburg, Mo., U.S.A. Eng. Pats. 20,982 of 1910; date of application, Oct. 21, 1909, and 24,216, Oct. 21, 1909.

(1). A perforated tube containing a number of alternate plates of zinc and copper connected together by copper wire is placed in the oil to be treated, a surface area of 80 sq. in. of each metal being sufficient for the treatment of 4 galls. of oil per hour. It is stated that the treatment produces more complete combustion of the oil, the proportion of air required being substantially increased. (2). The process is claimed specifically for the treatment of petrol, the perforated tube being placed in the petrol supply tank of an internal combustion engine.—H. H.

Coke ovens. T. von Bauer. Berlin. Eng. Pat. 7316, March 23, 1910.

See Fr. Pat. 412,843 of 1910; this J., 1910. 998.—T. F. B.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

[*Wood*] *Distilling apparatus.* T. B. Gautier, Hickox, Ga., Assignor to National Turpentine Co., Delaware. U.S. Pat. 980,509, Jan. 3, 1911.

The device for the dry distillation of wood, comprises a furnace, and a retort for the production of turpentine and other products from pine wood. Flues pass from the furnace to the retort, and along the larger portion of the length of the latter an outside radiating wall extends. Means are provided in the flues for controlling the products of combustion, and outlets for the surplus heat. The products of combustion impinge directly against the wall which heats the retort by radiation, and afterwards come in contact with the walls of the retort at the point farthest from the source of heat. There may also be several furnaces, each with a number of sides, and a "radiating wall," the furnaces arranged at different distances from the retort, in such a way that the products of combustion of all of them impinge directly against the radiating wall.—W. C. H.

High temperatures; Method of generating ——. W. C. Finck, Elizabeth, N.J., Assignor to G. H. Benjamin, New York. U.S. Pat. 980,087, Dec. 27, 1910.

A gas containing a high percentage of hydrogen is generated in a gas producer and conducted at a definite pressure to a burner where it mixes with air which is led in at a pressure $1\frac{1}{4}$ times as great and ignited. The ratio of volumes is also regulated.—H. H.

Heating furnaces; Process of ——. C. H. Köhn, Stade, Germany. U.S. Pat. 980,797, Jan. 3, 1911.

In heating furnaces by means of tar and other heavy hydrocarbons, the fuel is subjected to a preliminary heating, and is then raised to or above its vaporisation temperature. The heated fuel is atomised, "whereby a pitch-like residue is precipitated, and hydrocarbon vapours are produced." The vapours are conducted into the furnace and burned, whilst the hot pitch-like residue is separately conducted away, and employed for the preliminary heating of fresh fuel.—W. C. H.

Filaments and incandescence bodies for use with all systems of lighting. E. Cervenka. Fr. Pat. 419,702, Oct. 23, 1909.

Filaments or threads of difficultly fusible substances, such as platinum or quartz, are surrounded with incandescing substances such as thorium and cerium oxides. For example, the platinum or quartz thread may be coated with a paste which on heating leaves a porous mass of thorium and cerium oxides; or the thread may be interwoven with cotton, ramie or other fibre, which is afterwards impregnated and heated in the usual way.—A. T. L.

Filaments of electric incandescence lamps; Process for soldering —— to their supports. Lichtwerke Ges. m. b. H. Fr. Pat. 419,849, Aug. 29, 1910. Under Int. Conv., Sept. 3, 1909.

The connection between the filament and its support is covered with a paste composed of powdered tungsten and glycerotungstic ether, and the soldering is effected in the usual manner by the passage of a current.—A. T. L.

Coal and other carbonaceous substances; Process and apparatus for distilling, carbonising, or similarly treating ——. C. W. Tozer. Fr. Pat. 419,577, Aug. 22, 1910. Under Int. Conv., Sept. 3, 1909.

See Eng. Pat. 20,158 of 1909; this J., 1910, 685.—T. F. B.

Incandescent gas mantles; Manufacture of ——. I. Kreidl. Vienna. U.S. Pat. 980,802, Jan. 3, 1911.

See Eng. Pat. 17,862 of 1909; this J., 1910, 1097.—T. F. B.

Electrodes for electric arc lamps. Gebr. Siemens und Co., Lichtenberg, Germany. Eng. Pat. 9076, April 14, 1910. Under Int. Conv., May 14, 1909.

See Fr. Pat. 414,707 of 1910; this J., 1910, 1195.—T. F. B.

Pyrophoric products [alloys]. Fr. Pat. 419,388. *See* X.

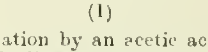
III.—TAR AND TAR PRODUCTS.

Benzene; The sulphonation of ——. R. Behrend and M. Mertelsmann. Annalen, 1911, **378**, 352—365.

When benzene is sulphonated with pure sulphuric acid at 240°—250° C., the *m*-disulphonic acid is produced, with about 1 per cent. of *p*-disulphonic acid. If a small amount of mercury is present, the *m*-disulphonic acid and *p*-disulphonic acid are in the proportion of 2 : 1. A similar result is obtained by using ferrous sulphate. The above acids are readily separated by means of the sodium salts, the salt of the *para*-acid being practically insoluble in a solution of the salt of the *meta*-acid. When the free acids are heated with sulphuric acid and a little mercury to 240°—250° C., an equilibrium is rapidly attained, when about one part of the *para*-acid is present with two parts of the *meta*-acid. The same equilibrium is reached more slowly without using mercury. When the sodium salt of either acid is heated with sulphuric acid to 240°—250° C., 1.3.5-benzenetrisulphonic acid is produced. The same acid can be obtained by the action of sulphuric acid and potassium pyrosulphate on benzene at 240°—250° C.—F. Shdn.

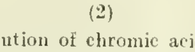
Thiophenic compound, $C_{10}H_6S_2$, and some of its derivatives. M. Lanfry. Comptes rend., 1911, **152**, 92—94.

The compound was isolated from the tarry mass which formed one of the crude products when a mixture of naphthalene and sulphur vapours was passed through a red-hot iron tube. The free naphthalene was removed from the tar by sublimation, and from the boiling alcoholic extract of the residue two crystalline products were obtained, the first consisting of small red prisms and the second of pearly scales. The red crystalline product formed about 0·2 to 0·4 per cent. by weight of the original mixture. It melted at 118·5° C. (corr.), boiled without decomposition at about 345° C., and sublimed at about 200° C. After purification it has the composition, $C_{10}H_6S_2$, and it is probably either phenothiophene (1), or phenodithiophene (2):—



$$\begin{array}{l}\mathrm{CH:CH\cdot C—C—CH}\\ \mathrm{\dot{C}H:CH\cdot\ddot{C}\cdot S\cdot\ddot{C}\cdot S\cdot\ddot{C}H}\end{array}$$

(1)



$$\begin{array}{l}\mathrm{CH—C\cdot CH\cdot C—CH}\\ \mathrm{\ddot{C}H\cdot S\cdot\ddot{C}\cdot\dot{C}H\cdot\ddot{C}\cdot S\cdot CH}\end{array}$$

(2)

Oxidation by an acetic acid solution of chromic acid, or an alkaline or acid solution of permanganate results in a complete breakdown of the molecule. Hydrogen peroxide acts upon the red compound in acetic acid solution, so as to yield first $C_{10}H_6S_2O_2$, and this, after losing one atom of sulphur as H_2SO_4, leaves the compound $C_{10}H_6SO_4$ which has not been isolated in a pure state. The first product forms pinkish yellow needles, melting at about 130° C., and gives a fine green colouration with isatin and sulphuric acid. It shows the behaviour of a paradiphenol. The second product crystallises in reddish needles melting at about 125° C. and gives no colouration with isatin.—E. W. L.

Patents.

Retorts for the distillation of tar, oils, and the like; Upright ——. R. Barlen, Duisburg, Germany. Eng. Pat. 9213, April 15, 1910. Under Int. Conv., April 16, 1909.

See Ger. Pat. 228,297 of 1909; this J., 1910, 1449.—T.F.B.

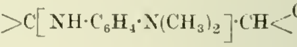
Diphenylene dioxide. R. Zaertling and H. Friedrich, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 981,348, Jan. 10, 1911.

See Ger. Pat. 223,367 of 1909; this J., 1910, 937.—T.F.B.

IV.—COLOURING MATTERS AND DYES.

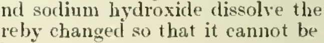
Oxindigo. K. Fries and A. Hasselbach. Ber., 1911, **44**, 124—128.

Oxindigo (the name indicating the oxygen isologue of Indigo)



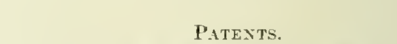
$$C_6H_4<\begin{smallmatrix}CO\\O\end{smallmatrix}>C:C<\begin{smallmatrix}CO\\O\end{smallmatrix}>C_6H_4$$

is prepared as follows: Coumarandion-1-[*p*-dimethylaminoanil] (I), obtained by condensing nitrosodimethylaniline with coumaranone, is boiled in xylene solution with 2-coumaranone, whereby the compound (II.) is produced. When this is suspended in a little glacial acetic acid and concentrated hydrochloric acid added' oxindigo crystallises out. On recrystallisation from glacial acetic acid or xylene, this forms lemon-yellow prismatic crystals which sinter at 250° C., and melt at 272° C. On careful heating it sublimes. Both sodium carbonate and sodium hydroxide dissolve the compound, but it is thereby changed so that it cannot be regenerated from the solution.—J. C. C.



$$C_6H_4<\begin{smallmatrix}CO\\O\end{smallmatrix}>C:N\cdot C_6H_4\cdot N(CH_3)_2$$

(I.)



$$C_6H_4<\begin{smallmatrix}CO\\O\end{smallmatrix}>C\left[NH\cdot C_6H_4\cdot N(CH_3)_2\right]\cdot CH<\begin{smallmatrix}CO\\O\end{smallmatrix}>_6CH_4$$

(II.)

Patents.

Indigo; Halogen derivatives of ——. Ges. fur Chem. Ind. in Basel. Seventh Addition, dated Oct. 16, 1909, to Fr. Pat. 375,514, Feb. 25, 1907 (this J., 1907, 920).

Penta- and hexa-halogenated derivatives of Indigo are obtained by brominating Indigo or its mono-, di-, tri-, or tetra-halogenated derivatives in the presence of chlorosulphonic acid. Example: 1 part of Indigo is introduced into a mixture of 10 parts of chlorosulphonic acid and 3 to 3·5 parts of bromine. The mass is kept at 16° C. and stirred for 14 to 18 hours. It is then poured on ice and the resulting hexabromoindigo is filtered off, washed, and dried. It gives very green shades of blue on animal or vegetable fibres.—J. C. C.

Disazo dyestuffs; Production of secondary ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Aug. 26, 1910 (under Int. Conv., Sept. 11, 1909), to Fr. Pat. 402,120, April 16, 1909 (this J., 1909, 1190).

Instead of the aminoazo-compounds mentioned in the chief patent, benzidine-*o*-disulphonic acid or tolidine-*o*-

disulphonic acid may be used. Example: the dyestuff obtained from 344 parts of benzidine-o-disulphonic acid which has been tetrazotised and combined with 313 parts of *p*-xylidine hydrochloride is tetrazotised and combined in alkaline solution with 726 parts of sodium 2-amino-5-naphthol-1 : 7-disulphonate. The dyestuff is isolated by means of salt. It dyes cotton in violet shades which are fast to light.—J. C. C.

Triphenylmethane dyestuffs dyeing on a chrome mordant; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 419,902, Aug. 31, 1910. Under Int. Conv., Nov. 11, 1909.

New chrome dyestuffs are prepared by condensing methylenedisalicylic acid or its derivatives in the presence of oxidising agents, with pyrazolones, or by first condensing these components in the presence of oxidising agents to the leuco-compounds and then oxidising the latter, or, further, by condensing the carbinols with the pyrazolones and oxidising the products. Example: A mixture of 21·1 kilos. of methylenedi-o-cresotic acid, 12·8 kilos. of 1-phenyl-3-methyl-5-pyrazolone, and 320 kilos. of sulphuric acid is stirred at 20°—45° C. with the necessary amount of nitrosylsulphuric acid until the quantity of dyestuff formed does not increase. The mass is then thrown on ice and the dyestuff filtered off. It is a yellowish brown powder which dyes chromed wool in orange brown shades.—J. C. C.

Dyestuffs of the triphenylmethane series; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 368, Jan. 6, 1910.

See Fr. Pat. 411,306 of 1910; this J., 1910, 937.—T. F. B.

Azo triphenylmethane dyes. A. Hausdörfer, Elberfeld, and C. Heidenreich, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 980,251 and 980,521, Jan. 3, 1911.

See Fr. Pat. 413,383 of 1910; this J., 1910, 1099.—T.F.B.

Azo dyes; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 2393, Jan. 31, 1910.

See Fr. Pat. 415,662 of 1910; this J., 1910, 1296.—T.F.B.

Azo dye. J. Jansen and W. Neelmeier, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 981,276, Jan. 10, 1911.

See Fr. Pat. 418,733 of 1910; this J., 1911, 78.—T. F. B.

Azo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 419,511, July 26, 1910. Under Int. Conv., Nov. 27, 1909.

See Eng. Pat. 28,717 of 1909; this J., 1910, 1050.—T. F. B.

Vat dye; Blue ——. W. Bauer, Vohwinkel, and A. Herre, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 980,140, Dec. 27, 1910.

See Eng. Pat. 7819 of 1909; this J., 1910, 81.—T. F. B.

Dyestuffs of the thioindigo series; Process of brominating ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 12,321, May 19, 1910. Under Int. Conv., May 19, 1909.

See Fr. Pat. 417,937 of 1910; this J., 1911, 17.—T. F. B.

Dyestuffs of the triphenylmethane series; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 17,087, July 18, 1910. Under Int. Conv., Sept. 7, 1909. Addition to Eng. Pat. 12,130 of 1910, dated May 25, 1909.

See Addition of July 7, 1910, to Fr. Pat. 417,490 of 1910; this J., 1911, 17.—T. F. B.

Disazo dyestuff; Process for preparing a ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 419,247, July 22, 1910.

See Eng. Pat. 17,614 of 1910; this J., 1910, 1298.—T. F. B.

Acenaphthene; Process for preparing oxidation products of —— and their conversion into vat dyestuffs. Kalle und Co. A.-G. Fr. Pat. 419,379, Aug. 16, 1910. Under Int. Conv., Aug. 17 and Oct. 11, 1909, and Jan. 10, 1910.

See Eng. Pats. 19,340 and 19,341 of 1910; this J., 1911, 17, and 1910, 1295.—T. F. B.

Monoazo dyestuffs; Orange-yellow —— and process of making them. Fabr. de Couleurs d'Aniline et d'Extraits ci-dev. J. R. Geigy. Fr. Pat. 419,642, Aug. 24, 1910. Under Int. Conv., Oct. 1, 1909.

See Ger. Pat. 226,242 of 1909; this J., 1910, 1450.—T. F. B.

Sulphide dyestuffs; Process for producing ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 419,665, Oct. 29, 1909.

See Eng. Pat. 24,703 of 1909; this J., 1910, 1002.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Hydrocellulose, II. H. Jentgen. Z. angew. Chem., 1911, **24**, 11—12; also C. G. Schwalbe, *ibid.*, p. 12—13.

In a previous paper (this J., 1910, 1052) the author argued that acids, *e.g.*, sulphuric acid, are only capable of hydrolysing cellulose when they are finely distributed in the molecular condition, and that ionised acids have no such action. Defending this view against criticisms by Schwalbe, the author points out: (1) that 1 per cent. aqueous solutions of acid have practically no hydrolysing action on cellulose; (2) that alcoholic solutions of acids hydrolyse only very slowly, and the rate of hydrolysis is directly influenced by the dissociating capacity of the solvent; (3) that 1 per cent. solutions of acid in non-dissociating solvents hydrolyse cellulose rapidly. In the preparation of hydrocellulose by Girard's method, the cellulose, steeped in a 3 per cent. solution of sulphuric acid, must first be dried in the air before the acid will act, whereby the latter becomes concentrated to about 30 per cent., at which concentration sufficient molecular sulphuric acid is adsorbed by the cellulose to effect its disintegration. In the production of hydrocellulose it is assumed that an adsorption compound is formed between molecular sulphuric acid and cellulose, that water must be present but not in sufficient quantity to cause complete ionisation of the acid. The adsorbed acid then promotes reaction between the cellulose and the water and acts as a catalyst. The production of such an adsorption compound is assumed in ester reactions, *e.g.*, in acetylation, as a primary phase, esterification is secondary, and hydrolysis, if any, is tertiary. Nitric acid also forms adsorption compounds with cellulose as a primary stage, and nitration is secondary. Schwalbe replying to the above contentions, holds that dilute aqueous acids do have a hydrolysing action on cellulose. Hydrocellulose may be prepared by Girard's method by steeping cellulose in acid of only 0·001 per cent. concentration. If this cellulose be dried in the air, the acid present will have a concentration of only 0·02 per cent., and still will hydrolyse the cellulose. He also contends that the hydrolysing power of alcoholic solutions of acid is reduced because the acid tends to form esters with the alcohol. He re-asserts his view that in the acetylation of cellulose, in presence of sulphuric acid or even of certain dissociable salts, hydrolysis precedes esterification.—J. F. B.

Cellulose nitrate: Behaviour of —— with dimethylaniline. J. Walter. Z. angew. Chem., 1911, **24**, 62—64.

On immersing guncotton or strips of celluloid (20 years old) in dimethylaniline and exposing them to the air in porcelain basins in the dark at 13° to 14° C., the following changes of colour were observed:—After 24 hours, greenish; after 48 hours, bluish in places; 60 hours, intense bluish-violet; 84 hours, strong blue; 132 hours, bluish-violet; and after 156 hours, violet. At 30° to 40° C. the colourations appeared more rapidly but still in the same order. Strongly violet samples of guncotton had an odour of methylphenylnitrosamine, and showed the yellow stain, which remained after ignition on paper. They burned not quite so instantaneously as uncoloured samples. The violet colouring matter could not be extracted by alcohol or boiling acetic or hydrochloric acid. In the case of the celluloid strips the violet colour changed to black on exposure to sunlight and was then not changed by any further exposure to light. Directions in which this reaction might be utilised are for colouring celluloid goods, ensuring the completeness of the denitration of artificial (collodion) silk, and the detection of cellulose nitrate in varnishes, etc. It might also be advantageous in the preparation of incandescence filaments to treat the substance with dimethylaniline prior to the actual denitration, so as to increase the amount of carbon left in the subsequent ignition. Similar colourations were produced by other substances (aniline, *o*- and *p*-toluidine, phenylhydrazine, dimethyltoluidine, methlydiphenylamine, *α*-naphthylamine, phenol, etc.) but they are neither so characteristic nor do they appear so rapidly as in the case of dimethylaniline.—C. A. M.

Cellobiose and the acetolysis of cellulose. W. Schliemann. Annalen, 1911, **378**, 366—381.

Cellobiose was obtained by the action of acetic anhydride and sulphuric acid upon cellulose (filter paper or cotton wool), and hydrolysing the product with alcoholic potassium hydroxide solution (this J., 1907, 482). When purified by repeated crystallisation, cellobiose, $C_{12}H_{22}O_{11}$, has $[\alpha]_D = +34{\cdot}6°$ in water at 20° C. The specific rotation increases by +0·02° for 1° C. The reduction factors for cellobiose after boiling for 4 minutes with Fehling's solution vary with the amount of sugar present; for 200 mgrms. it is 1·43; for 80 mgrms., 1·47; and for 50 mgrms., 1·52. The phenylosazone can be crystallised from water or alcohol and then melts at 208°—210° C.; when dissolved in absolute alcohol it has $[\alpha]_D = -17{\cdot}5°$. The octoacetate of cellobiose can be produced from the sugar or directly from cellulose by means of acetic anhydride and sulphuric acid. It melts at 222° C. and has $[\alpha]_D = +41{\cdot}5°$ in chloroform at 20° C. When boiled with acetic anhydride and fused sodium acetate, the cellobiose acetate is converted into an isomeride, with $[\alpha]_D = -7{\cdot}8°$ in chloroform, and —24·9° in benzene, both at 20° C. The author has studied the acetolysis of cellulose, that is the acetylation and subsequent hydrolysis of the molecule. A series of products was obtained and their acetyl-content and optical rotation determined. There was a gradation in the properties of these bodies, the limit being those of cellobiose acetate.—F. Shdn.

Patents.

Floss and waste silk in general: Process for the destruction of hairs and other foreign substances contained in ——. C. Seignol, Lyons, France. Eng. Pat. 17,263, July 20, 1910. Under Int. Conv., July 28, 1909.

See U.S. Pat. 974,440 of 1910; this J., 1910, 1371.—T. F. B.

Wool; Process of scouring ——. P. Schmid, Basle, Switzerland. U.S. Pat. 981,008, Jan. 10, 1911.

See Fr. Pat. 407,596 of 1909; this J., 1910, 558.—T. F. B.

Vegetable fibres; Process for separating ——. C. G. Schwalbe. Fr. Pat. 419,298, Aug. 12, 1910. Under Int. Conv., Aug. 14, 1909.

See Eng. Pat. 19,142 of 1910; this J., 1910, 1299.—T. F. B.

Fabrics; Carbonised —— and processes and apparatus for making them. F. L. Horton. Fr. Pat. 419,374, Aug. 16, 1910. Under Int. Conv., Aug. 18, 1909.

See U.S. Pat. 963,291 of 1910; this J., 1910, 940.—T. F. B.

Artificial silk and fabrics thereof; Manufacture of ——. J. H. C. Gebauer, Charlottenburg, Germany. Eng. Pat. 30,510, Dec. 30, 1909.

See Addition of June 27, 1909, to Fr. Pat. 403,264 of 1909; this J., 1910, 208.—T. F. B.

Artificial silks; Machines for spinning ——. L. Morane, Paris. Eng. Pat. 24,707, Oct. 24, 1910. Under Int. Conv., Oct. 28, 1909.

See Fr. Pat. 410,267 of 1909; this J., 1910, 810.—T. F. B.

Threads from cupro-ammoniacal solutions of cellulose; Manufacture of ——. A. Lecoeur, Rouen, and P. Rudolf, St. Aubin-Jouxte-Boulleng, Assignors to Le Crinoid Soc. Anon., Rouen, France. U.S. Pat. 980,294, Jan. 3, 1911.

See Fr. Pat. 410,827 of 1909; this J., 1910, 810.—T. F. B.

Cellulose derivatives from viscose; Method of producing stable soluble ——. L. Lilienfeld, Vienna. U.S. Pat. 980,648, Jan. 3, 1911.

See Eng. Pat. 8708 of 1908; this J., 1909, 257.—T. F. B.

Cellulosic films; Process for the continuous manufacture of ——. E. Brandenberger, Thaon-les-Vosges, France. U.S. Pat. 981,368, Jan. 10, 1911.

See Eng. Pat. 15,190 of 1909; this J., 1910, 147.—T. F. B.

Acetylcellulose; Treatment of —— to enhance its elasticity and its power of absorption for dyestuffs. E. Knoevenagel, Heidelberg, Germany. U.S. Pat. 981,574, Jan. 10, 1911.

See Addition of April 5, 1909, to Fr. Pat. 383,636 of 1907; this J., 1909, 1199.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Silk fibre; Increase in volume of the —— caused by the processes of mordanting, weighting and dyeing. P. Heermann. Färber-Zeit., 1911, **22**, 29—33.

Under the influence of the various operations of mordanting, weighting, etc., the volume of the silk appreciably increases. There is no direct relation between the increase in volume and the increase in weight of the silk. The author gives details of the processes employed, which include: (1), the boiling off, and treatment of the raw silk; (2), simple mordanting processes (iron, alum, chrome and tin mordants); (3), treatment with catechu, sumach and gall-nut extracts; (4), secondary and mixed processes, including the Prussian Blue and logwood treatments, pyrolignite of iron, tin salt, sodium phosphate and silicate, and also the dyeing process. The results obtained (the operations being in most cases carried out on the works scale) are tabulated and give: (a), the original thickness of the boiled-off fibre; (b), the thickness after treatment; (c), the percentage increase in thickness of the treated over the original fibre, as also the percentage increase in volume; and (d), in the case of certain mixed treatments the percentage increase in volume and thickness at different stages.—F. M.

Tannin; Determination of —— by means of casein. M. Nierenstein. Chem.-Zeit., 1911, **35**, 31.

The method of determining tannin in barks and fruits by precipitation with casein has been found to give results from 1 to 1·5 per cent. higher than the hide-powder method. The method is unsuitable for the analysis of tannin extracts, since these frequently contain alumina, which causes the casein to dissolve and renders the figures for the non-tannin substances too high. It may find an application, however, in the analysis of tannin in the dyeing industry. On shaking 100 c.c. of a solution of tannin (Schering's pure) for 10 minutes with 6 grms. of casein (freed from fat by extraction with ether) and then with a further 3 grms. of casein, filtering the liquid, and estimating the absorbed tannin as in the hide-powder method, the results showed that the tannin was quantitatively precipitated, whereas dextrose and gallic acid were not absorbed.—C. A. M.

Patents.

Washing, dyeing, and softening machines. W. G. Gibbins, Forest Gate, Essex. Eng. Pat. 15,871, July 2, 1910.

A cylindrical vessel, parts of which may be perforated, is enclosed in an outer casing and so mounted that it can oscillate round its own axis through one revolution. Through the centre of the vessel passes a loose shaft which has mounted on it a movable radial partition extending the whole length of the vessel. This partition, which is made of concave ribs, can be maintained substantially vertical by means of yielding springs, can be rotated from outside at a slower speed than that of the oscillating cylinder or can be fixed at its free end to the inner wall of the vessel by means of a clutch. Another partition fixed to the inner wall of the cylinder extends to the central shaft but is not attached to it. The material to be treated is placed in the cylinder on each side of the fixed partition together with a suitable liquor, and the vessel is oscillated. According to whether the movable partition is maintained yieldingly vertical, is set in motion, or is fixed to the inner wall of the cylinder, the material is submitted to a squeezing, rubbing or rinsing process respectively.—P. F. C.

Transfer printing. C. A. McKerrow, Wilmslow, and J. H. Gillett and Sons, Ltd., Chorley. Eng. Pat. 354, Jan. 6, 1910.

Paper is rendered impermeable by applying a suitable composition to its surface and allowing it to dry. A mixture of 8 oz. of gelatin, 80 oz. of water, 2 oz. of potash alum, 1 oz. of potassium bichromate and 4 oz. of glycerin is recommended for the purpose. A readily fusible coating such as is obtained by mixing 20 oz. of coal naphtha, 2 oz. of Japan wax, 2 oz. of gum thus and 1 oz. of white shellac is next applied to the paper and the required design is afterwards printed on to the waxed surface, care being taken that the wax is not cut into during the process. The transfer is effected by placing the design upon the fabric which is to receive it and then applying heat to the back of the paper. The wax melts and the detached design is fixed on the fabric. If desired, the design can be provided with an adhesive coating (such as varnish dusted over with resin) to assist the transfer. —P. F. C.

Discharge, or printing, effects on fibre; Production of ——, and discharging, or printing, pastes for use therein. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pats. 30,505, Dec. 30, 1909, and 13,911, June 8, 1910.

See Fr. Pat. 414,937 of 1909; this J., 1910, 1247.—T. F. B.

Discharge effects on fibre [dyed with sulphide dyes]; Production of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pats. 25,957 of 1910, dated Dec. 30, 1909, and 25,958, June 8, 1910.

See Addition of June 18, 1910, to Fr. Pat. 414,937 of 1910; this J., 1911, 21.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Lactic acid; Note on the [acidimetric] assay of ——. E. Elvove. Amer. J. Pharm., 1911, **83**, 14—19.

The official method of the U.S.P. of titrating the commercial "syrupy" acid, previously diluted with water at the boiling temperature, with phenolphthalein as indicator, the end reaction being read at the first appearance of neutrality, is shown to give too low results. It has been previously pointed out by Murray (Merck's Report, N.Y., 1907, **16**, 248) that the official requirements of the U.S.P. for 75 per cent. of lactic acid, with a sp. gr. of about 1·206 at 25° C. are out of harmony. Acid of this sp. gr. would contain from 85 to 88 per cent. of lactic acid. The experiments of the author show that this discrepancy is due to the official method of hot titration. Correct results may be obtained by boiling the acid with a known excess of caustic alkali solution, and then titrating the amount of alkali left uncombined, or, more conveniently, by the following simple manipulation, in the cold. About two grms. of the acid are weighed, added to 50 c.c. of $N/1$ sodium hydroxide solution, mixed well, and set aside for 30 minutes. The excess of alkali is then titrated back with $N/1$ sulphuric acid, with phenolphthalein indicator. Each c.c. of alkali used up is equivalent to 0·09 grm. of lactic acid.—J. O. B.

"Soda crystals"; Efflorescence of ——. D. Howard. Chem. News, 1911, **103**, 48.

With reference to the note of Cumming (this J., 1911, 23), the author states that he has never observed, in fifty years' experience, the absorption of carbon dioxide from the air by "soda crystals." He further points out that it used to be the practice in preparing "soda crystals" for exhibition purposes, to expose them to an atmosphere of carbon dioxide, and this may account for the added carbon dioxide needed for the formation of the sesquicarbonate found by Cumming.—A. S.

Potassium bicarbonate and magnesium carbonate trihydrate; Equilibrium between ——. M. Nanty. Comptes rend., 1910, **151**, 1352—1354.

By the interaction of potassium bicarbonate and magnesium carbonate trihydrate, the compound, $MgCO_3.KHCO_3,4H_2O$ is formed. The reaction is reversible, but Engel (Ann. Chim. Phys., [6], 1886, **7**) has stated that the equilibrium attained is different according to whether it is reached from one side or the other, *i.e.*, whether solutions of the two salts are mixed or the double compound is treated with water. Büchner (Z. Elektrochem., 1908, 63) has already refuted this statement for temperatures between 20° and 30° C., and the author has found that at atmospheric pressure, the final equilibrium attained at temperatures between 0° and 30° C. is identical whether it is reached from one side or the other.—A. S.

Chlorides; General method for the preparation of anhydrous ——. E. Chauvenet. Comptes rend., 1911, **152**, 87—89.

The method, which is particularly satisfactory in the case of the rare earths, titanium, zirconium, chromium, nickel, etc., consists in passing a slow current of carbonyl chloride over the oxide of the metal, which is contained in a boat in a Jena glass tube and heated to a temperature varying from 350° C. to 650° C. The chloride, if volatile, sublimes and condenses in the cooler portions of the tube. The following compounds were obtained from the corresponding oxides, the temperatures given being approximately those at which the reaction occurs:—VCl_4 (350° C.), WO_2Cl_2 (350°), $TaCl_5$ (400°), $TiCl_4+TiO_2Cl_2$ (450°), $ZrCl_4$ (400°), $ThCl_4$ (650°), $SnCl_4$ (400°), $BaCl_2$ (500°), $MgCl_2$ (450°), $ZnCl_2$ (450°), $GlCl_2$ (458°), Al_2Cl_6 (400°), Fe_2Cl_6 (350°), Cr_2Cl_6 (600°), $MnCl_2$ (450°), $NiCl_2$ (550°), UCl_4 (450°), $CeCl_4$ (600°), YCl_3 (600°), $LaCl_3$ (600° C.).—E. W. L.

Sodium phosphate: Investigations on an insoluble ——, and on complex compounds of ammonium citrate with alkaline-earths. A. Quartaroli. Staz. sperim. agrar. ital., 1910, **43**, 545—558. Chem. Zentr., 1911, **1**, 6—7.

By the interaction in solution of one molecular proportion of phosphoric acid, one equivalent of barium, and two equivalents of sodium, tribarium phosphate is first precipitated. On allowing the filtrate from this to stand, a further precipitate of the composition. $NaBaPO_4$, separates. Lithium gives an analogous compound but potassium does not. The compounds, which are only slightly soluble in cold, but readily soluble in boiling water, are regarded as compounds of alkalis with the hypothetical radical, $BaPO_4$; corresponding compounds of calcium do not appear to be formed. If a dilute solution of monobarium phosphate be treated with ammonia, a precipitate is formed, which redissolves on addition of a sufficient quantity of ammonium citrate, but remains insoluble in presence of ammonium aconitate or tricarballylate, indicating that the formation of the soluble compound is due to the alcoholic hydroxyl group of the citric acid, the compound produced being of the type, $CO_2NH_4\cdot CH_2\cdot C(OR)(CO_2NH_4)\cdot CH_2\cdot CO_2NH_4$, where $R = BaPO_4$. Monocalcium phosphate does not behave in a similar manner, and the author concludes that the group, $CaPO_4$, dissociates very much more readily than the group, $BaPO_4$.—A. S.

Calcium carbide; Equilibrium of the system containing —— calcium cyanamide, carbon, and nitrogen. M. de Kay Thompson and R. H. Lombard. Metallurg. and Chem. Eng., 1910, **8**, 617—620, 682—684.

In order to determine the equilibrium of the system containing calcium carbide, calcium cyanamide, carbon, and nitrogen at temperatures between 1050° C. and 1450° C. with reference to the reversible reaction $CaC_2+N_2\rightleftarrows CaCN_2+C$, a graphite crucible containing calcium carbide was heated in an Arsem vacuum electric furnace kept at a constant temperature, and exhausted so long as gases were evolved. Nitrogen was then admitted and the equilibrium pressure determined, after which the nitrogen was pumped out and the equilibrium pressure again determined from the other side of the equation. The detailed records of five experiments are given, and the results of eighteen experiments at different temperatures are tabulated and plotted, and it is shown that the relation between the temperature and pressure is linear. The following table gives the variation of the heat of the reaction at different temperatures:—

Temperature.	Gram calories.
1100° C.	63,900.
1200° C.	27,000.
1300° C.	18,800.
1400° C.	15,200.

The free energy increase of the reaction from left to right was found to be -1714 gram-calories at 1450° C. and -6700 calories at 1100° C. It was also shown that calcium cyanamide distils at 1050° C., and that lime appears to distil at 1500° C.—A. H. C.

Oxalates; Formation of acetaldehyde in the pyrogenic decomposition of ——. D. Ganassini and E. Scandola. Estr. aus Boll. della Soc. Medico-Chirurgica di Pavia, Sept. 30, 1910. Chem. Zentr., 1911, **1**, 63.

Some oxalates, especially the normal oxalates of the alkali and alkaline-earth metals, and of tin, when decomposed by heat, yield acetaldehyde among other products. The production of aldehyde only occurs in presence of water. The reaction can be used for the detection of oxalic acid, the acid being precipitated as the calcium salt, and the latter, after being washed and dried, heated in a test-tube, and acetaldehyde tested for in the vapours by means by sodium nitroprusside-piperazine test-paper (Boll. Chim. Farm. Oct. 1909). In the authors' experiments 5 grms. of substance were heated in a small flask fitted with a small Liebig's condenser. Oxalic acid, even in presence of water, yielded only formic acid, carbon monoxide and dioxide, and water. Commercial sodium oxalate which contains some water, or the anhydrous salt when moistened with water, gave the aldehyde reaction, as also did the lithium salt and the normal potassium salt, which contains one molecule of water of crystallisation; the acid potassium oxalate gave only a faint aldehyde reaction. Ammonium oxalate gave a negative reaction; magnesium oxalate gave a positive reaction, as also did the oxalates of calcium, barium, and strontium in presence of moisture. Manganese, ferrous, ferric, zinc, cobalt, nickel, copper, bismuth, cadmium, and lead oxalates gave no aldehyde, but tin oxalate gave a positive reaction, especially in presence of water.—A. S.

Yttrium earths; The fractionation of the —— by means of the succinates. R. C. Benner. J. Amer. Chem. Soc., 1911, **33**, 50—56.

The method proposed by Lenher for the rapid separation of the yttria earths by means of their succinates has been studied by the author. The succinates of the yttria group are crystalline bodies and are formed comparatively slowly by the addition of neutral ammonium or sodium succinate solution to a neutral nitrate solution of the yttrium earths. This retarded precipitation has the effect of causing a better separation than if the precipitation took place immediately. If the process is to be carried out on a commercial scale, the oxides can be obtained from the succinates by ignition, or the succinic acid may be recovered by treatment with sodium hydroxide. The separation was most satisfactorily made when the precipitating agent was added drop by drop to the boiling solution; the concentration of the yttria earths should not exceed 2 or 3 per cent. calculated as oxides. The process was tried on the mixed earths obtained from several minerals, the absorption spectrum of each fraction being studied and a determination of the "atomic" weight made by the oxalate method. In preparing the mixed oxides from the various ores studied, suitable methods of solution and treatment were adopted in each case to eliminate silica and the common metals (this J., 1908, 518, 832); the oxalates were then precipitated from the soluble double potassium sulphates by the addition of oxalic acid. These oxalates were, after ignition to oxides, dissolved to a neutral solution in nitric acid and upon this solution the fractionations were carried out.

Samarskite—Erbium and the metals having the higher atomic weights concentrated in the first fractions, while yttrium concentrated in the last.

Xenotime—Fractionation was performed on a solution containing 0·683 per cent. of oxides at the boiling point under constant agitation with a 2 per cent. solution of sodium succinate, added drop by drop; each fraction was filtered off after the addition of 12·5 c.c. of solution, the volume being kept constant. The "atomic" weights of the fractions obtained were 112·5, 109·4, 105·7, 101·6, 98·5. This separation was confirmed by the spectra.

Gadolinite (Norwegian)—The nitrate solution (2·5 per cent. calculated as oxides), was fractionated with successive additions of 40 c.c. of a 14 per cent. solution of sodium succinate. Eight fractions gave "atomic" weights 113·8, 109·9, 108·0, 107·3, 105·6, 103·2, 98·1, 95·1.

Fergusonite—The nitrate solution (1·085 per cent. as oxides) was fractionated with successive additions of 25 c.c. of a 5 per cent. solution of sodium succinate: "Atomic" weights, 115·4, 112·4, 110·5, 102·5.

Euxenite, gadolinite (*Texan*) and *keilhauite* gave results similar to *fergusonite*. In presence of a considerable quantity of oxides of the cerium group very little separation of the elements of the lower atomic weights takes place. Similar experiments were carried out on the erbium earths extracted from *monazite* and *samarskite* and separated from the yttria earths by the chromate method. Fractionation on a 1 per cent. solution with a 5 per cent. solution of sodium succinate gave fractions having "atomic" weights of 152·5, 154, 148·5, 139, 124; repeated fractionation gave still further separation. Yttrium succinate was found to have the formula, $Yt_2(C_4H_4O_4)_3,2\frac{1}{2}H_2O$; it is a white salt, slightly hygroscopic and is soluble to the extent of 0·1435 grm. in 1 litre of boiling water.—B. G. McL.

Thorium; Radio-activity of ——. E. Rutherford. Chem. News, 1911, **103**, 22.

A résumé of work done hitherto on thorium. The thorium emanation produces activity in substances exposed to it, and breaks up at the rate of 54 seconds for half-disappearance, so that in ten minutes practically none remains. There are four solid products of its disappearance. The first, "Thorium A," is produced by the expulsion of an α-particle, and decays to half-value in 10·6 hours, a slower decay than that of any of the other products, "Thorium B—C—D," the last of which emits both β- and γ-rays. A plate covered with this thorium-product would retain some activity for a day or two, and would possibly be of some utility—the corresponding radium-substance would only last an hour or two. The first of the transformation-products of thorium itself, is "Thorium X." When thorium solutions are precipitated by ammonia, thorium X remains in solution. It falls to half-value in 3·6 days. The next product is "Radiothorium," which falls to half-value in two years. The attempt to prepare it directly from thorium led to the discovery of the intermediate "Mesothorium," with a half-value period of 5·5 years. This has almost the same chemical properties as thorium X, and emits β- and γ-rays; from it is formed radiothorium which emits α-rays. The activity of mesothorium rises to a maximum in about 3·5 years from its formation, when it is about twice as great as at first; then it dies away again, but even after 10 years is still greater than its original value. For medical purposes mesothorium is about as good as radium, and as thorium is used in large quantities commercially, and mesothorium could be separated from it without affecting the yield of thorium; it might be put on the market at a lower price than radium, although the labour of extracting it is greater.—J. T. D.

Actinium; Investigation of the residues containing —— from radium extraction. C. A. von Welsbach. Monatsh. Chem., 1910, **31**, 1159—1202.

The author has examined the "hydrates" (about 1800 kilos.) obtained from 10 tons of pitchblende residues by precipitation of the hydrochloric acid extract (Debierne method) with ammonia (this J., 1908, 917), and an account of the complex methods employed for the separation of the various constituents is given. The material contained, besides about 78 per cent. of water, principally iron, aluminium, calcium, rare earth metals, bismuth, uranium, and silica, and was feebly radio-active. The chief primary radio-active substances found, apart from polonium, were ionium and actinium; the former of these appears to be homogeneous, but the latter, complex. Actinium apparently must be placed between lanthanum and calcium, but its degradation products are more nearly related to calcium, although not giving a sparingly soluble sulphate. In the presence of ammonium salts, actinium is not completely precipitated, either by ammonium oxalate or by ammonium hydroxide, but in presence of manganese, it can be entirely precipitated as manganite from basic solutions. Ionium, by prolonged contact, will excite radio-activity in other substances nearly related to it. The richest thorium-ionium preparation obtained was found to contain 2·5 per cent. of ionium. In the course of the investigation, phenomena connected with radio-activity were observed which are apparently not in harmony with current theories, and it is thought that several of the fractions isolated contain new elements. For the comparison of highly active fractions, a special "radio-activity balance" was employed.—F. Sodn.

Equilibrium [Carbonic monoxide, carbon dioxide]; Effect of temperature on the ——. T. F. E. Rhead and R. V. Wheeler. Chem. Soc. Trans., 1910, **97**, 2178—2189.

In view of the conflicting results of Boudouard (this J., 1899, 278, 279, 498, 742) and of Schenck and Zimmermann (this J., 1903, 630) on the dissociation of carbon monoxide into carbon dioxide and carbon, and the reverse reaction, the authors have investigated the problem by circulating carbon dioxide continuously over purified wood charcoal packed in a porcelain tube, and heated in an electric resistance furnace. No catalyst was used, since it appeared probable that in Boudouard's experiments where complete decomposition of carbon monoxide was obtained, oxidation of the carbon monoxide took place owing to incomplete reduction of the oxides of the metals used as catalysts. The authors obtained the following results, the figures representing the percentages by volume of carbon dioxide and monoxide in equilibrium, in presence of excess of carbon, at the temperatures given.

Temperature.	Carbon dioxide.	Carbon monoxide.
850° C.	6·23	93·77
900° C.	2·22	97·78
950° C.	1·32	98·68
1000° C.	0·59	99·41
1050° C.	0·37	99·63
1100° C.	0·15	99·85
1200° C.	0·06	99·94

At 850° C., the reduction of carbon dioxide by carbon takes place at a speed 166 times as great as the dissociation of carbon monoxide at the same temperature. It is probable that both reactions are unimolecular and are essentially surface phenomena, the rate of reduction of carbon dioxide and the rate of dissociation of carbon monoxide both varying directly with the partial pressure of the gas.—A. S.

Determination of small quantities of lime in presence of large amounts of magnesia. Liesse. *See* XXIII.

Gravimetric determination of tellurium and alkalimetric determination of telluric acid. Rosenheim and Weinheber. *See* XXIII.

Patents.

Sulphuric anhydride; Process for the preparation of —— by the action of the electric spark discharge on burner gases or other gaseous mixtures containing sulphur dioxide and oxygen. E. H. Riesenfeld. Ger. Pat. 229,274, May 13, 1909.

The essential feature of the process consists in keeping the reacting gases either during the whole of the reaction, or during the later stages at temperatures below 46° C. For example the reacting gases may be first passed through an ozoniser or treated with ozone in the usual manner, and then again subjected to the same treatment at a temperature below 46° C. It is stated that, whilst under the conditions hitherto used, the reaction between sulphur dioxide and ozone proceeds according to the equation:— $SO_2+O_3=SO_3+O_2$; at temperatures below 46° C., the boiling point of sulphuric anhydride, it proceeds according to the equation: $3SO_2+O_3=3SO_3$, and as the sulphuric anhydride condenses to a liquid as fast as it is formed, the reaction proceeds to completion.—A. S.

Volatile organic acids; Manufacture of —— from their calcium salts. R. S. Swinton, Linden, New Jersey, U.S.A. Eng. Pat. 4976, Feb. 28, 1910.

The calcium salt of a volatile organic acid (especially acetic acid) is superimposed in a dry, granular state above sulphuric acid, which is used in as concentrated a form as possible, in a suitable still. Steam is continuously introduced near the bottom of the still, the latter being insulated or steam jacketed, so as to avoid loss of heat and condensation. In this manner the reaction begins at the bottom and progresses regularly throughout the mass, the calcium salt subsiding gradually in the sulphuric acid as the reaction proceeds.—O. R.

Barium hydrate [hydroxide]; Manufacture of amorphous anhydrous ——. C. Rollin and Hedworth Barium Co., Ltd., Newcastle-on-Tyne. Eng. Pats. 26,696, Nov. 17, 1909, and 14,268, June 13, 1910.

Commercially pure crystallised barium hydroxide is melted in a closed vessel (*e.g.*, of steel), and a current of air (free from carbon dioxide) or other inert gas, at about atmospheric pressure and at a temperature above 100° C., but not more than slightly above 220° C., is passed slowly and continuously over the molten material which is preferably 2—3 inches deep. The moist air may then be carried through a heat interchanger and, after absorption of any carbon dioxide present, is passed to a dehydrating device such as a refrigerator; it is finally reheated (partially in the interchanger, if employed) and used again. When the mass of hydroxide shows a tendency to solidify, it is broken up, and the process of heating is continued at about 220° C., or (and this is preferred) the material is transferred to another vessel and heated at 100°—200° C. in a partial vacuum (10—12 inches of mercury), as described in Eng. Pat. 27,587 of 1908 (this J., 1910, 151). The first stage of the process should occupy about 3 days for 1 ton of crystallised hydroxide, and the second stage, 3—4 days, if effected by heat alone; about 2 days are required for the heating of 1 ton of partly dehydrated material under reduced pressure. The product is suitable for the manufacture of barium oxide for subsequent conversion to the dioxide.—F. Sodn.

Soda crystals; Manufacture of ——. L. Herve, Brussels. Eng. Pat. 30,386, Dec. 29, 1909.

Towards the end of the operation in the ordinary Leblanc process, in which sodium sulphate is heated with calcium carbonate and coal (carbon), a further quantity of calcium carbonate, preferably chalk, is added to the cooling mass. The mixture, which is still hot enough to decompose the added chalk, is well stirred and allowed to fall into iron tanks. A porous, solid mass is thus obtained, which is easily lixiviated and yields relatively pure lyes owing to the excess of quicklime contained. The rate and temperature of lixiviation are so arranged as to yield a constant supply of lye of 30° to 32° B., and the latter is purified by the addition of milk of lime, either before or during a final process of carbonation. (Reference is directed to Eng. Pats. 3242 of 1874; 3079, 2776, and 133 of 1878; 5312 of 1881; and 259 of 1885.)—O. R.

Salts or saline compounds containing silicates; Process for obtaining slightly soluble —— by electrolysis of aqueous solutions. B. Huick. Ger. Pat. 229,249, July 23, 1908.

An anode consisting of a heavy metal or an alloy of heavy metals is used, and the electrolyte contains at least two soluble salts, one of which yields with the anode an easily soluble salt, whilst the other is a soluble silicate, which reacts with the soluble heavy metal salt to form a slightly soluble silicate. The electrolyte may contain, in addition, one or more salts which yield slightly soluble compounds with the dissolved anode substance. Examples are given describing the preparation of lead silicate and of the white lead substitute called "lead snow," consisting of a mixture of lead silicate and sulphate.—A. S.

Carbon dioxide from air; Process and apparatus for freeing liquid ——. The Magnesite Co. m. b. H., Hamburg. Eng. Pat. 19,602, Aug. 22, 1910. Under Int. Conv., Aug. 21, 1909.

Liquid carbon dioxide, which contains compressed air, is slowly passed through a series of vessels, which communicate at their upper extremities with a common, air-collecting vessel at a higher level. The latter is provided with a spring-controlled, or other suitable form of exhaust valve, and the compressed air, which issues from the valve, is made to expand inside a jacketed space surrounding the valve, before escaping into the atmosphere. The escaping air thus serves to cool the valve and to condense any carbon dioxide, which might otherwise be wasted.—O. R.

Sulphuric acid; Apparatus for making ——. R. Moritz, Wasquehal, France. U.S. Pat. 981,103, Jan. 10, 1911.

See Fr. Pat. 395,694 of 1908; this J., 1909, 473.—T. F. B.

Solutions or quasi-solutions of certain metallic oxides; Method of obtaining ——. Z. Cartwright, Ilford. U.S. Pat. 980,143, Dec. 27, 1910.

See Eng. Pat. 24,842 of 1908; this J., 1910, 24.—T. F. B.

Carbon dioxide; Process and apparatus for removing air from liquefied ——. The Magnesite Co. Fr. Pat. 419,563, Aug. 20, 1910. Under Int. Conv., Aug. 21, 1909.

See Eng. Pat. 19,602 of 1910; preceding.—T. F. B.

Nitrogen-oxygen compounds; Process for producing —— from ammonia and air, by aid of a contact substance. K. Kaiser. Fr. Pat. 419,782, Aug. 27, 1910. Under Int. Conv., Aug. 31, 1909.

See Eng. Pat. 20,325 of 1910; this J., 1910, 1377.—T. F. B.

Oxygen; Process for the development of ——. L. Sarason, Berlin. Eng. Pat. 10,066, April 25, 1910. Under Int. Conv., April 26, 1909.

See Fr. Pat. 405,644 of 1909; this J., 1910, 425.—T. F. B.

Air; Process of liquefying —— and separating out oxygen. R. Mewes, Berlin. U.S. Pat. 980,813, Jan. 3, 1911.

See Fr. Pat. 358,236 of 1905; this J., 1906, 180.—T. F. B.

Oxygen and hydrogen; Electrolytic device for generating pure ——. R. Moritz, Wasquehal, France. U.S. Pat. 981,102, Jan. 10, 1911.

See Fr. Pat. 397,319 of 1908; this J., 1909, 799.—T. F. B.

VIII.—GLASS; CERAMICS.

Fireclay ware; Manufacture of —— and firing in tunnel-kilns. C. Schärtler. Sprechsaal, 1911, **44**, 17—18.

The manufacture of fireclay sanitary ware is being taken up in Germany with some success. Slip-casting (see Weber, this J., 1909, 835) reduces the cost of making by a third, and enables pieces 4 inches thick to be cast. An engobe is introduced between body and glaze, and is applied by an aerograph, which is said to be twenty times cheaper than brushing it on. The tunnel-kiln may conveniently be 330 feet long, and would hold about 80 trolleys laden with ware, the journey through the kiln taking six days. Care must be taken whilst charging the kiln with fuel to avoid cold draughts which set up cracking in the ware. The loss in manufacture should not exceed 10 per cent. for all causes. The space taken up by the ware in kiln is apt to obstruct the flame, causing over-firing of the goods nearest the fire and under-firing of the rest.—H. H. S.

Crystalline glazes; Micro-structure of ——. K. Endell. Sprechsaal, 1911, **44**, 1—4.

Photo-micrographs are given of five titania and one zinc crystalline glazes. The titania glazes were made up according to Heinecke's formulas (this J., 1910, 26). They contained from 10·8 to 11·5 per cent. of titania, and the author calculates that about 10 per cent. of the resulting glaze is crystalline, showing that most of the titania separates out. Four of the titania effects are due to crystals of rutile, while the fifth is supposed to be sagenite. The zinc glaze had the composition: $1{\cdot}0K_2O$, $1{\cdot}0Na_2O$, $1{\cdot}0CaO$, $1{\cdot}0BaO$, $8{\cdot}5ZnO$, $0{\cdot}5CuO$, $1{\cdot}0Al_2O_3$, $12{\cdot}0SiO_2$, $2{\cdot}0B_2O_3$. Crystals resembling willemite in appearance were obtained, and this is said to have been confirmed by evidences of the radio-activity which is often found in willemite.—H. H. S.

Enamels [containing fluorine]: Reactions during the melting of ——. M. Mayer and B. Havas. Sprechsaal, 1911, **44**, 6—7.

The paper is a sequel to a former one by the same authors (this J., 1909, 835). The amount of fluorine remaining in an enamel after firing depends on the temperature and duration of firing, but principally on the nature of the compound in which the fluorine is introduced. Thus 5 and 10 per cent. of fluorspar, aluminium fluoride, sodium fluoride and cryolite were introduced into a glass of the same composition in each case, and the percentage loss of fluorine was as follows:—

	5 per cent. added.	10 per cent. added.
Fluorspar	33·8	33·6
Aluminium fluoride	37·4	36·1
Sodium fluoride	15·8	14·2
Cryolite	14·4	16·1

The same compounds were used in making up undercoats and enamels of varying composition, and the analyses before and after melting confirm the conclusion that the amount of fluorine volatilised depends on the way it is introduced. A time-volatilisation curve is given showing that half the loss occurs in the first half-hour, and nine-tenths in the hour, while the reaction is complete in 2·5 hours. If boric acid be present, additional loss may be caused by volatilisation of boron trifluoride which asserts its presence by the usual green colouration of the flame. The loss of alkalis by volatilisation is very small. —H. H. S.

Lead poisoning [in potteries]; Question of —— at the Assembly of Delegates of the International Union for the Legal Protection of Workmen. Sprechsaal, 1911, **44**, 20—21.

This assembly, which met at Lugano in September last, made the following recommendations for the control of potteries:—I. *Suppression of lead poisoning.* Porcelain and high-fired stoneware shall be made free from lead. For lower-fired stoneware, a register shall be compiled of articles that can be made free from lead. In the case of ordinary earthenware and simple tiles prepared in small works or even houses, litharge and red lead are to be replaced by lead sulphide or other harmless compounds. Fritting and the introduction of unfritted materials are alike forbidden in such small works or premises. II. *Leadless processes, i.e.*, with materials containing less than 1 per cent. of lead, shall be subject to the ordinary regulations of factories, and to the liability that inspectors may take samples for analysis at any time. III. *Lead processes.* Alterations in the composition of the glaze shall be notified to the inspector. The mixing, milling and transporting of glazes shall be carried on in the wet or in machines impermeable to the glaze-powder. Frit-kilns shall be arranged so that the melt can be run into water. The openings of all kilns, milling and mixing apparatus shall be provided with exhaust fans. Each stage of manufacture shall be carried on in separate rooms. All rooms shall be 12 feet high and the walls covered to a height of 6 feet with washable paint. Every worker shall have a space of 530 cubic feet to himself. Lead processes shall not be conducted in living or sleeping rooms. Women and young persons under 18 shall not handle lead constituents at any stage. Working-hours shall be reduced in accordance with the danger of the processes. All workers shall be supplied with overalls, drinking water and lavatory conveniences. Comestibles and tobacco shall not be allowed in process rooms. Every worker shall be medically examined every three months and a register of health be kept. Persons suffering from plumbism shall be given work in leadless processes.—H. H. S.

Lead silicates in relation to pottery manufacture. Part II. E. Thorpe and C. Simmonds. Chem. Soc. Trans., 1910, **97**, 2282—2287.

In their previous paper (see this J., 1899, 494; 1901, 475, 476, 897) the authors pointed out that whether a lead silicate yields much soluble lead (to dilute acid) or not depends mainly upon the value of the ratio, number of acidic molecules: number of basic molecules, but that the possible different states of combination in which alumina and boric oxide may occur in the silicate, might modify the action. The effect of aluminium, sodium, and boric oxides has now been briefly studied, with the following results. Alumina has a marked effect in promoting the stability of the lead polysilicates towards acids, possibly owing to its function in the silicate being that of an acidic oxide. In the disilicates, this effect is less apparent, since these are already tolerably stable. Sodium oxide increases the solubility of the lead, especially in the polysilicates. Boric oxide sometimes increases the solubility of the lead, but in other cases has no such effect. (Compare Beck and others, this J., 1910, 353).—A. S.

Patents.

Glass pot heating furnace. H. E. Smythe, Pittsburg, Pa., U.S.A. Eng. Pat. 18,301, Aug. 2, 1910. Under Int. Conv., June 8, 1910.

The furnace is intended for heating glass pots which can be inverted to remove surplus glass, and is designed to utilise producer or other gas to give the heat necessary for melting out the glass. It has a well (preferably with an inclined bottom and opening into a tunnel) below the pot, and the furnace or well communicates by a lateral opening with a combustion chamber (preferably recuperative) in which the gas is burnt, the heated products of combustion being directed upwards through the lateral opening against the lower cavity of the glass pot. Air reaches the combustion chamber through a succession of annular spaces in the walls, and is thus heated before mixing with the gas to be burnt.—F. Sodn.

Glass furnaces. G. H. Baillie, London. Eng. Pat. 4316, Feb. 21, 1910.

See Fr. Pat. 418,555 of 1910; this J., 1911, 87.—T.F.B.

Glass; Manufacture of ——. A. G. Bloxam, London. From Siemens und Halske A.-G., Berlin. Eng. Pat. 16,441, July 9, 1910. Addition to Eng. Pat. 9563, May 2, 1908.

See Addition of June 8, 1910, to Fr. Pat. 389,962 of 1908; this J., 1910, 1382.—T. F. B.

Enamel coatings on metal; Process for obtaining ——. S. and A. Sonntag. Fr. Pat. 419,433, Aug. 17, 1910.

See Eng. Pat. 19,233 of 1910; this J., 1910, 1383.—T.F.B.

IX.—BUILDING MATERIALS.

Patents.

Bricks and other clay goods; Hoffmann kiln for burning ——. M. Hurll, Glasgow. Eng. Pat. 7585, Mar. 29, 1910.

The partition walls between the firing chambers are pierced with arched openings, opposite each fire-grate, and provided with ports which communicate with transverse flues below the floor of the kiln, and on the inside of that wall of each chamber which is furthest from the fire-grates. By this arrangement, with the aid of a powerful draught, a large volume of air can be passed through the fuel, and a high temperature attained. On the furnace side of each chamber, one or more air flues are arranged in the partition walls, with openings leading into the chamber, so that cold air can pass from the outside to the inside of the kiln and prevent excessive heating of the goods at that side of the chambers. The transverse flues underneath the floors of the chambers, which carry off the hot air and gases, communicate with longitudinal flues on each side of the kiln, which in turn are connected with the chimney. The end chambers of the kiln are similarly put in communication by means of flues which extend across the kiln. In the median wall of the kiln, vertical flues are arranged by which air is supplied to the under side of the fire-grates. Openings are provided in the roofs of the firing chambers, near to the median wall, adapted to receive curved connecting pipes, through which hot air can be passed from any of the chambers into the longitudinal flue in the median wall, and thence to the other chambers. —W. C. H.

Granite; Manufacture of artificial —— from blast-furnace slag. W. Hohrath. Fr. Pat. 419,884, Aug. 31, 1910. Under Int. Conv., Oct. 28, 1909.

Granite blocks, susceptible of a high polish, are made by the slow cooling of the molten slag, to which has been added a quantity of finely powdered aluminium. Materials such as sand and magnesia may be added if desired. —A. T. L.

Concrete; Process for the manufacture of liquid ——. H. J. Harms, jun., and G. E. Small, Orange, N.J., U.S.A. Eng. Pat. 16,028, July 5, 1910.

See Fr. Pat. 417,652 of 1910; this J., 1911, 29.—T. F. B.

Process of granulating molten slag. U.S. Pat. 980,606 See X.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Electro-steel; Study of the systems of producing ——. P. Weiller. Chem.-Zeit., 1911, 35, 27—28.

The author gives the results of observations on the working of various forms of furnaces in German electro-steel works. The working of an arc furnace demands much more attention than that of an induction furnace, whilst there is still a considerable difference in this respect between the Stassano furnace, in which the arc lies over the bath, and the furnaces of Girod, Heroult and similar systems. In these furnaces the arc passes from the electrodes to the bath, and is therefore influenced by all the irregularities of the latter. The Stassano furnace is easily started, and works evenly, whilst continual attention is required in other cases. This is due to the fact that an alternating current arc readily passes between carbon electrodes, and when once established remains constant, whereas this is not the case with metal electrodes, between which, under normal conditions, no alternating current arc is produced. Between carbon and metal an alternating current arc is produced by very strong currents, but it is unsteady and accompanied by pronounced fluctuations. If a furnace with a directly-acting arc is charged with cold material, it begins to work with loud crackling and scattering of small particles of metal, and the arc is often completely extinguished. Not until the charge has become hot does the furnace act more regularly, and even then it is necessary to guard against strong fluctuations of the current. The mode of construction of furnaces with an arc acting directly upon the bath is less favourable for the utilisation of heat than that of the Stassano furnace or induction furnaces. The efficient cooling of the carbons in the Stassano furnace, permits of the use of electrodes of smaller diameter, which has a favourable influence on the process. The loss of heat caused by the cooling water is compensated for by the good thermal isolation of the furnace. In the furnaces with an arc acting directly upon the bath, the slag is heated most strongly in the immediate vicinity of the arc, and the heat decreases very greatly towards the walls. The Stassano furnace has a much larger arc, which spreads out forming a broad sheet of flame over a large portion of the bath. It does not, however, equal the induction furnaces in regularity of heating. The Röchling-Rodenhauser furnace, the only induction furnace which has been extensively tried, has been condemned in some directions upon the ground that owing to the strong current passing through the bath (which is necessitated by the electromagnetic conditions of the furnace) microscopic particles of slag become emulsified with the metallic mass. Electric furnaces are usually praised for the high temperatures they will give, but in practical metallurgical work such high temperatures are not required. Normally the temperature of the bath in the electric furnace is only 50° to 100° C. higher than in the Martin furnace. Nor is there proof of the assertion frequently made that the slag in electric furnaces is especially hot, although, being very rich in lime, it incandesces more than Martin slag at an equal temperature. The only property which gives the electric furnace an absolute advantage over the Martin furnace is its deoxidising (and desulphurising) action. In well closed electric furnaces there is a reducing atmosphere, and in the case of induction furnaces such an atmosphere may be readily obtained by the addition of carbon. Since there is little doubt that lime and basic calcium silicates effect direct decomposition of the sulphides of all heavy metals in the presence of reducing agents, the reaction may be represented by the equation—$MeS+CaO+C=CO+CaS+Me$—where *Me* indicates iron, or another metal. Calcium silicates of high basicity, which are now regarded as solutions of lime in calcium orthosilicate, dissolve iron oxide, with formation of well-defined compounds of lime with iron oxide. Iron, too, dissolves its oxides, so that all iron oxide present is distributed between the metal and the slag. In order to convey fresh quantities of oxide into the slag it is necessary first to remove the oxide already present, and this is effected by strewing upon the slag a finely-divided reducing agent, usually carbon or ferrosilicon, in such a way that it does not reach the metal bath. In this manner the latter may be completely freed from iron oxide. At the same time the reducing agent, acting in conjunction with the lime, removes the sulphur from the bath. The removal of phosphorus by means of a lime-iron oxide slag is done in the same way as in the Martin furnace. Owing to these considerations the electric furnace enables products of the best quality to be obtained from cheap, impure raw material. It is also well adapted to take the place of the crucible, since the cost of heating is less and it does not, like the latter, require the use of pure material. Very soft metal, corresponding in quality to the purest Swedish iron, has also been produced in the electric furnace, which appears better adapted for this purpose than the Martin furnace. Both as regards hardness and durability, electro-steel is superior to Martin steel, though it is still undecided whether the reduction in the weight of steel for constructional purposes which is thus rendered possible, compensates for the considerable increase in cost. Speaking generally, it pays to produce cast-steel when the price of current does not exceed 4 Pf. (0·47d.) or machine steel at 7 to 8 pf. (0·82—0·94d.) per kilowatt hour. At the present time molten steel from the Martin furnace or converter is almost exclusively used, and the electric furnace is only employed for refining. At the ordinary price of current at the works, the electric furnace is far superior to the Martin furnace as a melting apparatus. Electric furnaces are now usually constructed to take a charge of 3 tons (metric), although furnaces of twice that capacity are being tried in certain works. Furnaces have been made with a capacity up to 15 tons, but their utility has not yet been established. An exception to this rule is offered by the Röchling-Rodenhauser furnace, one of which taking a charge of 8 tons has been working regularly for some time and gives such excellent results that there appears no objection against its being used for still larger quantities.—C. A. M.

Ferro-uranium and ferro-zirconium; Analysis of ——. W. Trautmann. Z. angew. Chem., 1911, 24, 61—62.

Ferro-uranium. From 0·4 to 0·6 grm. of the powdered alloy is heated with *aqua regia* until solution is complete, after which the liquid is diluted, cooled, and rendered alkaline with solid ammonium carbonate. After standing for 24 hours, with frequent stirring, it is filtered from the separated hydroxides of iron and aluminium and the silica and the filtrate boiled to decompose the remaining ammonium carbonate, whereby the bulk of the uranium is precipitated. The traces of uranium in the filtrate are removed by adding a few drops of ammonia solution, and the liquid is again filtered. The filter containing the uranium precipitates is washed with ammonium nitrate solution rendered faintly alkaline with ammonia, and the precipitates ignited in a porcelain crucible and weighed as U_3O_8. The carbon in the alloy is determined by combustion in oxygen, whilst the silica is determined in the usual manner. Aluminium, which is a frequent impurity in the alloy. is determined by fusing the powdered sample with sodium peroxide, extracting the fused mass with water, acidifying the solution with hydrochloric acid, and precipitating the aluminium and silica by means of ammonia, the silica being subsequently separated by means of hydrofluoric acid.

Ferro-zirconium.—Two methods are given for the analysis of alloys used in the steel industry, and containing (on account of the sp. gr.) not more than 20 per cent. of zirconium :—(1) The finely powdered alloy is oxidised by roasting in a platinum crucible, and is then fused with sodium carbonate and potassium nitrate. The fused mass is dissolved in water, a white potassium zirconium compound which separates being brought into solution by the addition of a few drops of hydrochloric acid. The solution is evaporated several times to render the silica insoluble, and the separated silica subsequently purified by fusion with potassium bisulphate and extraction with water and a little hydrochloric acid. The filtrate from the silica thus purified contains from 1·2 to 2·9 per cent. of the total zirconium in the alloy. The united filtrates are nearly neutralised and treated with a sufficient quantity of sodium thiosulphate, the liquid, after decolourisation, being boiled to precipitate the sulphur and zirconium. The precipitate is separated, ignited, fused with bisulphate, and again precipitated, in order to eliminate the iron simultaneously carried down. Aluminium, if present in the alloy, must be separated from the zirconium oxide by fusing the weighed precipitate with sodium peroxide, extracting the mass with hot water, acidifying the solution with hydrochloric acid, and precipitating the aluminium with ammonia. Its amount is then deducted from the previous weight. (2). From 0·4 to 0·6 grm. of the powdered alloy is roasted in a platinum crucible, and, after cooling, is heated in the covered crucible with pure hydrofluoric acid, or with ammonium fluoride and water, and sulphuric acid, until solution is complete. The excess of hydrofluoric acid is expelled by heating the crucible until vapours of sulphuric acid appear, after which it is cooled and the contents dissolved in warm water, with the addition, if required, of a few drops of hydrochloric acid. The zirconium in solution may then be determined by any suitable method. The two methods here described have given results agreeing within ±0·1 per cent. In determining the carbon by combustion of the alloy in a current of oxygen, it is unnecessary to add lead peroxide.—C. A. M.

Bullion and assay values ; Standardisation of ——. Inst. Mining and Met., Jan. 18, 1911, [76], 31—32.

The definitions previously recommended (see this J., 1910, 356) have been adopted by the Institution, the following general recommendation being included.

Reports of assay results, extraction tests, metallurgical and ore-dressing trials, etc., are sometimes so worded as to permit a wrong interpretation, and the necessity is urged for definite statements as to the nature and condition of the sample assayed, and, where advisable, an indication of the method of assay. Thus, in the case of such metals as copper, tin, lead, antimony, etc., where both " wet " and " dry " methods of assay are in use, results should be reported as obtained by " fire " assay or by " wet " assay, with further details as to method, if judged advisable. Similarly, it should be stated whether the sample was assayed in the condition in which it was received, or " air-dried," or dried at —° C. In reporting that an assay for such a constituent as tin, arsenic, tungstic acid, etc., corresponds to so much " black tin," " white arsenic," " wolfram " or other recognised saleable product, the report should give the assay result for such constituent, together with a definite statement as to the figures used in calculating such saleable product. Thus, an assay showing 1 per cent. of metallic tin might be reported as 1 per cent. of metallic tin, equivalent, if all could be extracted as such, to 1·5 per cent. of " black tin " containing 66·6 per cent. (or two-thirds) of its weight of metallic tin. Similarly, in reporting results, where assay values might be mistaken as representing available produce, it should be stated that such are merely " gross " assay values, a statement or estimate of the actual " commercial " values being added whenever possible. In such matters as ore-dressing, ore-treating processes, furnace work, etc., where so much depends on the way in which results are reported, on the nature of the sample and on the method of taking it and its relation to other samples, the necessity for careful phraseology and for the inclusion of exact data is emphasised, as also the necessity for care in preparing, describing, labeling, sealing and otherwise ensuring the correctness and authenticity of samples submitted for tests or assays.

Silver ; Adhesion of electrodeposited —— *in relation to the nature of the German silver basis metal.* A. McWilliam and W. R. Barclay. Inst. of Metals, Jan., 1911. [Advance proof.]

The authors have investigated the peeling of the silver deposit in high-grade plated goods when subjected to severe conditions of wear. Heavy deposits of silver were made, under similar conditions, on various grades of German silver, and the finished articles subjected to a cold bending test. The thicker the silver deposit, the greater was its tendency to strip off under the strain. It was found that the so-called higher grades of basis metal containing over 14 per cent. of nickel were of doubtful utility from this point of view, the deposits on the lower grade alloys being much more adherent. Microscopic examination confirmed this view, so that it seems advisable to avoid too high a percentage of nickel in the basis metal for high-grade electro-plate which has to endure rough usage. Although the alloys poor in nickel are not so white and not so strong as the richer alloys, the importance of the colour is not so great where there is a heavy deposit of silver, and it is quite possible to get articles of sufficient strength by suitable mechanical and thermal treatment of the alloys.
—W. H. P.

Copper and its alloys ; Production of a deep black colour on —— *in the cold way.* B. Müllaner. Elektrochem. Zeits., 1911, 17, 293—295.

A 5 per cent. solution of caustic soda is warmed to 100° C. and 1 per cent. of potassium persulphate is added. On immersing a copper article in this bath, oxygen is evolved, and the copper is coated in about five minutes with a deep black, very adherent coat of cupric oxide. It is important to keep the temperature above about 70° C., and to move the article to and fro during the process. The bath may receive fresh persulphate for several operations, but it finally becomes exhausted and gives a deposit of sulphur. It is essential that the copper should first be cleaned free from all traces of oxide, which would prevent the deposition of the adherent layer. The same process may be applied to alloys containing much copper, provided a longer time be allowed.—W. H. P.

Copper ; New mode of formation of colloidal ——. A. Rassenfosse. Bull. Acad. roy. Belg., Classe des sci., 1910, 738—741. Chem. Zentr., 1911, 1, 122.

If anhydrous copper sulphate be dissolved in concentrated sulphuric acid, and alcohol added so as to form a separate upper layer, a violet zone, probably containing cuprous sulphate, is formed between the two liquids ; the violet colour gradually changes to brown, owing to the production of a solution of colloidal copper. Methyl alcohol, ether, acetone, acetic acid, and chloroform act in a similar manner to ethyl alcohol. A solution of anhydrous copper phosphate in anhydrous phosphoric acid behaves in an analogous manner on addition of an organic substance.
—A. S.

Copper-zinc alloys ; A new critical point in —— *; its interpretation and influence on their properties.* H. C. H. Carpenter and C. A. Edwards. With an appendix by C. A. Edwards. Institute of Metals, Jan., 1911. [Advance proof.]

The authors have detected pyrometrically, both in heating and cooling curves, the thermal change at about 470° C. found by Roberts-Austen (this J., 1897, 249) in some copper-zinc alloys. It is not due to a eutectic. The change, a true critical point, is found in all alloys containing from about 63 to 40 per cent. of copper. At 470° C., on cooling, the so-called β-constituent splits up into an intimate mixture of α and γ. On heating, the reverse change takes place. Alloys which just above 470° C. contain β are seen microscopically, at very high magnifications, when cooled below 470° C. to contain α and γ. As γ is a very brittle constituent, the fact that the stable phase above 470° C. is β, and below this temperature α + γ, has an important bearing on the cause of the brittleness and decay of many brasses in engineering work. It also provides an explanation of the "crystallisation" of pure α-alloys, as α consists of copper + β. The brittleness is entirely removed by annealing above 500° C. The authors show the changes which must be effected in the usual copper-zinc equilibrium diagram in order to bring it into agreement with the new facts.

Solid solutions: The nature of ——. C. A. Edwards.

From a consideration of the properties of solutions, supported by the experimental evidence afforded by practical tests carried out by Bengough and Hudson (this J., 1910, 1163) on brass, and by Rosenhain (Proc. Phys. Soc. London, 1908, **21**) on the copper-aluminium alloys, the author shows that a constituent of a solid solution can retain its individual mechanical properties, and lays stress on the fact that although in a solid solution the constituents are so closely and intimately mixed that the mass appears homogeneous under the highest magnification, yet the primary crystals are large enough to retain their identity. The term "mixed-crystals" is therefore preferable to "solid solution," which should apply solely to supercooled liquids. Further considering the formation of mixed-crystals in an alloy, the author concludes that with the exception of the two series of mixed-crystals that may be formed at each end of a series, each constituent has an "intermetallic" compound as its foundation, though it may be impossible to ascribe a formula to it. —R. W. N.

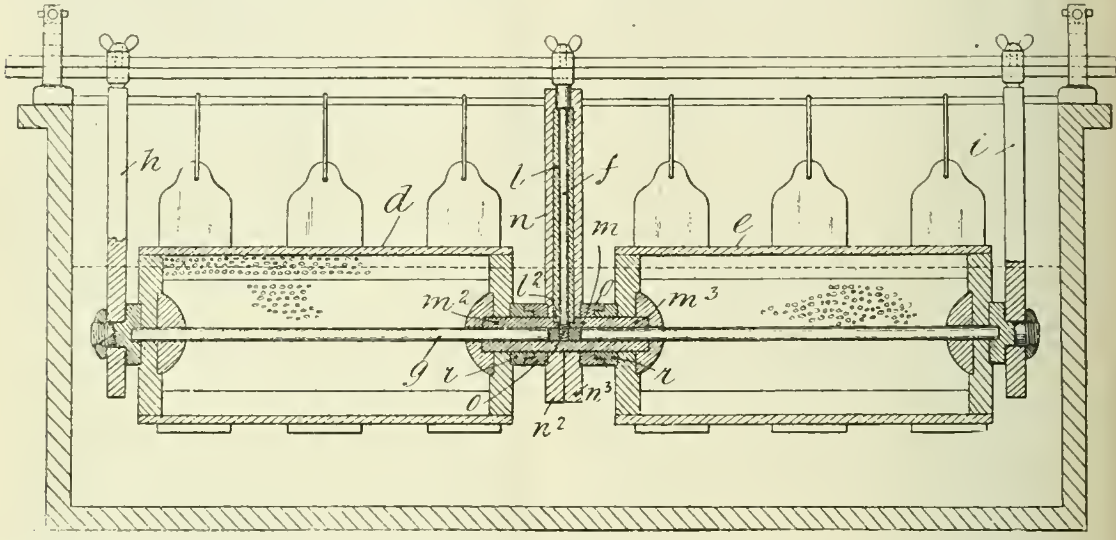
Aluminium-magnesium alloys; Electrical properties of ——. W. Broniewski. Comptes rend., 1911, **152**, 85—87.

The results obtained are exhibited in the form of curves having compositions by volume as abscissæ and electrical properties of the alloys as ordinates. The properties studied are (1) electrical conductivity, (2) temperature coefficient of resistance between 0° and 100° C., (3)—*a.* thermo-electric power relative to lead, *b.* variation of thermo-electric power with temperature, (4) electromotive force of solution in ammonium chloride relative to a carbon electrode with manganese dioxide as depolariser. All the curves indicate clearly the existence of the two compounds, $AlMg$ and Al_2Mg_3. These two compounds form an almost continuous series of solid solutions with one another, rendering their detection by thermal analysis difficult. The composition Al_2Mg_3 (and not Al_3Mg_4) was confirmed by examining a series of alloys prepared *in vacuo* in graphite crucibles. The existence of compounds, Al_4Mg and $AlMg_2$, was not confirmed by the study of the electrical properties. Moreover the microscopic structure of these alloys was shown to be heterogeneous.—E. W. L.

Patents.

Metals; Electrodeposition of ——. T. A. Smith and T. Deakin, Walsall, Staffs. Eng. Pat. 7225, March 23, 1910.

The material to be plated is contained in two rotatable barrels, *d* and *e*, suspended at their outer ends by non-conducting hangers, *h* and *i*. A metallic cathode conducting rod, *g*, passes along the axis of each barrel, and a hanger bar, *f*, is screwed into the stationary rod, *g*, so as to make a good electrical connection. The current thus leaves each barrel only at the adjacent ends of the barrels. The rod, *g*, and bar, *f*, are protected by liquid-tight tubes, or sleeves, *l* and *m*, constructed of wood, and engaging together at the point, l^2. The sleeve, *m*, engages with the barrels at the ends, m^2 and m^3, in liquid-tight recesses. The sleeve, *l*, is further surrounded by a sleeve, *n*, made up of two portions, n^2 and n^3, rigidly connected to bosses, *o*, which engage with corresponding bosses, *r*, the latter rotating with the barrels.—B. N.



Electroplating barrel apparatus. T. A. Smith and T. Deakin, Walsall, Staffs. Eng. Pat. 7226, March 23, 1910.

The invention is similar to the one described in Eng. Pat. 7225 of 1910 (see preceding abstract), with the exception that one barrel only is used.—B. N.

Electric smelting furnaces; Means for regulating the electrodes in ——. Aktiebolaget Elektrometall, Stockholm, Sweden. Eng. Pat. 12,430, May 21, 1910. Under Int. Conv., May 21, 1909.

The electrodes are hung in frames which slide up and down standards attached to the furnace. By means of extensible couplings and ball links, it is possible to work this movement from a fixed shaft controlled automatically or by hand, the couplings admitting of an extension corresponding with the greatest tilt of the furnace. The controlling gear thus does not take part in the movements of the furnace or get heated, as it would if it were attached to the furnace. When the electrodes are raised above the furnace crown, the standards can be rotated, bringing the electrodes clear of the furnace. A change of electrodes is then easily made.—T. St.

Furnace ; Electric melting ——. K. A. F. Hiorth, Christiania, Norway. U.S. Pat. 980,781, Jan. 3, 1911.

A transformer is provided with windings connected in series, and with secondary windings, closely surrounding the primary, of large cross-section and subdivided to reduce their temperature. The secondary windings have ends of the same kind of metal as that to be melted, and are connected in parallel, at different levels, with the bath of metal in an electric furnace, the latter being located outside the magnet frame of the transformer. The bath of metal is of less cross-section than the secondary windings, so as to have a considerably greater resistance than the windings.—B. N.

Metallurgical process [for iron]. J. C. Morris, Findlay, Ohio. U.S. Pat. 979,541, Dec. 27, 1910.

Fifty parts of cast iron or broken castings and 50 parts of steel clippings are melted in a suitable container. The mass being at the point of fusing, aluminium, $\frac{1}{16}$, magnesium, $\frac{1}{16}$, and silica, 1 part, are added ; and, finally, the metal is run into a mould.—C. A. W.

Iron ore ; Method of reducing ——. J. T. Jones, Iron Mountain, Mich. U.S. Pat. 981,280, Jan. 10, 1911.

Ore mixed with lump coke and fresh hydrocarbon fuel is fed in the top of a blast-furnace which has one set of tuyères situated about halfway up, and another set at about three-quarters-way up. The two sets of tuyères produce three main zones in the furnace. In the uppermost, the atmosphere is oxidising. The ore loses sulphur, the fuel is partly distilled, partly burnt, and the ore is strongly heated. The zone situated between the two sets of tuyères is in its upper portion a reducing zone. The ore is here reduced to metal without any metallic or slag-making constituents of the mass being rendered fluid. The reduced metal is later shielded from re-oxidation by the highly heated unconsumed coke. The lower half of the furnace forms a soaking and cooling chamber with a non-oxidising atmosphere.—T. St.

Spathic iron ore ; Process for increasing the reducibility of ——. Köln-Müsener Bergwerksaktienverein. Ger. Pats. 229,015 and 229,323, July 12 and October 13, 1908.

Spathic iron ore, preferably after concentration and after roasting in absence of air, is ground and moulded into briquettes, which are heated until a coherent mass is produced, sufficient air being supplied to convert the ore into easily reducible oxides. The briquettes produced are very strong and porous, and the process is stated to be especially applicable to the spathic iron ore of Siegerland, which when treated in this way and smelted, yields a pig-iron rich in manganese, without any special addition of manganiferous ore.—A. S.

Steel ; Manufacture of ——. W. R. Walker, New York. U.S. Pat. 980,369, Jan. 3, 1911.

The metal obtained by treatment in an open-hearth furnace or Bessemer converter is withdrawn into a movable ladle (containing the desired alloy additions) in which it is kept molten, by electrical means, until the reactions are complete and the impurities rise to the surface. The finished steel is then poured direct from the ladle into the moulds.—W. E. F. P.

Steel ; Carbonising ——. H. Rodman, Pittsburg, Pa., Assignor to Rodman Chemical Co. U.S. Pat. 981,474, Jan. 10, 1911.

The steel to be carbonised is made to form an electrode (cathode) in a bath of fused sodium carbonate, or other electrolyte containing carbon, which is ordinarily inactive as a carbonising agent by simple contact.—T. St.

Steel ; Unmagnetisable ——. F. Kohlhass, Düsseldorf, Germany. U.S. Pat. 981,575, Jan. 10, 1911.

This steel contains manganese about 9·8 to 10·3, carbon about 0·9 to 1, titanium about 0·2 to 1·4 per cent. Silicon must not exceed 0·8, sulphur 0·03, and phosphorus 0·015 per cent.—T. St.

Furnaces ; Regenerative [metallurgical] ——. A. W. and C. W. Catton, West Seattle, Wash. U.S. Pat. 979,647, Dec. 27, 1910.

The claim is for a combined furnace having an upper roasting and a lower smelting chamber. Both chambers are provided with two oppositely inclined sloping hearths which are used alternately. The hearths of the upper or roasting chamber are inclined from the centre to the ends of the furnace, and those of the lower chamber from the ends to a central lead pot. The furnace is heated by liquid fuel and is provided with chequerwork regenerators for preheating the air supply.—W. H. C.

Ore-furnace. C. Best, Oakland, Cal. U.S. Pat. 979,921, Dec. 27, 1910.

The furnace comprises a circular combustion chamber built around the bottom of a central vertical flue, into which the products of combustion are passed. The ore to be roasted is allowed to fall upon a series of separate overhanging shelves arranged helically down the inside of the flue, and in this way it is brought into contact with the hot fumes rising from the bottom. Each shelf is associated with an opening in the wall of the flue, so that the material under treatment is readily accessible.—C. A. W.

Copper bars, ingots and other articles ; Process of casting ——. L. Addicks and A. Marks, Assignors to United States Metals Refining Co., Chrome, N.J. U.S. Pat. 980,584, Jan. 3, 1911.

From a molten mass of electrolytically refined copper, only a relatively small amount is withdrawn at a time for casting purposes ; and this is replaced, as required, by the addition of solid copper which is then wholly or partly submerged in the bath. From time to time the molten metal is treated with suitable reagents for the maintenance of the proper oxide content, the amounts of metal withdrawn and added being such as to maintain the bulk at the proper casting temperature.—W. E. F. P.

Slag ; Process of granulating molten ——. H. Collosens, Berlin. U.S. Pat. 980,606, Jan. 3, 1911.

The molten slag, flowing in a continuous stream, is broken up by means of a horizontal blast and then subjected to the action of rotating streams of finely-divided salt solution.—W. E. F. P.

Zinc ; Furnace for volatilising —— from its ores. H. H. Hughes, Assignor to F. X. Heer and A. J. Eisenmayer, Springfield, Mo. U.S. Pat. 980,640, Jan. 3, 1911.

A rotatory, cylindrical retort, extending horizontally through the combustion-chamber of the furnace, is continuously charged from one end ; the opposite end communicates directly with a relatively large, stationary condenser, provided with a sealed discharge for the purpose of separating the liquid metal from the ore-residue.
W. E. F. P.

Zinc ores ; Method of treating ——, for the recovery of zinc therefrom. H. H. Hughes, Assignor to F. X. Heer and A. J. Eisenmayer, Springfield, Mo. U.S. Pat. 980,641, Jan. 3, 1911.

A horizontal retort, tapering towards the discharge end, and suitably mounted in a furnace, is continuously supplied with ore at its wider end. The charge is agitated during its passage through the hot retort, the volatilised metal and the ore-residue passing into the condenser together and being subsequently separated without the admission of air.—W. E. F. P.

Metallic articles; Process of treating ——. T. B. Allen, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 981,513, Jan. 10, 1911.

THE metal article is heated in contact with silicon to a temperature below the melting points of the metal and of silicon, in a non-oxidising atmosphere. An alloy of silicon and the metal is thus formed on the surface of the article, thereby protecting it from corrosion.—T. ST.

Alloy. W. B. Driver, East Orange, N.J. U.S. Pat. 981,542, Jan. 10, 1911.

The alloy consists of 35 to 60 per cent. of copper, with from 10 to 50 per cent. of manganese and from 10 to 50 per cent. of nickel. It is stated to have an abnormally high specific electrical resistance.—T. ST.

Alloy unattackable by acids. O. Delfosse. Fr. Pat. 419,292, Aug. 10, 1910.

THE alloy is composed of lead, 96 to 92, and antimony, 4 to 8 per cent., the proportions of the constituents being varied according to the resistance required in the finished metal. Thus for a hydraulic pressure of 10 kilos. and an air pressure of the same value, the thickness of the partition being 40 mm., the alloy should contain 92 per cent. of lead. For a smaller pressure, a larger content of lead and a thinner partition would be employed. In order to prepare the alloy, the lead is melted in a closed receptacle and mixed with the calculated quantity of molten antimony, the latter being introduced as soon as it has acquired a dark red tint. The mixture is well stirred and poured rapidly into a mould.—C. A. W.

Pyrophoric products [*alloys*]. L. Goldberg. Fr. Pat. 419,388, Aug. 16, 1910. Under Int. Conv., Sept. 2, 1909.

THE product consists of an alloy of manganese and antimony containing more than 10 per cent. of either metal. In addition, chromium, up to 20 but preferably below 10 per cent., and titanium up to 15 but preferably below 8 per cent., may be added, together with small quantities of aluminium and magnesium. The alloy possesses an advantage over metallic cerium inasmuch that the sparks produced by rubbing are obtained in a long thin jet; the friction piece therefore need never come into contact with the flame and so will always retain its temper.
—C. A. W.

Converter. H. A. Cinille. First Addition, dated July 27, 1910, to Fr. Pat. 416,771, Aug. 14, 1909 (this J., 1910, 1458).

THE method and converter employed for the production of a steel directly from cast-iron, without recarbonisation of the metal, can be applied to the refining of copper. The intervention of the electric current in the preliminary process, furnishes a heat sufficient to assure the fluidity of the slag, however great the content of impurities in the matte to be refined, and the subsequent blowing serves simply to oxidise the sulphides of iron or copper. In a similar manner, ferro-chrome or ferro-nickel may be treated with the blast so as to remove the iron, silicon and carbon, the final product after the oxidation of these elements being pure chromium or nickel, which, at the high temperature obtainable, may easily be poured. The converter is similar to that described in the original specification. In the case where one of the electrodes is constituted by the outer shell of the vessel itself, the cables conveying the current are attached to hook-shaped rods ʃ which pass through the iron-work, through an insulating layer of magnesia agglomerated with sodium silicate, and thence into a conducting bed of graphite agglomerated with pitch. The latter then serves to support a hearth of magnesia or dolomite mixed with a certain proportion of iron or steel scraps, so that the whole body forms a very resistant conductor. In the refining of a cast iron, by the method previously described, the blowing is stopped immediately after the "boil," the converter is brought back into the horizontal position and the cleaning of the metal is effected by a calcareous medium in a hot and reducing atmosphere of carbonic oxide. The metal is heated up and melted, and now possessing all the properties of electric steel, it is cast at a high temperature.
—C. A. W.

Tin; Removal of —— *from tin-plate scraps by means of chlorine.* C. von der Linde. Fr. Pat. 419,280, Aug. 4, 1910.

IF chlorine be allowed to act on tin-scrap, a certain amount of irregular action leading to local superheating is always produced. It is stated that this irregularity is caused by continuing the current of the gas for too long a time without interruption, and it is therefore proposed to divide the calculated quantity of chlorine into (say) five equal parts and to deliver these portions at nearly equal intervals of time. In practice a partial vacuum (60 mm.) having been obtained in the chamber, the tap is opened and chlorine is admitted in a rapid current until the pressure has been increased by about 200 mm. of mercury. The time occupied should not be greater than 15 minutes. When the depression of the manometer indicates that this quantity has been absorbed, the temperature is allowed to fall to about 40° C.; when chlorine is again introduced, possibly at another part of the receptacle, until a nearly equal increase of pressure is obtained. The process is thus repeated until, from the reading of the manometer, no further gas appears to be absorbed; a current of dry air is then admitted to the apparatus. The temperature of the walls of the receptacle should not exceed 50°—60° C.
—C. A. W.

Tin-plate scrap; Process for detinning ——. Dubois und Kaufmann. Ger. Pat. 228,952, May 16, 1907.

IN the detinning of tinned scrap by means of chlorine, claim is made for the use of carbon tetrachloride or tetrachloroethane for diluting the chlorine. The substances mentioned are grease solvents and hence facilitate the action of the chlorine on the tin. From the resulting solution, the tin can be recovered by electrolysis, or the tin chloride can be separated by evaporating the solvent, or by addition of water.—A. S.

Ores, blast furnace dust or other finely divided analogous materials; Enrichment of the products obtained in the agglomeration or the sintering of pulverulent ——. E. A. Pretceille. Fr. Pat. 419,526, Oct. 27, 1909.

THE pulverulent material, in which it is desired to increase the metallic content, is mixed in a suitable proportion with the combustible required in the agglomeration and saturated with a residual solution containing salts of the particular metal. Thus, in the case of a residue obtained in the roasting of iron pyrites, a solution of iron sulphate, a by-product in the precipitation of cement copper, would be employed. In the subsequent fusion or sintering, the iron sulphate is decomposed into sulphurous acid, which is disengaged, and iron oxide, whilst, at the same time, it serves to facilitate the agglomeration.
—C. A. W.

Copper pyrite, roasting residues, so-called "pyrite cinder"; Treatment of ——. H. Simonin. Fr. Pat. 419,528, Oct. 27, 1909.

THE finely crushed burnt pyrite is mixed intimately with about 10 per cent. of "taires," the residue, containing up to 40 per cent. of free or combined sulphur, obtained in the manufacture of Prussian blue from crude ammonia. The mixture having been heated on the hearth of a furnace out of contact with air, at a temperature sufficient to form the metallic sulphides, it is finally roasted in the usual manner in a current of moist air, the temperature of roasting being rather higher than that generally employed. The copper sulphate formed by this means may then be extracted with water and treated with scrap-iron in the ordinary manner.—C. A. W.

Ores or other materials; Method and apparatus for the separation of ——. F. A. M. Schiechel. Fr. Pat. 419,775, Aug. 24, 1910. Under Int. Conv., Sept. 21, 1909.

The apparatus, in its simplest form, comprises a central cylinder surrounded by an outer concentric reservoir, an annular space being left between the two vessels except at the bottom, where they communicate with one another. The area of the inner vessel is occupied by a sieve or screen attached to a light cylindrical frame so that it can be easily removed, whilst the outer vessel is closed at the top and provided with air and water cocks. The material, consisting for example of diamonds and earthy matter, is charged into the inner vessel through a hopper which has an extended outlet reaching nearly down to the surface of the sieve. A continuous current of water is then passed into the apparatus, so that it displaces the air and nearly fills the outer vessel, rises through the screen of the inner vessel and flows over the top into the annular space, whence it is carried away through an outlet provided for the purpose. The space in the outer vessel above the liquid is then placed in communication with an air pump, and, by this means, the air remaining at the top is subjected to an alternating movement of compression and expansion which is of course communicated to the liquid. The water is thus made to pass up through the material in a regular manner without the formation of channels in which stronger currents would circulate; the lighter material is carried over the edge and deposited more or less in the annular space, whilst the heavier portion is left on the screen.—C. A. W.

Steel; Process of refining ——. Soc. Anon. Electro-métallurgique (Proc. P. Girod), Ugine, France. Eng. Pat. 26,588, Nov. 16, 1909. Under Int. Conv., May 6, 1909.

See Fr. Pat. 402,758 of 1909; this J., 1909, 1204.—T. F. B.

Steel; Process of refining ——. Soc. Anon. Electro-métallurgique (Proc. P. Girod), Ugine, France. Eng. Pat. 27,003, Nov. 20, 1909. Addition to Eng. Pat. 26,588, May 6, 1909.

See Addition of Dec. 7, 1909, to Fr. Pat. 402,758 of 1909; this J., 1910, 827.—T. F. B.

Steel; Manufacture of ——. T. J. Hoskett. Fr. Pat. 419,241, July 20, 1910.

See Eng. Pat. 16,940 of 1909; this J., 1910, 1164.—T. F. B.

Ores containing silver, nickel, cobalt, and arsenic; Extraction of metals from ——. C. C. Cito, Irvington, N.J., U.S.A. Eng. Pat. 30,377, Dec. 29, 1909.

See U.S. Pats. 949,058 and 949,261 of 1910; this J., 1910, 361.—T. F. B.

Copper; Process of extracting —— from ore and slags, and apparatus therefor. A. Gadomsky, Tiflis, Russia. Eng. Pat. 3965, Feb. 17, 1910.

See Fr. Pat. 413,725 of 1910; this J., 1910, 1116.—T. F. B.

Copper ores and other ores; Process and apparatus for chloridising ——. A. Ramén and K. J. Beskow. Fr. Pat. 419,575, Aug. 22, 1910. Under Int. Conv., Aug. 24 and Sept. 27, 1909, and July 26, 1910.

See Eng. Pat. 23,108 of 1909; this J., 1910, 1459.—T. F. B.

Cutting, soldering, and autogenous welding of metals by means of blow-pipe jets. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 13,487, June 3, 1910.

See Fr. Pat. 416,001 of 1910; this J., 1910, 1256.—T. F. B.

Sodium; Means for the electrolytic manufacture of ——. P. L. Hulin, Grenoble, Assignor to Soc. d'Electro-Chimie, Paris. U.S. Pat. 979,497, Dec. 27, 1910.

See Fr. Pat. 393,706 of 1907; this J., 1909, 148.—T. F. B.

Ores; Processes for treating —— particularly for making sodium. H. Lage. Fr. Pats. 419,289 and 419,290, Aug. 11, 1910. Under Int. Conv., Sept. 29, 1909.

See U.S. Pats. 957,755 and 957,756 of 1910; this J., 1910, 756.—T. F. B.

Ore concentration; Apparatus for ——. T. J. Hoover, Assignor to The Minerals Separation, Ltd., London. U.S. Pat. 979,857, Dec. 27, 1910.

See Eng. Pat. 4911 of 1909; this J., 1910, 432.—T. F. B.

Separation [of ores, etc.]; Process of ——. H. A. Wentworth, Newton, Assignor to Huff Electrostatic Separator Co., Boston. U.S. Pat. 980,035, Dec. 27, 1910.

See Fr. Pat. 411,116 of 1909; this J., 1910, 958.—T. F. B.

Metals; Scaling, annealing, and coating ——. S. O. Cowper-Coles, London, Assignor to Metalloids, Ltd., Tipton. U.S. Pat. 979,931, Dec. 27, 1910.

See Eng. Pat. 23,181 of 1908; this J., 1910, 359.—T. F. B.

Smelting-furnace; Electric induction ——. K. A. F. Hiorth, Christiania. U.S. Pat. 980,259, Jan. 3, 1911.

See Fr. Pat. 416,079 of 1910; this J., 1910, 1394.—T. F. B.

Furnaces; Electric ——. J. H. Reid. Fr. Pat. 419,891, Aug. 31, 1910. Under Int. Conv., Oct. 16, 1909.

See U.S. Pat. 968,079 of 1910; this J., 1910, 1113.—T.F.B.

Mercury; Process of separating —— from poor ores by electrolysis. B. Szilard, Assignor to H. Bergerat, Paris. U.S. Pat. 980,364, Jan. 3, 1911.

See Ger. Pat. 223,152 of 1909; this J., 1910, 960.—T. F. B.

Zinc from its ores; Electric furnace for the continuous extraction of ——. E. F. Côte and P. R. Pierron, Lyons, France. U.S. Pat. 980,763, Jan. 3, 1911.

See Addition of Sept. 25, 1907, to Fr. Pat. 385,018 of 1907; this J., 1908, 632.—T. F. B.

Zinc oxide; Preparation of —— for smelting. The Metals Extraction Corporation, Ltd. Fr. Pat. 419,557, Aug. 20, 1910. Under Int. Conv., Aug. 23, 1909.

See Eng. Pat. 19,386 of 1909; this J., 1910, 1063.—T.F.B.

Metallic compounds; Method of separating ——. A. McKechnie, Birmingham, and F. G. Beasley, Smethwick. U.S. Pat. 981,451, Jan. 10, 1911.

See Eng. Pat. 29,287 of 1909; this J., 1910, 1391.—T. F. B.

Lead; Electrolytic refining of ——. Siemens und Halske A.-G., Fr. Pat. 419,769, Aug. 22, 1910. Under Int. Conv., Aug. 23, 1909.

See Ger. Pat. 223,668 of 1909; this J., 1910, 960.—T.F.B.

Precious metals from refractory ores; Process and apparatus for dissolving and extracting ——. Clancy Metals Process Co. Fr. Pat. 419,938, Sept. 1, 1910.

See U.S. Pats. 976,043, 976,044, and 976,045 of 1910; this J., 1910, 1459.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Nickel anodes; Velocity of solution and polarisation of —— in N/1 sulphuric acid ——. C. Russo. Gaz. chim. ital., 1910, **40**, II., 491—518.

The author's experiments on the velocity of the anodic solution of passive nickel in *N*/1 sulphuric acid were made under, as nearly as possible, constant conditions at the ordinary temperature (15°—16° C.), varying only the current strength. The results show that after passing the critical current strength (usually about 0·1 ampère) at which the nickel becomes passive, the velocity of solution decreases with increase of the current strength up to about 0·4 ampère and then increases with further increase of the current strength. On either side of the point of minimum velocity, the velocity of solution appears to be a linear function of the current strength. A discussion of the results and of results of anodic polarisation experiments leads the author to adopt the view that the passivity of nickel is due not to an enveloping film of gaseous oxygen, but to oxygen dissolved in the metal (compare Muthmann and Frauenberger, this J., 1904, 986): whilst the inversion point at 0·4 ampère appears to be connected with the discharge of HSO'_4 ions.—A. S.

Copper anodes; Behaviour of —— in chloride solutions. S. Dushman. J. of Phys. Chem., 1910, **14**, 885—908.

COPPER will dissolve as anode in hydrochloric acid wholly as cupric chloride or wholly as cuprous chloride, or as a mixture of these in any proportions. The formation of the cuprous salt is assisted by rapid stirring, high concentration of the chlorine ion, low current density, and increased rate of circulation of the electrolyte. It is therefore probable that there is equilibrium at the anode between cuprous ions, cupric ions and metallic copper. To calculate the concentrations at the anode, which differ very considerably from those in the diffused solution, the author calculates constants for the thickness of the diffusion layer and for the rates of diffusion of the different ions. The final data given are those of numerous electrolyses carried out with hydrochloric acid of concentration from $4·65 \times 10^{-3}$ to $16·15 \times 10^{-3}$ *N*, current from 0·013 to 0·051 amp., anode area from 18 to 47 sq. cm., and rate of circulation from 0·242 to 2·361 c.c. per second. The percentage of copper which dissolves in the cuprous state varies from 25 to 74. The value of the "constant" thus determined $\left(K = \frac{Cu''}{(Cu')^2}\right)$ varies from $0·5 \times 10^4$ to $3·5 \times 10^4$ which agrees with the value $1·5 \times 10^4$ obtained by Bodländer and Storbeck (this J., 1902, 1282) from their experiments on shaking copper powder and cuprous chloride with potassium chloride solutions. The agreement is more evident when the constant ($1·5 \times 10^4$) is used with the other data to calculate the fraction of copper dissolved in the cuprous state. The values calculated generally agree with those observed to within a few milligrams.—W. H. P.

Oil; Dielectric strength of ——. H. W. Tobey. Electrician. 1911, **66**, 491—493.

THE author discusses the dielectric strength of mineral oil, with regard to its use in electric power transmission apparatus. The voltage at which the oil breaks down varies greatly with circumstances and it is necessary to use a carefully chosen system of measurement, particularly in the shape of the terminals, which are preferably brass discs facing each other horizontally. The dielectric strength does not vary greatly with temperature, except in cases where the oil solidifies, when it rises considerably. The most important factor is the presence of small quantities of water which lower the dielectric strength considerably. The water is generally removed for technical use by calcium chloride or quicklime or by forcing the oil through a series of paper filters stretched on frames. When larger quantities are present, settling or centrifugal separation may be used first. In some cases a current of warm dry air or heating under reduced pressure is resorted to. Free sulphur has a deleterious effect on the dielectric strength but its importance lies principally in its corrosive action on the copper conductors. A valuable test for its presence is to dip a polished copper wire into the oil and note the rate at which it blackens. The author also points out that insulation resistance is not an indication of dielectric strength unless temperature be considered, since the former falls rapidly as the temperature rises, while the latter rises very slightly.—W. H. P.

Separation of metallic chromium during the electrolytic determination of manganese by Engel's method. Köster. *See* XXIII.

PATENTS.

Furnaces: Electric resistance ——. A. Petersson. Eng. Pat. 8711, April 11, 1910. Addition to Eng. Pat. 6035 of 1910 (see Fr. Pat. 414,296; this J., 1910, 1212).

THE charging material is introduced in the upper part of the furnace, and forced in a substantially horizontal direction towards a point below the end of a central electrode; or, where the electrodes are in the side walls of the furnace, the material is forced outwards towards points just below the electrodes.—B. N.

Oxygenating liquids [electrolytically]. F. A. Lindemann, Berlin, and C. L. Lindemann, Sidmouth, Devon. Eng. Pat. 13,927, Dec. 14, 1909.

THE oxygen, liberated by electrolysis and separated from hydrogen or other gases, is passed through the liquid to be oxygenated. In an alternative form, the vessel is divided into two compartments by a porous diaphragm, one electrode being placed in each compartment, and the liquid to be oxygenated surrounds the positive electrode. The oxygenated liquid is drawn off, and replaced by fresh electrolyte when necessary.—B. N.

[Electrical] Ozonising apparatus. W. W. Stanton, Merton Park, Surrey. Eng. Pat. 17,138, July 19, 1910.

THE apparatus consists of a series of parallel vacuum tubes mounted longitudinally in an enclosing box upon three supporting frames, clamped around each tube through rubber insulating and resilient sheaths. The parallel clamps embracing the tubes are threaded on cross-bolts provided with distance tubes and nuts, which bind the clamps and rubber sheaths evenly upon the electrodes. The central frame is fixed at its corners to the sides of the box by screws passing through rubber buffers, the frames supporting the ends of the tubes having rubber buffers bearing against the sides of the box, and forming resilient supports. The tubes are divided diagonally into two sets, each being connected to one of the terminals, so that an electric discharge takes place from one set to the other. The electrodes consist of one or more wires twisted or coiled in small spirals, and then coiled in larger spirals to fill the tube. The set of tubes is surrounded by a wire coil wrapped around the tubes throughout the greater part of their length, thus forming a wire cage through which the air to be ozonised is drawn. The apparatus is suitable for oil or other internal combustion engines, and the method of supporting the tubes enables the apparatus to be used on motor vehicles.—B. N.

Electrodes; Method of treating carbon ——. W. Gaston, New York. U.S. Pat. 979,465, Dec. 27, 1910.

THE electrode is provided with a "second binder," by saturating the hot finished carbon electrode, immediately after it comes from the baking furnace, with a boiling solution of a liquid hydrocarbon, such as pitch or tar. The electrode is allowed to remain in the liquid until the cracks and pores have become thoroughly impregnated. The liquid hydrocarbon is retained as such, and automatically prevents cracking of large carbon electrodes whilst in use.—B. N.

Cell; Electrolytic ——. D. S. Hartshorn, Boston, and A. A. Claflin, Medford, Mass. U.S. Pat. 979,485, Dec. 27, 1910.

A MOVABLE electrode, composed of a cyclic series of interconnected parallel bars mounted on a cylinder, is supported mostly above, but having a lower segment dipping below, the level of the liquid electrolyte. The electrode may be rotated so that the bars travel in a direction transverse to their length into and out of the electrolyte, moving along just below the surface, so as to agitate it. A stationary electrode of opposite polarity is located farther below the level of the electrolyte, so as to be in suitable proximity to the movable electrode, and in a position so that it is parallel to the path of the immersed electrode or concentric with the segment below the surface of the electrolyte.—B. N.

Cell ; Electrolytic ——. F. Weinberg, New York, Assignor to E. Berliner, Washington. U.S. Pat. 979,906, Dec. 27, 1910.

The aluminium electrode is given a preliminary immersion in a phosphate solution, which is independent of the electrolyte, and an alternating current is passed until the electrode is formed.—B. N.

Furnaces ; Electric induction ——. J. H. Reid. Newark, N.J., U.S.A. Eng. Pat. 9459, April 19, 1910.

See U.S. Pat. 956,544 of 1910 ; this J., 1910, 704.—T. F. B.

Induction-furnace ; Electric ——. C. Grunwald, Bredeney, Germany. U.S. Pat. 980,940, Jan. 10, 1911.

See Eng. Pat. 3599 of 1909 ; this J., 1910, 800.—T. F. B.

Furnace [*; Electric* ——]. M. Ruthenburg, Lockport, N.Y. U.S. Pat. 980,345, Jan. 3, 1911.

See Eng. Pat. 12,408 of 1908 ; this J.. 1909. 248.—T. F. B.

Electric batteries ; Depolarising agents for ——. A. T. K. Estelle, Fliseryd, Sweden. Eng. Pat. 11,837. May 12. 1910. Under Int. Conv., May 13, 1909.

See Fr. Pat. 415,414 of 1910 ; this J., 1910, 1317.—T. F. B.

Obtaining slightly soluble salts or salt-like compounds containing silicates by the electrolysis of aqueous solutions. Ger. Pat. 229,249. *See* VII.

XII.—FATS ; OILS ; WAXES.

Moroccan "*olive oil.*" E. A. Sasserath. Z. Untersuch. Nahr. Genussm., 1910, **20**. 749—750.

Considerable quantities of oil with a high iodine value are exported from N. Africa under the name of "olive oil" or "Moroccan olive oil," and are sold in Europe as pure olive oil, the higher iodine value being attributed by the importers to the effect of the soil upon the tree and the mode of obtaining the oil. The author has examined 500 samples of undoubtedly pure olive oil from all the oil-producing areas of N. Africa, and has not found any with an iodine value so high as that of the so-called "Moroccan olive oil." Further investigation has shown that the latter is derived from the kernels of the nuts of the argan tree (*Arganum sideroxylon*), a member of the *Sapotaceæ* and the only tree of any importance in the Atlas and Antiatlas districts of Morocco. The kernels examined yielded 50 per cent. of a golden yellow oil with an odour recalling that of arachis oil. It gave the following values :—Sp. gr. at 15° C., 0·9188 ; acid value, 0·18 ; saponification value, 192·12 ; iodine value, 95·94 ; Reichert-Meissl value, 1·8 ; and Hehner value, 95·6. It gave no characteristic reaction with Baudouin's or Halphen's reagent, but when shaken with nitric acid (sp. gr. 1·4) it gave a dark carmine red colouration persisting for an hour. This test, in conjunction with the high iodine value affords the means of distinguishing "Moroccan olive oil" from genuine olive oil.—C. A. M.

"*Cardamon oil*" *; Characteristics of* —— *and of the fat of margarine prepared therefrom.* A. Reinsch. Chem.-Zeit., 1911, **35**. 77.

During the closing months of 1910 numerous cases of poisoning by "backa" margarine were reported in Germany, and finally the cause was traced to the so-called "cardamon oil" which had been used in the preparation of the product. This oil, which had been imported from India by way of Bombay, was a greenish gray solid substance of the consistence of cocoanut fat, with an aromatic odour recalling that of bananas. In the purified state it was white to yellowish white, and had only a very faint odour. From 50 to 60 per cent. of this fat were used in the manufacture of "backa" margarine, and from 6 to 7 per cent. in other margarines made by the same firm. The following results were obtained in the analysis of the crude and purified "cardamon oil" and of samples of margarine containing that fat and as now prepared without it :—

	Butyro-refractometer reading at 40° C.	Acid value.	Saponification value.	Reichert-Meissl value.	Iodine value.	Optical rotation.
Crude "cardamon oil," 5 samples	70·4—71·3	18·8—28·7	203·1—205·3	0·85—1·33	93·0—94·7	+58·8—64·5
Purified "cardamon oil," 2 samples	69·7—71·1	0·8—7·9	203·5—208·1	0·62—1·14	88·5—94·0	+54·0—58·0
Backa margarine containing "cardamon oil"	60·3—63·9	—	201·1—206·3	0·95—1·54	86·2	+30·1—34·5
Luisa margarine containing "cardamon oil"	44·8	—	226·8—227·2	3·9—4·15	42·4—43·1	+ 3·9—4·0
Backa margarine as now made	43·6	—	227·4	4·6	38·9	0
Luisa margarine as now made	42·4	—	232·2	4·8	34·7	± 0
Chaulmoogra oil	71·1	44·8	200·3	0·29	97·8	+ 56·0

From these results, and in particular from the high optical rotation the conclusion was drawn that the so-called "cardamon oil" was chaulmoogra oil or an analogous fat belonging to the same group. The fat has also been put upon the market under the name of "Maratti fat" or "Marotty oil."—C. A. M.

Coffee berries ; Fatty oil and wax of ——. H. Meyer and A. Eckert. Monatsh. Chem., 1910, **31**. 1227—1251.

The oil extracted from the inner portion of the coffee berry by exhaustion with benzene was saponified by means of lithium oxide, in the presence of dilute alcohol, and the crystalline soap produced was separated into three fractions according to solubility ; the saturated acids from the first fraction were isolated by fractional precipitation of their lithium salts, and the unsaturated acids from the other fractions, separated as lead salts from the saturated acids, by solution in benzene, were identified by oxidation and bromination. The oil was found to contain about 40 per cent. of saturated acids, its approximate composition being :—carnaübic acid 10 per cent., daturic acid 1—1·5, palmitic acid 25—28, capric acid 0·5, oleic acid 2, and linolic acid 50 per cent. The wax present in the external layer of the coffee berry was examined by hydrolysing, under pressure, with alcoholic potassium hydroxide solution, and was found to be the carnaubic ester of a resin alcohol ; it is thus a tannol resin. The melting point of pure carnaubic acid is given as 74° C.
—F. Sodn.

Mulberry seeds ; Fixed oil of ——. L. Prussia. Chem.-Zeit., 1910, **34**, 830.

The seeds of *Morus alba* yield, on extraction with ether, 33 per cent. (A) and on pressing 24 per cent. (B), of a thick golden yellow oil with a faint odour, and a pleasant taste. It is very soluble in boiling 95 per cent. alcohol, soluble in an equal volume of absolute alcohol at 39° C., or of acetic acid at 41° C.; easily soluble in all fat solvents. The two oils, A and B, had the following characters:—Sp. gr. at 15° C., 0·9260, 0·9245; refractometer reading (Zeiss) at 40° C., 63·9, 63·6; acid value, 20·1, 28·2; saponification value, 190·1, 191·3; Hehner value, 94·95, 97·57; iodine value (Hübl), 140·4, 143·3; Reichert-Meissl value, 0·35, 0·10; oxygen absorption (Livache), after 6 days, 3·50, after 14 days, 9·38 (A). The fatty acids from the two oils had the following characters:—Sp. gr. at 100°/15° C., 0·8566, 0·8544; m. pt., 23·6°—25°, 22° 23° C.; solidif. pt., 20·8°—21·2°, 19·2°—19·6° C.; refractometer reading (Zeiss) at 40° C., 57·8, 53·3; acid value, 194·0 (B); saponif. value, 199·8 (B); iodine value (Hübl), 144·1 (B); iodine value of liquid fatty acids (Tortelli and Ruggeri), 146·5, 159·9; liquid acids, 79·4, 80·6 per cent.; solid acids, 20·6, 19·4 per cent.; mean molecular weight of insoluble acids, 270·4, 280·9.—J. O. B.

Fat contained in the seeds of the Japanese medlar (Eriobotrya Japonica). G. Maderna. Boll. Chim. Farm., 1910, **49**, 713—714. Chem. Zentr., 1911, **1**, 25—26.

The seeds contain 0·35—0·45 per cent. of fat. Specimens of the fat, prepared by pressing (I) and by extraction with ether (II), and of the fatty acids (III) separated therefrom, had the following characters:—Sp. gr. at 15° C., I. 0·967; m. pt., I. 49°, II. 48° C.; refractometer reading at 45° C., I. 75·5, II. 76; acid value, I. 90·5, II. 89·5; III. 160; saponification value, I. 179·9, III. 173; Hehner value, I. 92·6, II. 92·2; Reichert-Meissl value, I. 5·4; iodine value, I. 48·7, II. 48, III. 58·5. The product obtained by the oxidation of the liquid fatty acids by Hazura's method (permanganate in alkaline solution) yielded to ether, dihydroxystearic acid of m. pt. 234·5° C.; the residue melted at 154°—154·5° C. Arachidic and palmitic acids were detected in the solid fatty acids.—A. S.

Euphorbia elastica seeds; Constituents of ——. H. Okada. Apoth.-Zeit., 1910, **25**, 1014.

Euphorbia elastica, a recently discovered rubber tree, is known in Mexico, where it is indigenous, as "*Palo amarillo.*" The seeds comprise 31·9 per cent. of shells and 68·1 per cent. of kernels. The whole seeds contain 3·7 per cent. of moisture, 58·2 per cent. of oil, 4·5 per cent. of sugar (calculated as sucrose) probably a new sugar, isomeric with sucrose. The cold-pressed oil has the acid value, 2·4; saponification value, 195·4; iodine value, 110·4; Hehner value, 93; titer test, 55—57° C. The solid fatty acids consist of stearic and palmitic acids. The liquid fatty acids consist of butyric, oleic, linolic and linolenic acids. The non-fatty constituents of the seeds contain:—matter soluble in cold water, 51·2 per cent.; matter soluble in hot water, 32·8; water, 10; ash, 7·6; crude fibre, 2·7; total nitrogen, 9·4; water-soluble nitrogen, 4·5; protein nitrogen, 9; amide nitrogen, 0·4; peptone-nitrogen, 0·0; sulphur, 0·8; sugar, calculated as sucrose, 11·6; pentosans, 1·3 per cent. No diastase was present, but phosphorus was a constituent. The nitrogen is probably in the form of a vegetable casein. The oil is suitable for soapmaking, and the press-cake, from its high protein content, would prove a valuable fodder material.—J. O. B.

Fats; Decomposition of —— by bacteria. N. L. Söhngen. Koninkl. Akad. van Wetensch. Amsterdam, Wisk. en Natk. Afd., 1910, **19**, 689—703. Chem. Zentr., 1911, **1**, 248—249.

Dry sterile test-tubes were coated inside with a thin layer of fat, then a suitable nutrient solution was introduced, and the latter infected with bacteria. It was found that numerous bacteria are capable of causing the hydrolysis of fats under anaërobic conditions, of oxidising them under aërobic conditions, and of causing denitrification when nitrates or nitrites are added. The hydrolysis of the fat is always due to secretion of lipase by the bacteria; the glycerol and fatty acids produced are then further decomposed by the bacteria. Various lipolytic micro-organisms secrete two lipases, α- and β- lipase respectively, of which the former diffuses more rapidly than the latter, and decomposes fats in an acid as well as in an alkaline medium. β-Lipase can be formed in an acid medium, but will not decompose fats until after neutralisation of the culture-medium. Aërobic lipolytic bacteria grow well in culture media in which the fat is the only source of carbon and ammonium chloride serves as source of nitrogen. *Bacillus putrificus* Bienstock, a representative of the *Bac. mesentericus* group, *B. Stutzeri*, and *B. denitrofluorescens non-liquefaciens* may be added to the list of known lipolytic bacteria. Milk is a suitable medium for the growth of these bacteria. In spontaneously infected milk, preserved in the ordinary way, the growth and destruction of the lipolytic bacteria and of the lactic acid bacteria proceed almost parallel, being dependent in both cases on the amount of acid formed. The injurious action of lipolytic bacteria on dairy products depends, in addition to the decomposition of fat, chiefly on the formation of bitter, malodourous substances from albumin and casein.—A. S.

Fatty acids; Separation of liquid (unsaturated) from solid (saturated) ——, and ammonium salts of some fatty acids. P. Falciola. Gaz. Chim. Ital., 1910, **40**, II., 425—435.

The method previously described by the author (this J., 1910, 1462) for the separation of oleic acid from palmitic and stearic acids, by making use of the solubility of ammonium oleate in ammoniacal alcohol, does not give exact results in the case of mixtures of fatty acids from fats. The solubility of the ammonium salts of the solid saturated acids is increased somewhat by the presence of the ammonium salts of the liquid, unsaturated acids; and on the other hand, the ammonium salts of the solid acids always retain a certain quantity of the salts of the liquid acids. In many cases, however, especially where the mixed fatty acids consist mainly of solid acids, the method yields satisfactory results. From the mixed fatty acids (m. pt. 48·2° C., iodine value, 30·1) from a sample of tallow, a mixture of solid acids of m. pt. 54·5°—56° C., and iodine value 6·6—8·5, was separated. With a sample of sesamé oil, the mixed fatty acids were separated into liquid and solid acids, of which the former gave the Baudouin reaction, whilst the latter did not. In the case of olive oil, no solid acids could be separated from the mixed fatty acids by the method.

The normal ammonium salts of linolic, erucic, lauric, myristic and crotonic acids were prepared by passing dry ammonia gas into an ethereal solution of the acid, in the case of lauric acid in an atmosphere of hydrogen, and the corresponding salts of caprylic, capric, and butyric acids by passing ammonia into the acids themselves. The properties of these salts are described.—A. S.

PATENTS.

Soap [containing borax]. The Patent Borax Co., Ltd., and L. Bradford, Birmingham. Eng. Pat. 13,008, May 28, 1910.

Granulated or flaked soaps containing borax are prepared by treating soda soap with a hot solution of borax, or with hot borax mother liquors, or both, with or without the addition of powdered borax, and thoroughly incorporating the mixture by stirring. The resulting product is cooled by means of a blast of air forced through it, and is agitated, while cooling, to produce granules or flakes, which are subsequently dried at a low temperature.
—C. A. M.

Oil contained in hydrosilicates, fuller's earth, animal charcoal, or mineral black; Process for extracting —— that has been used for decolouring oils, and apparatus therefor. Soc. Anon. Huilerie et Savonnerie de Lurian, Bouches du Rhone, France. Eng. Pat. 5009, Feb. 28, 1910. Under Int. Conv., March 1, 1909.

See Fr. Pat. 409,915 of 1909; this J., 1910, 830.—T. F. B.

Manufacturing feeding cakes, and extracting oil from the seeds used. Eng. Pat. 29,438. *See* XIXa.

Manufacture of "compound lard." U.S. Pat. 980,809. *See* XIXa.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Turpentine oil, pine oil, and rosin spirit: Reaction of ——. C. Grimaldi. Chem.-Zeit., 1911, **35**, 52.

The author has previously detected camphene in rosin spirit by means of mercuric acetate solution (see this J., 1910, 372), and he now recommends the same reagent for distinguishing turpentine oil from pine oil (*Kienöl*) and rosin spirit, and for detecting the two latter in the former. 1·5 c.c. of the distilled oil are added to 100 c.c. of the reagent (a filtered aqueous solution containing 27·50 grms. of mercuric acetate in 110 c.c.) in a stoppered flask, and the mixture is shaken occasionally during 48 hours (frequently during the first few hours). 60 c.c. of nitric acid (3 vols. of acid of sp. gr. 1·4 to 1 of water) are now added, and after shaking, the mixture is allowed to settle. Turpentine oil gives a clear solution, whilst pine oil and rosin spirit give a turbid liquid from which a flocculent precipitate gradually deposits. In doubtful cases the test is repeated with a larger quantity of substance. By means of this test the author was able to detect adulteration of turpentine oil with 25 per cent., of pine oil or rosin spirit by using 8 c.c. of the sample, 400 c.c. of the mercuric acetate solution, and 320 c.c. of nitric acid. (See also this J., 1910, 963.)—A. S.

Patents.

Furnace [for producing lead pigments]. J. B. Hannay, Cove Castle, Scotland. Eng. Pat. 30,092, Dec. 23, 1909.

The furnace is particularly applicable to the production of white sulphate of lead pigments from ore by a continuous process, where the material is fed on to the top of a bed of coke, a current of hot air being passed through the furnace. In this way, the sulphide is converted into basic sulphate in the colder air at the top. In order that there should be no admission of cold air to the furnace, an air-tight chamber is arranged at the bottom immediately beneath the fire-bars, the whole air-supply being led through this vessel. The fire-bars, composed of hollow tubes closed at one end, are slightly inclined to the horizontal, and each contains a narrow pipe through which a stream of water is passed to the lower end, whence it fills the outer tube and flows away at the top. The bars are placed about 2¼ inches apart, the greatest space between the end bar and the circular side of the furnace being about 4¾ inches. In order, therefore, to support the material at the commencement, supplementary bars may be placed at the sides and afterwards removed when the coke is sufficiently caked.—C. A. W.

Ink; Transfer —— and process of producing the same. C. F. Morse, New York. U.S. Pat. 979,542, Dec. 27, 1910.

One part of glucose, which has been thinned by the gentle application of heat, is mixed with two parts of commercial corn (maize) syrup. To this vehicle the necessary amount of colouring matter is added; when, finally, the liquid is reduced to the proper consistence by the addition of glycerin.—C. A. W.

Transfer pictures for decalcomania and processes of manufacturing them. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 29,460, Dec. 16, 1909.

See Fr. Pat. 413,562 of 1910; this J., 1910, 1120.—T. F. B.

Colour lakes [from azo dyestuffs]; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 29,675, Dec. 18, 1909.

See U.S. Pat. 954,960 of 1910; this J., 1910, 686.—T. F. B.

Varnishes; Substances to be used as —— and for impregnation and insulation and method for their production. G. G. Diesser, Zurich Wollishefen, Switzerland. U.S. Pat. 981,178, Jan. 10, 1911.

See Fr. Pat. 393,948 of 1908; this J., 1909, 210.—T. F. B.

Obtaining slightly soluble salts or salt-like compounds containing silicates by electrolysis of aqueous solutions. Ger. Pat. 229,249. *See* VII.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; A new source of natural ——. J. Dybowski. Comptes rend., 1911, **152**, 98—100. (Cf. this J., 1910, 502, 641, 1023, 1025.)

The author draws attention to the importance of Jelutong as a source of rubber of good quality. The only method which appears to give good results in practice has as its basis, the treatment of the mass first of all with substances such as a mixture of alcohol and ether or carbon bisulphide, causing it to swell up and take the form of a jelly, in which condition it is readily susceptible to the action of solvents which remove the resins. Ordinary methods of resin-extraction at elevated temperatures, or of solution and re-precipitation result in the production of an inferior and unstable rubber.—E. W. L.

Hevea latex; Some analyses of ——. C. Beadle and H. P. Stevens. Analyst, 1911, **36**, 6—9.

It is pointed out that the properties of the latex examined by Faraday (Quarterly J. of Science, 1826, **21**, 19) show that it probably originated from *Castilloa elastica*, and not from *Hevea Braziliensis* as stated in various text books. From the experiments made by the authors, it appears that the composition of the latex of *Hevea Braziliensis* varies with the manner and frequency of tapping. Thus in the case of trees averaging seven or eight years in age, the total solids in the latex were approximately 40 per cent., and the sp. gr. ranged from 0·980 to 0·972, whereas the latex from the same trees more heavily tapped contained only 30 per cent. of total solids. The approximate amounts of caoutchouc (found by deducting 2·5 from the percentage of total solids) ranged from 43 to 18 per cent. In each case the latex consisted of the mixed product of at least 100 trees tapped in dry weather and without the addition of any water. In experiments to ascertain the effect of the age of the tree upon the composition of the latex, trees about four years old were tapped daily for several months at an early stage of the tapping period, and yielded latex containing from 22 to 25 per cent. of caoutchouc in one series of trials and from 27 to 33 per cent. in another. Comparison of these results with those obtained under similar conditions when the trees were older, showed that the latex from very young trees contained less caoutchouc than that from older trees. Analyses of the dried latex from the stems of the leaves and from the bark of trees of four and ten years of age gave the following results:—

	Dried latex from stems of leaves.	I. Dried latex from trees 4 years old.	II. Dried latex from trees 10 years old.	Calculated composition of I in fresh state.	Calculated composition of II in fresh state.
	per cent.	per cent.	per cent.	per cent.	per cent.
Acetone extract (resin)	7·12	4·06	4·13	1·22	1·65
Protein	13·02	4·90	5·08	1·47	2·03
Ash	1·19	0·80	1·75	0·24	0·70
Caoutchouc (by difference)	78·67	90·24	89·04	27·07	35·62
Moisture based on average results in tapping	——	——	——	70·00	60·00

Aqueous extracts of the total solids from these latices gave the following results (calculated as dextrose upon the rubber), when tested with Fehling's solution:—

	Before inversion.	After inversion.
	Per cent.	Per cent.
Latex from 10-year old trees	None	0·34
,, ,, 4 ,, ,, ,,	Trace	0·79
,, ,,petioles or leaf bases	0·36	2·25

Hence it would seem that the latex from primary tissues contains a much larger proportion of carbohydrates than that from the bark. The microscopical appearance of the former is also distinctive, only a relatively small number of caoutchouc globules of the ordinary size being seen, whilst there are many more globules only about one-third of the ordinary size. These lack the sharpness of definition of the ordinary globules, and exhibit rapid Brownian movement. The chief difference between the total solids from the latex from the petioles and from the bark is the larger proportion of nitrogenous compounds in the former. The dried latex from the leaf stems is "tacky" at first, but after being kept for a month or two and being passed between steel rollers, it loses its stickiness and has the appearance of guayule rubber of good quality. It is somewhat soft and of a pale colour, and is not nearly so strong as the rubber from the bark of mature trees.—C. A. M.

Rubber; Action of artificial manures on yield of —— and flow of latex in Manihot Glaziovii. Hawaii Experimental Station, Bull. No. 19. Gummi-Zeit., 1911, **25**, 577.

The yield of rubber was approximately doubled by manuring with ½ lb. of Chile saltpetre per tree. The action on the flow of latex occurred in 48 hours when the ground was moist.—H. E. P.

Plantation rubber; Variability of ——. F. Kaye. India Rubber J., 1911, **41**, 17—18.

Variations can arise from inequalities in the latex, or from inconstancy in coagulation. The latex varies in resin content according to the age of the tree. The sp. gr. and average yield of rubber vary according to the time of the year and according to location. The yield from 100 c.c. of latex collected in sectional areas of a large forest varied by 21·5 grms. in highest and lowest yields of chemically coagulated rubber. Neighbouring trees varied by 8 grms. per 100 c.c. These inequalities should be minimized by broad classification, and mixing in bulk. Conditions of coagulation vary similarly. The age of the latex, and the time, temperature and dilution employed, will all affect the result. The more consistent quality of Para rubber is probably due to elimination of many of these variations. The change in the quality of the water used to wash the rubber at different seasons is a possible factor in producing differences of colour. These are probably connected with the degradation of proteins.—H. E. P.

Rubber; Colour in raw ——. D. Spence. India Rubber J., 1911, **41**, 15—19.

The author points out that he does not hold the opinion with which he has been credited by Kaye (compare this J., 1911, 97), that the darkening of raw rubber is due entirely to enzymic action. This discolouration is probably due to the oxidation of polyhydric phenols, and it is emphasized that the velocity of oxidation depends not only on the enzymic activity, but also on the acid or alkaline reaction of the medium. The ease with which plantation Parà rubber can be obtained white is ascribed to the slight acidity of the medium.—H. E. P.

Rubber as tetrabromide; Determination of —— by Hübener's method. R. Becker. Gummi-Zeit., 1911, **25**, 531. (See this J., 1909, 803; 1911, 98.)

The author puts forward a number of difficulties in connection with the tetrabromide method as carried out by Hübener in the case of vulcanised rubber. The bromine derivatives of the rubber resins are insoluble in water and therefore either the sample must be freed from resin before bromination, or the product carefully washed with alcohol in which the resin bromides are soluble. The inclusion of bromine within the particles of hard, brittle bromide, and the difficulty of removing this by simply washing with water form a serious drawback. By the action of bromine on substitutes an oily product is formed which is insoluble in water and most likely contains bromine. It is proposed to surmount these difficulties by a combination of Hübener's method with that of Budde (this J., 1909, 1149). Hübener's procedure is adopted as far as the preparation of the bromide, which is then treated according to Budde's method, with this exception, that, in order to remove the oily brominated product from the substitutes present, the bromide must be warmed with ether on the water-bath, this oily product being insoluble in carbon bisulphide as well as in a mixture of carbon bisulphide and benzine with which the bromide has already been treated. Gutta percha and balata yield similar bromides to that of rubber itself and cannot therefore be differentiated from it by this method.—E. W. L.

Patents.

Caoutchouc; Manufacture of substances resembling ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 14,281, June 13, 1910.

See Fr. Pat. 417,768 of 1910; this J., 1911, 38.—T. F. B.

Rubber substitute and process for making it. A. R. van der Burg. Fr. Pat. 419,786, Aug. 27, 1910. Under Int. Conv., July 13, 1910.

See Eng. Pat. 16,758 of 1910; this J., 1911, 99.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Tanning materials; Extraction of ——. J. R. Blockey. Leather, 1911, 3, 21—22.

The theoretical aspects of the leaching of tanning materials, and the phenomena of diffusion so far as they affect the solution of the tannin from raw material, are described. From the principles outlined several practical conclusions are drawn. (1) It is impossible to extract all the tanning material in one extraction. (2) It is unwise to bring strong liquor into contact with nearly spent material; and therefore it is unwise to run back over the leaches, old layer liquors. (3) It is unwise to use water on any but the nearly spent material.—J. R. B.

[*Tannin and leather analysis.*] *Methods of the American Leather Chemists' Association for* 1911. J. Amer. Leather Chem. Assoc., 1911, 6, 3—23.

The latest official methods of the American Leather Chemists' Association are given under the following heads:—

Sampling. Number of packages to be sampled. Liquid extracts. Solid extracts. Crude tanning materials. Spent materials. Tanning liquors.

Tannin Analysis. Crude materials. Extracts. Liquors.

Leather Analysis. As distinct from the International association, definite rules and instructions are laid down for the estimation of moisture, fat, ash, water-soluble matter, glucose, and nitrogen. (The last by the Gunning modification of the Kjeldahl process.)

Provisional methods for the determination of saponification and acid values and the titer test for oils and fats are given, whilst official rules are laid down for the iodine value (Hanus' method) unsaponifiable matter, Maumené test, specific gravity, melting point, cold test and cloud test.—J. R. B.

Glue and gelatin industries ; Applications of cold in ——. P. Cavalier. Chem.-Zeit., 1911, **35**, 17.

The preliminary soaking of the hides or ossein in alkaline or acid baths for the preparation of glue takes one or two months, and to prevent putrefaction of the material during this period the temperature should be kept at about 10° to 15° C. This may be effected by chilling with cold air or more economically by cooling coils. A more important use of artificial cold, which is frequently applied, is for accelerating the solidification of the glue and gelatin solutions. These contain from 10 to 35 per cent. of total solids and are fluid above 60° C. They are introduced into moulds with a capacity of about 30 litres, and these are allowed to stand, usually over-night, for their contents to gelatinise. In order to obtain a jelly of sufficient consistence a temperature of 5° to 15° C. is necessary, and if the outside temperature does not fall below 13° C. the mass remains too long at 25° C. and begins to putrefy. This difficulty is obviated by drawing air cooled to 5° C. into the room, or by an installation of cooling pipes. In factories where bone glue is prepared—a form of glue which solidifies very slowly—artificial cooling is done on a large scale by means of chilling tables with a temperature of 3° to 4° C. On these tables are placed glass or zinc plates forming large trays of a depth of 10 mm. The glue or gelatin solution is poured into these trays, and solidifies almost immediately, after which the slab is cut into rectangles and rapidly dried. By these means the whole of the operations are carried on uninterruptedly, and, although the process is costly, all risks of putrefactive changes are obviated. The application of chilled dried air for drying gelatin or glue has not yet been introduced. The most favourable temperature for drying is one not exceeding 25° C., and to obtain this condition the air should have a temperature below 20° C. and a humidity of less than 0·50. If the exterior air has a temperature of 20° C. and a humidity of 0·80, it could be cooled to 5° C., and, after giving up the excess of moisture by condensation, could again be heated to 20° C. Since, however, the manufacture of 1000 kilos. of glue per day requires 1500 cubic metres of air per minute, the practical application of such a process would prove too costly, unless liquid air should be put upon the market at a cheaper rate.—C. A. M.

Patents.

Leather board ; Process of making ——. A. L. Clapp, Braintree, Mass., Assignor to Hide-Ite Leather Co., Boston, Mass. U.S. Pat. 981,591, Jan. 10, 1911.

The process consists in dissolving leather in an alkaline solution and then precipitating it. A waterproofing reagent is added to the precipitate and this mixture is treated with disintegrated fibrous leather.—G. W. McD.

Extracts containing tannin ; Clarifying ——. H. Damköhler and H. Schwindt, Bremen, Germany. U.S. Pat. 979,656, Dec. 27, 1910.

See Eng. Pat. 24,899 of 1909 ; this J., 1910, 365.—T. F. B.

Leather ; Process for detanning ——. A. G. Manns, Oconomowoc, Wis., U.S.A. Eng. Pat. 6268, March, 12, 1910.

See Fr. Pat. 413,613 of 1910 ; this J., 1910, 1121.—T. F. B.

Artificial leather ; Manufacture of ——. G. C. L. Forel, Lyons, France. Eng. Pat. 18,930, Aug. 11, 1910. Under Int. Conv., Sept. 23, 1909.

See Fr. Pat. 407,654 of 1909 ; this J., 1910, 504.—T. F. B.

Leather ; Process for waterproofing ——. E. Lapisse. Fr. Pat. 419,813, Nov. 4, 1909

See Eng. Pat. 27,583 of 1909 ; this J., 1911, 39.—T. F. B.

Caseine ; Process for rendering —— *plastic.* F. Lebreil and R. Desgeorge, Villeurbanne, France. Eng. Pat. 2027, Jan. 26, 1910. Under Int. Conv., Jan. 27, 1909

See Fr. Pat. 408,592 of 1909 ; this J., 1910, 580.—T. F. B.

XVI.—SOILS ; FERTILISERS.

Soil organic matter ; Methoxyl in ——. E. C. Shorey and E. C. Lathrop. J. Amer. Chem. Soc., 1911, **33**, 75—78.

It is well known that the quantity of organic matter in soils, which is produced by plant decay, is very variable. The authors have continued the chemical examination of the organic matter, endeavouring thereby to trace the chemical changes which go on during decay. Determinations of the methoxyl group were made by the Zeisel method on ten soils of varied origin, and containing percentages of total carbon ranging from 0·3 to 27·1. Two of the samples were found to contain no methoxyl, while the quantities present in the others attained a maximum of 1·114 per cent. in the soil with the highest carbon content, a peat from N. Carolina. It was found that the quantity of methoxyl bears no constant relation to the total carbon and, taking into consideration the fact that methoxyl groups are being added to the soil from three different sources, namely from alkaloids, essential oils and woody fibre (this J., 1907, 1248, and 1891, 576), and moreover are to be found in some soils and not in others, the authors conclude that there are fundamental differences, chemical, physical or biological, which decide the manner in which complex organic bodies break down during decay (see this J., 1908, 912, 1075 ; J. Amer. Chem. Soc., 31, 116, and **32**, 1674 ; J. Biol. Chem., **8**, 381).—B. G. McL.

Soils : Glycerides of fatty acids in ——. O. Schreiner and E. C. Shorey. J. Amer. Chem. Soc., 1911, **33**, 78—80.

Reference is made to the existence in soil organic matter of dihydroxystearic acid (this J., 1908, 1075), of cholesterol-like compounds (J. Amer. Chem. Soc., **31**, 116) and to the work of Lifschütz who showed that cholesterol compounds may be formed by the oxidation of oleic acid (this J., 1908, 525). In a previous paper (this J., 1911, 40) the authors isolated paraffinic acid and the present paper deals with the examination of the alcoholic filtrate then obtained from the lead salt of this acid. This yielded on evaporation an orange-coloured oil which partially crystallised on cooling. On saponification the oil was split up into glycerol and a complex mixture of fatty acids ; a small quantity of unsaponifiable matter was also found. It is consequently a mixture of glycerides of fatty acids. The authors are of the opinion that these glycerides are not formed by purely chemical reactions taking place in the soil but are unchanged plant residues. —B. G. McL.

Soils ; Paraffin hydrocarbons in ——. O. Schreiner and E. C. Shorey. J. Amer. Chem. Soc., 1911, **33**, 81—83.

The occurrence in various forms in the earth's crust of relatively enormous quantities of hydrocarbons compared with the minute quantities of similar bodies which have been observed to exist in plants precludes the possibility of the former being formed from unchanged plant residues. Theories have been advanced to show that they are the result of direct organic transformation within the earth's crust, and the authors have attempted to ascertain whether this transformation also goes on in the soil itself. A peaty soil containing 27 per cent. of organic carbon was extracted with boiling 95 per cent. alcohol, and the alcohol in the filtered liquid was evaporated and replaced by water. A brown resinous powder was deposited, which was extracted with petroleum ether and from this solution, after removal of the saponifiable matter, a solid hydrocarbon was isolated which was found to be hentriacontane, $C_{31}H_{64}$. As this hydrocarbon has been shown to exist

in beeswax and in certain plants, the authors conclude that there is no evidence to show that its presence in the soil is from another source than unchanged plant residues.
—B. G. McL.

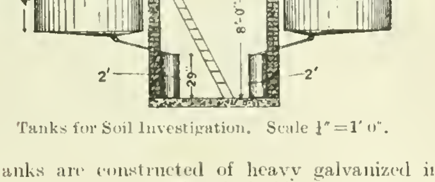
Soils: Importance of osmotic pressure and electrical conductivity in examining ——. J. König, J. Hasenbäumer, and H. Meyering. Landw. Vers.-Stat., 1910, **74**, 1—56. Chem. Zentr., 1911, 1, 259.

In determining the osmotic water-absorbing power of a soil (see this J., 1908, 1166), much more concordant results are obtained if the temperature be kept constant at 18° C. The quantity of soluble constituents can also be ascertained by determining the electrical conductivity of the soil, and this method is simpler and quicker. Since the conductivity increases with decrease in the size of the particles of soil, comparative determinations should always be made with soils of the same condition of fineness. These methods can be applied in examining the adsorption of fertilising salts by soils. Soils moistened with dilute solutions of different salts showed an increased electrical conductivity and osmotic water-absorbent power, except in the case of dipotassium phosphate, showing that with this salt, both the potassium and the phosphoric acid are completely adsorbed by the soil.

Culture experiments showed that soils depleted in nutrient materials can be rendered fertile by treatment with pure hydrogen peroxide, provided a sufficient quantity of humus-substances be present. A similar action could not be observed with calcium peroxide.—A. S.

Tanks for soil investigation at Florida Agricultural Experiment Station. A. W. Blair and S. E. Collison. J. Ind. Eng. Chem., 1911, 3, 32—33.

To supplement the field work in orange culture, and to estimate accurately the loss of soluble fertilizing materials in the drainage waters under different systems of fertilizing, and also to investigate the effects of the long-continued use of commercial fertilizers on the soil and on the orange tree, a series of soil tanks has been set up. Each tank has an inside diameter of 5 feet 3¼ inches, with a maximum depth of 4½ feet, and a surface area of one two-thousandth of an acre.



Tanks for Soil Investigation. Scale ¼″=1′ 0″.

The tanks are constructed of heavy galvanized iron, soldered, riveted, and painted inside and out. The bottom of a tank slopes to a point near one side, where there is a strainer opening into a two-inch tin-lined drainage pipe, the length of which is a little more than 4 feet. Four such tanks open into a central collecting pit, one drainage pipe entering at each corner, where are placed four receptacles for collecting the drainage waters. Connected with these receiving tanks is an overflow tank for use in case of an emergency (long-continued heavy rains). The collecting pit, which is about 8 feet deep and 6 feet square inside, is built of brick, with a concrete bottom, and is covered. The soil tanks were sunk into the ground to within a few inches of the top, and filled with soil to within three inches of the edge. Over the sloping part of the bottom was placed a layer of smooth quartz pebbles, the coarsest material being placed around the drainage opening and finest on the top. Above this was placed 45 inches of soil. The soil was well tamped as it was put in, each tank having the same weight of dry soil, 8625 lb.
—R. C. P.

Barley; Influence of fertilisation with sodium nitrate at different stages of growth, on the husk-content, endosperm-structure and protein-content of ——. F. Moertlbauer. Z. ges. Brauw., 1911, **34**, 13—17.

The author describes experiments conducted by Hellriegel's sand-culture method. The barley was grown in forty-one culture-pots, four of which, serving as controls, were supplied only with the usual plant nourishment, whilst to each of the remaining pots there was added besides, 3·7325 grms. of sodium nitrate. The experiments differed according as the nitrate was added all at once at one or other stage of growth, or in two equal amounts at different stages, or in small amounts throughout the whole growing period. The husk-content of the barley grains was in all cases diminished as the result of these additions of nitrate, the decrease amounting to 1—3·5 per cent., reckoned on the dry substance of the grains. The lowest values were obtained when the addition took place shortly before the emergence of the ear from the sheath, but the effect was almost the same when the nitrate was added in two equal amounts during the lengthening of the stem. In all the experiments the nitrate produced a marked difference in the endosperm-structure of the grain, the percentage of steely grains being increased two- to three-fold. This increase was greatest as the result of adding the fertiliser in the early stages of growth. The content of dry substance of the grains scarcely underwent any change in these experiments but it was slightly increased by early addition of nitrate. In all cases the protein-content of the grains suffered a marked increase, which was greatest when the fertiliser was added at the later stages of growth. Grain containing twice the normal amount of nitrogen was obtained as the result of adding the nitrate shortly before the ear began to emerge from its sheath. The experiments show that while both the protein-content and the steeliness of barley are increased by these excessive amounts of nitrate manure, variations in the time of manuring affect the two differently. Rigid conclusions as to the protein-content of a sample of barley cannot be drawn, therefore, from its degree of steeliness.—J. H. L.

Soot; Composition of —— H. W. Harvey. J. Agric. Sci., 1910, 3, 398—399.

The value of soot as a manure depends upon the ammonium salts which it contains and the nitrogen content of soot from dwelling houses depends in the main on the kind of coal burnt. There is a definite relation between the nitrogen content and the weight per bushel; a light soot contains the highest percentage of nitrogen. There is some loss of ammonia when soot is allowed to stand in a loose heap. The analysis of eight samples show that a bushel of soot contains about 1 lb. of nitrogen.
—E. F. A.

An insoluble sodium phosphate and complex compounds of ammonium citrate with alkaline-earths. Quartaroli. *See* VII.

Action of artificial manures on yield of rubber and flow of latex in Manihot Glaziovii. *See* XIV.

Fungicidal properties of liver of sulphur. Foreman. *See* XIXb.

Patents.

Fertilisers; Production of ——. L. R. Coates, Baltimore, U.S.A. Eng. Pat. 9279, April 16, 1910. Under Int. Conv., May 14, 1909.

See U.S. Pat. 947,798 of 1910; this J., 1910, 442.—T. F. B.

Bags for holding and conveying chemical manure and the like; Process of treating ——. C. de Guide, Flawinnes, Belgium, and F. Briart, Jeumont, France. Eng. Pat. 19,473, Aug. 19, 1910.

See Fr. Pat. 409,648 of 1909; this J., 1910, 751.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Beet (Beta maritima, L.); Examination of a wild ——. O. Munerati and G. Mezzadroli. Staz. sperim. agrar. ital., 1910, **43**, 577—584. Chem. Zentr., 1911, **1**, 26.

After a full description of the plant, with illustrations, the results of analyses are given showing that juice expressed at the end of August contained 10—14 per cent. of sugar and 0·4—0·7 per cent. of reducing substances. Beets of large, small, and medium size, respectively, analysed in the second half of October, had the following percentage composition:—

	Large.	Medium.	Small.
Water	91·2	89·9	90·4
Dry substance	8·8	10·1	9·6
Sugar (by polarisation)	6·0	7·2	7·2
Purity	68·01	71·2	73·0
Ash of interior part	3·1	3·0	3·30
Ash of outer part	4·9	5·5	

—A. S.

Sugar beet; Nitrogenous constituents of the —— and their behaviour during the process of raw sugar manufacture. J. E. Duschsky, I. R. Minz, and W. P. Pawlenko. Z. Ver. deut. Zuckerind., 1911, I—25. (See also this J., 1911, 101.)

During the past campaign the total nitrogen content of Russian beets was found to amount to 0·17—0·25 per cent., of which nitrogen content about one-half was protein nitrogen. No fixed relationship could be discovered between the total nitrogen and the "objectionable nitrogen" in the beet, although it was observed that in general the amount of the latter was from one-third to one-half of the former. Neither does there appear to be any connection between the sugar content of the beet on the one hand, and the total nitrogen or any of the single groups of nitrogenous substances on the other. Of the protein nitrogen, about four-fifths is separated during diffusion; whilst the remainder is almost all either precipitated or decomposed during defecation and saturation. Practically the whole of the "objectionable nitrogen" in the beet passes into the diffusion juice, and from thence through the various stages of manufacture to accumulate finally in the molasses.—J. P. O.

Cane sugar; Inversion of —— under the influence of acids and neutral salts. N. Deerr. Agric. and Chem. Series. Expt. Station Hawaiian Sugar Planters' Association. Bull. No. 35, 1910.

After describing a number of experiments dealing with the effect of various salts on the rate of inversion of sucrose by hydrochloric, sulphuric, oxalic, acetic, and phosphoric acids, the author discusses the application of these results to the manufacture of white or yellow grocery sugars destined for direct consumption. In making these products, either sulphurous acid or phosphoric acid or both may be used (*vide* this J., 1910, 642); and the degree of acidity permissible without any inversion of sucrose occurring will depend not only on the concentration of the free acid, but also upon the amount and the nature of the neutral salts of the juice. Thus, *e.g.*, a juice heavily limed, then sulphited to neutrality, will contain a large quantity of neutral salts, principally calcium sulphite; and to such a juice a larger amount of phosphoric acid may be added without danger of inversion than if less lime and sulphurous acid had been used. It is shown that, on heating a neutralised juice to 98° C., inversion will first occur in the presence of 6 c.c. of $N/10$ phosphoric acid per 100 c.c. of juice. If the juice be limed till alkaline to phenolphthalein, then sulphited at the rate of about 5 lb. of sulphur per 1000 imperial gallons, inversion will first commence at a temperature of 98° C. in the presence of 42 to 68 c.c. of $N/10$ phosphoric acid per 100 c.c. of juice.—J. P. O.

Cane sugar factories; Methods of chemical control for —— adopted by the Hawaiian Sugar Chemists' Association. Intern. Sugar J., 1911, **13**, 19—25.

Cane.—Samples consisting of three or four entire stalks should be taken from the carrier as often as possible, up to one every 2 hours. For the fibre determination, 200 grms. should be chopped into pieces ¼ in. or less in diameter, placed in a strong linen bag, and the juice expressed in a hydraulic press. The residue is treated with cold running water for 2 minutes, after which these two operations are repeated alternately five times. The bag is then placed in an air-bath at 125° C. for half-an-hour, and finally its contents removed and dried on a shallow dish for 4 hours at the same temperature. When a hydraulic press is not available, the sample is treated in cold running water for 12 hours, then dried as described. An alternative method is to use the formula, $f = \frac{100m}{100-b}$, in which f = the percentage of fibre in the cane, m = the moisture in the cane, and b = the total solids in the normal juice. The sucrose content of the cane may be calculated from either of the formulæ:

$$\frac{\text{Sucrose per cent. in normal juice } (100 - \text{per cent. of fibre in the cane})}{100};$$

$$\text{or } \frac{\text{Weight of sucrose in mixed juice} + \text{weight of sucrose in bagasse}}{\text{Weight of cane.}}$$

Normal juice.—For the total solids, samples of juice and bagasse are taken from each set of rollers, and also a sample of cane for fibre, the Brix, polarisation, and purity of the juices, and the polarisation and moisture contents of the bagasse, being determined. From the polarisation and moisture content of the bagasse, and the purities of the juices, the fibre content of the bagasse is calculated. From the ratio of fibre in the cane to fibre in the bagasse, the juice extraction on the cane for each set of rollers is calculated; then from the latter and the Brix of the juices, including the residual juice of the final bagasse, the Brix of the normal juice is obtained. The purity of the normal juice is found by averaging the purity of the mixed juice with that of the residual juice of the final bagasse, the latter being considered the same as the purity of the last mill juice. The percentage of sucrose in the normal juice is calculated for the Brix of the normal juice and purity of the normal juice. *Juices.*—Samples should be taken continuously if possible, and preserved in clean vessels to which has been added one part of formalin to 1000 parts of juice. The density may either be ascertained from the spindle reading or by means of the refractometer. The polarisation is found in the ordinary way, either dry basic lead acetate or a solution of this salt of 54° Brix being used for clarification, whilst the sucrose is determined by the Clerget method, 75 c.c. of the juice being made up after inversion to 100 c.c.

Bagasse.—For the sucrose and moisture contents the methods recently described in Bulletin 32, 1910, of the Association (this J., 1910, 1219) have been adopted. The Brix of the residual is calculated from the formula:

$$\frac{\text{Polarisation of bagasse}}{(W-f) \text{ Purity of residual juice}},$$

in which W = the weight of bagasse plus solution, from 100 grms. of bagasse, and f = percentage of fibre in the bagasse, taken as 50. The fibre in the bagasse may either be determined directly, using the method given above for cane, or calculated by difference.

Waste molasses.—Either the direct desiccation method employing bibulous paper, sand, or pumice stone, or else the refractometer, may be used for the total solids, and for the sucrose the modification of the Clerget process, described in Bulletin 31, 1910, of the Association (this J., 1910, 1123) has been adopted.—J. P. O.

Cane and juice weights; Use of inferential methods as a control for the ——. H. E. Savage. Intern. Sugar J., 1911, **13**, 15—18.

The sucrose ratio, which is used in cane factories as an inferential method of controlling the weight of cane worked, is known to vary quite considerably, even in the same locality. This variation is ascribed by the author, not only to the locality and the variety of the cane, but also to the fibre content of the cane, to the settings of the mills, and to whether the crusher, first mill, or mixed juice be used as the basis of reference. Further, the ratio may tend to rise if the cane be "flumed," or if it be wet with rain when milled. In place of the sucrose ratio, a much better inferential method is afforded by the use of the ratio: $\frac{\text{Brix of absolute juice}}{\text{Brix of crusher juice}}$, which in the author's experience averages 0·96. It is stated to be unaffected by locality or variety of cane, and its application as a means of checking the cane weights is illustrated by an example. This factor, however, may also vary somewhat according to whether the cane be flumed or is wet with rain when milled, unless it be stipulated which juice—crusher, first mill, or mixed be used in determining it. From a series of dry crushing tests, the author has found that the Brix of the mixed juice amounts to 0·986 times that of the crusher juice. Applying this to the "apparent juice extraction" figure, the value for the juice extracted per 100 of cane becomes $\frac{bp}{986B}$, in which b = the Brix of the dilute juice, p = juice per cent. of cane, and B = Brix of the crusher or first mill juice. The figure thus found, divided by unity minus the fibre content of the cane, represents the juice extracted per cent. of juice in the cane, a value which is stated to be of considerable use for controlling the efficiency of the crushing plant of the sugar factory.—J. P. O.

Sugar refining: "Eponite"; a substitute for animal charcoal in ——. F. Strohmer. Österr.-Ungar. Zeits. Zuckerind., 1910, **39**, 687—697.

On examining a decolourising substance, called "Eponite," which has recently been placed on the market, results were obtained indicating that this preparation may be taken into consideration as a substitute for animal charcoal in the sugar refinery. It is a fine mealy powder, of a dull black colour, containing about 82 per cent. of carbon and 1·7 per cent. of ash, and appears to be of vegetable origin. Experiments showed that it effects decolourisation best on being heated with the sugar liquor for 10 minutes at 80° C. with agitation, and that it has 10 times the decolourising power of new char of fine grain and good quality. Whereas an ordinary refinery charcoal has no decolourising action whatever on a 0·25 per cent. solution of saccharane (*cf.* Ehrlich, this J., 1910, 506), "Eponite" under the same conditions decreased the dark colour of the solution by about 40 per cent. Further experiments demonstrated that its decolourising power is not affected by the reaction of the solution; that it does not adsorb sugar from concentrated solutions when heated for 10 minutes at 80° C.; and that it has a deodourising action on impure sugar solutions, a property of some importance when working with beet liquors. It is also pointed out that the very high decolourising power of "Eponite" would permit of smaller plant than is at present required for passing sugar liquors over char, and that treatment in small tanks with the separation of the spent material by small filter-presses would appear feasible.—J. P. O.

Lævulose: Influence of inactive substances on the rotation of ——. N. Wender. Biochem. Zeits., 1911, **30**, 357—373 (Cp. Rimbach and Weber, this J., 1905, 515).

It is found that most inorganic acids cause an increase in the specific rotation of lævulose, and to an extent which increases with the concentration of the acid. The rotation is decreased by small quantities of boric acid, but is slightly increased by larger quantities: it undergoes a considerable decrease in presence of molybdic acid. Oxalic acid increases, and acetic acid slightly decreases the rotation. Alkalis cause a progressive decrease of the rotatory power of lævulose, which is to be ascribed to profound decomposition of the sugar (with formation of dextrorotatory "saccharin"). Weak organic bases, such as pyridine, hexamethylenetetramine, and urea, exert practically no influence on the rotation. Inorganic salts cause, in some cases an increase and in others a decrease of the rotation; it is shown that sodium chloride, sodium bromide, potassium bromide, and potassium iodide (at 10 per cent. concentration) increase the rotatory power of lævulose (in 5 per cent. solution). In general, the alcohols cause a considerable decrease of the rotation, the extent of the decrease being proportional to the alcohol-content of the solution, and the influence of acetone is similar. Thus, the rotatory powers of 5 per cent. solutions of lævulose (observed in a 200 mm. tube at 20° C.) in mixtures of water, and methyl alcohol, ethyl alcohol, or acetone, are given by the following equations:—

(1), methyl alcohol and water, $\alpha_D = -(9{\cdot}112-0{\cdot}0238\,p)$,
(2), ethyl alcohol and water, $\alpha_D = -(9{\cdot}112-0{\cdot}027\,p)$,
(3), acetone and water, $\alpha_D = -(9{\cdot}112-0{\cdot}0374\,p)$,

in which p represents the number of c.c. of methyl, or ethyl alcohol, or acetone, per 100 c.c. of solution.—L. E.

Cellobiose and the acetolysis of cellulose. W. Schliemann. *See* V.

PATENTS.

Saccharine juice; Continuous saturator for ——. R. Ehrhardt. Fr. Pat. 419,288, Aug. 10, 1910.

The lower part of the saturator is divided by a partition into two compartments, *a* and *b*. The gas is conveyed by pipes to distributors (which may consist of notched rims) at the bottom of each compartment. The juice that has been treated with lime is introduced at the bottom of compartment, *a*, and accumulates in this compartment until it overflows into compartment, *b*, which is provided with a system of tubes for re-heating the juice. An external vertical pipe communicates between the lower part of compartment, *b*, and a control-chamber; the upper end of this pipe is at the same height as the top of the partition which separates the compartments. By means of another pipe, the juice is withdrawn from the control-chamber to undergo the subsequent operations. The chief work of the saturator, which consists in the deposition of the scum, is effected in compartment *a*, whilst compartment *b*, serves for regulating the alkalinity of the juice which is controlled in the control-chamber.—L. E.

Sugar crystallising processes. P. Kestner, Lille, France. Eng. Pat. 4855, Feb. 26, 1910. Under Int. Conv., Feb. 26, 1909.

See Fr. Pat. 412,285 of 1910; this J., 1910, 1029.—T. F. B.

Sugar juice; Process and apparatus for separating impurities (defecation scum) from —— in making and refining sugar. J. J. Homans. Fr. Pat. 419,821, Aug. 29, 1910.

See U.S. Pats. 978,450 and 978,750 of 1910; this J 1911, 102.—T. F. B.

Dextrin, British gums, and the like; Production of ——. A. Fielding, Salford. U.S. Pat. 979,753, Dec. 27, 1910.

See Eng. Pat. 22,455 of 1909; this J., 1910, 1265.—T.F.B.

Gum tragasol; Manufacture of ——. The Gum Tragasol Supply Co., Ltd. Fr. Pat. 419,654, Aug. 25, 1910. Under Int. Conv., Aug. 28, 1909.

See Eng. Pat. 19,768 of 1909; this J., 1910, 1172.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Yeast; Washing —— with phosphoric acid. P. Petit. Brasserie et Malterie, 1910, 225; Woch. f. Brau., 1911, **28**, 19—20 (Cp. Moufang, this J., 1910, 103).

The author has made investigations in several breweries on the effect of treatment with dilute phosphoric acid for some hours, on the fermenting power of the yeast, and in some cases, with satisfactory results. The proportion of acid employed should be small; the amount required increases with the carbonate-content of the brewery water. In general, 150—200 grms. of phosphoric acid (of 45° Baumé) per hl. of wash-water, suffice. The action of the acid must not be too prolonged: if the treated yeast does not settle well, addition of a solution of commercial sodium phosphate (250—300 grms. of the salt per 100 grms. of acid of 45° Baumé) in a small quantity of water, is advisable. A yeast which becomes pasty or pulpy is not suitable for the treatment, and should not be used again. It is concluded that the use of phosphoric acid for washing yeast may be of considerable value, but certain precautions must be observed in carrying out the process. A successful result is not obtained with every yeast, and the result is influenced by the nature of the malt employed. Since, however, the washing of the yeast is never injurious, the treatment should be tried in every brewery in which the fermentation is not satisfactory (i.e. does not proceed far enough); in any case, the phosphoric acid exerts an antiseptic action on some, though not on the most dangerous bacteria.—L. E.

Yeast; Influence of acids on infected brewery —— in the laboratory and under practical conditions. G. Feuerstein. Woch. f. Brau., 1911, 28, 16—18 (Cp. Henneberg, this J., 1906, 1166).

The author describes experiments on the efficacy of treatment with dilute acids (mineral and organic) as a means of purifying yeast infected with sarcina. Thus, in two cases, 20 grms. of the dry yeast were treated with 100 c.c. of supply water that had been acidified with sulphuric acid (to the extent of 0·1, 0·3, 0·5, and 0·75 per cent. of free acid) or nitric acid (0·05 and 0·1 per cent. of free acid), phosphoric acid (0·5 per cent.), hydrochloric acid (0·1. 0·2 and 0·3 per cent.) or oxalic acid (0·2 per cent.). After the lapse of 7 hours, the supernatant liquid was decanted; the yeast that had been treated with nitric acid settled extremely well, but the treatment with sulphuric acid was very unsatisfactory in this respect. Neither acid (excepting sulphuric acid at a concentration of 0·75 per cent.) injured the fermenting power, though some of the other acids employed, viz., phosphoric, hydrochloric and oxalic acids, had a markedly injurious effect; the final attenuations, however, were practically the same in all cases. With regard to the purification, the results were very satisfactory; most of the acids employed freed the yeast from sarcinæ completely, and in the cases where the purification was not complete (*e.g.*, with 0·05 per cent. of nitric acid), failure is to be ascribed to the use of acid of insufficient concentration. It was also found that a culture yeast can be freed from torulæ, sarcinæ, and lactic and acetic bacteria, but not from wild yeasts, by treatment with dilute nitric acid (0·1—0·2 per cent. concentration). Under practical conditions, treatment of the washed, sarcina-infected yeast (about 100 litres) with dilute sulphuric acid (0·1—0·15 per cent. concentration) for 6 hours, followed by addition of the equivalent quantity of milk of lime, purified the yeast completely but seriously affected its settling power. Treatment of the washed, infected yeast with dilute nitric acid (at a concentration of 0·1 per cent. of free acid) followed by neutralisation of the acid with sodium hydroxide, proved entirely satisfactory, and the unsatisfactory result in the case of the sulphuric acid-treatment was found to be due to incomplete neutralisation of the acid by the lime. If the sulphuric acid is neutralised with sodium hydroxide, or by addition of considerable excess of milk of lime (*e.g.*, double the equivalent quantity), the purified yeast settles satisfactorily.—L. E.

Zymase; Extraction of —— by simple maceration. A. Lebedeff. Comptes rend., 1911, 152, 49—51.

It is shown that if a mixture of dried yeast (pressed and air-dried) and 2·5—3 parts of water is allowed to stand for some time (*e.g.*, overnight) at the ordinary temperature, and then transferred to a paper filter, a clear filtrate is obtained which possesses a much greater and more stable zymase-activity than the juice obtained by the method of Buchner and Hahn.—L. E.

Potato starch residues; Utilisation of —— in the distillery. G. Foth. Z. Spiritus ind., 1911, 34, 25—26.

Owing to the improved fermentation methods employed, the starch products of the distillery mash are now more completely utilised than formerly and the amount of residue available for use as cattle food obtained from the mash correspondingly lessened. Some distillers have therefore utilised the residual pulp of the potato starch factory. This can either be added (after preliminary liquefaction under steam pressure) to the mash before fermentation, or may be mixed with the distillery residue. Claims have been put forward that by the former process largely increased yields of spirit (as much as 260 litres from the residual pulp from 100 cwts. of potatoes) are obtained. The author shows that these figures are grossly exaggerated. Further experiments to determine the value to the distiller of the potato pulp employed in these two ways are being carried out. The second proposal to mix the starch factory residues in with the residue from the distillery, may prove advantageous, as the pleasant flavour of the distillery product would mask the tastelessness of the potato factory pulp. The latter fetches a lower price than its actual food value justifies, as on account of its tastelessness cattle do not take to it readily.—E. H. J.

Vinegar; Determination of the freezing point depression as a means of controlling the composition of ——. A. Silverman. Chem.-Zeit., 1911, 35, 43—44.

The author recommends a determination of the freezing point depression, *i.e.*, the difference between the freezing points of the sample and of water, as a means of rapidly judging the quality of vinegars. The determination can be completed within 20 minutes, and if the result lies within certain limits, it is stated to be unnecessary to make a complete analysis of the sample. The average results found by the author for four different kinds of vinegar are shown in the following table :—

	Freezing-point depression.	Acidity.	Total solids.	Ash.	Water.	Sp. gr.
	°C.	per cent.	per cent.	per cent.	per cent.	
"Treated" malt wine vinegar	1·135	5·06	1·7	0·2	93·24	1·133
Distilled wine vinegar	2·15	5·35	0·18	0·02	94·48	1·0063
Cider wine vinegar	2·67	5·8	2·73	0·3	91·41	1·155
Malt wine vinegar	3·33	6·06	1·9	0·2	92·04	1·194

—A. S.

Influence of fertilisation with sodium nitrate on the husk-content, endosperm structure and protein content of barley. Moertlbauer. *See* XVI.

Purification of waste waters from breweries by means of colloidal clay. Rohland. *See* XIXb.

Patents.

Brewers' yeast; Process for solidifying ——. C. Sureties, London. Eng. Pat. 29,379, Dec. 15, 1909.

Five parts of wet yeast are mixed with 1 part of a flour or meal prepared by drying and grinding spent hops;

the mixture is then dried in a current of air at a temperature of 95° F., and ground to a powder or pressed into cakes to which sweetening and flavouring substances may be added. The product may be used as a fodder when mixed with distillers' meal, brewers' grains, barley meal, etc., or as a fertiliser. A printing ink is prepared by mixing 1 part of the powder with 8 parts of liquid yeast, 1 part of vegetable oil, and a suitable quantity of colouring matter.—W. P. S.

Brewing ; Process and apparatus for ——. G. B. Whitaker, Halifax. Eng. Pat. 30,476, Dec. 30, 1909.

A process of brewing is described in which the only vessels employed are the boiling-copper and fermenting vats. The malt is previously crushed and the husks are separated by suitable machinery. The crushed malt kernels are mixed with liquor in an external pipe and the mash is delivered to the wort-copper. It is there subjected to a saccharification process and is finally boiled with hops. When boiling ceases, the hops are made to serve as a filter by placing perforated plates across the copper. The wort is continuously pumped from below the filter-plates to the upper part of the copper until it comes through sufficiently clear for running off. The apparatus consists of a boiling-copper having an inlet pipe connected with a grist-hopper, hinged perforated plates hanging vertically, but capable of being raised to a horizontal position ; lastly means for circulating the wort from below to the upper part of the copper.—J. F. B.

Malt beverages : Manufacture of ——. R. Wahl, Chicago, Ill. U.S. Pat. 979,810, Dec. 27, 1910.

Malt wort is inoculated with lactic acid bacteria and maintained, until the desired degree of acidity has been produced, at a temperature (46°—55° C.) that will promote the action of the lactic acid bacteria and prevent practically all other fermentation in the liquid. The liquid is then treated with hops and carbonated.—W. P. S.

Musts ; Process for continuous purification of sulphited fruit ——. M. Charpentier. Fr. Pat. 419,264, Oct. 21, 1909.

The sulphited must passes through a vessel wherein it is heated to about 85° C. by a steam coil made of stoneware. The hot must passes to the top of a column made entirely of wood and fitted with perforated plates provided with overflows. The descending must, which does not boil, encounters an ascending current of sterilised air introduced into the column under a slight pressure (about 55 cm. of water). The must loses a large quantity of free sulphurous acid, and other volatile substances, and passes from the bottom of the column, at a temperature of 60°—65° C., to the top of a second column, in which a reduced pressure of about one-third of an atmosphere is maintained. This column is constructed like the first, save that it is provided with a metal casing (with which the must does not come into contact) in order to maintain the partial vacuum. The descending must, which may be in a state of gentle ebullition, encounters an ascending current of carbon dioxide, whereby sulphurous acid is set free from combination with the sugars and expelled from the must. The desulphited must passes from the bottom of the second column to a wooden vat from whence it is transferred by a pump (provided with a bronze cylinder) through a regenerative cooler, to a wooden column similar to the desulphiting columns. Here, the must encounters sterilised air from which it absorbs the small quantity of oxygen necessary to the free development of the yeast in fermentation. With the exception of a few portions of apparatus made of bronze or copper, the must only comes into contact with pipes and apparatus made of stoneware and wood throughout the desulphitation process.—L. E.

Spirits ; Process for maturation of ——. F. Pinasseau. Fr. Pat. 419,591, Aug. 22, 1910.

The spirit flows from an air-tight reservoir through a pipe to the top of a column which is divided into two compartments by a perforated, false bottom. The upper compartment is filled with oak shavings, and the spirit, as it percolates through these shavings, is partially evaporated by a current of air which is made to traverse the compartment in the opposite direction. The air, charged with water and alcohol vapour, etc., passes from the top of the column to a coil contained in an artificially cooled vessel. The alcohol is collected in a vessel beneath the coil, whilst water and other substances are frozen and adhere to the walls of the coil from which they may be removed by filling the containing vessel with warm water. When all the spirit has passed from the reservoir through the column to the lower compartment, it is made to return through a pipe to the reservoir by exhausting the air from the latter.
—L. E.

XIXa.—FOODS.

Proteins in milk ; Degree of accuracy of determination of —— *by aldehyde titration.* H. D. Richmond. Analyst, 1911, **36**, 9—12.

A series of determinations has been made upon fresh samples of milk varying as widely as possible from the average composition, in order to ascertain the accuracy of the method in duplicate determinations and the constancy of the factor for calculating the percentage of proteins from the aldehyde figure (Analyst, 1906, **31**, 224). In each instance from 10 to 11 c.c. of the milk were treated with at least 1 c.c. of 0·5 per cent. phenolphthalein solution and neutralised with *N*/11 (approximately) strontia solution, after which 2 c.c. or more of 40 per cent. formaldehyde solution were introduced and the titration continued until the same degree of pink colour was apparent. The number of c.c. required, less the amount corresponding to the acidity of the formaldehyde solution, gave the aldehyde figure. The amounts of proteins were also calculated from the results of determinations of the nitrogen by Kjeldahl's method, multiplied by the factor 6.38. The results of 48 experiments showed that the probable error of a single titration was ±0·2°, whilst the factor 0·170 was found to be the most probable figure to express the relationship between proteins and the aldehyde figure. The accuracy of this method of determining proteins is of about the same order as the centrifugal methods of determining fat, or the calculation of solids-not-fat from the sp. gr. and the fat. Only in the case of abnormal samples of rare occurrence will there be any considerable error.—C. A. M.

Cereal flours ; Rapid detection of Melampyrum arvense, L., Lolium temulentum, L., and Lothyrus Aphaca, L., in —— *by means of colour reactions.* G. d'Ippolito. Staz. sperim. agrar. ital., 1910, **43**, 585—592. Chem. Zentr., 1911, **1**, 38—39.

Melampyrum arvense (purple cow-wheat) is coloured green by 10 per cent. hydrochloric acid, and thus becomes distinctly visible in the yellow flour-paste ; *Lolium temulentum* (darnel) and *Lathyrus Aphaca* (a species of pea) are both coloured red by this treatment, but can be distinguished by microscopic examination. In the case of the former the cells of the pericarp (fruit covering) have a bright red colour, whilst in the case of the latter, the cells of the testa (seed-skin) have a wine-red colour.—A. S.

Linseed ; Hydrolysis of the protein of ——. F. W. Foreman. J. Agric. Sci., 1910, **3**, 358—382.

The proteins of linseed were extracted with 0·2 per cent. potassium hydroxide solution and hydrolysed with hydrochloric acid of sp. gr. 1·16. They yielded glycine traces ; alanine, 1·03 per cent. ; valine, 12·71 ; leucine and isoleucine, 3·97 ; proline, 2·85 ; phenylalanine, 4·14 ; aspartic acid, 1·65 ; glutamic acid, 11·58 ; serine, traces ; tyrosine, 0·65 ; arginine, 6·06 ; histidine, 1·66 ; lysine, 1·19 ; ammonia, 1·94 ; and tryptophane, traces—in all amounting to 49·43 per cent. The chief feature of the hydrolysis is the very high proportion of valine, 12·7 per cent., as most proteins yield less than 1 per cent. of valine. The amount of tyrosine is exceptionally low and the accuracy of the methods of separating this amino-acid is open to doubt. Basic lead acetate precipitates from neutral or faintly alkaline solutions containing tyrosine, an insoluble basic salt, $2Pb(C_9H_{10}O_3N)_2,5Pb(OH)_2$. This separates in a granular state and is readily filtered and washed.—E. F. A.

Characteristics of "cardamom oil" and of the fat of margarine prepared therefrom. Reinsch. *See* XII.

Fatty oil and wax of coffee berries. Meyer and Eckert. *See* XII.

Constituents of Euphorbia elastica seeds. Okada. *See* XII.

Decomposition of fats by bacteria. Söhngen. *See* XII.

Patents.

Feeding cakes or the like for animals; Means for manufacturing —— and for extracting oil from the seeds used. T. MacDonald, Kingston-upon-Hull. Eng. Pat. 29,438, Dec. 16, 1909.

The apparatus consists of a hollow, steam-heated drum which may be provided with flanges; around this drum are mounted a number of rollers. A woollen or hair belt or band passes round the drum and one of the rollers, whilst a second similar belt runs round two of the rollers and over and under the intervening rollers so as to almost encircle or enclose the first belt. The seed is delivered into the space between the belts and as it is carried round is pressed between the drum and the rollers, suitable means being provided for applying pressure to the latter. One of the belts may be composed of strips, each having pockets, whilst the other belt is fitted with a number of dies so that small biscuits or nuts may be made instead of the cakes produced by the plain belts. The belts may be strengthened by flexible wire ropes which are woven or fixed in the fabric. The pressed cake is delivered from the apparatus at a point above or below that at which the seed is introduced and the expressed oil passes into a tank situated below the apparatus.—W. P. S.

Blood and blood products; Treatment of —— [separating and drying the serum and clot.], and apparatus therefor. R. Wilson, Birkenhead. Eng. Pat. 30,234, Dec. 24, 1909.

Coagulated blood is cut up into pieces which are then placed in a separator consisting of an inclined corrugated plate provided with plain side walls and a movable partially perforated plate at its lower end; the serum draining from the coagulated blood flows down the corrugations of the plate, passes through and under the perforated end-plate, and is collected in a suitable channel whence it is conducted to a settling tank. The clear serum is drawn off from the latter and evaporated to obtain a flaked albumin. The clot remaining in the separator is transferred to a drying chamber which is provided with scrapers; when partially dried, the clot is passed into a second drying chamber situated below the first and in which the drying process is completed. The first drying chamber is heated from below by means of steam, whilst the second chamber is heated both above and below. —W. P. S.

Milk and milk products; Process and apparatus for sterilising — [by means of ozone]. E. Wiener, Vienna. Eng. Pat. 19,621, Aug. 22, 1910.

The milk is forced through an atomising jet into a closed chamber, ozonised air begin introduced into the chamber at the same time. The atomising jet may be fitted in an inlet tube so that the current of milk draws the ozonised air into the chamber after the manner of a simple injector, or the ozonised air may be introduced under pressure so that the milk is drawn up a pipe and sprayed into the chamber. A third method consists in introducing both the milk and ozonised air under pressure. The ozonised air is then removed from the milk by allowing the latter to flow over the surface of inclined plates arranged in the chamber while a current of sterilised air is passed upwards through the chamber, or the milk may be allowed to collect at the bottom of the chamber where jets of sterilised air are blown through it. The treated milk leaves the chamber through a siphon outlet, whilst an opening at the top of the chamber allows the mixture of air and ozonised air to escape.—W. P. S.

"Compound lard"; Manufacture of ——. W. Mattheiss, Baltimore, Md. U.S. Pat. 980,809, Jan. 3, 1911.

"Compound lard" is prepared by mixing 100 lb. of cotton seed oil with 15—20 lb. of stearin, heating the mixture to the temperature of boiling water, stirring, and whilst stirring is continued, gradually reducing the temperature of the materials to about 80° or 90° F., and then allowing the mixture to remain at rest until it reaches the temperature of the air.—J. F. B.

Baking powder; Manufacture of ——. B. Federer, Schmarse, Assignor to Chem. Fabr. vorm. Goldenberg, Geromont und Co., Winkel on Rhine, Germany. U.S. Pat. 980,936, Jan. 11, 1910.

See Eng. Pat. 27,775 of 1909; this J., 1910, 973.—T.F.B.

Lemon juice; Treatment of ——. A. Fernbach, Paris. U.S. Pat. 981,405, Jan. 10, 1911.

See Fr. Pat. 415,067 of 1909; this J., 1910, 1267.—T.F.B.

Chocolate; Emulsified —— and process of preparing it. S. T. Achor. Fr. Pat. 419,832, Aug. 29, 1910.

See Eng. Pat. 10,777 of 1909; this J., 1910, 778.—T.F.B.

XIXb.—WATER PURIFICATION; SANITATION.

Ammonia; Determination of small quantities of ——. P. Artmann. Chem.-Zeit., 1911, **35**, 50—51, 64.

The iodometric method for the determination of ammonia previously described by the author (Z. anal. Chem., 1907, **46**, 5; compare also Rupp and Rössler, this J., 1905, 1256) can be utilised for the determination of small quantities (more than 2 mgrms. per litre) of ammonia, *e.g.*, in water analysis, the average error not exceeding 1·5 per cent. of the total quantity present. In this method the ammonia is decomposed by an alkaline hypobromite solution and the excess of the latter determined iodometrically. The solution containing the ammonium compound is rendered alkaline with 0·5 c.c. of $4N$ sodium hydroxide and made up to 100 c.c. with water free from ammonia and nitrites. It is then treated with 20 c.c. of alkaline hypobromite solution (400 c.c. of saturated bromine water in 1600 c.c. of cold $N/5$ sodium hydroxide; standardised by means of potassium iodide and thiosulphate), and after 2—3 minutes, with frequent shaking, 0·2—0·3 grm. of potassium iodide and 5 c.c. of $4N$ sulphuric acid are added, the flask is closed and shaken frequently during 5 minutes, and the iodine then titrated with a solution of thiosulphate which has been standardised by means of ammonium chloride and the alkaline hypobromite solution. The relative quantities of the solutions and the strength of the thiosulphate solution should be as follows:—

Ammonia content.	Water.	Hypobromite solution.	Thiosulphate.
Mgrms. per litre.	c.c.	c.c.	
below 5	100	10	$N/100$
5—15	100	10	$N/100$
15—30	100	20	$N/50$
30—50	50	20	$N/50$

Iron salts and nitrites must be removed before making the determination. This is effected by adding excess of

N/100 permanganate, then acidifying with sulphuric acid, adding excess of ferrous sulphate solution, titrating with permanganate, making alkaline with 4N sodium hydroxide and adding 1 grm. of barium carbonate, which precipitates the iron. Distillation of the solution containing the ammonia is only resorted to if substances are present which interfere with the iodometric method and cannot be removed by precipitation.—A. S.

Breweries; Purification of waste-waters from —— by means of colloidal clay. Rohland. Z. ges. Brauw, 1911, **34,** 25—27.

For rendering the waste-waters from breweries innocuous and fit for agricultural use, the author recommends certain kinds of clay, which have been employed successfully in the purification of waste liquors from other industrial sources. The best clays for the purpose are brown to black in colour and frequently very plastic; analyses of several are given in the paper. In contact with water they give rise to colloidal forms of silicic acid, hydroxides of aluminium, iron, etc., and organic substances. These have a marked adsorptive capacity for (1) all colloidal substances; (2) all complex colouring matters, and therefore most of those commonly met with; (3) the acid ions of carbonates, bicarbonates, borates and silicates, and in a less degree those of phosphates; (4) unsaturated hydrocarbons of the series C_nH_{2n} and C_nH_{2n-2} and; (5) strong and offensive odours. The purification of brewing waste-waters by this means presents no greater difficulties than are encountered in other clarifying processes. The clay, either finely pounded or in lumps just as it comes from the pits, is well mixed by a stirring arrangement with the waste-liquor in suitable reservoirs. The quantity of clay required depends upon the amount of impurities in the liquors. In Germany such clays can be obtained at a cost of M.80, (four pounds sterling), for 10 tons. When too thoroughly impregnated with waste-matter to be longer employed in purification they may find use as manures.—J. H. L.

Nicotine; Determination of —— in concentrated tobacco extracts [sheep-washes]. J. Schröder. Chem.-Zeit., 1911, **35,** 30.

Enormous quantities of concentrated tobacco extracts are used as sheep-washes in certain countries (*e.g.* at least 4 million kilos. a year on the La Plata farms). These are usually sold by weight, and not upon the proportion of nicotine they contain, and owing to the differences in the results given by different methods the author has already advocated that where the percentage of alkaloid is stated the method of analysis should also be given. Thus a sample guaranteed to contain 8 to 9 per cent. of nicotine, contained only 6·24 to 6·41 per cent. by Kissling's method, and 6·93 to 6·69 per cent. by Keller's method. By the following technical method due to Ulex which is widely used they gave 9·36 to 9·59 per cent. Ten grms. of the extract were triturated with 25 grms. of calcium oxide and 75 grms. of calcium sulphate and the dry mass allowed to stand for 3 hours over sulphuric acid, after which it was mixed with three litres of water containing 25 grms. of sodium hydroxide, two litres being then drawn off and 500 c.c. distilled, and the nicotine in the distillate titrated with N/10 hydrochloric acid, with litmus as indicator. The method of Tóth, recommended by Porchet and Régis (this J., 1909, 1220) as sufficiently accurate for technical purposes may under unfavourable conditions yield amounts of nicotine varying by as much as 20 per cent. of the actual quantity, and there is therefore still a need for a reliable method of determining nicotine.—C. A. M.

Liver of sulphur; Fungicidal properties of ——. F. W Foreman. J. Agric. Sci., 1910, **3,** 400—416.

Liver of sulphur is of general use as a fungicide and recently its use has been much extended in the attempts made to check the ravages of American gooseberry mildew. For this purpose it is used in large quantities and its analysis is therefore a matter of importance. No evidence was hitherto available as to which of the several constituents the fungicidal power is due. The commercial samples are yellowish-green, very deliquescent, almost completely soluble in water and alkaline to litmus, or whiter and less deliquescent, soluble and alkaline. It is made by fusing potassium or sodium carbonate with about half their weight of flowers of sulphur. In addition to the sulphhydrates, sulphides and polysulphides of either potassium or sodium, it contains free sulphur and various oxidation products: these latter possess little or no fungicidal properties. Experiments with the spores of *Botrytis cinerea* showed that the free sodium hydroxide is the most potent fungicidal agent in the whole mixture, potassium hydroxide being somewhat less poisonous. The use of soda instead of potash therefore both increases the value and reduces the price of liver of sulphur. Since polysulphides in dilute solution continually undergo hydrolytic dissociation, their effect upon spores cannot be determined independent of the free alkali, and they are continually yielding free alkali. If any toxic effect is to be attributed to the sulphur its conjoint action with the free alkali should make polysulphide much more toxic than the alkali, but the experiments recorded indicate that the reverse is the case. The mechanical action of the free sulphur may however, be a possible fungicidal factor. It is suggested that solutions of caustic soda much weaker than the solutions of liver of sulphur usually sprayed would be equally as effective as the latter. The following methods are proposed for the analysis of commercial liver of sulphur. (1) *Potash*, a rough idea of the amount present is obtained with sodium cobaltinitrite solution; (2) *free alkali and free sulphur:* 1 grm. is dissolved in water, filtered through tared papers and the insoluble sulphur is collected, washed and dried. The filtrate is neutralised with N/10 acid, with constant stirring until a faint opalescence appears; (3) *Total alkali* is determined in another portion of the filtrate: 20 c.c. are taken and 3 c.c. of N/1 acid and 50 c.c. of water added. The mixture is evaporated to 20 c.c., filtered and the filtrate titrated with N/10 soda using methyl orange as indicator; (4) *Precipitated sulphur:* 100 c.c. of the liver of sulphur solution are heated with 10 c.c. of N/1 acid on the water bath until the sulphur collects together at the bottom.—E. F. A.

Toxic action of dissolved substances; Kinetics of ——. Th. Paul, G. Birstein and A. Reuss. Biochem. Zeits., 1910, **29,** 202—278.

This is a long paper giving a considerable account of previous work on the subject together with full details of the authors' own experiments, the whole being treated from a mathematical point of view. *I. Influence of concentration.* Various strains of staphylococci were the organisms experimented on, and the garnet method of applying the disinfectant was employed. Isohydric solutions of the halogen acids, chloric and perchloric acids, nitric acid and sulphuric acid were used as the disinfecting substances, and it was found that the rates of disinfecting action of these acids varied among themselves due to a catalytic action of the anions. Isohydric solutions of acetic and *n*-butyric acids were compared with those of hydrochloric acid, and were found to be stronger disinfectants. N/25 to N/150 hydrochloric acid has a rate of disinfection, expressed as a constant, approximately proportional to the square root of the concentration, while that of N/6·6 to N/26 butyric acid is proportional to the square of the concentration, and that of N/2 to N/31 acetic acid directly to the concentration. The relationship between the disinfecting action of a substance and its concentration is given by the general equation $K=AC_{B}$, which shows that the constant K for the rate of disinfection is proportional to the power of the concentration C_{B}. The exponent B also characterises the process by which the poison is conveyed to the interior of the cells, such as, for example, adsorption. *II. Influence of neutral salts and temperature on the rate of disinfection by acids.* Certain inorganic salts increase the rate of disinfection by inorganic acids with the same or different anions, although the salts alone may have no disinfecting action; for instance, potassium iodide alone in N/100 solution is not a disinfectant, but when added in equal or double molecular proportions to hydrochloric acid, it increases the constant for the rate of disinfection by the acid from 0·015 to 0·089 and 0·185. The rates of disinfection by the acid-salt mixtures varied approximately as the concentration of the salt. With regard to the influence of temperature upon the rate of disinfection, it was found that the rate increased with increase of temperature, the coefficient for a rise of 10° being about 2 to 3.—J. H. J.

Patents.

Liquids; Sterilisation of —— [by means of ultra-violet rays]. V. Henri and A. Helbronner, Paris, and M. von Recklinghausen, Bas Meudon, France. Eng. Pat. 30,397, Dec. 29, 1909.

The apparatus consists of a cylindrical chamber which is made in three sections and mounted horizontally; the two end sections are fixed, whilst the middle section may be rotated. The lamps employed are fixed to a central rod passing through the chamber, and the liquid to be sterilised is admitted at one end of the chamber; the central section is then rotated rapidly so as to cause the liquid to recede from the lamps and form a layer round the walls of the section, leaving a space between the lamps and the inner surface of the liquid. Instead of rotating the section, a propeller may be provided in the chamber to attain the same object. If a sufficiently high speed be imparted to the liquid, the pressure in the space between the lamps and the liquid will be practically *nil*, but with a lower speed air may be admitted to produce the space. The liquid leaves the apparatus at the opposite end to the inlet. The apparatus may also be mounted vertically.
—W. P. S.

Liquids; Sterilisation of —— [by means of ultra-violet rays]. V. Henri and A. Helbronner, Paris, and M. von Recklinghausen, Bas Meudon, France. Eng. Pat. 14,128, June 10, 1910. Under Int. Conv., June 11, 1909.

The liquid is sterilised by means of rays emitted from a mercury vapour lamp placed above the surface of the liquid, the latter being caused to flow in a zigzag path in an open conduit situated beneath the lamp. Various means are described for directing the current of liquid; for instance, it may be conducted through a shallow tank provided with partitions reaching alternately nearly to the top and bottom, or the channel may be of spiral form. The interior walls of the channel may have reflecting surfaces so that the rays are caused to pass and re-pass through the liquid.—W. P. S.

Water and other liquids; Apparatus for the filtration and purification of ——. T. Hirst and C. Jones, Sheffield. Eng. Pat. 3034, Feb. 8, 1910.

The apparatus consists of a tank divided into a number of compartments by means of vertical partitions; the latter extend from the floor of the tank nearly to the top, but the height of the partitions decreases as they recede from the water inlet to the tank. Each compartment is also divided into two part by means of a partition reaching nearly to the bottom, and the second part in each tank is filled with filtering material. The water to be treated flows into the first compartment, passes under the dividing partition and upwards through the filtering material; it then flows over the partition separating the first compartment from the second, into the first part of the second compartment, thence upwards through the second filter, and so on. As the partitions gradually decrease in height, the water flows by gravitation through the whole series of compartments.—W. P. S.

Sterilisation of water or other liquids; Apparatus for the ——. C. S. Piestrak, Paris. U.S. Pat. 979,939, Dec. 27, 1910.

See Eng. Pat. 1117 of 1910; this J., 1910, 1406.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Strychnos Nux vomica L.; The alkaloids in —— during germination. O. Tunmann. Arch. Pharm., 1910, **248**, 644—657.

In the germination of *Strychnos Nux vomica L.*, brucine is formed first in all parts. Both strychnine and brucine are formed independently of light in the germination leaves before the chlorophyll makes its appearance. The alkaloidal content of the different parts in percentages is:—original seeds 2·98, seed husks after exfoliation 2·11, young germination rootlets 4·48, older germination rootlets 3·72, hypocotyledonous axis 2·43, young cotyledons whilst yellow 6·62, when older and green 4·65.
—F. Shdn.

Cocaine and certain other anæsthetics; Tests for ——. E. H. Hankin. Analyst, 1911, **36**, 1—6.

The permanganate test for cocaine may be rendered very sensitive by using for the purpose the film obtained by the evaporation of one drop of a strong solution of potassium permanganate on a glass slide. On adding to this a small drop of a solution of cocaine in a saturated or semi-saturated solution of alum (the use of the alum being to retard the action of the permanganate), cocaine permanganate crystals in the form of nearly square plates of pink colour are obtained within one or two minutes. In the case of lactate of cocaine the solution should be rendered alkaline with ammonia and shaken with ether, and the ethereal extract shaken with alum solution. The latter takes up the cocaine and is used for the test. Alypin in aqueous solution gives light pink permanganate crystals forming irregularly branched bunches of narrow and dented plates and needles. If dissolved in potassium bromide solution, alypin yields isolated plates or small rosettes. In this respect it differs from cocaine, which is unlikely to give crystals from an aqueous or potassium bromide solution. On the other hand, alypin does not readily yield crystals when dissolved in alum solution. Tropacocaine forms red or dark red crystals with permanganate more readily than any other cocaine substitute. When produced from an aqueous solution they vary in form, being frequently oblong with a slightly curved edge, whilst the crystals from an alum solution form feathery bunches. Scopolamine crystallises with difficulty with permanganate, the crystals being dark red in colour and of very variable form, *e.g.*, prisms or irregular hexagons. In the case of dilute solutions the test usually produces only oily drops or a granular precipitate. Beta-eucaine, stovaine, novocaine, holocaine and nirvanine give no crystals with permanganate, but only oily drops or granular precipitates. They may be differentiated, however, by Saporetti's bromine-water test (this J., 1909, 1103). Cocaine, scopolamine, stovaine and novocaine yield in this test a yellow precipitate soluble on warming. Beta-eucaine gives a yellow precipitate partially soluble on warming, but reprecipitates as a white deposit on boiling. Nirvanine gives a yellow precipitate soluble on warming, to form a red liquid with a pleasant odour. Holocaine gives a yellow precipitate soluble on boiling, and yielding a solution with a pinkish-white opalescence.
—C. A. M.

Codeine oxide. G. Mossler and E. Tschebull. Ber., 1911, **44**, 105—109.

Codeine (10 grms.) was heated on the water-bath with 50 c.c. of 3 per cent. hydrogen peroxide solution and 50 c.c. of water (see this J., 1910, 1471). Bimolecular codeine oxide, $C_{36}H_{44}N_2O_9,7H_2O$, was produced, forming long rectangular crystals m. pt. 200°—202° C. According to the amount of sulphuric acid produced when this substance acts upon a solution of sulphur dioxide in the presence of manganese chloride, it contains two atoms of active oxygen. The anhydrous substance has $[\alpha]_D = -99{\cdot}6°$ in water, and $-107{\cdot}2°$ in alcohol. When the hot alcoholic solution is treated with hydrochloric acid, codeine oxide hydrochloride, $C_{18}H_{21}NO_4,HCl,H_2O$, is produced, melting at 219°—220° C. and with $[\alpha]_D = -108{\cdot}2°$ in alcohol. This salt on treatment with sodium bicarbonate gives the monomolecular codeine oxide, $C_{18}H_{21}NO_4,H_2O$, m. pt. 215° C., and $[\alpha]_D = -97{\cdot}1°$ in water. When the hydrochloride is treated with sulphur dioxide, codeine is regenerated.—F. SHDN.

Colchicine; Toxicological detection of ——. H. Fuehner. Arch. exp. Pathol. u. Pharmakol., 1910, **63**, 357. Apoth.-Zeit., 1910, **25**, 826.

ABOUT 3 to 5 c.c. of the liquid to be tested are treated with 5 drops of 15 to 20 per cent. hydrochloric acid, and heated for half an hour in the boiling water bath. From 3 to 5 drops of ferric chloride solution are then added, until the green colour produced no longer deepens. The cooled liquid is then shaken out with one-third to one-fourth of its volume of chloroform. On separating, this is coloured either yellowish, or pomegranate-red, according to the amount of colchicine present. If the coloured liquids are too opaque, the mixture must be further diluted with water. In very dilute solutions, the red colour passes to yellow, and then to brown. The red tint will not be obtained with less than 2 to 5 mgrms. of colchicine. The first obtained green colour is more sensitive, but, alone, is not sufficiently characteristic.—J. O. B.

Datura Metel; Alkaloids of the seeds of ——. E. Schmidt. Arch. Pharm., 1910, **248**, 641—643.

THE seeds of *Datura Metel* have been found to contain both hyoscyamine and scopolamine (this J., 1905, 748). —F. SHDN.

Corydalis alkaloids (*r-corydaline, phenylberberine*). J. Gadamer. Arch. Pharm., 1910, **248**, 681—695.

IT has been found that there are two optically inactive forms of corydaline, melting at 158°—159° C., and 135° C. respectively (this J., 1905, 634). The former has been resolved into the dextro- and lævo-modifications, but the latter has not yet been resolved. Oxyberberine was treated with magnesium ethyl iodide in benzene, when a substance, $C_{19}H_{15}NO_5$, m. pt. 248° C., was produced. By the action of phenyl magnesium bromide in ether on oxyberberine, and subsequent treatment of the bromide produced with silver chloride, phenylberberine chloride, $C_{26}H_{22}NO_4Cl$, was obtained. It crystallises from water in long needle-like crystals of an orange-yellow colour, m. pt. 255°—257° C. with decomposition. The chloroaurate melts at 215°—216° C.; the acid sulphate and the nitrate were also prepared. Reduction with zinc and dilute sulphuric acid converts this substance to phenyltetrahydroberberine, forming nearly colourless, short crystals, m. pt. 223° C. The same body is formed when phenyldihydroberberine is reduced. The chloride of the latter substance when oxidised with iodine yields *iso*-phenylberberine chloride, $C_{26}H_{22}NO_4Cl$, m. pt. 275°—278° C. The aurichloride does not decompose below 280° C. After treatment with hydrogen sulphide, phenylberberine chloride and *iso*phenylberberine chloride were obtained. When *iso*phenylberberine is reduced with zinc and dilute sulphuric acid, a varnish-like substance, but no tetrahydroberberine, is produced.—F. SHDN.

Dihydroberberine. J. Gadamer. Arch. Pharm., 1910, **248**, 670—681.

WHEN a solution of berberine sulphate is evaporated with 30 per cent. sodium hydroxide solution, and the mass treated with water and acidified, dihydroberberine is formed, together with oxyberberine. Dihydroberberine can be crystallised from alcohol and melts at 164°—166° C. It differs from tetrahydroberberine by its greater tendency to oxidation, and its smaller solubility in absolute alcohol. Tetrahydroberberine hydrochloride is less soluble in hot water than dihydroberberine hydrochloride. The latter salt crystallises with 4 molecules of water. Dihydroberberine is somewhat less basic than tetrahydroberberine. The former base when converted into the salt of *d*-bromocamphorsulphonic acid could not be resolved into optical isomerides. When treated with methyl iodide, it yields some berberine methiodide. Tetrahydroberberine methiodide can be readily prepared and melts at 245°—250° C. Dihydroberberine has a stronger physiological action than tetrahydroberberine.—F. SHDN.

Angostura alkaloids. J. Troeger and H. Runne. Apoth.-Zeit., 1910, **25**, 957—959, 969—970, 977—978, 988—989. Chem. Zentr., 1911, **1**, 163—164. (See this J., 1910, 294.)

CUSPAREÏNE forms long needles, m. pt. 56° C. It contains two methoxyl groups and has the formula, $C_{18}H_{19}O_2N$. Quinoline is among the products formed when the alkaloid is heated with zinc dust. Cuspareïne dissolves in concentrated sulphuric acid without evolution of gas; the solution when treated with solid potassium bichromate gives a similar colouration to that yielded by strychnine under similar conditions. Angosturine, $C_{19}H_{15}O_4N$, forms almost white needles, m. pt. 233° C. Its yellow alcoholic solution exhibits a green fluorescence. The nitro-derivative produced by gently heating cusparine with fuming nitric acid in presence of glacial acetic acid, has the composition, $C_{17}H_{14}O_4N_2 + H_2O$, and not $C_{16}H_{14}O_4N_2 + \frac{1}{2}H_2O$ as stated by O. Müller.—A. S.

Eschscholtzia Californica; An alkaloid of ——. [*Ionidine*]. G. Brindejonc. Bull. Soc. Chim., 1911, [4] **9**, 97—100.

THE root of *Eschscholtzia Californica* has been found to contain an alkaloid, the amount being about 0·25 per cent. of the dried root. The base crystallises from alcohol in short colourless flattened prisms, permanent in the air. It melts at 154°—156° C. The solubility in 90 per cent. alcohol is 0·46 per cent. in the cold, and 7 per cent. at the boiling point. One part is soluble in 2500 parts of water. No crystalline salts were obtained. It has the composition $C_{19}H_{25}N_4O_4$, and forms an aurichloride, $B.HAuCl_4$. It is precipitated by picric acid, gold chloride, and platinum chloride. A strong violet colouration is produced with sulphuric acid containing traces of nitrous products, and with Fröhde's reagent. Owing to the strong violet colour produced in this way, the author has termed the alkaloid *ionidine*.—F. SHDN.

Hordenine; Formation of —— *during the germination of barley*. T. Torquati. Arch. Farmacol. sperim., 1910, **10**, 62—71, 97—119. Chem. Zentr., 1911, **1**, 166.

THE author determined the hordenine content of barley seedlings at five different stages of growth. Before germination the barley was free from hordenine, the quantity of which was at a maximum after four days, when it amounted to 0·4—0·45 per cent. (on the dry substance) in the rootlets and 0·1 per cent. in the entire seedling. The hordenine content then decreased with increasing age of the seedlings, becoming *nil* after 25 days. No formation of hordenine could be observed during the germination of wheat, peas, and lupins. For the determination of the hordenine the substance was macerated for 12 hours with a dilute solution of tartaric acid, then heated for 3 hours and filtered hot. The insoluble residue was triturated with freshly ground plaster of Paris, and extracted with alcohol. The residue left on evaporating the alcohol was dissolved in a little water, and colouring matters and fatty substances removed by shaking with ether, after which the solution was made alkaline with potassium carbonate, and the hordenine extracted by means of ether. The ether solution was concentrated, shaken with dilute sulphuric acid, and the hordenine extracted in a pure state from the acid solution by making it alkaline and shaking with ether.—A. S.

Cupréine; New reaction of ——. G. Denigès. Comptes rend., 1910, **151**, 1354—1355.

CUPRÉINE gives a fine green colour reaction when submitted to the test with hydrogen peroxide, ammonia, and a copper salt, previously described for the detection of morphine (this J., 1911, 47). The reaction appears to be due to the phenolic function of cupréine, since quinine and cinchonine do not give a similar reaction.—A. S.

Tai-tsa-ju; The source of the Chinese drug ——. H. Solereder. Arch. Pharm., 1910, **248**, 658—665.

The author considers that the Chinese drug "Tai-tsa-ju" is derived from the plant *Gelsemium elegans* Benth., well-known in China for its medicinal properties.—F. Shdn.

Ipomœa Horsfalliæ Hooker; *Chemical examination of the tuberous root of* ——. F. B. Power and H. Rogerson. Amer. J. Pharm., 1910, 355—360. Wellcome Chemical Research Laboratories, Reprint No. 111.

The tuberous root of *Ipomœa Horsfalliæ* Hooker, when dried in the water-oven, lost 83 per cent. of its weight. The concentrated alcoholic extract of the dried root was distilled in a current of steam. A quantity of resin separated amounting to 2·5 per cent. of the dry weight of the root. The resin when dissolved in absolute alcohol had $[\alpha]_D = -28·4°$. Extraction of the resin with light petroleum and boiling the extract with alcoholic potassium hydroxide yielded a crystalline substance, m. pt. 132°—133° C., giving the colour reactions of the phytosterols, and also another crystalline substance, m. pt. 56°—58° C. Some evidence was obtained of the presence of a glucoside in the alcoholic extract of the resin. The aqueous liquid left after the steam distillation was found to contain sugar and probably traces of β-methylæsculetin. The resin appears to be devoid of physiological action.—F. Shdn.

Iris versicolor rhizome (*blue flag root*); *Constituents of* ——. F. B. Power and A. H. Salway. Amer. J. Pharm., 1911, **83**, 1—14.

The therapeutic activity of the fresh rhizome of *Iris versicolor* appears to be well established, chemical investigation and physiological experiment confirm the opinion already recorded that the drug deteriorates with age. The commercial drug examined, was shown to be devoid of physiological activity. The absence of alkaloids and of glucosides having been established, the ground material was extracted with alcohol. The extract thus obtained yielded, on distillation, a small amount of yellow essential oil, sp. gr. 0·9410 at 20°/20° C., having an unpleasant odour. The portion of the alcoholic extract soluble in water contained a little *iso*-phthalic acid which has not been previously recorded as a plant constituent. A probable trace of salicylic acid, with tannin, and a sugar yielding *d*-phenylglucosazone, m. pt. 212° C. were also present. The portion of the above extract insoluble in water consisted mainly of a soft dark resin, amounting to 8·7 per cent. of the drug. From this, the following definite products were isolated:—A phytosterol, $C_{27}H_{46}O + H_2O$, m. pt. when anhydrous, 148° C., $[\alpha]_D = -35·6°$ in chloroform; myricyl alcohol, $C_{31}H_{64}O$; heptacosane, $C_{27}H_{56}$; ipuranol, $C_{23}H_{38}O_2(OH)_2$: and a mixture of lauric, palmitic, stearic, cerotic, oleic and linolic acids. No definite substances were found, to which the reputed properties of the drug could be referred. Physiological experiments with the total alcoholic extract, the total resinous portion, the portion of the alcoholic extract soluble in water, and the aqueous extract of the drug, prepared without heat, were all without result.
—J. O. B.

Essential oil of peppermint obtained by distilling the dry leaves of ordinary peppermint (*Mentha piperita*). J. Muraour. Bull. Soc. Chim., 1911, **9**, 66—67.

On distilling the dry leaves which fall during the growth of the plant, a fine yellow oil is obtained (400—500 grms. per 100 kilos. of the plant) which has an odour recalling that of Japanese peppermint oil and a density of 0·911—0·913 at 15° C. This oil is used to adulterate ordinary (French) peppermint oil, though some of the constants differ considerably; thus, two samples of the oil from the leaves of *Mentha piperita* were found to have rotatory powers (in a 100 mm. tube) of −38·18° and −40·04°, and ester-contents of 33·16 and 40·31 per cent. respectively, whereas the rotatory power of the ordinary or French oil ranges from −6° to −11°, and its ester-content from 7 to 10 per cent. Like the oil from the leaves of *Mentha piperita*, American peppermint oil has a high rotatory power (−25° to −33°), and the densities of the two oils are nearly the same; the American oil, however, does not contain more than 14 per cent. of esters, and whereas its menthol-content is 60—65 per cent., that of the oil from the leaves of *Mentha piperita* is practically the same (43·99 and 45·67 per cent. in the two samples investigated) as that of the French oil.—L. E.

Oil of Mespilodaphne pretiosa; Essential ——. Roure-Bertrand Fils. Wiss. u. ind. Ber. von Roure-Bertrand Fils, 1910, [3], **2**, 19—23. Chem. Zentr., 1911, **1**, 222—223.

By distilling the branches of the plant with steam, 0·5 per cent. of a yellowish oil with an odour resembling that of linaloe oil, was obtained. The oil (I.) is soluble in all proportions in 80 per cent., and in 1·25 or more volumes of 70 per cent. alcohol. From the wood of the plant by distillation with steam, 0·693 per cent. of oil was obtained, of which a portion was lighter and a portion heavier than water. The lighter oil (II.) has a slight greenish yellow colour; it is soluble in 0·5 vol. or more of 80 per cent., and in 1·5 vols. or more of 70 per cent. alcohol. The heavier portion (III.) is a light-brown oil soluble in 4 vols. or more of 80 per cent., but insoluble in 70 per cent., alcohol. It does not solidify at −15° C. and consists chiefly of a mixture of linalyl or geranyl acetate and benzoate. The total oil (IV.) from the wood is soluble in 1 vol. or more of 80 per cent., and in 5·5 vols. or more of 70 per cent. alcohol. The characters of the different oils are shown in the following table:—

	I.	II.	III.	IV.
Sp. gr. at 15° C.	0·8912	0·9539	1·0551	0·9808
Opt. rotation (100 mm.)	+ 7°20′	+ 8°48′	+ 3°8′	+ 7°12′
n_D^{20}	1·469	1·501	1·545	1·519
Acid value	1·4	0·7	3·5	2·1
Saponification value	13·3	100·8	203·7	128·1
Esters, as linalyl acetate	4·65 %	35·28 %	—	—
Saponif. value after acetylation ...	165·2	205·1	247·8	219·8
Alcohols, as linalool	51·8 %	66·6 %	—	—

A. S.

Oils from different varieties of basil; Essential ——. Roure-Bertrand Fils. Wiss. u. ind. Ber. von Roure-Bertrand Fils, 1910 [3], **2**, 38—41. Chem. Zentr., 1911, **1**, 223—224.

Besides the ordinary white (I.) and red (IV.) basil, the white varieties with crinkled leaves (II.) and with lettuce-like leaves (III.) were grown and oils distilled from the plants. It was found that the variety with the crinkled leaves, *Ocimum crispum*, Cam., is the most advantageous, both for the grower and the distiller. It yields 0·1285 per cent. of oil as compared with 0·0855 per cent. from ordinary white basil, 0·0780 per cent. from the variety with lettuce-like leaves, and 0·0370 per cent. from red basil. The characters of the oils are shown in the following table, columns V. and VI. relating to oils from ordinary white and red basil purchased in 1909.

	I.	II.	III.	IV.	V.	VI.
Sp. gr. at 15° C.	0·9168	0·9123	0·8975	0·8959	0·9125	0·9100
Opt. rotation (100 mm.)	−10°52	−10°30	−12°54′	−13°52′	−11°28′	−10°14′
Rotation of acetylated oil	+ 1°36′	+ 0°30′	+ 0°2′	+ 1°52′	+ 1°34′	+ 3°28′
n_D^{20}	1·488	1·484	1·479	1·477	1·484	1·477
Acid value	2·8	2·1	0·7	3·5	1·4	2·1
Saponification value.......................	5·6	4·9	7·0	9·8	3·5	7·7
Esters, as linalyl acetate	1·96 %	1·71 %	1·71 %	3·43 %	1·22 %	2·68 %
Saponif. value after acetylation	116·9	116·9	130·2	126·7	114·8	117·6
Alcohols, as linalool	35·19 %	35·19 %	39·66 %	38·46 %	34·50 %	35·43 %

Oil No. III. gave a slight turbidity with 70 per cent. alcohol, but the other oils were completely soluble in 2 vols. or more of that solvent. The estragol content was about 55 per cent. in all the oils.—A. S.

Essential oils from Brazilian plants. Roure-Bertrand Fils. Wiss. u. ind. Ber. von Roure-Bertrand Fils, 1910, [3], 2, 41—43. Chem. Zentr., 1911, 1, 224.

Paolo amarello oil was obtained in a yield of 0·41 per cent. from the wood of the plant. It is almost colourless and has an odour greatly resembling that of the oil from linaloe wood. It has the sp. gr. 0·8892 at 15° C.; optical rotation (100 mm.), −5°54′; saponif. value, 22·9; esters (as linalyl acetate), 8 per cent.; saponif. value after acetylation, 200·2. It is soluble in 2 vols. or more of 70 per cent. alcohol. *Turpentine-amarello oil*, obtained in a yield of 0·134 per cent. from the wood of the plant, has an odour of turpentine. It has the optical rotation, +8°32′ in a 100 mm. tube, and is miscible in all proportions with 90 per cent. alcohol. *Petitgrain oils.*—The characters of four oils of different botanical origin are shown in the following table:—

	I.	II.	III.	IV.
Sp. gr. at 15° C. .	0·8980	0·8584	0·8806	1·0643
Optical rotation. .	— 4°20′	+ 53°52′	+ 30°44′	+ 2°20′
Saponification value	161·4	12·5	43·8	265·0
Saponif. value after acetylation . . .	203·0	47·4	130·6	—

Oil I. from the branches of *Citrus bigaradia*, Risso is soluble in 3·5 vols. of 70 per cent. alcohol. Oil II. from *Citrus aurantium*, Risso is soluble in 0·5 vol. of 90 per cent. alcohol. Oil III. from *Citrus limonum*, Risso is soluble in 1 vol. of 85 per cent. alcohol. Oil IV. from *Citrus madurensis*, Loureiro is soluble in 1 vol. of 90 per cent. alcohol. *Tarragon oil*, obtained by distillation from *Artemisia Dracunculus* L., is soluble in 4 vols. or more of 80 per cent. alcohol. It has the sp. gr. 0·9814 at 15° C.; optical rotation (100 mm.), +2°56′; saponif. value, 29·8; esters (as linalyl acetate), 10·4 per cent.—A. S.

Lemon oil; The pinene-test for ——. E. J. Parry. Chem. and Drug., Jan. 28, 1911, 159—160.

In order to ascertain the value of Chace's pinene-test (see this J., 1908, 1174; 1909, 1325), the author examined ten samples of lemon oil of undoubted purity. The samples were submitted to: (1) Chace's test; and (2) a modification in which the first 10 per cent. of distillate was allowed to stand in contact with metallic sodium for two hours at 50° C., and then re-distilled before applying the test (compare Schimmel's Report, Nov., 1908, 62). Four of the samples in the direct test and all of them in the modified test gave a positive result, although in no case were the characters of the crystals so well-defined as in the micro-photographs published by Chace. It must, therefore, be concluded that a positive result in Chace's test is, in no way, a certain indication of adulteration. Moreover, if a sample of lemon oil is adulterated with oil of turpentine to such an extent that a copious amount of crystals of pinene nitrosochloride is obtained in the test, such adulteration can be detected more readily and with greater certainty by the ordinary methods of analysis.—A. S.

Camphor tree and its injuries: Life-history of Trioza camphoræ of the ——. C. Sasaki. J. Coll. Agriculture, University of Tokio, 1910, 2, 277—286.

A full description, with plates, is given of the life-history and structure of the camphor tree pest, *Trioza camphoræ*. The winged insects, about 1·65 mm. in length, appear in April in the immediate neighbourhood of the trees, and lay their eggs on the under surface of the leaves. As these eggs develop into larvæ and pupæ, large numbers of oval or round galls appear on the leaves, causing them to shrivel and fall off. This may bring about the death of younger trees. To prevent these injuries all fallen leaves must be carefully gathered and burnt, or else used up in the preparation of camphor. Badly infested trees should be cut down. Whale and herring oil soaps (1—2 per cent. solutions) applied to the infested leaves were found to be more efficient than soaps from shark or sardine oils.
—F. Shdn.

Essential oils; Constituents of ——. *Constitution of perilla-aldehyde. $C_{10}H_{14}O$.* F. W. Semmler and B. Zaar. Ber., 1911, **44**, 52—57.

A quantity of essential oil was obtained by distillation with steam from the Japanese plant, *Perilla nankinensis* Decne. and an aldehyde, $C_{10}H_{14}O$, was separated from it. Perilla-aldehyde boils at 104°—105° C. at 10 mm., and has the sp. gr. 0·9617 at 18° C., $n_D = 1·50746$, $[\alpha]_D = -146°$. The semicarbazone when crystallised from alcohol melts at 199°—200° C. When it is reduced by means of zinc dust and glacial acetic acid, and the acetate thereby produced is saponified, the corresponding perilla-alcohol is obtained, boiling at 119°—121° C. at 11 mm., and with the sp. gr. 0·9640 at 20° C., $n_D = 1·49964$, $[\alpha]_D = -68·5°$. The alcohol was converted into the chloride by means of phosphorus pentachloride, and reduced with sodium in alcohol. In this way *l*-limonene was produced. The oxime (m. pt. 102° C., b. pt. 147°—148° C. at 12 mm.) of the original aldehyde was prepared, dehydrated, and the resulting nitrile hydrolysed to perillic acid, $C_{10}H_{14}O_2$. This acid melts at 130°—131° C., has $[\alpha]_D = -20°$ in alcohol, and takes up bromine when dissolved in chloroform, producing a dibromide, m. pt. 166°—167° C. When the acid is reduced with sodium in amyl alcohol, a dihydro-acid, $C_{10}H_{16}O_2$, is produced, m. pt. 107°—109° C., b. pt. 152°—153° C. at 10·5 mm., and optically inactive. The corresponding dihydro-alcohol, $C_{10}H_{18}O$, boils at 114°—115° C. at 10 mm., has the sp. gr. 0·9284 at 19° C., and $n_D = 1·48191$. The author regards perilla-aldehyde as 1-methyl-4-isopropenyl-hexene-1-al-1^1.—F. Shdn.

Antipyrine in "migrænin" [antipyrine-caffeine-citric acid compound]; Iodometric determination of ——. C. Sleeswijk. Pharm. Weekblad, 1910, **47**, 1282—1283. Chem. Zentr., 1911, **1**, 268.

Solutions of 1·351 grms. of iodine and of 2·5 grms. of mercuric chloride, each in 200 c.c. of 95 per cent. alcohol, and of 1·1 grms. of the migrænin in 200 c.c. of water are prepared. 20 c.c. of the migrænin solution are mixed with 20 c.c. of the mercuric chloride solution, and titrated with the iodine solution until a yellow colour persists: 1 c.c. of the iodine solution is equivalent to 0·005 grm. of antipyrine.—A. S.

Antipyrine, thiopyrine, and anilinopyrine; The 1-nitro- and 1-amino-derivatives of ——. A. Michaelis. Annalen, 1911, **378**, 293—351.

When dimethyl sulphate is heated with nitrophenyl methylchloropyrazole, condensation takes place, and the corresponding methiodide can be made by treating the product with potassium iodide. Nitroantipyrine is obtained by treating the methiodide with silver oxide and evaporating. The nitroantipyrines form yellow crystals fairly readily soluble in water and feebly basic. 1-*o*-Nitroantipyrine melts at 187·5° C., the *para*-compound at 132° C., and the *meta*-compound at 98° C. Dinitro-derivatives can be prepared by the action of nitric acid, *p*-1.4-dinitroantipyrine melting at 276° C. Nitrous acid produces green nitroso-compounds. When reduced with tin and hydrochloric acid, 1-aminoantipyrines are produced, the *para*-compound melting at 210° C., the *ortho*- at 165° C., and the *meta*- at 148° C. These substances can be readily acetylated or benzoylated. The acetyl derivatives have a relatively small antipyretic action. 1-*m*-4-Diaminoantipyrine, obtained by reduction of the dinitro-compound, melts at 170° C., and is easily soluble in water and alcohol; 1-*p*-4-diaminoantipyrine melts at 279° C. Both these bases form acetyl compounds which possess small antipyretic action. The nitroantipyrines can be converted into the corresponding thio-compounds by the action of sodium or potassium sulphide. *o*-Nitrothiopyrine is a red substance, m. pt. 140° C.; the *para*-compound is also red and melts at 241° C., whilst the *meta*-compound is yellow and melts at 204° C. When reduced, aminothiopyrines are produced. When aniline is allowed to act upon nitrochloropyrazole, nitroanilinopyrine is produced, 1-*p*-nitroanilinopyrine forming dark-red crystals, m. pt. 168° C. Reduction of the nitro-compound with aluminium amalgam led to the production of *p*-azoanilopyrine, m. pt. 224° C.—F. Shdn.

Amines; Chemical structure and sympathomimetic action of ——. G. Barger and H. H. Dale. J. Physiol., 1910, 41, 19—59.

An action simulating that of the true sympathetic nerves, described by the authors as "sympathomimetic action" is not peculiar to adrenine,

$$C_6H_3(OH)_2(CHOH.CH_2.NH.CH_3)1:2:4,$$

but is possessed by a large series of amines. The simplest are the primary fatty amines. The lower members of this series have little activity, but from *n*-butylamine and upwards there is marked activity. Of the secondary amines, methyl-*iso*-amylamine was found to be active. Trimethylamine was practically inactive in this special direction. β-Phenylethylamine was distinctly more active than any of the above bases, and with aromatic amines, the more closely the structure approached to that of adrenine (see above), the greater the sympathomimetic action. All substances producing this action are primary or secondary amines. The quarternary amines corresponding to the aromatic members of the series, *e.g.*, hordenine methiodide, have an action closely resembling that of nicotine. The optimum carbon-skeleton for this activity consists of a benzene ring with a side chain of two carbon atoms, the terminal one bearing the amino-group. Another optimum condition is the presence of two phenolic hydroxyls in the 3:4 position relative to the side-chain. When these are present, an alcoholic hydroxyl still further intensifies the activity. A phenolic hydroxyl in the 1 position does not increase the activity. Catechol, $C_6H_4(OH)_2 1:2$, does not possess this particular activity.—F. Shdn.

Formaldehyde; Production of —— *from methyl alcohol by the contact method.* M. Le Blanc and E. Plaschke. Z. Elektrochem., 1911, 17, 45—57. (See also Orlow, this J., 1908, 139, 419, 1176.)

The authors have given special attention to the following points in the catalytic oxidation of methyl alcohol, in contact with a spiral of fine copper or silver gauze:—(1), the temperature of the gauze; (2), the air-alcohol ratio; and (3), the length of the gauze spiral. When (2) and (3) are constant, the principal reaction—formation of formaldehyde—accounts for an increasing percentage of the alcohol used as the temperature rises. There are, however, secondary reactions which result in destruction and loss of methyl alcohol, such as decomposition of the aldehyde to carbon monoxide and hydrogen, and direct oxidation of the alcohol beyond the aldehyde stage. The velocity of these reactions also increases with rise of temperature. The principal reaction is more accelerated up to about 450° C., but beyond that point rise in temperature gives poorer yields of formaldehyde, owing to the increasing predominance of the subsidiary reactions. For a given temperature the percentage yield of formaldehyde shows a maximum at about 0·46 grm. of oxygen per grm. of alcohol, while the loss by secondary reactions is least where the proportion of oxygen is lowest. Variation of the length of the catalyst in the authors' apparatus shows that the maximum yield for the principal reaction is obtained with a length of about 7 cm., while the secondary reactions produce a greater loss the greater the length of the spiral. From these considerations it is clear that the efficiency of the process must be judged from the point of view both of yield and of loss. The highest yield obtained was about 58 per cent. (accompanied by a loss of 15·5 per cent.), while the minimum loss was 11·76 per cent. (with a yield of about 51·4 per cent.). The above results refer entirely to silver gauze. Copper gives slightly less favourable results, while the optimum length of spiral (8—9 cm.) and air-alcohol ratio (about 0·39 grm. of oxygen to 1 grm. of alcohol) have different values. With regard to the mechanism of the reaction, the authors offer arguments and experiments, which lead to the conclusion that the first reaction is the loss of hydrogen by the methyl alcohol, which hydrogen is afterward oxidised by the oxygen present. The apparatus described by the authors includes a delicate gas pressure regulator, in which the movement of the mercury in the manometer in either direction from the level desired closes a circuit containing an electromagnet, which increases or decreases the resistance to the flow of gas.—W. H. P.

Formaldehyde; Simple method of determining ——. F. Herrmann. Chem.-Zeit., 1911, **35**, 25—26.

The inaccuracies in Legler's method of determining formaldehyde by conversion into hexamethylenetetramine, which are due to the slow action of ammonia solution and the instability of standard ammonia solutions, may be obviated by developing ammonia gas within the liquid itself from ammonium chloride by the addition of standard sodium hydroxide solution. The heat of the reaction causes the nascent ammonia to convert the formaldehyde instantaneously and completely into hexamethylenetetramine. A weighed quantity (between 4 and 4·5 grms.) of ordinary formalin solution is mixed in a stoppered bottle of 150 to 200 c.c. capacity, with 3 grms. of pure finely-powdered ammonium chloride and then with 25 c.c. of 2*N*-sodium hydroxide solution added from a burette as rapidly as possible, and the bottle is closed and allowed to stand. As soon as its contents have cooled to the ordinary temperature, 50 c.c. of water and 4 drops of a 1 per cent. solution of methyl orange are introduced, and the liquid titrated with *N*/1 sulphuric acid, to obtain the number of c.c. of *N*/1 alkali solution consumed in the formation of the hexamethylenetetramine. The result multiplied by 0·06 gives the quantity of formaldehyde in grms. in the formalin solution. The results thus obtained are closely concordant, and are practically identical with those given when the liquid is allowed to stand for 24 hours before the titration.—C. A. M.

[*Acidimetric*] *assay of lactic acid.* Elvove. *See* VII.

Determining nicotine in concentrated tobacco extracts. Schröder. *See* XIXb.

Patents.

Para-oxyarylarsinic acids; Manufacture of derivatives of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst on Maine, Germany. Eng. Pat. 13,485, June 3, 1910. Under Int. Conv., June 9, 1909.

See Ger. Pat. 224,953 of 1909; this J., 1910, 1178.—T.F.B.

Santalol compound. R. Berendes, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 979,639, Dec. 27, 1910.

See Ger. Pat. 226,229 of 1909; this J., 1910, 1474.—T. F. B.

Hexamethylene-tetramine-monoguaiacol and hexamethylene-tetramine-diguaiacol. E. Barell and F. Elger, Basle, Assignors to the Hoffmann-La-Roche Chemical Works, New York. U.S. Pats. 979,916 and 979,917, Dec. 27, 1910.

See Eng. Pat. 19,805 of 1909; this J., 1910, 373.—T. F. B.

Formaldehyde; Process for making ——. O. Blank. Fr. Pat. 418,349, Sept. 25, 1909.

See Ger. Pat. 228,697 of 1908; this J., 1911, 49.—T. F. B.

Octadionol and its homologues; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 419,346, Aug. 13, 1910. Under Int. Conv., Aug. 31, 1909.

See Ger. Pat. 227,177 of 1909; this J., 1910, 1332.—T.F.B.

Octenedione and its homologues : Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 419,589, Aug. 22, 1910. Under Int. Conv., Aug. 31, 1909.

See Ger. Pat. 227,176 of 1909 ; this J., 1910, 1332.—T.F.B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Filter for ultra-violet rays and its applications. H. Lehmann. Physik. Zeits., 1910, **11**, 1039—1047. Chem. Zentr., 1911, **1**, 55—56.

The filter used by the author is similar to those previously described by Wood (this J., 1903, 440) and by Kalähne. It consists of a vessel of Jena blue "uviol" glass filled with copper sulphate solution, and coated on the outside with a preparation of nitrosodimethylaniline and gelatin. A quartz lamp or an iron arc is used as the source of ultra-violet rays and lenses of quartz or of "U-V" crown glass for concentrating the rays. In describing the possible applications of such a light-filter, it is pointed out that on exposure to the rays, chemically pure substances exhibit only faint luminescence, whereas commercial products of second quality show very strong luminescence, mostly extending only to individual crystals or agglomerates of crystals. Different types of glass each exhibit characteristic fluorescence-colours. Many substances exhibit notable phosphorescence ; rods of fused sodium hydroxide, for example, show a reddish-white effect in the cone of ultra-violet rays, and a green colour when rapidly removed therefrom.—A. S.

Patents.

Lithographic stone. C. Mateham and W. T. Gale, Bristol. Eng. Pat. 30,330, Dec. 28, 1909.

The surfaces of slabs of the bituminous calcite, from the blue or lower lias, are planed or chiselled, rubbed with grit or sand and water, polished with pumice, and finished with "snake-stone." The lithographic stone for receiving directly a photographic image, consists of a blue lias stone prepared as above, and covered with a photographically sensitised coating.—W. C. H.

Vanadium acid oxalate [photographic intensifier] and process of making same. P. Rehländer, Charlottenburg, Assignor to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 979,887, Dec. 27, 1910.

See Ger. Pat. 215,071 of 1909 ; this J., 1909, 1274.—T.F.B.

XXII.—EXPLOSIVES ; MATCHES.

Patents.

Explosives. C. F. G. Van Pittius, Amsterdam. Eng. Pat. 555, Jan. 8, 1910.

Claim is made in the manufacture of explosives for the separate preparation of an active substance in the following manner. Resin (10 parts) and stearin (5 parts) are mixed together and heated at 150° C. Paraffin (10 parts) of a melting point of 70° C. is then added. Trinitrotoluene (25 parts) in which nitroglycerine (5 parts) or nitrocotton (3 parts) has previously been dissolved, is then added. The whole is well incorporated at 85° C. with another 50 parts of melted trinitrotoluene, and when cooled the mixture forms a reddish-brown paste. To produce the explosive, oxidising salts are added and the following compositions are, amongst others, given as examples :—Nitrotoluene mixture (20 parts), sodium nitrate (30 parts), potassium perchlorate (20 parts), and ammonium perchlorate (30 parts). Nitrotoluene mixture (8 parts), and ammonium nitrate (92 parts).—G. W. McD.

Explosive. C. E. Griffing, Salt Lake City, Utah. U.S. Pat. 979,476, Dec. 27, 1910.

A granulated mixture of potassium chlorate (40 parts), sugar (35), coal (10), manganese dioxide (10), and milk sugar (5 parts).—G. W. McD.

Nitrating cellulose ; Apparatus for ——. A. F. du Pont and J. T. Thompson, Assignors to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 979,560, Dec. 27, 1910.

The apparatus consists of a rotating platform, with a number of equi-spaced vessels mounted upon it. Each vessel has sections with perforated walls between the sections, and there is an outlet and a valve in the lower section. Means are provided which, in the movement of the platform, open the valve.—G. W. McD.

Gunpowder ; Manufacture of smokeless ——. C. Claessen, Berlin. Eng. Pat. 29,882 of 1909, date of appl., May 12, 1910.

See Addition of April 2, 1910, to Fr. Pat. 410,239 of 1909 ; this J., 1910, 1229.—T. F. B.

Nitrocellulose gunpowder. C. P. H. Claessen, Berlin, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 979,431, Dec. 27, 1910.

See Eng. Pat. 11,365 of 1910 ; this J., 1910, 1084.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Lime ; Determination of small quantites of —— in presence of large amounts of magnesia. C. Liesse. Ann. Chim. Analyt., 1911, **16**, 7—8.

The method consists in diluting the solution to a point at which magnesium oxalate is soluble, *i.e.* 1 : 1500. Contamination of the precipitate of calcium oxalate is thus avoided. One or two grms. of the substance are treated with hydrochloric acid, water is added, and then ammonia until the solution is alkaline, when the silicia, iron, alumina, etc., are filtered off. The solution is diluted, cold, with water, to a bulk of one and a half to three litres, according to the amount of magnesia present. One grm. of ammonium oxalate is added, and the solution acidified with acetic acid, stirred, and filtered after two hours. The precipitate is weighed, after ignition, as calcium carbonate. The method gives good results with substances containing 0·5 per cent. of lime and 99·5 of magnesia.—R. W. N.

Zinc ; New test-paper for the volumetric determination of ——. R. C. Kopenhague. Ann. Chim. Analyt., 1911, **16**, 10—12.

For use in the volumetric estimation of zinc by the sodium sulphide method, the author recommends paper prepared and used as follows : close-fibred filter-paper is cut into strips and soaked in a 10 per cent. solution of cadmium nitrate, after which it is dried at 80° or 90° C. This paper gives good results if small drops of the assay solution are placed on it without, as is usual, an interposed filter-paper. It is best to observe the colour about 20 seconds afterwards.—R. W. N.

Iron, chromium, and aluminium ; Separation of ——. Tcharviani and Wunder. Ann. Chim. Analyt., 1911, **16**, 1—7.

The mixture of oxides of the three metals is fused for seven hours with sodium carbonate in a platinum crucible, leached out with water, and the iron separated by filtration. An excess of ammonium nitrate is then added, which throws down the alumina. This is filtered off, after which the filtrate is acidified with nitric acid, the chromate reduced with alcohol, and an excess of ammonia added, which precipitates the chromium. To obtain the latter in a pure state it must be redissolved in hydrochloric acid, and re-precipitated with ammonia. Neither precipitation with ammonia from an acid solution, whether sulphuric, hydrochloric, or nitric, nor from an alkaline solution, after decomposing the aluminate with ammonium chloride, has given the authors such a pure alumina precipitate as the above method. The chromate is rapidly and completely reduced by alcohol in presence of nitric acid. —R. W. S.

Manganese ; Separation of metallic chromium during the electrolytic determination of —— by Engels' method. J. Köster. Z. Elektrochem., 1911, **17**, 57—58.

The author deals with criticisms advanced by C. N. Otin (this J., 1909, 715) against Engels' method of determining manganese (this J., 1896, 219). The main points are : (i.), ammonium acetate is to be added instead of sodium acetate; (ii.), the current density is not very high, 0·6—1·0 amp. per sq. dm. ; (iii.), the metallic deposit which is said to be obtained on the cathode, contains comparatively little manganese, and consists mainly of chromium from the chrome alum which is added before electrolysis. The deposit is not obtained at all, however, even in the absence of ammonium sulphate, if Engels' instructions are followed. —W. H. P.

Nickel and cobalt ; A new reaction of —— and its use in distinguishing these metals. H. Weil. Bull. Soc. Chim., 1911, **9**, 20—22.

Neutral solutions of nickel and cobalt salts produce with potassium chromate solution precipitates of hydrated basic chromates, $2NiO.NiCrO_4$ and $CoO.CoCrO_4$, respectively. The nickel compound, chocolate-brown in colour, is formed very slowly in the cold, even in concentrated solutions. To obtain a rapid precipitation it is necessary to heat to boiling. This reaction will show 0·000028 grm. of nickel. The cobalt compound differs from the one just described in being reddish-brown in colour, in having a strong tendency to adhere to glass vessels, and in being formed rapidly in the cold in solutions containing more than 2 grms. of cobalt per litre. From more dilute solutions the precipitation occurs on heating to boiling, and in this way 0·000032 grm. of cobalt has been detected. Both compounds are formed only in neutral solutions ; they are soluble in very weak acids and in ammonia. The recognition of nickel and cobalt in solutions containing both metals in about equal amounts is simple. The solution is treated in the cold with a 10 per cent. solution of potassium chromate. The cobalt precipitate, formed in the cold, is filtered off, and the filtrate heated to boiling to precipitate the nickel. If the solution of the metals contains very little nickel relatively to the cobalt, the filtrate from the cobalt chromate is, as before, heated to boiling, when a precipitate appears containing nickel with a little cobalt. This precipitate is washed free from potassium chromate solution, dissolved in ammonia in the cold, and evaporated by heating in a small basin. If nickel is present the basic chromate separates after a time with its characteristic colour, whilst the cobalt compound becomes dirty green. It is possible in this way to detect one part of nickel in presence of 100 parts of cobalt. If, in the solution of the metals, nickel preponderates greatly, *e.g.*, in the proportion of 50 : 1, the cobalt chromate does not separate in the cold. In this case the liquid is heated to boiling, and the basic chromate precipitate then formed is filtered, washed, dissolved in ammonia and evaporated as described above. The formation of a dirty green deposit shows the presence of cobalt.—J. H. L.

Tellurium ; Gravimetric determination of —— and alkalimetric determination of telluric acid. A. Rosenheim and M. Weinheber. Z. anorg. Chem., 1911, **69**, 266—269.

The aqueous solution, preferably contained in a covered beaker enclosed in a low-pressure autoclave, is heated to about 130° C. (corresponding to a pressure of 3—4 atmos.) for half an hour with a feebly ammoniacal 10 per cent. solution of hydrazine sulphate, and, on cooling, the tellurium, which is thus reduced to the metallic state, is collected in a Gooch crucible, washed with very dilute sulphurous acid, and dried at 105°—115° C., in a current of carbon dioxide. Telluric acid is determined by mixing the solution to be examined with a large excess of $N/10$ barium hydroxide (or $N/10$ sodium hydroxide mixed with barium chloride solution) and, without filtering from the precipitated barium tellurate ($BaTeO_4$), titrating the excess of alkali with $N/10$ oxalic acid, using phenolphthalein as indicator.—F. Sodn.

Calcium carbide ; Use of —— for determining moisture. I. Masson. Chem. News, 1911, **103**, 37—38.

The author recommends the use of calcium carbide for the determination of moisture (see this J., 1906, 780 ; 1910, 210) ; the acetylene produced is measured, or the increase of pressure is observed. The method has been adopted in Australia for the determination of moisture in sheep's wool (see Orme Masson, Proc. Soc. Chem. Ind. Victoria, 1909), and is recommended as suitable for use in the case of cotton, paper, fabrics, wood pulp, tobacco, flour, soils, minerals, coal, butter, cocoa, etc. The carbide should be standardised with a known quantity of water, although the yield of acetylene from a given quantity of commercial carbide under widely different methods of treatment is practically constant at 10·5 c.c. of gas at 0° C. and 760 mm. for every 18 mgrms. of water.—A. S.

Determining tar and tar-constituents in gas. Feld. *See* IIa.

Determination of tannin by means of casein. Nierenstein. *See* VI.

[*Acidimetric*] *assay of lactic acid.* Elvove. *See* VII.

Formation of acetaldehyde in the pyrogenic decomposition of oxalates. Ganassini and Scandola. *See* VII.

Analysis of ferro-uranium and ferro-zirconium. Trautmann. *See* X.

Standardisation of bullion and assay values. *See* X.

Separation of liquid (*unsaturated*) *from solid* (*saturated*) *fatty acids.* Falciola. *See* XII.

Reaction of turpentine oil, pine oil, and rosin spirit. Grimaldi. *See* XIII.

Determination of rubber as tetrabromide by Hübener's method. Becker. *See* XIV.

[*Tannin and leather analysis.*] *Methods of the American Leather Chemists' Association for* 1911. *See* XV.

Use of inferential methods as a control for the cane and juice weights. Savage. *See* XVII.

Methods of chemical control for cane sugar factories adopted by the Hawaiian Sugar Chemists' Association. *See* XVII.

Determination of the freezing point depression as a means of controlling the composition of vinegar. Silvermann. *See* XVIII.

Degree of accuracy of determination of proteins in milk by aldehyde titration. Richmond. *See* XIXa.

Detecting Melampyrum arvense L., Lolium temulentum L., and Lathyrus Aphaca, L., in cereal flours. d'Ippolito. *See* XIXa.

Determination of small quantities of ammonia. Artmann. *See* XIXb.

Determining nicotine in concentrated tobacco extracts. Schröder. *See* XIXb.

Fungicidal properties of liver of sulphur. Foreman. *See* XIXb.

Tests for cocaine and other anæsthetics. Hankin. *See* XX.

Toxicological detection of colchicine. Fuehner. *See* XX.

New reaction of cupréine. Denigès. *See* XX.

The pinene-test for lemon oil. Parry. *See* XX.

Iodometric determination of antipyrine in migränin. Sleeswijk. *See* XX.

Determining formaldedyde. Herrmann. *See* XX.

Patent.

Colour of liquids ; Apparatus for use in determining the ——. J. W. Lovibond, Salisbury. Eng. Pat. 14,926, June 21, 1910.

In this modification of Lovibond's tintometer the liquid is placed in a container tube (closed by a flat plate of transparent glass) which is supported in alignment with one of the sighting tubes of the apparatus, whilst the coloured standard glasses are placed beneath the other sighting tube in the usual manner. The apparatus, which is used in a more or less vertical position, has a single eye-piece for comparing the tint of the column of liquid with the standard colour scale, and by progressively increasing the quantity of liquid in the container tube according to the depths marked upon a scale on the tube, the "specific colour curve" may be determined for increasing densities. The light is reflected upwards through the liquid by means of a reflector, with a standard "dead-white" surface, which is inclined at an angle of 45° to the line of sight, and may be folded out of the way when the instrument is not in use.—C. A. M.

XXIV.—MISCELLANEOUS ABSTRACTS.

Swelling and mixing ; Analogy between ——. J. R. Katz. Koninkl. Akad. van Wetensch. Amsterdam, Wisk. en. Natk. Afd., 1910, **19**, 649—666. Chem. Zentr., 1911, **1**, 192.

The author determined the amount of heat developed by the absorption of different quantities of water by 1 grm. of cellulose, casein, "artificial starch," and wood-fibre respectively and plotted curves correlating this heat of imbibition with the quantity of water absorbed. Curves were also plotted representing the heat developed in mixing sulphuric acid, glycerol, and phosphoric acid respectively with different proportions of water. It was found that in all cases, in both sets of experiments, curves of very similar hyperbolic form were obtained. In another series of experiments, gelatin, casein, cellulose, amorphous calcium phosphate, gum arabic, serum albumin, peptone, and amorphous silicic acid respectively were swollen with water and the relation between the vapour pressure and the quantity of water absorbed determined, similar determinations being made for mixtures of sulphuric acid, glycerol, and phosphoric acid respectively with water. In this case also the two sets of S-shaped curves obtained were very similar in appearance. In a third series of experiments the volume-contraction was determined for swollen casein and wheat starch and for mixtures of sulphuric acid, glycerol, and phosphoric acid with water, and here again the two sets of curves (hyperbolic) were very similar.—A. S.

Trade Report.

British India. Revised Tariff valuations for 1911.

A Customs notification has been issued, revising the tariff valuations fixed for various goods imported into India, with effect from Jan. 1st, 1911. The notification is reprinted in the issues of the Board of Trade Journal for Jan. 19th and 26th, and Feb. 2nd and 9th.

Books Received.

The Journal of the Municipal School of Technology, Manchester. Vol. 3.

This volume contains 34 papers.

Review of the Trade of India in 1909-10. [Cd. 5384.] Wyman and Sons, Fetter Lane, E.C. Price 1s. 1d.

Foolscap volume containing a map and 92 pages relating to the trade of India for the year ended March 31st, 1910, with corresponding figures for the two preceding years.

Washing and Coking Tests of Coal at the Fuel-Testing Plant, Denver, Colo. July 1, 1908, to June 30, 1909. By A. W. Belden, G. R. Delamater, J. W. Groves, and K. M. Way. U.S. Depart. of the Interior, Bureau of Mines. Bulletin No. 5. Government Printing Office, Washington.

This bulletin deals with the tests made at Denver, with the object of determining the possibility of improving the quality of coals for coking, by washing, and also determining the feasibility of making coke in beehive ovens from these coals.

U.S. Department of Agriculture. Report of the Chemist for 1910. By H. W. Wiley. Government Printing Office, Washington.

Die Anlauffarben. Eine neue Methode zur Untersuchung opaker Erze und Erzgemenge. Von Dr. Max Leo. Theodor Steinkopff's Verlag. Dresden, 1911. Price M. 2.

8vo. volume, pamphlet style, containing 68 pages of subject matter, with three coloured plates and a table, also a bibliographic index and an alphabetical index of subjects. The subject matter is classified as follows :—I. Definition of the term "Optical separation of opaque minerals." II. Methods of optical distinction so far adopted. III. Corrosion methods. IV. Electro-colourimetric indications, etc. V. Superficial colour shades. VI. Relation of these colours to crystalline structure, and examples. VII. Distinction between positive and negative pyrites, and their distinctive crystalline structure. VIII. Colour shades of different minerals, etc. IX. Colouring superficially by solvents. X. Colouring by saline reactions. XI. Behaviour of the ore on colouring when treated in bulk. XII. Electrolytic colouring, etc. XIII. Influence of intimate mixture of the ores. XIV. Colouration results with pyrites, pyrrhotite, Barnhardtite, and cuban. XV. Contribution to a system of minerals. XVI. System of nickel- and cobalt ores.

Die Kristallgruppen nebst ihren Beziehungen zu den Raumgittern. Von Dr. E. Sommerfeldt, Professor der Mineralogie an der Universität Tübingen. Theodor Steinkopff's Verlag, Dresden, 1911, Price M. 3.

8vo. volume similar to preceding, containing 79 pages of subject matter illustrated with 50 figures, and 14 stereoscopic plates. The text is subdivided into three parts :—I. The introduction, with general description of the six crystallographic systems, etc. II. The holohedral crystalline systems (based on Bravais' theory of spacing). III. The crystalline systems, spaced in accordance with the foregoing theory.

DIE VERWERTHUNG DES LUFTSTICKSTOFFS MIT HILFE DES ELEKTRISCHEN FLAMMENBOGENS. Vortrag gehalten am 23 September, 1910, auf der 82'ten Versammlung Deutscher Naturforscher und Ärtzte in Königsberg i. Pr., von PROF. DR. J. ZENNECK. S. Hirzel's Verlag, Leipzig, 1911. Price M. 1.60.

PAMPHLET, bound, and of 8vo. size, containing 29 pages of subject matter, and 29 illustrations.

THE MINERALOGY OF ARIZONA. By F. N. GUILD, Professor of Chemistry and Mineralogy, University of Arizona. The Chemical Publishing Co., Easton, Pa., U.S.A. 1910. Price $1.00. Williams and Norgate, 14. Henrietta Street, Covent Garden, London, W.C.

SMALL 8vo. size, with 99 pages of subject matter, and an alphabetical index. The subject matter is subdivided into the following groups :—I. Native elements. II. Sulphides, arsenides, etc. III. Sulpho salts, sulpharsenides, etc. IV. Chlorides, fluorides, bromides, etc. V. Oxides. VI. Oxygen salts. VII. New minerals discovered in Arizona.

MERCK'S INDEX. 3rd. Edit. E. MERCK. 16, Jewry Street, E.C., 1911. Price 6s. 6d.

LARGE 8vo. volume, containing 392 pages of subject matter. It forms an index of drugs, fine chemicals, and preparations, etc., alphabetically arranged, and to each being given its special properties, functions, formula or composition. This is included under SECTION I., and fills pages 1—274. SECTION II. is devoted to a series of chemicals and preparations for analysis and microscopical work. These are also alphabetically arranged, to each being assigned its composition, formula, properties and chief functions (pages 277—288). Pages 290—292 are occupied with an alphabetical list of indicators, colouring matters, etc., for analytical and microscopical purposes, alphabetically arranged, and particulars, functions, etc., assigned to each. SECTION III. is devoted to Drugs. This fills pages 299—363, is alphabetically arranged, and each drug is briefly described under the following classified heads :—(i.) Etymology, (ii.) Origin, (iii.) Family, (iv.) Common name, (v.) Occurrence, (vi.) Means of distinction or determination, (vii.) Use. SECTION IV., Minerals (pages 367—376). Minerals, alphabetically arranged, and briefly treated under the heads (i.) Etymology, (ii.) Chemical composition, (iii.) Use.

MICRO-ORGANISMS AND FERMENTATION. By ALFRED JORGENSEN. Translated by S. H. DAVIES, M.Sc. Fourth Edition, completely revised. Charles Griffin and Company, Limited. Exeter Street, Strand, London. 1911. Price 15s. net.

8vo. volume, containing 420 pages of subject matter, with 101 illustrations, a bibliographic list filling 60 pages, and an alphabetical index of subjects. The subject matter is arranged in the following classes :—I. Microscopical and physiological examination. II. Biological examination of air and water. III. Bacteria. IV. Moulds. V. Yeasts. VI. The pure culture of yeast on a large scale.

THE CHEMISTRY AND TESTING OF CEMENT. By CECIL H. DESCH, D.Sc. ; Ph.D. Graham Young Lecturer in Metallurgical Chemistry in the University of Glasgow. Edward Arnold, 41 and 43, Maddox Street, Bond Street, London, W. 1911. Price 10s. 6d. net.

8vo. volume, containing 260 pages of subject matter with 18 illustrations, and alphabetical indexes of subjects and authors. The subject matter is classified according to the following plan :—I. History of calcareous cements. II. Raw materials and processes of manufacture of cements. III. Chemical components of cements. IV. Constitution of cements. V. Setting and hardening. VI. Physical properties. VII. Mechanical properties, Concrete and artificial stone. VIII. Resistance of cement and concrete to destructive agents. IX. Chemical analysis of cements. X. Revised British Standard Specification, 1910.

*New Books.

Bau, Dr. A. : Bierbraurei. (IV. 118 S. m. 47 Abbildgn.) 8°. Leipzig. B. G. Teubner. 1911. Cloth M. 1.25.

Bertolo, P. Guida di analisi chimica qualitativa. 2a ediz. Catania. 8°, p. 112. 1910. Lire 4.

Blücher, H. : Modern industrial chemistry. From the German translated by J. P. Hillington, M.A. (XVI, 779 S. m. 1 Taf.) gr. 8°. Berlin. F. Siemenroth. 1911. M. 25.

Campetti, A. : Compendio di fisica-chimica. Milano. 8°, p. 390. U. Hoepli. 1910. Lire 10.

Changrin, E. : Chimie générale appliquée à l'agriculture. 3e édition. Paris. Hachette et Cie. 1910. 2.50 fr.

Chemie, Methoden d. organ. Hrsg. v. Weyl. 13 Lfg. Lpzg., G. Thieme. 1910. M. 2.60.

Classen, H. : Beet sugar manufacture ; author. tr. from the third German ed. by W. T. Hall. N. Y., Wiley, 1910. c. 15+ 343 p. 8°, cl., $3 net.

Cohn, Geo. : Die Pyrazolfarbstoffe. Lex. 8°, VII, 176 S. Stuttgart, F. Enke. 1910. M. 5.

Crémier, V. : La photographie des couleurs par les plaques autochromes, in- 16, Paris, H. Dunod et E. Pinat. 1911: 2 fr. 75.

Dejonghe, G. : Technologie sucrière. T. I. Fabrication du sucre de betteraves, 368 fig., in-8° Paris. H. Dunod et E. Pinat. 1910. 15 fr.

Electro-Plating and Electro-Refining of Metals (The) Being a new edition of Alexander Watts' Electro-Deposition. Revised and largely re-written by Arnold Philip. 8vo, pp. 704. C. Lockwood. London. 1911. Net 12s. 6d.

Elektrochemie, Monographien üb. angewandte. Hrsg. v. Ob.-Ingen. Chefchem. Dir. Vikt. Engelhardt. gr. 8°. Halle a. S. 1910.

38. Bd. *Ebert*, Willy, u. Chem. Jos. Nussbaum, Hypochlorite u. elektrische Bleiche. Praktisch angewandter Tl. (XII, 367 S. 54 Fig. u. 33 eingedr. Tab). M. 18.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding list can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

Applications.

1123. Mueller. Arrangement of filling for cooling towers, etc. Jan. 16.

1179. Bone, Wilson, and McCourt. Furnaces. Jan. 17.

1241. Humphrey. Methods of compressing gases and utilising the expansive force thereof. Jan. 17.

1311. Leigh. Apparatus for separating solids and liquids.* Jan. 18.

1327. Mackey. Apparatus for treating liquids containing finely divided matter in suspension. Jan. 18.

1518. Dreaper. Treatment of gases. Jan. 20.

1628. Schou. Apparatus for absorbing gases or vapours. [Swed. Appl., Jan. 24, 1910.]* Jan. 21.

1655. Morton. Apparatus for mixing or beating liquids or semi-liquids. Jan. 23.

1741. Milch, and Maschinenfabr. Gans und Co. Drying animal matters and depriving them of fat.* Jan. 23.

1832. Liese. Recovery of heat from waste industrial water. [Ger. Appl., Jan. 26, 1910.]* Jan. 24.

Complete Specifications Accepted.

16,523 (1909). Manlove, Alliott, and Co., and Liversedge. Apparatus for evaporating, drying, distilling, or crystallising. Jan. 25.

4789 (1910). Summers. *See under* XIII.

20,945 (1910). Paton. Centrifugal machines. Jan. 25.

29,737 (1909). Normandy. *See under* XIX.

26,231 (1910). Jones. Trays for filter-presses. Feb. 1.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION: HEATING; LIGHTING.

Applications.

1161. Deutsche Gasglühlicht A.-G. Drawn wires suitable as illuminating bodies for electric incandescent lamps. [Ger. Appl., Aug. 13, 1910.]* Jan. 16.

1186. Tattersall. Retort for producing charcoal.* Jan. 7.

1313. Fabry. Cooling coke-oven gas.* Jan. 18.

1384. Fraser. Compound fuel. Jan. 19.

1687 and 1688. Tanne and Oberländer. *See under* III.

1706. Deuts. Hüttenbau-Ges. Regenerative retort furnaces. [Ger. Appl., Jan. 31, 1910.]* Jan. 23.

1847. Milbourne and Turner. Gas retorts. Jan. 24.

2003. Cowper-Coles. Manufacture of smokeless fuel briquettes. Jan. 26.

2042. Wolf. *See under* VII.

2138. Hutchins. Gas producers.* Jan. 27.

2253. Folliet-Mieusset. Gas producers.* Jan. 28.

Complete Specifications Accepted.

1900 (1910). Gutehoffnungshütte Akt.-Verein. Gas producers. Feb. 1.

1906 (1910) Kros. Regenerative coke ovens. Feb. 1.

7704 (1910). Benninghoff and Klönne. Coke ovens and retort furnaces. Jan. 25.

11,459 (1910). Williams. Manufacture of incandescent mantles for gas lighting. Feb. 1.

12,296 (1910). Scott. Gas purifiers. Feb. 1.

12,894 (1910). Dempster and Sons, Ltd., and Broadhead. Gas purifiers. Feb. 1.

25,739 (1910). Higgins and Kemp. Spirit for use in internal combustion engines or in making illuminating gas. Feb. 1.

III.—TAR AND TAR PRODUCTS.

Applications.

1687. Tanne and Oberländer. Separation of solid hydrocarbons from naphtha residues and tars. [Addition to No. 27,116 of 1909.]* Jan. 23.

1688. Tanne and Oberländer. Separation of solid hydrocarbons from naphtha residues and tars. [Ger. Appl., Oct. 27, 1909.]* Jan. 23.

1728. Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of anthranol.* Jan. 23.

2137. List and Schmidt. Process of making coal-tar hydrocarbons soluble in water and soaps obtained thereby.* Jan. 27.

IV.—COLOURING MATTERS AND DYES.

Applications.

1235. Kalle und Co. Manufacture of azo colouring matters. [Ger. Appl., Feb. 14, 1910. Addition to No. 8127 of 1910.]* Jan. 17.

1441. Newton (Bayer und Co.). Manufacture of dyes suitable for development. Jan. 19.

1729. Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of brown sulphurised vat dyestuffs.* Jan. 23.

1730. Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of disazo dyestuffs.* Jan. 23.

2233. Act.-Ges. f. Anilinfabr. Manufacture of yellow wool dyestuffs. [Ger. Appl., Sept. 23, 1910.]* Jan. 28.

Complete Specifications Accepted.

933 (1910). Newton (Bayer und Co.). Manufacture of azo dyestuffs. Jan. 25.

1212 (1910). Newton (Bayer und Co.). Manufacture of dyestuffs of the anthracene series. Jan. 25.

1623 (1910). Bennett. *See under* XIX.

1807 (1910). Meister, Lucius, und Brüning. Manufacture of dyestuffs of the anthraquinone series. Feb. 1.

9633 (1910). Meister, Lucius, und Brüning. Manufacture of yellow monoazo dyestuffs. Jan. 25.

11,172 (1910). Newton (Bayer und Co.). Manufacture of azo dyestuffs. Feb. 1.

11,473 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds and colouring matters of the anthracene series. Feb. 1.

12,139 and 12,140 (1910). Newton (Bayer und Co.). *See under* VI.

22,014 (1910). Meister, Lucius, und Brüning. Manufacture of green to black vat dyestuffs. Feb. 1.

22,780 (1910). Act.-Ges. f. Anilinfabr. Manufacture of brominated anthraquinone derivatives applicable as vat dyestuffs. Feb. 1.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

1436. Soc. Anon. pour la Fabr. de la Soie de Chardonnet. Treatment of solutions of cellulose. [Fr. Appl., Aug. 10, 1910.]* Jan. 19.

1539. Meister, Lucius, und Brüning. Manufacture of new effect papers. [Ger. Appl., Feb. 25, 1910.]* Jan. 20.

1556. Newton (Bayer und Co.). Manufacture of dyed acidyl derivatives of cellulose. Jan. 20.

2258. Carozzi. Process for dry cleaning wool.* Jan. 28.

Complete Specification Accepted.

13,692 (1910). Lindsay. Pyroxylin compounds and their manufacture. Feb. 1.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

1247. Rachou and Chaumat. Process and apparatus for indigo dyeing. [Fr. Appl., Jan. 18, 1910.]* Jan. 17.

1303. Marr. Apparatus for drying sized warps and yarns. Jan. 18.

1556. Newton (Bayer und Co.). *See under* V.

1727. Müller. Bleaching process. [Addition to No. 9369 of 1910.]* Jan. 23.

1941. Sumner. Apparatus for bleaching and for preparing bleaching, deodorising, and disinfecting solutions.* Jan. 25.

1974. Hey (Goetz). Apparatus for dyeing, bleaching, and otherwise treating fibrous substances. Jan. 25.

2232. Act.-Ges. f. Anilinfabr. Production of black dyeings on the fibre. [Ger. Appl., April 14, 1910.]*

Complete Specifications Accepted.

1799 (1910). Brückner. Rendering linen waterproof and washable. Feb. 1.

1814. (1910). Marr. Apparatus for drying yarn, etc. Feb. 1.

11,182 (1910). Eycken. Device for dyeing pieces of fabric. Feb. 1.

12,139 (1910). Newton (Bayer und Co.). Production of azo dyes on the fibre. Jan. 25.

12,140 (1910). Newton (Bayer und Co.). Production of colours on the fibre. Jan. 25.

15,407 (1910.) Derreumaux-Bulteau. Means for dyeing fabrics. Feb. 1.

17,331 (1910). Brierley and Melling. Machines for bleaching, washing, and treating textile fabrics. Feb. 1.

18,356 (1910). Gessner. Finishing woollen textile fabrics. Jan. 25.

25,007 (1910). Act.-Ges. f. Anilinfabr. Production of fast dyeings. Feb. 1.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

1143. Le Nitrogène Soc. Anon. Recovering nitrous vapour diluted in a mixture of oxygen and nitrogen. [Swiss Appl., Jan. 15, 1910.]* Jan. 16.

1148. Harger. Manufacture of compounds containing nitrogen, hydrogen, and carbon. Jan. 16.

1240. Gordon. Manufacture of sulphuric acid. Jan. 17.

1359. Gerlache. Manufacture of metallic amides. Jan. 18.

1386. Kuhr, George, and Jobling. Production of liquid hydrogen. Jan. 19.

1535. Wedge. Treatment of sulphides and sulphates. [U.S. Appl., Jan. 20, 1910.]* Jan. 20.

1626. Chem. Werke vorm. H. Byk. Manufacture of calcium perborate. [Ger. Appl., Jan. 22, 1910.]* Jan. 21.

1750. Williams. Production and fixing of ozone. Jan. 24.

2042. Wolf. Manufacture of ammonium sulphite and sulphate from coke-oven gases.* Jan. 26.

2116. Devaucelle. Manufacture of ammonia.* Jan. 27.

2135. Ashcroft. Production of cyanamides and cyanides of the alkali metals.* Jan. 27.

Complete Specifications Accepted.

23,976 (1909). Phillips and Bulteel. Production of oxidised nitrogen and ammonia. Jan. 25.

2440 (1910). Bessler, Waechter, and Co., and Rouse. Preparation of soluble alkaline silicates containing ferric oxide. Feb. 1.

11,878 (1910). Lane. Construction and working of hydrogen producing apparatus. Jan. 25.

22,506 (1910). Stock. Manufacture of pure tetraphosphorus trisulphide. Feb. 1.

VIII.—GLASS; CERAMICS.

Applications.

1277. Hague. Manufacture of artificial corundum abrasives from aluminous earths and ores. Jan. 18.

1362 to 1364. Burckhardt. Manufacture of quartz ware. Jan. 18.

1859. Kersten. Preparing mixtures for the manufacture of glass.* Jan. 25.

2038. Burckhardt. Manufacture of quartz. Jan. 26.

2039. Burckhardt. Manufacture of fused quartz. Jan. 26.

2109. Frost, and Harvey Frost and Co., Ltd. Emery and similar abrading materials. Jan. 27.

IX.—BUILDING MATERIALS.

Application.

1439. Thom. Production of a silicate of lime stone. Jan. 19.

Complete Specification Accepted.

24,483 (1910). Haltenberger and Berdenich. Impregnation of timber. Feb. 1.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

1131. Buddeus. Process and apparatus for roasting fine ores.* Jan. 16.

1134. Sieurin. Reduction of ore.* Jan. 16.

1211. Appellqvist and Tyden. Separating the constituents of rock and the like. [Swed. Appl., Feb. 5, 1910.]* Jan. 17.

1267. Renwick. Processes for roasting sulphide ores.* Jan. 17.

1275. Sulman, and Metals Extraction Corporation, Ltd. Treatment of complex sulphide ores containing zinc. Jan. 17.

1477. Wedge. Desulphurising ores. [U.S. Appl., Jan. 20, 1910.]* Jan. 19.

1703. Türke and Hofheimer. Means for regenerating metals.* Jan. 23.

1724. Price. Furnaces for melting, smelting, refining, etc. Jan. 23.

1819. Thompson (A.-G. Mix und Genest). Pickling aluminum and its alloys prior to galvanising or coating.* Jan. 24.

1813. Poldihütte Tiegelguszstahlfabrik. Nickel-steel alloy for firearms. [Austrian Appl., June 25, 1910.]* Jan. 24.

1958. Sulman, and Metals Extraction Corporation. Recovery of zinc and other metals from solution. Jan. 25.

2004. Cowper-Coles. Rendering iron and steel non-corrosive. Jan. 26.

2250. Folliet-Mieusset. Furnaces for treating zinc and zinc compounds.* Jan. 28.

Complete Specifications Accepted.

23,499 (1909). British Thomson-Houston Co. (General Electric Co.). Treatment of tungsten to facilitate working. Jan. 25.

4466 (1910). Eldred. Platinum clad metals. Feb. 1.

5712 (1910). Schoop. Coating surfaces with metal, and soldering and uniting metals. Feb. 1.

9818 (1910). Gutensohn. Recovery of zinc from ores, refuse, and waste materials. Jan. 25.

11,839 (1910). Marks (Armstrong & Co.). Cementation of articles of iron, steel, and steel alloys. Feb. 1.

13,012 (1910). Thompson (Mix und Genest Telephon u. Telegraphenwerke). Pickling aluminium and its alloys prior to coating. Jan. 25.

17,632 (1910). Sinding-Larsen. Treatment of titaniferous iron ores. Jan. 25.

22,204 (1910). Langbein-Pfanhauser-Werke. Manufacture of sheets, wire, etc., of electrolytic iron. Feb. 1.

XI.—ELECTRO-CHEMISTRY.

Applications.

1544. Heraeus Ges., and Frenzen. Electric furnaces. [Ger. Appl., Jan. 20, 1910].* Jan. 20.

1609. Reid. Electric furnaces.* Jan. 21.

1746. Von Koch. Production of continuous constant electric discharges in gases. [Swedish Appl., March 26, 1910.]* Jan. 23.

Complete Specification Accepted.

1558 (1910). Naylor. Regenerating and improving lead electrodes of secondary batteries. Jan. 25.

XII.—FATS; OILS; WAXES.

Applications.

1741. Milch. and Maschinenfabr. Gans und Co. *See under* I.

2137. List and Schmidt. *See under* III.

2186. Adams. Candles. Jan. 28.

Complete Specification Accepted.

2266. (1910). Boardman. Manufacture of soap. Feb. 1

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Application.

1980. Leishman. Compound for use as a substitute for boiled linseed oil, etc., in varnishes, paints, linoleum, and the like.* Jan. 26.

Complete Specification Accepted.

4789 (1910). Summers. Apparatus for drying white lead, colour powders, and other materials. Jan. 25.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

1124 and 1125. Newton (Bayer und Co.). Manufacture of new caoutchouc substances. Jan. 16.

1445. Heinemann. Synthetic caoutchouc. Jan. 19.

1723. Tolkien. Substitute for india-rubber and its manufacture. [Addition to No 23,755 of 1907.] Jan. 23.

Complete Specification Accepted.

17,645 (1910). Allsebrook and Docherty. Treating waste rubber to reform it or to produce vulcanite, ebonite, etc. Feb. 1.

XV.—LEATHER; BONE; HORN; GLUE.

Application.

2185. Byrom. Process of tanning leather. Jan. 28.

XVI.—SOILS; FERTILISERS.

Application.

1876. Mitchell. Soil and manure sterilisation and plant refuse destruction. Jan. 25.

XVII.—SUGARS; STARCHES; GUMS.

Application.

2022. Lagrange. Continuous conversion of refinery treacle into fine grains or crystals.* Jan. 26.

XVIII.—FERMENTATION INDUSTRIES.

Complete Specification Accepted.

1949 and 17,025 (1910). Harrison. Combined mash tun and wort back for use in brewing. Jan. 25.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

1122. Pusey and Fleming. Preservation of milk. [Australian Appl., Jan. 20, 1910.]* Jan. 16.

1170. Harris (Knox and Rogers). Germicidal vapours and the like. Jan. 16.

1941. Sumner. *See under* VI.

2264. Hughes. Stirling, and Thwaites. Refuse destructor furnace.* Jan. 28.

Complete Specifications Accepted.

29,737 (1909). Normandy. Apparatus for water distilling and filtering. Feb. 1.

1623 (1910). Bennett. Treatment of saffron for flavouring or colouring purposes. Feb. 1.

7466 (1910). Herendeen. Flour and process for making the same. Jan. 25.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

1555. Newton (Bayer und Co.). Manufacture of pharmaceutical products. Jan. 20.

1704. Johnson (Badische Anilin und Soda Fabrik). Manufacture of isoprene. Jan. 23.

Complete Specifications Accepted.

815 (1910). Gelhaar and Carlson. Production of compounds of guanidine. Jan. 25.

21,414 (1910). Kalle und Co. Manufacture of therapeutic preparations. Feb. 1.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Complete Specification Accepted.

4208 (1910). Dawson, Finlay, and Thames Colour Plate, Ltd. Colour screens for colour photography. Feb. 1.

XXII.—EXPLOSIVES; MATCHES.

Application.

1237. Gregorini. High explosive. [Ital. Appl., Jan. 17, 1910.]* Jan. 17.

XXIII.—ANALYTICAL PROCESSES.

Application.

1683. Sanders, and Sanders, Rehders, and Co. Apparatus for analysing gases. Jan. 23.

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Birmingham Section.

Meeting held at Birmingham University, on Thursday, October 20th, 1910.

DR. T. SLATER PRICE IN THE CHAIR.

THE ESTIMATION OF SMALL QUANTITIES OF LEAD IN BEER.

BY ARTHUR W. KNAPP, B.SC., F.I.C.

The possible source of this impurity which led to this investigation was the lead service-pipe. In recent years, I am informed, these are generally tin-washed or lined with block tin. It is still customary to avoid drinking the beer which has stood in the pipe all night, as it is stale and is thought to contain lead. Carbon dioxide may cause the solution of the lead, and the risk is increased by the acidity of the beer. The following is an account of experiments performed in search of a satisfactory method of estimation.

Qualitative.—10 c.c. of the beer are diluted to 50 c.c. in a Nessler glass, and 5 c.c. of dilute acetic acid (roughly deci-normal) and 3 c.c. of a saturated solution of sulphuretted hydrogen are added. Darkening is readily observed when anything above ½ a grain of lead (or ¾ of a grain of copper or tin) per gallon is present.

Quantitative.—Any difficulty that this presents is due to the fact that the amount of lead is so small that it can only be estimated by a colorimetric method. Hence it is necessary first to obtain a colourless or almost colourless solution. Several attempts were made to accomplish this:—

1. *Electrolytic deposition.* The results were very low (see Table) and the working out of the correct conditions appeared laborious.

2. (*a*) and (*b*). *Precipitation of the lead as sulphide, filtration and solution of the precipitate.* When ammonia solution and ammonium sulphide are added to beer, a precipitate is produced. This was left all night to settle, in the hope that it would completely bring down the lead sulphide. After filtration the precipitate was dissolved in hydrochloric acid and the lead estimated with sulphuretted hydrogen. The results were low, chiefly because the lead had been imperfectly precipitated by the ammonium sulphide and passed through the filter, colouring the filtrate.

3. *Attempted destruction of the coloration in beer without ignition.* Heating with nitric acid, or with mixtures of nitric and sulphuric acids, as suggested by F. W. Richardson (this J., 1902, 21, 901), Lander and Winter, etc., greatly reduces the colour. A small quantity of a yellow liquid is obtained, but on dilution and neutralisation, the solution becomes as brown as the original beer.

An attempt was made to get more complete oxidation by heating in a Kjeldahl flask with nitric and sulphuric acids for two days. Even after this period the solution remained yellow, so that ignition seems advisable.

4. (*a*) and (*b*). *Ignition with sulphuric acid,* either with or without previous treatment with nitric acid, was tried with the intention of producing an ash in which the lead existed as lead sulphate. The lead sulphate was dissolved out of the ash with an alkaline solution of ammonium acetate and estimated colorimetrically with sulphuretted hydrogen. The results were low, possibly because of the formation of lead phosphate and the difficulty of completely removing the lead from the ash.

6. *Process adopted.* The following method was evolved from Allen's process for estimating heavy metals in canned foods (Allen, IV., p. 295, 1898). 100 c.c. of beer are evaporated to about 20 c.c. in a porcelain dish, which is as large as will conveniently go into a muffle. 10 c.c. of nitric acid are carefully added and the evaporation continued until there is about 4 c.c. of a viscous liquid. 1 grm. of magnesia is well mixed with the syrup and the whole dried and ignited in an open muffle till the ash is white. The ash is dissolved in 15 c.c. of dilute nitric acid (roughly three times normal strength), neutralised with dilute ammonia solution, made acid with 10 c.c. roughly normal acetic acid and diluted to 100 c.c. The small amount of insoluble matter is allowed to settle, and 50 c.c. of this solution in a Nessler glass is treated with 3 c.c. saturated sulphuretted hydrogen water and compared with standards put on at the same time.

To make the standard solution of lead, a strong solution containing 1·831 grms. of lead acetate, and 6 c.c. of glacial acetic acid, per 100 c.c. is first prepared. 1 c.c. of this solution is diluted to 100 c.c. to obtain the standard solution (1 c.c.=0·0001 grm. of lead).

Notes on the process.—Experiments showed (1) That the heating in the muffle caused no appreciable loss of lead. (2) That the presence of nitrate and acetic acid did not interfere with the colouration obtained with sulphuretted hydrogen. (3) That any tin present did not interfere with the estimation of the lead; presumably it is converted into the insoluble dioxide. (4) That the presence of as little as 1 part of copper per 100,000 was indicated in the process by a faint blue when the ammonia solution is added. If the presence of copper were suspected, it might be estimated colorimetrically with potassium ferrocyanide in the solution obtained. (5) That caustic alkali, acetic acid, nitric acid, magnesia, etc., may contain traces of lead. For example, the nitric acid used contained 0·16 part of lead per 100,000, and one sample of heavy magnesia as much as 10 parts per 100,000 (compare C. A. Hill, Chem. and Drug., 1908, p. 796). Hence it is necessary to ascertain the amount of lead in the chemicals used. The amount of lead found in blanks varied from 0·0001 to 0·0002 grm., according to the chemicals used.

TABLE

Showing comparative results obtained by the above processes.

In all cases 100 c.c. of beer were taken to which 1 part of lead per 100,000 had been added. In all cases the lead was estimated colorimetrically with sulphuretted hydrogen.

Outline of Method.	Lead. Parts per 100,000. Actually present.	Total found.	after subtraction of blank.
1. *Electric current* passed for 2 hours through beer with 5 c.c. glacial acetic acid. Deposit dissolved in a few drops of nitric acid	1·0	0·3	—
2 (*a*). Precipitate obtained with *ammonium sulphide* dissolved in hydrochloric acid	1·0	0·4	—
2 (*b*). Precipitate obtained with *ammonium sulphide* dissolved in sulphuric acid, ignited, and extracted with ammonium acetate	1·0	0·4	—
3. Heated with 10 c.c. nitric acid and 25 c.c. sulphuric acid in *Kjeldahl* flask for 2 days	1·0	0·6	—
4 (*a*). Charred and ignited with 10 c.c. *sulphuric acid* and sulphate dissolved out with water	1·0	0·5	0·4
4 (*b*). Charred and ignited with hydrochloric acid and *potassium chlorate*, converted into sulphate, and extracted residue with ammonium acetate	1·0	0·6	—
5. Charred and ignited with various amounts of nitric and sulphuric acids and *magnesium oxide*, and dissolved residue in hydrochloric acid	1·0	0·8	0·7
6. Process adopted and described at length above .... (1)	1·0	1·1	0·9
(2)	1·0	0·9	0·8
(3)	1·0	0·8	0·7
(4)	1·0	0·9	0·8

The quantities of lead actually found in samples of beer, which had stood in pipes from 7 to 8 hours, were very minute.

In conclusion I wish to thank my chief, Mr. J. F. Liverseege, for suggestions and criticism given throughout the investigation.

Discussion.

Mr. F. H. Alcock asked if Mr. Knapp could say that the test tube contained lead and lead only. He did not approve of the hydrogen sulphide process. In the Pharmacopœia, for instance, they were told that the presence of lead was indicated by hydrogen sulphide; but he had proved that the greater part of that colouration was often due to copper. He thought it wrong to state that there was one-millionth part of lead until the absence of copper had been proved or it had been removed. Colouration *per se* was not evidence of the presence of lead.

Mr. Knapp said that of metals that gave a darkening with sulphuretted hydrogen, only lead, copper and tin might reasonably be expected to be present in beer. In his process the tin was not obtained in solution and hence did not interfere in the estimation. Any copper present increased the coloration obtained with sulphuretted hydrogen and if its presence were suspected, it should be estimated in the solution finally obtained (which contains ammonium nitrate) by the potassium ferrocyanide method.. Tartaric acid was used in the manufacture of beer, but he did not think that could be the chief source of the lead. He understood that 4 oz. of tartaric acid were used in preparing 10 gallons of finings; and 10 gallons of finings were used to clarify about 1,200 gallons of beer. So there was about 1 part of tartaric acid put into 50,000 parts of beer. Even if there were 1 grain of lead per lb. of tartaric acid, the amount of lead in the beer from this source would be far too small to estimate. No platinum vessels were used; a flat porcelain dish was employed throughout. He did not think the lead came from the ingredients but from the pipes. In many instances these were tin-lined or tin-washed. Even where they were tin-lined, there would be wiped-lead joints.

London Section.

Meeting held at King's College, London, on Monday, February 6th, 1911.

MR. E. GRANT HOOPER IN THE CHAIR.

CHEMISTRY OF THE LEAD CHAMBER PROCESS.

BY F. RASCHIG, PH.D.

If the question be asked what are the reactions which occur in the lead chambers one must be perfectly clear to begin with as to what are the substances which *enter* into the chamber-reactions. There is no doubt as to the sulphur compound concerned: it is sulphur dioxide, SO_2, which enters into reaction in the chamber with the reddish-yellow nitrous gases which arise from the oxidation of nitric oxide by atmospheric air. On the colourless nitric oxide itself sulphur dioxide has no action; and a simple experiment (nearly a century old, for Davy first tried it in 1812) will show us further, that sulphur dioxide alone will not react on the red nitrous gases either. In a dry litre flask with a glass stopper I place a glass bulb containing about half a gramme of liquid nitrogen peroxide, N_2O_4, fill the flask, by a delivery tube reaching to the bottom, with dry sulphur dioxide gas, stopper it, and shake vigorously. The bulb breaks: the flask fills with red vapours: but no reaction of sulphur dioxide on them is to be seen. Only if water be added does such a reaction begin. I open the flask—a small portion of its contents, through the increased pressure within, escapes—and quickly pour in 1 c.c. of water. Now I shake again, and we see that reaction is taking place; for the walls of the flask become covered with crystals like hoar frost, the yellow colour of the gas pales, and soon it becomes quite colourless. Now the pressure within has decreased; for when I ease the stopper a little, air rushes in, the contained gases redden, and the reaction sets in anew, as we see in a few seconds by the colour again disappearing. Thus the play can be set going again several times, but each time with lessened vigour till finally it ceases altogether. It can be aroused afresh, however, if I add 2 c.c. more of water; the crystals dissolve in this to sulphuric acid and evolve nitrous gases, which can be treated anew with sulphur dioxide, air and water as before.

In this way we imitate in the laboratory a cyclic process, typical of the formation of sulphuric acid in the chambers; in this process the chamber crystals, which we have seen, and of which the composition is $HNSO_5$ or constitutionally $O_2N.SO_3H$, nitrosulphonic acid, decompose in contact with water, according to the equation,

$$2HNSO_5+H_2O=2H_2SO_4+NO+NO_2 \quad (1)$$

yielding sulphuric acid and a mixture of nitric oxide and nitrogen peroxide, and these red gases react with sulphur dioxide, water and air to form again nitrosulphonic acid

$$NO+NO_2+H_2O+2SO_2+O_2=2HNSO_5 \quad (2).$$

We see from the equations as well as from the experiment that for the carrying out of the process not only sulphur dioxide and nitrous gases, but also oxygen (or air) and water are necessary. If these be available, then, practically as well as theoretically, we can convert sulphur dioxide completely into sulphuric acid by means of nitrosulphonic acid.

Is this really, however, the path followed by the series of reactions in the chamber process? Davy certainly believed it to be so, and till very recently his view, modified in details according to changes in the way of regarding the nature of the nitrous gases, was generally accepted. True, chamber crystals could never be observed whilst the chambers were working normally; but it was assumed that the nitrosulphonic acid dissolved in the chamber acid, preserving in solution all its characteristic chemical properties.

Examining Davy's theory, however, with a critical glance, sharpened by later knowledge of the sulphur-nitrogen compounds, we discover discrepancies which we cannot explain. In the first place, we must note that one is obliged to assume the existence in the chambers of places with varying water-content, places poor in water, where the chamber crystals can be formed according to equation (2), and places rich in water where they can be destroyed again, according to equation (1). Such variations in the distribution of water are not unlikely in chambers where the present methods of blowing in steam or injecting spray are adopted; but sulphuric acid can be made if, instead of water, sulphuric acid itself, a little weaker than the final product of the chamber, be introduced. There can be no question of spots poor or rich in water. Besides, we certainly know that a vigorous formation of sulphuric acid, equal to almost one seventh of the whole production, takes place in the Glover tower. One cannot assume an alternation of places rich and poor in moisture in the Glover tower; yet here the formation of sulphuric acid, calculated per cubic metre of reaction-space, is far greater than in the chambers.

Another phenomenon which will not fit in with the old theory is the colour of the chamber gases. A mixture of nitric oxide and nitrogen peroxide, such as would be produced in reaction (1), is bright yellow. The chamber gases as they leave the Glover tower, however, are colourless, and in the first portion of the chambers, where the reaction is most vigorous, they show but a faint colour. This is a sign that they contain here far more nitric oxide than corresponds to the relation $NO+NO_2$. The old theory gives us no explanation of the presence of such high proportions of nitric oxide.

And finally, a reaction of nitrosulphonic acid has lately* been closely studied, from which it appears that this substance dissolves without decomposition only in highly concentrated sulphuric acid, and that in acids of the concentrations met with in the chambers and in the Glover tower it no longer exists, but is decomposed into sulphuric acid and nitrous acid according to the equation

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* Z. angew. Chem. 1907, **20**, 718.

$$HNSO_5 + H_2O = H_2SO_4 + HNO_2.$$

Here is a decinormal solution of nitrosulphonic acid, made by dissolving 6·9 grms. of well-dried sodium nitrite in 95 per cent. pure sulphuric acid and making up to a litre. I place 100 c.c. of this colourless solution in a 200 c.c. flask, add a drop of metallic mercury, and shake. After half a minute the acid becomes coloured a fine sky-blue. I can now pour off the liquid from the mercury, and if I shake further, there begins the evolution of a colourless gas which reddens in the air—of nitric oxide, in fact. On shaking long enough, the acid loses its colour again. All the nitrosulphonic acid has been decomposed, according to the equation

$$HNSO_5 + H = H_2SO_4 + NO,$$

into nitric oxide and sulphuric acid. This operation, in which the mercury serves as a reducing agent, is carried out every time one determines the nitrogen-content of nitrous acids, nitre, explosives, etc., in Lunge's nitrometer; and the blue coloration has often been observed. We can understand from the experiment shown, what sort of chemical compound it is which causes this blue coloration, for we saw that it arose from the reaction of a reducing agent, mercury, upon nitrosulphonic acid, and that it disappeared again with production of sulphuric acid and nitric oxide. It must therefore have the composition H_2NSO_5; for only a body of this composition can be produced by the action of hydrogen on nitrosulphonic acid

$$HNSO_5 + H = H_2NSO_5$$

and then decompose into nitric oxide and sulphuric acid

$$H_2NSO_5 = H_2SO_4 + NO.$$

This composition is confirmed by other investigations, into which I will not now enter. I have called the blue substance "Nitrosisulphonic acid." It is a very unstable substance, which it has not yet been possible to isolate in a pure state. Even in 95 per cent. sulphuric acid it is not permanent; as we have seen, it is completely decomposed on shaking for some time. On this complete decomposition depends, in fact, the possibility of determining nitrogen in Lunge's nitrometer. If the liquid is not shaken, the decomposition is less rapid, but is ultimately no less complete. In less concentrated sulphuric acid the substance decomposes more rapidly: in fact instantaneously, if the sulphuric acid solution is poured into water. It forms a copper salt, however, which is much more stable than the acid itself, and is coloured so deeply blue that its formation can serve as an indication of the existence of minute quantities of the acid which themselves would give no visible coloration. To 50 c.c. of the bright blue solution of nitrosisulphonic acid, made from $N/10$ nitrosulphonic acid by means of mercury, I add 5 c.c. of cold saturated solution of copper sulphate, and you see that the colour becomes a deep dark blue, like that of an ammoniacal copper solution. From this solution we can learn some of the characteristic properties of nitrosisulphonic acid. To 10 c.c. I add a drop of nitric acid: the colour vanishes instantly, for the nitric acid oxidises nitrosisulphonic acid, in sulphuric acid solution, to nitrosulphonic acid. I pour another 10 c.c. of the dark blue solution into 100 c.c. of water; the colour vanishes, for decomposition into sulphuric acid and nitric oxide occurs. To the remainder of the blue liquid I add an equal volume of sulphuric acid of sp. gr. 1·6, and you see that the colour remains. I can add again the same volume of the same acid, and though the colour has weakened it does not disappear. Only on adding still greater quantities of the 1·6 acid does the colour at last vanish.

From this last experiment we may conclude that nitrosisulphonic acid is for some considerable time stable in sulphuric acid of sp. gr. 1·6, *i.e.* acid containing 70 per cent. of H_2SO_4.

The preceding experiments were made with a solution of nitrosulphonic acid in 95 per cent. sulphuric acid. Let us now see how it behaves towards mercury when it is dissolved in weaker acids. I have here solutions in 90, 80, 70 and 60 per cent. acid. Such solutions can be quite readily prepared by dropping the finely powdered and thoroughly dried nitrite into the acid, stirring vigorously the while; if the acid be poured on the nitrite, decomposition and evolution of red gases occurs. Of each of these solutions, and of the solution in 95 per cent. acid, I pour 40 c.c. into a 100 c.c. flask, add to each a drop of mercury, and, to make the reaction more striking, 1 c.c. of cold saturated copper sulphate solution; then I shake the flasks. Again you see the intense blue coloration rapidly appears in the 95 per cent. acid; it also appears, but less rapidly and with lower intensity, in the 90 per cent., hardly to a visible extent in the 80 per cent., and is entirely absent in the 70 per cent. and 60 per cent. acids. I may shake the last two acids for any length of time; evolution of nitric oxide occurs, indeed, but no trace of blue coloration can be perceived. Yet we have before seen (and we shall learn again later in another way) that the blue copper nitrosisulphonate is quite stable in 70 per cent. acid. And now we have established that, though mercury clearly reacts on a solution of nitrosulphonic acid in 70 per cent. sulphuric acid, and causes evolution of nitric oxide, yet *no* blue coloration is produced.

For this weakening and non-appearance of the blue coloration in weaker acids there is only one explanation, namely, that in 90, 80, etc. per cent. acid the nitrosulphonic acid is partially or entirely destroyed, that is to say decomposed into nitrous and sulphuric acids. Thus it is soluble without decomposition only in 95 per cent. acid, it shows signs of decomposition even in 90 per cent. acid, in 80 per cent. it is almost entirely and in 70 per cent. it is completely decomposed. So, if I allow mercury to react as a reducing agent on solution in the last-named acid, no reduction-product of the nitrosulphonic acid can arise, but only that of the nitrous acid, namely nitric oxide, as we have seen. All this is true for the ordinary temperature. At higher temperatures—say 50° to 100° C.—we may be sure that the decomposition would go farther, and that even in 80 per cent. acid—Glover acid—no trace of nitrosulphonic acid can exist.

From these observations we must draw the conclusion that nitrosulphonic acid, as an intermediate product in the formation of sulphuric acid by the chamber-process, must be left out of consideration inasmuch as the process continues in concentrations of sulphuric acid from 60 per cent. at the end of the chambers to 80 per cent. in the Glover tower, and in the latter case the temperatures concerned are such that even a temporary formation of nitrosulphonic acid is out of the question. If, then, in our first experiment, where sulphur dioxide, water, air, and nitrous gases were brought together in a litre flask, we *did* see the formation of nitrosulphonic acid, it must be that we worked under conditions which do not exist in the chambers. Indeed, we produced there an acid far stronger than is formed in the chambers; for a 70 per cent. acid, which is about the average production of the chambers, contains approximately 44 per cent. of sulphur dioxide, 11 per cent. of oxygen, and 45 per cent. of water. So, if we wish to imitate the chamber process in a glass flask, and desire to see the true intermediate products of the reaction, we must use about the same weight of water as of sulphur dioxide, or, in a litre flask, about 3 c.c. of water instead of the 1 c.c. which we actually used.

Let us repeat the experiment exactly as before, only adding at once 3 c.c. of water. Here, save in the first instant, before the water has become uniformly spread about the flask, we no more see any nitrosulphonic acid. We notice, too, that the process goes on much more rapidly than before, and the red colour of the vapours very rapidly vanishes, even though it be renewed by the frequent entrance of air. We see the resulting sulphuric acid deposit on the sides of the flask in oily drops; but on closely examining these drops, especially in daylight, it is seen that they are coloured reddish blue, and that they gradually lose their colour, evolving at the same time tiny gas-bubbles. These are precisely the appearances which we have learnt to recognise with nitrosisulphonic acid; and the gas, disengaging itself in tiny bubbles must be nitric oxide, for we see the colour of the contents of the flask gradually vanishing, and on allowing air to enter, the gaseous portion reddens. There can be no doubt that nitrosisulphonic acid has here been formed, and the assumption is almost forced on us that in this substance we have the *true intermediate product* of the chamber process. For nitrosisulphonic acid is, as we have seen, in contrast to nitrosulphonic acid, stable for a sensible time in 70 per cent. sulphuric acid; and its decomposition in the chamber process with evolution of nitric oxide accounts for the fact that the chamber gases at the beginning of the system, where the reaction is most vigorous, and still more the gases entering the chambers from the Glover tower, are light-coloured, in consequence of their containing a high proportion of nitric oxide. As soon as air enters, red nitrous gases are formed from the nitric oxide, and these will react again with sulphur dioxide to produce nitrosisulphonic acid.

If we wish to convince ourselves by experiment, whether or no nitrosisulphonic acid is formed from sulphur dioxide and these red gases, under chamber conditions, we must beforehand answer the question: What is formed from nitric oxide when it reacts on air? What is the chemical nature of these red gases? For long we believed that we knew, and we alleged that, in this oxidation of nitric oxide there was formed, according to the equation,

$$2NO+O=N_2O_3,$$

the anhydride of nitrous acid, a substance well known to us at low temperatures as a gorgeous blue liquid. But Ramsay, and also Lunge and Porschnew, shewed that this substance, when vaporised, dissociates into $NO+NO_2$, and it thus seems that gaseous nitrous anhydride cannot exist, and hence cannot be formed during the oxidation of nitric oxide by air.

We have arrived then at the conviction, that the product of the oxidation of nitric oxide is nitrogen peroxide, formed according to the equation

$$NO+O=NO_2,$$

a substance which we know not only as a yellow liquid of the composition N_2O_4, but also as a light-brown gas of the same formula, which on gentle warming dissociates and has then the composition NO_2, becoming at the same time much darker. This view is now generally held; but it must not be overlooked that the properties of the brown gases which the oxidation of nitric oxide yields, do not correspond, in many points, with those of nitrogen peroxide. This is not the time or place to dilate more fully on these relations, which I have described in long papers.[*] I will only sum them up by saying that all experiments lead to the conclusion that when air reacts on nitric oxide, two different substances are successively formed. The first, which is produced after a very short time, dissolves in acids or in alkalis to nitrous acid; behaves, in fact, as if it were nitrous anhydride, N_2O_3. The second, which demands for its complete formation about 100 times as long, dissolves in acids and alkalis half to nitrous and half to nitric acid; behaves as though it were N_2O_4, and reacts with water according to the equation

$$N_2O_4+H_2O=HNO_2+HNO_3.$$

I have grounds for the conjecture that the first product is an isomer of nitrogen peroxide, which on solution in acid or alkali reacts according to the equation

$$\text{Iso—}N_2O_4+H_2O=2HNO_2+O\ ;$$

and that the second, more slowly formed product, is similarly an isomer of nitric anhydride, reacting on solution according to the equation

$$\text{Iso—}N_2O_5+H_2O=HNO_3+HNO_2+O.$$

At first sight it must appear strange, that in these equations oxygen and nitrous acid should arise simultaneously and not nitric acid, the highest oxidation-product of nitrogen that is stable at ordinary temperatures. But the researches of Harries have made us familiar in organic chemistry with substances of similar properties, compounds of ozone with certain hydrocarbons, which when decomposed by water yield hydrogen peroxide and an aldehyde, whilst we should expect an acid to be formed.

I will not insist, however, on these views, which have by no means entirely emerged from the realm of hypothesis. I must, however, establish the fact that only the first product of the oxidation of nitric oxide, that which on solution yields nitrous acid, is serviceable in the chamber process. This is shown by the researches of Lunge, who has proved that in those very portions of the chambers where the reaction is most vigorous, the red chamber gases dissolve in concentrated sulphuric acid to nitrous acid, or to its compound with sulphuric acid, nitrosulphonic acid; and in the next place I have myself[*] shown that a substance, which on solution in acid behaves in the same way as the second oxidation-product of nitric oxide, namely ordinary nitrogen peroxide, which dissolves half to nitrous and half to nitric acid, acts on sulphur dioxide in presence of water only very slowly and incompletely—for the nitric acid remains without action, and only the nitrous acid from the other half yields sulphuric acid.

We must admit, then, that the nitrogen compound effective in the chambers is nitrous acid, HNO_2, which exists dissolved in the tiny droplets of sulphuric acid which as mist fill the chamber; and the question of the chemical nature of the chamber process narrows itself to the inquiry, how, under chamber conditions, that is to say in presence of air, water, and much sulphuric acid of 60 to 80 per cent., does sulphur dioxide react on nitrous acid? Is nitrosisulphonic acid really formed under these circumstances?

To get closer to this problem by experiment, let us again have recourse to our $N/10$ solutions of sodium nitrite in 95, 90, 80, 70, and 60 per cent. sulphuric acid. We have 100 c.c. of each of them in these washbottles, with 1 c.c. of cold saturated solution of copper sulphate added to each, the more easily to recognise any formation of nitrosisulphonic acid: the washbottles are connected in order in series, with the 95 per cent. acid at the beginning, and I pass a rapid stream of sulphur dioxide through the whole. Very soon the 70 per cent. acid becomes yellow, brown, and then deep blue. On continuing the stream of gas the colour slowly disappears; this, however, is not a chemical action of the sulphur dioxide, but a mere mechanical effect of the stream of gas, for a current of air, hydrogen, or carbon dioxide, or the production of a partial vacuum in the flask, will equally effect the decomposition of the unstable nitrosisulphonic acid into nitric oxide which passes on and sulphuric acid which remains behind.

Now that the experiment has gone on for a while, the 80 per cent. acid, in place of the 70 per cent. acid, has become a beautiful blue; and this colour does not fade nearly so rapidly on farther passage of the gas as did the colour of the 70 per cent. acid: a sign that nitrosisulphonic acid is the more stable, the more concentrated the sulphuric acid in which it has been dissolved. The 90 and the 95 per cent. acid show no alteration, no matter how long the gas be passed; and the 60 per cent. acid also shows no coloration, but a rapid evolution of gas, which investigation proves to be nitric oxide.

What does this experiment teach us? First, that sulphur dioxide does not react on nitrosulphonic acid: for in the flasks with 95 and 90 per cent. acid, where the nitrosulphonic acid is present wholly or almost wholly undecomposed, nothing happens. Second, that sulphur dioxide reacts on nitrous acid, which is dissolved in sulphuric acid of the concentrations occurring in the chambers, with formation of nitrosisulphonic acid, which later breaks up into sulphuric acid and nitric oxide. Even in 60 per cent. acid this reaction occurs; but the nitrosisulphonic acid breaks up so rapidly after its formation, that only traces, too small to recognise, exist at any one instant, and we see only the product of its decomposition, the nitric oxide.

With the knowledge so far obtained, we have been able to explain a good part of the working of the chamber process. The nitrous acid forms with sulphur dioxide the blue nitrosisulphonic acid; this dissociates into sulphuric acid and nitric oxide, and the latter is oxidised again by the air to nitrous gases, which dissolve in the water sprayed into the chambers, or in the mist of sulphuric acid, to nitrous acid. The cycle, which results in the formation of sulphuric acid from sulphur dioxide, air, and water, is completed. Only one question remains to be answered, though that is an important one: *How* is nitrosisulphonic acid, H_2NSO_5, formed from sulphur dioxide, SO_2, and nitrous acid, HNO_2?

To answer it, we will repeat the experiment in which nitrosisulphonic acid was formed so rapidly, that namely with the solution of nitrous acid in 70 per cent. sulphuric acid, and carefully observe all the accompanying phenomena. I place 100 c.c. of this solution, with one c.c. of copper sulphate as indicator, in a 200 c.c. cylinder, and lead sulphur dioxide slowly in, through a tube with an opening only a millimetre wide. The gas-bubbles are completely absorbed by the liquid; but throughout the whole liquid we see, in the tiniest bubbles, another gas being evolved, which reddens in the air over the liquid, and hence must be nitric oxide: and *during* this nitric oxide evolution the acid gradually turns blue through the formation of nitrosisulphonic acid. We see, then, that when nitrosisulphonic acid is formed from sulphur dioxide and nitrous acid, nitric oxide gas is evolved; and we are in a position to express the reaction by an equation—

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[*] Z. angew. Chem. 1907, **20**, 701.

[*] Z. angew. Chem. 1905, **18**, 1301.

$$2HNO_2+SO_2=H_2NSO_5+NO.$$

Thus have we forged the remaining link of the chain. The formation of sulphuric acid in the chambers occurs in this way, viz.:—the nitrosisulphonic acid, formed according to the above equation, dissociates into sulphuric acid and nitric oxide

$$H_2NSO_5=H_2SO_4+NO,$$

and finally the nitric oxide, with air and water, becomes oxidised to nitrous acid

$$2NO+H_2O+O=2HNO_2.$$

With these summary equations we have reached our goal, *arithmetically* speaking: the whole sulphuric acid process is brought into an equation which balances, and the correctness of which has been experimentally proved. In the *chemical* sense, however, we are far from having finished. For the chemist's questioning goes farther and deeper. He is not content that the equations should merely balance. He wants to know whether the reaction which they express is consistent with the chemical character of the compounds concerned, what is the constitution of each of these compounds, and how the chemical changes can be understood from such constitutions. To take a familiar example from inorganic chemistry, when one has proved that from ammonia, by the action of sodium hypochlorite, hydrazine can be produced, the following equation, which indicates an oxidation, may serve in the first place to express the reaction—

$$2NH_3+NaOCl=N_2H_4+NaCl+H_2O.$$

But the chemist at once asks: Can one transform ammonia into hydrazine by other oxidising agents? Answer: No. Immediately arises the question: Why not? And the answer is only found, when on further investigation it is observed that from ammonia and hypochlorite chloramine is first produced—

$$NH_3+NaOCl=NH_2Cl+NaOH;$$

and that then chloramine with ammonia and sodium hydroxide reacts to form hydrazine and sodium chloride—

$$NH_2Cl+NH_3+NaOH=N_2H_4+NaCl+H_2O.$$

Thus the reaction is brought one step more in accord with our chemical ideas.

But with the summary equations given above for the process of formation of sulphuric acid our thirst for chemical knowledge is not satisfied. We ask farther: What is the mechanism of the reaction by which, from two molecules of nitrous acid and one molecule of sulphur dioxide, nitrosisulphonic acid is formed? But to answer this we must go into the question: How does sulphur dioxide behave otherwise towards nitrous acid? How outside of the chambers? How under entirely different conditions? And is its behaviour then in accord with that in the chamber process? How, for example, do the salts of these acids react on each other?

You will remember that Divers and Haga have shown that the normal sodium sulphite does not react with a nitrite.

I have here a 10 per cent. solution of sodium sulphite, $Na_2SO_3.5H_2O$. This solution turns faintly red on adding a drop or two of phenolphthaleïn: I add a few drops of *N*/10 hydrochloric acid to decolorise it. Now I put 10 c.c. of this solution into each of two test-tubes, add to one 5 c.c. of a 5*N* sodium nitrite solution, and heat the liquid in both tubes to boiling. In both, a red colouration appears, a sign that free alkali has been formed, obviously through production of sodium bisulphite. Now I cool both tubes: that containing no nitrite loses its colour, but the other remains slightly red. Some change must then have occurred during the heating; and since we know that alkali does not react on sodium nitrite, the change must apparently have been caused by the bisulphite, produced during the heating, reacting on the nitrite.

In fact, bisulphite reacts very energetically on nitrite. I pour into a beaker of ¾ litre capacity 125 c.c. of 5*N* solution of sodium nitrite (350 grms. of commercial nitrite dissolved and made up to a litre) and add a few drops of phenolphthaleïn. The liquid becomes faintly red, for usually a trace of alkali clings to the nitrite. Then I quickly add 300 c.c. of 5*N* solution of sodium bisulphite (the commercial solution of sp. gr. 1·32 is approximately 5*N* and can be used for this experiment). Naturally the red colour vanishes at once, for the mixture is acid. But after a few moments the liquid heats up, finally to boiling, and the red colour appears again. Sodium nitrilosulphonate has been formed in the solution according to the equation

$$NaNO_2+3NaHSO_3=N(SO_3Na)_3+NaOH+H_2O.$$

This salt is very soluble; on the other hand the corresponding potassium salt is very sparingly soluble, so when I pour the hot liquid into a litre of cold saturated solution of potassium chloride, the whole solidifies to a paste of crystals of potassium nitrilosulphonate.

The acid corresponding to these salts is not stable. As soon as the salt is made acid, a sulpho-group splits off

$$N(SO_3H)_3+H_2O=NH(SO_3H)_2+H_2SO_4$$

in the form of sulphuric acid, and we get the salts of imidosulphonic acid, $NH(SO_3H)_2$. And even this is not long stable in the free state; it in turn loses a sulpho-group and yields aminosulphonic acid $NH_2(SO_3H)$. which is quite stable. It should be noted that this substance must be boiled for many hours with water or heated under pressure to 150° C., in order to split off the last sulpho-group and produce ammonia from it.

Nitrilosulphonic acid contains, without doubt, three sulpho-groups with their sulphur-atoms united to nitrogen: sulphur and nitrogen being thus in direct combination with one another. Such acids (and we shall learn to know several of them) are called sulphur-nitrogen acids. One can make a simple representation of their mode of origin, if one assumes that the sulphurous acid of bisulphites has an unsymmetrical constitution, namely $H.SO_2.OH$, whilst one can represent nitrous acid as ONOH or as $N(OH)_3$; then the hydrogen united with the sulphur of the sulphurous acid unites with the hydroxyl or the oxygen of the nitrous acid to form water, and the $3SO_3H$ residues unite with the trivalent nitrogen-atom to nitrilosulphonic acid. But the assumption that three molecules of bisulphite *simultaneously* enter into reaction with one molecule of nitrite does not commend itself to us: we are inclined to say that one of these three molecules of sulphite must always be the first to attach itself to the nitrite molecule, and we come naturally to the assumption that the reaction is carried out in three phases, in the first of which one molecule of bisulphite attaches itself to one molecule of nitrite

$$ON.NaO+H.SO_2.ONa=ON.SO_2.ONa+NaOH,$$

and a substance $ON.SO_3Na$ is formed, which must be called sodium nitrososulphonate. In the second phase a second molecule of bisulphite reacts with this substance

$$ON.SO_3Na+H.SO_2.ONa=HON.(SO_3Na)_2,$$

forming sodium hydroxylaminodisulphonate, and only in the third phase is this transformed into nitrilosulphonate:

$$HON.(SO_3Na)_2+H.SO_3Na=N(SO_3Na)_3+H_2O.$$

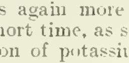
That these considerations are correct, is shewn by the fact that we can actually obtain the product of the second stage, sodium hydroxylaminodisulphonate. It is only necessary to keep the mixture cold and the third phase does not act in. To 100 c.c. of 5*N* nitrite solution I add 200 grms. of ice, then, whilst constantly stirring, 100 c.c. of bisulphite solution, and finally 20 c.c. of glacial acetic acid. The solution thus obtained contains the very soluble sodium salt of hydroxylaminodisulphonic acid; if a portion be mixed with an equal volume of cold saturated solution of potassium acetate, in a few seconds the slightly soluble potassium salt precipitates.

Free hydroxylaminodisulphonic acid is not stable; if one attempts to prepare it, it breaks up into hydroxylaminomonosulphonic acid and sulphuric acid, and this in turn, if heated for some hours to 100° C., loses sulphuric acid and yields hydroxylamine. This is now an industrial method of preparing hydroxylamine.

Very interesting results are obtained on the oxidation of the hydroxylaminosulphonic acids. To the solution of sodium disulphonate just prepared, I add 25 c.c. of 20 per cent. ammonia, then 400 c.c. of potassium permanganate solution (32 grms. per litre). At once there is a copious precipitate of manganese peroxide. I stir, and pour the liquid on a large filter; the filtrate runs through coloured deep violet, deceptively like a solution of permanganate, of which, however, it does not contain a trace, as one sees on acidifying a little test portion of the liquid, when the colour immediately vanishes. The colouration is due to the sodium salt of an acid $O:N:(SO_3H)_2$. The corresponding potassium salt is again more sparingly soluble, and precipitates after a short time, as soon as I add 500 c.c. of cold saturated solution of potassium chloride to 250 c.c. of the violet solution of the sodium salt. The colour of the solid salt is orange. I can drain it, and dissolve in water: it dissolves again with a blue-violet colour. On adding acid the compound is at once destroyed and the colour vanishes; on adding alkali the colour is not restored, so that the free acid is not stable.

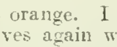
The beautiful blue colour of this compound is due to its containing quadrivalent nitrogen. We know another compound of tetrad nitrogen which is coloured a fine blue, the substance NH_3Na, formed from ammonia and sodium; and hence we may conclude that the fine blue nitrosisulphonic acid which has been occupying us so much is also a compound of tetrad nitrogen. For some time indeed it was thought that the beautiful blue substance formed by nitrous acid and sulphurous acid in strong sulphuric acid solution was identical with nitrosodisulphonic acid $ON(SO_3H)_2$; but this supposition must be rejected, in view of the fact that nitrosodisulphonic acid is immediately destroyed by acids.

Hydroxylaminomonosulphonic acid can also be oxidised in alkaline solution by permanganate; but here the oxidiser does not attack the hydrogen of the hydroxyl group, but removes the hydrogen-atom directly attached to nitrogen. The two residues thus arising $HO.N.SO_3Na$ unite to form a compound



$$\begin{array}{c}HO.N.SO_3Na\\ |\\ HO.N.SO_3Na,\end{array}$$

which however is not stable, for on the one hand it loses at once a molecule of water, and on the other splits off a sulpho-group as sulphite in exchange for hydroxyl, and we obtain a solution of



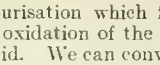
$$O\begin{array}{l}\diagup N.ONa\\ \quad\ |\\ \diagdown N.SO_3Na.\end{array}$$

By means of potassium acetate we can again precipitate the sparingly soluble potassium salt, and we find it to be a substance known for 111 years—it is the potassium nitric-oxide-sulphite of Davy, which is formed when nitric oxide is passed through a solution of potassium sulphite. This salt was also investigated in the pure state by Pelouze as long ago as 1834.

A quite different oxidation-product of hydroxylaminomonosulphonic acid is formed when the oxidation is effected in strong sulphuric acid solution by means of Caro's acid, H_2SO_5, prepared from persulphuric acid under the influence of concentrated sulphuric acid. I have here in a 200 c.c. flask a mixture of 100 c.c. of concentrated sulphuric acid with 5 c.c. of cold saturated copper sulphate solution. It has been for some hours in ice, so that the acid is thoroughly cooled. Now, continually agitating, I pour in a solution of 2 grms. of sodium hydroxylaminomonosulphonate in 2 c.c. of water. In another flask I have had for several hours 5 grms. of potassium persulphate dissolved in 100 c.c. of concentrated sulphuric acid and cooled in ice, and I now pour 5 or 10 c.c. of this oxidising medium into the liquid in the first flask. In a few seconds a fine blue-violet colour appears. Usually it vanishes again in a short time, but I can restore it once or twice by renewed additions of Caro's acid.

This blue-violet compound, soluble in concentrated sulphuric acid, is well known to us. There can be no doubt that here we have again the nitrosisulphonic acid with which we have dealt before at considerable length; and that the decolourisation which follows its formation is due to the *further* oxidation of the nitrosisulphonic acid to nitro-sulphonic acid. We can convince ourselves of the correctness of this assumption, if we shake the decolourised solution with a drop of mercury. The solution again becomes blue, and *now* the blue colouration is permanent.

Through this formation of nitrosisulphonic acid from hydroxylaminomonosulphonic acid we have ascertained its constitution: it *must* contain the sulpho-group directly combined with nitrogen, and if we bear in mind that its blue colour indicates a compound of quadrivalent nitrogen, no constitution is possible other than



$$O=N\begin{array}{l}\diagup OH\\ \diagdown SO_3H\end{array}.$$

Its dissociation into nitric oxide and sulphuric acid occurs simply by the molecule of this extremely "labile" compound rupturing across the dotted line, and the residues on the right hand coalescing to form sulphuric acid.

If we now come back to the products of the reaction of bisulphite on nitrite, we see that in the whole scheme which begins with nitrous acid and ends with nitrilosulphonic acid

			$N(SO_3H)_3$
		$HON(SO_3H)_2$	$NH(SO_3H)_2$
	$ON(SO_3H)$	$HONH(SO_3H)$	$NH_2(SO_3H)$
ONOH	ONH	$HONH_2$	NH_3

there are still lacking the two members of the first reaction-phase, viz.: nitrososulphonic acid, and the product of its hydrolysis, ONH, to which the name of nitroxyl has been given. One cannot help thinking that sodium nitrososulphonate *must* arise as the first product of the reaction of bisulphite on nitrite, and I have instituted an experimental research to prove it; but we cannot lay hold of it. It passes so rapidly, with the help of a second molecule of bisulphite, into hydroxylaminodisulphonate, that we invariably obtain only the latter. I formerly thought I had obtained basic salts of nitrososulphonic acid or of the corresponding dihydroxylaminomonosulphonic acid, $(OH)_2N.SO_3H$, and considered I had proof for this constitution in the fact that on acidifying, these salts split off sulphuric acid and evolve nitrous oxide, which is none other than the anhydride of the hypothetical nitroxyl, ONH. But Divers and Haga [*] have shewn that these salts are double salts of hydroxylaminodisulphonate and nitrite, and the evolution of nitrous oxide from them is simply explained, for, on acidifying, nitrous acid and hydroxylamine are produced, which react on each other to form nitrous oxide.

We cannot, then, exhibit the first stage of the reaction of bisulphite on nitrite. But that it does occur we see at once if we allow free nitrous acid to react on sulphurous acid in aqueous solution. The free acids react exactly as do the salts, but the reaction proceeds considerably more rapidly, and even the end-product, nitrilosulphonic acid, cannot be held—it decomposes so quickly in acid solution into sulphuric acid and aminosulphonic acid. But the last-named acid can always be detected in this reaction, and if I mix one molecule of nitrous acid with a great excess, say, 20 molecules, of sulphurous acid, I can convert it quantitatively into aminosulphonic acid. Here too, as in the case of bisulphite and nitrite, the road must lie over nitrososulphonic and hydroxylaminodisulphonic acids: but, in this instance, the first phase, viz.: nitrososulphonic acid, can be arrested. For if we do not work with such great excesses of sulphurous acid, the reaction is sluggish to go beyond nitrososulphonic acid, and if to one molecule of nitrous acid we add not more than 1·2 to 1·5 molecules of sulphurous acid, molecule reacts on molecule, according to the equation

$$HNO_2+SO_2=ON.SO_3H.$$

I have here 2 c.c. of 5*N* sodium nitrite diluted to a litre, and acidified with 2 c.c. of 10*N* sulphuric acid—sufficient acid to set free not only the nitrous acid but also the sulphurous acid from an equivalent quantity of bisulphite. Further, I have here 10 c.c. of 5*N* bisulphite diluted to 250 c.c. The nitrous acid is thus 1/100 *N* and the bisulphite 1/5 *N*. To obtain equal numbers of molecules reacting, I must mix 10 c.c. of the bisulphite solution with 200 c.c. of the nitrous acid. I pour into a 300 c.c. flask 250 c.c. of the nitrous acid, quickly add 10 c.c. of the bisulphite, stopper the flask, and shake vigorously. If I now add 10 c.c. of potassium iodide starch solution (containing 10 g. KI and 2 g. starch per litre) the whole instantly turns blue, a sign that there is still nitrous acid present.

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[*] Chem. Soc. Trans. **77**, 432.

Now I repeat the experiment, but take only 150 c.c. of the nitrous acid. On adding the starch and iodide the liquid remains colourless, and will indeed decolourise some of the blue liquid from the former experiment—it still contains sulphurous acid. Thus 150 c.c. of the nitrous acid solution is too little, and 250 c.c. too much; one must use 200 c.c., so that both shall disappear, which shews that one molecule of nitrous acid reacts on one of sulphurous, the proportions needed to form nitrososulphonic acid.

But if we look for nitrososulphonic acid in the liquid, we do not find it, but only the products of its hydrolysis, sulphuric acid and nitrous oxide:

$$2(ONSO_3H)+H_2O=N_2O+2H_2SO_4.$$

However short the time after the reaction, the calculated amount of sulphuric acid is always there. If, however, a large quantity of acid (which in this case must be hydrochloric) be added to the liquid in which it is formed, a certain time, say a minute, elapses after addition of barium chloride before a precipitate of barium sulphate begins to form. Clearly, nitrososulphonic acid is an extraordinarily unstable substance, which, when it has opportunity for further change, immediately breaks up into sulphuric acid and nitrous oxide, but is slightly more stable in presence of a great excess of acid.

This is precisely the case which interests us, however; for it occurs in the chambers, save that sulphuric, not hydrochloric acid, accompanies the nitrososulphonic acid which is formed from sulphurous and nitrous acids. Let us then see whether addition of sulphuric acid occasions a change in the chemical behaviour of nitrososulphonic acid. I pour into a 300 c.c. flask 200 c.c. of the just mentioned *N*/100 solution of nitrous acid, add 10 c.c. of iodide and starch solution as indicator, when of course a deep blue colour appears, and then from a burette 6 c.c. of the same *N*/5 bisulphite solution, of which 10 c.c. are needed to convert the 200 c.c. of nitrous acid completely into nitrososulphonic acid; then I shake the bottle. You see that the blue colour disappears (for the sulphurous acid reacts more rapidly on the iodine than on the nitrous acid), but after a few seconds it suddenly reappears throughout the whole liquid, a sign clearly that nitrous acid is still present. Now I add the remaining 4 c.c. of the bisulphite solution; on shaking the blue colouration disappears again, and this time does not reappear. There is now no nitrous acid remaining.

Quite another picture is seen, if I place in a 500 c.c. flask another 200 c.c. of nitrous acid solution with starch and iodine, but in this instance add 50 c.c. of 10 *N* sulphuric acid. I also run in now 6 c.c. of bisulphite solution and shake. The blue colouration disappears as before, but this time it does *not* appear again on allowing the liquid to stand; there is clearly no longer nitrous acid present. But in the liquid a gas appears, and this gas is nitric oxide, for red vapours shew themselves above the liquid. On the surface of the liquid these red vapours dissolve to nitrous acid, and here we see the blue colouration being gradually produced, and spreading in coloured streaks through the liquid. If I put in a stopper and shake, the evolution of gas becomes more vigorous, as do also the oxidation of this gas by air and the re-absorption of the nitrous acid, and you note the whole liquid at once become blue again. Now I can add again a few c.c. of bisulphite till the colour disappears, and again by shaking with air produce nitrous acid and blue colouration; and the same occurs for the third time, and so on. I can carry on the experiment for hours. I can in fact make it continuous, by allowing bisulphite slowly to flow in, and shaking all the while. Under these circumstances there is never decolourisation; but as soon as I cease the shaking and hence the aeration of the whole, the blue colour vanishes, and if we now pour the colourless liquid into a 500 c.c. cylinder, we see that the blue colouration appears again, from the surface downward, obviously under the influence of air.

I have already added far more than the 10 c.c. of bisulphite, equivalent to the nitrous acid present, and converted them completely into sulphuric acid; for the presence of the blue colouration is a sign that no sulphurous acid remains in the liquid; and I could, if time allowed, carry on the process for much longer, and thus with the help of water, air, and an exceedingly small amount of nitrous acid, oxidise a very large amount of sulphurous acid to sulphuric acid. We have here really imitated the chamber process in a beaker, and shewn that we pass from sulphurous to sulphuric acid by means of nitrososulphonic acid.

Now, we may ask—What is the difference between the experiment in almost neutral solution, where one molecule of nitrous acid and one molecule of sulphurous acid are converted sharply into nitrososulphonic acid, (which then immediately dissociates into sulphuric acid and nitrous oxide, thus bringing the reaction to an end and rendering any farther oxidation of sulphurous acid impossible) and the experiment in strongly acid solution, which never ends, but, like a typical catalytic reaction, compels infinitely large quantities of otherwise indifferent substances to vigorous action, by means of a negligibly small amount of the catalyst? Let us call all the observed phenomena to remembrance. Consider, that in the strongly acid solution of nitrous acid, instead of the calculated 10 c.c. of bisulphite, 6 c.c., or little more than half, were enough, to carry the reaction so far that all the nitrous acid disappears. Clearly one molecule of sulphur dioxide has reacted here with *two* molecules of nitrous acid; *i.e.* the nitrososulphonic acid first formed, (when it could not immediately decompose, but was rendered stable by the strong acid present), has at once reacted on a second molecule of nitrous acid. And as we have seen that nitric oxide is evolved during this reaction, no other explanation is conceivable than that the nitrososulphonic acid has here acted as a reducer and the nitrous acid as an oxidiser, and that again our old friend nitrosisulphonic acid has appeared, according to the equation

$$ON.SO_3H+HONO=NO+H_2NSO_5.$$

Of course this nitrosisulphonic acid, being dissolved in comparatively dilute sulphuric acid, decomposes at once into sulphuric acid and nitric oxide, and cannot be recognised save through the presence of the product of its decomposition. But I can gradually increase the strength of the sulphuric acid, without altering qualitatively any part of the whole reaction-complex. Quantitatively, the evolution of nitric oxide becomes steadily more obvious; and when we have reached 70 per cent. sulphuric acid, the formation of nitrosisulphonic acid becomes evident, as we saw before when we led in a stream of sulphur dioxide, by appearance of the deep blue colour of its copper salt.

It is interesting, and will enable us better to understand the oxidation of nitrososulphonic acid, a compound of triad nitrogen, to nitrosisulphonic acid, in which the nitrogen is tetrad, if we notice that in the endeavour to pass from triad or pentad to dyad or tetrad nitrogen a character reappears which is exhibited by nitrous acid. This acid, too, shews a certain stability only in very dilute aqueous solution; if we try to procure stronger solutions by acidifying more concentrated solutions of nitrite, the substance HO NO dissociates as indicated by the dotted line into nitric oxide and hydroxyl, and two molecules of the latter then oxidise another molecule of nitrous acid to nitric acid:—

$$2HO+HNO_2=H_2O+HNO_3.$$

In the chambers a similar dissociation of nitrous acid occurs; but here the hydroxyl attaches itself to a molecule of nitrososulphonic acid, in order to convert it into nitrosisulphonic acid.

By relating the processes going on in the chambers to the behaviour of well-known and frequently observed nitrogen compounds we have satisfied the last postulate which the new theory of the chamber process demanded. That theory can now be expressed in four equations, from the integral of which the catalyst disappears, and there remains an oxidation of sulphur dioxide by means of water and oxygen to sulphuric acid.

$$\begin{array}{cr}
\mathrm{2NO+H_2O+O=2HNO_2} & 1. \\
\mathrm{HNO_2+SO_2=ONSO_3H} & 2. \\
\mathrm{HNO_2+ONSO_3H=NO+H_2NSO_5} & 3. \\
\underline{\mathrm{H_2NSO_5=NO+H_2SO_4}} & 4. \\
\mathrm{SO_2+O+H_2O=H_2SO_4} &
\end{array}$$

We have only now to inquire whether the phenomena which the chamber process presents to us, especially in cases of disturbance of its regular working, find explanation by means of these equations. Such a phenomenon is the appearance of chamber crystals, nitrosulphonic acid, $HNSO_5$, when water is deficient in the chambers. To explain it, we must remember that we saw that the blue nitrosisulphonic acid is the more stable, the stronger the sulphuric acid in which it is dissolved. But the continuance of the process depends upon its speedy decomposition. If this does not occur, since deficiency of water causes the sulphuric acid formed to be stronger than normal, there is soon a shortage of nitrogen, for nitric oxide is no longer being formed from nitrosisulphonic acid. And the small amounts of nitric oxide that do still exist are converted by the large amounts of oxygen that have not been used up, not only into the first product of their oxidation (which afterwards dissolves in the droplets of sulphuric acid to nitrous acid), but also partly into the second, which yields half nitrous and half nitric acid. As soon, however, as this nitric acid meets nitrosisulphonic acid in strong sulphuric acid solution, oxidation of the nitrosisulphonic acid to nitrosulphonic acid results, as we have seen before. Thus, in the simplest manner, is explained the formation of chamber crystals in the chamber, and also in the experiment with which we began this lecture; they are in all cases only a secondary product, arising from the oxidation of nitrosisulphonic acid by nitric acid.

Another not uncommon phenomenon of disturbance is the appearance of acid, red in colour and foaming with nitric oxide, the so-called "purple acid," from the Gay-Lussac tower. It is produced when the chemical process is not completed at the end of the chambers, so that sulphur dioxide reaches the Gay-Lussac tower. We can now say at once what this purple acid is—obviously nitrosisulphonic acid with all its characteristic properties. We can indeed at once suggest a means whereby its occurrence (which naturally involves loss of nitre, for the purple acid is constantly giving off nitric oxide) can be prevented, even if the entry of sulphur dioxide into the Gay-Lussac tower can *not* be avoided. We have only to add the nitric acid, which must be constantly supplied in the Glover tower to make up for the unavoidable losses of nitre in the system, through the Gay-Lussac tower. It then oxidises any nitrosisulphonic acid to nitrosulphonic acid, and the exit of purple acid from the tower ceases.

And lastly, the new theory throws a much-desired light on the question of the losses of nitrogen in the chamber process. We know that in the chambers the ideal of a catalytic process, the continuous combination of unlimited amounts of sulphur dioxide, water, and oxygen, through the instrumentality of a small quantity of nitric oxide, never disappearing from the process, is not reached. There are constant losses of nitrogen oxides, which must be balanced by continuous additions of fresh material. True, the whole of the acid produced contains in solution traces of nitrous compounds, but this is far from accounting for the whole of the loss to the system. It has long been suspected that nitrous compounds which escaped detection were formed in small quantity in the system; and especially nitrous oxide was suspected, for formerly we could not detect it certainly in mixtures of which it constituted only a small percentage. Since, however, it has been rendered practicable, by the use of liquid air, to apply extremely low temperatures, it has been possible to isolate nitrous oxide from such mixtures; in fact in 1904 Inglis[*] succeeded in proving in this way the existence of nitrous oxide in the exit gases of the chambers, and Hempel[†] confirmed this in 1906.

But if we ask *how* nitrous oxide is formed in the chamber process, the new theory, and only the new theory, gives us at once the desired answer. Whenever, exceptionally, a molecule of nitrososulphonic acid does not find the requisite amount of sulphuric acid to ensure its stability and to enable it to react with nitrous acid, but meets only with water or very weak acid, it decomposes directly, as we have shewn before, into sulphuric acid and nitrous oxide, and thus its nitrogen is lost for the chamber process. For nitrous oxide is at ordinary temperatures chemically a completely indifferent substance.

Here, though, we can draw a practical conclusion from the theory. If we take care that at no point in the chambers can water be present, that is if we no longer blow in steam or water but spray dilute sulphuric acid (as has already been suggested repeatedly), *this* source of loss will in all probability vanish, or at least be considerably lessened.

The losses of nitre by nitrous oxide formation, then, find their simple explanation in a partial decomposition of nitrososulphonic acid in a wrong direction. But we see at once that a third reaction of nitrososulphonic acid is conceivable, which also entails loss of nitrogen. It may, exceptionally, react with a second molecule of sulphur dioxide to form hydroxylaminodisulphonic acid, and the latter with a third molecule to nitrilosulphonic acid. These sulphonic acids are, of course, not permanently stable in the chambers, but split off their sulpho-groups and finally yield hydroxylamine or ammonia. Hydroxylamine itself, again, is very unstable, and at once with nitrous acid yields nitrous oxide, or with sulphurous acid yields aminosulphonic acid according to the equation

$$\mathrm{NH_2OH+SO_2=NH_2.SO_3H.}$$

It is not to be expected, therefore, that we shall be able to identify hydroxylamine in the chambers.

Ammonia, too, yields with nitrous acid water and nitrogen, and as far as it is produced in the chambers, it is probably at once destroyed in that way. But in many systems which work with several chambers in series it often happens that the acid from the first or the second chamber is not nitrous, but contains free sulphurous acid. In this case it would not be impossible that ammonia should remain; and in 1887, when I first[*] suggested this new theory of the chamber process, I looked for ammonia in such acids, and found it to be indeed present. Since then its presence under the same circumstances has been verified by others.[†]

Here, I think, lies the best touchstone for the new conception of the chemistry of the chamber process. Whatever evidence of the correctness of this theory of the mechanism of the process—hardly to be explained in any other way—may be derived from a study of the known properties of sulphur dioxide and nitrous acid, all this sinks in importance when compared with the fact that it was possible to *predict* a peculiarity of the chamber process, namely the possible formation of ammonia, of which no one had thought, nor on the basis of the older theories could have thought. The fact that this prediction was confirmed by experiment, gave me courage to proceed in the building up and development of the new theory, and strengthened me against being thrown off my path by opposition and criticism. The theory is not yet adopted by everyone; but if I secure acceptance for it this evening, here in the country where the chamber process originated, I shall have made much progress. The practical results, which inevitably follow in the wake of a clearer scientific insight into a technical process, will take care of themselves.

Discussion.

The Chairman heartily congratulated the author upon the success with which he had wrestled with this lengthy paper in a foreign tongue—and also on the most successful experimental demonstrations. When it was remembered that the lead chamber manufacture of sulphuric acid had gone on for some 160 years, it was at first sight a little surprising that any question should remain as to the exact nature of the reactions which occurred when sulphur dioxide, oxygen and water combined to form sulphuric acid. Undoubtedly, however, the part played by the oxides of nitrogen had always been a subject of discussion and indeed of controversy. In the name of the Society he desired to express their indebtedness to the authorities of King's College for so kindly placing the large lecture theatre at their disposal, and to Professor Millar Thomson and his staff for the great assistance they had rendered in connection with the lecture.

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[*] This J., 1906, **25**, 149.

[†] Z. Elektrochemie, 1906, **12**, 600.

[*] Annalen, **241**, 248.

[†] Annalen, **248**, 130.

Dr. E. Divers said that the case for Dr. Raschig's theory was of the very strongest. Nitrous fumes and sulphur dioxide did not act at all in absence of water and in its presence only formed the lead-chamber crystals, nitrosulphonic acid, when its quantity was relatively small. But nitrosulphonic acid (to adopt throughout these remarks, without thereby always accepting, the nomenclature used in the paper), in presence of such proportions of water as were found in the lead-chambers or Glover tower, did not form at all, even in solution, according to Dr. Raschig's novel and convincing method of testing for it. This observation might be described, in order of development, as his first contribution to the theory of the lead-chamber process, and it was an important one. They were thus left to seek for an explanation of the production of sulphuric acid in what happened when the proportion of water present was too great to admit of the formation of nitrosulphonic acid. Since, in presence of enough water, nitrous fumes became nitrous acid, there had to be determined how this nitrous acid interacted with sulphur dioxide or sulphurous acid. In the conditions maintained in the chamber process, one of which was the presence of chamber acid already formed, the primary action could not be immediately ascertained and it had also, for many years, seemed impossible to make out what first occurred in presence of water only or of bases. By Dr. Raschig and also by Haga and himself it had been made known, years ago, that, with the sulphurous acid in excess and no base present, products were obtained which served to prove that hydroxylaminodisulphonic acid, $HON(SO_3H)_2$, had been formed. Much earlier still, Fremy had found such a substance as this to be formed in presence of bases, and it was also known that sulphuric acid and nitrous oxide might be the only products when bases were absent. In this state of things, Dr. Raschig had succeeded in making a second contribution to the history of the sulphuric acid process. He had shown that just in simple molecular proportions and in no others, sulphur dioxide and nitrous acid, when brought together, were wholly converted into nitrous oxide and sulphuric acid. This conversion could only happen through the union of the interacting acids to form a substance which at once decomposed into these products. This substance, unknown and having only a transitory existence, Dr. Raschig had named nitrososulphonic acid. Dr. Raschig's third contribution to knowledge of the nature of the production of sulphuric acid in the lead chamber process had been made in the form of important additions to what was already known of the blue-violet substance which gives colour to the purple acid sometimes observed in the Gay-Lussac tower. This substance, as a product of the reduction of nitrosulphonic acid, had been examined in 1896 by Sabatier and described in a series of articles in the *Comptes rendus* (this Journal, 15, 622) but that chemist had made little of his facts. He had only suggested that the blue-violet substance might be the free acid of Fremy's coloured salt, *potassium sulphazilate*, named in the present paper, nitrosodisulphonic acid, and he (Dr. Divers) had himself defended that view, unsupported however by his colleague, Professor Haga. Dr. Raschig had since shown that the two coloured acids could not be the same. Nitric oxide, always observed (Carpenter and Linder, this Journal, 1902, 21, 1492) when the blue-violet nitrosisulphonic acid was formed, was, as Dr. Raschig had shown them, not only produced together with that acid, by the interaction of sulphur dioxide and nitrous acid dissolved in chamber acid, but was again a product of the decomposition of the nitrosisulphonic acid itself. This acid could be nothing, he had made clear, but a combination in some form of the elements of sulphuric acid with those of nitric oxide. Then, as a consequence of this investigation, Dr. Raschig had been able to go on and make a fourth contribution to his subject, which might be said to be the essential point of his theory. That was that the blue nitrosisulphonic acid was the transition substance, the pivot, one might say, of the catalysis by which continuously sulphur dioxide, oxygen, and water became the sulphuric acid of the lead chambers. When it was remembered that Dr. Raschig had scrupulously observed, so far as possible and as seemed necessary, the conditions obtaining in the normally working manufacture, it had to be recognised that he had done a great and satisfying piece of much needed work in developing his theory of the lead chamber process for making sulphuric acid. He had also accounted for chemical losses of "nitre" never before recognised. Another and most interesting part of his investigations, which served to show why nitric acid was not produced in appreciable quantity in the process, had been his observation of the nature of the union of nitric oxide with atmospheric oxygen, to which Dr. Raschig had in his paper only briefly alluded. The question of the chemical constitution of the products, which Dr. Raschig had brought into his theory or referred to in his paper, remained, in his (Dr. Divers's) opinion, still undetermined and he would shortly offer to the Society a paper giving a discussion of this question, which could not at that moment be gone into. He was not without hope that Dr. Raschig might be led to adopt some of the points he would then make, which is no way would affect the validity of Dr. Raschig's theory as a whole and in its essential parts. [In consequence of the lateness of the hour when the discussion took place, most of Dr. Divers's remarks, as above given, had to be made in writing after the meeting.]

Professor H. E. Armstrong said the demonstrations Dr. Raschig had given were most striking; the meeting therefore had been one of great value, perhaps especially to the younger chemists present. It was an unusual occasion to see for once a real chemist at work; a man who not only had a lively imagination but also fingers. He took it that their verdict would be that in the main he had proved his case. It was noteworthy that so much sulphuric acid had been made without the guidance of any proper theory. That brought home to them the great fact that, after all, practice did count and that it usually counted in advance of theory. But Dr. Raschig had also shown them that was not always the case. Among other substances he had introduced to their notice was one which appeared in Equation 15, namely, hydrazine. The methods which he had given for the production of this remarkable compound were the outcome of his theoretical conceptions—it was a great achievement to have given the means to produce that compound in any desired quantity. He had also devised practical methods of making hydroxylamine on a large scale, which again were the outcome of theoretical conceptions. The story they had heard related to work that was wonderful all through; he might refer especially to the extraordinary observations Dr. Raschig had made as to the way in which nitric oxide underwent oxidation, as shown in Equations 10, 11, and 12; he thought that was one of the most striking pieces of acute observation brought forward in recent times. He was hoping to have heard that he had gone further with the investigation; he trusted Dr. Raschig would now have leisure to work it out, because the oxidation of nitric oxide was one of the most extraordinary cases of change they had to deal with.

Mr. Arthur Carey referred to the last sentence of Dr. Raschig's paper in which he spoke "of the practical results which follow each successive increase of clearer insight into a technical process." With such a statement all manufacturers must be in hearty accord. Dr. Raschig had produced an intelligible theory of sulphuric acid manufacture, and he hoped with the help of it the manufacturers would be able to make material progress. There was one definite suggestion thrown out by Dr. Raschig as a means of preventing losses of nitre which he hoped would soon be practically tried. The suggestion he referred to was that a spray of weak sulphuric acid should be substituted for water or steam in the lead chambers so as to avoid the formation of the nitrous oxide produced when nitrosisulphonic acid is decomposed by water. As one who had to do with the manufacture of sulphuric acid in lead chambers, he expressed his appreciation of Dr. Raschig's great work and the brilliant paper in which he described and demonstrated it.

Dr. J. K. H. **Inglis** wrote as follows :—If the equations representing the Raschig and Lunge theories are compared, it is obvious that there is a striking difference between the complexities of the two sets of reactions that may be supposed to take place. Lunge represents the preparation of sulphuric acid as depending on the formation and decomposition of chamber crystals. Now the equation that must be written to represent the direct formation of this substance from oxides of nitrogen, oxygen, sulphur dioxide and water is a complicated one, *viz.*, $4NO_2 + 4SO_2 + O_2 + 2H_2O = 4NO_2SO_3H$. In this case then we must suppose that eleven molecules interact together to give four molecules of nitrosulphonic acid. The reaction might be written, it is true, in a simpler form, though this is not done by Lunge : but in any case the number of molecules interacting, the " order " of the reaction, must be very large. On the other hand, in the Raschig theory although many different reactions take place, each reaction involves the interaction of only a relatively small number of molecules, usually only *two or three*, as may be seen from his equations 1, 2, 3, 4. Equation 1 should probably be written $NO + NO_2 + H_2O = 2HNO_2$. Now in all apparently complex reactions that have been studied, it has been found that the reaction takes place in stages and that each stage is a comparatively simple process. This therefore seems to render Dr. Raschig's explanation more probable than that of Lunge. As regards the formation of nitrous oxide, my experiments in 1904–6 proved that the loss in this form is very small compared with the mechanical loss. I hardly think therefore that Dr. Raschig's suggestion that dilute sulphuric acid should be used instead of water would make any difference.

Dr. **Raschig** briefly replied (in German).

Manchester Section.

Meeting held at Manchester, on Friday, December 9th, 1910.

R. H. CLAYTON IN THE CHAIR.

THE BACTERIAL PURIFICATION OF AMMONIA RECOVERY LIQUOR.

BY GILBERT J. FOWLER, D.SC., EDWARD ARDERN, M.SC., AND WILLIAM T. LOCKETT, M.SC.

Many years ago experiments on the purification of Manchester sewage, which contained rather more than 0·5 per cent. of ammonia recovery liquor, showed that it was possible to purify the liquor when mixed in this proportion with sewage. Further, an accidental discharge into the sewer, of an abnormal volume of waste liquor from spent oxide washing, which contains a fair proportion of thiocyanates, occurred on December 2nd, 1899, but it was found that the filters dealing with this sewage were capable of reducing the oxygen absorption from permanganate, from 34·3 to 3·6 parts per 100,000.

Since then Frankland and Silvester[*] have shown that sewage containing 9 per cent. of ammonia recovery liquor can be satisfactorily purified on bacterial filters.

As a very large proportion of the oxidisable matter contained in this waste liquor consists of tar acids, and thiocyanates, experiments were first made in 1899, on the oxidation of pure solutions of phenol and ammonium thiocyanate. The filters consisted of glass tubes 30 inches long by 2 inches diameter, filled with mature filtering medium taken from a primary contact bed dealing with Manchester sewage.

These experiments showed that a solution of ammonium thiocyanate was capable of oxidation on bacterial filters, with the formation of nitrate and sulphate, and also that dilute solutions of phenol were readily oxidised.

As regards the thiocyanate, the experiment is practically an intensification of Munro's[*] fermentation experiments with garden soil and thiocyanate.

Since the date of the above experiments, considerable attention has been devoted to the examination of ammonia recovery liquor.

Its composition varies with the concentration, *i.e.*, with the degree to which the ammonia is removed in the distillation, as will be seen from the following typical analyses of various liquors.

Results in parts per 100,000.

Sample.	Oxygen absorption from permanganate.		Free and saline ammonia.	Ammonia evolved by alkaline per-manganate
	4 hours.	3 minutes		
a (mean of 5) ...	551	421	32·9	14·4
b ,, 4) ...	887	727	4·9	20·7
c	484	380	90·0	8·6
d	874	—	5·4	13·5
d	602	448	50·0	23·5

Frankland and Silvester in the paper previously referred to, give the following analyses :

	Parts per 100,000.		
	Average.	Maximum.	Minimum.
Phenol	140·1	172·3	108·0
Thiocyanate (as CNS.)	153·8	171·7	143·0
Thiosulphate (as S.)	46·8	52·5	41·1
Oxygen absorption, 4 hours	499·4	564·0	401·2
,, 3 minutes	333·9	391·7	300·0
Free and saline ammonia	12·8	17·2	9·6
Ammonia evolved by alkaline permanganate	14·2	20·8	11·4

Skirrow[†] gives the following analysis together with the proportion of the total oxygen absorption due to the various constituents.

	Parts per 100,000.		
		Oxygen absorption 3 minutes.	Per cent. of oxygen absorption.
Tar acids	212	284·7	52·0
Thiocyanates (as CNS.)	225	182·7	33·3
Thiosulphate (as S.)	64	53·0	9·7
Ferrocyanide (as Na salt.)	28	0·5	0·1
Other bodies (by difference)		26·9	4·9
Total		547·8	100·0

In 1908 Calmette[‡] stated that a solution of potassium thiocyanate entirely escaped oxidation when treated on aerobic bacterial filters.

It should be mentioned, however, that Calmette's filters were matured with arable soil extracts only, and consequently must be looked upon as purely nitrifying filters. Experiments referred to later will indicate that under such circumstances oxidation would hardly be expected.

Calmette's statement, however, drew the attention of the authors again to the question of the oxidation of ammonia recovery liquor, and the earlier experiments quoted were repeated in 1908, and again in greater detail during the present year.

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[*] Frankland and Silvester. This Journal, March 30th, 1907.

[*] J.C.S. Vol. 49, pp. 651 and 677.

[†] Skirrow. This Journal, January 31st, 1908.

[‡] Recherches sur L'épuration biologique et chimique des eaux d'egout par Le Dr. Calmette. Troisième Vol. 1908, pp. 80, 81.

The experiments in 1908 were conducted with similar filters to those used in 1899, with the exception that the filtering medium was taken from a mature secondary filter instead of from a primary filter as in the previous case. Solutions of potassium and ammonium thiocyanates only were dealt with, and although the action proceeded considerably slower than in the earlier experiments, it was found possible, by allowing numerous contacts, with the filtering medium, to eventually completely decompose both potassium and ammonium thiocyanate with the formation of nitrate and sulphate.

The difference in the filtering medium employed is probably the explanation of the retarded action, as in the later experiments the filters would more nearly approach the nitrifying filters of Calmette than in the former case.

Experiments conducted during the present year have been carried out in greater detail than the earlier ones alluded to, and they may be described as follows :—

Description of filters.—The filters used consisted of stoneware pipes 24 inches in length by 4 inches diameter, with one end cemented ; filled with cinders either from ¼ in. to 1 in. or ⅛ in. to 1 in. in size, matured in the first case by treating with septic tank effluent (which would contain approximately 0·5 per cent. ammonia recovery liquor) until nitrification was established.

These filters have been worked both as trickling filters and contact beds, but owing to the difficulty of controlling the former system of filtration, the filters have been worked entirely as contact beds in the experiments quoted.

Method of working filters.—To overcome the dilution effect of the interstitial water of the filters, it was found necessary at the commencement of an experiment to allow a "short" contact of the solution under investigation with the filtering media.

The filters were filled with the solution, allowed to stand 15 minutes, and discharged, the total time taken for filling, contact and discharge being half an hour. The filtrate obtained was taken as a starting point, and is referred to later in this paper at the "original" solution.

The solutions were allowed two contacts per working day. Half an hour each for filling and discharge, with 1½ hours contact. In general the procedure was as follows :—

At commencement.—Filling 9.0 a.m. to 9.5 a.m. "Short" contact 9.5 to 9.20 a.m. Discharge 9.20 to 9.30 a.m. Filtrate = "original" solution.

1st contact.—Filling 9.30 to 10 a.m. Contact 10.0 to 11.30 a.m. Discharge 11.30 to 12 noon.

2nd contact.—Filling 3.0 p.m. to 3.30 p.m. Contact 3.30 to 5 .0 p.m. Discharge 5.0 p.m. to 5.30 p.m.

3rd contact.—Filling 9.0 to 9.30 a.m. Contact 9.30 to 11.0 a.m. Discharge 11.0 to 11.30.

4th contact.—Filling 3.0 p.m. to 3.30 p.m., etc.

Filters were allowed to rest from Saturday noon to Monday 9.0 a.m.

METHODS OF ANALYSIS.

Thiocyanate.—Determined by the addition of ferric chloride to minimum quantities of the solutions and comparison of coloration produced with that obtained with varying quantities (0·1 c.c.—1·0 c.c.) of a standard solution of ammonium thiocyanate containing 1 grm. of the pure salt per litre.

Thiocyanate in presence of phenol.—In the filtration experiments on mixtures of thiocyanate and phenol it was found possible by using minimum quantities of solution to determine the thiocyanate directly as above. Experiments showed that the phenol present was insufficient to affect the coloration produced.

Phenol.—The general method adopted was that described by Skirrow in a paper on the "Determination of phenols in gas liquors, etc."* In the case of filtrates containing phenol alone the determinations were made direct, by addition of required amount of potash, formation of tri-iodo-phenol, and titration of excess of iodine with thiosulphate.

Phenol in presence of nitrite.—Whenever nitrite appeared in the filtrates it was found necessary first of all to decompose it by the addition of urea and sulphuric acid. Experiments have shown that urea does not interfere with the subsequent reaction.

Phenol in presence of thiocyanate.—The method adopted in this case is described in the paper previously quoted, and consists essentially of separation of phenol from thiocyanate by a series of distillations and determinations of phenols in the distillates.

I. OXIDATION OF THIOCYANATES.

(*a*) *Comparison of potassium and ammonium thiocyanate.*—The first point investigated was the comparison of the oxidation of ammonium and potassium thiocyanates.

Although the results of the first experiments were rather favourable to the potassium salt, as the result of a number of determinations it may be concluded that there is no material difference between the rates of oxidation of the two salts.

In the following tables are given the results of a typical experiment.

OXIDATION OF THIOCYANATES.

Experiment 7.	Results in parts per 100,000.			
	$NH_4.CNS$.		K.CNS.	
	4 hours oxygen absorption.	Thiocyanate as CNS.	4 hours oxygen absorption.	Thiocyanate as CNS.
"Original" solution	8·20	9·3	8·20	9·4
Filtrate after 2 contacts ..	6·50	6·9	6·70	7·2
,, ,, 4 ,, ..	4·70	5·0	5·00	5·0
,, ,, 6 ,, ..	3·30	3·1	3·30	3·3
,, ,, 8 ,, ..	1·83	1·2	2·06	1·5
,, ,, 9 ,, ..	0·74	0·3	1·26	0·8
,, ,, 10 ,, ..	0·46	0·15	0·57	0·4

(*b*) *Course of reaction.*—As a result of the previous experiment it was decided to continue the investigations with potassium thiocyanate, so that the oxidation of the CNS radicle could be more readily followed.

Numerous experiments were therefore carried out on the filtration of solutions of potassium thiocyanate, and the following determinations made at intervals during the course of the experiment, viz., oxygen absorption from permanganate, thiocyanate, nitrogen and its various compounds, and sulphate.

In order to eliminate any error due to oxidation changes in the filtering medium itself, a control filter was worked with tap water, side by side with the one dealing with thiocyanate.

In Table A are given the results of typical experiments.

Assuming that the oxidation changes in the medium of the working filter are identical with those of the blank filter receiving water, the above results show that practically 50 per cent. of the nitrogen contained originally in the thiocyanate was recovered as ammonia and nitrate, and rather over 70 per cent. of the sulphur originally present was found as sulphate in the final filtrate.

(*c*) *Effect of the addition of nitrate.*—(i.) In the form of potassium nitrate. (ii.) In the form of a highly purified sewage effluent containing a large proportion of oxidised nitrogen.

The object of this experiment was to determine how far denitrification changes were concerned with the purification process.

1. In Table B are given the mean of results of three experiments.

It will be seen that the addition of nitrate appears slightly to retard rather than facilitate the reaction.

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* Skirrow. This Journal, Jan. 31st, 1908.

TABLE A.—OXIDATION OF POTASSIUM THIOCYANATE.
Results in parts per 100,000.

	Control filter receiving water.				Filter receiving thiocyanate.				
	4 Hours oxygen absorptn.	Ammoniacal nitrogen.	Nitrous and nitric nitrogen.	Sulphate expressed as—CNS.	4 Hours oxygen absorptn.	Ammoniacal nitrogen.	Nitrous and nitric nitrogen.	Sulphate expressed as—CNS.	Thiocyanate as —CNS.
Experiment 2—									
" Original " solution	0·07	nil	0·11	—	7·60	0·03	0·09	—	8·9
Filtrate after 2 contacts ..	0·20	nil	0·29	—	5·60	0·13	0·28	—	—
,, ,, 4 ,, ..	0·34	nil	0·65	—	3·67	0·38	0·62	—	—
,, ,, 6 ,, ..	0·60	nil	0·47	—	2·27	0·54	0·80	—	—
,, ,, 8 ,, ..	0·37	nil	0·55	—	0·51	0·80	0·94	6·6	trace
Experiment 3—									
" Original " solution	0·47	nil	nil	—	7·90	nil	0·12	—	8·9
Filtrate after 9 contacts ..	0·46	nil	0·30	1·2	0·57	0·62	0·77	7·6	trace
Experiment 4—									
" Original " solution	0·40	nil	trace	—	7·70	trace	0·17	—	8·9
Filtrate after 2 contacts ..	0·30	nil	0·47	—	6·30	0·08	0·33	—	6·8
,, ,, 4 ,, ..	0·20	nil	0·47	—	4·30	0·35	0·52	—	4·9
,, ,, 6 ,, ..	0·40	nil	0·59	—	2·80	0·59	0·69	—	2·5
,, ,, 9 ,, ..	0·31	nil	0·53	1·8	0·57	0·71	0·52	7·4	0·2
Experiment 5—									
" Original " solution	0·50	nil	0·05	—	8·20	trace	0·12	—	9·15
Filtrate after 8 contacts ..	0·23	nil	0·33	1·2	1·20	0·77	0·77	7·9	0·8

TABLE B.—FILTRATION OF POTASSIUM THIOCYANATE AND NITRATE.
Results in parts per 100,000.

	Thiocyanate plus nitrate.			Thiocyanate (alone).	
	4 hours oxygen absorption.	Thiocyanate as CNS.	Nitric N.	4 hours oxygen absorption.	Thiocyanate as CNS.
" Original " solution	7·93	9·3	11·5	8·20	9·5
Filtrate after 2 contacts........................	6·07	6·7	—	6·17	6·9
,, ,, 4 ,, ...	4·55	4·9	—	4·25	4·7
,, ,, 6 ,, ...	3·25	3·4	—	2·70	2·8
,, ,, 8 ,, ...	2·30	2·1	—	1·53	1·4
,, ,, 9 ,, ...	1·75	1·6	—	0·79	0·7

TABLE C.—FILTRATION OF POTASSIUM THIOCYANATE AND HIGHLY PURIFIED SEWAGE EFFLUENT.
Results in parts per 100,000.

	Thiocyanate and effluent.				Thiocyanate (alone).			
Experiment 2.	4 hours oxygen absorption.	Thiocyanate as CNS.	Ammoniacal N.	Nitrous and nitric N.	4 hours oxygen absorption.	Thiocyanate as CNS.	Ammoniacal N.	Nitrous and nitric N.
" Original " solution	8·00	9·2	0·23	1·92	8·30	9·2	0·13	0·31
Filtrate after 4 contacts............	4·60	4·5	0·59	2·47	4·20	4·2	0·60	—
,, ,, 8 ,, ...	2·46	2·2	0·59	3·05	1·77	1·4	0·61	1·17
,, ,, 9 ,, ...	1·83	—	0·74	3·26	1·14	—	0·67	1·17
,, ,, 10 ,, ...	1·46	1·0	—	3·46	0·46	trace	—	1·23

(2) The results of experiments on the addition of nitrate in the form of a highly purified sewage effluent are given in Table C.

These results show that the final oxidation change is obviously one of nitrification. The fact that the activity of the filter is not increased by the addition of sewage effluent, is probably due to there being already suitable conditions for the adequate nitrification of the thiocyanate as evidenced by the formation of nitrates in the filter receiving thiocyanate alone.

The constant increase of nitrate in the filtrates obviously gives no indication of denitrification.

(*d*) *Filtration of stronger solutions of KCNS.*—The later experiments were confined to the oxidation of increased strengths of potassium thiocyanate solution of which the following typical examples may be given.

Results in parts per 100,000.

	4 hours oxgyen absorption.	Ammoniacal nitrogen.	Nitrous and nitric nitrogen.	Thiocyanate as CNS.
Experiment 3.				
" Original " solution	13·20	0·14	0·38	15·3
Filtrate after 4 contacts ..	7·80	0·63	0·77	9·8
,, ,, 8 ,, ...	4·71	1·06	1·10	4·5
,, ,, 12 ,, ...	2·29	1·32	1·48	1·5
,, ,, 16 ,, ...	0·97	0·99	1·91	nil
Experiment 11.				
" Original " solution	17·40	0·22	0·49	18·7
Filtrate after 4 contacts ..	10·30	1·04	1·04	11·2
,, ,, 8 ,, ..	6·70	1·59	1·15	6·1
,, ,, 12 ,, ..	1·66	1·86	—	1·0
,, ,, 14 ,, ..	0·46	2·35	1·76	trace

It will be seen that the results are similar to those obtained with the weaker solutions of thiocyanate, the stronger solutions, of course, requiring further contacts with the filtering medium, to effect complete oxidation.

It may be mentioned that special observations with the stronger solutions of thiocyanate have shown that while nitrites are always found in the filtrate by far the greater proportion of the oxidised nitrogen appears as nitrate.

Bacterial examination of the filtrates from the thiocyanate solutions of the greatest strength used, showed apparently no inhibiting effect.

II.—Oxidation of Phenol.

(a) *Filtration of phenol solution.*—A large number of experiments have been carried out on the filtration of varying strengths of phenol solution.

Typical results obtained are given in the following table :

Filtration of Solution of Phenol.

Results in parts per 100,000.

		4 hours oxygen absorption.	Phenol.
Experiment 5.	" Original " solution ..	27·2	15·2
	Filtrate after 1 contact	12·0	6·6
	,, ,, 2 contacts	3·8	1·6
	,, ,, 3 ,,	0·5	nil.
Experiment 10.	" Original " solution ..	48·0	27·0
	Filtrate after 1 contact	36·2	20·1
	,, ,, 2 contacts	21·0	11·9
	,, ,, 3 ,,	10·8	6·1
	,, ,, 4 ,,	4·1	2·4
	,, ,, 5 ,,	0·6	nil.
Experiment 14.	" Original " solution ..	87·0	44·4
	Filtrate after 1 contact	77·0	41·6
	,, ,, 2 contacts	69·3	36·0
	,, ,, 3 ,,	58·0	32·0
	,, ,, 4 ,,	55·6	30·4
	,, ,, 5 ,,	49·2	26·3
	,, ,, 6 ,,	46·8	25·6
	,, ,, 7 ,,	42·4	22·4
	,, ,, 8 ,,	36·8	21·1
	,, ,, 9 ,,	31·6	17·8
	,, , 10 ,,	28·4	12·5
	,, ,, 11 ,,	20·6	10·6
	,, ,, 12 ,,	12·4	5·4
	,, ,, 13 ,,	7·2	2·4
	,, ,, 14 ,,	2·7	0·8
	,, ,, 15 ,,	0·4	nil.
Note :—Filter rested one week prior to			
Experiment 16.	" Original " solution ...	90·00	48·7
	Filtrate after 7 contacts	4·20	—
	,, ,, 8 ,,	0·77	nil.
Experiment 17.	" Original " solution ...	88·00	47·1
	Filtrate after 8 contacts	9·30	4·1
	,, ,, 9 ,,	4·40	1·4
	,, ,, 10 ,,	0·74	nil.
Experiment 22.	" Original " solution ...	113·20	61·2
	Filtrate after 8 contacts	60·00	—
	,, ,, 16 ,,	2·40	1·0
	,, ,, 17 ,,	·34	nil.
Note :—Filter rested for one week prior to			
Experiment 25.	" Original " solution ...	109·60	60·0
	Filtrate after 1 contact	87·00	—
	,, ,, 9 contacts	8·40	—
	,, ,, 11 ,,	·89	—
Experiment 31.	" Original " solution ...	116·80	61·9
	Filtrate after 4 contacts	61·60	—
	,, ,, 9 ,,	2·50	—
Experiment 33.	" Original " solution ...	127·20	67·6
	Filtrate after 9 contacts	4·74	—

The above results show that solutions of phenol containing 10 to 15 parts of phenol per 100,000 are rapidly oxidised on bacterial filters, three contacts with the filtering medium being sufficient to complete the oxidation of the phenol.

They also show that it is possible to oxidise solutions containing as much as 68 parts phenol per 100,000, although in this case, numerous contacts with the filtering medium are required.

Further, experiments Nos. 14 and 16, 22 and 25, clearly indicate the beneficial effect of a prolonged recuperative period, on the activity of the filter.

(b) *Course of reaction.*—Although no attempt has been made to isolate intermediate products, it is most probable that the final oxidation products are carbonic acid and water.

Examinations of the final filtrate after the complete oxidation of phenol, showed only small quantities of carbonic acid and bicarbonate, in fact the amount found was only equivalent to 1·9 per cent. of the original carbon present.

It must therefore be concluded that the carbonic acid formed is either absorbed by the filtering medium or evolved during the oxidation periods between the fillings.

The increase in total solids in the final filtrate from the filter dealing with the phenol solution, over the amount in the filtrate from the control filter was found to be only 2·2 parts per 100,000.

This result corroborates the conclusion that the final oxidation products of phenol are carbonic acid and water, inasmuch as the bicarbonate present is sufficient to account for the increase of the solids in solution.

(c) *Effect of the addition of nitrate.* (i.) In the form of potassium nitrate.

(ii.) In the form of a highly purified sewage effluent containing a large proportion of oxidised nitrogen.

The results of typical experiments are given in Tables D and E.

It will be seen that both in the case of the addition of potassium nitrate alone and of nitrate with a sewage effluent, the oxidation of phenol was somewhat facilitated.

In each case an actual loss of nitrate is to be noted, in fact, in the first set of experiments, with sewage effluent alone, the whole of the nitrate was reduced and consequently in the later experiments, one of which is given above, a further quantity of nitrate was added in order to ensure excess.

This diminution of nitrate with the production of nitrite, indicates that in the conditions of the above experiment, the oxidation change was due to some extent to denitrification.

The earlier filtration experiments showed that the oxidation could proceed in the absence of nitrates, and consequently it would appear that denitrification is not an essential factor in the process.

(d) *Effect of the addition of KHO to the phenol solution.*—It was thought of interest to determine if the addition of caustic potash to the phenol before filtration, would affect the action in any way.

In the experiment, the results of which are given below, potash was added to the original solution until a reaction was given with phenolphthalein, and again after each contact with the filtering medium, a slight excess of potash was added.

Filtration of Phenol with KOH.

Results in parts per 100.000.

Experiment 3.	Phenol with KOH.		Phenol (alone).	
	4 hours oxygen absorption.	Phenol.	4 hours oxygen absorption.	Phenol.
" Original " solution......	33·60	17·3	34·20	18·0
Filtrate after 1 contact ..	28·20	14·5	27·20	13·6
,, ,, 2 contacts..	18·80	9·6	18·00	9·2
,, ,, 3 ,, ..	10·67	5·5	9·13	4·7
,, ,, 4 ,, ..	4·83	2·7	3·37	1·7

The above figures show that the addition of potash has apparently no effect on the reaction.

TABLE D.—FILTRATION OF PHENOL AND NITRATE.

Results in parts per 100.000.

	Filter "A." Phenol with KNO_3.				Filter "B." Phenol (alone).			
	4 hours oxygen absorption.	Phenol.	Nitrous nitrogen.	Nitric nitrogen.	4 hours oxygen absorption.	Phenol.	Nitrous nitrogen.	Nitric nitrogen.
"Original" solution	61·33	32·0	nil	10·29	61·33	31·0	—	—
Filtrate after 3 contacts	13·60	6·6	·06	8·65	28·60	15·7	—	—
" " 4 "	4·74	2·7	·06	—	21·00	12·6	—	—
" " 5 "	0·60	nil	·05	8·23	14·10	7·9	—	—

Note.—In order to obviate any possible error due to difference in activity of the two filters, nitrate was then added to the control filter. The results from the latter at once improved, and finally the control became as efficient as the one originally receiving nitrate, as is seen by following figures.

	Filter A. Phenol with KNO_3.				Filter B. Phenol with KNO_3.			
"Original" solution	58·67	29·1	·01	10·21	58·67	30·7	trace	10·54
Filtrate after 1 contact	37·60	17·9	·01	—	38·40	19·0	·06	—
" " 2 contacts	22·40	10·4	·11	8·63	21·20	10·7	·09	8·65
" " 3 "	—	5·0	·12	—	10·80	4·5	·19	—
" " 4 "	2·43	1·7	—	8·23	2·00	1·7	—	7·90
" " 5 "	0·49	—	—	—	0·46	—	—	—

TABLE E.—FILTRATION OF PHENOL AND HIGHLY PURIFIED EFFLUENT.

Results in parts per 100,000.

	Phenol and nitrate with sewage effluent.				Phenol and nitrate.			
	4 hours oxygen absorption.	Phenol.	Nitrous nitrogen.	Nitric nitrogen.	4 hours oxygen absorption.	Phenol.	Nitrous nitrogen.	Nitric nitrogen.
"Original" solution	70·86	34·0	·01	2·88	72·00	34·2	·01	2·30
Filtrate after 1 contact	45·60	22·0	·22	—	43·60	22·3	·13	—
" " 2 contacts	27·60	13·5	·25	2·30	24·60	12·2	·13	2·07
" " 3 "	15·70	6·9	·25	—	13·10	5·0	·16	—
" " 4 "	5·31	2·2	·16	2·07	3·31	1·3	·16	1·38
" " 5 "	1·03	0·2	·20	1·73	0·74	nil	·13	1·44

TABLE F.—FILTRATION OF MIXTURES OF PHENOL AND THIOCYANATE.

Results in parts per 100,000.

	(*a*) Equal absorption.			(*b*) Equal parts by weight.		
	4 hours oxygen. absorption.	Thiocyanate as CNS.	Phenol.	4 hours oxygen absorption.	Thiocyanate as CNS.	Phenol.
	Experiment 7.			Experiment 4:—		
Phenol solution	18·80	—	—	76·00	—	—
Thiocyanate solution	18·60	—	—	19·00	—	—
Mixture	19·00	—	—	47·60	—	—
Original solution	16·00	9·6	3·5	33·50	10·0*	15·1
Filtrate after 1 contact	8·30	7·6	1·2	24·80	8·2	8·6
" " 2 contacts	6·20	6·8	nil	15·60	6·7	4·4
" " 3 "	4·63	5·0	nil	8·00	5·2	1·5
" " 4 "	—	—	nil	4·50	4·6	nil
" " 5 "	2·17	2·3	nil	3·26	3·3	nil
" " 6 "	—	—	nil	2·63	2·4	nil
" " 7 "	1·09	0·7	nil	2·00	1·9	nil
" " 8 "	—	—	nil	1·29	1·5	nil

* Equivalent to 16·7 parts KCNS.

III.—OXIDATION OF SOLUTIONS CONTAINING BOTH THIOCYANATE AND PHENOL.

Filtration experiments with solutions of thiocyanate and phenol (*a*) in proportion to their oxygen absorption from permanganate; (*b*) in approximately equal parts by weight have confirmed the results of the experiments previously quoted.

In every case it has been found that the phenol is more rapidly oxidised than the thiocyanate.

The results in Table F may be given as typical.

IV.—Bacteriological Investigation.

The bacterial content of the filtrates from the various filters was determined from time to time.

In the case of the filters dealing with thiocyanate a variety of organisms was generally found, while in the case of the filtrates from the filters dealing with phenol solution only two or three types of organisms appeared.

Thus in the case of the phenol a definite selective action was clearly established.

It therefore became of interest to investigate the question from the point of view of bacterial action.

In the first case, a filtrate from one of the filters dealing with phenol solution with added nitrate, which still contained a considerable amount of unoxidised phenol, was placed in a bottle and aerated continuously by means of a suction pump.

A control experiment was made by similarly aerating a sterile solution containing as nearly as possible the same quantity of phenol, nitrate and nitrite as in the filtrate.

The air passing through the solutions was drawn first through a cotton wool plug and the control solution and afterwards through the filtrate. By this means any change in phenol solutions possibly due to air infection, would be readily detected by a change in the phenol content of the control.

The results of the experiment are given below.

Similar investigations are in progress in regard to the bacterial oxidation of thiocyanate of potassium.

The results so far obtained indicate that the oxidation of thiocyanate is probably due to two or more organisms acting in symbiosis.

V.—Summary and Conclusions.

The foregoing investigations have established :—

1. That solutions of thiocyanate and phenol can be oxidised on bacterial filters.

2. That no essential difference exists in the rate of oxidation of potassium and ammonium thiocyanates.

3. That about 50 per cent. of the nitrogen of the thiocyanate is recovered as ammonia and nitrate, and about 70 per cent. of the sulphur as sulphate.

4. That denitrification changes do not play an important part in the oxidation of thiocyanates.

5. That solutions of thiocyanate up to a concentration of 18·7 parts CNS per 100,000 can be oxidised.

6. That solutions of phenol up to 68 parts phenol per 100,000 can be oxidised on bacterial filters.

7. That the products of oxidation of phenol are most probably carbonic acid and water.

8. That the oxidation of phenol may be due to a limited extent to denitrification, but is essentially a direct process.

Aeration of Filtrate containing Phenol.
Results in parts per 100,000.

	Filtrate.				Control.			
	4 hours oxygen absorption.	Phenol.	Nitrous nitrogen.	Nitric nitrogen.	4 hours oxygen absorption.	Phenol.	Nitrous nitrogen.	Nitric nitrogen.
At commencement	19·60	9·8	·07	10·29	19·60	9·0	0·05	8·65
After aerating 1 day	18·40	—	—	—	—	—	—	—
" " 2 days	16·60	8·2	·07	—	—	—	—	—
" " 6 "	11·30	5·5	·05	—	—	—	—	—
" " 9 "	8·10	3·9	·05	—	18·80	—	0·03	—
" " 16 "	2·06	—	·05	—	—	—	—	—
" " 19 "	0·80	0·2	—	8·91	18·20	9·4	0·03	—
" " 53 "	—	—	—	—	17·20	—	—	—

It will be seen from the above table that the oxidation of phenol in the filtrate was gradual, and that complete oxidation took place in 19 days, whereas the control experiment showed practically no change in phenol content after 53 days' aeration.

The filtrate was examined bacterially at the commencement and towards the end of the experiment. The bacterial content was practically confined to two species of organism, viz., *B. liquefaciens fluorescens*, and a chromogenic organism which was practically non-liquefying. There was a decrease in the number of organisms present in the filtrate, as the experiment continued.

The above experiment showed conclusively that it was possible by bacterial action to oxidise solutions of phenol.

This experiment led to investigations on the action of organisms in pure culture on phenol solutions.

The organisms present in the above filtrate were isolated and solutions of phenol inoculated with the cultures obtained.

The results of this investigation were communicated to the Royal Society on November 17th last, and the final conclusion was that a specific organism closely resembling *B. Helvolus* (Zimmermann) is capable of completely oxidising phenol in dilute solution.

The strongly aerobic character of the organism is illustrated by an experiment in which a similar filtrate to the one used in the experiment previously described, was incubated in absence of air. No change in phenol content occurred even after 14 days, while even after eight months incubation a large proportion of the phenol originally present was unaffected.

9. That the oxidation of phenol proceeds equally in solutions faintly acid or slightly alkaline solutions to phenolphthalein.

10. That phenol is more rapidly oxidised on bacterial filters than thiocyanates.

11. That the oxidation of phenol can be brought about by the action of a single species of organism.

12. That the oxidation of thiocyanate is in all probability due to the combined action of several organisms.

It will be noted that attention has been confined in the foregoing paper to the oxidation of thiocyanates and phenol, as being the main oxygen consuming constituents of ammonia recovery liquor. At the same time it may be mentioned that experiments have been made and are still in progress on the oxidation of thiosulphate on bacterial filters.

It was originally intended to include in the present paper, experiments on the influence of ammonia recovery liquors on the oxidation of the organic matter contained in domestic sewage.

The inclusion of these experiments would, however, unduly prolong the paper, and at the same time introduce practically a new subject.

In view also of the importance of the questions involved, it was considered essential that further rather more complete investigations should be made before publication of the results.

For the above considerations it has been deemed advisable to leave these investigations for the subject matter of a future paper.

EXPERIMENTS ON THE BACTERIAL PURIFICATION OF AMMONIA RECOVERY LIQUOR AT THE GAS WORKS OF THE MANCHESTER CORPORATION.

BY GILBERT J. FOWLER, D.SC., AND ALFRED L. HOLTON.

Owing to the increasing objections that are being raised throughout the country as to the discharge of the waste liquor from ammonia recovery plants into sewers and waterways, experiments were initiated in 1904 to obtain trustworthy data as to the possibility of purifying these liquors on bacterial filters. Facilities were given by the Gas Committee of the Manchester Corporation for the trials to be made in connection with their ammonium sulphate plant at the Bradford Road gas works. The experiments have been carried out under the joint supervision of the authors of the paper. the analyses quoted have been made in the laboratory at the Davyhulme Sewage Works.

The liquor in all cases has been carefully freed from suspended solids by adequate sedimentation.

A tower filter was constructed of timber. The filtering medium was at first filled in to the depth of 4 yards, the upper surface area being one yard. Hard screened boiler clinker was used of the following sizes, beginning from above downwards :—4½ ft., ¼in. to ½ in. ; 6 ft., ½ in. to 1 in. ; 1 foot rough clinker. The filter was put into operation on May 7th, 1904. Indifferent results were obtained on attempting to purify the waste liquor directly on ordinary clinker in July, 1904 ; therefore, the upper cubic yard of medium was replaced by material from the Davyhulme Sewage Works and the crude liquor was diluted with water. Distribution was effected by dripping from a height on to a brick, from which the liquid splashed in a fine spray.

It was quickly realised that only in a few exceptional cases would it be possible to utilise fresh water for dilution, on account of expense. Arrangements were therefore made by means of duplicate tanks to mix the crude liquor with 9 volumes of the effluent and to pump this mixture up to the top of the filter. At the same time one volume of purified effluent (equal, *i.e.*, to the volume of crude liquor) passed away continually into the sewer. These arrangements can be understood from Figure.

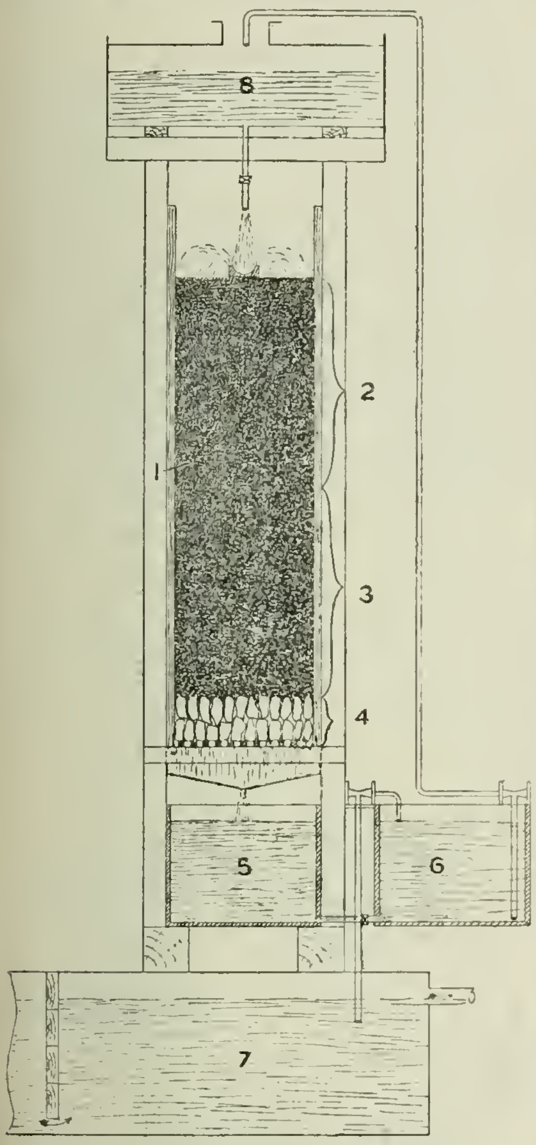
A record of the experiments during 6½ years is given in the table.

RECORD OF TRIALS OF EXPERIMENTAL FILTER AT BRADFORD ROAD GAS WORKS.

Date.		Rate of Flow per Cubic yard per diem.	Dilution.		Per cent. purification. Inlet to outlet (with dates of sampling).	Remarks.
From.	To.		Diluent.	Per cent. of waste Liquor.		
1904. May 7	1904. May 21	24	Nil	100	Per cent. 20—June 9	
July 20	July 30	6	water	10	52—Aug. 20	Top cubic yard of filtering medium replaced with material from Davyhulme Sewage works.
Sept. 4	Sept. 21	6	,,	15	92—Sept. 15—19	
Sept. 21	Oct. 14	6	,,	15	91—Sept. 21—Oct. 4	
Oct. 15	Nov. 24	6	,,	20	94—Nov. 15—18.	
Nov. 29	1905. Jan. 13	6	,,	25	68—Nov. 29—Jan. 13	
1905. Jan. 25	Mar. 10	12	,,	25	81—Feb. 18—Mar. 8—9	
Mar. 13	April 17	24	,,	25	82—Mar. 13—24, April 15	
June 19	June 24	33	,,	25	67—June 21	
Sept. 12	Dec. 14	50	,,	25	68—Oct. 23—24, Nov. 15	
1906. Jan. 15	1906. Jan. 27	17	,,	25	11—Jan. 25	
April 10	April 19	8	,,	10	83—April 10—19	
Aug. 13	Sept. 2	27	,,	10	93—Aug. 22, Sept. 1	
Oct. 23	Nov. 19	27	effluent water one day per week	10	91—Oct. 24, 7, 9, 31—Nov. 1	
Nov. 19	Dec. 15	27	effluent water	50, 40, 10	76—Nov. 21, 4, 7,—Dec 6, 8, 12	Dec 4th, 1906.—The top layer of fine coal removed, and filter made 3 yards deep.
Dec. 31	1907. Feb. 23	27	,,	10	68—Jan 9, 19, 30—Feb. 13, 21	
1907. Mar. 4	April 11	27	,,	10	77—Mar. 9, 18	
May 28	June 15	103	effluent	10	75—June 3, 6, 7, 8, 11, 12, 14, and 15	
Aug. 14	Oct. 1	103	,,	10	75—Aug. 24, 8—Sept. 14, 20, 24 and 27	
Oct. 9	Oct. 19	103	,,	10	52—Oct. 17 and 19	
Oct. 29	Nov. 28	70	,,	10	50—Nov. 1, 2, 7, 9, 12, 14, 22, and 28	
Dec. 11	Dec. 24	70	water one day per month	10	59—Dec. 13, 16, 17, and 19	
1908. Jan. 2	1908. Feb. 22	70	,,	10	62—Jan. 14, 29—Feb. 1, 10	
Feb. 28	April 15	70	,,	10	74—Mar. 10, 28—April 6, 15	
Aug. 19	Oct. 10	70	,,	10	72—Aug. 28, 31—Sept. 4, 5	
1909. April 29	1909. May 12	17	effluent	10	64—April 30—May 12	
May 12	May 20	33	,,	10	75—May 13, 20	
July 1	July 17	70	,,	10	83—July 2, 16	
Oct. 5	Oct. 16	83	,,	10	69—Oct. 12, 13 and 14	
Nov. 28	1910. May 14	100	,,	10	59—Jan., Mar., April, May	
June 14	July 15	100	,,	10	81—June 30—July 12, 15	
Aug. 8	Aug. 28	100	,,	10	84—Aug. 16, 27	
Sept. 6	Sept. 23	100	,,	10	62—Sept. 7, 10 and 14	
Oct. 4	Oct. 30	100	,,	10	72—Oct. 12, 14, and 20	

During these runs the filter was at rest each Sunday for 24 hours.

It is of interest to note that recent bacteriological examinations of the purified effluent have shown that large numbers of organisms are present, and among them an organism similar to the one described in the paper read before the Royal Society on November 17th last,* and which is capable of actively oxidising phenol.



Experimental Waste Liquor Filter.

1. Tower, 4 yards deep, 1 yard square.
2. 1½ cubic yards of ¼ in. to ½ in. screened boiler clinker.
3. 1½ cubic yards of ½ in. to 1 in. screened boiler clinker.
4. Rough boiler clinker.
5. Collecting tank.
6. Mixing tank.
7. Waste liquor tank.
8. Diluted waste liquor feed tank.

From the data given in the table the following points may be emphasised :—

1. The filter has been at work for six years, and is still as efficient as ever.

2. The effluent from the filter can be used for dilution, no other diluent having been employed for 18 months.

3. A high percentage purification is obtained, viz., from 55 per cent. to 84 per cent. calculated on the diluted liquor, which is equivalent to 92 per cent. and 98 per cent. respectively when calculated on the undiluted liquor.

4. The material has never been re-screened. At the end of 2½ years the material was taken out for examination on account of unexplained deterioration in results. The material was not sterile, and was replaced with the exception of the fine surface layer and 3 feet of upper material. The material from Davyhulme became mixed with the screened boiler clinker on refilling.

5. For the last year the rate of flow has been constant, viz. :—100 gallons per day per cubic yard. This appears to be the economic rate for an average liquor.

Assuming an outflow of 4,000 gallons of waste liquor per ton of sulphate of ammonia made, a filter bed of 400 cubic yards will be required per ton of sulphate of ammonia made per diem. This is, of course, simply an average figure.

Such an estimate should ensure about 90 per cent. purification calculated on the crude liquor, and for discharge into sewers communicating with sewage works this should be ample.

Experience has shown that where the local conditions are favourable the bacterial method is likely to be less costly than any other process which can insure an equivalent degree of purification.

EXPERIMENTS ON THE BACTERIAL PURIFICATION OF AMMONIA RECOVERY LIQUOR AT THE CHEMICAL WORKS OF THE BRADFORD CORPORATION.

BY GILBERT J. FOWLER, D.SC., AND STEPHEN W. SHEPHERD.

The experiments at these Works were begun at the request of the Bradford Corporation Gas Committee in May, 1908. The flow of liquor at these Works amounts to 30,000 gallons per day, and it has a higher oxygen absorbed figure than the effluent produced at the Manchester Corporation Gas Works, viz., over 700 on the 4 hours' oxygen test as compared with about 500.

The Chemical Works adjoin the Corporation Sewage Works and certain experimental sewage filters were available for the bacterial purification of the waste liquor. After consideration of the local circumstances it was decided, with the consent of the Sewage Committee, to utilise one of these filters for the purpose of the experiment. Arrangements were readily made for conveying the liquor to this filter and water from the stream near the Chemical Works was used for dilution, the dilution being made in an old boiler of some 5000 gallons capacity.

The filtering medium used was hard clinker of the following dimensions beginning at the top :—6 in. material ⅛ in. to ¼ in., 2 ft. 6 in. of ¼ in. to 1 in., 1 ft. of 1 in. to 2 in., and 1 ft. of large clinker up to 6 in. The total depth of the filter was thus 5 ft. ; the superficial area was 24 sq. yds., giving a total cubic filter space of 40 cubic yds.

The distribution was effected by means of lead gutters dripping on to small pieces of slate. The filter with the necessary pumping arrangement was ready for use in October, 1908.

During the earlier period of working the filter several difficulties were encountered, viz., preliminary inoculation ; strength of liquor ; and frost.

Eventually in July, 1909, the filter was re-inoculated with an extract of soil which had been covered with cow dung, and which quickly showed a strong development of nitrate. The liquor was now diluted 19 to 1 instead of 9 to 1. At this dilution more organisms were found in the liquid before filtration than after filtration, a state of things which is characteristic of filters in good condition.

From this time the results improved until in November, 1909, it was possible to pass through 3200 gallons with a reduction in the 3 minutes' oxygen test from 24 to about 5, or nearly 80 per cent. As already stated, the Frizinghall liquor is considerably stronger (measured by the oxygen test) than the liquor at Bradford Road, Manchester, consequently the rate of flow just mentioned which equals 80 gallons per cube yard compares very well with the 100 gallons per cube yard obtained at Bradford Road, Manchester.

Up to this time, however, water or dilute sewage from the neighbourhood of the Chemical Works had been used

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*On the oxidation of phenol by certain bacteria in pure culture. Fowler, Ardern and Lockett. *Loc. cit.*

for dilution partly owing to the difficulty in operating the pump, necessary if the effluent from the filter itself was to be used for dilution. Towards the end of February of this year it was, however, possible to use the effluent for dilution purposes, and a 12 days run was given to the filter under these conditions, the flow varying from 3250 to 3500 gallons per 24 hours or between 80 and 90 gallons per cube yard. Under these conditions an effluent was obtained with a 4 hours' oxygen test of 12·2, compared with the same test for the crude liquor of 738. That is to say a total purification of over 98 per cent.

In the table are given the final results obtained when using the effluent from the filter for diluting purposes.

This result was highly satisfactory and judging from the long experience with the Manchester filter there seemed no reason to doubt that such results can be maintained. An examination of the filter on March 21st last showed that practically no clogging had taken place. The presence of live worms in the upper layer of the filter indicated that the conditions were favourable for organic life.

In the light of these experiments the Bradford Gas Committee arranged to equip a large circular filter $\frac{1}{10}$ acre in area, 8 ft. deep, adjoining the experimental filter, in such a way that from $\frac{1}{4}$ to $\frac{1}{3}$ of the total quantity of liquor might be dealt with thereon.

The material is again hard clinker graded as follows, beginning at the top:—

6 feet	$\frac{1}{4}$ in. to 1 in.
1 foot	1 in. to 2 in.
1 foot	up to 6 in.

TABLE.—*Results obtained from experimental filter treating mixed effluent and crude liquor, February 16th to 28th,* 1910.

Analytical figures in parts per 100,000.

	Crude liquor.	Mixture crude liquor and effluent.	Final effluent.
Character of samples	Turbid reddish brown, tarry small, alkaline reaction	Brownish liquid, tarry smell.	Clear yellow liquid, no smell
Oxygen absorbed—			
4 hours' test	738	30·0	12·2
3 minutes' test	448 (one sample)	24·0	10·2
Nitrogen—			
Ammoniacal	27·7	4·75	5·08
Albuminoid	18·5	0·98	0·59
Nitrous	..	strong	Fair
Nitric and nitrous	..	0·90	1·44
Chlorine	..	135·2	128
Sulphocyanates	..	Present (dark brown with ferric chloride)	Present (red colour with ferric chloride)
Phenol	..	Present	Nil
Alkalinity (N/100 acid per 100 c.c.)	..	26. M.O.	18 M.O.
Bacteria per c.c.	Nil	$\frac{1}{4}$ c.c. plates liquefied in 3 days	320,000 approx. in 3 days
Rate of flow per cubic yard	..	80—87·5	..
Percentage purification calculated on oxygen test	..	..	Calculated on mixed liquid, **59**. Calculated on crude liquor, **98**
Remarks	Average of 2 samples analysed in Dr. Wilson's laboratory and in Manchester.	—	—

The distribution is effected by a rotary trough sprinkler.

The pumping arrangements are nearly completed, and it is hoped that the filter may be put into operation at an early date.

DISCUSSION.

The CHAIRMAN said a great deal had been done lately with a view to the prevention of the contamination of waste liquors by phenols and sulphocyanides. It had been found that phenols were practically constant in all parts of gas liquor. They could not prevent the condensation of the phenols merely by keeping the liquors hot. Gas works liquor contained a large amount of sulphocyanide. In one works he was acquainted with (where the gas was well scrubbed) it contained up to one per cent. This was not the case with coke ovens, where the percentage was something like 0·1. Some years ago Dr. Frankland made experiments with a liquor similarly diluted but with 90 per cent. of domestic sewage. A satisfactory product was obtained with three contacts. In what respect did the process of one contact described by Dr. Fowler show an advantage? He also wished to know if the filter described showed any advantage over those used at these Sewage Works? He understood it was necessary to have double contact to get to a certain final point. Was it the intention to be able to get down to a one grain limit, by treating the stronger material before it went into the sewer?

Mr. O'SHAUGHNESSY thought, from the sewage expert's point of view, the importance of the papers could not be exaggerated. The important point, from a financial point of view, was that the antiseptic bodies were prevented from going into the sewage and inhibiting the purification of the whole body of sewage. Had Dr. Fowler investigated the effect of septic action? There was an enormous power possessed by an oxidising filter for transferring oxygen directly to the bodies dealt with. The authors mentioned what they called a septic tank effluent, but in his opinion it was not an accurate term to employ. The tank simply acted as a sedimentation tank, the liquor being almost antiseptic to aerobic organisms, and only becoming amenable to purification when put on to oxidation beds. An interesting point was the relative merits of percolation as against contact. He himself was not satisfied with the effect of percolation in the experiments of Dr. Frankland and Mr. Sylvester. He thought in their case it largely resolved itself into a question of efficient distribution on the contact beds. He inquired whether the authors had discovered any serious choking of the primary filters?

Mr. COLEMAN asked if sulphides were oxidised.

Mr. H. L. TERRY understood that where nothing very definite was done with regard to ammonia liquors it was recognised they brought down the efficiency of the outfall works. At a sewage works the liquor was aerated as much as possible. With regard to nitrifying, phenol was a very common constituent of sewage. He would instance the Aldershot Camp, where land treatment was adopted with satisfactory results. He understood that tank treatment had no practical effect on the phenol.

Mr. ROSS said that with a fairly strong effluent, as described, a high oxygen figure was obtained at the works. What was the relative putrescibility of the sewage effluent?

Mr. G. GUNN said that at the works with which he was concerned they had to purify two million gallons of water every 24 hours by means of mechanical filters. At certain times there were large quantities of river water which was quite brown. They attributed this colour to gas works letting in tar liquors. Apparently the particular organism mentioned in the papers was not able to cope with the situation, as the colouring matter went right through the filter, and the filtrate was in a fluorescent condition. Upon running this water on to open sand beds the whole of the colouring matter was taken out. The sand beds could be used for 13 weeks without being cleaned. They had not been able to find any of the colouring matter on the surface of the filters when they came to clean them. There was a slight trace of calcium carbonate owing to the use of a certain proportion of lime for purifying the water before it went through the mechanical filters.

Mr. D. H. Byrom asked what became of the ferrocyanide, and whether there was any trouble arising from the iron precipitate in the way of clogging.

Dr. Craig asked whether it would be possible to purify the gas liquor by precipitating the thiocyanate previous to filtering. He understood this was already being done on a large scale. Would such a process assist purification, and would it be profitable from a financial point of view ?

Dr. F. W. Skirrow said the nitrifying bacteria did not appear to have much to do with the oxidation, but that one particular kind of bacteria, which apparently had not as yet only a very nebulous name, did the work. The phenol and sulphocyanide liquors were apparently very much more dilute at the sewage works than the strength which Dr. Fowler had given as the optimum for purification, and naturally the conclusion would be arrived at, at the sewage works, that the nitrifying bacteria did not do the work on the phenol and the sulphocyanide. It was a question whether the particular bacteria which oxidised the phenol and the sulphocyanide did anything at all at the sewage works. Taking into consideration the dilution in which it arrived there, it would probably have a stimulating rather than an inhibitory action.

Dr. J. Grossmann was of opinion that the cyanide originally present in the liquors was converted into sulphocyanide on standing. In a coke works, the same quantity of coal was passed through, and practically the same amount of ammonia was obtained and distilled off each day. Therefore, in a coke works, the liquor was probably not kept in stock more than three days, and comparatively little sulphocyanide was formed. In the case of a gas works the amount of ammonia distilled varied at different seasons. In some cases the liquors were stored over the summer months, being constantly stirred up by the addition of fresh liquor and brought into contact with oxygen. The sulphuretted hydrogen became oxidised to a certain extent, free sulphur being formed which combined with cyanogen. He had tried to oxidise waste gas liquors by blowing air through, and had succeeded in oxidising a certain amount of the sulphocyanide. He could not, however, get rid of the phenols, and gave the matter up as hopeless. He had come to the conclusion that it would bo practicable to evaporate the liquors at a gas or coke works, because there was always a considerable amount of waste heat available, as with suitable plant one could evaporate about seven pounds of water per pound of coke or its equivalent in waste heat. There was one point which Dr. Fowler seemed to have overlooked—namely, that in the oxidation of the sulphocyanides and the thiosulphates there must always be free acid formed. Therefore the liquors, after passing through the filters, must be acid, or, if not acid, must have combined with something else which was formed. Dr. Fowler had made his experiments on potassium and sodium compounds ; but the liquors, of course, contained calcium compounds, and it might have been more satisfactory if calcium sulphocyanide had been used. The technical difficulties in the adoption of Dr. Fowler's method were considerable ; the available space at a gas works was generally limited, whilst there was an abundant amount of waste heat available, and he therefore considered the boiling down of the liquors the shortest and most satisfactory solution of the problem.

Mr. Gunn further inquired whether if the bacteria bed at the sewage works was inoculated with the particular bacteria, in addition to those which were present for nitrifying, the action took place side by side with the oxidation action.

Mr. Gaunt asked whether it would be practicable to control the temperature at the works. He understood that after the settling out of the lime the temperature was something over 30° C. It was known that many of the bacteria had an optimum temperature, and that certain actions went on much more vigorously in tropical countries in connection with sewage purification.

Mr. Crowther asked for more information with regard to the action of phenol upon the bacteria in question, and what would be the action of a stronger solution of phenol with regard to what he termed its poisoning properties. If the bacteria were subjected to the action of a stronger phenol than they could consume, were they anæsthetised or killed ? Would the culture grow again after it had been separated from the phenol ?

Dr. Fowler, in reply, said a few experiments had been tried with percolating filters, which indicated that as good results could be obtained as with contact beds. The experiments in the laboratory were chiefly by contact, because of the greater convenience and more accurate working, though on a practical scale he had always chosen the percolating filter because of its economical construction. They could work to nine feet, which he thought was economically the best depth, and therefore they could obviously construct a much cheaper filter than if they had three contact filters with their appurtenances and floor spaces. The question of cost largely conditioned the matter. He rather agreed with Mr. O'Shaughnessy that the main difficulty was distribution. With perfectly accurate distribution probably better results would be obtained than with contact beds, but there was not a great deal in it. The effect of the ammonia liquors that went into the sewers of Manchester was to raise the " oxygen absorbed " figure for the sewage two whole numbers at times, and it was quite certain they could bring that down by filter beds erected at Bradford Road on an area of about an acre. He took Mr. Ross's point perfectly clearly, but the subject was such a large one it had been purposely left out of consideration. The oxygen-absorbed figure in itself did not matter very much. What was of very much more importance was that the whole rate of action and efficiency of a sewage works was undeniably affected by the liquors. Experiments had been made by adding various percentages of liquors to sewage and bubbling air through. Sewage without the liquor was oxidised weeks before sewage containing a small percentage of crude liquor. It was quite true the filter beds must be inoculated. Replying to Dr. Skirrow, the organism was undoubtedly present in the sewage filters at the sewage works. It was not simply a question of nitrification, though that point did enter into consideration, especially in regard to the final oxidation of sulphocyanates. He was quite convinced of the presence of the phenol oxidising organism in ordinary sewage filters, but it would be much easier to inoculate the comparatively small area required at the gas works than to deal with the whole sewage works. With regard to the intensification of the strength of the phenol, that point had not yet been worked out. They had recently made some cultures from the filter mentioned in one of the papers, and had succeeded in isolating an organism practically identical, though differing somewhat morphologically from the specific organism under consideration. The new organism, as a matter of fact, oxidised phenol with still greater rapidity. In his opinion it would ultimately be found there was a closely allied family of organisms, and that they were all strongly aerobic. Their limit of temperature was also somewhat defined. They would not work at blood heat. A temperature of about 22° C. was the optimum. There was no reason, as Mr. Gaunt had remarked, why the temperature should not be regulated exactly. They did not act if put in a closed bottle, which partly answered the question as to the effect of septic tanks. The fact that there was very little decrease in the oxygen-absorbed figure in septic tanks, together with much laboratory work, had led the authors to suppose that very little change did take place. The breaking up was a purely oxidising effect. The average rate that had been taken was 100 gallons per cube yard—that is to say, 300 gallons per surface yard. This worked out, roughly speaking, at 1½ million gallons per acre. He did not know very much about the problem before it reached his stage of the matter, but he took it there should not be a very large amount of ferrocyanide present. He had had to deal with one liquor which contained large quantities of cyanides, and in such a case he would certainly recommend a preliminary treatment with iron salts. The normal amount of ferrocyanide did not affect the filter appreciably. The particular filter instanced had been in use seven years, and had never been washed out on account of choking. It had been taken down for the purpose of investigating another point, and the material was not found to be sterile, and was put back and had acted ever since. The question of cost was a difficult one to discuss at a meeting like the present. In the case of the Bradford experiments all the conditions were favourable, as the foundations for the filters were immediately available and it was only necessary to fill them with medium. As the result of an actual tender for a filter to deal with a daily output of 5,000 gallons of liquor, the capital cost was £200 for the pump, filter, tanks, and everything else. The cost of pumping was the main cost. There was 500 cubic yards of filter space. In many places in Scotland the liquor was evaporated, though there was a certain amount of nuisance arising from that process. It seemed to him the problem was very similar to that of the purification of distillery effluents, which the Royal Commission on Sewage Disposal had considered very carefully. It was entirely a question of local conditions and of available space. In the absence of a definite assurance from Mr. Gunn that the river water mentioned by that gentleman contained gas liquor, it was impossible for him (the speaker) to express an opinion. He believed the very dark colour shown by the sample on the table was due to very finely divided matter, possibly in a colloidal state, and perhaps by filtering through very fine filters some of it might be eliminated. He was aware of certain liquors which had a trace of sulphides in them, and this was a matter to be taken into consideration. The sulphides were readily oxidisable. The copper process again involved the question of cost. After the thiocyanates had been removed by copper there still remained the phenol. Unless it was possible to make copper thiocyanate precipitate pay it was scarcely worth while to partially purify the effluent and filter it afterwards, when one process would do the whole thing. Regarding Dr. Grossmann's suggestion as to the oxidation of dilute solutions without bacteria, he did not anticipate any great success, for the simple reason that air had been bubbled through solutions for weeks and months, and nothing had happened in control experiments on bacterial action. In the case of phenol nothing happened with the pure culture of the *bacillus fluorescens*. It was not until the actual organism required was put in that the phenol disappeared. The question of free acid was an interesting one, but he would remind Dr. Grossmann that they obtained ammonium sulphate. The nitrogen was converted into ammonia. It was true the liquors were slightly alkaline with lime to begin with. The acidity rose as the effluent passed through the filter, the filtrate containing bicarbonates. With the small quantity of lime present in most clinker materials it took a very long time for it to be completely dissolved by the small traces of acid. If it were not that they could not find any sign of phenylsulphuric acid being formed, one would, of course, be inclined to think it was a very likely reaction, as had been suggested by Dr. Schryber. It was his (the speaker's) intention to experiment with the action of other phenol bodies, such as salicylic acid. The question of calcium sulphocyanate was of some interest, but they had not, as a matter of fact, used that compound. They had obtained results with potassium sulphocyanate in the laboratory, and also results with calcium thiocyanate in the works.

A NEW METHOD FOR THE VOLUMETRIC DETERMINATION OF FREE ACID AND BASIC ALUMINA IN ALUMINIUM SALTS.

BY THOS. J. I. CRAIG, D.SC.

Beilstein and Grosset (Z. anal. Chem., **29**, 73; this J., 1890, 416) reviewed former methods for determining free acid in aluminium sulphate and advocated converting the latter into alum, dissolving out the free acid with alcohol and titrating with $N/10$ caustic potash and litmus as indicator. In Thorpe's Dictionary of Applied Chemistry, 2nd edition, 1891, **1**, 77, Congo Red is recommended as an indicator while titrating aluminium sulphate for free acid; with practice, fairly good results may be obtained by using it in very dilute solution (about $N/5000$) as an outside indicator, when the aluminium salt is comparatively pure.

Beilstein and Grosset's method involves considerable time and trouble. In the Congo Red method, the personal factor comes largely into play owing to the small change of colour for a relatively large addition of standard solution. The presence of ferric sulphate also makes the Congo Red test unreliable.

The following method is based on the fact that an excess of neutral potassium fluoride decomposes aluminium salts, forming two stable compounds reacting neutral to phenolphthalein, while any free acid remains unaltered, thus:— $Al_2(SO_4)_3 + (xH_2SO_4) + 12KF = 2(AlF_33KF) + 3K_2SO_4 + (xH_2SO_4)$. The precipitated aluminium potassium fluoride is insoluble in presence of a moderate excess of potassium fluoride, and is not appreciably attacked by dilute acid or by dilute caustic alkali.

The solutions required are:—0·2 per cent. solution of phenolphthalein. Potassium fluoride solution, prepared by dissolving the pure salt in distilled water, bringing to 1·45 sp. gr. and neutralising if necessary with caustic potash or sulphuric (or hydrofluoric) acid until about 1 c.c. in 10 c.c. of distilled water shows a faint pink colour with phenolphthalein; insoluble matter is filtered off but not washed, and the clear solution is diluted to a sp. gr. of 1·35 (containing about 0·5 grm. potassium fluoride per c.c.) and preserved in a glass bottle internally coated with wax. Standard sulphuric acid and standard caustic potash, which may be normal, seminormal or deci-normal, which must be free from alumina and such like bases; the acid is standardised with pure anhydrous sodium carbonate using methyl orange as indicator; the alkali is standardised against the acid, in about 40 c.c. of distilled water to which 10 c.c. of the above potassium fluoride solution have been added, using phenolphthalein as indicator.

A weighed portion of the substance to be tested is dissolved in water to form a solution 200 c.c. of which contain 1 to 3 grms. of alumina; the solution is filtered and 20 c.c. are gradually added, with stirring, to 10 c.c. of the potassium fluoride solution to which from 50 to 60 c.c. of distilled water and 0·5 c.c. of phenolphthalein solution have been added.

When free acid is present in the material the mixture is practically colourless, and standard alkali is slowly added until a faint permanent pink colour is obtained. The amount of alkali required is calculated to free acid (each c.c. $N/2 =$ 0·02 grm. of SO_3). Should the material being tested be neutral then one drop of $N/2$ alkali will intensify the already slight pink colour of the mixture. If on the other hand the material is basic, a deep red colour will be developed in the mixture by the formation of caustic alkali, thus:—

$$Al_2O(SO_4)_2 + 12KF + H_2O = 2(AlF_33KF) + 2K_2SO_4 + 2KOH$$

The alkali produced cannot be correctly taken as a measure of the basicity as a small but appreciable quantity of it is precipitated as a basic double fluoride neutral to phenolphthalein; standard acid is, however, added until the red colour disappears. A similar amount of standard acid, plus a known excess equal to 4 c.c. $N/2$ (or more if necessary) is now added to a fresh portion of the filtered solution of the basic material, heat is applied to ensure combination between the basic alumina and the added acid, and, after cooling, the test is proceeded with as in the case of substances containing free acid. The amount of acid which has combined is thus found and is calculated to basic alumina (each c.c. $N/2 =$ 0·0085167 grm. of Al_2O_3). The volume of liquid at the end of the test may be from 60 to 120 c.c.

If sodium salts are present, it is advisable to add from 20 to 30 c.c. of a neutral saturated solution of potassium sulphate to the solution of the aluminium salt before it is mixed with the potassium fluoride, to minimise the tendency to form insoluble basic sodium double fluoride. When ammonium is present, the ammonia (owing to its well known action on phenolphthalein) must be removed by heating with a known excess of standard alkali before mixing with the potassium fluoride. It is essential that insoluble matter be always filtered off from the solutions of aluminium sulphate, etc., before adding to the potassium fluoride. If iron salts are present an increased quantity of potassium fluoride solution may be required. An indication that too little fluoride is being used, is that the almost colourless iron potassium fluoride precipitate darkens during the titration, owing to its decomposition by the alkali.

The accuracy of the method was established by tests made on pure potash alum and pure aluminium sulphate, chloride, and acetate which had been carefully analysed gravimetrically and to which known amounts of acid and alkali had been added.

The method may also be applied to the determination of free acid in salts of iron and zinc, except that they require a somewhat larger excess of potassium fluoride.

The advantages of this new method are its exactness, its rapidity of execution and its applicability to aluminium salts in general and also to other metallic salts.

Discussion.

Dr. Gilbert Fowler said he had experienced considerable trouble in arriving at the free acid in presence of ferric salts, and he was glad to learn there was a solution of the difficulty.

Mr. Crowther inquired whether the author's process might not afford a ready means for the determination of alumina in caustic soda.

Mr. Ross asked whether the author had used certain fluoresceins as indicators.

Mr. Gunn asked if a 1 per cent. solution of Congo Red was dried on pure filter paper, whether the neutral alum salt had not the same action on the indicator as in the case of solution; the acid had a stronger affinity for the Congo Red than for the cellulose, so that a clearer indication of the end of the reaction was obtained. He had used this method and had found it fairly accurate.

Dr. Craig, in reply, thought the suggestion with regard to alumina in caustic alkali was a good one, though he had not tried it personally. The reaction should go quantitatively, if no basic compound were formed, and the additional amount of alkali found after treating with potassium fluoride would represent the alumina. He had not tried the indicators mentioned by Mr. Ross, nor the Congo Red on filter paper. He had used a dilute solution of Congo Red as an outside indicator with pure aluminium salts and obtained quite good results. If, however, ferric salts were present he considered their action on Congo Red completely vitiated the test.

Meeting held at Manchester on Friday, January 6th, 1911.

MR. R. H. CLAYTON IN THE CHAIR.

ELECTROLYTIC BLEACHING LIQUORS.

BY S. H. HIGGINS, M.SC.

So many conflicting opinions have been given and wild statements made concerning this subject that the author made experiments to compare electrolytic liquor with other more commonly used bleaching liquors.

In the following experiments a well-known make of electrolyser was used, which produced a 1·5 per cent. solution of chlorine: in the case of the production of solutions of low chlorine contents the cost of the brine is too high to make the method of industrial importance. Salt from Middlesbrough known as "rough English salt" of 92 per cent. purity and containing no iron was used.

It was found that the electro-chemic was always alkaline, and, indeed, all electrolytic liquors must be alkaline. Firstly, the electrolytic decomposition of the salt results in the production of sodium and chlorine: the sodium reacts with the water to produce caustic soda, and this compound by the circulation of the liquor in the apparatus is brought into contact with the chlorine liberated at the other electrode. If all the caustic soda unites with all the chlorine gas, *i.e.*, if the circulation is perfect, then the liquor remains neutral, but some chlorine actually escapes, hence the liquor is always alkaline, the caustic soda predominating. Of course, the better the circulation the less the alkalinity and the more active the electro-chemic.

The following solutions were prepared:—

(1) Electro-chemic by dissolving 220 lb. of salt in 186 gallons of water and electrolysing for 8 hours at a temperature of 20° C. with a current of 50 amps. and 110 volts.

(2) Bleaching powder solution by treating bleaching powder with water in a stirring apparatus. The residues were always washed twice so as to extract as much chlorine as possible from the powder. The solution obtained had a specific gravity of 1·08. This solution was used when freshly prepared to make

(3) Sodium hypochlorite solution by adding sodium carbonate solution until the supernatant liquor gave no precipitate either with the bleaching powder or the sodium carbonate solution.

Stability of the bleaching liquors.—Large quantities of these three liquors were made to about the same chlorine contents and allowed to stand in air, small samples being titrated with decinormal sodium thiosulphate solution at intervals to ascertain their rates of decomposition. At the same time electro-chemic of one-half and one-tenth the original strength and calcium and sodium hypochlorites of one-tenth the original strength were allowed to stand.

Table I. gives the results obtained. It is seen that there is practically no difference between the stabilities of the three liquors; the electro-chemic is as stable as the chloride of lime solution. Some evaporation took place during the five days but this was about the same for all samples.

Table I.

Time.	c.c $N/10$ thiosulphate for 5 c.c. of liquors.			c.c. $N/10$ thiosulphate for 25 c.c. of liquors.			
	Elec. chem.	Bleaching P. solution.	Sodium hypochlorite.	Elec. chem. half strength.	Elec. chem. 1/10 strength.	Bleach. Pow. 1/10 strength.	Sod. Hypo. 1/10 strength.
Original	11·75	12·0	11·8	5·9	5·9	5·8	5·8
3 hours	11·75	12·0	11·8	5·9	5·9	5·8	5·8
6 ,,	11·75	12·0	11·8	5·9	5·9	5·8	5·8
24 ,,	11·75	11·9	11·8	5·9	5·9	5·8	5·8
76 ,,	11·6	11·4	11·5	5·9	5·7	5·25	5·4
100 ,,	11·2	11·1	11·2	5·75	5·6	5·2	5·2
120 ,,	10·9	10·9	10·9	5·7	5·55	5·1	5·2

Effect of prolonged agitation on the liquors.—It has been said that electro-chemic must be carefully handled syphoned and not agitated, as it readily decomposes This, however, is not the author's experience. Shaking the three liquors in flasks for many hours did not cause appreciable decomposition.

Bleaching effect of the liquors.—The three strong liquors after standing five days were diluted to half strength with water and into 1½ litres of each 35 grms. of brown linen cloth were placed. At intervals the solutions were tested to give Table II. 10 c.c. of liquor was titrated in each case. The figures show that there is practically no difference between the rates of bleaching of the three liquors; the bleaching powder solution bleached as rapidly as the electrolytic liquor.

Table II.

Time.	Elec. chem.	Bleach. pow. solution.	Sod hypo.
Original	10·95	10·95	10·95
1hr. 20min. .	8·2	8·2	8·4
2hrs. 20mins.	7·8	7·8	8·0

Tensile strengths of the yarns after bleaching.—The linen cloth used in the previous experiment was taken from the same piece. After the bleaching the pieces were washed, soured, well washed and dried. The pieces were then separated into warp and weft yarns, and these were broken in a Schopper testing machine. In order to get a good average strength 30 yarns were broken in each case. The following mean values were obtained :—

	Warp grms.	Weft grms.
Electro-chemic	738	507
Bleaching powder	741	501
Sodium hypochlorite	729	520

Again it is seen that there is no difference between the actions of the electro-chemic and the other bleaching solutions. The lack of regularity in the figures is due to the irregular composition of all linen yarns.

During the bleaching the liquors became milky in all three cases, and to about the same degree. Acid was required to clear the cloth in all cases. The samples of cloth were approximately the same colour after the bleaching ; one sample could not be distinguished from another. The electro-chemic and other chlorine solutions were found difficult to wash out from the cloth. This is also the case on the large scale where, *e.g.*, the salt from the electro-chemic is readily washed out of the cloth, but the last traces of chlorine are difficult to remove.

It has been said that when bleaching powder solution is used for bleaching the goods have a harsh feel, but this is merely due to lack of souring or proper washing. Souring leads to the production of calcium chloride or sulphate which, if left in the cloth, cannot produce harshness ; calcium chloride is sometimes used along with starch to give a full soft finish.

Stability of the bleaching liquors when acidified.—To 1 litre of the three bleaching liquors 10 c.c. of pure hydrochloric acid were added and the liquors were again allowed to stand in air. They were tested at intervals as before to give Table III. 5 c.c. of liquor was titrated with thiosulphate in each case.

In the case of the electro-chemic a sudden evolution of chlorine took place owing to the acid not being carefully added. so that this trial was repeated. Both results are given in the table.

Table III.

Time.	Elec. chem.	Bleach. pow. solution.	Sod. hypo.	Elec. chem. again.
Original .	14·5	15·0	14·4	12·8
3½ hours	9·7	10·7	10·7	10·5
6½ ,,	8·5	9·5	9·7	9·3
25 ,,	5·4	7·2	9·7	6·8

The figures show that there is little difference between the stabilities of the liquors when acidified.

Rate of bleaching of acidified liquors.—After the liquors in the previous experiment had stood 3½ hours, 250 c.c. of the liquors were made up to 2 litres with water, and into each 28 grms. of brown linen cloth were placed.

The following results were obtained on titrating the liquors at intervals. (Table IV.) 25 c.c. of liquor were titrated in each case.

After the action the cloth was about the same colour in all cases, showing that the bleaching effect was similar. It is noticed that the sodium hypochlorite bleached as rapidly as the electro-chemic, the bleaching powder solution being only a little slower in action.

Table IV.

Time.	Elec. chem.	Bleach. pow. solution.	Na. hypo.
Original	5·9	6·5	6·5
½ hour	4·4	5·0	5·1
2½ hours	2·7	3·3	3·1
4½ ,, ...	1·9	2·5	2·5
21 ,, ...	0·5	1·4	1·1

Stability of sodium hypochlorite solution on the addition of caustic soda and of common salt.—Calculation showed that the electro-chemic used in the previous experiments contained about 120 grms. of undecomposed salt per litre. This quantity of salt was added to sodium hypochlorite solution to ascertain the effect on the stability of the solution. At the same time 10 grms. of caustic soda were added to 1 litre of the hypochlorite. These liquors were allowed to stand in air and gave the following results, 5 c.c. of liquor being titrated with thiosulphate in each case.

	With sodium chloride.	With caustic soda.
Original	11·6	11·6
After 3½ hours	11·6	11·6
,, 20 ,, ...	11·4	11·6
,, 66 , ...	11·1	11 6

Rate of bleaching of sodium hypochlorite solution containing salt and caustic soda.—Into the solutions at the end of the previous experiment 28 grms. of linen cloth were placed and the same amount into a litre of sodium hypochlorite solution of the same strength as the other liquors. The liquors were tested as before. 5 c.c. being titrated with thiosulphate in each case.

	Sodium hypochlorite	Do. with sodium chloride.	Do. with caustic soda.
Original	11·5	11·5	11 5
After 1hr. 20min.	8·0	7·8	8·2
,, 3hr. 20min.	6·5	6·2	6·95
, 20hrs.	3·3	2·7	4·8

The figures show that the addition of common salt in large quantity to sodium hypochlorite solution slightly decreases its stability and increases its bleaching effect. This change, however, is so small as to be of no practical use. Caustic soda as expected increases the stability and decreases the rate of bleaching of the hypochlorite.

It was noticed that the three original chlorine solutions had a green colour, this colour being about the same for all three liquors. The addition of acid intensified this colour and made the liquor less stable : caustic soda took most of the colour away and made the liquor more stable. It is, therefore, evident that there is some connection between the intensity of this colour (supposed to be due to free chlorine) and the rate of bleaching of the liquor. Carbon dioxide when passed through bleaching powder solution first precipitates the free lime and then drives off chlorine, hence air (containing carbon dioxide) hastens the action of bleaching liquors because it decreases their alkalinity and sets free the chlorine which is used in the bleaching. Similarly carbon dioxide brought into contact with alkaline sodium hypochlorite solution first combines with the free alkali and then assists in the bleaching of any material with which the hypochlorite solution is brought in contact. Alkaline hypochlorite solutions are slow in bleaching action because the carbon dioxide of the air is deterred from assisting in that action. On the other hand, hypochlorites are hastened in bleaching action by the addition of common salt, because it is well known that water containing small quantities of common salt dissolves carbon dioxide more readily than water containing no salt.

It might be mentioned in passing that these considerations have some connection with the high bleaching activity of "old chemics." Some bleachers treat all their cloth with bleaching powder solution in cisterns and after one bleach use the spent liquor from the cistern for making up the liquor for the next lot of goods. In this way they save the chlorine left in the cistern after the first bleach, but unfortunately they complicate their bleaching action. These old or recovered liquors, if made up to the same chlorine contents as the original freshly prepared liquor, are found to be of a much greater bleaching efficiency. This increased activity is highly desirable in some cases, but in others it leads to complications and even to the tendering of the fabrics. Sometimes the liquors are recovered in the way stated for six months, and during this time they become very active but of indefinite composition. The bleacher is working in the dark, and in many cases he has to suffer. This increased activity has been attributed to the accumulation of calcium chloride in the liquor. The author evaporated a quantity of recovered liquor and found it to contain 5 per cent. of calcium chloride and a large amount of dissolved organic matter. To ascertain the effect of the presence of calcium chloride 1 litre of liquor of chlorine contents equal to that used in the cisterns on the large scale was made. This was divided into two equal volumes, and in one volume 25 grms. (*i.e.* 5 per cent.) of calcium chloride were dissolved. The chlorine in 10 c.c. of the liquor was found by titration with decinormal thiosulphate solution, and then into each sample of liquor 36·6 grms. of boiled linen were placed. These proportions of solution, chlorine and linen were a rough reproduction of the conditions on the large scale. At intervals the liquors were titrated to give the table. 10 c.c. of liquor titrated.

	Bleaching liquor alone.	+ 5 % calcium chloride.
Original	6·1	6·1
After 1 hour	4·7	4·6
„ 3 hours	4·0	3·9
„ 20 hours	2·2	2·0

It is seen that the addition of calcium chloride slightly increases the bleaching efficiency. This slight increase, however, is not sufficient to account for the active nature of the "old chemic" of which the author has experience. On investigation it was found that the "old chemic" gave a precipitate with lime water and this precipitate contained the organic matter which as shown by evaporation the "old chemic" contains. It is, therefore, evident that on adding freshly prepared bleaching powder solution (which contains free lime) to "old chemic" a precipitate is formed, eliminating the free lime from the solution and thus increasing the activity of the bleaching liquor. The bleacher knows that on adding lime he can restore his liquors to their original bleaching efficiency, and he generally does this when his liquors become sharp and dangerous to use.

To account for the increased bleaching efficiency caused by the addition of calcium chloride the author thinks it probable that the same explanation as applied to the case of the addition of common salt will serve; it is probable that calcium chloride like sodium chloride assists the attraction of carbon dioxide by water. This matter the author is at present investigating.

Rates of bleaching of sodium hypochlorite and of electro-chemie with additions.—The effect of the addition of common salt and of caustic soda to electro-chemic was now tried, bleaching taking place alongside similar solutions of sodium hypochlorite made from bleaching powder solution. In each case 14 grms. of brown linen cloth were immersed in 1 litre of the liquor. 25 c.c. of liquor were tested in each case.

Time.	1	2	3	4	5	6
			Diluted from previous experiment.			
	Electro-chemic +60 grs. salt.	Electro-chemic +caustic soda.	Sod. hypochlorite +caustic soda.	Sod. hypochlorite +salt.	Sod. hypochlorite as 4 +60 grs. salt.	Sod. hypochlorite.
Original	5·6	5·7	2·9	2·9	2·9	3·0
1 hour, 20 mins.	4·2	4·6	2·4	2·0	1·9	2·2
2 hours 20 „	3·7	4·3	2·0	1·6	1·5	1·9
4 „ 10 „	3·2	3·85	—	—	—	—
5 „	—	—	1·6	1·15	1·0	1·4
24 „	1·7	2·5	·8	·4	·2	·6

From the above experiments it is evident that sodium hypochlorite solution properly made from bleaching powder solution can be used for all the purposes for which electro-chemic is used.

The alkalinity of the hypochlorite made from bleaching powder depends upon the care used in making it. In some cases bleaching powder and soda ash are made into a paste and extracted with water. The best method, however, is to extract the chlorine from the bleaching powder by water and then treat the solution obtained with soda ash solution. After extracting the bleaching powder with water there is an insoluble residue containing principally lime, which is thrown to waste, but if the bleaching powder itself be used for making the hypochlorite then this residue acts with the soda ash, rendering the resultant liquor strongly alkaline. In mixing the bleaching powder solution and the soda ash it is preferable to have the former in slight excess if a quick acting liquor is desired. If the cheap salt cake is used in place of the soda ash, then excess of the cake does not give an alkaline liquor.

Among the advantages claimed for electro-chemic are that the white produced is more permanent; that the bleached material produced is stronger; that there is a saving in acid; that goods lose 2 per cent. less in weight; but these statements have never been proved. There is no doubt that the process is extremely clean and that there are no troublesome residues to get rid of. Also electro-chemic is suitable for wood pulp, raw cotton, cops, etc., which are difficult to rinse; if the liquor is not thoroughly washed away the salt which remains has no harmful effects. The opponents of the electrolytic bleach urge that the liquor acts so rapidly that it oxidises the outside of the fibre to oxycellulose without thoroughly bleaching the inside of heavy yarns. This is certainly erroneous since the sodium salt solutions have at least the penetrating power of calcium solutions, and if the bleaching is too rapid the solution can easily be diluted. The author thinks that such an erroneous opinion has arisen simply because experimentation has not been persevered with.

The constant strength of electro-chemic has been urged in its favour, but bleaching powder solution if carefully made is generally of fairly constant strength. In the production of the electro-chemic we depend on a steady current and a constant temperature to give a constant product. One finds that the temperature has to be carefully watched, whereas the current is bound to fluctuate throughout the day, even if obtained from town or county supplies. As bleaching powder solution is steady enough in composition to satisfy the none too great demands of the cotton bleacher this matter of constant strength has no importance. From what has been stated above, it is evident that electrolytic bleaching can only make headway in consideration of any economy it can show over other bleaching methods.

Relative costs of bleaching liquors.—(1) Bleaching powder solution: Careful treatment will extract practically all the chlorine from the bleaching powder, but suppose that chlorine equal to 30 per cent. of its weight is actually extracted. Taking bleaching powder as £4 10s. a ton, then 1 ton of chlorine costs £15 when it exists in bleaching powder solution.

(2) Sodium hypochlorite solution: On precipitating bleaching powder solution with soda ash at £4 5s. per ton the author found that a ton of chlorine required 1·8 tons of soda ash to precipitate the lime to which it was united. Therefore, 1 ton of chlorine costs £22 10s. as sodium hypochlorite. If sodium sulphate at £2 2s. 6d. a ton is used the cost is about £20 per ton of chlorine.

(3) Electro-chemic: On electrolysing 3 cwt. of salt dissolved in 186 galls. of water for 10 hours with a current of 50 amps. and 110 volts. at a temperature regulated to 20° C., the liquor was found to contain 14 grs. of chlorine per litre. 186 galls. = 26·2 lbs. of chlorine, so that 86 electrolyses give 1 ton of chlorine. Salt for 86 charges $= 86 \times 3 \div 20 = 13$ tons. Current for 86 electrolyses $= 50 \times 110 \times 10 \times 86$ watts $= 4730$ kilowatts $= 6340$ H.P. hours.

Total cost:—

(1)	Salt at 20s. a ton	£13
	Current at ½d. a unit	£10
		£23
(2)	Salt at 10s. a ton	£6 10 0
	Current at ¼d. per H.P.	6 0 0
		£12 10 0

In considering the cost of the electro-chemic one must also take into account the high cost and the depreciation of the electrolysers. The dissolving of the salt is comparable in time and apparatus with the dissolving of bleaching powder.

From the figures given it is evident that the whole question of economy depends upon the price of the salt and the current; these factors vary considerably for different situations. It is seen that using a salt costing 23s. a ton the cost of the salt alone is as high as the total cost of the bleaching powder which the electrolyser seeks to displace. Similar the current at ¾d. a unit will be equal to the total cost of the bleaching powder.

But for a works with cheap salt and also cheap current then it might pay to instal the electrolytic method.

Discussion.

Mr. J. Hübner said he had had experience with electrolysers of various types, and he could not altogether agree with Mr. Higgins as to the decomposition of various bleaching liquors. He had found in every instance that electrolytic solutions containing a high percentage of chlorine decomposed more rapidly than solutions of bleaching powder. The rate of decomposition was without doubt to a very large extent depending upon the alkalinity of the liquor, the exposure to the air and the temperature. He had always found that, at the beginning, the electrolysed solution bleached more rapidly, but the final result was identical with that obtained by bleaching with bleaching powder, or sodium hypochlorite.

Mr. R. E. Crowther referred to the carbon dioxide absorption in the presence, and absence, of sodium chloride. He inquired whether Mr. Higgins had done any definite work in this direction, or had he merely quoted someone else's authority?

Mr. W. F. A. Ermen said he had superintended one electrolytic bleaching experiment which was continued for about six months. The solution of salt was used over and over again. That is to say, every day, after it had been used for bleaching, it went back into the electrolyser until it became too dirty and too full of organic matter. They came to practically the same conclusion as Mr. Higgins. In places like Manchester, chlorine, in the form of bleaching powder solution, could be obtained for something like £15 a ton, whereas to make chlorine by an electrolyser would cost something like £20 per ton. That was not taking into account the large capital outlay upon the very expensive electrolyser.

Mr. G. Gunn asked if Mr. Higgins considered that calcium chloride or sodium chloride played any other function than assisting in intensifying the bleaching action, and had he considered whether it held the products of chlorination in solution? From the experiments he had made he was inclined to think that calcium chloride had the property of holding the products of the bleaching reaction in solution. For instance, if sulphite pulps were bleached the first action that took place was really one of chlorination of the colouring matter, because it could be extracted afterwards in its coloured condition, and if the residue was washed out the bleaching action could be completed with a very small percentage of bleach. He thought that from the coloured solution, they could precipitate nearly all the colouring matter with the addition of lime water. He was inclined to think, from observation, that calcium chloride had the property of holding many products of the bleaching action in solution.

Mr. Higgins, in reply, said with regard to Mr. Hübner's question it was purely a matter of how the bleaching powder solution was made, or how the hypochlorite was made. If it was a strong solution there was naturally less lime in the liquor, in proportion to the chlorine, than there was in a weak solution. He had always found it better to make a strong solution. Perhaps Mr. Hübner in comparing an electrolytic liquor with other liquors had used the other liquors in an alkaline state. He did not think that sodium hypochlorite was ever used in any other than an alkaline state. On the market it was very alkaline. It was only when prepared very carefully that liquor could be obtained which was anything like neutral. The liquors he had experimented with were all in the same state as far as alkalinity was concerned, or practically so. The outcome of the experiments depended entirely upon this. By adding a little acid, or a little alkali, they could make the solutions into any state desired. The absorption of carbon dioxide by common salt solution was not his own discovery. With regard to the salt being used again for electrolysis many difficulties had been experienced, because the peptic matters in solution clung to the electrodes, thus tending to decrease electrolytic decomposition: the amount of chlorine produced in a certain time using old salt solutions was very much less than with pure salt. He had not made any experiments with regard to calcium chloride holding products in solution.

BLEACHING FAULTS.

BY S. H. HIGGINS. M.SC.

The bleacher of heavy linens finds from time to time that the bleached goods contain damages which are like cuts with a sharp instrument. In most cases one yarn is the cause of the whole trouble, and this yarn running right through a piece of linen cloth might totally damage it. When this yarn, which is usually quite black and is therefore called "black yarn," is separated from the other yarns, it is found to be quite tendered at the black parts and sometimes in other parts where the black impurities have evidently been separated during the bleaching process. These black yarns are found to be caused by oil and by substances mixed with the oil. At one spinning mill water from a steam engine condenser found its way into a pond which supplied water for the spinning processes. In this way the oil from the engine cylinder got into the yarn. The trouble was not so great in the winter time when there was plenty of water, but during a dry summer when the pond was very low the proportion of oil to water became more pronounced, and was found to cause a large number of black yarns.

It was noticed that this fault seldom appeared in goods which were woven from yarns spun by the same firm. In such cases it would be easy to remedy such defects, but in the case of goods sent to the bleacher by a merchant who has bought them from a manufacturer, who again has bought his yarns from an outside spinner, the cause of the trouble is difficult to locate. Yet there can be no doubt that the trouble originates in the spinning process. The author communicated with a large Continental linen bleacher, who, however, could not account for the damage but at the same time attributed it to the spinning process.

Sometimes the black yarns are not tender and the blackness can be removed by hand washing, but whenever there is any quantity of the impurity the soundness of the cloth is generally affected. In some cases the tenderness is not visible until the subsequent laundring, and sometimes not until the goods have been in use some time. They are then returned to the retail merchant, then to the wholesale merchant, then to the manufacturer, and finally to the bleacher, on whom all trouble with the goods finally alights. If the fault can only be detected before leaving the making-up room the trouble is not nearly so serious.

A piece of linen came to the author's notice a short time ago which had loom oil along the selvedges, and at this part the piece became quite rotten on bleaching. On extracting the oil from the bleached piece with ether the linen was still discoloured, so that it was evident that the oil contained some impurity which had been injurious to the linen. In lye boiling the oil is sometimes separated from the linen, but in such a case the impurity from the oil is often left attached to the linen fibres.

If mineral oil has been used in the manufacturing there is no practical means of getting rid of splashes of it on the cloth except by hand washing before the bleaching process. The boiling of the goods in soap and aniline oil, and the addition of phenol to the boiling liquors have been suggested, but the author does not know that these means have been adopted on the large scale to get rid of oil. Since such bodies have an inclination to cling to the cloth their use is to be considered very carefully. Running the pieces through a fairly strong emulsion of olive oil in soda, and then soaping hot has also been recommended. This is no doubt fairly effective, for the author has found a vegetable oil very useful in removing large quantities of grease from textile fibres, but the effect of the oil and soap on the fabrics would be so marked that in the case of many finishes much more treatment would be required to get rid of the effects of the detergents on the fibre.

In attempting to account for the black yarn damages, an examination of the yarns leads one to the conclusion that during the spinning process so much foreign matter has been incorporated with the yarn at the black parts that, when this matter is wholly or partially removed in the bleaching operations the structure of the fibre falls to pieces, and thus produces defects in the cloth. On examining the black parts under the microscope the blackness appears as small irregularly dispersed patches; the tendered warp affects the weft crossing it, making the weft yarns also tender, and thus producing the cut. In the case of a black weft yarn, the warp in the immediate neighbourhood of the black patches becomes tendered, and the cut then stretches across the piece instead of along it. It was noticed that at the black parts the twist of the yarn was irregular. It therefore seemed probable that during the long boiling during the bleaching the grit of the black particles caused the fibres to untwist just as sand and water cause paper to go to pulp on shaking. On adding sulphuric acid and potassium bichromate to the contents of the microscope slide the linen dissolved leaving the finely divided specks of black matter. At first these specks resisted chemical reagents and were thought to consist of carbon. W. Spring (Z. Chem. u. Ind. Colloide, 1909, **4**, 161—168; see this J., 1909, 430) points out that carbon promotes the decomposition of soap solutions. An acid salt (soap) is produced and the carbon combines with this to form an adsorption compound. Lampblack also forms a more or less stable compound with solid substances and especially with cellulose. It was thus thought that these supposed particles of carbon in the black yarns bound up in the fibres (cellulose) acted on the soap of the boiling liquors and attracted the acid constituents as described by Spring, this action bursting the fibres in some parts and untwisting them in others.

But these explanations did not entirely account for the fact that the tendered yarns reduced Fehling's solution, and therefore contained the so-called oxycellulose, although one would expect that such yarns, being in a free condition after bursting in the boiling operation, would tend to become over-oxidised when brought in contact with bleaching powder solution. In fact, it is often found that a ragged mechanical damage becomes over-oxidised at the ragged fringe during the bleaching operation.

It was afterwards found that the black specks on the yarns consisted of copper oxide.

Ulzer and Ziffer (Mitt. K. K. Techn. Gewerbe-Museums, 1910, **20**, 19—20; see this J., 1910, 811) state that a weaver employed nothing but a saponifiable oil as lubricant. This oil had a rather high acid value, and during the bleaching damaged places were produced in the weft coinciding with the parts which had been contaminated with oil. The presence of oxycellulose and copper was proved in the fibres surrounding the damaged places. The oil had dissolved metal from the brass parts of the loom, and during boiling the copper soap thus produced had been converted into copper oxide; this had acted catalytically in the bleaching bath, causing an excessive local evolution of oxygen. That this was the cause of the tendering was proved by the results of parallel trials, and it is evident that for loom lubrication only such oils as tend to remain neutral should be used.

The author has never found this trouble arise with cotton goods, although often thick black yarns appear in these. In cotton bleaching the cost of the damaged material is not so great as for linen, and therefore this damage is not of so great importance as it is to the linen bleacher. It is probable that the explanation of Ulzer and Ziffer accounts for the fault which has troubled heavy linen merchants for some time. Manufacturers had been pressed in many cases to use vegetable oil, but it is evident that the oil should keep neutral if the trouble is to be entirely eliminated.

A peculiar trouble recently arose with a brass starch mangle bowl. It was found to turn black gradually, and to require turning about every six months, while the iron parts of the mangle were found to rust very rapidly. In time the "nip" of the bowl became irregular, causing uneven starching, and finally a black mark was produced on cloth run through the mangle.

On examining the bowl it was found to contain many small holes, which seemed to be caused by the vibration of the machinery disintegrating the brass, but on turning the bowl it was found to be very brittle at the surface and much eaten away. The turnings were found to contain mercury. Mercuric chloride in very small quantities had been used in the starch as an antiseptic, and had acted with the metal of the bowl; mercury had been liberated from the chloride and had amalgamated with the copper of the brass to form the brittle copper amalgam. Experiment showed that mercuric chloride in very dilute solution attacked brass and appreciably hastened the rusting of iron. On removing the mercuric chloride from the solution in the mangle the trouble ceased.

Other antiseptics were tried, *e.g.*, formalin and phenol, but these have their disadvantages; if used in any quantity they give the goods an objectionable smell. Salts of copper have often been used as antiseptics, but with brass bowls a similar trouble to that with mercuric chloride might be experienced; the zinc of the brass might displace the copper. If metallic salt solutions are used the metals of these salts must be more electro-positive than zinc or copper. Zinc salts give no trouble and are of very strong antiseptic value.

Discussion.

Mr. W. F. A. Ermen said he had examined a case of tendering of cotton which had occurred after dyeing with primuline and then bleaching it. Either the whole batch would be tender, or a portion of a warp or some of the hanks. This was found to be due to the dyed cotton having been bleached either in a box with a copper pipe at the bottom, or in a box lined with copper. The portions anywhere near the copper were most seriously tendered, especially when the goods were left in the boxes for a considerable time. Upon discontinuing the use of copper boxes the tendering came to an end. He had recently found another case in which cotton dyed with Mikado Yellow showed a diminution in strength of 15 to 20 per cent. This he found to be due to being dyed in a copper dye-tank. He had examined a large quantity of the yarn, but although obviously the copper box was the cause of the tendering, he was unable to discover the least trace of copper in the yarn.

Mr. Higgins said it had taken him some time to find the copper oxide in the yarn; the quantities were very minute. The matter was of very great importance to the linen industry, and it was hoped that a means had now been found of overcoming the difficulty.

New York Section.

Meeting held at Chemists' Club, on Friday, November 25th, 1910.

DR. C. F. MCKENNA IN THE CHAIR.

THE ACTION OF OILS AND TARS IN PREVENTING MOULD GROWTH.

BY JOHN MORRIS WEISS.

In comparing creosotes used for wood preserving, much attention has been paid to the physical properties of the oils. Boiling point tests, evaporation tests, etc., have been carried out, to ascertain whether the oil would remain in the wood. The advocates of water gas tar distillates maintain, as their main argument, that the oils they sell for creosoting are high boiling and not likely to volatilise. They assert that the action of a creosote is mainly waterproofing in character, and that if an oil will stay in the wood, the most essential object is attained. The real antiseptic effect of the oil after penetrating the wood is a point which has been very little investigated. The purpose of this paper is to consider particularly this phase of the subject, namely, the antiseptic action of coal tar and coal tar creosotes compared with water gas tar and water gas tar distillates, as far as the prevention of mould growth is concerned, and to present results of experiments carried out on this line.

To determine the comparative effects of coal tar and water gas tar, a series of experiments was carried out in the laboratory on an ordinary gray mould such as forms in damp cellars. This contained a species of penicillum and spore-forming soil bacteria, both of which are rapid in development and similar in propagating qualities and conditions of growth to the wood destroying fungi proper. It was grown in a broth consisting of 2 per cent. agar agar, 2 per cent. malt extract and 5 per cent. Liebig's extract of meat. Varying percentages of the oils or tars under investigation were added to portions of the broth and the effects noted. It is reasonable to suppose that the effect of two oils under such conditions in the laboratory, would be similar to the processes in the impregnated wood, and afford a means of judging the relative efficiency of the two substances used.

The materials selected for trials for antiseptic effect were (1) American coal tar creosote, (2) German coal tar creosote, (3) Water gas tar distillate, (4) Undistilled coal tar, (5) Undistilled water gas tar.

The method of manipulation was as follows: A weighed quantity of sterile broth was placed in a sterilised separating funnel, and a definite percentage of oil or tar added; the funnel was then shaken until the contents were thoroughly mixed after which the mass was poured into a sterilised Petri dish and allowed to coagulate. It was then inoculated in several places with an active mould culture, covered, and allowed to stand for four weeks. At the end of this period the condition of the broth was noted.

Four kinds of results were noted: "Strong growth," where there was no considerable difference in appearance between the infected broth and a similar one to which no antiseptic had been added: (2) "Retarded growth," where the speed and amount of growth was considerably lessened; (3) "Slight growth," where spore formation apparently ceased and the growth of the mould was confined to a very small area around the points of inoculation; (4) "No growth," which is self-explanatory.

Table I shows the usual tests on the three oils used in the investigation. Table 2 shows the results of the tests on antiseptic properties of these oils. In table 3 is shown a similar comparison of the two tars investigated along with the ordinary tests of free carbon and specific gravity. In all the mould experiments, the end points of slight growth and no growth were re-checked, so that the results are as accurate as possible.

These results show that coal tar creosote prevents mould growth very much better than the corresponding water gas tar product. Indeed, the latter has only one-sixth the efficiency of the coal tar oil. Advocates of the use of water gas tar frequently state that prejudice against it exists in favour of coal tar creosote. This prejudice appears to be well founded. The difference between the German and American creosote samples is not so marked, but is considerable, since it takes one-third more of the former to produce the same antiseptic effect. This difference may be due to several causes—the higher percentages of tar acids, naphthalene, or lower boiling constituents in the American creosote. The precise reason cannot be stated, but an investigation on this subject is in progress. A creosote oil of pure coal tar origin, free from all acid and basic bodies, from which almost all the naphthalene has been removed, has been prepared, also known mixtures with tar acids, pyridine, and naphthalene, to ascertain the effect of these variously prepared oils on mould growth. Also, the effect of fractions of the neutral oil of varying boiling points will be noted. From data thus obtained, I hope to be able to determine the portions of coal tar creosote which are antiseptically most efficient and desirable for the purposes of wood preservation.

The tar results in table 3 are in my opinion not strictly comparable with the oil results, because the tars, on account of their high viscosity, do not mix as thoroughly with the agar agar medium as do the oils. For contrasting two tars, however, the method is a comparable one, as the same relative conditions are attained. It will be noted that the same relative efficiency exists between coal tar and water gas tar as between the corresponding oils. If anything, the laboratory conditions favoured the water gas tar, since crude water gas tar has a lower viscosity and contains a greater percentage of oil than crude coal tar.

The facts established then are:—

1. That coal tar creosote is much stronger antiseptically in preventing mould than water gas tar distillate.

2. That the former is antiseptically more efficient in about the proportion of six to one.

3. That the same relative antiseptic efficiency holds good with the undistilled tars.

Table I.

	Water gas tar distillate.	American creosote.	German cresote.
Percentage water	0·5	0·3	0·7
Limpid point ° C.	Below 0° C.	35·4°	Below 0° C.
Specific gravity at 15° C.	1·024	1·041	1·090
Per cent. tar acids	0	10·0	6·5
Per cent. dry naphthalene	0	12·6	trace
Creosoters' test—			
170° C.	0	0	0
200°	1·1	2·7	0
210°	2·7	14·3	1·2
235°	18·9	58·2	14·3
270°	50·2	77·2	36·4
315°	81·4	92·1	62·5

TABLE II.

Antiseptic in broth.	Water gas tar distillate.	American coal tar creosote.	German coal tar creosote.
Per cent.			
0·05	strong growth	strong growth	—
0·10	,, ,,	retarded growth	strong growth
0·15	,, ,,	no growth	retarded growth
0·20	,, ,,	,, ,,	no growth
0·25	,, ,,	,, ,,	,, ,,
0·30	retarded growth	—	,, ,,
0·35	,, ,,	—	,, ,,
0·40	,, ,,	—	—
0·50	slight growth	—	—
0·55	,, ,,	—	—
0·60	,, ,,	—	—
0·65	,, ,,	—	—
0·70	,, ,,	—	—
0·75	,, ,,	—	—
0·80	,, ,,	—	—
0·90	no growth	—	—
1·00	,, ,,	—	—

TABLE III.

	Undistilled coal tar.	Undistilled water gas tar.
	Per cent.	Per cent.
Free carbon	5·38	0·42
Specific gravity at 15·5° C.	1·194	1·109
0·5 per cent. tar	strong growth	strong growth
1·0 ,, ,, ...	retarded growth	,, ,,
1·5 ,, ,, ...	slight growth	,, ,,
2·0 ,, ,, ...	no growth	,, ,,
2·5 ,, ,, ...	,, ,,	,, ,,
3·0 ,, ,, ...	,, ,,	,, ,,
3·5–10·0 ,, ,, ...	—	,, ,,
11·0 ,, ,, ...	—	retarded growth
12·0 ,, ,, ...	—	slight growth
13·0 ,, ,, ...	—	no growth
14·0–20·0 ,, ,, ...	—	,, ,,

Mr. C. C. **Tutwiler** said that in light of the favourable report recently published in the Railway Age Gazette, August 19th, 1910, giving the result of the well-known Santa Fe test, extending over a number of years, of crude Bakersfield petroleum (which was not claimed to be antiseptic), it would seem that the statement credited to the advocates of water gas tar creosote by Mr. Weiss "that the action of creosote was mainly a waterproofing one" was justified. If at the same time water gas tar creosote oil had antiseptic properties, as shown by Mr. Weiss' experiments, even though to a less degree than coal tar creosote oil, it should be highly suitable for wood preservation. Theoretically considered, Mr. Weiss' findings might have been expected, because chemically the two oils were similar, both being made up of aromatic hydrocarbons, the most important difference between the tars from which they were derived being the absence from the water gas tar of those tar acids or oxygenated compounds which occurred in coal tar. It was interesting to note that there was now being obtained by water gas tar distillers, many of the compounds which for many years were obtained exclusively from the distillation of coal tar, such as benzol, toluol, solvent naphtha, heavy naphtha, and naphthalene. All these products were now generally recognised by the consumer as equal to those obtained from coal tar, and if true for these oils, why should not a satisfactory creosoting oil be obtained? It was probable that the presence of the tar acids in the coal tar creosote gave it its greater antiseptic value, and it was to be regretted that Mr. Weiss did not include in his comparison, coal tar creosote with the tar acids removed, water gas tar creosote with two or three per cent. of tar acids added, and a heavy oil derived from coal tar, such as carbolineum, which, though of well known preservative value, contained no tar acids, these being removed by distillation, and also Bakersfield petroleum. If it were true that the waterproofing property of an oil was the important consideration, then water gas tar creosote should be particularly well adapted for the purpose, because it was less volatile than a coal tar creosoting oil of the same gravity. If moderate antiseptic properties were important, it would meet this requirement also as shown by Mr. Weiss, and if an antiseptic value equal to coal tar creosote was necessary, he had no doubt that it could be cheaply and effectively imparted by the addition of a small percentage of crude tar acids or by mixing it with coal tar creosote having a percentage of tar acids rather above the average. In view of the difficulty met with at the present time in securing a high grade coal tar creosote, or indeed a sufficient quantity of inferior grades to meet the growing demands of the large users of timber, the possibility of securing a good preservative from water gas tar was of more than passing interest.

SOME RECENT PUBLICATIONS ON CREOSOTE OIL.

BY S. R. CHURCH.

Writers on creosote oil almost invariably refer for historical data to "Coal Tar and Ammonia" by George Lunge, a new edition of whose work appeared in 1909. A careful comparison of chapter 8 on creosote oil, shows that there is not very much additional matter since the 1900 edition of the same work. Lunge first describes the usual method of collecting creosote oil in the distillation of coal tar as practised in English tar distilling plants. He mentions various uses for the oil besides the preservation of timber, such as the manufacture of lubricants and lighting. Not much oil is used for either of these purposes to-day: certainly not in this country.

Coming to the application of creosote oil for pickling timber, an account of the development of the industry is given. Lunge quotes from such authorities as S. B. Boulton and C. M. Tidy, on the value of creosoting from chemical and mechanical standpoints (this J., 1884, 622, and 1885, 531). The value of high boiling oils on account of their permanence was recognised by both Boulton and Tidy. At the same time both these authors recognised that creosote oil must necessarily contain antiseptic compounds which would, as Boulton states, either kill the germs or prevent them from entering the substance, or both. An interesting point of Boulton's in this connection is that coal tar creosote contains higher phenols than carbolic and cresylic acid; in other words, it contains phenoloid bodies in the high boiling portions of the oil. Recent examination of oils from a great many different tars made in our laboratory, bears out this statement. Very considerable proportions of tar acids were found in the distillate above 270° C. from a number of different tars.

In Circular No. 98, of the Bureau of Forest Service, U.S. Dept. of Agriculture, issued May 9th, 1907, "Quantity and Character of Creosote in Well-Preserved Timbers," Professor Gellert Alleman gives the amount of creosote oil used per year from 1903 to 1905, viz.:—

7,700,000	gallons in	1903
8,650,000	,,	1904
13,550,000	,,	1905.

Inasmuch as the best obtainable figures for the year ending June 30th, 1909, indicate the use of 56,000,000 gallons, a remarkable increase in the volume of the industry during the five years from 1903 to 1908 is shown. It is probable, however, that the figures each year become more complete, and that the earlier figures were considerably short of the actual quantity used. Professor Alleman made an investigation of oils extracted by him from 37 different samples of wood, representing ties, piles, and paving blocks, both English and American, which deserves study.

"The Practical Distillation of Coal Tar Creosote" (Forest Service Circular No. 80, March 9th, 1907), and "The Analysis and Grading of Creosotes" (Circular No. 112, February 26th, 1908) are by Arthur L. Dean and Ernest Bateman. In the former, the authors publish the results of an extended series of tests to determine the differences in results between different methods of distilling, that is with different sizes and shapes of distilling vessels. They came to the conclusion that, other things being equal, the difference in results, due to the use of a retort and ordinary distilling flask, or a three-bulb distilling flask, is not great. In Bulletin No. 112 the authors propose tests by means of which coal tar creosote can be distinguished from oils having similar physical properties, but of different origin. They also tentatively classify creosote oils according to value, based on analysis by the methods proposed. This circular has done much to stimulate investigation of creosote oil by chemists. Two of the tests proposed by Messrs. Dean and Bateman, namely, the sulphonation test and the index of refraction, were new to most chemists. The sulphonation test has been under trial in the laboratories of the Barrett Manufacturing Company, and some modifications have been made in it in order to secure concordant results. As regards the test for indices of refraction, it is a question whether specific gravity tests of the several fractions will not give just as valuable indications as to the nature and origin of the material. From their tests, which included fourteen samples of coal tar creosote oil, Dean and Bateman prepared curves showing the highest and lowest ranges of the specific gravities and indices of refraction of the several fractions distilled from these oils, and their tentative classification was based on these results. Their distillation method, while undoubtedly giving slightly more concordant results than the standard method, ought not, in my opinion, to supersede the standard method for reasons that will be mentioned later.

In Circular No. 128 of the Forest Service, "Preservation of Piling against Marine Wood Borers," C. Stowell Smith gives descriptions of some of the borers that attack timber. As typical of the class commonly known as "ship worms," he states that in some cases *Xylotrya* have reached a length of six feet with a diameter of over one inch. Other specimens, he states, "seldom obtain a length of over five inches, and a diameter of ½ inch."

The Forest Service Bulletin No. 78, by W. F. Sherfesee, on "Wood Preservation in the United States," gives in concise form a comprehensive description of the subject of wood preservation, describing first the causes of decay, next the different preservatives used, as well as the various processes by which these preservatives are injected. The estimated annual saving that would result from proper preservative treatment of all kinds of structural timber which can be treated with profit is placed by him at $71,780,000.00.

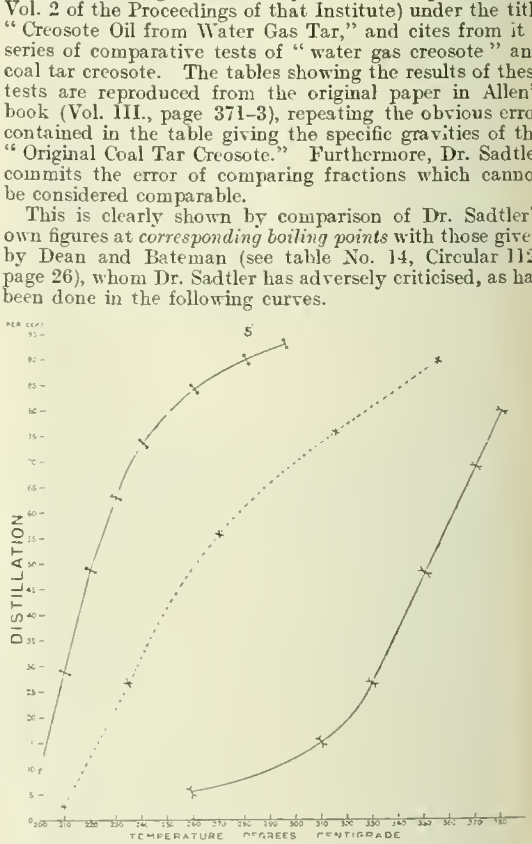
Another active group of investigators on the subject of timber preservation, has been the Committee on Wood Preservation for the American Railway Engineering and Maintenance of Way Association. In July, 1905, Bulletin No. 65 was issued containing the Association's method for analysis of coal tar creosote. This method, with slight modifications, is still the standard method of the Association, and has also been adopted by the U.S. Wood Preservers' Association. The Committee wrote to the chemists of the principal creosoting works of this country, and tar distillers and creosote oil users of Europe, asking for criticisms of the proposed method, and published the replies in Bulletin No. 72, February, 1906. The Committee's method came as near as any method possibly could, to being an average of the various suggestions received, and in a very able summing up of the matter Von Schrenk, Fulks, and Kammerer show that no radical changes in the method were warranted. I would commend this article of Dr. Von Schrenk to any chemist or engineer drawing up specifications for creosote oil.

Bulletin No. 120, February, 1910, gives reports of the various sub-committees of the Committee on Wood Preservation. The Committee on Preservatives reports briefly concerning the use of crude petroleum, wood creosote, and petroleum tar creosote as substitutes for coal tar creosote. The Bulletin also contains the report of the most recent investigation of treated ties laid in Texas in 1902. The Texas experiment was possibly the largest one yet undertaken to determine by actual results the value of various treatments. A full description of the undertaking is found in Bulletin No. 51, Dept. of Agriculture, by H. Von Schrenk. Unfortunately the results are somewhat clouded by disputes as to the way in which some of the ties were treated and by the fact that the several treatments were made at a number of different points. In these tests, no ties were treated with creosote oil alone. Harry D. Tiemann, of the United States Forest Service, contributes an article in this Bulletin on the "Physical Structure of Wood in Relation to its Penetrability by Preservative Fluids," showing why seasoned timber can be treated to so much better advantage than green timber. C. J. Humphrey of the Bureau of Plant Industry, has also contributed a paper to Bulletin No. 120 on "Fungi which live on Structural Timber." This paper shows how to determine by experiment the action of various preservatives in preventing the decay of wood.

In the recently issued Volume No. 3 of Allen's "Commercial Organic Analysis," S. S. Sadtler of Philadelphia, the author of the chapters on bitumens and phenols, advocates that the term "creosote" should be restricted to the phenolic derivatives from wood tar, coal tar, blast furnace tar, shale oil, bone oil, or other sources, the crude products from which they are derived being the corresponding "creosote oils." Thus "creosote oil" depends for its name upon the phenoloid bodies contained in the oil, and this suggests the inconsistency of using the term "creosote oil" to describe products which contain no phenols or phenoloid bodies.

The same author quotes much of Dr. S. P. Sadtler's results given in a paper read before the American Institute of Chemical Engineers in July, 1909 (and published in Vol. 2 of the Proceedings of that Institute) under the title "Creosote Oil from Water Gas Tar," and cites from it a series of comparative tests of "water gas creosote" and coal tar creosote. The tables showing the results of these tests are reproduced from the original paper in Allen's book (Vol. III., page 371–3), repeating the obvious error contained in the table giving the specific gravities of the "Original Coal Tar Creosote." Furthermore, Dr. Sadtler commits the error of comparing fractions which cannot be considered comparable.

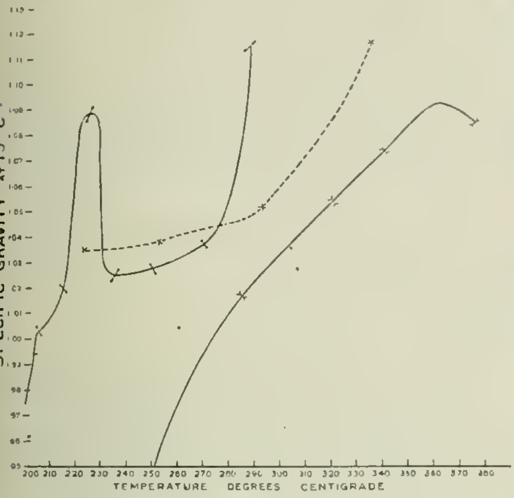
This is clearly shown by comparison of Dr. Sadtler's own figures at *corresponding boiling points* with those given by Dean and Bateman (see table No. 14, Circular 112, page 26), whom Dr. Sadtler has adversely criticised, as has been done in the following curves.



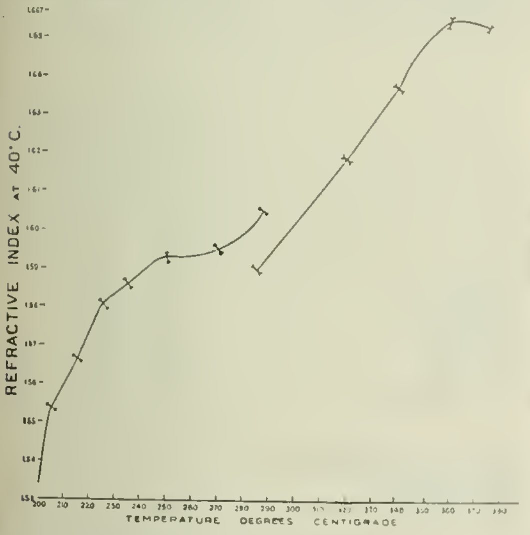
Curve 1 shows graphically the distillation range of the oils. This and the following curves are drawn from the figures given by Dr. Sadtler, with the exceptions to be noted hereafter. These are necessarily not perfect curves, but are drawn on a basis of the points given in the tables in order to show graphically the comparison which it is desired to make. The first line is the coal tar creosote; the third line the water gas tar distillate. The dotted line is to represent an oil complying with the specifications adopted by the American Railway Engineering and Maintenance of Way Association, showing that the coal tar oil tested by Sadtler was not of such character as is generally required by large users of creosote oil at present.

Curve 2 shows comparison of the same oils as to specific gravities of fractions. It is to be noted that at the only point where they are comparable, the coal tar oil is rationally higher than the water gas oil. There is also a curve to show the specific gravities of the fractions of what may be called the "Maintenance of Way Specifications Oil," showing a rational increase in the gravity of each fraction, and accordingly higher specific gravities than found in the water gas oil.

Curve 3 gives a comparison of the refractive indices, as given in Sadtler's tables. Here also the coal tar creosote is higher than the water gas oil at the only comparable points. We do not propose to deal with the questions as to whether the oils compared fairly represent the oils offered to creosoters of lumber to-day or not. As a matter of fact, oil is usually bought on definite specifications dealing not only with its physical properties but its origin.



Hence any conclusion that oil from water gas tar is superior to, or equal to, coal tar creosote, if drawn from Sadtler's analysis is inadmissible.



It is impossible to close this paper without some recognition of two very important reports in regard to timber preservation that were made about twenty-five years ago. The first is Mr. S. B. Boulton's article entitled "The Antiseptic Treatment of Timber" (Proc. Inst. Civil Engineers—this J., 1884, 622), and the second is a Report of the Committee of the American Society of Civil Engineers on timber preservation, published in full in the Transactions of the Society for 1885 and written by Octave Chanute, who was Chairman of the Committee. It appears that at this time there was a scare regarding the probable disappearance of the timber supply, which led to the work of this Committee, and also to the first concerted forestry investigations by the U.S. Government. The investigations proved that the supply of timber was greater than had been feared, and possibly there was a lapse of interest in the subject after that for some ten or fifteen years. At any rate the railroads seem to have done more experimental work and investigation of the subject in the early 'eighties than has been done since until very recently. Possibly one thing that tended to discourage these early attempts, was the very small amount of merit that many of the preservative treatments possessed.

THE CHARACTERISTICS OF CREOSOTE AND TAR OILS AVAILABLE FOR WOOD PRESERVATION.

BY CHARLES N. FORREST.

Out of the 85 wood treating plants in the United States, 64 employ creosote or tar oils as a preservative. Some 50 of these plants are commercial enterprises and the rest belong to railroads and other private companies (Proceedings Wood Preservers Assoc., 1910). There are some six plants engaged in the manufacture of wood paving blocks, although not exclusively so in every instance. The commercial plants belong to about 44 individual companies and use a variety of processes, including the Bethell, Labrot, Lowry, Reuping, and open tank.

It has been estimated, from somewhat incomplete data, that 18,717,808 cubic feet of timber of all kinds except cross-ties, and 9,620,420 cross-ties, were treated with creosote or tar oils in 1908, and for that year the Forest Service, U.S. Department of Agriculture, has estimated the consumption of preservative oil as 57,548,268 gallons. Of this oil 67½ per cent. was imported and the 32½ per cent. obtained from domestic sources. The Forest Service reports a total consumption of oil in 1909 as 51,431,212 gallons, about 73 per cent. of which was imported. The returns from domestic sources are, however, reported as incomplete.

The crude tars from which the preservative oil now available for wood treatment is obtained are all produced in the manufacture of gas, both coal and water, and of coke, and differ from one another. The tar from down-draught bee-hive coke ovens, and from some types of water gas and oil gas producers, contain paraffins and olefines, and should not be placed in the same class as the tar from which the type creosote of commerce was originally obtained.

The late Dr. H. W. Jayne, in a paper on "The Coal Tar Industry in the United States," presented at the Fourth International Congress of Applied Chemistry, classified crude tars as follows:—"Small gas works, sp. gr. 1·22, and free carbon from 20 to 25 per cent.; large gas works, where the retorts have regenerative firing, sp. gr. 1·28 to 1·30, and free carbon 30 to 40 per cent. Otto system by-product ovens, sp. gr. 1·24, and high free carbon. Semet-Solvay by-product ovens, sp. gr. 1·20, and free carbon from 8 to 10 per cent."

A sample of crude tar from one of the latest installations of the Otto by-product ovens in this country, recently examined by the author, had a sp. gr. of 1·165, and free carbon 5·3 per cent. Crude water gas tar, from which large quantities of wood treating oils have been prepared, sp. gr. 1·08, contains less than 1 per cent. of free carbon.

To the tar distiller, in this country at least, the chief value of the tar lies in the pitch residue. The yield of pitch and its free carbon contents are, therefore, very important considerations. Trade customs and necessities have established certain grades of pitch, which are regulated chiefly by melting point and free carbon contents, for roofing, paving, waterproofing, and other purposes.

In order to meet the demand for moderately low carbon pitch and for creosote oil containing but little solid naphthalene, gas works coal-tar is advantageously mixed with coke oven and water gas tars and the combination distilled in the usual manner. It has been recently stated that "it is from the distillation of water gas tar, under certain rather rigid conditions, that consumers of creosote oil in this country will have to look for increased supplies." (The Examination of Creosote—T. H. Davis—Oil, Paint, and Drug Reporter, February 14, 1910.)

On account, however, of the almost total absence of free carbon in water gas tar, and the pitch therefrom being not entirely satisfactory for roofing and some other purposes, the distillation of straight water gas tar for the production of creosote is not at present profitable. The straight undistilled water gas tar, from which about 25 per cent. of light oils have been removed, has been used successfully in certain directions, as will appear later, and the mixed distillate of this tar with coal and coke tar distillates, provided the combination has been intelligently made, undoubtedly forms the bulk of the creosote of the present time.

In the absence of paraffins and olefines there is no chemical means at present available for identifying the source of the individual oils in such mixtures.

In addition to the distilled creosote oil consumed in the wood treating industry, large quantities of undistilled tars and mixtures of tar and creosote oil are also used as preservatives. These tar mixtures are used chiefly in connection with the production of wood paving blocks, and while they have formerly been referred to as heavy creosote oils, recent specifications (New York City, 1909) calling for such oil, merely define it as a "preservative oil." While it does not appear possible at the present time satisfactorily to define creosote oil, the term should not be applied without qualification to other than pure distillates.

There is a growing demand for extra heavy oils for wood preservation. Reports have recently been published showing the changes which take place in the oil in treated timber upon prolonged exposure, which seem to warrant the use of high boiling oils for this purpose (Changes which take place in Coal Tar Creosote during Exposure—Von Schrenk, Fulks and Kammerer—Bulletin No. 93, American Railway Engineer and Maintenance of Way Association—Quantity and Character of Creosote in Well-Preserved Timber—Alleman-Forest Service, U.S. Dept. of Agriculture, Circular No. 98), and a very recent specification requires the use of a mixture of "a heavy distillate of coal tar with either refined coal tar or coal tar pitch" (Creosoted Wood Block—American Society for Municipal Improvements, 1910).

There is no doubt that a large proportion of the specifications now calling for special and practically impossible oils are based chiefly upon theory and that wood treaters have suffered considerable embarrassment on this account. Dean and Bateman (Forest Service, U.S. Dept. of Agriculture, Circular No. 112) have given the characteristics of a number of creosote oils and emphasized the importance of the high boiling ingredients of the same. It is impracticable for the wood treater to carry a stock of two or three different kinds of oil, or to change his stock of a single kind further than the slight alterations in the specifications of the principal consumers require from time to time.

The simple oils and tars which are available and are consumed in large quantities at the present time have the following characteristics :—

TABLE 1.

	Domestic distilled oil.	Foreign distilled oil.	Otto coke oven tar.	Otto coke oven distilled oil.	Water gas tar refined.
Specific gravity at 15° C.	1·03	1·04	1·16	1·09	1·13
Free carbon	none	none	5·3	none	0·6
Tarry matter ..	0·5–2·0	0·7	58·0	10·0	51·0
Tar acids	7·0	13·6	trace	trace	none
Solid napthalene	—	18·0	—	—	—
Distillation—					
Below 170° C.	0·42	0·70	0·60	1·60	0·50
170—205°	4·50	1·50	0·90	2·40	0·50
205—235°	51·95	35·20	6·90	19·80	1·70
235—255°	22·01	32·60	7·20	7·70	4·10
255—270°			4·20	7·50	5·80
270—315°	10·99	20·00	7·90	11·60	15·00
Residue above 315°	10·13	10·00	72·30	49·40	72·40
	100·00	100·00	100·00	100·00	100·00
Insoluble in di-methyl sulphate	none	none	none	none	none
Condition of residue	soft	soft	hard	soft	hard
Paraffin scale ...	none	none	none	none	none

With very few exceptions wood treating companies do not distil their own oil and they are, furthermore, quite closely restricted in securing stocks from the limited sources of supply at home and abroad to the standard grades of domestic and foreign oils mentioned above. The only recourse in meeting the demand for a larger percentage of high boiling constituents is to use a mixture of distilled oil and tar. In the absence of an excessive amount of suspended matter, no difficulty is experienced under the ordinary working conditions of any of the pressure processes in securing satisfactory penetration of such mixtures up to 50 per cent. or more of the tar.

The relative degree of fluidity at 95° C. of the distilled oils and tars given above, as determined by a viscosity test, is as follows :—

Distilled oil	1·0
Otto tar	1·7
Water gas tar	2·3

The most viscous of these tars has been readily injected into yellow pine paving blocks to the extent of 20 pounds per cubic foot, and into piles to the extent of 15 pounds. No fear, therefore, need be entertained that saturation cannot be obtained with mixtures of oil and tar as thorough as with straight distilled oil.

Three classes of materials which have been used extensively for the treatment of wood paving blocks are shown in the following table :—

TABLE 2.

	Water gas, tar	Coal tar	Distilled oil
	Per cent.	Per cent.	Per cent.
Specific gravity at 38° C.	1·12	1·17	1·10
Insoluble in carbon bisulphide	0·60	3·5	none
Distillation—			
Below 170° C.	0·50	0·10	—
170°—205°	0·50	2·00	—
205°—235°	1·70	2·90	—
235°—255°	4·10	7·30	—
255°—270°	5·80	7·20	—
270°—315°	15·00	9·70	25·00
315°—370°	24·60	16·40	60·00
Residue above 370°	47·80	54·40	15·00
	100·00	100·00	100·00
Insoluble in di-methyl sulphate ..	none	none	none
Condition of residue	hard	hard	soft
Sp. gr. distillate— .... 255°—315° C. at 60° C.	1·00	1·02	1·08

The heavy distilled oil mentioned above is believed to be manufactured at the treating plant where it is used.

The author, in a recent paper upon the subject of "Preservatives for Wood Paving Blocks" (Engineering Record, April 16, 1910), has shown that waterproofing rather than preserving from decay is the chief object in saturating such blocks. For this purpose the tar is much more efficient than a distilled oil, either of the average or of high density. Yellow pine blocks, 3 × 3 × 8 inches, treated to the extent of 20 pounds per cubic foot, when first dried at 100° F. for 24 hours and then immersed in water for 24 hours, absorb water to the extent of from 6 to 8 per cent. when treated with distilled oil and from 1 to 2 per cent. when treated with tar.

Dr. Sadtler has called attention to the characteristics of pure distilled oils from water gas tar (Creosote Oil from Water Gas Tar—The Chemical Engineer, Vol. 10, p. 74), but at the present time such oil is not a commercial possibility. Several samples have been examined by the author, with the following results :—

TABLE 3.

Identification.	1·07 oil.	1·12 crude oil.	1·12 prepared oil.	1·12 deodorized oil.
	Per cent.	Per cent.	Per cent.	Per cent.
Specific gravity at 65° C. .	1·072	1·118	1·119	1·121
Flash test (Cleveland cup)	83° C.	77° C.	102° C.	107° C.
Insoluble in carbon bisulphide	0·30	none	none	none
Insoluble in petroleum naphtha	0·50	0·30	0·30	0·20
Paraffin scale	none	none	none	none
Distillation—				
Below 170° C.	0·25	0·79	0·12	0·10
170°—205°	0·43	0·44	0·48	0·44
205°—235°	0·87	0·75	1·00	0·87
235°—270°	2·11	1·69	1·44	2·00
270°—315°	12·56	4·62	6·00	4·43
315°—370°	62·37	36·40	31·74	32·56
Residue above 370°	21·21	55·31	59·22	59·60
	100·00	100·00	100·00	100 00
Condition of residue	soft	soft	soft	soft
Insoluble in dimethyl sulphate	none	none	none	none

These oils contain practically no solid naphthalene, and are very fluid at 95° C.

Considering the obscure source of supply of the materials now available for wood treating purposes and the fact that the wood treater is a middleman, and not the producer of the oil, it can be readily appreciated why he will furnish an affidavit concerning the nature of the oil he is using with considerable reluctance, and especially as to whether it is derived exclusively from coal tar, further than a chemical analysis can determine that fact. The wood treater has no definite or original knowledge upon this point, and the right of engineers to exact such an affidavit is questionable.

The characteristics which are determined by a laboratory examination, and which are considered to be sufficient to determine whether the preservative material is satisfactory for the specific purpose involved, are as follows :—

Specific gravity—preferably at 38° C.

Free carbon—insoluble in benzene or carbon bisulphide.

Pitch or tarry matter—insoluble in alcohol or petroleum naphtha.

Tar acids—volume removed from distillate by caustic soda solution.

Naphthalene—solid from distillate or fraction 210° to 235° C.

Distillation—under standard conditions.

Specific gravity of certain or all fractions of distillate.

Sulphonation test of distillate.

Refractive index of distillate.

Dimethyl sulphate test of distillate.

It is undoubtedly advantageous to make all specific gravity determinations, upon both the original oil and the fractions thereof, at a temperature sufficiently elevated to ensure solution of all crystallisable substances, and to compare the gravity with water at the same temperature.

Whether the determination of insoluble carbon and pitch shall be made with a hot or cold solvent should be stated. The action of hot solvents is more complete, but it is frequently more advantageous and sufficiently accurate to proceed with cold solvents.

Tar acids have fallen somewhat into disrepute, and little attention is now paid to them. Creosote distilled from some by-product tars and from water gas tar contains but little if any tar acids.

Solid naphthalene should always be pressed from the chilled distillates, as otherwise it will be dark and very impure. Sublimation is scarcely necessary for general purposes, but the custom of reporting certain fractions obtained by distillation as naphthalene is, of course, arbitrary and incorrect.

There is a greater diversity of opinion as to the essential details of the distilling apparatus, time and cuts of the fractions, etc., but the method in general use, and one which has been found by the author to answer all practical purposes, is that recommended several years ago by Von Schrenk, Fulks, and Kammerer (Bulletin 65. American Railway Engineer and Maintenance of Way Association), which involves the use of an 8-oz. covered retort, 100 grams of oil, the thermometer bulb one-half inch above the surface of the oil, and distillation at the rate of one to two drops per second.

The specific gravity of the individual fractions, or certain groups of same, obtained in the distillation test are frequently instructive.

Dean and Bateman (*loc. cit.*) have recommended a sulphonation test of certain fractions, also a determination of the indices of refraction of the same for the detection of paraffins and olefines, but a more satisfactory and convenient test for the same purpose is applied by the author as described by Dr. Sommer (Methods of Asphalt Examination—Journal of Industrial and Engineering Chemistry, Vol. 2, p. 186). The method is described by Dr. Sommer as follows :—

"Dimethyl sulphate dissolves oil products of benzene (benzole) character or pyro distillates, whereas it does not dissolve paraffin or olefine hydrocarbons, such as are produced by the distillation of mineral oil. . . . Four c.c. of the distillate obtained by destructive distillation . . . . are put in a 10 c.c. graduated cylinder with glass stopper, and 6 c.c. of dimethyl sulphate are added and shaken thoroughly for one minute. If the distillate is not entirely soluble, separation takes place within a few minutes and a separating mark can be accurately read."

The following results showing the availability of the test are given as follows :—

PERCENTAGE OF COAL-TAR BY SOLUBILITY OF THE DISTILLATE IN DIMETHYL SULPHATE.

Description of product.	Solubility in per cent.
E. grade petroleum....................	Not soluble
Natural asphalt	,, ,,
Coal-tar	100 per cent.
20 per cent. tar + 80 per cent. petroleum	15 ,, ,,
40 ,, ,, + 60 ,, ,,	30 ,, ,,
50 ,, ,, + 50 ,, ,,	35 ,, ,,
60 ,, ,, + 40 ,, ,,	40 ,, ,,
80 ,, ,, + 20 ,, ,,	60 ,, ,,

In view of the wide distribution of the gas and coke plants producing by-products throughout the civilised world, it may be thought a simple matter for wood treating plants to obtain supplies of preservative tar-oils of any desired character. The collection, refining, and distribution of tars has, however, become a business possessing many peculiarities, and large supplies of creosote or tar, either foreign or domestic, are rather closely controlled.

A distinction between what is or may be produced and what is actually available in sufficient quantity to meet the requirements of all or a majority of the 64 wood treating plants, which now consume nearly 60 million gallons of preservative oils annually, is not generally made by either scientific investigators or engineers.

An inspection of recent specifications and publications from different sources upon this subject discloses a wide diversity of opinion on what constitutes a desirable preservative oil for timber. Apparently little if any consideration is given the wood treater, who is supposed to comply with all or any of these specifications, in spite of the fact that, with practically no exception, none of them prepare their own oil. Undoubtedly much of this divergence of opinion is based upon theories unsupported by scientific facts. It is the cause of much unnecessary embarrassment to an industry of great magnitude.

The characteristics of the available creosote of normal density are fairly represented in the data presented in Table 1 for foreign and domestic oils of that class. This is practically the standard creosote oil of the present time for general wood treating purposes.

No large supply of high density distilled oil, or of extremely low carbon coal tar prominently mentioned in certain types of specifications and publications during the past 5 or 6 years, is at present available to even a majority of the wood treating plants in the United States. The characteristics of some oils and tars of these types which have been produced experimentally and under closely guarded trade relations have been given, but the restrictions affecting commercial operations with these materials are so unnecessarily narrow that only a limited number of favoured contractors can command a supply.

The production of crude tar in the United States may still be inadequate to supply the entire demands of our wood treating plants with specially refined products, and for the consumption in other directions, but a rational consideration of this subject and the substitution of scientific facts for much of the unfounded prejudice which now prevails, would undoubtedly lead to a very material reduction in the vast amount of tar oils annually imported into this country and a wider latitude in the choice of desirable materials for all classes of wood treatment.

Yorkshire Section.

Meeting held at Queen's Hotel, Leeds, on Monday, January 16th, 1911.

MR. JOHN W. COBB IN THE CHAIR.

THE RELATION BETWEEN CHEMICAL CONSTITUTION AND FASTNESS TO LIGHT AND OTHER AGENCIES OF POLY-HYDROXY-BENZOPHENONE DYES.

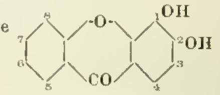
BY EDWIN ROY WATSON, M.A., B.SC., AND JATINDRA MOHAN DUTTA, M.A.

The poly-hydroxy-benzophenones possess especial interest because they are the simplest dyes built on the same lines as the important natural dyes of the alizarin, xanthone, and flavone series. In the poly-hydroxy-benzophenones the dyeing properties seem to be due to the -CO- group between the two nuclei and several hydroxyl groups attached to the nuclei. In alizarin we have the same arrangement with the addition of a second -CO- linking between the two nuclei; in the xanthone series the same arrangement with the addition of an -O- linking between the two nuclei. This group, therefore, seemed especially interesting to study in order to learn how to build dyes on the plan of the natural substances with great fastness to all agencies.

Selection of dyes for examination.—There appear to be no observations of dyeing properties of di-hydroxy-benzophenones, from which it was concluded that three or more hydroxyl groups in the molecule are necessary to give dyeing properties. It was thought that probably Liebermann and v. Kostanecki's rule would apply in this group as well as in the anthraquinone group owing to the similarity of structure, and therefore preference was given to those compounds containing two hydroxyl groups in the o-position to one another and adjacent to the -CO- group as likely to be faster to washing and alkalis than other members of the group. Nine such derivatives of benzophenone have already been described by the Badische Anilin und Soda Fabrik (Ger. Pat. 49,149, April 24, 1889, Kl. 22: Ber., 23, R. 43) and six of these were prepared for the present investigation together with a tetrahydroxy-benzophenone not possessing the grouping above mentioned in order to see if the assumption of Liebermann and v. Kostanecki's rule was here warranted. From two of these seven poly-hydroxy-benzophenones xanthone derivatives were easily prepared, and their properties were compared with the parent substances. The dyes prepared were :—

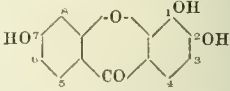
2.3.4—Trihydroxy-benzophenone (Ger. Pat. 49,149);
2.3.4.4′—Tetrahydroxy-benzophenone. (Ditto);
2.3.4.3′—Tetrahydroxy-benzophenone. (Ditto);
2 3.4.2′—Tetrahydroxy-benzophenone. (Ditto);
2 4 3′ 4′—Tetrahydroxy-benzophenone. (Kostanecki Ber. **27**, 2,000);
2.3.4.2′.4′—Pentahydroxy-benzophenone. (Ger. Pat. 49,149)
2.3.4.3′.4′.5′—Hexahydroxy-benzophenone. (Ditto);

1.2—Dihydroxy-xanthone



(Graebe and Eicheagrün, Ber. **24**, 969).

1.2.7—Trihydroxy-xanthone



(not previously described, prepared from the above pentahydroxy-benzophenone in the same way as Graebe and Eichengrün prepared 1.2-dihydroxy-xanthone from 2.3.4.2 -tetrahydroxy-benzophenone. The pentahydroxy-benzophenone was heated with water in a sealed tube for 2½ hours at 180°—220° C. The tube after cooling contained a woolly mass of long needles. The trihydroxy-xanthone is sparingly soluble in water, but can be crystallised out of dilute alcohol in needles. It does not melt even at 285° C., and its alkaline solution is beautifully fluorescent).

Testing the fastness to various agencies.—Before describing the present determinations it may be remarked that the Badische Anilin und Soda Fabrik in Ger. Pat. 49,149 describe the yellow shades obtained from 2.3.4-trihydroxy-benzophenone on alum-mordanted cotton as not inferior to Alizarin Red in point of fastness to light, air, acids, alkali and soap. The dyeings with the other substances described in the patent are said to be generally similar.

For the present experiments, dyeings were made with 2 per cent. dyestuff on woollen cloth mordanted with alumina. It was remarked that only the trihydroxy-benzophenone, hexahydroxy-benzophenone and the di-hydroxy-xanthone gave quite full shades. Next in strength of shade were 2.3.4.4′-tetrahydroxy-benzophenone and the pentahydroxy-benzophenone, whilst the others gave indifferent shades. No connection between this and chemical constitution can be detected.

Fastness to light.—The determinations were made by methods already described. (Watson, Mem. As. Soc. B., Vol. II., No. 3) and fastness is recorded according to the British Association Committee's Scale, I. being most fugitive and V. most permanent :—

Dye.	Fastness.
2.3.4-Trihydroxy-benzophenone	III.
2.3.4.4′-Tetrahydroxy-benzophenone	IV—V.
2.3.4.3′-Tetrahydroxy-benzophenone	III—IV.
2.3.4.2′-Tetrahydroxy-benzophenone	III.
2.4 3.′4′-Tetrahydroxy-benzophenone	III.
2.3.4.2′4′-Pentahydroxy-benzophenone	II.
2.3.4.3.′4.′5′-Hexahydroxy-benzophenone ..	I—II.
1.2-Dihydroxy-xanthone	II.
1.2.7-Trihydroxy-xanthone	II.

It will be noticed that all the members of the series cannot be called very fast to light; in fact hexahydroxy-benzophenone must be regarded as fugitive. This is disappointing as from analogy with the alizarin series it was hoped that the benzophenone molecule would have been able to carry a large number of hydroxyl-groups without having the fastness to light diminished. Here as in the azo-series (Watson, J. Soc. Dyers and Col., 26, 237–8) the general effect of increasing the number of hydroxyl groups is to decrease the fastness to light. But the fact that 2.3.4.4′-tetrahydroxy-benzophenone and 2.3.4.3′-tetrahydroxy-benzophenone are faster to light than 2.3.4-trihydroxy-benzophenone is an exception to this rule. Among the tetrahydroxy-benzophenones a relation may be observed similar to one which has been seen among the amino-azo-benzenes. In 2.3.4.4′-tetrahydroxy-benzophenone the hydroxyl group in the second nucleus is in the *p*-position to the -CO- or chromophore group. This position gives the greatest fastness. In 2.3.4.3-tetrahydroxy-benzophenone the solitary hydroxyl group is in the *m*-position to the -CO- or chromophore group and the fastness to light is less. Finally with the hydroxyl group in the *o*-position to the chromophore, as in 2.3.4.2, the fastness to light is least. Compare with p-amino-azo-benzene which is faster to light than m-amino-azo-benzene and much faster than o-amino-azo-toluene (Watson, Sircar, and Dutta, J. Soc. Dyers and Col., 26, 237–8). It is of special interest to notice that the two xanthones have not greater, but rather less fastness than the polyhydroxy-benzophenones from which they derive.

Fastness to soaping.—Tested by the method already described (Watson, Mem. As. Soc. B., *loc. cit.*). In no case was any reduction of shade intensity observed, but on the contrary a general deepening, but not darkening, of shade was produced. This was especially noticeable in the case of trihydroxy-benzophenone, hexahydroxy-benzophenone and 1.2-dihydroxy-xanthone, in fact, in just those cases where the original shade was fullest.

Fastness to alkali.—Tested by the method already described (Watson, Mem. As. Soc. B., *loc. cit.*). Here also, especially in the case of trihydroxy-benzophenone, hexahydroxy-benzophenone and dihydroxyxanthone a considerable deepening and brightening of shade was observed, the shade becoming more orange. Only in the case of 2.4.3′.4′-tetrahydroxy-benzophenone was any reduction of shade observed, and here the shade was reduced to less than half its original intensity.

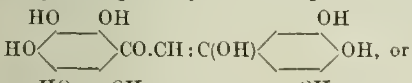
Fastness to acid.—Tested by the method already described (Watson, Mem. As. Soc. B., *loc. cit.*).

Dye.	Intensity after acid test—expressed as percentage of original intensity.
2.3.4—trihydroxy-benzophenone	100 per cent.
2.3.4.4′—tetrahydroxy-benzophenone	100 ,,
2.3.4.3′—tetrahydroxy-benzophenone	>75 ,,
2.3.4.2′—tetrahydroxy-benzophenone	75 ,,
2.4.3.′4′—tetrahydroxy-benzophenone	25 ,,
2.3.4.2.′4′—pentahydroxy-benzophenone ..	100 ,,
2.3.4.3.′4.′5′—hexahyrdoxy-benzophenone	100 ,,
1.2—dihydroxy-xanthone	>75 ,,
1.2.7—trihydroxy-xanthone	50 ,,

The results show full justification for the assumption that Liebermann and v. Kostanecki's rule would apply in this group. 2.4.3.′4′-tetrahydroxy-benzophenono is the only dye appreciably faded by alkali, whilst in the acid test also just those dyes which do not contain two hydroxyl groups in the o-position to one another and adjacent to the –CO– group *viz.*, 2.4.3′.4′-tetrahydroxy-benzophenone and the two xanthones, are the most affected.

General conclusion.—The group does not show that unvarying fastness to all agencies as was expected from analogy with the alizarin series. The brightening and deepening of shade on treatment with alkali, although interesting, must be regarded as a defect unless the shade once brightened is permanent. This has not yet been tested. The only dye of the group which was practically unaffected by all agencies was 2.3.4.4′-tetrahydroxy-benzophenone.

It is very interesting to note that the xanthones are not so fast to light or acid as the polyhydroxy-benzophenones from which they derive. This seems to show that there is no special virtue for dyeing purposes in the pyrone ring, and probably such compounds as



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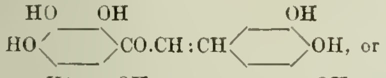

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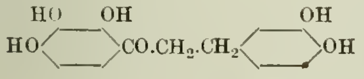


would be equally valuable as dyes as the flavones and could undoubtedly be much more easily synthesised.

Discussion.

Mr. T. Fairley asked if all the dyestuffs of that class were yellow. How would the complexity of the molecule be likely to affect this colour? At the violet end of the spectrum the vibrations were shortest and he suggested that increase in the weight of the molecule might cause shifting from the red to the violet end of the spectrum. Do these formulæ actually represent the dye or was there likelihood of some change such as polymerisation occurring on deposition on the fibre?

Dr. L. L. Lloyd said that according to von Kostanecki's work the hydroxyl groups in the *ortho*-position to the ketonic group were very stable and were very difficult to etherify. This stability of the *ortho*-hydroxy group was supposed to render the lakes produced far more stable. The compounds 4 and 6 in the table, however, proved that not to be the case, which appeared to show that the chemical properties of the substances in no manner give an idea of their dyeing properties. All the dyestuffs examined were yellow, which was attributable to their having only one chromophoric group; in the alizarin series there was a possibility of two chromophores. Accepting that, how could one account for the polygenetic properties of alizarin and for the monogenetic properties of Alizarin Blue?

Dr. H. Ingle asked if the author had made any attempt to explain the formulæ on Thiele's theory of partial valencies. He had found it very useful with regard to iodine derivatives of the complex organic compounds and thought that some interesting conclusions might be reached. According to Thiele the colour of compounds was due to double linkages.

Mr. E. R. Watson, in reply, said that the compounds investigated were unfortunately all yellow. It was curious that in this series it was impossible to rise above yellow, whilst in the alizarin series, so similar to it, one could get right to the other end of the spectrum by the introduction of sufficient hydroxyl groups. It had always been accepted that greater complexity would tend to shift the colour towards the violet end of the spectrum. It might be that in the case of the purple alizarin derivatives polymerisation occurred on the deposition of the dye on the fabric, but there seemed no particular reason why there should not be similar polymerisation in the case of the poly-hydroxy-benzophenones. He believed that Dr. Lloyd's and Dr. Ingle's explanation was the one which would be generally accepted, *viz.*, that in the poly-hydroxy-anthraquinones it was possible to have two quinonoid groupings at the same time, whilst in the benzophenone series only one such grouping was possible. But at the same time this suggestion did not seem to explain other facts which were known, *e.g.*, the dye obtained by diazotising para-rosaniline and coupling with salicylic acid was only yellow in colour, although in it three quinonoid groupings were possible at the same time. Dr. Lloyd had said that he would have expected 2.3.4.2′-tetrahydroxy-benzophenone to be more stable than 2.3.4.3′ or 2.3.4.4′. The authors also had expected 2.3.4.4′ to be the least stable. That the reverse was the case might perhaps be explained by Prof. Green's suggestion, referred to in the previous discussion (Watson, Sircar, and Dutta's paper, this J., Jan. 15, 1911, p. 9) with reference to the fastness to light of p-amino-azo-benzene, m-amino-azo-benzene and o-amino-azo-toluene.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—
English.—8*d.* each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1*s.* each, to the Secretary of the Society.
French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs Bourgeois, Paris (3e.).
German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Evaporators, condensers, steam and other boilers, and superheaters; Apparatus for the transmission of heat between fluids, including ——. W. J. Rusdell, London. Eng. Pat. 30,363, Dec. 29, 1909.

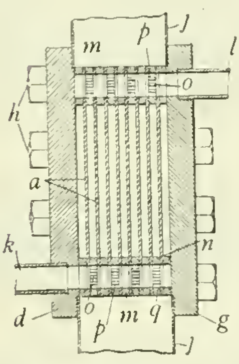


Fig. 1

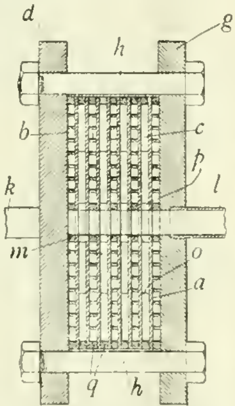


Fig. 2

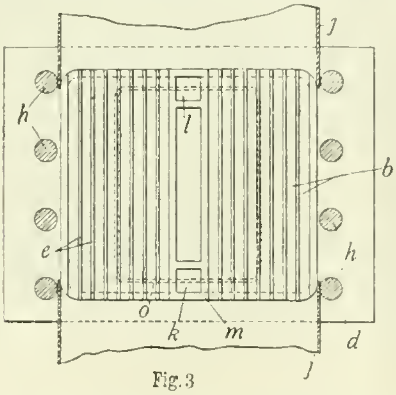
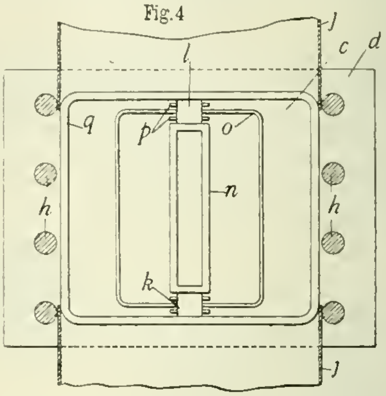


Fig. 3



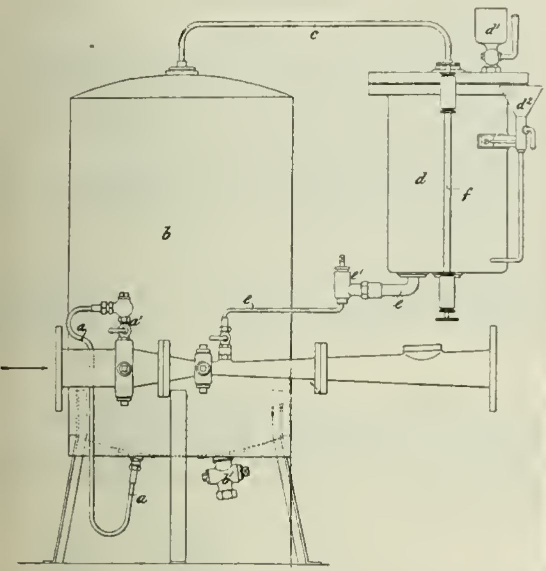
The patent relates to apparatus of the type referred to in the title, and constructed from a number of plain or corrugated plates separated by narrow spaces and held together between end plates, the jointing between the edges of the plates being effected by the pressure of bolts passed through the end plates. Claim is made for the provision of "one or more communicating passages through the sides of the plates, the passages in the successive plates being relatively co-axial and being arranged so that the fluids flow, in adjacent spaces or passages formed by the plates, in relatively opposite directions." In the application of the invention to a steam generator, figs. 1 and 2 are respectively a sectional end elevation and sectional plan; fig. 3 is a sectional front elevation along one of the hot gas spaces between the plates, and fig. 4 is a similar view along one of the water or steam spaces. The plates, *a* (Fig. 1), are separated to form hot gas or flame spaces, *b*, and water and steam spaces, *c*. Near both its upper and lower edges each plate is provided with an aperture, that at the lower edge forming part of the water inlet passage, *k*, and that at the upper edge forming part of the steam outlet passage, *l*. Access of steam or water to the hot gas spaces is prevented by jointing pieces or frame-like members, *m*, placed in the spaces, *b*, between the plates and having apertures as shown for the water and steam. The central aperture shown in the part, *m* (fig. 3), is not essential, being only provided for economy of material. On each side of the part, *m*, distance-pieces or strips, *e*, are arranged for keeping the plates the required distance apart and supporting them against the steam pressure in the spaces, *c*. In each of the latter spaces is placed an element, *n*, corresponding with part of the element, *m*, in the spaces, *b*, and also other pieces as *o* and *p*. In the vicinity of the apertures, *l* and *k*, these pieces enable the requisite pressure to be obtained between the plates to produce steam-tight joints around the apertures. The pieces, *o*, also serve to divide the steam space in such a manner that the fluid passing therethrough is compelled to distribute itself evenly throughout such space before passing away as steam at the upper end. The peripheral joint around the four sides or edges of each steam space is formed by a metal band, *q*, of rectangular section. The hot gases are conducted to and from the boiler by the conduits, *i*. All the necessary joints between the plates are produced by the pressure of the bolts, *h*, passing through the end plates, *d* and *g*. By providing the openings, *l* and *k*, in the sides of the plates, the necessary water inlet and steam outlet are obtained in a simple manner, thus permitting the use of plain and inexpensive end plates.—W. E. F. P.

Filter; High pressure ——. J. Burgess, Cheltenham, and J. F. Muir, South Melbourne, Australia. Eng. Pat. 1353, Jan. 18, 1910. Under Int. Conv., Sept. 6, 1909.

The invention refers "to the class of filter wherein paper pulp or other similar filtering materal, is arranged in a plurality of compartments one above the other, to enable the filtering material to be more readily cleaned, the compartments being separated from each other by intermediate chambers with separate inlet and outlet connections for cleaning purposes." The apparatus thus comprises a series of superimposed filtering compartments separated from each other by "scouring chambers." The filtering compartments (comprising strainers, distance-frames and perforated division-plates) are charged with paper pulp or other filtering medium. and the filtration is conducted in an upward direction. Each scouring chamber is provided with a separate inlet and outlet, the removal of the deposited solid matter, (scouring). from any section being effected by the use of live steam or other means.—W. E. F. P.

Mixing liquids in different proportions ; Apparatus for —— W. G. Kent and W. G. Ardley, London. Eng. Pats. 2643, Feb. 2, 1910, and 8957, April 13, 1910.

The liquid used in the larger quantity flows through the conical venturi tube in the direction shown by the arrow see Fig.) and owing to the constriction an increase of pressure is produced on the inlet side of the conical constriction. This pressure is proportional to the volume of liquid flowing through the tube and is communicated by the liquid in the tube, *a*, to the air in the vessel, *b*, compressing it to a greater or less degree. The vessel, *b*, communicates with the vessel, *d*, which contains the other liquid, by the pipe, *c*, and the compressed air forces the liquid out of the vessel, *d*, through the pipe, *c*, into the main on the up stream side of the venturi tube. The vessel, *d*, is provided with a gauge, *f*, and with the funnels, d^1, d^2, for filling. A preliminary adjustment of the relative quantities of the two liquids is effected by the taps, a^1, e^1, and subsequently any variation in the main flow in the direction of the arrow is immediately followed by a similar variation in the flow of the liquid from the vessel, *d*.—W. H. C.



Dry-kiln. J. R. Ripley, Memphis, Tenn. U.S. Pat. 978,209, Dec. 13, 1910.

Warm air is introduced into a drying kiln through a number of vertical inlet pipes which carry oppositely disposed distributing nozzles and are continually reciprocated vertically, the arrangement being such that when one nozzle is at its uppermost position the corresponding oppositely disposed nozzle is at its lowermost position. In this manner a constant reversal of draught through the kiln is obtained. In an example three inlet pipes are employed in a long drying chamber, the central pipe carrying two nozzles which turn outwards towards the ends of the chamber while the pipes disposed at the ends of the chamber carry single nozzles pointing inwards. The outer pipes are reciprocated together in an opposite direction to the central pipe. Outlet flues are disposed at the ends and centre of the chamber to carry off the moist air currents separately. Steam may be introduced with the air when necessary. The materials to be dried are introduced on trucks running in channels below the drying chamber.—H. H.

Vacuum drying apparatus. (1) E. W. Strohn, Buffalo, N.Y., and (2) L. W. Treichler, Williamsville, N.Y., Assignors to J. P. Devine Co., Buffalo, N.Y. U.S. Pats. 981,494 and 981,501, Jan. 10, 1911.

The drying chamber is connected with the vacuum pump by means of a filter containing a liquid through which the vapour passes on its way to the pump. In (1) a by-pass, situated between the inlet and outlet connections of the filter, is normally closed by a gravity seating valve opening in a direction towards the inlet; this valve, operated by the pressure in the exit connection, opens the by-pass upon the vacuum being broken therein. In (2) the valve-controlled opening to the filter is automatically operated by a float in the filtering liquid, pressure thus being admitted to the inlet, upon the vacuum being broken in the exit, connection.—W. E. F. P.

Liquids ; Process for desiccating certain —— by atomising. A. Lumiere. Fr. Pat. 419,192, Oct. 19, 1909.

The liquid, such as milk, blood, yolk-of-egg, etc., is delivered through an atomising jet into a chamber where the spray comes into contact with a current of dry heated air introduced at the bottom of the chamber. The latter is divided into two parts by means of a partition; the spray of liquid is carried by the current of air over this partition and the dry powder resulting from the desiccation is deposited on travelling bands situated in the second compartment. The dry powder may be removed either continuously or at intervals.—W. P. S.

Drying apparatus. C. Scherf, Brussels. Eng. Pat. 1960, Jan. 26, 1910.

See Fr. Pat. 411,891 of 1910 ; this J., 1910, 931.—T. F. B.

Drying plant ; Hot-air ——. G. H. Thorp, Yarasloff, Russia. U.S. Pat. 981,719, Jan. 17, 1911.

See Fr. Pat. 411,287 of 1910 ; this J., 1910, 932.—T. F. B.

Evaporating liquids to dryness ; Method of and apparatus for ——. A. W. Mathys, London. From A. G. Kalb, Chicago. Eng. Pat. 10,753, May 2, 1910.

See U.S. Pats. 957,685, 957,686, 957,849, and 957,850 of 1910 ; this J., 1910, 743.—T. F. B.

IIa.—FUEL ; GAS ; MINERAL OILS AND WAXES.

Coal ; Formation of —— *: Action of physical and chemical agents on wood, peat, and lignite.* O. Boudouard. Rev. Mét., 1911, 8, 38—46.

On the assumption that coal results from the decomposition of vegetable substances, in support of which the results obtained by numerous investigators are quoted, the author adds the results of his experiments on the action of air, water, heat and pressure on wood, peat, and lignite. Tables are given showing the character of the coke produced and the amounts of volatile matter and ash. It is concluded that the humic acids formed during the fermentation by micro-organisms under suitable conditions of air, moisture, and temperature, becoming gradually enriched in carbon by the action of heat and pressure, and finally, yield coal and anthracites.—A. H. C.

Coal, coke, etc. ; Production of —— in Germany. Board of Trade J., Feb. 2, 1911. [T.R.]

The "Frankfurter Zeitung" of 25th January publishes the following particulars of the production and imports and exports of coal, coke, etc., of Germany, in 1910, as compared with the previous year :—

	Production.		Imports for home consumption.		Exports (domestic produce).	
	1909.	1910.	1909.	1910.	1909.	1910.
	Metric tons.	Metric tons.	Metric tons.	Metric tons.	Metric tons.	Metric tons.
Coal	148,959,000	152,882,000	12,199,000	11,196,000	23,351,000	24,258,000
Coke	21,408,000	23,600,000	673,000	622,000	3,445,000	4,126,000
Lignite	68,356,000	69,105,000	8,166,000	7,398,000	40,000	62,000
Briquettes*	18,809,000	19,561,000	211,000	241,000	1,621,000	1,988,000

*Coal and lignite briquettes.

Gases ; Combustion of —— without flame. A new property of copper. J. Meunier. Comptes rend., 1911, 152, 194—196. (See also this J., 1908, 494 ; 1909, 195 ; 1910, 12.)

A copper wire (best of electrolytic copper) is heated in the luminous flame of a Bunsen burner till its surface is reduced and shows a metallic glance ; the air is then admitted, and the copper soon emits a red glow. If now it be lowered into the burner tube it continues to glow, without inflaming the gaseous mixture. The intensity depends on the proportions of gas and air, about 30 per cent. of gas affording the maximum. If the gas be shut off the glow ceases, but is renewed on turning on the air again, unless the cooling of the copper should have proceeded too far. The copper becomes exceedingly friable under this treatment—can be crushed to powder under the fingers ; and the powder has a crystalline appearance under the microscope. Often, in the preparation of the copper wire, a portion of the copper volatilises and tints the flame just before the red glow is established ; it is probable that the inter-crystalline amorphous portions of the copper are those which thus volatilise.—J. T. D.

Burning alcohol ; Experiments on extinguishing the flame of ——. M. Olié. Mém. Poudres et Salpêtres, 1910, 15, 160—163.

The experiments were carried out in a metallic chamber 4 m. long, 3 m. wide and 3·1 m. high, provided with a door and windows. The steam used to extinguish the flames was delivered into the chamber through a number of orifices and came from a boiler working at a pressure of 5 kilos. per sq. cm. (71 lb. per sq. in.). The experiment was so arranged that the steam was delivered at the rate of 650 kilos. per hour. When the chamber was completely closed up, 1, 2 and 5 litres of 96 per cent. alcohol were ignited in the chamber, and, after burning for 5 minutes the flames were immediately extinguished when steam was admitted. 10, 20, 30, and 40 litres of alcohol were placed in trays, allowing a free surface of burning of 0·7, 1·4, 2·1 and 2·8 sq. m. respectively. After ignition the flame was, in the first three instances, put out by steam in 2 minutes, 30 seconds, and 25 seconds respectively, and, in the last instance, almost immediately the steam was turned on. Some of the panes of glass in the windows were removed and three ventilators 0·3 m. in diameter, provided with valves, were placed in the roof. Under these conditions the flames from 170 litres of 96 per cent. alcohol, with a burning surface of 7 sq. m., were put out on admission of steam in 2¾ minutes. The flames from a mixture of 150 litres of 93 per cent. alcohol and 150 litres of 87 per cent alcohol, with a burning surface of 6·1 sq. m., were extinguished by the steam in 3 mins. 40 secs. The flames from a mixture of 110 litres of 92 per cent., and 250 litres of 85 per cent. alcohol, which had been burning fiercely for 4 minutes, were extinguished in 3 minutes on the admission of steam. The actual quantity of steam required was, at the maximum, only from 40 to 50 kilos.—G. W. McD.

Petroleum production of the United States in 1910. U.S. Geol. Survey Bulletin. Oil, Paint, and Drug Rep., Jan. 30, 1911. [T.R.]

The year 1910 has been sufficiently eventful in the development of new oil supplies in the United States more than to keep up the country's production of the last three years. In fact, the production increased to over 200,000,000 barrels, which is two-thirds of the world's production and several million barrels more than the whole world produced seven years ago.

The most surprising developments of the year were in the Sunset-Midway district of California. The developments in the Caddo field of Louisiana also entirely changed the position of that field. Connected with the developments in both these fields were important changes in the conditions of marketing the oil.

The production of oil in the United States in 1910, as reported by D. T. Day, of the United States Geological Survey, was between 200,000,000 and 208,000,000 barrels, approximately as follows :—

Illinois	32,000,000
Appalachian and Lima-Indiana fields	32,000,000
Gulf and Caddo fields	14,000,000
Mid-Continent and Rocky Mountain fields	53,000,000
California	73,000,000
	204,000,000

Stocks increased over 50 per cent. on the Pacific Coast. Prices of crude oil declined except in the mid-continent field, where they increased to 44 cents a barrel.

The following figures show the exports of various mineral oils from the principal customs districts of the United States :—

	1909. Gallons.	1910. Gallons.
Crude	128,239,923	119,630,159
Illuminating	1,039,742,219	932,343,617
Naphtha	57,555,061	79,059,528
Lubricating and paraffin	157,147,914	158,866,676
Residuum	114,109,989	107,095,460
Total	1,496,795,106	1,396,995,440
Total values	$99,876,190	$88,571,319

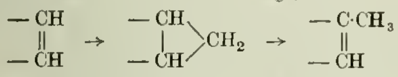
Petroleum from Fergana (Transcaspian). J. Bobrzynski. Petroleum, 1911, 6, 485—486.

The rise of the Fergana petroleum industry only dates back to the beginning of the present century, the construction of a railway line from Samarkand to Andischan having played an important part in its development. Samples of petroleum from this district previously examined have been characterised by their high content of paraffin wax (*e.g.* 2·6 per cent. in Liakon petroleum, and 9 per cent. in Tschimion petroleum after distilling off the benzine and light oil). The sample examined by the author was a blackish brown, fairly fluid product with a sp. gr. of 0·8935 at 20° C. The following fractions were obtained on distillation of 100 c.c. at the ordinary pressure : From 130° to 175° C., 3·5 ; 175° to 200° C., 5 ; 200° to 225° C., 5·5 ; 225° to 250° C., 8 ; 250° to 275° C., 5·3 ; 275° to 300° C., 7·5 ; 300° to 325° C., 7·8 ; 325° to 350°, 13 ; and residue and loss, 44·4 c.c. The petroleum thus contained only a very small proportion of light petroleum spirit, but more than 30 per cent. of lamp oil, in which respect it agreed with other Fergana samples. The residue was relatively fluid at the ordinary temperature, and the last fraction only became semi-solid when chilled in a freezing mixture. The fractions from 161° C. to 315° C., obtained by distillation under reduced pressure, showed an increasing optical rotation in the polarimeter (in a 200 mm. tube) of + 0·32 to +2·40, and it appeared probable that, as in the case of other petroleums, there would have been a decline from this maximum optical rotation, on

continuing the distillation. Examination of the residue left from the distillation under reduced pressure showed that only traces of a vaseline-like body were present, and that the petroleum thus differed as regards solid constituents from other petroleums from this district.
—C. A. M.

Petroleum distillates ; Action of formaldehyde on ——. Formation of liquid condensation products. A. M. Nastukow and K. L. Maljarow. J. Russ. Phys.-Chem. Soc., 1910, 42, 1596—1604.

On treating the fraction of ordinary kerosene of b. p. 200°—250° C. with its own volume of formalin and 0·75 time its volume of sulphuric acid, the authors obtained, in addition to solid condensation products, also liquid condensation products, b. p. above 250° C. These products, amounting to 19 per cent. of the weight of the kerosene, have very high formolite numbers (see this J., 1904, 1082). The fraction of the liquid products, b.p. 186°—188° at 50 mm., has the formula $C_{15}H_{28}$, the formolite number 105, sp. gr. 8498 at 21·5°/21·5° and n_{23}= 1·4703 ; its viscosity is 2·07 compared with that of the original kerosene fraction as unity, or, in Engler degrees, 6·57 at 21° C. The reaction of formation of these liquid products is regarded as a union of the methylene group of the formaldehyde with the ·C : C· group of the original naphthene or olefine, the instability of the trimethylene ring thus formed leading to the re-formation of a double linkage, thus :



$$\begin{matrix}-CH\\ \|\\ -CH\end{matrix} \rightarrow \begin{matrix}-CH\diagdown\\ |\quad\; CH_2\\ -CH\diagup\end{matrix} \rightarrow \begin{matrix}-C\cdot CH_3\\ \|\\ -CH\end{matrix}$$

The solid condensation products mentioned above are soluble in benzene, toluene, etc., and are termed soluble formolites.—T. H. P.

[Minerol] Lubricating oils ; Chemicol composition of ——. A. M. Nastukoff. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. IVAI, 9—13.

The author has already shown (see this J., 1904, 1082) that petroleum and its distillates react with formalin, and in presence of strong sulphuric acid a yellow insoluble solid residue of " formolit " is obtained. The reaction has been shown to be characteristic of unsaturated cyclic hydrocarbons and may be applied quantitatively to the examination of commercial oils, the weight in grms. of formolit obtained from 100 c.c. of an oil being known as its formolitic index. The application of this test to American and Russian lubricating oils shows that most of these consist chiefly of unsaturated cyclic hydrocarbons. The American oils have, as a rule, higher formolitic indiees, and they form more definite types, than Russian oils of the same kind. This is best shown by cylinder-oils ; those from America rarely have indices below 90, whereas the indices of the Russian cylinder-oils examined ranged from 58 to 87. Machine- and spindle-oils have lower formolitic indices and vaseline-oils gave the lowest values of any examined. By altering the conditions of the reaction (decreasing the amount of sulphuric acid, and increasing the time of reaction), the author has isolated a series of formolits some of which are liquid (see preceding abstract).—J.H.L.

Bituminous road binders ; Examination of ——. P. Hubbard. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. II, 245—261.

As the result of work which has been done in the Office of Public Roads, U.S. Dept. of Agriculture, the author believes that the most important determinations needed for the valuation of the two classes of bituminous road binders are as follow :—*Oil and oil products, including asphaltums :* (1) colour, (2) odour, (3) specific gravity, (4) flash and burning points, (5) flow or melting point, (6) consistence, (7) volatilisation, (8) inorganic matter, (9) bitumen insoluble in naphtha (petroleum spirit). *Tar and tar products :* (1) (2) and (3) as above, (4) flow- or melting-point, (5) consistence, (6) distillation, (7) free carbon or soot (matter insoluble in carbon bisulphide). The following are the methods which have been adopted for these tests :—*Specific gravity.* A thin spindle hydrometer s used for liquid bitumens which are not too viscous. For more viscous liquids and semi-solids, a wide-mouthed pycnometer of 25 c.c. capacity, fitted with a glass stopper having a capillary opening is weighed empty (*a*) and filled with water at 25° C. (*b*) ; the difference *b*—*a* is called *c*. About 15 c.c. of the melted bitumen are introduced into the empty pycnometer, and after cooling to 25° C. the weight (*d*) is taken. The empty space is now filled with water at 25° C. and the weight (*e*) again taken. The specific gravity is then : sp. gr. $= \frac{d-a}{c-(e-d)}$. Oils of low specific gravity are of little value as permanent binders. In the case of tars, coke-oven tars of medium density are usually the best. *Flash point and burning points* are determined by the open cup method. *Flow point and melting point.* A liquid bitumen is cooled below its congealing point, and then allowed slowly to regain atmospheric temperature, the flow point being taken as the temperature at which flow is visible within 30 seconds when the containing tube is held at an angle of 45°. For solids a half-inch cube is suspended on the lower arm of a piece of No. 12 B. and S. wire bent at right angles and hung beside a thermometer in a covered glass beaker, the cube being 1 inch above the bottom of the beaker. The beaker is heated in a water or sulphuric acid bath, the temperature of which is caused to rise 5° C. per minute, and the melting point is taken as the temperature at which the cube of bitumen touches the bottom of the beaker. *Consistence.* For harder bitumens one of the standard forms of penetrometers may be used, whilst for softer bitumens, an apparatus has been devised in the New York Testing Laboratory (this J., 1910, 710), but has not yet been extensively tried in the U.S. Office of Public Roads. *Volatilisation test.* 20 grms. of the material are heated for 5 hours at a constant temperature of 163° C. (325° F.) or 205° C. (400° F.) in a weighed dish, 2¼ ins. diam. and 1 $\frac{5}{16}$ in. high, and the loss in weight determined. The temperature is ascertained by a thermometer immersed in a non-volatile oil heated in the same oven as the material being tested. The residue should be examined with respect to its consistence, and as to whether it is greasy or sticky. *Distillation test.* 250° c.c. of the tar are heated gradually in a tubulated glass retort of 750 c.c. capacity, provided with a cork stopper carrying a thermometer, the bulb of which is on a level with the mouth of the retort. Three fractions are collected : up to 110° C., 110°—170°, and 170°—270° C. After the first fraction has been collected, an asbestos cover is placed over the retort, and the flame is regulated so that about 2 drops of distillate pass over per second. *Total bitumen, and also inorganic matter, and free carbon in tars.* 1—2 grms. of material are digested over night with 100 c.c. of carbon bisulphide, the mixture is poured on to a coarse asbestos filter in a platinum Gooch crucible, and the insoluble matter (free carbon in the case of tars) washed with carbon bisulphide, dried for 20 mins. at 80° C., weighed, and then incinerated. *Bitumen (asphaltenes) insoluble in naphtha (petroleum spirit)* is determined in the same manner as total bitumen, but using " 86° naphtha " as solvent. Asphaltenes impart body and consistence to an oil, and paraffin oils are of little value as road binders compared with those of asphaltic character. This is probably due to the asphaltic hydrocarbons being selectively held by the finer products constituting the body of the road (compare Day and Gilpin ; this J., 1909, 831).

The bituminous products employed as road binders include crude, distilled and residual petroleums, blown oils, petroleum pitch ; crude water-gas tar, coal tar, refined tar products, tar pitches ; asphaltums, gilsonite, and grahamite fluxed with liquid bitumens, and no single set of specifications will ever prove quite satisfactory (compare Bull. No. 34, Office of Public Roads, U.S. Dept. of Agriculture).—A. S.

Mincral [coal-tar] pitch. Bernus. *Sec* III.

Patents.

Coal mines ; Process for preventing explosions of coal dust in ——. H. Kruskopf, Dortmund, Germany. Eng. Pat. 4592, Feb. 24, 1910.

The gallery walls are freely sprinkled with a calcium or magnesium chloride solution which has been rendered thick and pasty by the addition of, for example, 3 per cent. of hydrated lime and 2 per cent. of starch. By this means as much as 2·8 kilos. of water can be caused to adhere to a square metre of surface without appreciable evaporation, whereas with the unthickened lye only 20 to 30 grms. of water per sq. metre can be accumulated on the surface to be kept cool.—H. H.

Coke and gas oven. L. Wilputte, Joliet, Ill., Assignor to H. Koppers, Essen-on-the-Ruhr, Germany. U.S. Pat. 981,344, Jan. 10, 1911.

The oven chamber is provided with an upright, sliding door at the discharge end, and with an external air-tight hood, in which is a water-sealed downward discharge opening adapted to act as a deflector.—W. E. F. P.

Gas producers of the rising-grate type. E. Hall-Brown, Glasgow. Eng. Pat. 4125, Feb. 19, 1910.

The patent relates to a device for preventing the access of dust and ashes to the rack and pinion mechanism by which the grate is raised and lowered. The ram and its pinion are enclosed in a metal casing, of which the portion extending above the pinion is provided with two or more telescopic draw-tubes, so that the ram remains enclosed during the whole of its vertical stroke.—W. E. F. P.

Gas-producer. G. P. Davis, Detroit, Mich. U.S. Pat. 980,923, Jan. 10, 1911.

A pair of generator chambers having open upper ends, and ash-pits and a common water-seal at their lower ends, communicate by means of a passage situated just above the water level. Means are provided for closing the upper end of either chamber, and for changing the direction of flow of the gas, the arrangement being such that the gas issuing from the bottom of the open chamber passes through the connecting passage into the closed chamber, which it traverses in an upward direction, and is drawn off by a side pipe situated above the zone of combustion. —W. E. F. P.

Oil-converting process. J. H. Adams, Brooklyn, N.Y. U.S. Pat. 976,975, Nov. 29, 1910.

Kerosene or similar oils are "cracked" by bringing them into contact with an incandescent electric heater which is placed inside an open tube of non-heat-conducting material dipping into an oil converting chamber, so that the oil is heated as far as possible by direct contact with the incandescent body and not vaporised unchanged by radiated or transmitted heat therefrom. The upper end of the non-conducting tube is connected with a large cylindrical still head, the top of which is held in place by springs so as to act as a safety valve in case of sudden evolution of vapour. The vapours given off are passed to a condenser to which is connected an exhauster for maintaining the pressure as low as possible throughout the system. The condensed oil or gasolene is drawn off by means of a pump.—H. H.

[*Petroleum*] *Oil distilling and refining apparatus.* J. S. Cosden, Bigheart, Okla. U.S. Pat. 981,176, Jan. 10, 1911.

The apparatus consists of a number of nearly horizontal pipes, situated one above the other in a suitable heating chamber, and having their ends connected in series. The crude petroleum traverses the pipes by gravity, the volatile portion passing to a system of primary condensers, also connected in series, in which commercial products of varying density and specific gravity are obtained; the lighter products are obtained by means of a system of secondary condensers connected with the primary ones by a series of pipes. Means are provided for the reception of the non-volatile residuum in tanks; and for injecting steam into the pipes for the purpose of preventing overheating and consequent obstruction.—W. E. F. P.

Distilling oils of the petroleum, tar, and like industries using a high vacuum; Apparatus for ——. L. Steinschneider, Brünn, Austria-Hungary. U.S. Pat. 981,953, Jan. 17, 1911.

In distilling plant for oils working under high vacuum, the pumps for withdrawing the fractions from the various coolers are placed at such a distance below the coolers that the weight of the columns of oil in the suction pipes enables pumps of small suction power to be employed. —H. H.

Coking processes. L. L. Summers, Chicago. Eng. Pat. 7049, March 21, 1910. Under Int. Conv., April 26, 1909.

See U.S. Pat. 951,786 of 1910; this J., 1910, 479.—T. F. B.

Distilling retorts; Upright ——. C. Bolz, Budapest, Hungary. Eng. Pat. 17,949, July 28, 1910.

See Fr. Pat. 410,411 of 1909; this J., 1910, 807.—T. F. B.

Water-gas producer. B. Spitzer, Assignor to Dellwik-Fleischer Wassergas-Ges., Frankfort on Maine, Germany. U.S. Pat. 981,708, Jan. 17, 1911.

See Eng. Pat. 18,256 of 1906; this J., 1907, 815.—T. F. B.

Sulphate of ammonia; Process for producing —— *in the manufacture of gas.* K. Burkheiser, Hamburg, Germany. Eng. Pat. 17,359, July 21, 1910. Under Int. Conv., July 21, 1909. Addition to Eng. Pat. 20,920 of 1908, dated October 14, 1907.

See Addition of July 2, 1910, to Fr. Pat. 394,926 of 1908; this J., 1911, 13.—T. F. B.

Vacuum still for pitch, petroleum, etc. Ger. Pat. 227,179. *See* III.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patent.

Distillation-furnace for fuels of high moisture-content, such as peat and the like. G. O. Wolters. Ger. Pat. 229,606, Oct. 16, 1909.

A gas-producer is placed inside the shaft of the distillation-furnace and the feeding device at the top is so arranged that the fuel can be supplied at will to the gas producer or to the distillation-chamber. By this means the production of heating gas can be increased as desired, according to the water-content of the fuel to be distilled, and the heat radiated from the walls of the producer is utilised in the distillation.—A. S.

III.—TAR AND TAR PRODUCTS

Mineral [*coal-tar*] *pitch.* S. Bernus. Bull. Soc. Chim. Belg., 1911, **25**, 7—40.

The author first describes the production of pitch from coal-tar and then discusses its composition. He finds that it is impossible to ascertain the nature of the volatile portion of pitch by the method of distillation, but by using various solvents such as carbon tetrachloride, carbon bisulphide, alcohol, ether, acetone, etc., he has been able to extract two classes of bodies from pitch, leaving a residue of carbonaceous matter and ash, which has no agglomerative value. These bodies form two groups: the first which he calls "hydrocarbides" are of a buttery consistence, have a brownish-black colour, are of complex composition and melt easily. They are chiefly distinguished by the property they possess of adhering easily to particles of coal. The second group which he calls "carbenes" form a brilliant black crystalline powder very similar in appearance to coal-dust. They do not soften below a temperature of 200° C., and even then do not adhere strongly to particles of powdered coal, but they are easily soluble in the first group of bodies and increase their agglomerative power. They are, however, altered when heated to 300° C., and then lose their power of adhering to particles of coal.

The author then discusses the theory of agglomeration of particles of coal and points out that briquettes cannot be made by compressing coal without admixture of an agglomerant, but that in order to obtain satisfactory briquettes each particle of coal must be covered with a film of pitch. Further the mixture of coal and pitch ought to contain from $2\frac{1}{2}$ to 3 per cent. of moisture as it enters the press, and the temperature at which the compression takes place ought to be between those at which the pitch fuses and liquefies respectively. Pitch intended for briquetting should be tested to ascertain:—(1) The content of plastic matter; (2) the temperature at which it softens sufficiently to bind together the particles of coal; (3) the temperature at which the pitch begins to stick to the machine; (4) the percentage of ash; and (5) the percentage of volatile matter. In some cases pitch is regenerated by the addition of oils and for this purpose either the heavy oil draining from crude anthracene, or tar, which has been heated until the light-oil has been distilled off are preferable. Low boiling oils such as creosote are liable to cause trouble by volatilising in the press, which works at a temperature of from 300° to 350° C. Methods of ascertaining the points of fusion and liquefaction are described including those suggested by M. E. Schenk and by Klimont, which depend upon the temperature at which a drop of mercury commences to sink into and finally disappears beneath the surface of the sample of pitch. The former is termed the point of fusion and the latter of liquefaction.—W. H. C.

Patents.

Still for pitch, petroleum, etc.; Vacuum ——. K. Schliemann. Ger. Pat. 227,179, Nov. 3, 1909.

In the still is fixed an upright cylindrical vessel, the top of which is open and projects above the level of the liquid which is being distilled; it also communicates with the still by means of a tube attached to it at a point near the top, but below the surface of the liquid, and reaching nearly to the base of the still. The liquid passes off by another tube communicating with the pitch reservoir; the pitch is automatically removed from the still by the suction produced by the column of liquid in this latter tube.—T. F. B.

Anthraquinone derivatives containing sulphur; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 229,110, Aug. 1, 1909.

New derivatives of anthraquinone containing sulphur, different in physical and chemical properties from the anthraquinone mercaptans, are produced by the action of sulphantimonates, sulpharsenates, or sulphostannates on diazo compounds of anthraquinone derivatives.—T. F. B.

Arylsulpho-diazo-imino compounds; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 229,247, July 8, 1909.

Arylsulpho-diazo-imino compounds are obtained by the action of aromatic diazo or tetrazo compounds on non-hydroxylated arylsulphaminosulphonic acids of the benzene or naphthalene series, at the ordinary temperature. The products are insoluble in alcohol, ether, and benzene; the monosulphonic acids are very sparingly soluble in water, but the di- and polysulphonic acids are readily soluble, and can be crystallised from water. All the new substances are stable below 100° C., but at higher temperatures they explode, with partial carbonisation. By treatment with amines and phenols, the arylsulphaminosulphonic acid residue is eliminated, with formation of ether diazo-amino compounds or amino-azo or hydroxy-azo compounds.—T. F. B.

Apparatus for distilling oils of the petroleum, tar and like industries. U.S. Pat. 981,953. *See* IIa.

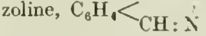
IV.—COLOURING MATTERS AND DYES.

Ink-forming substances from benzene derivatives; Preparation of ——. A. Fiechter. Chem.-Zeit., 1911, 35, 115.

When certain benzene derivatives, *e.g.*, aniline, chloronitrobenzene, nitrobenzoic acid and similar compounds, are heated with sulphuric acid and sulphur, good yields are obtained of substances which, on the addition of alkaline reagents, such as dilute solutions of caustic alkalis, sodium carbonate, or ammonium carbonate, or lime water, form inks. The substances are insoluble in the dilute acid liquid in which they are formed. The ink obtained from aniline sulphate is bluish-grey, that from chloronitrobenzene reddish-violet, and that from nitrobenzoic acid blue in colour.—E. W. L.

Patents.

Azo dyestuffs; Process for preparing ——. M. T. Bogert. Ger. Pat. 228,796, June 13, 1909.

By combining diazo or tetrazo salts with derivatives of quinazoline,  $C_6H_4<\begin{matrix}N=CH\\CH:N\end{matrix}$, dyestuffs are obtained which dye wool, silk, and in some cases cotton. The azo group is united to the benzene nucleus of the quinazoline.
—T. F. B.

Anthracene vat dyestuffs; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 229,165, Feb. 6, 1910.

When the benzylidine or benzyl derivatives of β-amino-anthraquinone are heated with sulphur to high temperatures, compounds are obtained which appear to contain a thiazole nucleus; they are applicable as vat dyestuffs.—T. F. B.

Disazo dyestuffs containing the sulpho-group; Process for preparing secondary ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 229,303, Dec. 30, 1908.

One mol. of a diazo compound is combined with an amino-quinol dialkyl ether, and the amino-azo dyestuff thus formed is diazotised and combined with a second azo dyestuff component; either this or the original diazo compound, or both, contain sulpho groups.—T. F. B.

Vat dyestuffs; Process for preparing ——. Kalle und Co. Ger. Pat. 229,267, May 11, 1909.

Azo dyestuffs are condensed with 3-oxy-(1)-thionaphthene-2-carboxylic acid or its substitution products, in presence of alkalis or alkaline substances, and without addition of solvents or diluents; new dyestuffs are thus obtained, differing from Thioindigo Red and its symmetrical substitution products, and possessing some of the properties of the azo dyestuffs employed.—T. F. B.

Indigo; Process for preparing halogen derivatives of ——. Badische Anilin und Soda Fabrik. Ger. Pat. 229,304, July 5, 1908. Addition to Ger. Pat. 160,817, Feb. 24, 1904.

If, in the process described in Ger. Pat. 226,319 (this J., 1910, 1450), the chlorine is replaced by bromine, bromo-derivatives (up to the tetrabromo-compounds) of indigo, mono- or di-halogen-indigos, or the corresponding indigo white compounds, or their homologues, are obtained.
—T. F. B.

Acid wool [anthracene] dyestuffs; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 229,408, March 28, 1909.

Acid wool dyestuffs are obtained by treating β-anthraquinonyl-arylureas (see U.S. Pat. 958,325 of 1910; this J., 1910, 749) with chlorosulphonic acid or with fuming or concentrated sulphuric acid.—T. F. B.

Iron-gall colours for inking-ribbons, stamp-pads, drawing-inks, etc.; Process for preparing ——. E. Beyer, Ger. Pat. 229,467, April 6, 1910. Addition to Ger. Pat. 224,637, Oct. 3, 1909 (see this J., 1910, 1120).

By allowing ketones, especially acetone, to act on ammonium ammoniumoxyferrigallate or similar ferro- or ferrigallic acid compounds, colouring matters are obtained which are soluble in water (unlike the aldehyde compounds); they are isolated from the aqueous solutions by adding excess of acetone, and then worked up into inks as usual. —T. F. B.

Azo dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 933, Jan. 13, 1910.

See Addition of July 30, 1910, to Fr. Pat. 414,294 of 1910; this J., 1911, 77.—T. F. B.

Monoazo dyestuffs; Manufacture of yellow ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 9633, April 20, 1910. Under Int. Conv., Oct. 16, 1909.

See Fr. Pat. 415,017 of 1910; this J., 1910, 1297.—T. F. B.

Azo colouring matter; Manufacture of a new ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 15,390, June 27, 1910.

See Ger. Pat. 228,258 of 1909; this J., 1911, 17.—T. F. B.

Disazo dyestuff. A. L. Laska, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 982,507, Jan. 24, 1911.

See Eng. Pat. 15,391 of 1910; this J., 1910, 1196.—T.F.B.

Disazo dyestuff. A. L. Laska, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 982,508, Jan. 24, 1911.

See Eng. Pat. 17,088 of 1910; this J., 1910, 1297.—T. F. B.

Disazo dyestuff. A. L. Laska, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 982,509, Jan. 24, 1911.

See Eng. Pat. 17,614 of 1910; this J., 1910, 1298.—T.F.B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cellulose; Determination of ——. C. Councler. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. I., 25—26 (see this J., 1907, 942).

Cross and Bevan's method is recommended for determining cellulose in raw materials (wood); in the case of purified products, however, the 1 per cent. sodium hydroxide employed in this method, attacks the cellulose, and the author recommends Müller's method in such cases.—L. E.

Sulphite wood pulp; The yield of —— *from raw wood.* Matheus. Papierfabr., 1911, 9, 93—95.

Laboratory control in a sulphite wood pulp mill should treat the lye-production and the wood-digestion processes on systematic chemical principles. The losses of sulphur and lime occasioned by the formation of calcium sulphate in the lye, even in small proportions, are very great in total, and the rapid incrustation of the heating pipes is most objectionable. By correct burning, the residual sulphur in the pyrites may be reduced to 2·5 per cent., but in some mills as much as 15 per cent. of sulphur is found in the roasted product. The most suitable size and shape of the wood chips must be studied from the point of view of uniform digestion, best utilisation of the digester-space and the smallest consumption of liquor. Useful work may be done in the laboratory in investigating the influence of variations of the composition of the lye, the temperature, duration, etc. of the digestion process, employing a small lead-lined digester, capable of holding 300 grms. of wood and 1·5 litres of lye, and heated in an oil bath. According to the conditions selected, the yield of cellulose from wood (dry weights) may range from 39 to 60 per cent. The products obtained with high yields are characterised by their hardness, imperfect separation of the fibres, toughness and resistance to bleaching, whereas those obtained with low yields give soft, well separated, easy-bleaching fibres The yield, however, does not by itself afford an exact indication of the character of the product. For instance, in two digestions, each yielding 53 per cent. of cellulose, one conducted at 114° C. for 40 hours and the other at 120 ° C. for 10 hours, the two products were totally different in quality and bleaching properties.—J. F. B.

Cellulose; Mercerised ——. C. G. Schwalbe, Ber., 1911, 44, 151—152; C. F. Cross, *ibid.*, 153—154.

Commenting on the views expressed by Miller (this J., 1911, 81) as to the nature of mercerised cellulose, Schwalbe claims that he had already proved that mercerisation is unaccompanied by the combination of water with the cellulose. The proof adduced by Miller, by weighing the cellulose before and after mercerisation, is without value, since a gain due to hydration might be neutralised by a loss due to the solubility of a portion of the cellulose in the liquid. In measuring the degree of mercerisation by means of substantive dyes, Miller's statement, that an increase in the intensity of the dyeings only begins after mercerisation with a 9 per cent. soda lye, is not supported by Hübner and Pope's results (this J., 1904, 401). The results obtained by Miller by dyeing in an ethereal solution of rosaniline base are of very doubtful value, being seriously influenced by the purity and degree of oxidation of the cotton. Cross also points out the invalidity of arguments based on the absence of a gain in weight as the result of mercerisation, without taking account of the portion of the cellulose soluble in the alkaline lye, and affirms that an increase in weight does in fact take place. The author in defending the application of the term "hydration" to this reaction, further argues that the water is taken up by the cellulose in definite quantitative proportions and that this combination is accompanied by fundamental changes in the physical properties of the cellulose. The hydrates of the celluloses and their derivatives, which are capable of existing between the temperatures of 0° and 50° C. are described as definite and well characterised compounds. If all these yield the same anhydrous cellulose on drying at a high temperature, this fact may be regarded as analogous to the production of the same anhydrous salt by heating the various crystal-hydrates, say of sodium sulphate.—J. F. B.

Patents.

Fibre pulp; Manufacturing ——. C. L. Weiberg, Assignor to A. Hesselbacher, Detroit, Mich. U.S. Pat. 981,042, Jan. 10, 1911.

Wood chips and the like which have been previously freed from oil of turpentine and other resinous products, are treated with a solution of potassium sulphydroxide, KHS (1·1165 sp. gr.) and sodium sulphydroxide, or other solution having a similar action. The solution is caused to pass through the mass out of contact with it, so as to maintain the heated condition of the solution and the temperature of the mass. The same solution is subsequently sprayed upon the mass for direct circulation through it, and the liquid is thus continuously circulated through the mass, first out of contact and then in contact therewith, whilst the mass is boiled by dry steam until complete maceration of the wood tissues is effected. The vapours and moisture are withdrawn, the emulsion of wood fibre and solution allowed to settle, and the remaining chemical solution is removed from the fibre, the emulsion of the latter being finally withdrawn.—B. N.

Celluloid; Process for preparing a substance having the nature of —— from acetyl cellulose. A. Eichengrün. Fr. Pat. 419,530, Aug. 11, 1910. Under Int. Conv., Nov. 27, 1909.

Acetyl cellulose is moistened with a solution of a camphor substitute (such as phenol or chloral hydrate) in a suitable volatile solvent. The mixture is submitted to pressure and afterwards heated to volatilise the solvent. The product, after drying completely, is a homogeneous mass resembling celluloid. The solvent employed for dissolving the camphor substitute must not have any solvent action on the acetyl cellulose.—P. F. C.

Artificial silk and other artificial fibres; Mixing of xanthate and analogous products used in the manufacture of ——. C. C. Leclaire. Fr. Pat. 419,852, Nov. 5, 1909.

A rotatable hollow metallic receiver is jacketed so that it can be kept cool by circulating a refrigerating liquid round it. The materials to be mixed are placed inside the receiver which already contains a number of balls having metallic cores covered by a coating of slightly vulcanised rubber. When the receiver is rotated, the balls, colliding with one another or with the smooth internal walls of the receiver, grind the materials and convert them into a uniform mixture.—P. F. C.

Pulp for use in the manufacture of paper; Manufacture or treatment of —— and other like materials and apparatus therefor. H. Arledter, Frodsham. Eng. Pat. 2018, Jan. 26, 1910.

See Fr. Pat. 418,584 of 1910, this J., 1911, 80.—T. F. B.

Composition or material [from acetylcellulose] and method of making same. W. G. Lindsay, New York. Eng. Pat. 10,795, May 2, 1910. Under Int. Conv., May 5, 1909.

See Fr. Pat. 415,518 of 1910; this J., 1910, 1299.—T.F.B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Vat dyes; Some applications of the ——. A. R. Malloch. J. Soc. Dyers and Col., 1911, 27, 26—32.

Experiments performed to determine the loss of indigo by over-reduction during the setting of the vat by different methods, showed that the loss could not be reduced below 5 per cent. for the zinc-bisulphite or hydrosulphite vat, 12 per cent. for the zinc-lime vat and 23 per cent. for the copperas vat. The zinc-lime vat gave the best shade and it also loses less indigo on standing than either of the other two. The satisfactory discharging of indigo by means of hydrosulphite is difficult, and even if anthraquinone is added to the printing paste the goods must be washed immediately after ageing. This is not necessary, however, if a discharge colour is used containing hydrosulphite, anthraquinone, zinc oxide and Leukotrope W (B.A.S.F.) or Hydrosulphite CL (M., L. and B. or Cassella). After printing, the goods are aged for 3—5 minutes in air-free steam at 214°—216° F. After steaming the printed parts are a bright orange colour which is removed by washing, leaving a good white. Freiberger discharges indigo by printing the goods with a paste containing sodium nitrate and nitrite, then drying and passing them quickly through a strong bath of sulphuric acid (80° Tw.). A thorough washing and drying complete the process. The application of indigo to calico-printing is hindered by the necessity of using strong alkali and the Hydron Blues (Cassella), which are equal to indigo in fastness and can be applied without alkali, are therefore useful as substitutes for indigo in calico printing. The bromo-indigos including the Ciba Blues (S.C.I.), Indigo M.L.B., 2B, 4B, and 6B (M.L. and B), Indigo K.2B (Kalle) are now largely used for the production of very fast and bright blues. They are best dyed from the hydrosulphite vat and printed with a colour containing weak caustic soda and glucose with a little hydrosulphite and potassium sulphite. The Indanthrene (B.A.S.F.), Algole (Bayer), Helindone (M.L. and B), Thioindigo (Kalle) and Ciba (S.C.I.) dyestuffs all give shades of excellent fastness to light and washing, the hydrosulphite method being the best for dyeing with them and either the hydrosulphite or the glucose reduction method for printing, though the details of the processes vary according to the dyestuff used. Sulphur dyestuffs to be suitable for printing must be free from sulphur, insoluble matter and mineral salts except in the case of the Auronal colours (Weiler-ter-Meer) which contain sulphides as a necessity: the glucose reduction method of preparing the printing colour utilises the dyestuff better than the hydrosulphite process and the printing colours obtained keep better. The thickening agent employed must be able to withstand the action of caustic soda; the most suitable paste is one prepared from pure starch which has been treated with sodium peroxide or sodium perborate. After printing the goods must be aged for at least 5 minutes in air-free steam. Sulphur dyestuffs cannot be satisfactorily discharged, but good resist effects can be obtained with zinc chloride. Since the vat dyestuffs can be printed with hydrosulphite and caustic soda they are useful for discharging grounds which are destroyed by either of these agents, such as direct dyeings with substantive dyestuffs and grounds dyed with insoluble azo colours. Coloured discharges can also be obtained on grounds dyed with basic dyestuffs by printing on the tannin-prepared cloth a paste containing a vat dyestuff, hydrosulphite and enough caustic soda to discharge the tannin. The goods are then steamed, hung, fixed in tartar emetic and dyed with basic dyestuffs.
—P. F. C.

Patents.

Bleaching liquids; Manufacture of ——. Deutsche Solvay-Werke Act.-Ges., Bernburg, Germany. Eng. Pat. 21,411, Sept. 14, 1910. Under Int. Conv., Dec. 31, 1909.

Chlorine is made to act on a lye containing sodium hydroxide and sodium carbonate. The gas first acts in accordance with the equation: $2NaHO+Cl_2=NaOCl+NaCl+H_2O$. When the whole of the sodium hydroxide has been converted, the chlorine next attacks the carbonate, forming hypochlorous acid thus: $Na_2CO_3+Cl_2+H_2O=NaCl+NaHCO_3+HOCl$. The proportions of hypochlorous acid and sodium hypochlorite in the final bleaching liquor can therefore be varied at will by adjusting the relative quantities of hydroxide and carbonate. The yield of available chlorine obtained in this way is much higher than when the caustic soda and the soda lyes are separately treated with chlorine and afterwards mixed, whilst the stability of the liquor (even when the proportion of free hypochlorous acid is considerable) is much better than that of electrolytic bleaching lye. Example: 50 kilos. of chlorine are caused to act in a slow jet and avoiding strong heating on 3 cubic metres of an alkaline lye containing 34·2 kilos. of sodium hydroxide and 41·6 kilos. of sodium carbonate, the liquor being well stirred during the operation. The bleaching lye thus obtained contains 16·35 grms. of available chlorine in a litre, of which 60 per cent. is in the form of sodium hypochlorite and 40 per cent. as hypochlorous acid.—P. F. C.

Dyeing and washing machines. G. Turnbull, Bradford. Eng. Pats. 953, Jan. 13, 1910, and 12,741, May 25, 1910.

The machine is provided with a vat and boiler, both containing the dye or washing liquor, and two sets of perforated pipes are arranged round the walls of the vat, with suitable connections from each set of pipes to the top and bottom of the boiler. The connections are provided with suitable cocks, to enable the liquor to be circulated from the bottom of the vat towards the top, or in the reverse direction. The boiler is provided with a perforated ring for projecting live steam into the liquid for heating purposes. The vat is also provided with a series of superposed trays for separating and supporting layers of the material to be treated.—B. N.

Dyeing acetylcellulose : Process of ——. E. Knoevenagel, Heidelberg, Germany. U.S. Pat. 979,966, Dec. 27, 1910.

Acetylcellulose is treated with an aqueous solution of a phenol, rinsed in water, and then dyed in the dye-bath (compare Fr. Pat. 383,636 of 1907 ; this J., 1908, 332). —T. F. B.

Dyeing compound and process of producing the same. G. S. Whitty, Assignor to F. W. Devoe and C. T. Raynolds Co., New York. U.S. Pat. 982,194, Jan. 17, 1911.

A powdered coal tar dyestuff, an "accelerating agent" and a paste obtained by treating gum tragacanth with water are thoroughly mixed together and the product is dried in the form of tablets.—P. F. C.

Dyeings on cotton capable of being discharged ; Production of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 419,559, Aug. 20, 1910. Under Int. Conv., Feb. 4, 1910.

Cotton is padded with a solution of an azo-dyestuff produced by combining a diazotised aminonaphtholsulphonic acid with *m*-phenylenediamine or one of its derivatives, and is afterwards dried. The colour is then fixed on the fibre by a passage through a bath of diazotised *p*-nitraniline.—P. F. C.

Multicolour effects on fabrics made of vegetable fibres ; Production of ——. M. Becke. Ger. Pat. 228,693, Aug. 12, 1909.

Dyed or undyed vegetable fibres are impregnated with manganese-oxygen compounds which possess oxidising properties, and are then woven with untreated fibres ; the fabrics thus obtained are dyed in baths containing direct cotton dyestuffs, diazotisable azo dyestuffs, certain basic dyestuffs, or indigo, and then treated with an agent which removes the manganese compound. The untreated fibres will be coloured by the second dyeing, whilst the treated fibres will retain their original colour.—T. F. B.

Aromatic ammonium compounds ; Manufacture of —— [*for use in discharging pastes*]. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pats. 15,722 of 1910, dated Dec. 30, 1909, and 17,099, July 18, 1910.

Aromatic ammonium compounds for use in the preparation of the discharging pastes for carrying out the process described in Fr. Pat. 414,937 of 1910 (this J., 1910, 1247), are obtained by treating a tertiary amino compound with a halogen-aralkyl sulphonic or carboxylic acid, or with an ester of either of these acids ; the compounds used should contain a halogen atom in the side-chain : such products are produced, for example, by heating a mixture of benzyl chloride *p*-sulphonic acid and dimethylaniline, or a mixture of benzyl chloride carboxylic acid (obtained by chlorinating *p*-toluic acid chloride, while hot, in absence of chlorine carriers, and "saponifying" with sulphuric acid) and dimethylaniline. Sulphonic acids of quaternary ammonium compounds are also obtained by the action of sulphonating agents on the corresponding ammonium compounds, such as dimethylphenylbenzyl ammonium chloride, trimethylbenzylammonium chloride, or naphthalene-trimethylphenylammonium chloride (obtained by condensing dimethylaniline with ω-chloro-β-methylnaphthalene). The sulphonic and carboxylic acids obtained by the above processes are colourless, well crystallised substances, and from their properties the sulphonic acids appear to be inner anhydrides formed by the linking of the sulpho group and the hydroxyl group of the ammonium compounds.—T. F. B.

Variable and ulti-cmolour effects on fabrics ; Production by printing of ——. Soc. de la Manufacture d'Indiennes E. Zundel. Fr. Pat. 419,203, May 20, 1910.

A thin coating of colour is applied to the face of the material by means of a finely engraved roller such as the steel bowl of a Schreiner calender. In the case of plain fabrics and most fancy cloths, only the weft takes the colour, the warp remaining unaffected. The slight pressure necessary for the operation is obtained by passing the fabric between the engraved printing roller and a friction-driven rubber pressure roller. The ends of this roller are made of slightly greater diameter than the middle parts which come in contact with the fabric, so that the contact necessary for the friction-drive can be effected between the two rollers even when the fabric is travelling between them.—P. F. C.

p-Nitraniline Red or Naphthylamine Claret effects on direct dyestuffs ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pats. 228,753, Oct. 1, 1909, and 228,754, Jan. 4, 1910.

(1) Fabrics dyed with direct dyestuffs are printed with a hydrosulphite discharge paste containing β-naphthol, then steamed and treated with diazotised *p*-nitraniline or *a*-naphthylamine, and finally treated with a dilute solution of sulphuric acid, which develops the red or claret dye, enabling good red or claret effects to be produced on dark grounds ; in practice, it is advisable to repeat the treatments with the diazo compound and the acid. (2) The goods may be treated with dilute sulphuric acid before as well as after the treatment with the diazo compound. White and red effects on dark grounds are obtained by employing a hydrosulphite discharge without β-naphthol. The first treatment with sulphuric acid facilitates the formation of the dyestuff; also, in the production of white discharges, it prevents the formation of the brown stain due to the reduction of the dyestuff by the hydrosulphite. —T. F. B.

Water-proof linen ; Production of ——. H. Peters, London. Eng. Pat. 870, Jan. 12, 1910.

A liquid having the consistence of thin cream is obtained by mixing 60 grms. of calcium or barium carbonate, 60 grms. of zinc sulphide, 80 grms. of sodium-casein containing 94 per cent. of casein, 200 grms. of hot water and 30 grms. of "methyl aldehyde." The addition of 2 per cent. of glycerin prevents coagulation. The article to be treated is dipped in this solution, then dried and afterwards dipped in a solution of trinitrocellulose or triacetylcellulose in an organic solvent. An alternative to this second dipping liquor is a hot aqueous solution of sodium-casein mixed with "methyl aldehyde."—P. F. C.

Starched linen articles ; Process for treating ——. A. A. A. Zimmer, London. Eng. Pat. 6519, March 15, 1910.

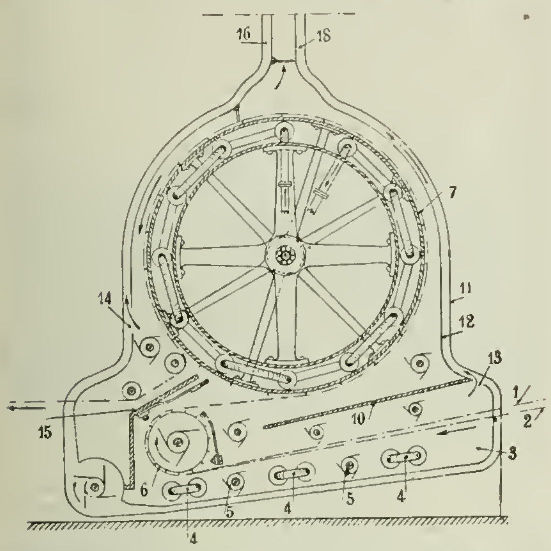
The articles are impregnated with a solution of nitrocellulose or celluloid dissolved in alcohol and ketone solvents of different boiling points, the following being given as a suitable solution : alcohol, 60 parts, acetone, 30 parts, to which 5 parts by weight each of castor oil and camphor are added. The articles are dried in cabinets at a comparatively high temperature, and finally polished by successive applications of pumice stone powder, powdered talc, and powdered chalk.—B. N.

Linen articles ; Process for treating starched ——. A. A. A. Zimmer, London. Eng. Pat. 12,406, May 21, 1910.

Starched and ironed articles are coated with a solution of cellulose acetate in a mixture of trichloro-ethane, trichloro-ethylene, castor oil and camphor. An alternative to this solution is obtained by dissolving cellulose butyrate in a mixture of acetone, trichloro-ethylene, castor oil and camphor. After drying the coated articles are finally polished by successive applications of powdered pumice stone, powdered talc, and powdered chalk.—P. F. C.

Drying mechanism for sized yarns and the like ; Cylindrical ——. G. Masurel, Roubaix, France. Eng. Pat. 4895, Feb. 26, 1910. Addition to Eng. Pat. 20,391 of 1909, dated Nov. 20, 1908 (this J., 1910, 940).

The materials to be dried comprising the combined layers, 1 and 2, enter the chamber, 3, of the machine, and at once pass over a steam heating device, 4, which has fans, 5, arranged between the coils. After next travelling over a small drum, 6, they pass round the large drum, 7, and over guide rollers out of the machine. Underneath the partition, 10 (which is placed just above the first traverse of the materials), and just above the baffle-plate, 15, arranged below the exit, openings, 13, and 14 respectively are made in the inner wall of the hollow casing, 11, 12. The machine has therefore three separate passages for the removal of the vapours, the most moist air being withdrawn by the channel, 18, and the least moist by the channel, 16.—P. F. C.



Multi-colour effects [*on textiles*] *: Process for producing* ——. M. Becke. Fr. Pat. 417,959, June 13, 1910. Under Int. Conv., Aug. 11, 1909.

See Ger. Pat. 228,693 of 1909 ; preceding.—T. F. B.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

German potash production. Chem. Trade J., Jan. 28, 1911, and Oil, Paint, and Drug Rep., Jan. 30, 1911. [T.R.]

Over and above the 69 works that are at present engaged in producing potash in its various forms, besides in some cases treating it chemically and preparing it for market, there are, it is said, 79 more in process of formation, whilst over 25 undertakings or projected undertakings are in the hands of promoters. There are also over 24 houses which devote themselves specially, if not exclusively, to the business of boring for potash ; giving a total of 197 houses engaged in various ways on the German potash fields.

The following table illustrates the progress made by the syndicate since the year 1900, both in point of sales of pure potash and their value ; also the progress made in extending the membership of the syndicate itself ; but above all, perhaps, as showing that as the membership grew the sales per unit of membership declined to a very striking extent :—

Year.	Total sale (Pure potash).		No. of syndicated works.	Average sale per syndicated work.	
	Quantity.	Value.		Quantity.	Value.
	Dop. zent.	Marks.		Dop. zent.	Marks.
1900	2,942,540	56,230,316	12	245,212	4,685,860
1901	3,328,890	59,128,509	19	175,205	3,112,027
1902	3,097,536	56,889,087	23	134,675	2,473 439
1903	3,533,238	64,108,854	27	130,861	2,374,402
1904	4,191,422	74,077,764	27	129,312	2,743,621
1905	4,832,682	81,642,749	28	172,596	2,915,812
1906	5,474,436	91,683,987	34	161,013	2,696.588
1907	5,577,546	93,422,074	40	139,439	2,335,552
1908	5,915,761	97,813,218	49	120,730	1 996,188
1909	6,753,318	116,505,730	56	120,595	2,080,459
1910	8,000,000*	123,000,009*	65	123,077*	1,892,307*

*Estimated.

Although the total sale of the potash industry in 1910 has increased by something like 32,000,000 marks in value on the basis of the syndicate's prices, the sales of the syndicate itself have only increased by something like 6,500,000 marks, although the number of its members had been increased. As a matter of fact, it is the outsiders whose increase of production contributes so largely to the healthy appearance of the potash export report for 1910, their increase being far in excess of the increase achieved by the syndicated works, as shown in the above table.

The Bundesrat has considerably increased the quantity of potash which can be exported by German potash works during the period from May 1 to December 31, 1911. The amounts in metric tons of pure potash (K_2O) which can be sold without being subjected to the special tax are now fixed as follows, with comparison of amounts as determined in June, 1910 :—

Classification.	For home consumption.		For exportation.	
	Old allow'ce.	New allow'ce.	Old allow'ce.	New allow'ce.
	Tons.	Tons.	Tons.	Tons.
Carnallite with 9 to 12 per cent. K_2O	3,050	3,550	110	160
Crude salts with 12 to 15 per cent. K_2O	126,520	130,570	79,600	99,700
Salts for fertilizer with 20 to 22 per cent. K_2O ..	580	780	11,060	17,860
Salts for fertilizer with 30 to 32 per cent.	320	1,270	9,020	9,020
Salts for fertilizers with 40 to 42 per cent. K_2O, including potash fertilizer with 38 per cent. K_2O	37,540	41,740	14,750	17,950
Muriate of potash	35,250	40,750	55,760	104,360
Sulphate of potash with over 42 per cent. K_2O ..	1,020	1,020	23,200	28,900
Potassium magnesium sulphate	100	100	4,640	4,640
Total	204,380	219,780	198,140	282,590

Fluorine contained in blendes ; Influence of —— on the lead of sulphuric acid chambers. P. Truchot. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. II, 62—63.

Zinc blende which is now widely used as a source of sulphur for the manufacture of sulphuric acid, nearly always contains calcium fluoride, the fluorine content ranging from a few grams up to 250—300 grms. per 100 kilos. Tests made by the author show that lead is attacked notably by sulphuric acid of 53° B. containing small quantities of hydrofluoric or hydrofluosilicic acids, and it appears certain that the life of the sulphuric acid chambers, especially of the first chamber, and of the lead of the Glover tower, must be considerably shortened by the use of blende containing fluorine. Fluorine compounds also attack the silicious lining of the Glover tower. (Compare this J., 1908, 981.)—A. S.

Tartaric materials ; Note on the Goldenberg-Geromont method for the analysis of ——. O. Tobler and R. Caramelli. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. I, 27—29.

The authors object to the modification of the Goldenberg-Geromont method (see this J., 1908, 245) of determining total tartaric acid proposed for adoption as a standard method by the Congress. The error introduced by making the mixture, after treatment with potassium carbonate, up to 200 c.c., filtering, and using 100 c.c. of the filtrate for the subsequent determination, will be greater the larger the amount of insoluble calcium carbonate, and the difficulty is not adequately met by the suggested corrections. The authors put forward an alternative modification. (See also this J., 1910, 814.)—A. S.

Copper ; Rate of dissolution of metallic —— in aqueous ammonia. E. Yamasaki. Proc. Seventh Int. Congr. Appl. Chem., London, 1909, Sect. X, 174—180.

The solution of copper by aqueous ammonia in presence of oxygen may be represented by the equation :

$Cu+xNH_3+\frac{1}{2}O_2+H_2O=Cu(NH_3)_x(OH)_2$. The coefficient, x, is probably 4, but its exact value is relatively unimportant so long as excess of ammonia is present. The velocity of the reaction increases regularly up to a maximum, the dissolved copper exerting a catalytic action. In the author's experiments two small plates of electrolytic copper were rotated rapidly in an aqueous solution of ammonia, through which a current of purified air was passed. The partial pressure of the oxygen and the concentration of the ammonia solution in contact with the copper were kept practically constant, the latter by passing the air through three wash-bottles containing aqueous ammonia before leading it into the reaction-vessel. It was found that the initial velocity of solution is independent of the concentration of ammonia. The velocity increases proportionally to the concentration of dissolved copper, the maximum being attained at a concentration of copper which is smaller, the smaller the concentration of the ammonia. The decrease of the velocity of solution after the maximum is passed, appears to be due to the hydroxyl ion, copper hydroxide being sometimes deposited as a film on the copper, whilst the velocity is diminished by addition of sodium hydroxide. By addition of ammonium sulphate (chloride, nitrate) in concentrations up to 0·1 grm.-mol. per litre, the accumulation of hydroxyl ions is diminished, and the maximum velocity is not attained until a much larger quantity of copper has dissolved, the initial velocity and rate of acceleration remaining unaltered. With higher concentrations of ammonium sulphate (1 grm.-mol. per litre), the acceleration is reduced considerably. The accelerating effect of the dissolved copper is probably due to the formation of a cuprous-ammonium complex and its subsequent oxidation, the latter proceeding much more rapidly than the former :

$$Cu(NH_3)_{\ddot{x}}+Cu+yNH_3=2Cu(NH_3)_{\frac{\dot{x}+y}{2}}$$

$$2Cu(NH_3)_{\frac{\dot{x}+y}{2}}+(x-y)NH_3+\frac{1}{2}O_2+H_2O=2Cu(\ H_3)_{\ddot{x}}+2HO.$$

This is confirmed by the fact that a deep blue solution of cupric-ammonium hydroxide is gradually decolourised when shaken with finely-divided metallic copper, and remains colourless so long as air is excluded, rapidly regaining its blue colour, however, when shaken with air. By using pure oxygen instead of air, the initial velocity of solution is increased considerably, but the acceleration due to dissolved copper is not affected. The initial velocity and the acceleration due to dissolved copper are increased by about 15 per cent. for a rise of temperature of 10° C. (between 20° and 35° C.), and they are proportional to the two-thirds power of the number of revolutions of the copper plates per minute. From the results of the investigation the author lays down the following rules for the rapid preparation of Schweitzer's cuprammonium solution :—(1). The ammonia solution should be concentrated and its concentration maintained. (2). The ammoniacal solution should contain a tolerably large amount of copper in solution to begin with : if this condition be fulfilled, the use of pure oxygen instead of air is not particularly advantageous. (3). The surface of the copper should be as large as possible. (4). The solution should be vigorously stirred.—A. S.

Mercury in nitric acid; Influence of minute quantities of ferric salts and of manganese nitrate on the rate of solution of ——. P. Chandra Rây. Chem. Soc. Proc., 1911, 27, 4.

Minute quantities of ferric nitrate (0·026 grm.) or ferric sulphate (0·0025 grm.) in dilute nitric acid (50 c.c.) containing 12 to 13 per cent. of the acid have a marked retarding effect on the dissolution of mercury in it. Manganese and sodium nitrates, on the other hand, accelerate the dissolution of mercury in nitric acid.

Zinc peroxides. O. Carrasco. Gaz. chim. ital., 1911, **41**, I., 16—20. (Compare De Forcrand, this J., 1902, 505, 1041; Kazanezky, this J., 1911, 83.)

By the action of an ethereal solution of hydrogen peroxide on pure zinc oxide, under different conditions, the same compound is always obtained. After drying at 60°—70° C. it has a composition corresponding to the formula, $Zn_4O_7+2H_2O$. It is stable even at 70°—80° C. and cannot be oxidised further. It is not decomposed by cold water, but when heated with water to 100° C. it evolves oxygen, and after about 8 hours is completely converted into a stable compound of the composition, $Zn_3O_5+H_2O$. The two peroxides of zinc thus obtained have a faint reddish-yellow colour and do not absorb carbon dioxide when exposed to the air. When heated in a capillary tube both decompose with explosion at 212°—216° C., but the compound, $Zn_4O_7+2H_2O$, shows signs of decomposition even at about 150° C. Since in these compounds there are more atoms of active oxygen than possible molecules of water, they must be regarded as true peroxides, more or less hydrated, and not as addition compounds of condensed hydrated oxide of zinc with hydrogen peroxide. The other compounds described by De Forcrand (*loc. cit.*) must be regarded as higher hydrates of these two peroxides. The zinc peroxides resemble persulphuric acid rather than the hydrated peroxides of the alkali and alkaline-earth metals, magnesium, etc., and they may be regarded as "perzincic acids" of the probable constitution : $HO.Zn.O.O.Zn.O.O.Zn.O.O.Zn.OH+H_2O$ and $HO.Zn.O.O.Zn.O.O.Zn.OH$.—A. S.

Tungstic acid; Electrolytic reduction of ——. A. Rosenheim. Proc. Seventh Int. Cong. Appl. Chem., London, 1909. Sect. X., 122—129.

Since tungstic acid does not dissolve to an appreciable extent in aqueous hydrochloric acid, it was electrolysed in solution in alcoholic hydrochloric acid; absolute alcohol saturated with hydrochloric acid dissolves 5·83 grms. per cent. of tungstic acid at 25° C., and 9·8 grms. at 75° C. A graphite anode in concentrated aqueous hydrochloric acid contained in a clay cell was used in all cases. The colourless solution first became deep blue (containing sexa- and quinquevalent tungsten, then green, containing only quinquevalent tungsten, which on further reduction changed to olive green (mixture of quinque- and quadrivalent), then to brown (quadrivalent), and in some cases to trivalent tungsten. When polished or platinised platinum were used as cathodes, only green solutions of quinquevalent tungsten were produced; with mercury cathodes, using a current density of 0·025 amp. per sq. cm. of cathode surface, quinquevalent tungsten was formed, whilst with 0·07 amp. and over, trivalent tungsten (red-brown solutions, oxidised by air) was produced. With lead cathodes the results were similar to those with mercury, except that the tervalent tungsten formed violet-red solutions. Zinc cathodes also give rise readily to the tervalent form. The electrolysis of tungstic acid dissolved in hydrofluoric acid was also examined; 100 grms. of the solution at 25° C. are saturated when containing 44·7 grms. of tungstic acid, and at 50° C., 55·3 grms. When using a mercury cathode, under various conditions of temperature and current density, only deep blue-violet solutions, containing quinquevalent tungsten, were formed.
—T. F. B.

Uranium colloid; A new ——. A. Samsonow. Z. Chem. Ind. Kolloide, 1911, **8**, 96—97.

In attempting to prepare uranous chloride by the electrolytic reduction of uranyl chloride, the author obtained besides the dark green uranous chloride solution, a black precipitate soluble in water. The solution of the black substance had the properties of a solution of an electropositive colloid, which proved to be uranous oxide, UO_2. It can be also obtained by the reduction of uranous chloride with zinc or copper in weak hydrochloric acid solution. Solutions of the colloid containing uranous chloride are much more stable than those free from that substance.
—A. S.

Celtium. A new element, accompanying lutecium and scandium in gadolinite earths. G. Urbain. Comptes rend., 1911, **152**, 141—143.

In treating gadolinite earths for lutecium, a few drops of mother liquor were obtained, containing an earth differing from lutecium in magnetic permeability and in spectrum. Its chloride lies in volatility between the chlorides of lutecium and of scandium, its hydroxide is a stronger base than scandium hydroxide but weaker than lutecium hydroxide, and in all its other characters examined it lies between these two metals. The author proposes for this new element the name *celtium* and the symbol Ct.—J. T. D.

Radium emanation; Condensation of ——. A. Laborde. Le Radium, 1910, **7**, 294—295. Chem. Zentr., 1911, **1**, 292.

If radium emanation be condensed at the temperature of liquid air, and the temperature then allowed to rise again, gas begins to be evolved again at a lower temperature (by about 20° C.) in a glass tube than in a metal tube. If a current of air carrying radium emanation be led at a constant velocity through a tube immersed in liquid oxygen, then with a tube 18 cm. long and 0·22 cm. diam., only 0·2—0·7 per cent. of the emanation escapes condensation if the tube be of metal (tin or copper), but 60—70 per cent. if the tube be of glass. The poor heat-conductivity of the glass does not appear to be the cause of this difference, for better condensation can be effected in a glass tube if a thin copper wire (0·024 cm. diam.) be placed inside it. Nearly as good condensation can be obtained in a glass tube as in a metal one, if the tube be long enough; a glass tube 1·6 m. long gives equivalent results to a tin tube 18 cm. long.—A. S.

Radium on ammonia; The direct action of ——. E. P. Perman. Chem. Soc. Proc. 1911, **27**, 7.

The rate of decomposition of ammonia by the direct action of radium bromide has been measured approximately. The pressure of the ammonia, together with its decomposition products, decreased for five weeks, and then steadily increased. The reaction appears to be of the first order.

Helium; Presence of —— in the air of Naples and of Vesuvius. A. Piutti. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. II., 83—86.

The author tested, for helium, sublimations and incrustations collected at different times and from different localities on Vesuvius. The gases liberated on heating the substance under examination were absorbed by cooled charcoal according to Dewar's method. Helium was detected in the air of Naples and of Vesuvius, and also in the gas from Vesuvian sanidinite (0·106 c.c. of total gas per grm.) and from pink tourmaline from Elba (0·511 c.c. per grm.). The radioactivity of the sanidinite was found to be due mainly to zircon crystals of sp. gr. 4·416 at 15°/4° C. Helium was detected in these zircon crystals and also in zircons from seventeen other localities in Europe, Asia, and America.—A. S.

Helium; Researches on ——. II. Radio-inactive minerals containing helium. A. Piutti. Proc. Seventh Int. Congr. Appl. Chem. London, 1909. Sect. II., 86—93.

In the examination of zircons from different localities (see preceding abstract) it was observed that some very faintly radioactive specimens contained more helium than others of greater radioactivity. Tests with a larger number of various other minerals from different localities showed that whilst in general the helium content was higher the greater the radioactivity, yet in many cases helium could be detected when the radioactivity was not measurable with the Wilson electroscope. In the case of large tourmalines from Maharitra (Madagascar), it was found that the radioactivity and helium content were greater in the darker (green) outer portion of the crystals than in the lighter-coloured (pink) inner portion.—A. S.

Less common elements; Bibliography of the progress in analytical separation of the ——. 1907—1909. Cerium, glucinum, gold, indium, iridium, lithium, molybdenum, palladium, platinum, selenium, tantalum, tellurium, thorium, titanium, tungsten, uranium, vanadium, zirconium. H. R. Moody. Proc. Seventh Inter. Congr. Appl. Chem., London, 1909. Sect. I., 148—157.

Industrial treatment of vanadinite for the production of vanadic acid. Gin. *See* X.

Theory of the lime-kiln. Decluy. *See* XVII.

Patents.

Nitrous sulphuric acid; Process of denitrating —— in the lead chamber process of manufacturing sulphuric acid. W. Salessky. Fr. Pat. 419,609, Aug. 23, 1910.

Denitration is effected in the presence of air, to the exclusion of sulphur dioxide. Air, at about 200° C., is introduced, with superheated steam, at the base of the Glover tower (where this is employed), and the gases from the pyrites burners are passed directly to the chambers. A special chamber is also provided, in which the oxides of nitrogen are mixed with such a quantity of air that they are converted, as far as possible, into nitrogen peroxide, before they are admitted to the lead chambers. The process is claimed to accelerate the formation of acid in the chambers.—F. Sodn.

Hydrocyanic acid; Process of making ——. O. Liebknecht, Frankfort-on-Maine, Germany, Assignor to Roessler and Hasslacher Chem. Co., New York. U.S. Pat. 967,943, Aug. 23, 1910.

A mixture of an alkylamine with sufficient ammonia to combine with the excess of carbon, is heated, *e.g.*, by passing the gaseous mixture through a red-hot tube; under favourable conditions, an almost quantitative yield of hydrocyanic acid is obtained, the reaction when trimethylamine is used being represented by the equation, $(CH_3)_3N+2NH_3=3HCN+6H_2$. (Compare Ger. Pat. 223,027 of 1909; this J., 1910, 1157).—T. F. B.

Sodium carbonate; Process of manufacture of ——. E. Jolicard. Fr. Pat. 419,194, Oct. 20, 1909.

A mixture of common salt or sodium sulphate and carbon is heated to 600°—750° C. in a continuous shaft-furnace or other suitable furnace. The mixture may be made into briquettes, and it may contain a metallic oxide or be heated in the presence of steam. Typical examples are represented by the following equations:—

(1) $2NaCl+ZnO+C+2O=Na_2CO_3+ZnCl_2$,
(2) $2NaCl+H_2O+C+2O=Na_2CO_3+2HCl$,
(3) $2\ NaCl+C+3O=Na_2CO_3+2Cl$,
(4) $Na_2SO_4+H_2O+3C+2O=Na_2CO_3+H_2S+2CO_2$,
(5) $Na_2SO_4+2C+O=Na_2CO_3+CO_2+S$.

—F. Sodn.

Milk of lime; Filter with automatic separation of impurities specially applicable to the filtration of ——. T. Valbusa. Fr. Pat. 419,481, Aug. 19, 1910. Under Int. Conv., Jan. 5, 1910.

The apparatus consists of an inclined cylinder, having a portion of its upper surface perforated, so as to form a filter. Milk of lime, introduced at the lower end of the cylinder, passes out through the perforations to a trough arranged below, and, at the same time, stones and other impurities are retained and carried forward by the rotation of an endless screw, to be discharged at the upper end of the cylinder.—F. Sodn.

Arsenic and lead; Process of separating salts of ——. L. Brunet. Fr. Pat. 419,418, Oct. 25, 1909.

Residues containing arsenious oxide and lead sulphide, sulphate, or oxide, are fused with sodium nitrate, and the sodium and lead arsenates, thus produced, are separated by lixiviation. A small proportion of sodium sulphate present in the aqueous extract may be removed by treating the solution with barium arsenate suspended in water.
—F. Sodn.

Potassium sulphate and potassium alum; Process of manufacture of —— from alunite or analogous rocks. Soc. Dior Fils. Fr. Pat. 419,854, Nov. 5, 1909.

The finely-crushed raw material is calcined sufficiently to decompose most of the aluminium sulphate present, and the potassium sulphate, together with any potassium aluminium sulphate, is then extracted with water. The potassium sulphate and potassium alum are subsequently separated by crystallisation, or the whole is converted into alum by adding the necessary quantity of aluminium sulphate. The insoluble residue may be utilised in place of bauxite.—F. Sodn.

Sulphur contained in sulphates, and chiefly in calcium sulphate; Process for the utilisation of ——. R. Wedekind und Co. m. b. H. Fr. Pat. 419,871, Aug. 30, 1910. Under Int. Conv., April 12, 1910.

Calcium or other sulphate is decomposed by heating with sand, the necessary heat being derived from the roasting of pyrites, a sufficient quantity of which is mixed with the material. The mixture may consist, for example, of 5 kilos. of calcium sulphate ($CaSO_4.2H_2O$) and 2 kilos. of sand to every 3 kilos. of granular Spanish pyrites, the ingredients being mixed in the moist state and the mass then dried and broken up. Apparatus of the Huntington-Heberlein or Dwight-Lloyd type may be employed, and the roasting of even very rich pyrites offers no difficulty. —F. Sodn.

Cuprammonium solution; Process for the continuous preparation of ——. J. Foltzer. Ger. Pat. 229,677, April 4, 1908.

In order to avoid the external cooling of the reaction chamber and to obtain a solution of which the ammonia concentration is as low as possible, the copper (turnings) is spread over a large surface in an atmosphere saturated with ammonia, and is sprayed with ammonia solution from above. The copper is preferably disposed on a perforated plate; the cuprammonium solution drains through the perforations and is then conducted out of the reaction chamber.—A. S.

Hydrogen; Process for the production of —— *by the reaction of steam with hydrocarbons or organic compounds containing carbon, hydrogen, and oxygen, at a high temperature.* O. Dieffenbach and W. Moldenhauer. Ger. Pat. 229,406, June 3, 1909.

The essential feature of the process is that the mixture of steam with a hydrocarbon or other suitable organic compound is heated to the reaction temperature, or kept in contact with the catalyser used, for only a short time and is then suddenly cooled or removed from the catalyser, in order that the carbon dioxide formed as primary product, in addition to the hydrogen, shall have little or no opportunity for being reduced to carbon monoxide. From the resulting mixture of hydrogen and carbon dioxide, the latter can easily be removed, leaving more or less pure hydrogen. A suitable way of carrying out the process is to use as catalyser wire gauze of nickel, cobalt, platinum, etc., disposed transversely to the direction of flow of the gases, and heated electrically to the requisite temperature. Instead of using external heating, the required temperature may be attained partly or entirely by combustion of a portion of the hydrocarbon by means of admixed oxygen or air. If air be used, the reaction product contains hydrogen, nitrogen, and carbon dioxide, and after the absorption of the latter, a mixture of hydrogen and nitrogen is left, suitable for employment in the manufacture of hydrogen cyanide.—A. S.

Oxalic acid and other organic acids as well as other oxygenated products of carbon; Process for manufacturing —— *with recuperation of the alkalis employed by the use of superheated steam under pressure.* A. Deiss, Sousse, Tunis, and C. J. Fournier, Cannes, France. Eng. Pat. 19,679, Aug. 23, 1910. Under Int. Conv., Sept. 2, 1909.

See Fr. Pat. 406,722 of 1909; this J., 1910, 564.—T. F. B.

Bichromate of sodium; Production of granular ——. R. Wedekind und Co. m. b. H., Uerdingen on Rhine, Germany. Eng. Pat. 19,677, Aug. 23, 1910. Under Int. Conv., April 12, 1910.

See Ger. Pat. 228,427 of 1910; this J., 1910, 1454.—T.F.B.

Air; Liquefaction of —— *and its separation into its constituents.* G. Claude, Assignor to Soc. l'Air Liquide, Paris. U.S. Pat. 981,748, Jan. 17, 1911.

See Fr. Pat. 401,496 of 1908; this J., 1909, 1127.—T. F. B.

VIII.—GLASS; CERAMICS.

Fused silica ware. J. F. Bottomley. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. II., 181—183.

The limits of temperature at which a furnace for the production of fused silica ware (see Eng. Pats. 10,670 and 18,437 of 1904, 21,018 of 1905, and 14,674 of 1906; this J., 1905, 673, 846, 1109; 1907, 322) can be worked, are very narrow, as the temperature at which the carbon, used as resistance material reacts with silica to form carborundum is very close to the temperature required for working the silica. The high viscosity of the silica even at very high temperatures renders it very difficult to get rid of air-bubbles and obtain a transparent product. At the present time charges of 70 lb. of fused silica can be made and the plastic mass is so ductile that it can be drawn to a length of 60 feet or more of $\frac{3}{4}$ in. tubing. Fused silica ware which has been subjected for long periods to a very high temperature tends to become brittle owing to reversion of the silica from the vitreous to the crystalline state (see Day and Shepherd, this J., 1907, 95). An investigation of this change at the National Physical Laboratory showed that it became evident at about 1188°C., but was not serious even after heating for 8 hours at that temperature. Heating for 4 hours at 1353° C., however, caused a reduction of 40—60 per cent. in the strength. Transparent silica proved stronger than the non-transparent material at all temperatures. For short periods, *e.g.*, in pyrometric measurements, fused silica ware can be used at temperatures much above 1200° C. Fused silica is a better insulator than glass, especially at high temperatures; its specific inductive capacity is 3·5—3·6. The non-transparent material has the sp. gr. 2·07, and the transparent, 2·22. Fused silica has been adopted as material for beakers and basins for the concentration of sulphuric acid, for gutters and lips for Glover towers, for pipes, coolers, etc.; a spiral cooling worm has recently been made. The largest article yet made of fused silica is a cylindrical vessel, 2 ft. 6 in. high and 12 in. diameter, with a capacity of 50 litres. W. Rosenhain stated that silica is better than porcelain for electric resistance furnaces wound with platinum foil, as there is no appreciable action on the platinum. A silica tube which has been quenched from 1000° C. for a number of times, gradually becomes porous, so that a vacuum cannot be maintained in it. Silica tubes can be bent and worked at temperatures very little above 1500° C. (See also this J., 1901, 250; 1903, 866, 1195; 1905, 457, 620; 1906, 697; 1909, 384; 1910, 1201.)—A. S.

Zirconia in enamelling; Use of ——. J. Grünwald. Sprechsaal, 1911, **44**, 72.

Zirconium and titanium oxides have both been suggested as substitutes for tin oxide in rendering enamels opaque. Hartmann states that 14—17 per cent. of zirconia is necessary and that cryolite must also be present. He gives the following recipe for an enamel: Frit felspar 37·5, borax 18, cryolite 21, quartz 10·5, saltpetre 0·7, zirconia 8; and an additional 6 parts of zirconia and 7 of clay to be added during milling. The author points out the commercial impracticability of working with such a high content of cryolite and zirconia, and states that the introduction of zirconium borate would lead to striations in the enamel. He finds that the opacity effect of titania and zirconia increase with increasing additions of clay, and thinks that this may be the only practical way of using these oxides as tin substitutes. Zirconium silicate, which, with the oxide, is the most abundant source of the compounds of this metal, does not cause opacity. On the whole, zirconia cannot as yet be said to be a satisfactory substitute for tin oxide.—H. H. S.

IX.—BUILDING MATERIALS.

Road building; Contribution of chemistry to the art of ——. A. S. Cushman. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. II., 217—226.

The author deals first with the requisite properties of rocks to be used for the making of roads, with special reference to the cementing power of the rock dust and of the methods for determining it (see this J., 1903, 743; 1904, 269; 1905, 970). The cementing power of rock dust is increased when a system of wet grinding is used, and hence it would appear that in most cases the surface of roads will be better the more wet rolling they receive. Again increased cementing powers are obtained by mixing together dusts from acidic and from basic rocks, and this principle of blending rocks for road-making has been successfully applied in England and in the United States. Referring to the growing use of bituminous substances for treating road surfaces, the author points out the evil results which may follow from the employment of unsuitable materials. The following specifications for oils to be used for treating road surfaces have been suggested by the office of Public Roads, U.S. Dept. of Agriculture. (1). The specific gravity should not be less than 0·95. (2). The flash-point should not be lower than 300° F. (3). The oil should not lose more than 35 per cent. when heated to 400° F. for 7 hours, and the residue should be smooth and firm, but not brittle when cold, and should possess good adhesive and cohesive properties. (4). The oil should dissolve to the extent of 98 per cent. in carbon bisulphide and to at least 88 per cent. in "88° naphtha." A study of available by-products which have been suggested for road-making has been made by the Office of Public Roads, U.S. Dept. of Agriculture. For the results obtained with molasses and slags, see this J., 1909, 93, 711. The waste lyes from paper pulp mills, when concentrated to 15°—30° Bé. act as binders for rock dusts not only by reason of their glutinous nature, but also because they induce the necessary hydrolytic reactions. The cemented material is, however, not completely resistant to water, and probably it would be necessary to emulsify the waste pulp lyes with mineral oils before using them for the treatment of road surfaces.
—A. S.

Portland cement made in rotary kilns; Silica in ——. O. Dormann. Z. angew. Chem., 1911, **24**, 157—160.

In a rotary kiln the finely divided raw materials offer a large surface to the action of the powdered fuel, and consequently to the action of the ash resulting therefrom. The ash therefore exercises a much greater influence on the clinker which is produced, than is the case in shaft or ring kilns, in which the fuel ash can have only a localised action on the relatively small surface of the compressed raw materials with which it is in contact. According to the author the coal ash is responsible for the two outstanding faults of rotary kiln practice, namely (1), the difficulty of producing slow-setting cement, and (2) the formation of rings of sintered material inside the kiln, with the consequent working difficulties and lining expenses. He attributes this unfavourable effect to the ratio of silica to alumina + ferric oxide, ($SiO_2 : R_2O_3$), indicated by the average composition of the coal ash analysed, which was found to be as low as 1—1·5 : 1, whereas the ratio $SiO_2 : R_2O_3$ in ideal cement clinker should lie between the limits 2·5—3 : 1. As a remedy the author proposes the addition of finely ground quartz sand to the raw materials used, the amount to be added depending on the composition of the fuel ash, and the amount of calcareous raw material employed being regulated in proportion. The author has carried out his remedy successfully in actual practice.—O. R.

Silicates; The fusion of —— with special reference to Portland cement. E. Dittler. Z. angew. Chem., 1911, **24**, 115—116.

The modern classification of silicates is based not on the ratio of the oxygen of the bases to that of the acids, but upon the results of physico-chemical determinations, such as thermal analysis, the phase rule, electrolytic dissociation, etc. From melting point determinations, silicates fall into two classes, *viz.*, those with a sharp melting point and low viscosity of the fused mass, and those with a "fusion interval." In the latter case the silicate does not again crystallise but yields a glass. The fusing and solidifying points do not coincide, and the viscosity masks the appearance of fusion. From fusions of the second class, the silicate with the greatest rate of crystallisation separates first, not the silicate which is in excess. Doelter's "heat microscope" enables the changes occurring on fusion to be observed and photographed under a magnification of 375 diameters, at temperatures, measured with a thermo-couple, between 1400° and 1600° C. In the fused state silicates show thermolytic and electrolytic dissociation, and the electric conductivity at high temperatures is as high as with aqueous solutions. The conductivity curve of silicates with a sharp melting point shows a break at the melting point. A lime silica clinker which is too rich or too poor in lime cracks, but with a molecular ratio of $5CaO.2SiO_2$ a product is obtained which sets well and does not split, and among calcium aluminates a similar limit exists, *viz.*, $5CaO,2Al_2O_3$. Aluminates are not stable in silicate fusions, but go over into silicates.—W. C. H.

Meta-calcium silicate $CaSiO_3$, and calcium-aluminium silicate $Ca_3Al_2Si_2O_{10}$; The fusion of ——. E. Rohland. Tonind-Zeit., 1911, **35**, 118—119.

Dölter has produced these silicates by fusing together their constituents, and has measured their electrical resistances when in the fused condition. In fusion they are conductors, and it can be assumed that, like aqueous solutions, they are dissociated, and conform to the ionic hypothesis. Platinum electrodes 12 × 11 mm. and 26 mm. apart were used. The silicate powder was pressed round the electrodes in a kaolin trough, and the resistances measured with a Wheatstone bridge. Experimental errors, such as defective contacts, gas bubbles, etc., prevent very accurate determinations being made. Calcium metasilicate occurs naturally as the monoclinic mineral, wollastonite, but on fusion changes into the rhombic form, which is always formed when the mineral is produced artificially. The resistance increases somewhat when the mineral is heated a second or third time. There is not a great difference between the conductivity of wollastonite and that of the artificial silicate, and the rate of dissociation is less than in the case of the felspars. Dissociation seems to occur below 1260° C. whilst the material is still in the sintering stage. Calcium aluminium silicate, which occurs naturally as gehlenite, and can be produced artificially, melts at about 1200° C. and has a lower specific resistance, and a greater rate of dissociation than the calcium metasilicate, and polarises strongly. The author points out that Portland cement powder would certainly show the phenomena of electrolytic dissociation, under similar treatment, but only to a small extent at the temperatures at which Dölter measured the conductivity of the above silicates. The occurrence of electrolytic dissociation, although only to a small extent, during sintering can be explained on the assumption that sintering is not a superficial fusion, but the fusion of portions of a heterogeneous mixture, whilst other portions remain in the solid condition and are saturated by the fluid portions. Conduction and electrolytic dissociation would occur with those parts of a cement which by sintering assumed the fluid state, but only at temperatures above 1400° C. would the electrolytic dissociation reach an appreciable amount. The experiments on the silicates do not prove that these or similar compounds are contained in cement, but that there are no stoichiometric combinations, but rather adsorption compounds of lime.—W. C. H.

Puzzuolanas; Chemical examination of ——. R. Feret. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. II, 17—19. (Compare this J., 1908, 983.)

The author subjected twenty-one different samples of puzzuolana to various chemical tests with a view to determine whether their value for the preparation of mortar could be determined in such a manner. None of the methods, however, gave results corresponding with those yielded by mechanical tests of the mortars prepared with the puzzuolanas, and the author doubts whether any purely chemical method would be quite satisfactory, as the value of a puzzuolana probably depends upon its colloidal as well as chemical character. In discussion, Le Chatelier stated that the value of puzzuolanas for the preparation of mortar is due to their high content of silica. In certain conditions alumina is able to combine with lime and behave in a similar manner to puzzuolana.—A. S.

Cements ; Decomposition of ——. H. Le Chatelier. Proc. Seventh Int. Congr. Appl. Chem. London, 1909. Sect. II., 10—15.

The author has examined the effect of saturated calcium sulphate solution, a solution of magnesium sulphate containing 6 grms. of the anhydrous salt per litre, and a solution of the same composition as the water of the Mediterranean Sea on different hydraulic products, including Portland cement, slag cement, quick-setting cements, puzzuolanas, and silicious limes and cements. The test-pieces were prepared with as large a quantity of water as possible in order that they should be porous, and so exhibit as quickly as possible effects caused by the saline solutions. It was not found possible to derive any definite relationship between the composition and resistance of the different materials. The results show that none of the materials can be considered absolutely safe for prolonged immersion in sea-water. The resistance of cements to sea-water is increased by addition of puzzuolana and by gauging with as small a quantity of water as possible. (See also this J., 1902, 409 ; 1908, 983.)—A. S.

Examination of bituminous road binders. Hubbard. *See* IIa.

Patents.

Rock material, more particularly raw materials for cement ; Wet process for the treatment of ——. W. P. Thompson, London. From Amme, Giesecke und Konegen Akt. Ges., Brunswick, Germany. Eng. Pat. 27,568, Nov. 26, 1910.

The process has for its object the removal of the coarse particles of stone always present in the slurry obtained by ordinary wet-grinding operations. For this purpose, the product issuing from the tube-mill of the ordinary wet-grinding plant passes into a chamber containing a revolving drum partly immersed in the slurry ; which latter is thus conveyed, on the periphery of the drum, from the inlet, to the outlet, side of the chamber. By means of scrapers located, at a short distance from the periphery of the drum on the inlet side of the chamber, only the fine materia is allowed to pass over to the outlet side, and is there removed from the surface of the drum by closely-fitting scrapers.—W. E. F. P.

Refractory material. H. A. D. Collins, London. U.S. Pat. 982,252, Jan. 24, 1911.

See Eng. Pat. 27,619 of 1906 ; this J., 1908, 162.—T. F. B.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Mineral and metal production of the United States in 1910. Eng. and Min. J., Jan. 7, 1911. [T.R.]

The following are particulars of the production of various metals, minerals, etc., in the United States during 1909 and 1910 :—

——		1909.	1910.
Mineral and chemical substances—			
Ammonium sulphate	tons of 2,000 lb.	106,500	116,000
Arsenic	lb.	2,015,880	2,652,000
Bromine	lb.	1,100,000	850,000
Coal, anthracite	tons of 2,000 lb.	77,126,980	80,381,306
Coal, bituminous	,,	367,076,821	403,533,152
Coke	,,	35,076,902	35,625,865
Copper sulphate	lb.	45,000,000	26,356,788
Iron ore	tons of 2,240 lb.	53,086,869	54,295,200
Magnesite	tons of 2,000 lb.	7,942	8,000
Petroleum	bbl. of 42 U.S. gals.	182,058,458	210,636,505
Tungsten ore	tons of 2,000 lb.	1,607	2,130
Zinc oxide	,,	76,600	78,000
Metals—			
Aluminium (*e*)	lb.	15,000,000	12,000,000
Copper (*a*)	lb.	1,105,336,326	1,086,151,430
Ferromanganese	tons of 2,240 lb.	225,040	240,525
Gold (*b*)	dols.	99,673,400	96,055 214
Iron	tons of 2,240 lb.	25,570,431	27,055,067
Lead (*c*)	tons of 2,000 lb.	371,502	401,524
Nickel (*f*)	lb.	19,284,172	29,359,544
Mercury	flasks of 75 lb. net.	20.952	21,500
Silver (*b*)	fi. oz.	54,721,500	56,438,695
Zinc (*d*)	tons of 2,000 lb.	266,462	278 380

(*a*) Production from ore originating in the United States. (*b*) The statistics for 1909 are the final and those for 1910 are the preliminary statistics reported by the director of the Mint. (*c*) Production of refined lead from ore and scrap originating in the United States ; antimonial lead is included. (*d*) Total production of smelters, except those treating dross and junk exclusively ; includes spelter derived from imported ore. (*e*) Estimated. (*f*) Imports for first 11 months of each year. This nickel is smelted in the United States for the production of metal, oxide, and salts

Iron ores ; An abstract of the methods of the United States Steel Corporation for commercial sampling and analysis of iron ores. J. M. Camp. Proc. Seventh Intern. Congr. Appl. Chem., London, 1909, Sect. I, 101—106.

Iron ore sampling in general. A brief introduction upon iron ore sampling, emphasising the latitude necessary under different conditions, is given.

Car sampling at producer's end. Samples are taken uniformly over the surface of the cars on parallel lines or over a zig-zag course. Very lumpy ore is sampled by the rope net system. The proper proportion between lump and fine ore is maintained, and a portion of the ore is reserved in a closed can for the moisture determination.

Cargo sampling at consumer's end. Several practices are followed, depending upon the conditions. Samples may be taken from each grab during the unloading. The general plan is to sample the tops of the piles before unloading has commenced, then the exposed faces of ore during the process of unloading, or after the greater part of the ore has been removed.

Car sampling at consumer's end. Not less than ten, and as many as fifty equal sized samples are taken from each car at points symmetrically arranged on the piles of ore in each end of the car. The proper proportion of lump and fine ore is maintained, and a portion of the sample is reserved for the moisture determination.

Preparation of samples in general. The ideal practice of preparing samples is outlined.

Preparation of sample at producer's end. The sample is dried, and alternately crushed and quartered until about three ounces remain. This amount is crushed until it will all pass through a hundred mesh sieve, and constitutes the sample for analysis.

Preparation of sample at consumer's end. The practice is essentially the same as previously outlined.

Methods of Analysis. *Iron.* One-half to one gram of the sample is dissolved in hydrochloric acid and stannous chloride. The determination is completed by the bichromate or the permanganate titration. The residue, if suspected of containing iron, is fused with sodium carbonate, the fusion is acidified and the iron titrated.

Silica. Hydrofluoric acid method. One gram of the sample is dissolved in hydrochloric acid and the solution evaporated to dryness. The residue is dissolved in dilute hydrochloric acid and hot water, the insoluble matter is filtered off, ignited, and weighed. The residue is treated with sulphuric and hydrofluoric acids, the silica being determined by difference. When all or part of the filtrate is used for the phosphorus or other determinations, one to five grams of the sample are dissolved in hydrochloric acid, the solution is filtered and the filtrate evaporated to dryness. The residue, containing the greater part of the iron, is dissolved in hydrochloric acid, and if the solution is to be used for the phosphorus determination, the excess of acid is evaporated and nitric acid added. The residue from the fusion is moistened with dilute hydrochloric acid, and dissolved in hot water. Both solutions are filtered into a suitable flask if the phosphorus determination follows, otherwise into a volumetric flask. The residue is ignited and weighed as silica.

Phosphorus. Fusion method. The entire filtrate obtained in the preceding determination, or an aliquot part of the filtrate in the volumetric flask, after being boiled with nitric acid is rendered ammoniacal, and nitric acid is added with from 5 to 10 c.c. in excess. To the solution heated to 80° C. ammonium molybdate solution is added, the flask is agitated and the precipitate allowed to subside. The determination may be completed gravimetrically: by direct weighing of the yellow precipitate on a tared filter after drying at 110°—120° C.; or by dissolving this precipitate with ammonium citrate solution, reprecipitating with magnesia mixture and estimating as magnesium pyrophosphate. The estimation may be effected volumetrically: with titration of the yellow precipitate by the acid alkali method; or after solution in ammonia and reduction with zinc by the permanganate titration.

Direct determination of the soluble phosphorus. One to five grams of the sample are dissolved in hydrochloric acid, the excess of acid is evaporated and the solution is filtered into a suitable flask. Ammonia and nitric acid are added, as previously described, and the determination is completed by one of the methods already given.

By ignition of the insoluble residue. One to five grams of the sample are dissolved in hydrochloric acid and the solution is filtered. The insoluble residue is ignited and transferred to the filtrate, which is evaporated to dryness. The residue is dissolved in hydrochloric acid, the excess evaporated, and nitric acid is added. The solution is filtered into a suitable flask and the determination completed as previously described. With unknown ores, and at regular intervals with all ores, as a check, the insoluble residue is fused as outlined under the *Fusion method.*

When titanium is present. Two grams of the sample are fused with sodium carbonate, the fusion is disintegrated with hot water and the residue filtered off. The filtrate is acidified with hydrochloric acid and evaporated to dryness. The residue is moistened with dilute hydrochloric acid, dissolved in hot water, the solution is filtered, and the determination is completed in the usual manner. The phosphorus may be separated from the large amount of sodium chloride present in the filtrate by precipitation with a ferric iron solution and ammonia. The resulting precipitate is filtered off, redissolved in nitric acid, and the determination is completed as previously directed.

Alumina. Phosphate method. For this determination the hydrochloric acid filtrate from the silica, representing one gram of the sample, or the hydrochloric acid solution of the precipitated iron and alumina in the gravimetric estimation of manganese, is used. To the cool, dilute solution, a solution of ammonium phosphate is added, then ammonia until a faint precipitate persists. This is dissolved with 1½ c.c. of strong hydrochloric acid, and a solution of sodium hyposulphite is added. The solution is heated to boiling, ammonium acetate and acetic acid are added, and boiling is continued for ten minutes. The precipitate is filtered off, ignited, and weighed as aluminium phosphate.

Ether method. One to five grams of the ore are dissolved in hydrochloric acid, the solution is filtered and evaporated to dryness. The residue is subjected to hydrofluoric acid treatment: it is then fused with potassium bisulphate, the fusion is dissolved in hydrochloric acid, and the solution evaporated to dryness. The residue containing the greater portion of the iron is dissolved in hydrochloric acid of sp. gr. 1·13, the solution is transferred to a separating funnel and an ether extraction made. The acid solution is drawn off and combined with the solution obtained by dissolving the residue from the fusion. The ether is evaporated, and any ferrous iron present oxidised. A basic acetate precipitation is made, followed by an ammonia precipitation, the second precipitate being ignited and weighed as oxides of iron, aluminium, and phosphorus. The iron is determined by fusion with sodium carbonate and solution in hydrochloric acid, or by direct solution in hydrochloric acid and stannous chloride, with subsequent titration. The weight of the combined oxides minus that of the ferric oxide and phosphorus pentoxide gives the weight of alumina.

Manganese. Gravimetric method. The solution, representing one gram of the sample, after fusion of the insoluble residue and separation of the silica, is boiled with nitric acid. A basic acetate separation is then made; if more than 1 per cent. of manganese is present, two separations are effected. The filtrate, or the combined filtrates are heated to boiling, and the manganese is precipitated by the addition of ammonia and ammonium persulphate. After ten minutes boiling, the precipitate is filtered off, ignited, and weighed as manganese tetroxide, Mn_3O_4, or it may be dissolved, reprecipitated, and estimated as manganese pyrophosphate. The ignited precipitate of manganese tetroxide is liable to be contaminated with small amounts of silica, which may be determined and deducted from the original weight.

Volhard's method. One or two grams of the sample are dissolved in hydrochloric acid. Nitric acid or potassium chlorate is added, and the excess of acid evaporated. The solution is diluted, transferred to a volumetric flask, and zinc oxide emulsion is added. An aliquot part of the solution is taken, heated to boiling, and titrated with permanganate. Or the titration is effected in the entire solution in the presence of the iron precipitate.

Colour comparison or titration method. One gram of the sample is dissolved in hydrochloric and sulphuric acids, and evaporation is conducted until sulphuric acid fumes appear. The solution is transferred to a small volumetric flask, and an aliquot portion is transferred into a test tube if for colour comparison, or into a small flask if for titration. The solution is heated, and the manganese oxidised by silver nitrate and ammonium persulphate. The manganese is estimated by comparison of the permanganic acid colour against a standard, or by titration with sodium arsenite. If the insoluble residue is suspected of containing manganese, it is filtered off and decomposed by treatment with hydrofluoric and sulphuric acids.

Peroxide reduction method. One-half to three grams of the sample are dissolved in hydrochloric acid, the residue being subjected to hydrofluoric acid treatment if suspected of containing manganese. The solution is evaporated almost to dryness, nitric acid is added, the solution boiled until clear, and the manganese is precipitated with potassium chlorate. The solution is cooled, diluted, and a definite amount of hydrogen peroxide is added. After reduction, the excess of peroxide is determined by permanganate titration, the relative value between these solutions being known.

Lime. The filtrate from the persulphate precipitation of the manganese, after the basic acetate or ammonia separation of the iron and alumina, is used for this determination. After the addition of ammonium oxalate and ammonia, the solution is evaporated to a volume of 150 c.c. Ammonia is again added, the solution is boiled, the precipitate is filtered off, ignited, and weighed as lime. The ignited precipitate is liable to be contaminated with small amounts of silica, which may be determined and deducted from the original weight.

The precipitate may be dissolved on the filter in dilute sulphuric acid, and the lime determined by permanganate titration.

Magnesia. The filtrate from the calcium oxalate is made slightly acid with hydrochloric acid and a solution of ammonium phosphate is added. The solution is cooled, then 25 c.c. of ammonia are slowly added. After continuous stirring for one hour, or after sufficient time on standing for complete precipitation, the precipitate is filtered off, ignited, and weighed as magnesium pyrophosphate.

Sulphur. Fusion method. One gram of the sample is fused with sodium carbonate and a little potassium nitrate. The fusion is disintegrated in hot water and the solution filtered. To the filtrate a slight excess of hydrochloric acid is added, the solution is heated to boiling, and the sulphur precipitated with barium chloride. The precipitate is allowed to subside, is filtered off, ignited, and weighed as barium sulphate. If the ignited precipitate is suspected of containing traces of silica, it may be purified by the addition of a drop of sulphuric and a few c.c. of hydrofluoric acids.

Wet method. Five to ten grams of the sample are dissolved in *aqua regia*, and the solution is evaporated to dryness. The residue is dissolved in hydrochloric acid and the excess of acid evaporated. The solution is filtered, the filtrate is heated nearly to boiling and barium chloride added. The excess of acid is again evaporated, the solution is diluted, the precipitate allowed to subside and the determination is concluded as previously described.

Ignition loss. One gram of the sample is ignited in a crucible with a closely fitting cover until constant weight is obtained.

Moisture. Not less than two kilograms of the sample reserved for the moisture determination is dried at 100° C. until constant weight is obtained.

Malleable cast-iron; Production of ——. U. Savoia. Proc. Seventh Int. Congr. Appl. Chem., London, 1909, Sect. IIIA, 100—102.

HAVING shown that the graphitic grains present in malleable cast-iron were derived from the cementite without any oxidation of the carbon, the author placed eight pieces of white cast-iron in a box, four embedded in the ordinary mixture of sand and iron oxide on one side of a partition and four in ordinary sand on the other side. The box was uniformly heated to a temperature of 950° C. for 96 hours. The results of the tests are given, and it is shown that there was very little difference between the two methods, any difference being in favour of the sand. Microscopical examination also showed that a similarity of structure existed irrespective of the material in which the test-pieces had been heated, and it is recommended that in future the practice of heating in ordinary sand be adopted, for the reason that the products so heated have never given any cause of complaint. The use of lime instead of sand as recommended by Namias was found to give cleaner products without affecting the mechanical and microscopical properties of the material.—A. H. C.

Iron castings; Chemical standards for ——. J. J. Porter. Trans. Amer. Foundrymen's Assoc., 1911, 19, 35—200.

IN the first part of this report the constitution of castiron is discussed, and equilibrium diagrams are given of the pure iron-carbon system (Upton) and for that containing one, two and three per cent. of silicon. The influence of the percentage of total carbon, the rate of cooling, the silicon, sulphur, and manganese on the amount of graphite is discussed and it is also stated that the combined carbon is decreased to the extent of 0·45 per cent. by one per cent. of silicon, and it is increased by 0·045 per cent. by 0·01 of sulphur, 0·40 by one of manganese, and 0·17 by one of phosphorus, and the influence of the carbon on the physical properties of cast-iron is expressed diagrammatically (Howe). The influence of the presence of silicon, phosphorus, sulphur, manganese, copper, oxygen, nitrogen, aluminium, titanium, and vanadium on the character, constitution and physical properties is then given in respective detail. The second part of the report deals with the properties of cast-iron from every point of view. The following practical rules for obtaining strong castings are given: "Use a strong brand of iron, avoid oxidation in melting, keep the silicon as near to 1·5 per cent. as possible, the phosphorus at 0·5, or under, the sulphur under 0·10, the manganese up to one per cent. for large castings and 0·5 for small ones, and use 10 to 25 per cent. of steel scrap in the mixture." The chemical composition of a large number of strong irons is tabulated. The rules for obtaining the maximum elasticity and toughness are: "Keep the silicon at 1·5 to 2·0 per cent., sulphur under 0·08, phosphorus under 0·5, the manganese at 0·25, using good irons and good cupola practice to ensure the absence of dissolved oxide." The effect of the composition on total shrinkage is given in the following table:—

Silicon decreases by 0·083 per cent. for each 0·2 per cent. content.
Sulphur increases ,, 0·083 ,, ,, ,, 0·03 ,, ,, ,,
Phosphorus decreases by 0·125 ,, ,, 0·10 ,, ,, ,,
Manganese increases by 0·083 ,, ,, ,, 0·20 ,, ,, ,,

"In order to obtain a fluid iron keep the phosphorus up to 1·0 to 1·25 per cent., if the work permit use a soft iron containing 2 per cent. of silicon and low in combined carbon, if necessary use deoxidising agents to prevent oxidation, and plenty of coke. To obtain a high permeability keep the silicon at about 3·0 per cent., manganese 0·5, the carbon low, and allow the castings to cool completely in the sand before shaking out. The composition of acid resistant castings should be silicon 0·8 to 2·0 per cent., sulphur 0·02 to 0·03, phosphorus 0·4 to 0·6, manganese 1·0 to 2·0, and total carbon 3·0 to 3·5." In the next portion of the report the suggested composition of ninety different products made from cast-iron, and the analyses of 230 brands of iron with the sources of supply are given, while the last portion is devoted to a bibliography of the subject.—A. H. C.

Manganese; The influence of —— on the properties of mild steel. G. Lang. Metallurgie, 1911, 8, 15—21, 49—53.

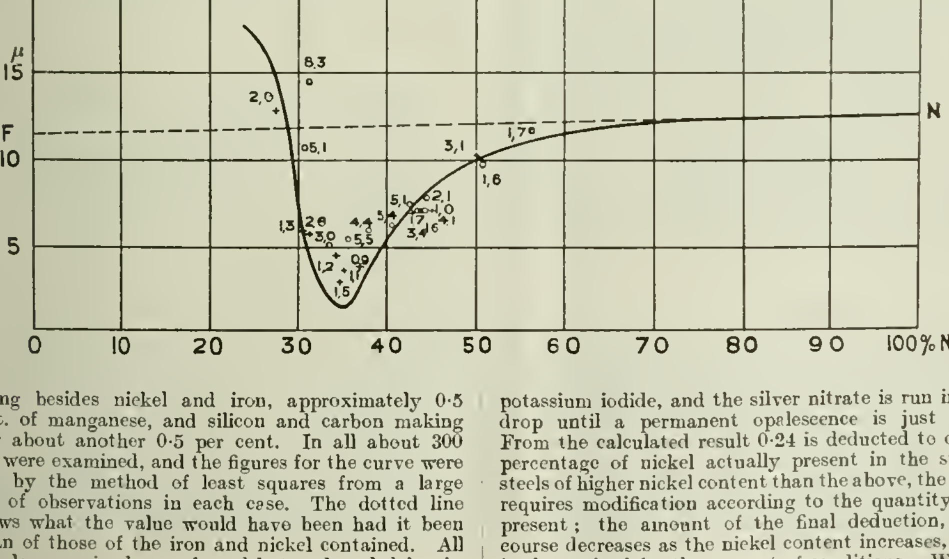
BY using manganese prepared by the alumino-thermic reaction, the author was able to prepare a series of steels with manganese varying from 0·285 to 2·470 per cent., the greatest variation in carbon being at the same time kept as low as 0·036 per cent. In the steels containing over 0·8 per cent. of manganese the maximum variation of carbon was only 0·012 per cent. The billets were rolled hot to 30 mm. diameter for the mechanical tests, and for the electrical and magnetic tests the rods were further rolled to 8 mm., and then turned to 6 mm. diameter. One set of test-pieces received no heat treatment, a second set was heated to 900° C. for an hour and allowed to cool slowly, covered with kieselguhr, and a third set was heated to 900° C. for an hour and quenched in water at 15° C. The heating of the wire for the magnetic and electrical tests was carried out in a lead-bath and lasted half an hour. The results of the tests showed that the effect of manganese up to 1·5 per cent., is to improve the mechanical properties of steel in all respects. Especially where high tenacity is desired, a manganese content of over 1 per cent. is to be recommended. The tensile strength rises 1·5 kilos. per sq. mm., and the hardness about 5 (Brinell) for each additional 0·1 per cent. of manganese, up to a content of 3 per cent. Both these properties have considerably higher values in the quenched than in the unquenched steels. The elongation and reduction of area are practically constant up to 1·5 per cent. of manganese, then fall off somewhat rapidly. Microphotographs show that quenched steel containing 2 per cent. of manganese is entirely martensitic in structure, and that this structure is already quite apparent in quenched steel with 1 per cent. of manganese. As regards magnetic and electrical properties, as the manganese content rises, the coercive force and hysteresis energy become greater, the permeability diminishes, the retentivity remains practically constant, and the electrical resistance increases. The heat treatment has no effect on the resistance.—T. St.

Steels; The wear of —— by abrasion. F. Robin. Rev. Mét., 1911, 8, 47—84.

The wear, *i.e.*, the loss of weight due to abrasion under given conditions, being a function of the mineralogical hardness and of the constituents of the metals, the author has devised a test for wear capable of industrial application. The *figure of wear* characteristic of the metal is determined by the loss of weight obtained by friction on Oakey's emery paper (No. 2½) mounted on a horizontal disc, and renewed for every test, under constant speed, pressure, and time. It was found that the pressure increased the wear, which was proportional to the surface abraded whatever its shape. The wear of carbon steels is not inversely proportional to their carbon content, but shows a minimum at about 0·4 per cent. of carbon. Pure and refined metals show the most resistance. Phosphorus increases the resistance considerably, while manganese and silicon in carbon steels diminish it. Cast irons are the more resistant the higher the phosphorus and cementite content. Among the austenitic steels nickel-steels and those with a high manganese content are very resistant and Hadfield's steel varies very little with the speed and pressure used in the test; pearlitic chrome steels, particularly when tempered, wear very little. Doubly tempered carbon steels, and tungsten and molybdenum pearlitic steels wear with the greatest ease, while vanadium lessens considerably the resistance to wear. When comparing the Brinell and other tests for hardness with the resistance to wear, it was found that the latter gave more sensitive results. When a large proportion of a very hard constituent is enclosed in a more malleable constituent, the indications given by the abrasion test and the penetration tests of hardness are of inverse order. The results obtained explain the combined effects of mineralogical hardness, malleability and brittleness of steel.—A. H. C.

Nickel steels; Anomalous expansion of ——. C. E. Guillaume. Comptes rend., 1911, **152**, 189—191.

The variation of the coefficient of expansion with the content of nickel is expressed in the curve (fig. 1), for so-called "normal" reversible nickel steels, that is, alloys containing besides nickel and iron, approximately 0·5 per cent. of manganese, and silicon and carbon making together about another 0·5 per cent. In all about 300 samples were examined, and the figures for the curve were deduced by the method of least squares from a large number of observations in each case. The dotted line FN shows what the value would have been had it been the mean of those of the iron and nickel contained. All the samples examined were forged hot and cooled in air. The effect of manganese in altering the coefficient of expansion of a nickel steel of given nickel content is seen from the positions, with regard to the curve, of the circles on the diagram, which give the coefficients for nickel steels containing the percentages of manganese specified. The crosses on the diagram show the same thing for chromium.—J. T. D.



Nickel; Rapid determination of —— in steels. G. Raulin. Monit. Scient., 1911, **74**, 84—86.

The author employs a modified cyanometric process, having shown that, although high results are obtained the error is practically constant for steels having a nickel content within a given range; for example, with steels containing up to 10 per cent. of nickel, the indicated percentage of the latter metal is greater than that actually present by 0·24. It is stated that a single assay may be performed in half an hour, the results obtained being sufficiently accurate for all practical purposes (within 0·04 per cent.) and being uninfluenced by the presence of silicon, manganese, chromium, tungsten, molybdenum, sulphur and phosphorus. The solutions required are:—(1) *Silver nitrate*, 5·788 grms. per litre. (1 c.c. = 0·001 grm. of nickel); (2). *Potassium cyanide*, about 4·45 grms. per litre. To improve the keeping qualities of this solution, 0·5 grm. of sodium hydroxide is added; (3). *Potassium iodide*, 200 grms. per litre; (4). *Ammonium sulphate*, 600 grms. per litre; (5). *Ammonia solution*, 165 c.c. of ammonia (22°) diluted to 1000 c.c. For steels containing up to 10 per cent. of nickel, 1 grm. of the metal is dissolved in 20 c.c. of hydrochloric acid (1 : 1), 10 c.c. of 1 to 1 nitric acid (1 : 1) are added and the solution is boiled; it is then transferred to a 500 c.c. flask containing 200 c.c. of water, ammonia solution added until the colour of the liquid just changes from yellow to red (no iron being precipitated) and then a calculated excess of the potassium cyanide (the amount of which may be roughly estimated by preliminary trial if the approximate nickel content of the steel is unknown) is introduced. Ammonia solution is now added until the precipitation of the iron is just complete, and 20 c.c. in excess. Too large an excess increases the solubility of the silver iodide formed at a subsequent stage. The whole is diluted to exactly 500 c.c., and filtered through a large plain filter, the first 20 c.c. of the filtrate being rejected. The next 250 c.c. of filtrate are transferred to a flask, 10 c.c. of the ammonium sulphate solution are added (which increases the intensity of the subsequent turbidity and prevents the precipitation of the potassium nickelocyanide), and 5 drops of the potassium iodide, and the silver nitrate is run in drop by drop until a permanent opalescence is just produced. From the calculated result 0·24 is deducted to obtain the percentage of nickel actually present in the steel. For steels of higher nickel content than the above, the procedure requires modification according to the quantity of nickel present; the amount of the final deduction, which of course decreases as the nickel content increases, must also be determined for the new set of conditions.—W. E. F. P.

Ferro-vanadium; Preparation of —— by electrolysis of the trioxide dissolved in calcium fluovanadate. G. Gin. Proc. Seventh Int. Cong. Appl. Chem., London, 1909. Sect. X, 10—11.

The most suitable method for the preparation of ferro-vanadium by direct electrolysis has proved to be to electrolyse the trioxide dissolved in fused calcium fluovanadate. The anodes used were of carbon, and the cathodes consisted of conical agglomerates of ferro-vanadium. The furnace was lined with pure alumina, melted in the electric furnace, and agglomerated by heating to redness with tar and a little vanadic anhydride. The bases of the cathodes were embedded in graphite resting on copper plates connected with the negative poles of the generator. A current density of 0·7 amp. per sq. cm. of anode section proved the most convenient. The metal was first deposited on the points of the cathodes (which pass through the furnace lining), and continued to form until a continuous mass resulted. It could not be melted, as the necessary temperature was above that of volatilisation of the bath. When the requisite quantity of metal had been formed, the bath run off, the furnace was broken up, and the mass of metal separated from the tops of the cathodes adhering to it.—T. F. B.

Wulfenite; Treatment of —— to obtain ferromolybdenum of low carbon content. G. Gin. Proc. Seventh Int. Cong. Appl. Chem., London, 1909, Sect. X. 8.

Wulfenite is smelted in the electric furnace with suitable quantities of coke and magnesium carbonate, the lead which is liberated being collected. The magnesian slag is pulverised and treated with boiling water, and the solution cooled, whereupon it deposits crystals of magnesium molybdate containing 4 mols. of water, of m. pt. 1440° C. These are dehydrated by calcination, powdered, mixed with the requisite amount of 50 per cent. ferrosilicon, and briquetted by means of tar or pitch. When these briquettes are heated in a furnace, the following reaction occurs :—$4MgMoO_4 + 3FeSi_2 = Mo_4Fe_3 + 4MgSiO_3 + 2SiO_2$. If the magnesium molybdate is heated with molybdenum silicide, pure molybdenum is obtained.—T. F. B.

Ferro-alloys; Decarburisation of ——. G. Gin. Proc. Seventh Int. Cong. Appl. Chem., London, 1909, Sect. X, 9—10.

When ferro-alloys, prepared by reducing minerals by means of carbon, are decarburised by heating them in presence of a mineral which oxidises the carbon, a prolonged heating is necessary to complete the oxidation, the time required being greater the lower the carbon content to be realised. On the other hand, the decarburisation is not accelerated, but rather decreased by further increasing the temperature. This may be accounted for by the assumption that, although more oxide is dissolved at the higher temperature, equilibrium is established with the carbon monoxide dissolved at that temperature; the amount of carbon monoxide necessary for equilibrium probably reaches a minimum near the point of solidification of the alloy. For example, when a molten bath of ferro-chromium is allowed to cool in presence of an oxidising mineral, evolution of gas (probably carbon monoxide) commences after a time, and becomes more rapid as the temperature of solidification is approached.—T. F. B.

Gold; The electrolytic refining of ——. T. K. Rose. Proc. Seventh Int. Congr. Appl. Chem., 1909, Sect. IIIa, 15.

In 1878 Wohlwill of Hamburg introduced his process at the Norddeutsche Affinerie, and it has since been applied elsewhere in Germany, but although superseding sulphuric acid for parting in Germany and North America, it has made little progress in that direction in other countries. In the Wohlwill process the electrolyte is a solution of gold chloride containing from 20 to 30 grms. of gold per litre and from 20 to 100 c.c. of concentrated hydrochloric acid per litre. It is heated to about 60°—70° C. The anodes consist of impure gold, usually containing about 60 or 70 parts of silver per 1000, and the cathodes of pure sheet gold. The anodes dissolve partly as trivalent gold forming $HAuCl_4$, and partly as univalent gold. The gold monochloride formed at the anode is partly decomposed into the trichloride, and metallic gold which it deposited, though some of the univalent gold ions reach the cathodes. The higher the current density the more tervalent gold is dissolved and the less gold monochloride is formed, so that there is less gold in the slimes at the bottom. The current employed in the United States is from 300 to 600 ampères per square metre of anode surface. The deposition of gold at the cathodes is greater than the amount dissolved at the anodes, owing to the presence of impurities in the unrefined gold, so that it is necessary to add chloride of gold to the solution at intervals. Silver is converted into silver chloride at the anodes and falls to the bottom of the vessel, or is in part dissolved. The anodes may contain up to 150 per 1000 of silver, but if such a large proportion is present it is necessary to scrape the silver chloride from the surface of the plates. Platinum is dissolved with the gold and accumulates in the solution, from which it is recovered in the ordinary way. The deposited gold is nearly pure.

The electrolyte is circulated by mechanical means, and is renewed when it has been made foul by the accumulation in it of copper, palladium, etc. Lead makes the deposited gold impure, but may be rendered insoluble by the addition of sulphuric acid.

Brown gold. Hanriot. Comptes rend., 1911, **152**, 138—141.

The shrinkage of brown gold (this J., 1911, 89) on heating is gradual, and attains its maximum only after five or six hours. The shrinkage by attack with acid is the same (with the same composition of alloy) whether the attack by acid take place at 60°, 80°, or 100° C. The brown gold does not shrink if heated to any temperature short of 250° C. Above that, the shrinkage increases rapidly, up to 500°, beyond which it remains almost constant up to the melting-point. The thickness of the sheet is without influence on the shrinkage by heat, except that thicker sheets require longer treatment with acid to extract all the silver. The limiting value of the shrinkage (at 900° C., say) is the same whether the rise of temperatures be gradual or more sudden, but it is much more rapidly attained if the alloy has been previously heated to 700° C. The composition of the alloy has an effect on the shrinkage by heat, opposite in direction to that which it exerts on the shrinkage by acid, so that the differences shown by different alloys when attacked by acid tend to be lessened when they are subsequently heated. But differences between sheets of the same alloy unannealed, once annealed, and twice annealed, shown on attack by acid, persist after heating.—J. T. D.

Platinum and illuminating gas. Mylius and Hüttner. Tätigkeitsber. der Physik.-Techn. Reichsanstalt. Z. Elektrochem., 1911, **17**, 38.

More soot was deposited from illuminating gas on platinum containing 3·5 per cent. of iridium than on pure platinum. For example, on passing illuminating gas over pieces of the sheet metal of 8 sq. cm. area heated to 650° C., 14 mgrms. of soot were deposited in 1 hour, 19 mgrms. in 2 hours, and 58 mgrms. in 6 hours on pure platinum, whilst on the metal containing 3·5 per cent. of iridium, the corresponding amounts were 29, 55, and 409 mgrms. On burning off the deposit, the iridium containing metal showed much greater corrosion and loss of weight than the pure platinum. The effects on the impure platinum are still greater when the metal is in contact with oxides, such as lime, magnesia, or alumina (fireclay), in which case the metal may become perforated at the zone of contact. This injurious action of iridium does not, however, appear to be sufficient to account for the great differences observed in the behaviour of "good" and "bad" platinum ware; and the presence of small quantities of iron or other base metals appears to have little effect. In the case of two platinum vessels of which one was strongly and the other only slightly corroded, the only essential difference of composition was the presence of 0·2 per cent. of rhodium in the former, and it is to this that the difference in behaviour was probably due. Experiments in this direction are to be made.—A. S.

Platinum wires; Curious heating of thin ——. J. A. Le Bel. Comptes rend., 1911, **152**, 129—131.

When a thin platinum spiral is placed in a heated enclosure, such as a metal tube, it shows an ultimate temperature the same as that of the enclosure if the material of the tube be annealed brass, bronze, or porcelain. If the tube be of copper or nickel, however, the temperature of the spiral is slightly but quite definitely higher than that of the enclosure (about 0·1° at 500° C.). The spiral may be enclosed in a tube of glass or mica within the enclosure, without sensibly reducing its excess of temperature, which thus appears to be caused by some radiation from the hot walls of the enclosure, not by any vapours from them. This radiation can traverse thin sheets of most metals, but is more readily absorbed by the noble metals; and for its exhibition it is necessary that the thickness of wall of the hot metal enclosure should not be much less than 6 mm.—J. T. D.

Nickel bronzes [*copper-nickel alloys*]. R. Adan. Proc. Seventh Int. Congr. Appl. Chem., London, 1909, Sect. IIIa, 103—108.

The author shows the advantages of the utilisation of copper-nickel alloys in the place of the usual bronzes. The results of the tests are given which were applied to an alloy of which the composition is not given. The alloy was shown by analysis and microscopical examination to be of uniform composition. A one per cent. solution of sulphuric acid was shown to attack this alloy, phosphor bronze, and ordinary bronze in the ratio of 1 : 2 : 100, while the corrosion by a one per cent. sodium hydroxide solution was in the ratio of 1·0 : 1·16 : 1·22. A large number of purposes for which the alloy may be used are indicated.—A. H. C.

Non-ferrous alloys; Thermal treatment of ——. A. Portevin. Proc. Seventh Int. Congr. Appl. Chem., London, 1909, Sect. IIIa, 8—13.

It is pointed out that copper alloys having a transformation point below their temperature of solidification should be capable of being tempered and annealed with marked alteration of their mechanical properties. In the case of copper-tin alloys containing from 9 to 31 per cent. of tin, a transformation point occurs at 550° C., and an alloy containing 13 per cent. of tin had its elongation altered on tempering from 3 to 10 per cent. An alloy containing 10·1 per cent. of aluminium tempered at 750° C. had its tensile strength altered from 25 to 35 kilos. with a slight diminution in elongation. The relation of the effect of annealing brass cartridge metal at various temperatures to the hardness, and the value of the microscopical examination in determining the size of the crystal produced as a measure of the hardness and the temperature of annealing, are discussed.—A. H. C.

Bearing-metals (*white metal*). *Part I.* E. Heyn and O. Bauer. Mitt. Kgl. Materialprüfungsamt, 1911, **29**, 29—49.

The chemical composition, mechanical properties, and the microscopic structure of white metals composed of tin, copper, and antimony, were examined. After melting five times, the proportion of copper is slightly increased, and that of tin and antimony decreased. The ratio of tin to antimony is not thereby appreciably affected; neither are the structure nor the mechanical properties. Sudden cooling increases the mechanical resistance of the metal. The appearance of a fractured surface can, to a certain extent, be taken as a guide to the mechanical properties, provided the composition is known. Microscopic examination gives much information as to the pouring temperature and the rapidity of cooling. Quick cooling gives a fine grain; dull if the metal is poured at a low temperature, brilliant if poured very hot. Slow-cooled specimens show no difference, whether poured at a high or at a low temperature. The appearance of the fracture is not a guide to the composition, nor to any chemical changes in the metal. The addition of deoxidising substances seems to be superfluous, as there was no appreciable change after five meltings. When aluminium was added as a deoxidising agent, a white efflorescence of alumina was observed on the surface of the castings after a few weeks. This may not, however, be detrimental in the bearing. Magnesium similarly used gave no such efflorescence. The principal points to be observed in casting bearings are: to pour at a moderate temperature, and to cool sufficiently rapidly.—R. W. N.

Babbitt metal; Rapid analysis of ——. P. H. Walker and H. A. Whitman. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. I., 107—113.

The following method is as accurate as the alkaline sulphide process, and much more expeditious:—*Copper.*—One grm. of the alloy is heated with 20 c.c. of hydrochloric acid and 5 c.c. of water, solution being completed by addition of nitric acid in small amounts. The solution is heated on the steam-bath until practically all the acid is expelled and the residue is pasty. The residue is treated with 25 c.c. of a solution prepared by dissolving 200 grms. of tartaric acid and 260 grms. of potassium hydroxide in water and making up to 500 c.c. The mixture is then heated on the steam-bath until solution is completed, treated with 25 c.c. of water, boiled, treated with 25 c.c. of a 0·2 per cent. solution of invert sugar, boiled for 2 minutes, and filtered through asbestos. The precipitate of cuprous oxide is washed with water, and dissolved in nitric acid, the copper solution being collected in a 200 c.c. flask. The copper is then determined volumetrically (*e.g.*, by the method of Jamieson, Levy and Wells, this J., 1908, 572). The results are uniformly low owing to the fact that nearly 6 per cent. of the copper present is not precipitated as cuprous oxide, and the requisite correction should be made. *Lead.*—0·5—1 grm. of alloy is dissolved as above described, and the solution is evaporated to dryness on the steam bath, the residue being treated with 5 c.c. of concentrated hydrochloric acid (or with 10 c.c., if as much as 10 per cent. of antimony is present) and warmed for a few minutes. The mixture is removed from the steam bath, 150 c.c. of 95 per cent. alcohol then being added, with stirring; the whole is allowed to stand at room temperature for 2 hours, the precipitate then being transferred to a Gooch crucible, washed with about 100 c.c. of 95 per cent. alcohol, sucked as dry as possible, and then dried for 1 hour at 105° C. To the weight of lead chloride obtained is added 0·0085 grm. as a correction for the amount of lead chloride left in solution. *Antimony.*—Low's method (J. Amer. Chem. Soc., 1907, 66) is slightly modified as follows:—One grm. of alloy is heated with 10—15 c.c. of concentrated sulphuric acid in a 450 c.c. Erlenmeyer flask, on a hot plate. When decomposition is complete, the solution is cooled, treated with 200 c.c. of water and 20 c.c. of concentrated hydrochloric acid, boiled to expel all sulphur dioxide, cooled, and titrated rapidly with potassium permanganate that has been standardised against metallic antimony. When a pink colour shows after agitating the liquid, the end-point is attained; this colour very soon disappears. The results are accurate enough for commercial purposes, though they tend to be 0·3—0·4 per cent. too high. *Tin.*—Low's method is used, but it is best to take a separate portion of the alloy and to effect reduction with steel turnings instead of with metallic antimony. From 0·2 to 1 grm. of alloy (the portion should not contain more than 0·2 grm. of tin) is decomposed exactly as described under antimony. The cooled solution is treated with 200 c.c. of water, 30 c.c. of concentrated hydrochloric acid, and about 1 grm. of steel turnings, and heated. When reduction appears complete, but before the last particles of steel have dissolved, the Erlenmeyer flask is fitted with a doubly bored rubber stopper carrying a tube which extends below the surface of the liquid, and the short arm of a bent tube, the long arm of which reaches nearly to the bottom of a 100 c.c. Erlenmeyer flask containing a solution of sodium bicarbonate. This small Erlenmeyer flask is held on the bent tube by a cork which has a notch cut in it to act as a vent. A current of carbon dioxide is passed through the tube reaching below the surface of the liquid in the large Erlenmeyer flask, the liquid is boiled until all the steel has dissolved, and cooled as quickly as possible, the stopper of the flask is loosened, some starch solution is added cautiously, and the contents of the flask are titrated with *N*/10 iodine solution, the current of carbon dioxide being continued throughout these operations. It is necessary to exclude air absolutely and to standardise the iodine solution with pure tin. The results obtained are accurate.—L. E.

Aluminium and aluminium ware; Corrosion of ——. E. Heyn and O. Bauer. Mitt. Kgl. Materialprüfungsamt, 1911, **29**, 2—28.

The paper is a report of tests made on aluminium sheet, and pressed ware made therefrom, with a view to finding the nature and causes of the efflorescence forming on such articles. When aluminium is attacked by water or solutions, two distinct forms of corrosion are observed: (*a*) corrosion of the whole surface, caused by the transformation of aluminium into aluminium hydroxide; and (*b*) local corrosion, accompanied by blisters and scaling, which causes serious damage, although the amount of aluminium actually transformed into hydroxide may be comparatively small. The state of the metal and the nature of the liquid acting on it determine whether the corrosion follows (*a*) or (*b*). Hard cold-rolled aluminium is liable to (*b*), though distilled water, and some solutions of salts such as sodium chloride, calcium chloride, etc., only produce (*a*). Ordinary water or solutions of similar composition invariably produce (*b*). Annealing such hard metal at 450° C. entirely removes this liability to (*b*), and the corrosion is limited to (*a*), which is less harmful. A solution which attacks strongly with the effect (*b*) does not necessarily produce the (*a*) effect to a similar extent, and *vice-versa*. Ordinary water attacks soft aluminium as in (*a*) more than it does the hard sheet, but the (*b*) corrosion is much less with the soft than with the hard metal. The blisters and scales (*b*) are very generally found in lines agreeing with the direction of rolling of the sheet from which the articles have been pressed. This shows that there is a distinct relation between the process of cold-rolling and the (*b*) form of corrosion. Analysis shows that in each case of (*b*) on the examined vessels, there was present, besides aluminium hydroxide, some lime and silica. It follows that, in cases where this corrosion has taken place on articles during storage before any use, it cannot be ascribed to the condensation of moisture from the air. The only possible explanation would seem to be that the articles must have been, at some time, wetted with ordinary water, or a similar solution, and stored without proper drying. No connection could be traced between the chemical composition of the metal and its liability to corrosion of the form (*b*). A coating of vaseline is advised, where possible, as this greatly reduces corrosion. It may be found advisable, with the same object in view, to anneal aluminium-ware, though this reduces its mechanical strength; or the sheet metal might be subjected to a less severe cold-rolling than at present.—R. W. N.

Aluminium methoxide and the coating of aluminium with metals. E. C. Szarvasy. Proc. Seventh. Int. Cong. Appl. Chem., London, 1909. Sect. X, 62—63.

Aluminium methoxide is formed as a gelatinous mass when an electric current is passed between aluminium and another metal (platinum, nickel, copper, tin, etc.) in absolute methyl alcohol; the formation is greatly accelerated by dissolving a small quantity of a metallic chloride in the methyl alcohol. The metal of the cathode is deposited on the aluminium, which is dissolved. This reaction has been successfully used to obtain smooth, adherent coatings of copper, tin, and nickel on aluminium, the article to be coated being immersed in a concentrated solution of the necessary metal chloride in methyl alcohol and a current passed.—T. F. B.

Lead, tin and antimony; The constitution of the ternary alloys of ——. R. Loebe. Metallurgie, 1911, **8**, 7—15, 33—49.

In the first part of this paper the various types of binary and ternary alloys, with the corresponding heat diagrams, are considered at length. For the construction of the diagram for the ternary alloys of lead, tin and antimony, 12 series of alloys were prepared and cooling curves taken. In each of eleven of these series, the amounts of two of the three metals were in the same ratio to each other, whilst the amounts of the third metal were varied from 0 to 100 per cent. of the whole. In the alloys of the twelfth series, the percentage of tin was kept constant and the relative amounts of antimony and lead were varied. The alloys were made from pure metals, about 30 grms. being taken for each experiment. The resulting diagrams represented that type of ternary alloys in which two components form three series of mixed cyrstals with each other, the third forming neither mixed crystals nor compounds with either of the other two. In the system lead—tin—antimony, the tin and antimony behave as a binary system, the lead acting solely as a solvent. It was not possible, however, to obtain results to satisfy all theoretical demands owing to the difficulties caused by the rate of diffusion lagging considerably behind the normal rate of cooling, and by the segregation arising from the great differences of specific gravity of the phases formed. Microphotographs of many of the alloys are given, and these fully confirm the conclusions arrived at from the thermal investigations.—T. St.

Vanadinite; Industrial treatment of —— *for the production of vanadic acid.* G. Gin. Proc. Seventh Int. Cong. Appl. Chem., London, 1909. Sect. X, 13—20.

The vanadinite used in these experiments, which was associated with apatite, contained 9·13 per cent. of vanadic anhydride, 53·5 per cent. of lead oxide, 4·76 per cent of cupric oxide, and 2·84 per cent. of phosphoric anhydride. The mineral is smelted in the electric furnace with 6 per cent. of its weight of carbon, which is sufficient to reduce the base metals, leaving the vanadium in the slag in the form of trioxide. From every 1000 kilos. of mineral there were obtained about 490 kilos. of lead and 35 kilos. of copper, together with 300 kilos. of slag containing 24 per cent. of vanadium trioxide. The slag is pulverised and gently heated in a current of air until all the vanadium trioxide is oxidised to tetroxide: at this stage, sodium carbonate and a little nitrate are added to complete the oxidation to vanadic anhydride; the mass is then fused, cooled, pulverised, and treated with boiling water, which dissolves the sodium metavanadate together with the phosphate, silicate, and aluminate. The cooled solution is treated with carbon dioxide to precipitate silica, and then ammonium carbonate is added and the solution concentrated until ammonium metavanadate is precipitated; the precipitation is assisted by the addition of ammonium chloride. The ammonium vanadate is washed, dried, again washed with water acidified with nitric acid, and calcined to obtain vanadic acid. The mothor liquors are treated with lime to recover ammonia and caustic soda. The energy consumption amounted to 300 kilowatt-hours per 1000 kilos. of mineral, which, at 2·5d. per kilowatt-hour, represents a total cost of about £263 (6600 fr.) per ton of vanadic acid produced from ore at £14 per ton. Where electric furnace treatment is inadmissible, it may be replaced by treatment in a water-jacket furnace, in which case the lead and copper are separated, and the slag is oxidised on the hearth of a reverberatory furnace and mixed with sodium carbonate and nitrate as before. The above process might prove too costly for ores containing only 9 to 10 per cent. of vanadic acid, since the recovery of the soda is never complete, so the process was modified as follows:—The vanadiferous slag is melted with sodium bisulphate in an iron or steel pan similar to those used in the Pattinson process or for making black-ash; when the reaction has ceased, the mass is run off on to plates of silicon-steel, pulverised, and digested with water in a wooden vessel supplied with an agitator, steam being introduced during the process. The copper, silver, and arsenic are precipitated from the solution by means of hydrogen sulphide, ammonia is added, and the iron and alumina are removed by further addition of hydrogen sulphide. The solution now contains the vanadium in the form of thiovanadate, which is converted into vanadium sulphide by neutralising with dilute acid; the sulphide is finally converted into vanadic acid by roasting. The total cost of one ton of vanadic acid, from the same mineral, was about £235 (5900 fr.). The costs given above do not take into account the values of the base metals produced, which should more than cover the cost of treatment.—T. F. B.

Eutectic alloys. C. H. Desch. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. IIIa, 109—111.

The mechanical properties of eutectic alloys are dependent on the manner in which the component crystals are interlocked. In some eutectics neither constituent exhibits definite crystal outlines, whilst in others the crystalline arrangement is due to one of the constituents. This is the case in alloys of copper and antimony in which the antimony determines the crystalline arrangement, and it would seem to be associated with the power possessed by some substances of forming crystal skeletons rather than small crystals. The author finds that free antimony is able to form fern-like growths, and in the presence of excess of antimony the eutectic structure has a definite orientation to these crystals. In the copper-silver alloys, and in copper containing oxygen the small rod like crystallites are rounded. This is considered to be due to the action of surface tension at the time of solidification.
—A. H. C.

Metals; Corrosion of ——. Report to the Corrosion Committee of the Institute of Metals. G. D. Bengough. Inst. of Metals, January, 1911. [Advance proof.]

This report has been prepared in order to give a comprehensive review of the present knowledge of the corrosion problem before starting any experimental work upon the subject, and is devoted to the study of brass containing 70 per cent. of copper and 30 of zinc as used for condenser tubes. The contributions of about fifteen authorities are discussed and while they nearly all attributo the corrosive action of sea water to electrolytic action, they are not unanimous in their selection of the voltaic couple and their views are often mutually contradictory. This is especially so in the case of cupric oxide, but there is a general agreement that the presence of cuprous oxide is harmful. With regard to the means of preventing corrosion, it is fairly agreed that :—(1). The tubes should be kept free from any solid deposit by cleaning at frequent intervals; (2). A protective coating of tin or other suitable substances should be used; (3). The access of stray currents to the tubes should be prevented; (4). The use of olive oil should be abandoned. The author believing that corrosion is essentially an electrolytic problem, then gives a general account of the ionic theory of solution, and restates the problem of corrosion from the ionic point of view. Two series of experiments are suggested. *Series I.*—Forty-eight condenser tubes, three feet in length, should be submitted to the action of sea-water by means of a plant of which the details are given. Not only is the water to be stagnant in some of them, but its speed in others is to be capable of variation, and the effects of the presence in the tubes of deposits of ferric oxide or basic chloride should be studied. Simultaneously with this main test, portions cut from the same tubes should be tested so that the rate of corrosion was accelerated by either (1), increasing the temperature of the corroding liquid, (2), using acids instead of salt water, or (3), by using a small external electromotive force. *Series II.*—A series of electrode potential experiments should be made upon both copper and brass, pure and with definite quantities of added impurities, in order to determine the effect of solution pressure, and also the depolarising action of the added substances.—A. H. C.

Amalgams containing silver and tin. R. A. Joyner. Chem. Soc Proc., 1911, **27**, 5.

The non-existence of any compound of silver with tin other than Ag_3Sn is confirmed. The "ageing" of filings of silver-tin alloy has been experimentally verified and investigated. The composition of saturated liquid amalgams of tin, of silver, and of tin with silver has been determined at a number of temperatures, and the equilibrium diagram representing the ternary systems existing below 63° C. has been ascertained. No ternary compound exists at these temperatures, and the stable solid phases are the compound, Ag_3Hg_4, and a solid solution containing a small amount of mercury dissolved in tin. No solid solution exists between these two solid phases. The alloys of silver with tin are thus completely decomposed by the action of excess of mercury. At higher temperatures a ternary compound is formed.

Colloidal mercury. C. Amberger. Z. Chem. Ind. Kolloide, 1911, **8**, 88—93.

By reduction of dilute mercurous nitrate solution with hydrazine or hydroxylamine in presence of an alkaline solution of lysalbinic or protalbinic acid (see Paal, this J., 1902, 994, 995, 996), a liquid hydrosol of mercury is obtained which appears opaque and bluish-grey by reflected light and transparent and reddish-brown by transmitted light. It is, however, not stable, decomposing even when dialysis is attempted. A solid hydrosol, soluble in water, can be obtained by precipitating the colloid from the liquid hydrosol by means of acetic acid, dissolving the precipitate in the smallest possible quantity of alkali, and rapidly evaporating the solution *in vacuo*. In this way, using lysalbinic acid, a product having the colour of metallic mercury and containing up to 92·6 per cent. of mercury can be obtained, but its solubility diminishes from day to day. Glistening black products of lower mercury content (50 per cent.), obtained by using protalbinic acid, however, remain unaltered for months; but when dissolved in water, the solutions are not stable. Colloidal mixtures of mercury and mercuric sulphide obtained in a similar manner, but using sodium hydrosulphite as reducing agent, are much more stable, both in the solid form and in solution, than the products containing only colloidal mercury, and this is attributed to a protective action exerted by the colloidal mercuric sulphide.—A. S.

Metals; Solubility of colloidal —— in distilled water in presence of air and in a vacuum. M. Traube-Mengarini and A. Scala. Atti R. Accad. dei Lincei, Roma, 1910, [5], **19**, II., 505—508. Chem. Zentr., 1911, **1**, 281—282. (See this J., 1910, 700.)

In presence of air, distilled water attacks aluminium on warming, and zinc and iron even in the cold, colloidal solutions being produced. In a vacuum lead and iron, the only metals examined, also yield colloidal solutions with distilled water. The solutions become turbid on standing in the air, the iron solution becoming first greenish and then reddish, whilst in the lead solution a white turbidity is produced. From the iron solution, after some time, even in a vacuum, black, greenish, and red particles separate, but the greenish particles gradually become red.
—A. S.

Combustion of gases without flame. A new property of copper. Meunier. *See* IIa.

Separation and determination of zinc. Piperaut and Vila. *See* XXIII.

Patents.

Electro-deposition of metals; Apparatus for the ——. T. A. Smith and T. Deakin, Walsall, Staffs. Eng. Pat. 7224, March 23, 1910.

The apparatus is of the form in which an inclined barrel, in the electrolytic tank, carries the work, the barrel being provided with fittings, at its upper end, comprising a hollow, non-conducting shaft carrying a cross-bar, by means of which it may be attached to and easily detached from the barrel. The outer end of the shaft carries part of the driving gear, and a detachable bearing on the tank supports the shaft and the other part of the driving gear. Passing through the shaft is an axial conducting rod. detachably connected at its outer end with a negative conductor carried by the tank, and at its inner end suitably arranged for conductive connection with the work, so that it may be easily detached from the barrel. All the fittings at the upper end of the barrel may be detached in one piece, thus giving free access to the open end. and providing for easy handling of the work.—B. N.

Metals ; Electrolytic deposition of —— and more particularly of gold and silver on all non-conducting bodies. J. A. Honoré. Fr. Pat. 419,814, Nov. 4, 1909.

The objects are covered, before receiving the metallic deposit. with a layer of a composition formed from betuline, dammar resin, boiled linseed oil, and oil of turpentine. When the objects are of wood, or other porous material. a layer of another composition. formed from Judæa bitumen, marine glue, boiled liquid paraffin, and oil of turpentine is applied previously.—B. N.

[*Tungsten*] *Ores ; Treatment of* ——. C. M. Johnson, Avalon. Pa., Assignor to Crucible Steel Co. of America. U.S. Pat. 977,096, Nov. 29, 1910.

The patent relates to the preparation of tungsten ores for use in steel manufacture, and the process consists in subjecting the finely powdered ore to the action of a pre-determined quantity of charcoal (or other carbonaceous matter) in a reducing furnace. The product so obtained is added to the steel direct, the iron content of the tungsten ore being thus utilised, while manganese, silica, etc., are fluxed away. Ores containing sulphur, arsenic, etc., are roasted before reduction ; scheelite (calcium tungstate) is not suited to the process.—W. E. F. P.

Babbit material. J. L. Jones, Oakmont, Pa., Assignor to Westinghouse Electric and Manufacturing Co., Pa. U.S. Pat. 981.767, Jan. 17, 1911.

Claim is made, in general, for material consisting of lead or lead alloy (new or scrap) with a small percentage of vanadium ; and in particular for the alloys of which the percentage compositions are as follow : (*a*) Lead $83\frac{1}{3}$. tin $8\frac{1}{3}$, antimony $8\frac{1}{8}$, vanadium approximately $\frac{1}{4}$. (*b*) Tin $8\frac{1}{3}$, antimony $8\frac{1}{8}$. vanadium between $\frac{1}{100}$ and $\frac{1}{2}$, and the remainder lead.—W. E. F. P.

[*Copper*] *Smelting process and apparatus therefor.* R. Fleming, New Rochelle, N.Y. U.S. Pat. 981.850, Jan. 17, 1911.

A comparatively long and narrow layer of molten matte is formed in an enclosed, horizontal chamber, under controlled conditions of heat and oxidation, and is maintained in a molten condition by means of a heating current passing longitudinally through it. The sulphide copper ore is charged into the chamber through hoppers, and forms a series of conical heaps along the path of the heating current, but extending above the level of the matte and being out of contact with the walls of the chamber. By the combustion of the volatilised sulphur the exposed portion of the ore receives a preliminary heating, and is finally smelted by the heating action of the current, means being provided for the removal of the matte and slag produced.—W. E. F. P.

Aluminium and copper alloys ; Process of making ——. J. G. and W. F. Mellen, Bridgeport, Conn. U.S. Pat. 982.218. Jan. 17, 1911.

The copper (or other "foundation metal") is heated to a temperature above its melting point, and the aluminium added. An addition of oxidising agent and flux (such as potassium bichromate and borax respectively) is then made, and the mixture stirred and skimmed, after which a deoxidising agent, and finally ammonium chloride, are added.—W. E. F. P.

Sulphide ores ; Process for roasting ——. C. W. Renwick, Isabella, Tenn. U.S. Pat. 981.880, Jan. 17, 1911.

During its downward passage through a series of superposed, heated chambers, the ore is subjected, alternately, to the action of an upward current of heated air or oxygen, and to that of the sulphurous gases resulting from the operation. The latter action is effected either by conveying the gaseous products from the uppermost to the lowest chamber. or by causing them to return through the series of chambers in the same direction as that of the ore. —W. E. F. P.

Zinc ores ; Process of desulphurising ——. A.-G. für Bergbau, Blei- und Zinkfabrikation zu Stolberg und in Westfalen. Ger. Pat. 229,528, Sept. 1, 1908.

The feature of the process is the combined use of a blast and movement of the ore during the roasting.—A. S.

Ferroboron ; Method of producing ——. C. A. Hansen, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 982,135, Jan. 17, 1911.

The process consists in heating a boron compound (such as colemanite) with a mixture of silicon and metallic iron, or with ferro-silicon, to a temperature of about 2000° C. —W. E. F. P.

Furnace ; Electric arc —— for the production and refining of electro-steel and method of working the furnace. Ges. für Elektrostahlanlagen m.b.H. Fr. Pat. 419,551, Aug. 20, 1910.

Induction resistances are intercalated in the electric circuit, with the object of diminishing harmful influences on the generator, such as great variations of the current and short-circuiting of the arcs. These influences are not objectionable during the production of the steel, and during this time the resistances are not put in circuit.—B. N.

Ores ; Process and apparatus for the electrical reduction of ——. O. Frick. Ger. Pat. 229,171, Sept. 29, 1909.

The invention relates to furnaces of the type in which the charge descends a shaft and falls into a smelting chamber below, in such a way that one or several free surfaces, not in contact with the furnace walls, are formed. The electrodes project into the smelting chamber against these free surfaces. According to the present patent, in order to prevent excessive consumption of the electrodes and to render the distribution of the heating effect of the current more uniform, the electrodes are surrounded by charcoal in small pieces. Besides the main shaft of the furnace, auxiliary shafts are provided through which the charcoal is supplied, and which also serve as conduits for the introduction of the electrodes. The auxiliary shafts are provided with gas-outlets for the reduction products, these being at such a distance from the reduction zone of the furnace, that the temperature of the gases or vapours escaping through them is higher than the condensation point of any reduced metal vapour present. —A. S.

Alkali metal from its alloys ; Process for separating an ——. R. J. McNitt. Fr. Pat. 419,830, Aug. 29, 1910. Under Int. Conv., Sept. 9, 1909.

The alkali metal is separated from its alloys, *e.g.*, a sodium-lead alloy. by distillation in vacuum, so as to work at low temperatures and under satisfactory economic conditions. —B. N.

Briquetting fine ore and other materials ; Process for ——. M. Glass. Vienna. Eng. Pat. 28,829, Dec. 9, 1909.

See U.S. Pats. 958,623. 958,700, and 958,701 of 1910 ; this J., 1910, 764.—T. F. B.

Pyrophoric alloys. L. Goldberg, Berlin. Eng. Pat. 684, Jan. 10, 1910.

See Fr. Pat. 419,388 of 1910 ; this J., 1911. 136.—T. F. B.

Furnaces; Electric ——. J. H. Reid, Newark, N.J., U.S.A. Eng. Pat. 1189, Jan. 17, 1910.

See Fr. Pat. 411,583 of 1910; this J., 1910, 958.—T. F. B.

Aluminium and its alloys; Processes for pickling —— prior to coating. W. P. Thompson, Liverpool. From Mix und Genest Telephon- und Telegraphenwerke, Berlin-Schönberg, Germany. Eng. Pat. 13,012, May 28, 1910.

See Fr. Pat. 415,123 of 1910; this J., 1910, 1315.—T. F. B.

Metalliferous materials; Method of treating ——. C. F. Siegert, Jeppes, Transvaal. U.S. Pat. 981,696, Jan. 17, 1911.

See Fr. Pat. 404,754 of 1909; this J., 1910, 283.—T. F. B.

Tin scraps; Process of detinning ——. C. von der Linde, St. Tönis, Germany. U.S. Pat. 981,775, Jan. 17, 1911.

See Fr. Pat. 419,280 of 1910; this J., 1911, 136.—T. F. B.

Magnesium-zinc alloy. W. Rübel, Berlin. U.S. Pat. 982,022, Jan. 17, 1911.

See Fr. Pat. 407,814 of 1909; this J., 1910, 636.—T. F. B.

Gold-leaf; Composition for making ——. L. Kurz, Fuerth, Germany. U.S. Pat. 982,370, Jan. 24, 1911.

See Eng. Pat. 28,081 of 1908; this J., 1909, 608.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Electrolytic reduction of tungstic acid. Rosenheim. *See* VII.

Patents.

Furnaces; Electric ——. M. Ruthenburg, London. Eng. Pat. 20,404, Sept. 1, 1910.

The furnace is of the kind in which the material under treatment is subjected to the action of a magnetic field during fusion, and is provided with electrodes in the form of magnet poles of square or angular cross-section. One of the poles forming the electrodes is connected with the electro-magnetic part of the circuit by an insulated joint, which allows of the distance between the edges or corners of the two electrodes being varied. One or both poles may be rotated, so as to bring corners of the poles into adjacent relationship to one another for the production of an intense magnetic field.—B. N.

Furnace; Electric ——. C. Hering. Fr. Pat. 419,715, June 28, 1910. Under Int. Conv., July 6, 1909.

The furnace has a bath of melted material, and an electric current, proportioned with reference to the transverse section of the material, is passed through a mass of molten material in communication with the bath, thus producing in an automatic manner a continuous agitation of the material, owing to the so-called "pinch" effect. The electrode is provided with a resistance, such that the heat developed in the electrode, by the current transmitted through it, is equal to double the loss of heat by conduction through the electrode when the current is not passed. In a modified form of the process, one or more arcs are introduced into the furnace between parts of the melted material.—B. N.

Electrodes in electric furnaces; Regulating ——. J. H. Reid. Fr. Pat. 419,892, Aug. 31, 1910. Under Int. Conv., Jan. 13, 1910.

The furnace is provided with several electrodes, each of which is connected in a permanent manner by means of gearing with a spindle driven by a motor. Between the spindle and the electrode is an electromagnetic connection, provided with two electromagnets which are controlled by the current which traverses the electrodes. If the current rises too high, one electromagnet is brought into action, causing the movement of the armature in one direction and through the gearing a corresponding movement of the electrodes, and if the current falls, the second electromagnet is brought into action automatically and the electrodes are moved in the opposite direction.—B. N.

Coils and the like; Filler for ——. G. H. Rupley, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 981,798, Jan. 17, 1911.

The filler, for oil-immersed transformer windings, is composed of 25 per cent. of carnäuba wax and 75 per cent. of copal gum.—B. N.

Galvanic element with depolariser, containing new compounds of manganese very rich in oxygen. C. F. G. A. Heil. Fr. Pat. 419,770, Aug. 22, 1910. Under Int. Conv., Jan. 4 and March 14, 1910.

The element contains dark brown manganic hydroxide, $Mn(OH)_3$, or black peroxidised hydroxide, $MnO(OH)_2$, both of great electrical conductivity. A mixture of the above may be employed, or other depolarisers to which a quantity of the hydroxides have been added.—B. N.

Insulating layers of oxides or salts; Process for preserving —— on wires, ribbons, or bobbins, principally of aluminium or alloys of aluminium. Specialfabrik für Aluminium-Spulen und -Leitungen Ges. m. b. H. Fr. Pat. 419,961, Sept. 2, 1910. Under Int. Conv., Sept. 4, Oct. 7 and 14, 1909, and April 25, 1910.

The material, in a sufficiently liquid state, is introduced into the bobbins, after the metal has been already oxidised, and if necessary covered—with the aid of external increased pressure or by employing a vacuum. The material is allowed to harden, before introducing the bobbins into motors or magnets, to a high degree of mechanical resistance. The wires may be covered during the winding by using a soft material as a covering, and a viscous liquid so that it is not expelled from between the coils of wire by the pressure during the winding. The metallic surface may be treated with a protective material, which acts simultaneously chemically, such as a varnish or oxidising paint, or the metal may be treated with an oxidising liquid and then covered with varnish or paint.—B. N.

Electric-arc reactions on gases; Means for ——. O. Weber and G. Schreiber, Griesheim, Assignors to Chem. Fabr. Griesheim-Elektron, Frankfort-on-Maine, Germany. U.S. Pat. 981,727, Jan. 17, 1911.

See Ger. Pat. 228,422 of 1909; this J., 1910, 1462.—T.F.B.

Electrical effluvia; Apparatus for producing and utilising ——. L. Gerard, Brussels, Assignor to Gerard Ozone Process Co. U.S. Pat. 982,587, Jan. 24, 1911.

See Eng. Pat. 1253 of 1908; this J., 1909, 610.—T. F. B.

Electrolytic cell. J. R. Crocker, Assignor to McDonald Electrolytic Co., New York. U.S. Pat. 982,037, Jan. 17, 1911.

See Fr. Pat. 412,054 of 1910; this J., 1910, 1010.—T. F. B.

XII.—FATS; OILS; WAXES.

Lipolytic enzyme in sweet almonds. M. Tonegutti. Staz. sperim. agrar. ital., 1910, **43**, 723—734. Chem. Zentr., 1911, **1**, 332.

If 5 grms. of powdered almond kernels be allowed to stand in contact with 10 c.c. of chloral solution at 35° C., the acidity of the solution increases up to a certain limit, but no such increase takes place if the almonds be previously dried at 100° C. The production of acid must therefore be due to a lipase. In a further series of experiments, 4 grms. of powdered almonds, 5 c.c. of a fatty oil, and 10 c.c. of chloral solution were made into an emulsion and allowed to stand, with and without addition of 3 c.c. of $N/10$ sulphuric acid. The increase of acidity (expressed as c.c. of $N/10$ potassium hydroxide) in 6 hours, with almonds of seasons 1908 and 1909 respectively, was: without sulphuric acid—almond oil, 5·7 and 8·6; olive oil, 10·3 and 9·9; castor oil, 16·0 and 13·5; with sulphuric acid—almond oil, 11·5 and 14·5; olive oil, 9·5 and 10·0; castor oil, 18·5 and 20·0. The lipolytic activity of the almonds increases considerably on germination. A mixture of 5 grms. of almonds, 5 grms. of olive oil and 10 c.c. of chloral solution required 4 c.c. of $N/10$ potassium hydroxide immediately after preparation, and 12·5 c.c. after 4 hours. The same mixture with the addition of 1 grm. of germinated almonds required 5 c.c. immediately after preparation and 33·5 c.c. after 4 hours. Emulsin was found to possess no lipolytic activity either in acid or alkaline solution.—A. S.

Cholesterol and fatty acids. J. R. Partington. Chem. Soc. Proc. 1911, **27**, 14.

The solids separating from a fused mixture of cholesterol with palmitic, stearic, or oleic acid are found, by an examination of the freezing-point curves, to be either pure substances, or mechanical mixtures of these substances, and not compounds, as has been previously assumed.

Waxes of the Coniferae. J. Bougault. J. Pharm. Chim., 1911, **3**, 101—103.

A small quantity of thapsic acid (this J., 1910, 576), m. pt. 124° C., has been found in the wax of *Juniperus sabina* in addition to juniperic and sabinic acids. The "etholides" of the wax of *Thuya occidentalis* have been hydrolysed and were then found to contain sabinic acid, hitherto found only in the wax of *Juniperus sabina*.—F. Shdn.

Soaps in solution; Studies of the constitution of ——. The electrical conductivity of sodium stearate solutions. R. C. Bowden. Chem. Soc. Proc., 1911, **27**, 5.

At 90° C. the equivalent conductivity of sodium stearate in aqueous solution is about half that of sodium acetate, being 88·3 mhos in a weight-normal solution, about 77 for solutions between $N/2$- and $N/20$-, but rising to 125·9 in $N/100$-solution. It is considered that these measurements demonstrate the presence of a high concentration of free electrolyte in solutions of sodium stearate. The change in conductivity with the dilution differs from that in solutions of sodium palmitate, but it is not less remarkable. Attention was drawn to the connexion between these phenomena and the analogous behaviour of certain non-aqueous solutions as well as to the salting out from soap solutions of acid sodium salt by means of concentrated solutions of sodium hydroxide.

Value of certain paint oils. Gardner. *See* XIII.

Patents.

Olive oil and other vegetable oils; Method of extracting ——. G. Quintanilla. Fr. Pat. 419,207, June 7, 1910.

The extraction is effected in essentially the same manner as in the "Acapulco" process claimed in Fr. Pat. 365,187 of 1906 (this J., 1906, 938), with the exception that a current of air is made to pass through the apparatus in such a way as to produce a partial vacuum. A shaft passes through the middle of the extractor and is provided with a crank carrying several brushes formed of copper spirals, which act upon the mass to be extracted and keep the filtering gauze clean. This gauze, which is preferably of nickel, is fixed to a perforated false bottom, which, like the rest of the apparatus, may be made of aluminium. A special arrangement is also provided at the side for the removal of the olive stones.—C. A. M.

Waxes of every kind; Purification and decolourisation of ——; and process for decolourising solid and semi-solid fats of every description. R. Schilling. Fr. Pats. 419,784, Aug. 27, 1910 (under Int. Conv., Dec. 23, 1909), and 419,785, Aug. 27, 1910 (Under Int. Conv., May 10, 1910).

Waxes, resinous bodies or solid or semi-solid fats are treated, either in the melted state or in solution, with aluminium oxide obtained from an aluminium amalgam, to effect decolourisation. The melted waxes, etc., may be filtered through a layer of the oxide, preferably heated, or they may be mixed therewith, and subsequently separated by filtration or by allowing the oxide to deposit.—C. A. M.

Rosin soap; Process for the manufacture of ——. F. S. Havens, Hartford, Conn., Assignor to Harrison Bros. and Co., Inc., Philadelphia, Pa. U.S. Pat. 981,647, Jan. 17, 1911.

Desiccated rosin soap is manufactured by dissolving rosin in a non-aqueous solvent, adding to the solution a smaller proportion of a non-aqueous solution of caustic soda, and evaporating the solvent from the solution of rosin soap thus obtained.—E. W. L.

Soaps containing mercury compounds; Production of ——. Farbenfabriken vorm. F. Bayer und Co. 1st Addition, dated Aug. 23, 1910 (Under Int. Conv., Sept. 3, 1909), to Fr. Pat. 402,740, May 5, 1909 (this J., 1909, 1211).

The mercuric substitution compounds of carboxylic acids of the aliphatic or aromatic series may be incorporated in the free state or in the form of anhydrides with the soaps, and it is not necessary to use them in the form of their alkali salts as previously claimed.—C. A. M.

Carbon tetrachloride and other halogenated hydrocarbons; Process for rendering —— soluble in dilute soap solutions. G. Fendler and L. Frank. Fr. Pat. 419,235, July 18, 1910. Under Int. Conv., July 19, 1909.

Hydrocarbons or their halogen derivatives are emulsified with small quantities of soap (preferably potash soap) or similar substances (*e.g.*, extracts containing saponin), and the emulsions thus produced are dissolved in solutions of soap of such dilution that the halogenated or other hydrocarbons would not dissolve alone. For example, 100 grms. of oleine are dissolved in 10 kilos. of carbon tetrachloride, and the solution is emulsified with the calculated quantity of a 2 per cent. solution of caustic potash, 50 to 100 grms. of the product are then dissolved in 10 litres of a 0·5 — 1 per cent. soap solution.—T. F. B.

Carbon tetrachloride, tetrachloro-ethane, and their derivatives, as well as benzine; Process for rendering —— soluble in, or emulsifiable with water. A. Schmitz. Fr Pat. 419,649, Aug. 25, 1910.

Carbon tetrachloride, tetrachloro-ethane, etc., is heated with an alkali salt of a mono- or dihydroxylated fatty acid or of a resin, with addition of free alkali if necessary, at 40°—100° C., until the product dissolves in or emulsifies with water. For example, 50 kilos. of a salt of an hydroxylated acid are heated with 15 kilos. of tetrachloro-ethane at 40°—100° C., sufficient alkali being added to render the solution alkaline to phenolphthalein: the heating is continued till the mixture emulsifies with water, when 35 litres of distilled water are added. The products are intended for use in cleansing textiles, etc.—T. F. B.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Ochres and coloured earths. M. Meyer and P. Bonomi da Monte. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. II., 199—204.

French ochres are produced in the Departments of Yonne and Vaucluse, chiefly in the neighbourhood of Auxerre and of Apt. The red ochres are mostly made by calcining the yellow earth, except for a small quantity obtained near Apt. French yellow ochres, even the darker kinds, are always lighter-coloured than the Italian earths; the French red ochres have also a lighter colour than the Italian earths, but the colour of the latter is brighter. The results of the analysis of two samples of French ochre are given in tables, together with those of three samples of Sienna ochre and three of Verona ochre. The ferric oxide in all cases appears to be present as limonite, $2Fe_2O_3,3H_2O$, and whilst in the Sienna earths the whole of the combined water is united to the ferric oxide, in the Verona and French earths, a portion is also united to the alumina and silica in the form of clay substance. The French ochres contain less ferric oxide and also a smaller amount of insoluble silicates after disaggregation than the Italian earths, but a much larger proportion of clay substance (about 70 per cent.) than the latter (less than 10 per cent.). When mixed to form oil paints, the amount of oil required to give a paint of a given density is inversely proportional to the specific gravity of the earth in the case of yellow orches. The colour of the dried paint is the same as that of the original earth in the case of French yellow ochres, but browner in the case of the Sienna and especially of the Verona earths, owing to their larger content of dark-coloured insoluble silicates; the same rule holds in the case of the calcined red ochres, but the differences are not so pronounced. In oil paints, the Sienna earth has the greatest covering power, but the French ochre is not much inferior. The covering power varies directly with the content of ferric oxide, and inversely with the content of lime, magnesia, potash, and insoluble silicates. Hence the Verona ochre though much richer in ferric oxide than French ochre has only about the same covering power, owing to its much higher content of the other substances mentioned. When mixed with lime and water to form water colours, the dried coatings in all cases have the same colour as the original earths, no darkening being observed as with oil paints. In the case of the yellow ochres, the covering power of the water colours is inversely proportional to the specific gravity of the earth, being greatest with the French and least with the Verona ochres. In the case of red ochres, the Sienna earths are the best, and the Verona earths the worst, the covering power varying directly with the content of ferric oxide. (See also this J., 1898, 508; 1900, 943; 1901, 83, 770; 1904, 844.)—A. S.

Cobalt oxide; Use of —— for making pigments. J. J. McEachern. Mining World, Chicago, 1911, **34**, 71—73.

SINCE the discovery of the Ontario silver-cobalt deposits, the production of cobalt oxide has greatly increased, and the successful treatment of a complex lead-copper-zinc-cobalt ore mined in Missouri has still further augmented it, so that at present the production is considerably greater than the consumption. The price of cobalt oxide has fallen from 2·02 dollars (8s. 5d.) per lb. in 1906 to about 80 cents (3s. 4d.) per lb. at the present time. At the latter price, green cobalt pigments could probably be manufactured at such a cost as to compete with the better class of green pigments in common use. Blue cobalt pigments, on the other hand, could not be made so cheaply as to compete in price with ultramarine blue of the first quality, but could do so if the price of cobalt oxide fell to 50 cents (2s. 1d.) per lb. At either price for cobalt oxide, the blue cobalt pigments would be cheaper than Prussian blue, but their colouring power would not be so good as that of the latter. The cobalt blue pigments are more permanent than either ultramarine or Prussian blue, and are not affected by other materials in the paint composition. —A. S.

Paints; Submarine and fire-proof ——. C. Coffignier. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. IVA1, 96—101.

A GREAT advance in the manufacture of submarine paints was made by Holzapfel in 1895. He employed two coats, the first being anticorrosive and the second containing toxic salts in a suitable vehicle. The interaction between the salts, however, and their gradual hydration, produced changes of volume which led to cracking, and the paints lasted only about six months. The Soc. de Prod. Chim. de Vernier has produced a paint of which the outer coat contains no ready-formed salts, but an amalgam of copper, together with an earthy pigment in a waterproof vehicle. When this coat begins to be attacked by marine organisms, the amalgam becomes exposed and local voltaic currents are set up which produce toxic salts of copper and mercury. This action occurs only in the places where it is required, and the paint will last for 12—18 months.

The action of a fire-proof paint depends on the evolution of ammonia, but the solubility of ammonium salts makes them unsuitable as ingredients. The best results have been obtained by using the insoluble ammonium magnesium phosphate (see Terrisse and Coffignier, this J., 1909, 1050) together with the pigment, and a special vehicle consisting of linoleate of lead in benzene or oil of turpentine.—J. H. L.

Paint oils; Value of certain ——. H. A. Gardner. J. Franklin Inst., 1911, **171**, 55—72.

IN the drying tests here described the oils were exposed in the lids of tin canisters about 3 inches in diameter so as to obtain films corresponding more closely than the ordinary films on glass with the layers of paint in practice. The covers containing the test samples were placed on perforated shelves in a box which had glass sides and was provided with an opening through which passed a continual current of air previously dried by means of sulphuric acid. The oxygen absorption was determined by ascertaining the increase in weight at intervals during a period of 20 days, and similar tests were made in a current of moist air. It was found that the proportion of lead or manganese driers that gave the best results with linseed oil also gave the best results with soya bean oil. In parallel experiments in which zinc and lead paints were prepared from these oils without driers, the linseed oil paints were practically dry in less than two days, whereas the soya bean oil paints took four days to form a skin, and then remained "tacky" for a long period. In the case of mixtures of the two oils however, a moderate proportion of soya bean oil did not appear to have any injurious effect upon the drying of the paints. Since tung oil forms a soft opaque film on oxidation, special processes are required to render it suitable for ordinary paints or varnishes. The author has found that lead tungate, precipitated from saponified tung oil with lead acetate, yields, when dried and fused with a small proportion of colophony and borate, a drier that gives a perfectly transparent film. The samples of menhaden oil examined (iodine values 149 to 164) were found to dry fairly rapidly, and it is suggested that the high proportion of stearin in this oil may account for its waterproofing properties and render it suitable for the protection of iron and steel. The so-called "waste oil," or mixture of fats and fatty acids obtained from the garbage in large cities, was found to be of little value as a paint oil; but it is suggested that it might be found of use, in admixture with linseed oil, for coating iron and steel submerged in sea water with a soft elastic waterproof film. In practical field tests a white paint consisting of 45 per cent. of corroded white lead, 45 per cent. of zinc oxide, 5 per cent. of asbestine, and 5 per cent. of calcium carbonate, incorporated with linseed oil proved very satisfactory when applied to fences. The same pigment incorporated with 50 per cent. of linseed oil and 50 per cent. of a product sold as "pine oil" also gave a very white paint of excellent properties. This "pine oil" was a colourless liquid (b.p. 210° C.) obtained in the manufacture of wood turpentine. It had good penetrating properties and was nearly free from the disagreeable odour of many products of low boiling point. When mixed with 10 per cent. of a lead and manganese linoleate drier, it dried on glass in 2½ hours, forming a durable film. With regard to the most suitable proportions of driers, experiments with a pure linseed oil showed that an increase in the percentage of lead oxide caused a relative increase in the oxygen absorption, but that a very large percentage caused the film to form a leathery skin. Manganese oxide caused a more pronounced absorption of oxygen than lead oxide during the first few days, whilst an increase in the proportion of manganese up to a certain point (0·02 per cent.) caused an increase in the absorption of oxygen, but further additions beyond that amount were apparently valueless. The films were harder and more brittle than in the case of the oils containing lead oxide. Oils containing a large proportion of manganese absorbed oxygen very rapidly, so that the surface of the film became coated with a skin, beneath which the drying continued very slowly. Any excess of manganese beyond 0·02 per cent. caused brittleness and the so-called " burning-up " of the film. Similarly in the case of lead driers any excess of lead beyond 0·5 per cent. did not improve the drying property, and caused the film to be brittle. The drying of oils containing lead oxide was less affected by conditions of moisture in the atmosphere than in the case of oils containing manganese, though frequently the lead oxide oils were the better in a dry atmosphere. In general, varnishes rich in manganese dried more rapidly in dry air, whilst those containing only a small proportion of manganese dried more rapidly in moist air. In the experiments with mixed driers the best results were obtained with a combination of 0·5 per cent. of lead linoleate and 0·02 per cent. of manganese linoleate.—C. A. M.

Oil paintings ; Photochemical deterioration of ——. M. Toch. Proc. Seventh Int. Cong. Appl. Chem., London, 1909. Sect. IX., 31—35.

The deterioration of oil paintings is due to the action of white lead on the colouring matter contained in the linseed oil. Bleached linseed oil when mixed with zinc oxide and kept in the dark, also turns yellow. Similar experiments on mixtures of white lead and zinc white with the colouring matter of flax seed, grass, and the fossil resins, with and without linseed oil, all had the same result, *viz.*, a darkening of the mixture. When gum dammar was mixed with the pigment, only slight decomposition was observed in presence of turpentine, and none in presence of naphtha and small quantities of benzene. When used for painting, a dammar as nearly colourless as possible should be selected. If linseed oil has to be used, the raw unbleached product should be chosen. Poppy-seed and walnut oils do not become yellow so rapidly as linseed oil, but they are slower in drying. Further experiments with linseed oil indicated that paintings which had become discoloured with age, could be permanently restored to their original brilliancy by exposure to sunlight, providing that they contained no asphaltum or bitumen. (See this J., 1908, 311.)—T. F. B.

Turpentine and turpentine substitutes. Chem. Trade J., Feb. 4, 1911. [T.R.]

The United States Consuls at London, Liverpool, Johannesburg, and Berne have recently made inquiry into the markets for turpentine or its substitutes in their respective consular districts. Their reports follow:—

London.—There are a number of substitutes for turpentine upon the English market, the price ranging, according to a local dealer, from 1s. to within a few pence of the price of pure spirits of turpentine. The bulk of these substitutes is sold direct to the painters and paint manufacturers. The manufacture of these substitutes has been in progress for a long time, and is particularly active when the price of turpentine goes above 50 cents per gallon in the United States. The imports of turpentine into the United Kingdom during 1909 amounted to 589,880 cwt., valued at £681,122. Of this amount the United States furnished 476,484 cwt., valued at £595,977 ; Russia, 77,382 cwt., valued at £48,517 ; France, 31,084 cwt., valued at £30,024 ; Germany, 2,290 cwt., valued at £1,280 ; and other countries, 2,640 cwt., valued at £5,350.

Liverpool.—Regarding the prospects of introducing a turpentine substitute into this market, it appears from inquiry made of several firms in Liverpool, that substitutes for turpentine are manufactured by many of the distillers in this locality. A substitute which is well thought of by the trade, and which is manufactured in this country, commands a good sale at the price of £27 10s. per ton f.o.b. Liverpool. The imports of turpentine into Liverpool from the United States in 1909 amounted to 48,422 cwt., valued at £78,170.

South Africa.—There is considerable sale for turpentine substitutes in this market owing to the prevailing high price of turpentine. With good local agencies a satisfactory trade might be established. Shipment of goods of this description must be in tins and not in barrels. The packing is usually in tins of 5 galls. each and smaller, as required.

Switzerland.—The imports of turpentine oil into Switzerland in 1909 amounted to 3,044,260 lb., distributed among the following countries : United States, 13,660 ; Belgium, 8,150 ; France, 1,518,000 ; Spain, 1,515,000 ; Austria-Hungary, 440 ; England, 660 ; Germany, 5,950 ; and Italy, 2,400. The average price delivered at the Swiss boundary was 65s. per 100 kilos. There is no Customs duty. The oil is usually shipped in metal receptacles containing 352·7 lb., and its specific gravity is 0·900.

Separation and determination of zinc. Piperaut and Vila. *See* XXIII.

Patents.

Lead paints and process of manufacturing the same. A. S. Ramage. Fr. Pat. 419,470, Aug. 17, 1910. Under Int. Conv., Jan. 3, 1910.

Basic compounds of lead, such as red lead, basic lead carbonate, etc., are treated with a saturated organic acid, preferably a higher acid of the fatty acid series (*e.g.*, stearic acid), so that part at least of the oxygen or hydroxyl in their molecules is replaced by the acid radical. Thus the solution of an alkali salt of, *e.g.*, stearic acid, may be treated with a basic lead pigment, and the resulting product washed, dried, and incorporated with linseed oil. Pigments thus prepared remain well in suspension in the oil, and the paints dry well and with a good lustre.—C. A. M.

Lead carbonate ; Process for the manufacture of basic —— *from impure lead oxide or products containing lead oxide.* H. Hof and B. Rinck. Ger. Pat. 229,422, June 22, 1909.

The material is extracted with a boiling concentrated solution of magnesium chloride (*e.g.*, the final mother liquor obtained in the manufacture of potassium salts), and the solution is cooled. The mixture of lead-magnesium chloride and magnesium oxychloride which separates, is drained with the aid of suction, and treated with water, whereby the double salt is completely and the magnesium oxychloride is partly decomposed. After filtering, the residue is mixed with water and treated with carbon dioxide at about 80° C. until the whole of the lead is converted into basic carbonate, which is freed from magnesium chloride, etc., by washing with hot water. The product is stated to be pure white in colour, free from chlorine compounds, and to possess a high covering power. (Compare Ger. Pats. 226,245 and 227,389 ; this J., 1910, 1321, 1379.)—A. S.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Rubber in vulcanised rubber goods ; Direct determination of ——. G. Hübener. Chem.-Zeit., 1911, **35**, 113—115. (See this J., 1911, 98.)

The author finds that the presence of bituminous substances such as asphaltum and " mineral rubber " results in high values for rubber content being obtained in his tetrabromide method. This is due to the fact that these hydrocarbons form bromine-derivatives which are insoluble in water. These bromine compounds are, however, soluble in a mixture of equal parts of absolute alcohol and carbon tetrachloride, whereas the rubber bromide is insoluble, and by extracting the bromide with such a mixture it is found that the error is eliminated. In answer to Becker's criticisms (this J., 1911, 142) the author confirms his previous statements, admitting, however, that, as pointed out above, the presence of bitumen has an influence on the results. The oily product obtained by the action of bromine on substitute present in mixings does not contain combined bromine, and any free bromine is removed by washing with hot water. By the statement that gutta-percha does not form an insoluble bromine derivative (under the conditions of the analytical process) was meant either that no bromine derivative was formed, or that, if formed, it was decomposed by the action of the acids (sulphuric and possibly sometimes nitric) formed by oxidation.

Moreover pure gutta was not referred to, but the gutta-percha of commerce, and taking the percentage of hydrocarbon, $C_{10}H_{16}$, present in such a sample, determined by Budde's method, to be 18·79 per cent., and the percentage of gutta-percha in the mixing to be 10 per cent., the result could only be affected to the extent of 1·88 per cent. The results obtained in presence of gutta-percha were certainly some 0·5 to 1·0 per cent. high, but this cannot be attributed, without further evidence, to the formation of a gutta-percha bromine derivative.—E. W. L.

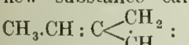
Rubber goods; Determination of "mineral rubber" and similar products in ——. R. Becker. Gummi-Zeit., 1911, **25**, 598.

Extraction of the sample with pyridine results in the passage of rubber into the extract with the "mineral rubber," asphaltum, etc. If, however, carbon bisulphide be employed as solvent the extraction is complete in an hour, provided that the sample is sheeted before extraction. Under these conditions there is no appreciable solution of the rubber. It must be remembered that a portion of the bituminous substance is removed by acetone extraction, and this must be taken into account.—E. W. L.

Patents.

Substances of the terpene series; Production of ——. E. Black, London, and G. A. Morton, Liverpool. Eng. Pat. 27,397, Nov. 24, 1909.

Unsaponifiable resins, such as jelutong, *Xanthorrhœa* resins, etc., are treated with a solution of an alkali to remove any saponifiable matter which they may contain, extracted by means of a solvent, and then subjected to destructive distillation (*e.g.*, at 30°—80° C.), whereby hemiterpenes, terpenes, and their homologues are produced. When pontianak is treated by this process isoprene is produced, whilst from the resin of *Xanthorrhœa preisii* is obtained a new substance called "mortonene," of the formula,



$\mathrm{CH_3.CH:C}<\begin{array}{l}\mathrm{CH_2}\\ \vdots\\ \mathrm{CH_2}\end{array}$

: this has a sp. gr. of 0·720 at 60° F., and a boiling point of 32°—35° C.; it is analogous to isoprene in many of its properties, and it forms a green nitrosite when treated with ethyl nitrite and chloroform, but does not form metallic derivatives.—T. F. B.

Indiarubber and the like; Artificial production of ——. E. Black, London, and G. A. Morton, Liverpool. Eng. Pat., 27,398, Nov. 24, 1909.

Indiarubber and similar substances are produced from certain hemiterpenes or carbohydrates by the action of micro-organisms such as those found in trees and plants from which rubber, balata, gums, and resins are obtained; these micro-organisms are also stated to be obtainable from soils. The hemiterpenes, isoprene and "mortonene" (see Eng. Pat. 27,397 of 1909; preceding), are best treated with the micro-organisms of *Landolphia* latex, whilst the carbohydrates (*e.g.*, inositol) give better results with micro-organisms of *Hevea* latex. The treatment of the substance with the culture may take place at a temperature of 30°—35° C., and may occupy from a day to several weeks; the action may be accelerated by the addition of magnesium pyrophosphate or other substances.—T. F. B.

India-rubber; Method and appliances for drying and otherwise treating [smoking] ——. T. Cockerill, Colombo, Ceylon. Eng. Pat. 341, Jan. 6, 1910.

The wet rubber is passed in a continuous sheet into a cylindrical chamber, where it passes round about two-thirds of the circumference of a perforated drum and then out, and into a second similar chamber and round a second perforated drum. The chambers are capable of being heated and the interior of each drum is connected with an air exhauster by means of which a reduced pressure may be maintained inside the chambers. At the entrance to the first, and the exit from the second chamber, and also between the two chambers a double gate or valve is arranged so that the sheet of rubber can be passed by intermittent travel into and out from the chambers without destroying the vacuum within them. For example, in passing the sheet into the first, or drying, chamber the outward half of the double gate is opened and a portion of the sheet travels into the space between the outward and inward parts of the valve, where the slack is taken up by a jockey-roller. The outer valve is then closed by lowering the gate on to the rubber sheet, which rests on a sill, and the inner valve is opened. The drum then revolves through a distance sufficient to take up the slack, when the inner valve closes and the process is repeated. During its intermittent progress through the drying chamber, the sheet is dried, the moisture being removed by the air-exhauster, and the rubber then passes through the second double valve into the second, or smoking, chamber, where a similar method of travel is carried through. Smoke is introduced into this chamber and is drawn by means of the vacuum into the pores of the dried rubber sheet, which finally emerges through the third double valve. During its progress through the apparatus the sheet of rubber is supported by an endless cloth band.—E. W. L.

Latex of caoutchouc producing plants; Coagulation of ——. The firm W. Pahl, Dortmund, Germany. Eng. Pat. 26,173, Nov. 10, 1910. Under Int. Conv., Feb. 4, 1910.

Coagulation is effected by the passage of carbon dioxide into the latex. Among advantages claimed for the process are the following:—coagulation is rapid; the rubber obtained has extraordinary elasticity, which prevents the formation from it of sheets by means of wooden rollers, as in the case of rubber obtained by acetic, sulphuric, and hydrofluoric acid coagulation; no violet-coloured pellicle is formed as in the case of coagulation by means of acetic, sulphuric, hydrofluoric and citric acids, phenol, alcohol, etc.; the growth of mould does not occur on the rubber, whether the latter be fumed or not.—E. W. L.

Rubber; Recovery of ——. H. T. G. van der Linde, New York. U.S. Pat. 979,902, Dec. 27, 1910.

In order to assist, and render more complete, the separation of rubber from woody tissue, such as that of the Guayule shrub, the latter (*e.g.*) is ground in a pebble mill in the presence of water and some solvent, or intumescent, of rubber—such as paraffin or other petroleum distillate (*e.g.*, naphtha of 62° Bé.)—which renders the particles of rubber with which it comes in contact more buoyant. At the same time the buoyancy of the particles of resin is not materially affected, but the binding properties of the resin are rendered somewhat more pronounced, so that when, finally, the rubber is separated from the fibre—bagasse—by flotation, the latter can be readily compressed into briquettes, which, after stacking and drying, form a good fuel. The small amount of fibre remaining mixed with the rubber may be removed, and the solvent or intumescent recovered by the ordinary methods. The process is also applicable to the recovery of waste vulcanised rubber, particularly to the separation of the rubber from the slimy masses of oxycellulose, etc., with which it is mixed, after the destruction of canvas, etc., by means of acid, and the removal of impurities by washing.
—E. W. L.

Rubber; Process of colouring ——. F. Paulet. Fr. Pat. 419,281, Aug. 11, 1910.

By adding iodine to a rubber mixing, after the addition of the other ingredients, the subsequent vulcanisation is assisted in such a way as to render possible the production of any desired colour in the finished article, whether rubber shoe, waterproof cloth, etc., and by whatever method vulcanised, by the use in the mixing of the appropriate colouring matter.—E. W. L.

Rubber; Substance resembling —— and process of making same. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 419,316. Aug. 12, 1910. Under Int. Conv., Sept. 11, 1909.

Isoprene is heated with or without the addition of neutral, alkaline, or acid reagents, and is thus converted into a substance resembling rubber. For example, (1) isoprene is heated in an autoclave at 200° C. for 10—12 hours, when it is converted into a highly tenacious and elastic but still sticky mass. To remove the stickiness the mass is treated with steam, and the product obtained in this way resembles natural rubber. (2) Isoprene is heated in an autoclave at 90°—100° C. for 6 days. Steam is introduced into the viscous mass, first at ordinary pressure until all the unchanged isoprene is removed, then under a reduced pressure until no more oil distils over. On cooling, pure white rubber of excellent quality remains. (3) 100 parts of isoprene are dissolved in 200 parts of benzene and the solution is heated in an autoclave at 120° C. for two days. The unchanged isoprene, the benzene and some terpene are distilled off; a transparent, tenacious mass remains, which when washed with alcohol loses its transparency and assumes the appearance of rubber.—E. W. L.

Rubber; Industrial manufacture of ——. G. Reynaud. Fr. Pat. 419,860, Nov. 6, 1909.

The process consists in subjecting turpentine oil to the action, first of sulphuric acid (53 Bé.) diluted with one-third or one-fourth of its volume of water, then of acid of 53 Bé. strength, then of concentrated hydrochloric acid in the cold, and finally of boiling dilute hydrochloric acid. It is best carried out by immersing a sheet of natural or manufactured rubber in the turpentine oil (1 kilo. of rubber to 2 to 3 kilos. of turpentine) until the oil is completely absorbed, then plunging the mass into the diluted sulphuric acid and allowing it to stand for 12 to 24 hours. When the mass is completely impregnated with the acid, it is put into the stronger acid for some hours until saturated with it. By this means the turpentine oil is converted into a pasty, elastic substance. The mass is washed thoroughly with water and either put into use as it is, or preferably, further treated by immersion in concentrated hydrochloric acid for a few hours, after which the acid is diluted and raised to the boil for a few hours. This final treatment results in the production of a firm, "nervy" product, having, when washed, all the physical and chemical properties of natural rubber.—E. W. L.

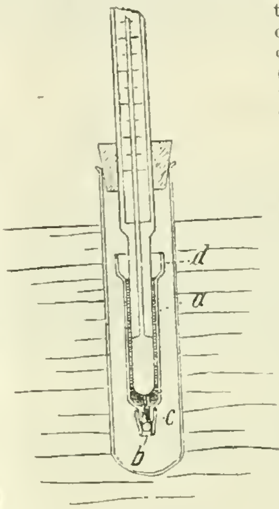
XV.—LEATHER; BONE; HORN; GLUE.

Tannins from mangrove-trees and their decolourisation. A. Romer. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. IVa1, 376—378.

The bark of mangrove-trees contains usually a large proportion of tannin, which in some cases amounts to 50 per cent. of the dry substance. Moreover, the species in which this proportion is highest, viz., *Rhizophora mucronata*, *Brugiera gymnorhiza* and *Ceriops candolleana*, have well-developed barks, constituting 10—23 per cent. of the total weight of the stem. In these species also, the proportion of tannin in the bark increases with the age of the trees. Unfortunately for its industrial use, the tannin is accompanied by a colouring matter, which imparts to the leather an intense red colour, and hitherto it has been found impossible to produce complete decolourisation without destruction of the tannin. The author now announces that by acting on the bark extract with chromous acetate in quantities of 0·25—1 per cent., complete decolourisation is attained without any loss of tannin or harmful effect upon the leather. In practice, the chromous acetate is added, in the form of a paste, to the vigorously stirred bark extract of 25°—30°, at a temperature of about 70° C. The reaction, which is accompanied by evolution of hydrogen, is complete in 1—2 hours (see also Feuerlein, Eng. Pat. 25,182 of 1907; this J., 1908, 991).—J. H. L.

Gelatin; Analysis of ——. J. Herold. Chem.-Zeit., 1911, 35, 93—94.

The quality of gelatin, that is, the quantities of glutin and glutose it contains, may be determined by ascertaining the difference between the melting point of a 20 per cent. solution of the gelatin and that of a 20 per cent. solution of a mixture of equal parts of the sample and glutose (prepared by heating gelatin with ammonia under pressure). The difference between the melting points of the mixtures is proportional to the percentages of glutin contained (see this J., 1910, 441). Best quality gelatin (containing 82 per cent. of glutin, 17 per cent. of water, and 1 per cent. of ash) shows a difference value of 1·2° C., for a 10 per cent. solution, and the quantity of glutin in any given sample may therefore be calculated accordingly. The apparatus employed in taking the melting points of the jellies is shown in the illustration. The glass vessel, *a*, is closed at its lower end by means of a short piece of rubber tubing, *b*, containing a glass bead, *c*; mercury is then poured into the vessel so as to form a layer about 2 mm. in depth, and the gelatin solution is introduced until the vessel is filled up to the lower part of the wide portion of the vessel as shown at *d*, the thermometer being already in position. When the gelatin solution has set, the vessel is immersed for 30 minutes in a water-bath at a temperature of 19° C. The rubber cap, *b*, is then removed, the mercury is shaken out and the vessel and thermometer are fitted into the test-tube which is surrounded by water at a temperature of 40° C. The temperature at which the vessel, *a*, begins to slip off the bulb of the thermometer is taken as the melting point of the jelly.—W. P. S.



Organic jellies; Structure of ——. H. R. Procter. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. IVa1, 74—78.

The author points out that jelly and gel are not synonymous terms; many gels are not jellies, and it is doubtful whether a jelly is necessarily a gel. The typical organic jellies, such as those of gelatin and agar-agar, have characteristics which mark them off from the gels, or coagulated precipitates of inorganic sols, whatever these classes may have in common. A solution of the purest gelatin at a sufficiently high temperature appears perfectly transparent, is almost free from ultra-microscopic particles, and shows only a slight Tyndall effect which may be due to impurities. When the solution sets there is no known alteration in its optical properties and no separation of water, but the gelatin acquires a certain amount of rigidity. The structure of the gelatin molecules is that of chains of amino-acids, probably branched, and the author suggests that at a certain temperature these may polymerise, or adhere by their residual valencies to form a molecular network which, while allowing the free permeation of the solvent and of dissolved crystalloids would still have a degree of solid cohesion. This inter molecular linking occurs without any alteration in th average distance between the molecules, and the proces therefore differs from the separation of a crystalloi from solution, for in the latter case, owing to the smalle size and more definite polarity of the molecules, thei aggregation results in a closer and more regular packin than obtains in solution, and produces a very rigid soli in which only a definite proportion of solvent can l included. The main difference between the molecul network postulated by the author, and the micellar structure observed by van Bemmelen and others in the case of true inorganic gels, is in actual size. But the difference is important; for the latter structure is coarse in comparison with molecular dimensions, whereas the former is so fine that the constituents are within the range of each other's molecular forces, and the jelly forms a solid solution of a more or less intimate sort. From this point of view the author considers the swelling of gelatin in water and its dehydration by alcohol. The former action tends to a definite maximum, which is a true equilibrium. Gelatin solutions set at temperatures which are not widely affected by concentration, but the more dilute the solution, the more open must be the molecular network and the greater the "swelling maximum." After the gelatin has been dried and again allowed to swell in water, it tends to resume its original setting volume, but the result is influenced by various factors. (See also this J., 1908, 1043.)—J. H. L.

PATENT.

Skins of animals; Process for unhairing ——. E. Lasbordes. Fr. Pat. 419,594, Aug. 22, 1910.

The skins are immersed, for from six to twelve hours, in a bath prepared as follows:—A paste of emulsified stearic acid (see Fr. Pats. 399,514 and 400,792; this J., 1909, 979, 1094) is neutralised, or rendered slightly alkaline, and then mixed with ammonium carbonate in the proportion of 200 to 300 grms. of the latter to 1 kilo. of the paste. 1500 grms. of the mixture are then added to 100 litres of cold or lukewarm water. The temperature of the bath and its concentration are varied according to the nature of the skins to be dealt with. After dipping, the skins are placed in piles, covered over, and allowed to soak for some hours, after which they can be unhaired. —E. W. L.

XVI.—SOILS; FERTILISERS.

Soils; Electrical bridge for the determination of soluble salts in ——. R. O. E. Davis and H. Bryan. U.S. Dept. Agric., Bureau of Soils. Bull. No. 61, 1910, pp. 36 (compare this J., 1910, 829).

Electrical methods for determining the amount of soluble salt in a soil depend on the fact that the dissolved salts conduct the current and that the resistance of the solution depends on the concentration of the dissolved salts. The soil is saturated with moisture and placed in a cup forming one arm of a Wheatstone bridge provided with a telephone receiver and induction coil. The bridge is designed in a portable form for field use and its parts and dimensions are described in detail. From the experimental work it is found that the resistance of a soil having the same salt content increases with the fineness of texture of the soil. The resistance is much greater when the salt is partly carbonate than when other salts alone are present. The resistance is also increased by the presence of organic matter. Some few minutes must be allowed to elapse after moistening a dry soil before the resistance is determined. When concentrated solutions are to be used, the cup is only partly filled. In the field the method is only accurate when the soil contains little or no carbonate and organic matter. However, if a special table be constructed for the particular combination of salts in the area under examination, the salt content can be mapped by means of the bridge with fair accuracy. When the proportion of carbonate varies widely over the area tested, the bridge is less useful. With soils high in organic matter a special standard may be prepared, but this is a laborious process and it is better to abandon the bridge method. The permissible limit of organic matter is variable; 5 per cent. is dangerous and 10 per cent. fatal; when much carbonate is present still lower percentages are permissible. Measurements must be made at the same temperature or corrected for temperature. Tables are given showing corrections for temperature and also showing the percentage of mixed salt in sand, loam, clay loam and clay with given resistances.—E. F. A.

Soil organic matter; Chemical nature of ——. O. Schreiner and E. C. Shorey. U.S. Dept. Agric., Bureau of Soils, Bull. No. 74, 1910. pp. 48. (Compare this J., 1911, 40, 100.)

The average organic content of the soils of the United States is 2·06 per cent. and of subsoils 0·83 per cent. This is made up of a large number of compounds which have previously been spoken of as humus bodies. The detailed study of these has now resulted in the separation of 20 organic substances belonging to eight or nine different classes of chemical compounds. The isolation of four of these has been previously described (this J., 1908, 912, 1075; 1911, 40). The soil is extracted with alkali and the solution rendered acid. From the acid filtrate there has been isolated xanthine, hypoxanthine, cytosine, histidine, arginine and a pentosan. The precipitate represents the so-called humic and ulmic acids from which have now been isolated resin acids, resin esters, glycerides, a paraffinic acid, $C_{24}H_{48}O_2$, lignoceric acid, $C_{24}H_{48}O_2$, phytosterol, agrosterol, and agroceric acid. The organic soil constituents insoluble in alkali comprise the so-called humin and ulmin of which the identity of the components is still unknown. No one soil contains all the compounds mentioned and they occur in different proportions in different soils. The manner in which these compounds have been identified, is described, and their possible sources and their relation to other compounds are discussed.—E. F. A.

Phosphates of calcium; Proximate analysis of ——. P. Hardy and J. Vandormael. Bull. Soc. Chim. Belg., 1911, **25**, 43—57.

The authors show by comparison with figures obtained by calculation from a complete analysis of the raw material, that a closely approximate figure for the quantity of sulphuric acid required to decompose the calcium phosphate can be obtained from a determination of some only of the elements present. If the lime, phosphoric acid, sulphuric acid, ferric oxide and alumina be determined; then if the amount of lime required by the phosphoric acid in the finished superphosphate, and that required by the sulphuric acid in the raw material be deducted from the total lime found, the amount of sulphuric acid required will be that necessary to combine with the residual lime and the oxides of iron and aluminium.—W. H. C.

Nitrogenous fertilisers; New —— utilising atmospheric nitrogen. R. Guillin. Proc. Seventh Int. Congr. Appl. Chem., London, 1909, Sect. VII., 194—196.

Cyanamide in contact with water at 12°—15° C. slowly gives off ammonia. 1 grm. of cyanamide gave in a week 0·0091 grm. and in two weeks 0·0169 grm. of ammonia. Cyanamide is often regarded as toxic, but this is not the case, although when added at the moment of sowing it causes a delay in growth. Wheat grains, swollen by soaking for 24 hours in water, were sprinkled with cyanamide and dicyanodiamide and after a time cleaned and sown. After 3 days the grains treated with dicyanodiamide had grown regularly and normally; those treated with cyanamide only developed after 5 days and growth was backward. Dicyanodiamide is not a plant poison. An equal number of grains were soaked 24 hours at 15° C. in solutions containing 28 grms. of different fertilisers per litre and then the number which germinated was determined. In water this was found to be 49, in dicyanodiamide 48, in sodium nitrate 40, in ammonium sulphate 36. In the dicyanodiamide solution, on standing, there was a considerable growth of mould; green algae develop normally in dicyanodiamide solutions containing 5 grms. per 1000, so that it is not a poison for the lower plants. On the other hand nitrifying bacteria do not attack it. Basic calcium nitrate cannot be mixed with superphosphate for use as a manure. Calcium nitrite-nitrate is also quite unsuitable, as nitrous fumes are liberated. Ordinary calcium nitrate (13 per cent. of nitrogen) can be mixed with twice its weight of superphosphate without deterioration of either constituent.—E. F. A.

Fertilisers, etc., in the Cape of Good Hope ; Sale of ——. Board of Trade J., Jan. 26, 1911. [T.R.]

A Proclamation (No. 178 of 1910) lays down the Regulation governing the sale, analysis, and examination of fertilisers, farm foods, and seeds in the province of the Cape of Good Hope, with effect from 5th December, 1910.

The effect of the principal Regulations is as follows :—Every fertiliser or farm food intended for sale in the Cape of Good Hope shall, before sale, be registered with the Department of Agriculture in accordance with prescribed rules, particulars being required in the form of registration as to the name and address of the manufacturer or importer, as well as the brand and composition of such fertilisers and farm foods. The sale of any fertiliser or farm food is prohibited, unless an invoice, in prescribed form, is handed or forwarded to the purchaser or his representative stating the quantity sold, name of braud, and their component parts. Provision is made for samples of every registered fertiliser and farm food to be taken at least once annually. All fertilisers and farm foods imported shall be subject to examination and detention by an officer of Customs, and samples may be taken for analysis. If the samples do not conform to the registered composition of the brand, the importation is prohibited until such registration has been amended. The selling of killed or dyed seeds is prohibited. The sale of certain specified articles as pest remedies is prohibited, and provision is made for samples of any pest remedy intended for sale to be taken for analysis.

Proclamation No. 453 of 1909, promulgating similar regulations, is repealed.

Plants ; Action on ——, *of substances extracted from coal-tar and employed in agriculture.* M. Mirande. Comptes rend., 1911, **152**, 204—206.

A great many substances prepared from coal-tar are used for preserving wood (palisading, hop- or vine-poles, etc.), destroying moss on tree-trunks, spraying to destroy insects, etc. These all contain creosote, and give off vapours which are destructive to leaves, flowers, shoots, etc., in the same way as coal-tar vapours, blackening them, and causing death by plasmolysis. The various phenols are the active agents in this. Great caution is necessary in the use of these substances, to prevent vapours (and still more to prevent the liquids themselves) from coming in contact with plants. Wood impregnated with them continues to give off vapours for considerable periods of time.—J. T. D.

Manganese ; Influence of —— *on the development of Aspergillus niger.* G. Bertrand and M. Javillier. Comptes rend., 1911, **152**, 225—228.

Cultures of *Aspergillus niger* were grown in nutritive solutions to which had been added varying quantities of pure manganese salt (free especially from zinc and iron), and the yields compared with those in similar solutions containing no manganese. The yields were increased considerably by small additions of manganese, the increase growing at first rapidly with the quantity of manganese (1 to 1000 parts per million of solution), then more slowly. Not till the added manganese amounted to 2 per cent. was there any diminution in the yield, and that is perhaps attributable to increased osmotic pressure rather than to a specific injurious action of the manganese. The plant never assimilated nearly the whole of the manganese added, even in the case of very great dilutions. Even the plants from the blank cultures showed traces of manganese in their ashes, derived perhaps from the glass vessels ; had this not been so, the difference in yield due to the added manganese would probably have been greater still.
—J. T. D.

Patents.

Fertiliser, insecticide and fungicide. W. F. K. Stock, Darlington. Eng. Pat. 10,511, April 29, 1910.

Spent oxide and "carbon waste" are dried in a kiln or on a drying-floor, and are then mixed with crude, drained naphthalene, either by hand or mechanically. The mixture is ground to pass a sieve of suitable mesh (*e.g.* $\frac{1}{12}$ to $\frac{1}{4}$ inch). The carbon waste employed is obtained in the recovery of alkali from the liquors that remain after boiling esparto grass or wood pulp with caustic soda, for the removal of colouring matter, resin, etc., in the manufacture of paper pulp. The liquors are concentrated to small bulk in vacuum evaporators, and are then transferred to a rotary furnace and fired. The charred mass is lixiviated, and the black insoluble residue forms the "carbon waste" referred to.—E. W. L.

Fertilisers. A. A. Forbes and R. R. Macfarlane, Vancouver, Brit. Columbia. Eng. Pat. 19,706, Aug. 23, 1910.

Fish, or fish refuse, either raw or steamed, is reduced to pulp by passage through rollers or cutters and 3100–4000 lb. are mixed with 25 to 22·5 lb. of sodium chloride. 125 to 128 lb. of sulphuric acid are then added and thoroughly mixed with the mass, which is allowed to macerate for several hours. 150 to 600 lb. of quicklime are then spread on the bottom of vats or bins, the pulp is introduced on top of it, and a further quantity of quicklime (150 to 600 lb.) is spread over the mass and raked under. When the lime is thoroughly hydrated, the mass is turned and mixed, and is then spread out, 100 to 90 lb. of sodium chloride are added, and the mass again mixed and dried in a rotary or other dryer. The dried product is then thoroughly mixed with 500 to 200 lb. of sodium nitrate, 300 to 450 lb. of potassium chloride, and, for certain crops, 150 to 300 lb. of calcium phosphate. The mixture is crushed by rolls ready for packing. The fertiliser is not liable to spontaneous combustion.—E. W. L.

Phosphoric acid soluble in citric acid ; Process of manufacture of ——. Mahlwerke Friedrichsthal (Proprietor A. Hauck). Fr. Pat. 419,520, Aug. 3, 1910. Under Int. Conv., Dec. 7, 1909.

Crude phosphates are heated with a reducing agent, such as carbon, and the resulting product is heated or fused in the presence of air or other oxidiser.—F. Sodn.

Superphosphates ; Manufacture of ——. G. Cusatelli. Fr. Pat. 419,716, June 30, 1910.

A little nitric acid is added to the sulphuric acid usually employed in the treatment of phosphates, the acid (41°—42° B.) being preferably added in the proportion of 3—4 per cent. of the quantity of sulphuric acid (52°—53° B.) required for the treatment of 100 kilos. of tribasic phosphate, and about 20 per cent. less than the normal quantity of sulphuric acid being used. The decomposition is said to be accelerated by this addition, and a product of better quality obtained than with sulphuric acid alone.
—F. Sodn.

Fertiliser ; Process for the preparation of a solid —— *that can be scattered.* Badische Anilin und Soda Fabrik. Ger. Pat. 229,163. Aug. 13, 1909.

Although in the literature both calcium nitrate and calcium nitrite are described as salts which readily deliquesce, it has been found that mixtures of calcium nitrate and nitrite in which the nitrate-nitrogen does not exceed 15 per cent. of the total, form dry friable powders which do not deliquesce readily even in moist air. Claim is made for the production of a fertiliser consisting of such a mixture, by evaporating a solution containing the two salts, such for example as is obtained by the absorption of the nitrous gases produced by the oxidation of atmospheric nitrogen. Mixtures of calcium nitrite and nitrate can readily be prepared having a nitrogen content equal to or higher than that of Chile saltpetre.—A. S.

Nitrogen-fixing organisms; Use of —— in agriculture and horticulture. W. B. Bottomley, London. U.S. Pat. 982,569, Jan. 24, 1911.

See Eng. Pat. 11,365 of 1909; this J., 1910, 581.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Beet juices; Treatment of —— with sulphur dioxide. A. Aulard. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. V., 106—109.

In 1898 the author recommended the preliminary treatment of diffusion juices with sulphur dioxide in the cold, to be followed by almost complete neutralisation with lime. The substitution of baryta for lime gives better results, and after filtering through sand, a highly decolourised juice is obtained. One subsequent carbonatation, using 0·8 to 1·0 part of lime to 100 parts of beet-root, yields a juice with only a slight yellowish colour and having a purity 0·7 to 1·2 per cent. higher than that of juices which have undergone double carbonatation without sulphitation. —J. H. L.

Sugar industry. Use of liquid sulphur dioxide in the ——. A. Aulard. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. V., 100—105.

Liquid sulphur dioxide, which can now be bought cheaply and of a purity of 99·6—99·8 per cent., is much more convenient for the sulphitation of sugar juices than the gas from sulphur kilns, and in using it there is much less likelihood of inversion of the sugar by sulphuric acid. Sulphitation in alkaline solution, as carried out in the "sulphocarbonatation" process of Weisberg (this J., 1902, 1406; 1903, 1057; 1904, 496) gives very good results The bisulphites formed in solution by this process not only have a preservative influence on the juice, but during the evaporation of the latter they effect a considerable reduction in the amount of nitrogen present and also exert a strong decolourising action. Inversion is not to be feared, and the sugars from such juices do not contain sulphurous acid, free or combined. The removal of iron salts by the second carbonatation, after their reduction to the ferrous state by the sulphur dioxide, is very complete, and this is of importance when sugars of good colour are required. The only drawback to the process known to the author is that the filters require more frequent renewals, than with the older processes: this difficulty can, however, be obviated by using sand filters.—J. H. L.

Cane sugar house. Sulphitation in the ——. F. Zerban. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. V., 272—285.

The sulphur dioxide introduced into the cane juice is eliminated very quickly during the process of manufacture; when the proper amount is used and the subsequent addition of lime is carried to the neutral point, the first molasses contain only 8·72 per cent., and the second only 2·45 per cent. of the quantity originally added to the juice. Owing to concentration, however, these products actually contain much more sulphur dioxide than 0·035 per cent., the limit fixed by the United States Department of Agriculture, in Food Inspection Decision, No. 76, now repealed. If the manufacturer wishes to keep within this limit he must use less than 0·05 per cent. of sulphur dioxide in clarification, and this amount is of little use for the purpose. When the ordinary amount is used, the quantity of free sulphur dioxide—and this is the only factor to be considered from the physiological standpoint—in the final products must be exceedingly small, probably entirely negligible.—J. H. L.

Lime-kiln; Theory of the ——. H. Decluy. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. V., 142—189.

The paper contains a summary of work carried out during the past ten years, and already published. It describes an exhaustive quantitative investigation into the reactions of the lime-kiln, and the influence of various factors on the composition of the saturation-gas therefrom.—J. H. L.

Molasses waste liquors. Preparation of adenine from ——. K. Andrlík. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. V., 318—320.

The author has attempted to determine the proportion of adenine in molasses waste liquors, and has succeeded in isolating 0·08 per cent. The liquor (40 kilos.) was diluted with twice its volume of water, and boiled for an hour with copper sulphate, and then for a further half-hour after having been made faintly alkaline with caustic soda. The precipitate was suspended in water and decomposed by sulphuretted hydrogen in presence of baryta, the latter being removed, after the filtration from copper sulphide, by means of carbon dioxide. On concentration of the filtrate from the barium carbonate, crude adenine separated in crusts, from which 20 grms. of the pure substance, representing 0·05 per cent. of the original liquors, were obtained. A further quantity of 0·03 per cent. was isolated from the mother liquors by precipitation with picric acid.—J. H. L.

Molasses waste liquors; Guanine-pentoside from ——. K. Andrlík. Proc. Seventh Int. Congr. Appl. Chem., London, 1909, Sect. V., 331—337.

It is found that on boiling molasses or molasses waste liquors with copper sulphate, then adding sodium hydroxide and boiling again, a precipitate is obtained from which a substance of the formula, $C_5H_8O_4,C_5H_5N_5O,2H_2O$, can be isolated in quantity amounting to 0·02 and 0·04 per cent. of the molasses and molasses waste liquor respectively. One hundred parts of water dissolve 3 parts of this substance, which crystallises from the solution in fine, colourless needles; the solution gives the xanthine reaction, and, with α-naphthol and sulphuric acid, the reaction for sugar. The substance turns brown on heating in a capillary tube at 234°—241° C., and melts with blackening and evolution of gas at a temperature above 300° C. It is insoluble in 96 per cent. alcohol, ether, chloroform, and benzene, slightly soluble in cold, and readily soluble in hot, glacial acetic acid. It is lævorotatory in aqueous solution, and a 1 per cent. solution in dilute sulphuric acid has a specific rotation of $[\alpha]_D = -13{\cdot}95°$. On hydrolysis with dilute sulphuric acid, the substance was found to yield 41·9 per cent. of a lævorotatory pentose ($[\alpha]_D = -16{\cdot}7°$), and about 40 per cent. of guanine. Hence, it is a guanine-pentoside, and is not identical with the vernine and vicine discovered by E. O. v. Lippmann in molasses waste liquors.—L. E.

Sugar in human diet. F. Dupont and J. Tribot. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. (See also this J., 1908, 1171.) Sect. VIIIc, 238—242.

A short account of the production and consumption of sugar in various countries is given, and the value of sugar as a food is briefly discussed. It would appear that for an adult, a consumption of 100—150 grms. of sugar per day is not excessive, and twice as much may be taken by those engaged in hard physical work. It is recommended that the various Governments should remove the tax on sugar or reduce it to 5 or 10 francs per 100 kilos. (2 to 4 shillings per cwt.).—L. E.

Dextrins; Analysis of commercial ——. C. A. Browne and A. H. Bryan. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. V, 337—342.

The method proposed by F. Lippmann (this J., 1902, 1101) for determining the dextrin-content of commercial dextrins by difference is open to the objection that organic materials other than dextrin which are soluble in cold water are included. The authors recommend the following scheme of analysis:—*Specific rotation.*—Ten grms. of the finely divided sample are dissolved in about 50 c.c. of cold water and treated with 5 c.c. of alumina cream; the whole is made up to 100 c.c., shaken, filtered, and polarised in a 200 mm. tube, a 6 per cent. solution of potassium bichromate in a 3 mm. tube being used as a light filter. The specific rotation $[\alpha]_D = \frac{34 \cdot 68 \times V}{20}$, where V = Ventzke reading. *Viscosity.*—The viscosity of a solution of 100 grms. of the sample in 200 c.c. of cold water is determined with any standard viscosimeter; comparative results should always be made with the same instrument, under similar conditions of temperature, and with the same time-interval after preparing the solution; the viscosity should be determined again, on the same solution, after 24 and 48 hours. *Moisture.*—From 2 to 5 grms. of the sample are dried for 4 hours at 105° C. (absolute constancy of weight cannot be attained). *Ash.*—From 5 to 10 grms. of the sample are heated in a platinum dish to low redness, care being taken not to fuse the ash. *Soluble starch.*—Presence of soluble starch is indicated by a blue iodine reaction with the filtered, hot aqueous solution of the sample. Two 10-grm. portions are dissolved in 50 c.c. of cold water; one of these solutions is made up to 100 c.c. with cold water, shaken, and filtered, 20 c.c. of the filtrate being evaporated to dryness and heated for 4 hours at 105° C.; the residue, less the ash on incineration, represents the organic matter soluble in cold water. The second solution is heated to boiling, cooled, made up to 100 c.c., shaken, and filtered, the weight of organic matter soluble in hot water, in 20 c.c. of the filtrate being determined as in the preceding case. The difference between the weights of organic matter soluble in hot and cold water respectively, represents the soluble starch. *Unconverted starch.*—If the residue, insoluble in hot water, is found, on microscopical examination, to contain grains which give a blue colour with iodine, it is collected and washed, the starch being determined by the usual method. *Reducing sugars.*—An aliquot part of the cold water extract is treated by Allihn's method, the result being expressed as dextrose. *Dextrin.*—The specific rotation of the sample, less that part of it due to reducing sugars (dextrose), is multiplied by 100/186 to obtain the calculated percentage of dextrin ($[\alpha]_D$ for pure dextrin = 186°). *Undetermined soluble matter.*—The content of organic matter soluble in cold water, less the calculated content of dextrin (and reducing sugars), gives the content of undetermined soluble matter.—L. E.

Erratum: This Journal, Jan. 16, 1911, page 43, col. 1, line 32 from top, *for* "nitric" *read* "citric."

XVIII.—FERMENTATION INDUSTRIES.

Malt analysis; Improvement in the method of ——. J. O'Sullivan. J. Inst. Brew., 1911, **17**, 35—42.

The object of the following procedure is to determine the composition of the starch transformation products in the standard brewer's extract, and the transforming power (T. P.) of the malt (*i.e.*, percentage of maltose produced, referred to the starch of the malt). *Cold water extract.*—This is obtained by the method prescribed by the "Malt Analysis Committee" (this J., 1906, 236), save that $N/10$ potassium hydroxide is used instead of $N/10$ ammonia. The cupric oxide reducing power of the extract (10 c.c.) is determined gravimetrically, the result being expressed as grms. of maltose per 100 c.c. *Mash extract.* — Fifty grms. of ground malt are directly introduced into a 515 c.c. (Heron's) flask, and placed in a water-bath at 68° C. (154°—155° F.) until the temperature of the malt is 60°—61° (140°—142° F.). 360 c.c. of distilled water at 68° C. are then added, with shaking; from this stage, the mash is treated as in the standard method (*loc. cit.*), save that it is heated to 75° C. (167° F.) instead of to 70° C. (158° F.) for 10 minutes. The cupric oxide reducing power of the extract (3 c.c.) is determined as before.—If a and b represent the specific gravities, and c and d the reducing powers (grms. of maltose per 100 c.c.) of the mash extract and cold water extract respectively, $a—b$ = sp. gr. of mash extract due to starch products, and $c—d$ = grms. of maltose in the starch products of the mash extract. It is found that, on the average, the mash extract contains 0·04 grm. more of albuminoids than the cold water extract (per 100 c.c.). Correcting for this, the weight, e, of starch products per 100 c.c. of mash extract $= \{(a—b) \div 4\} — 0 \cdot 04$, and the percentage of maltose in the starch products $= \{(c—d) \times 100\}/c$. Addition of the weight of maltose divided by 1·055, and the weight of dextrin (found by deducting the weight of maltose from the weight of starch products) gives the weight of starch in 10 grms. of the malt. As the author shows, the sucrose, which is present in the malt, is not hydrolysed in the cold water extraction owing to the alkalinity, nor in the mash extraction owing to the temperature. Of 20 malts examined by the above method, 16 were found to possess transforming powers of 80—93·6, the transformation of the starch in many of these malts going beyond the so-called "resting stage." It was also found that there is no relation between the diastatic power and the maltose produced, whereas the number obtained for the transforming power represents the percentage of maltose produced under standard conditions. To determine the theoretically possible yield of alcohol from a malt, the sucrose-content of the cold water extract should be found in addition to the other data; if the percentages of starch, sucrose, and other sugars (comprising dextrose, lævulose, and maltose) are multiplied by 0·57, 0·53, and 0·52 respectively, the products, added together, give the theoretical yield of alcohol.—L. E.

Enzymes; Chemical composition and formation of ——. *II.* H. Euler and B. af Ugglas. Z. physiol. Chem., 1911, **70**, 279—290 (see this J., 1910, 1403.)

Various workers have observed that phosphoric acid and phosphates exert a favourable influence on the fermentative power, or zymase-activity of yeast (cp. Moufang, this J., 1910, 506). The influence of phosphate-treatment on the invertase-content of yeast appears to be greatly dependent on the state of the yeast. Thus, in one series of experiments, the authors have found that treatment of a washed and strongly pressed bottom-fermentation beer yeast with a 0·3 per cent. solution of neutral sodium phosphate and 2 per cent. of sucrose (e.g., for 40 minutes) greatly increased the invertase-activity of the extract from the dried yeast; in other experiments, however, the phosphate treatment had only a slight effect on the invertase-activity. Treatment of the same yeast (1 grm. of yeast suspended in 20 c.c. of a 10 per cent. solution of sucrose) with neutral sodium phosphate under the same conditions as above, increased the zymase-activity very considerably. Treatment with acid (mono-) sodium phosphate, on the other hand, weakened the zymase-activity of the subsequently dried yeast, but increased the zymase-activity of the yeast provided that the yeast was not subsequently dried. The process of drying yeast by keeping it in a vacuum for 5 minutes at 40° C., injures its zymase-activity very greatly; the injury cannot be due to the influence of this temperature for so short a time, and the authors advance the following provisional explanation:—In living yeast, the zymase is combined as a chemical complex, wholly or in part with the protoplasm; if the vital activity of the cells is temporarily or permanently arrested, the protoplasm-constituent which causes fermentation, *i.e.*, the zymase combined with the protoplasm is rendered inactive, and only that part of the fermentation enzyme which is free or becomes free on dehydrating the yeast *in vacuo* or by treatment with alcohol, remains active. —In support of this view, the authors quote experiments showing that the fermenting power of living yeast is enormously reduced by the presence of antiseptics (chloroform, toluene); the chemical change on which the toxic action of the antiseptic depends, is transmitted to the zymase-complex whilst the latter forms part of the plasm, but the zymase, when separated from the plasm, is, like most enzymes, not affected by antiseptics. Buchner's work has shown that the zymase of yeast juice is not weakened by chloroform, and the authors have made the same observation in the case of permanent yeast ("*Dauerhefe.*") According to Buchner, yeast treated with toluene, forms only traces of carbon dioxide (from sugar) corresponding to the amount of zymase existing in the cells, whilst the same yeast in absence of toluene, produces a vigorous fermentation, *i.e.*, continuously elaborates a fresh supply of zymase; against this view the authors raise the following objections:—In fermentation with yeast juice or permanent yeast, there is no decrease in speed during the first half of the reaction, *i.e.*, so long as no enzyme is precipitated and endotryptase-action does not gain the upper hand; hence, in these cases, there can be no decrease in zymase-content, and it is very improbable that the free zymase should be consumed only in the living cell. In presence of chloroform, permanent yeast is much more active than living yeast, but the content of active zymase is certainly not smaller, and is probably much greater in living yeast than in permanent yeast; the living yeast must therefore contain at least as much zymase as the permanent yeast, and consequently, more than is active in presence of chloroform.—L. E.

Enzyme action; Synthetic ——. *II.* J. H. van 't Hoff. Sitzungsber. Kgl. Preuss. Akad. Wiss., 1910, **48**, 963—970.

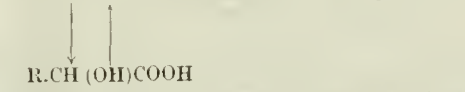
The author has previously dealt with the equilibrium of enzyme actions in general (*loc. cit.*, 1909, **42**, 1065), and he has now investigated special cases. Emmerling has shown (this J., 1902, 60) that amygdalin can be synthesised from glucose and the monoglucoside of mandelonitrile by the action of maltase, and Visser has obtained a glucoside by the action of emulsin on saligenin and glucose. If the formation of a glucoside from glucose and an alcohol is a thermo-neutral reaction (and this is at least approximately true), it is to be expected that, in the solid state, there is equilibrium between the two systems: alcohol + glucose⇄glucoside + ice, and that, in the liquid (or gaseous) state, there is equality of the molecular products: alcohol × glucose = glucoside × water. Esterification reactions are not strictly thermo-neutral, and in such reactions, divergencies from the above equality are observed; according to Menschutkin, the esterification of secondary alcohols by the equivalent quantity of acid corresponds to this theoretically normal equality the limit of transformation being about 50 per cent., whereas esterification proceeds farther with primary alcohols, and not so far with tertiary alcohols. The author finds that with the glucosides of tertiary alcohols (phenols), to which class most naturally occurring glucosides belong, the limit (of glucoside-formation) is below the theoretically normal value, under the influence of enzyme-action; thus, in a mixture of the glucoside (salicin, arbutin, æsculin) with the alcoholic product of decomposition, moistened with a saturated aqueous solution of glucose, the action of the enzyme (emulsin) causes a practically complete disappearance of the glucoside. With the glucoside of a primary alcohol (glycerol), the limit of glucoside-formation is above the theoretically normal value. Under the influence of 0·44 grm. of emulsin at 31° C., a solution of 3·3 grms. of glucose hydrate in 6·7 grms. of glycerol, was found to undergo a decrease in glucose-content of 31 per cent. in 25 days, from which it would appear almost certain that glycerol-glucoside is formed; the presence of water accelerates the synthesis, the formation of glycerol-glucoside proceeding at a maximum rate when 1 part of water per 2 parts of glucose hydrate is added. The synthetic action was found to be approximately proportional, within the limits of experiment, to the amount of enzyme used, and the synthetic activity of a fresh preparation of emulsin is considerably greater than that of an old one.—L. E.

Fermentation with yeast; Degradation of amino-acids by ——. O. Neubauer and K. Fromherz. Z. physiol. Chem., 1911, **70**, 326—350.

It has been shown by Ehrlich (this J., 1905, 683; 1907, 480) that the fusel oil produced in fermentation is not formed from the sugar, but from amino-acids susceptible to the action of the yeast, and that it is quite a general rule that under the action of fermenting yeast, each amino-acid yields the alcohol containing one carbon atom less, the process being expressed thus: $R.CH(NH_2)COOH + H_2O = R.CH_2OH + CO_2 + NH_3$. The authors have investigated the question as to whether the keto-acid corresponding to the amino-acid occurs as an intermediate product in the degradation of the amino-acid by yeast. It is found that in the degradation of phenylaminoacetic acid by yeast (in presence of sugar), the corresponding keto-acid, phenylglyoxylic acid, $C_6H_5.CO.COOH$, is formed as well as benzyl alcohol; besides these substances, *l*-mandelic acid (which, according to supplementary experiments, is produced by reduction of part of the phenylglyoxylic acid by the yeast), and *l*-acetylphenylaminoacetic acid occur in the fermentation-product. Yeast can also oxidise mandelic acid to phenylglyoxylic acid, but the extent of transformation is so small as to be practically insignificant in view of the large quantity of phenylglyoxylic acid formed from the amino-acid in fermentation. This leads to the view that in the conversion of the amino-acid into the keto-acid, oxidation precedes the liberation of ammonia:

$$C_6H_5.CH(NH_2).COOH + O = C_6H_5.C(OH)(NH_2)COOH,$$
$$C_6H_5.C(OH)(NH_2)COOH = C_6H_5.CO.COOH + NH_3.$$

In further support of the view that keto-acids occur as intermediate products in the degradation of amino-acids by yeast, the authors have subjected *p*-hydroxyphenylpyrotartaric acid to the action of yeast (in presence of sugar and small quantities of ammonium chloride and sodium bicarbonate). Since this acid, like tyrosine, should yield *p*-hydroxyphenylethyl alcohol, and the latter substance is formed in small quantity, in ordinary fermentation (see following abstract), control experiments were also made. It is found that an abundant conversion of the keto-acid into *p*-hydroxyphenylethyl alcohol occurs. This conversion comprises both a reduction process and liberation of carbon dioxide, and further experiment shows that, most probably, the liberation of carbon dioxide precedes the reduction, *p*-hydroxyphenylacetaldehyde being formed as intermediate product. In conclusion, the authors advance the following scheme as representing the degradation of amino-acids by fermenting yeast:—



$$\begin{tikzcd}
\mathrm{R.CH(NH_2)COOH} \arrow[r, "+O"] & \mathrm{R.C(OH)(NH_2)COOH} \arrow[r, "-NH_3"] & {} \\
\mathrm{R.CO.COOH} \arrow[r, "-CO_2"] \arrow[d, shift right] & \mathrm{R.CHO} \arrow[r, "+2H"] & \mathrm{R.CH_2OH} \\
\mathrm{R.CH(OH)COOH} \arrow[u, shift right] & &
\end{tikzcd}$$

The acetylamino-acid (*l*-acetylphenylaminoacetic acid), which is not included in the above scheme, is, most probably, like the alcohol-acid (*l*-mandelic acid), the product of a secondary reaction.—L. E.

Tyrosine; Fermentation of —— *to p-hydroxyphenylethyl alcohol* (*tyrosol*). F. Ehrlich. Ber., 1911, **44**, 139—146.

The author has previously shown (this J., 1907, 480; 1909, 848) that the fermentation of α-amino-monocarboxylic acids by yeast, with the production of the higher alcohols, *e.g.* fusel oil, is a more or less general reaction which takes place according to the equation: $R.CH(NH_2).COOH + H_2O = R.CH_2OH + NH_3 + CO_2$. In the present paper he deals with the fermentation of tyrosine, which is converted into *p*-hydroxyphenylethyl alcohol (tyrosol), not previously described. This alcohol may be prepared either by cultivating yeast in a solution of tyrosine containing sugar and nutrient salts or by the fermentation of tyrosine with a large quantity of yeast and sugar. The yield of tyrosol amounts to 60—80 per cent. of the theoretical quantity; 15 grms. of tyrosine (from silk) are dissolved in a solution of 1,200 grms. of sucrose in 10 litres of water, and 600 grms. of fresh-pressed yeast are uniformly distributed through the liquid. Fermentation proceeds for 3—4 days, the filtered product is evaporated to a syrup which is dissolved in 5—6 parts of alcohol and filtered. The alcohol is evaporated and the residue dissolved in water with addition of a little sodium bicarbonate; the solution is then exhausted with ether. The tyrosol thus obtained is purified by crystallisation from chloroform. Tyrosol crystallises in rhombic needles, melting at 93° C. and boiling at about 310° C. It is readily soluble in water, alcohol, and most organic solvents, but nearly insoluble in light petroleum spirit. It has a strong bitter taste, which doubtless contributes to the flavour of fermented liquids. It gives a large number of characteristic colour reactions, some of which serve to distinguish it from tyrosine. It yields a dibenzoate melting at 111° C., crystallising in felted needles, which compound serves for its quantitative determination. Tyrosol is a normal product of the nitrogenous metabolism of yeast, since it may be detected among the products of the fermentation of pure sugar by pure yeast, the dead cells yielding the tyrosine necessary for its production; like fusel oil and succinic acid, it is found as a normal by-product in all fermented beverages, and it is only formed when the yeast ferments sugar.—J. F. B.

Ozone; The use of —— in the brewery. L. v. Vetter. Woch. Brau., 1911, **28**, 13—16, 26—31.

Laboratory experiments with the "Ozonair" apparatus so arranged as to give currents of from 220—7000 volts, the air current, previously dried, being 10 litres, varying from 5 to 60 minutes, gave concentrations of ozone between 0·03 and 0·50 per cent. by volume. The other factors: (1) the number of coils in the transformer, (2) the size of the electrodes, (3) the temperature of the air current, were constant throughout. The ozone was estimated by absorption in potassium iodide solution and titration with $N/100$ thiosulphate in sulphuric acid solution. Yeast, when treated with ozonised air, not only exhibited a higher specific resistance than the other micro-organisms met with in brewing practice, but even when killed by the ozone was found to exert a decided antiseptic influence. Treated yeast when pressed absolutely dry was still capable of liberating iodine from potassium iodide solution. To determine the best conditions for obtaining the highest degree of purification from other organisms, compatible with the quantity of ozone which the yeast can endure, several quantities of 10 grms. were suspended in 250 c.c. of water and exposed to a current of ozonised air for varying periods. The ozone concentration was 0·14 per cent. by volume. These were then allowed to ferment for 12 hours, the water poured off, and a litre of hopped wort added. The examination of the yeast deposited showed that No. 5 was snow-white and very compact, requiring a glass rod to break it up. Nos. 3 and 4 were almost as good. No. 2 broke down easily, and was brown in colour. No. 1 was extremely dark in colour, and was spongy. Nos. 2 and 5 smelt quite fresh, whilst No. 1 gave the usual odour of unwashed yeast. Fermentation proceeded at 6° C. After the primary fermentation the liquid was drawn off into bottles; one portion was left in the cellar until secondary fermentation was complete, and the flavour was tested, another portion was kept under observation at 25° C. to determine the relative soundness, whilst the remainder was left on the forcing tray until the fermentation was complete. Yeast submitted to ozonised air with low ozone content for a longer time is preferable as regards vitality to yeast exposed to higher concentrations for shorter periods. From the evidence supplied in the following tables, the author concludes that ozone eliminates the weaker cells, partially reducing the quantity of yeast present, and thus hindering the fermentation at the outset.

No.	Time of aspiration in minutes.	Total amount of ozone grms.	Concentration of the wort at the start.	Start of fermentation.	Per cent. Balling by pyknometer.						Final attenuation.	Degree of fermentation.	
					1st day	2nd day	3rd day	4th day	5th day	6th day		Apparent.	Actual.
1	0	0·0	11·40	1	9·0	7·8	5·8	4·6	3·9	Put into bottles.	2·4	78·9	63·9
2	5	0·03	11·38	2	9·4	8·1	5·3	3·8	3·0		2·4	78·85	63·86
3	20	0·12	11·38	3	10·6	9·1	6·6	3·4	2·8		2·2	80·7	65·3
4	75	0·45	10·33	4	10·2	9·5	8·0	7 1	5·3	3·8	2 3	77·7	62·9
5	150	0·90	10·33	no action	—	—	—	—	—	—	—	—	—

No.	Soundness for periods of	Microscopical examination.
1	10 days	Sarcina in full growth (packets), normal yeast thickly interspersed with cocci: short rod forms.
2	16 ,,	Less sarcina, yeast cells free from cocci: short rods as in No. 1.
3	25 ,,	Normal yeast: short rods.
4	20 ,,	Normal yeast: short rods.

The residual yeast however was much stronger and more active. In practice the yeast is exposed to a current of air containing 1·4 c.c. of ozone per cubic metre, maintained at the rate of 12 cubic metres per hour. The resulting fermentation is said to be quite normal, and although a slight difference could be detected in the new beers, the flavour of the finished, mature beers was also normal; they have greater stability, and exhibit a higher specific resistance to infection. These beers were quite sound after 86 days, whilst the ordinary beers kept only 32 days. Experiments with pure cultures of sarcina showed that when mixed with ozonised yeast a distinct antiseptic effect was exerted by the latter. Beers infected with sarcina which could not be treated directly with ozone, on account of the acidity developed, but in which the by-products, not eliminated by the treatment, had not seriously affected the flavour, were successfully dealt with by the addition of 5 to 10 per cent. of "krausen" from a beer containing ozonised yeast. Positive results have been obtained with ozone as a sterilising agent in dealing with the tuns, coolers, pipes, bottles, casks, and in ventilating the brewery generally. With the paper pulp filtering medium, however, the results, on the practical scale, were a failure. All rubber connections must be avoided. Ozone will probably displace the more costly methods of sterilisation now in use being free from so many disadvantages.—E. H. J.

Beers; Secondary fermentation in English ——. C. G. Matthews and F. E. Lott. Proc. Seventh Int. Cong. Appl. Chem., London, 1909. Sect. VIb, 202—210.

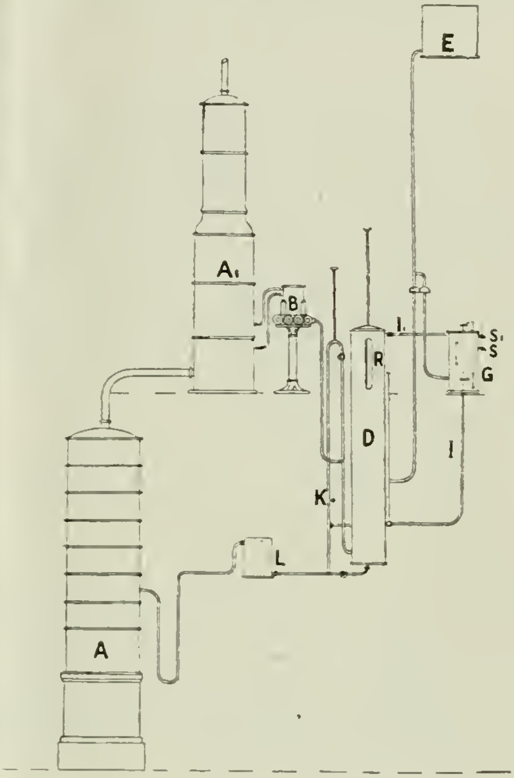
Secondary fermentation is usually effected, not by primary yeasts, but by distinct varieties of saccharomycetes brought into the beer by aerial or other communication According to Claussen, Schiönning, and others, true secondary fermentation in English beers requires torulæ as well as saccharomycetes, and the flavour of English beers is dependent on this fact. The authors consider that the intentional infection of beers with secondary yeasts would be quite unnecessary in most cases, especially where dry-hopping is employed, this treatment constituting the best method of practical infection. The nature and composition of the residual solids in a racked beer play the chief rôle in the secondary fermentation. The carbohydrates are the chief substances involved in this process, and of these, the substances (conveniently termed amyloins) intermediate between maltose and stable dextrin, are the most important. The authors quote the results of experiments on conditioning or secondary fermentation. In experiments with a mild ale, it was found that a low temperature (50°—60° F.) is inimical to active conditioning, even when cold-water-malt extract and secondary yeasts are added; mild ale, brewed with highly cured malt, will not attenuate very low even under favourable conditions (*i.e.*, high temperatures and addition of cold-water-malt extract). Experiments with a pale ale showed again that low temperature restricts the fermentation, and that finely ground malt accelerates the fermentation much more than does cold-water-malt extract alone, and to about the same extent as the extract in conjunction with hops or with secondary yeasts; it would appear that nearly all the dextrin could be degraded and fermented, but not in less than 10 or 12 days. Experiments with another pale ale showed that at a temperature of 75° F. active fermentation proceeds rapidly, and that an increase in the quantity of added malt causes a lower attenuation after the first three days, but that the total degradation is not attained in less than 10 days, even when as much as 10 oz. of malt per barrel are added. The authors recommend the following method for ascertaining the conditioning power of beers:—Half a grm. of finely ground malt is added to about 250 c.c. of the ale in a screw-stoppered bottle. The bottle is then kept at a temperature of 75 ° F., the appearance of the ale is noted in 48 hours (pressure being relieved if necessary), and the gravity is taken on the fourth and sixth days with a small saccharometer.—L. E.

Wines; Elimination of crystalline deposits in —— by cold filtration. F. Malvezin. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. VIb, 68—70.

The crystalline deposits of wines, which consist chiefly of potassium bitartrate, are only precipitated on cooling the wine. One method for effecting precipitation consists in keeping the wine for several days at as low a temperature as the wine will sustain (without freezing) and then racking off the wine from the deposit. This method, however, is costly and injures the quality of the wine. The author prefers a method which consists in cooling the wine, under a certain pressure, to the lowest temperature permissible, filtering the wine, at this temperature, through a special filter, and then gradually warming the wine to the ordinary temperature, the wine being subjected to pressure throughout the operation. The whole process only occupies about 2 minutes; great economy is effected, in that the cold, filtered wine passes through a regenerator where it serves to effect a partial cooling of a fresh portion of wine. With regard to the quality of the treated wine, he process is very satisfactory.—L. E.

Fusel oil of a high degree of concentration and purity; Separation of ——, applicable to any type of distilling or rectifying apparatus. G. Garbarini. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. VIB, 51—55.

The author describes an apparatus for obtaining fusel oil of a high degree of purity from spirit distilling apparatus In the accompanying figure, A is the distilling and A_1, the ectifying column. The tail products are separated in B, and pass over to the vessel, D, from which, when it is nearly ull, most of the liquid siphons over and returns through K and the heater, L, to the distilling column. The tail products are thus continuously separated and returned o the column for concentration, until, after four or five days, the liquid passing from B to D contains distinct globules of fusel oil which rise to the surface and collect in the upper part of D. When a sufficient quantity of fusel oil has thus been separated, communication between D and the tube, K, is closed and that with the tube, I_1, opened, so that the fusel oil passes over from D to G, this being hastened by running water into D from E. A concentrated solution of calcium chloride is now run from E into G, and the contents of G well mixed by means of the agitator shown. After separation the saline solution is run off through the tube, I, and passed to the distilling column in order to recover the ethyl alcohol it contains. The fusel oil is washed two or three times with water in G and then run off through the taps, S, S_1. It contains a small proportion of ethyl alcohol, but is of sufficient purity (88—89 per cent.) for commercial purposes.—A. S.



Alcohol; Some substances present in —— which can affect its quality. E. Bauer. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. VIb, 77—81.

Both crude and refined spirit not infrequently present an objectionable odour. Owing to the minute amount in which the substance responsible for this odour is present, several attempts, made by the author, to isolate it were fruitless. Examination of a very pungent maize spirit, however, showed that the odour was due to an aldehydic, highly volatile body, which, the author concludes, must have been acrolein. In general, the occurrence of acrolein in alcohol is to be traced to decomposition of glycerol of fermentation in the still; in the particular case cited above, a bacterial decomposition of the maize-oil may have occurred, thus causing an increase in the quantity of glycerol and, subsequently, of acrolein. The improvement in the quality of spirit on long storage may chiefly be due to the disappearance of acrolein. Ammonia is another substance which affects the quality of alcohol injuriously, and, so far as the author's investigations go, it is present in larger or smaller traces in all crude spirit. In determining the acidity of alcohol, it is always necessary in the first place to heat the alcohol to 63° C., in order to expel carbon dioxide ; as indicators, cochineal and hæmatoxylin are preferable to phenolphthalein, whilst Congo Red and rosolic acid are useless. Alcohol contains free sulphuretted hydrogen and sulphur in organic combination ; since the sulphur is chiefly present in the latter condition, and it is the sulphur thus combined which is chiefly responsible, even when present in very small quantity, for the leek-like odour and flavour of the spirit, it is generally sufficient to determine the total sulphur. This is done by treating at least 1000 c.c. of the alcohol with bromine-water, diluting with 300 c.c. of water, distilling off the alcohol, and precipitating the sulphuric acid in the residue with barium chloride. Two samples of crude molasses spirit were found to contain 0·00506 and 0·00689 grm. of sulphur per 1000 c.c. respectively. Refined spirit frequently presents an opalescent to milky turbidity on dilution with water ; in two cases, this was found to be due to caoutchouc, the presence of which in the alcohol may be traced to contact of the latter with rubber tubing ; the author considers that alcohol-turbidity in general is due to this cause. In one case, however, in which the alcohol in the receiver of the rectifying apparatus was turbid, the phenomenon was traced to the presence of cupric hydroxide, probably formed by the action of ammonia on dissolved organic copper salts.—L. E.

Fermentation residues from breweries, distilleries, starch factories, etc. ; Drying ——. A. Aulard. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. VIb, 38—45.

Spent grains that are destined for feeding cattle, etc., should be submitted to a drying process. For this purpose the author recommends the use of Huillard's drying apparatus (see this J., 1904, 1079), grains that contain much water being first treated in a filter-press. The dried grains, containing say 8—10 per cent. of water, should be light in colour and of an aromatic odour (this odour is often only observed when the grains are mixed with tepid water). A small quantity of phosphatic chalk, or of salt, is sometimes added to supplement the deficiency of mineral matter, and an addition of molasses is equally advisable.—L. E.

Extinguishing the flame of burning alcohol. Olié. *See* IIa.

Note on the Goldenberg-Geromont method for the analysis of tartaric materials. Tobler and Caramelli. *See* VII.

Patents.

Beer ; Manufacture of ——. E. W. Kuhn, London. Eng. Pat. 772, Jan. 11, 1910.

A definite quantity of malt, according to the amount of alcohol to be contained in the finished beer, is mashed in the usual way at a temperature of 145°—155° F., and the wort is then boiled. The remainder of the malt required for the production of the beer is separately mashed at a temperature of 175°—185° F., in order that the starch shall not be converted into fermentable substances ; this wort is boiled with hops and then added to the first wort. Nitrogenous substances may be removed by chilling the wort before the latter is fermented.—W. P. S.

Fermented beverages containing low percentages of alcohol ; Manufacture of ——. C. W. Nance. Eng. Pats. 4800 and 7188, Feb. 25 and Mar. 22, 1910.

After brewing with malt and other constituents, excluding the hops, fermentation is arrested by heating under reduced pressure, any excess of alcohol beyond the required amount being removed at the same time. An infusion of hops is subsequently added.—J. P. O.

XIXa.—FOODS.

Milk ; Fermentation of citric acid in ——. A. W. Bosworth and M. J. Prucha. New York Agric. Exper. Stat., Bull. No. 14, 1910, 43—48.

During the spontaneous souring of milk the citric acid present as a normal constituent is converted into acetic acid and carbon dioxide. The change is brought about by the action of *B. lactis aerogenes*, and not by any of the other common dairy bacteria. Two molecules of acetic acid are produced for every molecule of citric acid present. During the process of cheese-making, all the citric acid is fermented before the cheese is placed in the press.—W. P. S.

Cocoa ; Composition [and analysis] of ——. F. Bordas. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. VIIIc, 187—193.

The composition of various kinds of pure cacao paste used in the manufacture of chocolate is sensibly the same, even though the cacao beans used in the manufacture are derived from different sources. The following formulæ are based on results obtained with cacao pastes made from various kinds of cacao bean :

Percentage of non-fatty matter insoluble in water × 1·30= Percentage of dry, fat-free cocoa.

Percentage of non-fatty matter insoluble in water × 2·95= Percentage of dry entire cocoa.

The quantity of fat or butter removed per 100 parts of the pure cocoa is given by the formula $X = \frac{100(2{\cdot}95\,I-A)}{2{\cdot}95\,I}$ in which I represents the percentage of water-insoluble, non-fatty matter in the sample under investigation and A=100 less the percentage of moisture in the sample. Cocoa contains 2·9—3·8 per cent. of mineral matter, the chief constituent of which is potash. It is shown that whilst ordinary cocoa contains on the average, 2·54 parts of potash (K_2O) per 100 parts of fat-free dry cocoa, cocoas that have been treated with alkali contain considerably more (*e.g.*, 4·82—6·41 parts). According to the author, addition of potassium salts renders cocoa distinctly alkaline to litmus paper, whereas ordinary cocoas are slightly acid. Cocoa fat (cacao butter) should have a saponification value of 187—193, an iodine value of 33—39, an oleo-refractometer deviation of 18—19, and a Zeiss butyro-refractometer deviation of 40—45 ; a pure solvent should be used for extracting the fat, and the kind of solvent used should be stated, since the values obtained may be affected by the degree of purity and the kind of solvent. Using invertase for hydrolysis, the author has found 0·65 per cent. of sucrose in a mixture of pure cocoas, a proportion which would be increased if the cocoa were partially freed from fat to convert it into " soluble cocoa " or cocoa powder. The erroneous opinion that cocoa powder may contain 3—4 per cent. of sucrose is due to the use of acid for hydrolysis, whereby glucosides, starch and inulin, as well as sucrose, are decomposed. The determination of starch in cocoa is effected on the material after it has been freed from fat and sugar and treated with 50 per cent. alcohol ; the same results are obtained whether hydrolysis is effected by acid or by malt extract, though the former agent, being more rapid in its action, is to be recommended. It is shown that, on the average, cocoa contains 28·5 parts of starch per 100 parts of insoluble (fat-free) matter ; in determining the amount of foreign farinaceous matter in cocoa, it may be assumed that this foreign matter contains 75 per cent. of starch ; then, if A = amount of starch found, X = amount of insoluble matter in the cocoa, Y = amount of foreign farinaceous matter, and M = amount of insoluble matter found in the sample,

$$0{\cdot}285X + 0{\cdot}75Y = A,$$
$$X + Y = M,$$

from which X and Y may be calculated. The detection of foreign starches under the microscope is a relatively simple matter and it is advisable to examine the starchy material in this way. To determine the cellulose, the residue left on the filter in determining the starch, is treated with warm 0·1 per cent. solution of sodium hydroxide, washed with water and alcohol, dried and weighed, a deduction being made for the mineral matter present. Using this method, the author has found that the cellulose-content of a number of cocoas ranged between 13·8 and 16·6 parts per 100 parts of insoluble (fat-free) matter.—L. E.

Chocolate ; Need for a definition of —— in England. N. P. Booth. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. VIIIc, 178—179.

It is suggested that the following definitions for chocolate goods are reasonable and could be conformed to by makers of the genuine article ; they are not more stringent than the standards enforced in some foreign countries. *Unsweetened chocolate* should be prepared exclusively from roasted, shelled, finely ground cacoa beans and should not contain less than 45 per cent. of cacoa butter. *Sweetened chocolate* should consist only of the products of roasted, shelled, finely ground cacoa beans together with not more than 65 per cent. of sugar. *Granulated* or *ground chocolate for drinking purposes* should contain the same ingredients as *sweetened chocolate* but the proportion of sugar may be raised to not more than 75 per cent. *Chocolate-covered goods* should consist of confectionery covered with *sweetened chocolate* as defined above. *Milk chocolate* should be composed exclusively of roasted, shelled cacoa beans together with sugar and not less than 15 per cent. of the dry solids of full-cream milk. All these products might also contain a small quantity of harmless flavouring matter. The addition of starch, fats or powdered cacoa-shell to articles sold under the name of *chocolate* should not be permitted.—J. H. L.

Coffee. IV. K. Gorter. Annalen, 1911, **379**, 110—130. (See this J., 1908, 242, 464 ; 1910, 587.)

Chlorogenic acid after being purified by means of its calcium salt, melts at 208° C. (uncorr.). The following characteristic reaction, by means of which it has been detected in the seeds of *Kopsia flavida*, of *Helianthus annus*, and of *Strychnos Nux vomica*, is described. The acid is boiled for 1 hour with dilute (1 : 4) hydrochloric acid, and the solution extracted with ether. The ethereal solution is washed with dilute bicarbonate solution and with water, and then shaken with dilute ferric chloride solution (1 drop of a 5 per cent. solution and 4 c.c. of water). The ethereal layer becomes coloured pale yellow, whilst the aqueous solution soon acquires an intense violet colour. 2 mgrms. of chlorogenic acid can be detected by this test, if the ethereal solution be not too concentrated. Chlorogenic acid is considerably stronger than acetic acid, its dissociation constant being $k = 2{\cdot}2 \times 10^{-3}$ at 27° C. The view that the caffeine in coffee is present as potassium-caffeine chlorogenate is maintained, and it is pointed that the experiments of Lendrich and Nottbohm (this J., 1909, 379) do not invalidate this view, since on adding pure caffeine to coffee from which the caffeine has been previously extracted, the alkaloid would combine with the potassium chlorogenate present in the coffee. The constitution of chlorogenic acid is discussed and a formula for it is proposed. —A. S.

Food ; Preservatives in ——. E. J. Bevan. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. VIIIc, 205—211.

The paper is chiefly based on the report of the Departmental Committee appointed to enquire into "The Use of Preservatives and Colouring Matters in the Preservation and Colouring of Food" (see this J., 1901, 1228). The author is strongly of the opinion that legislative effect should be given to the recommendations of the Committee.—L. E.

Food ; Use of preservatives in ——. J. C. Thresh. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. VIIIc, 211—215.

It is contended that generally speaking, the use of food preservatives, in reasonable quantity, has not been proved to exert any injurious effect on health and that in many cases the use of such preservatives is justifiable. Against the conclusions of Wiley (cp. this J., 1908, 350, 914 ; 1909, 255) it is urged that in the experiments on which these conclusions are based, (1) the preservative was not, save in the case of formalin, administered with the food but in single daily doses, enclosed in capsules ; (2) large quantities were administered than would ever be taken in preserved foods ; (3) the controls were insufficient and inadequate. The author refers to a U.S. Report, according to which benzoic acid and benzoates, in the quantities used for food preservation, neither injure health nor impair the quality or nutritive value of foods (cp. this J., 1909, 215). He considers that in some cases (*e.g.*, milk) the use of preservatives is neither necessary nor desirable and that if legislative action is necessary, it should be directed to preventing the use of preservatives in such cases.—L. E.

Formic acid ; Determination of —— in foods. H. Fincke. Z. Unters. Nahr. Genussm., 1911, **21**, 1—15.

The conditions under which mercuric chloride is quantitatively reduced by formic acid have been worked out by Auerbach and Plüddemann and described in their paper on the determination of formic acid (Arbeit. Kaiserl. Gesundheitsamte, 1909, **30**, 178) ; the author has submitted the process to a critical examination and finds that it yields trustworthy results. When many determinations of formic acid have to be made, it will be found quicker to use the method volumetrically by heating the formic acid solution for 2 hours with the addition of sodium acetate and an excess of mercuric chloride solution (58·87 grms. of mercuric chloride and 15 grms. of sodium chloride per litre), and then titrating back the excess of mercuric chloride. For an occasional determination, however, it will be found more convenient to weigh the precipitated mercurous chloride ; in this case, standard solutions are not necessary, the formic acid solution being heated with sodium acetate and mercuric chloride and the precipitate collected on an asbestos filter, washed with water, alcohol and ether, dried for 1 hour at 100° C., and weighed. In separating formic acid from foods, the sample should be acidified with tartaric acid and steam-distilled until at least 1500 c.c. of distillate have been collected. Should formaldehyde or other aldehyde be present, the vapours from the distillation flask must be passed through a flask containing water and calcium carbonate before being condensed ; the formic acid is retained in the calcium carbonate flask (which is heated separately) whilst the aldehydes pass over with the steam. At the end of the distillation, the contents of the calcium carbonate flask are poured on a filter, the residual calcium carbonate is washed, and the formic acid is determined in the filtrate. Should sulphurous acid be also present in the food under examination, the distillate or filtrate from the calcium carbonate is neutralised, evaporated to a volume of about 100 c.c., sodium hydroxide and hydrogen peroxide are then added, and the mixture is placed aside for 4 hours at the ordinary temperature ; the excess of hydrogen peroxide is destroyed by the addition of freshly precipitated mercuric oxide, which is allowed to act for 30 minutes, the mixture being then filtered and the formic acid determined. Salicylic acid yields an insoluble compound when heated with mercuric chloride and sodium acetate, but the presence of sodium chloride retards or inhibits the formation of this compound. The quantity of sodium chloride in the above-mentioned mercuric chloride solution is usually sufficient for this purpose, should the food contain only a small amount of salicylic acid, but it is advisable to concentrate the neutralised distillate by evaporation and to add 1 grm. of sodium chloride, 2 grms. of sodium acetate, and 0·5 grm. of mercuric chloride for every 50 c.c. of the concentrated solution obtained ; the process is then continued as described. Sugars do not yield any volatile substances which reduce mercuric chloride if an organic acid be employed for acidifying the material to be distilled. The solution must, however, be dilute and the sugars must not be allowed to caramelise.—W. P. S.

Lithium in water ; Determination of ——. M. T. Lecco. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. I, 68—69.

The author recommends that lithium should be determined in the systematic analysis of natural mineral waters. He suggests for this purpose the following procedure, which was found to give, generally though not invariably, satisfactory results :—The filtrate from the magnesium phosphate, containing, as it does, all the lithium, is evaporated to dryness in a platinum basin, over a water-bath. The residue is dried above 100° C., and the lithium in it determined as phosphate by Mayer's method. If no precipitate appears, the amount of lithium present is negligibly small. Usually a cloudy solution is obtained, but as this may be due to impurities derived from the reagents or the glass vessels, a qualitative test of the precipitate is desirable.—J. H. L.

Sugar in human diet. Dupont and Tribot. *See* XVII.

Drying fermentation residues from breweries, distilleries, etc. Aulard. *See* XVIII.

Modification of the furfural-hydrochloric acid method for the determination of pentosans. Böddener and Tollens. *See* XXIII.

Determination of pentosans with the aid of Fehling's solution. Flohil. *See* XXIII.

Patents.

Wheat; Treatment of germ of —— and obtaining a preparation therefrom for incorporation with flour and meal. J. Wallis and J. and T. H. Wallis, Ltd., Beddington, Surrey. Eng. Pat. 12,432, May 21, 1910.

Germ of wheat is cooked or roasted at a temperature of about 460° F., then cooled, and ground into a medium meal. The latter is mixed thoroughly, in suitable quantities, with flour and wheat meal and the mixture is used for making bread, etc.—W. P. S.

Food product from the germs of cereals; Manufacture of a ——. A. Nilson, Assignor to Wahl-Henius Institute of Fermentology, Chicago, Ill. U.S. Pat. 976,488, Nov. 22, 1910.

Germs of cereals are heated for about 3 hours at a temperature of from 120° to 212° F., with a solution containing a quantity of sodium carbonate equal to from 3 to 5 per cent. of the weight of the germs. The solution is then separated, concentrated, and clarified by sedimentation or filtration in order to remove the precipitated bitter principles. The resulting liquid is next submitted to lactic fermentation, concentrated if desired, and carbonated. The extracted germs may be used as a cattle-food.—W. P. S.

Food product [from wood]; Process of forming a ——. J. K. George, Assignor to Classen Lignum Co., Chicago, Ill. U.S. Pat. 981,634, Jan. 17, 1911.

Wood is digested with an acid in order to convert the cellulose into sugars and to render the residue of the wood digestible; the acid and a part of the fermentable sugars are then removed from the mass, and molasses is added to the residue.—W. P. S.

Chocolate, cocoa, and cocoa products; Process applicable in the manufacture of ——. F. W. Hildesheim. Fr. Pat. 419,659, Aug. 25, 1910. Under Int. Conv., July 11, 1910.

The chocolate paste or cocoa mass is delivered from a hopper provided with a stirrer and is passed between rollers which are heated to a temperature of not less than 60° C. The paste then falls into a suitable receptacle. If desired, the paste may be passed between several successive pairs of heated rollers. The object of the process is to produce in a short time a material similar to that obtained by grinding for many hours in an ordinary puddle-mill.—W. P. S.

Desiccating certain liquids by atomising. Fr. Pat. 419,192. *See* I.

XIXb.—WATER PURIFICATION; SANITATION.

Manganese in drinking water; Identification and determination of ——. Klut. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. VIIIA, 288.

For the detection of manganese, Volhard's method, depending on the formation of permanganic acid by oxidation with nitric acid and lead peroxide, is recommended. Small quantities of manganese in water may be determined by a modification of Volhard and Treadwell's method, the permanganic acid produced by oxidation with nitric acid and lead peroxide being estimated colourimetrically by comparison with standard solutions containing nitric acid and permanganate. For quantities of manganese of 10 mgrms. or more per litre, Von Knorre's method (this J., 1902, 72) is best. The permanganate is converted into manganese dioxide by means of ammonium persulphate in sulphuric acid solution, and the dioxide is titrated with hydrogen peroxide solution which has been standardised against permanganate.—A. S.

Nitrification and the absorption theory. F. W. Stoddart. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. VIIIA, 183—210.

The author gives the results of experiments which have been carried on for more than 25 years. The general plan was to allow solutions of ammonium salts (in some cases also clarified sewage) to trickle continuously over a column of air-charged medium rendered active by seeding with a culture of the oxidising organisms. The apparatus consisted of a glass tube, 1 in. inside diameter, filled to a height of 3 ft. with fragments of white marble which passed a sieve of 6 meshes and were retained by one of 8 meshes per inch. The tube communicated above and below with the air. The detailed results of numerous experiments under varying conditions are given. Similar results were obtained whether the solution of ammonium salt was allowed to flow on to the material in the form of drops or as a fine continuous stream, by means of a thread or wire; hence air is not supplied to the material to any appreciable extent, by an "injector action" of the drops of liquid. The author's view is that the replenishment of the oxygen is due to diffusion from the outer air following the partial vacuum caused by the absorption of oxygen in the production of nitrate. The nitrification was not nearly so good when an intermittent flow of the ammonium salt solution was used as when the flow was continuous, the reduction in the efficiency of the filter being greater, the longer the intervals of rest. This is not due to the diminution of the activity of the organisms owing to deprivation of nourishment, since a filter which has been left idle for some days will resume its full activity when a continuous flow of ammonium salt solution is applied. Nitrification is markedly increased by rise of temperature up to about 30° C., but higher temperatures act adversely. With solutions containing from 0·5 up to 50 or 60 parts of ammoniacal nitrogen per 100,000, the results indicate that a cubic mass, 3 ft. each way, of the medium will completely nitrify half a pound of ammoniacal nitrogen in 24 hours at the ordinary temperature, whilst by using a column of material in which the depth is increased at the expense of the superficial area, a much greater efficiency is obtained. The author is unable to confirm Adeney's view that the presence of humus is necessary for the formation of nitrate. Experiments are also described showing that the oxidation products of ammonium compounds, urea, and the soluble organic compounds of sewage pass through the filter in an exactly analogous manner to a salt such as sodium chloride, thus disproving Dunbar's absorption theory (see this J., 1900, 842), according to which the dissolved organic matters are merely retained by the filter during the passage of the sewage, and are oxidised subsequently during the period of rest. In the author's opinion Dunbar's theory can apply only to matter mechanically suspended in the sewage. In applying the results of his experiments to practical sewage disposal, the author maintains that the first step should be the production from the sewage of a perfectly limpid liquid, however putrescible. In such a liquid, the dissolved organic matters could be completely oxidised by a continuous flow filter properly designed and operated, and much greater quantities could be dealt with than has been found possible up to the present (see this J., 1902, 183).—A. S.

Sewage; Decomposition of —— in presence of sea water considered chemically and bacterially. J. E. Purvis, G. H. Macalister, and E. Minnett. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. VIIIA, 272—288.

Experiments were made as to the influence of sea water on the decomposition of sewage, mixtures of sea water and sewage being incubated for different periods and then examined both chemically and bacteriologically. The results showed that in mixtures containing 1, 5, or 10 per cent. respectively of either weak or strong sewage, about 70 per cent. of the organic nitrogenous compounds (as shown by the yield of total ammonia) remained undecomposed after 18 days incubation, and that neither nitrites nor nitrates were produced. Any nitrates present were quickly decomposed, and nitrites also disappeared in, at the most, four days. The bacteriological tests showed that the total number of organisms in sewage was reduced much more rapidly in presence of sea water, than in the sewage alone. Nitrifying organisms quickly disappeared both in sewage alone and in the mixtures with sea water. Denitrifying organisms were more resistant, but in the case of them also the number was lessened much more markedly in presence than in absence of sea water. The results of the investigation show that sewage should be subjected to a preliminary purification before being discharged into the sea or into a tidal estuary.—A. S.

"Sewer-gas"; Poisoning by ——. W. Göhlich. Chem.-Zeit., 1911, **35**, 129—130.

A workman engaged in cleaning a sewer was taken ill, and later died, and the autopsy showed a typical case of hydrogen arsenide poisoning. Two samples of the contents of the sewer were taken and were found to consist more of sludge than of water. The sludge was centrifugalised and the liquid portion examined. No hydrogen sulphide nor hydrogen arsenide was present. The reaction was strongly acid due to sulphuric acid, and distinct quantities of arsenic were detected. On adding either pure zinc or pure iron to the sample, hydrogen arsenide was evolved, and this reaction at once explained the cause of the man's illness, as he used iron implements in cleaning the sewer. The amounts of sulphuric acid present were 0·84 and 1·82 grms. (SO_3) in 100 c.c. of the two samples, and of arsenic 0·275 and 0·73 grm. (As_2O_3). As to the reason of the acid and the arsenic being in the sewer, it was found that near the place the effluent from an artificial manure works, where sulphuric acid and phosphate were used, entered the sewer, and acid and arsenic were found in this effluent. Another interesting observation made was that the stonework of the drain from the manure works contained deposits of sulphide of arsenic, the result of chemical reactions arising from the putrefaction of fæcal matter also entering the drain.—J. H. J.

Nicotine in concentrated tobacco extracts; Determination of ——. H. Ulex. Chem.-Zeit., 1911, **35**, 121.

The author's method for the determination of nicotine in tobacco extracts has been found to give satisfactory results even when ammonium salts are present. 10 grms. of the extract, which may be thinned by the addition of 1—3 c.c. of water, are rubbed with enough soda-lime-calcium sulphate mixture (1 part of soda-lime, 5 parts of ignited calcium sulphate) to form a rough powder. This is ground in a mortar, and sifted through a hair-sieve (220 holes to the sq. cm.). The coarse powder is again ground up with more of the lime mixture, and sifted. This is repeated till all has gone through. If the mass becomes warm in the process, it must be cooled. The sifted mixture (about 50 grms.) is placed in a shallow dish, 15 cm. diam., which is put in a desiccator over strong sulphuric acid for an hour in order to remove the last traces of ammonia. The dry powder, with 3—4 grms. of sodium hydroxide, is added to 1·5 litres of boiling water in a lead flask, containing 4 grms. of paraffin to prevent frothing. One litre of liquid is distilled over with steam. A further litre of boiling water is added and a second litre of distillate collected, the whole being titrated with $N/2$ hydrochloric acid using litmus as indicator.—F. Shdn.

Fertiliser, insecticide, and fungicide. Eng. Pat. 10,511. *See* XVI.

Patents.

Sewage sludge; Method of and apparatus for drying ——. J. Grossman, Manchester. Eng. Pat. 28,516, Dec. 7, 1909.

The apparatus employed is similar to that described in Eng. Pat. 19,922 of 1906 (this J., 1907, 1077), and two of the machines may be used, one being placed above the other; the upper one may be of a conical shape instead of cylindrical. Besides being heated internally by means of steam, the cylinders are heated externally by a furnace, the greatest heat being applied to the end of the cylinder at which the sludge is introduced; the hot gases from the furnace may be admitted to the interior of the cylinder. The dried sludge may be employed as fuel in the furnaces. The apparatus may be used in conjunction with the distillation apparatus described in Eng. Pat. 16,397 of 1908 (this J., 1909, 1000). Means are provided for condensing the volatile products leaving the drying cylinders. —W. P. S.

Sewage; Treatment of ——. F. J. Commin, London. Eng. Pat. 16,508, July 11, 1910.

A continuous and regulated current of the sewage is passed through a septic tank, the inlet and outlet being at the same level and at opposite sides of the tank. Deflecting plates are arranged across the tank between the inlet and outlet, with the object of allowing solids in suspension in the sewage to either rise or fall into the liquid filling the tank. Having once passed into the body of the tank, the particles are prevented, by the shape of the baffle-plates, from again mixing with the sewage as it flows from the outlet of the tank.—W. P. S.

Sewage; Process for the treatment of ——. J. L. F. Garrigou. Fr. Pat. 419,703, Nov. 2, 1909.

The sewage is separated into two portions, liquid and solid; the liquid portion is then treated with a quantity of sulphuric acid sufficient to combine with the whole of the ammonia present and the ammonium sulphate is separated from the solution by freezing the latter. The concentrated ammonium sulphate solution thus obtained is evaporated. The solid portion of the sewage is drained, frozen to remove excess of liquid, and then dried by heating under pressure at a temperature of from 130° to 150° C. The waste heat from the latter operation may be employed for evaporating the ammonium sulphate solution.—W. P. S.

Disinfecting compound. W. Dreyfus, New York. U.S. Pat. 978,142, Dec. 13, 1910.

Three lb. of potassium hydroxide are dissolved in 7 galls. of grain or wood alcohol and 24 lb. of paraform (polymerised formaldehyde) are added; 2 galls. of this solution are added to 10 galls. of a solution prepared by heating equal parts of natural or synthetic oil of wintergreen and refined mineral oil to a temperature of 100°—150° F., and the mixture is then diluted with mineral oil to a volume of about 54 galls.—W. P. S.

Cleansing and disinfecting fluid. A. H. Peter, Hastings-on-Hudson. U.S. Pat. 981,876, Jan. 17, 1911.

See Eng. Pat. 644 of 1910; this J., 1910, 1268.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Camphor in Burma. Oil, Paint, and Drug Rep., Jan. 30, 1911. [T.R.]

THE camphor tree, principally the *Blumea balsamifera*, seems to be indigenous to certain parts of Burma, and the experiments conducted by the forest department to cultivate the *Cinnamomum camphora* show that this tree can be successfully grown in the upper Chindwin, Myitkyina, and Bhamo districts, as also at Momeik, while in Maymyo the tree is said to flourish. The experiments of the past few years go to show that it can be successfully grown in Upper Burma, and the species should also do well at suitable elevations in the Shan States. There is, therefore, a fair prospect of a camphor plantation on a large scale in Burma proving successful and profitable, and there is no reason why a camphor industry should not be started in the province. A series of experiments made by the forest department indicated that the branches and leaves of *Blumea balsamifera* could be profitably utilised as a source of camphor. In North Hwensi a crude process is already in use, and the product finds a ready market locally. In Kengtung a considerable export trade exists with the Southern Shan States, the average annual output being between 14,000 and 18,000 lb.

Opium production in Austria; The expressed juice of unripe poppy-heads and ——. W. Mitlacher and R. Wasicky. Z. Allgem. oesterr. Apoth-Ver., 1911, **49**, 53—56.

EXPERIMENTS have been carried out by the authors in order to ascertain if the expressed juice of poppy-heads could be utilised as a practicable source for opium alkaloids. Two kinds of poppy, yielding blue seeds and white seeds respectively, were cultivated last year at Korneuburg, in Austria. Opium was collected from them in the ordinary way, the cost being 167 kronen (£7) per kilo. The opium from the blue-seeded poppy contained 5·09 per cent. of morphine and 4·07 per cent. of narcotine and codeine, but opium collected from the same variety of poppy later in the season contained less of these alkaloids. The white-seeded poppy gave an opium containing 3·9 per cent. of morphine and 3·5 per cent. of narcotine and codeine. About 254 plants were grown on 25 sq. metres of ground, and yielded 1670 heads weighing 12—24 grms. each. 300 heads of the blue-seeded poppy gave 300 c.c. of expressed juice, which contained 0·015 grm. of morphine, whereas the opium from the same number of heads would have contained 0·32—0·36 grm. of morphine. The marc left after pressing was extracted with warm water and the extract contained 0·05 grm. of morphine. Similar results were obtained with the white-seeded poppy.—F. SHDN.

Xanthaline and papaveraldine; The identity of ——. B. Dobson and W. H. Perkin, jun. Chem. Soc. Proc., 1911, **27**, 4.

THE authors have made a careful study of the alkaloid xanthaline, which T. and H. Smith (Pharm. J., 1893, 793) isolated in very small quantities from opium, and they find that this alkaloid is identical with papaveraldine.

Quinine sulphate; Radiation and luminescence of —— *and ionisation produced by it.* de Broglie and L. Brizard. Comptes rend., 1911, **152**, 136—138.

CONSIDERATION of the phenomena observed when quinine sulphate is being heated, or is cooling after being heated, leads to the hypothesis that sudden decrepitations of the crystals occur, accompanied by electric discharges. The rapid succession of scintillations from these discharges produces the apparently continuous luminescence observed. The ionisation of the surrounding gas, its unsymmetrical nature, its dependence on the nature and pressure of the gas, and the fatigue of the phenomenon when repeated on the same sample, are all explicable on this hypothesis.
—J. T. D.

Strophanthus seeds; Assay of ——. J. Haycock. Brit. and Col. Drugg., 1911, **59**, 94.

THE oil in powdered strophanthus seeds can be determined by extracting with light petroleum or ethyl ether at the ordinary temperature, none of the strophanthin being dissolved. On evaporating the solution, the oil can be weighed after drying at 100° C. A previous treatment of the powder with light petroleum or ether helps in the subsequent determination of the strophanthin. The powder is exhausted with 70 per cent. alcohol, the strong tincture evaporated to a soft extract at a low temperature, and dissolved in 100 c.c. of water. After adding 2 c.c. of 25 per cent. sulphuric acid, the liquid is shaken out three times with 20 c.c. of ether. The aqueous portion is heated to 75° C. for 1 hour. When cold, the strophanthidin formed by the heating is removed by shaking out three times with chloroform. The chloroform extract is evaporated, a little alcohol added, and the residue weighed after drying below 65° C. The result divided by 0·365 gives the amount of strophanthin present.—F. SHDN.

Strychnine and brucine; Research on ——. [*Bromine derivatives of strychnine.*] R. Ciusa and G. Scagliarini. Gaz. chim. ital., 1911, **41**, I., 38—45.

BY the action of bromine on strychnine dissolved in glacial acetic acid, a dibromo-compound, $C_{21}H_{22}O_2N_2Br_2$, is obtained, which exists in two forms. The more soluble modification melts at 122° C., and by repeated crystallisation from alcohol, or on melting, changes into the more stable form melting at 260° C.; the former crystallises in colourless rosettes of needles and the latter in monoclinic crystals. When boiled with water this dibromo-compound is converted into an isomeride, soluble in hot water, which when treated in aqueous solution with ammonia or sodium acetate yields monobromostrychnine melting at 222° C., and hence must be regarded as the hydrobromide of the latter compound. Monobromostrychnine when treated with bromine in glacial acetic acid solution, yields an orange-yellow crystalline perbromide, probably $C_{21}H_{21}O_2N_2Br, HBr.Br_4.H_2O$, and two other compounds, probably the dibromide of monobromostrychnine and its hydrobromide.
—A. S.

Atropine; Determination of ——. *Determination of the alkaloids in belladonna extracts.* M. Javillier. Bull. Sci. Pharmacol., 1910, **17**, 629—634. Chem. Zentr., 1911, **1**, 430.

IN the determination of atropine as silicotungstate (compare this J., 1910, 1176), the solution of the alkaloid should not be too dilute, as atropine silicotungstate is not completely insoluble in water. Hydrochloric acid is added to the solution in such quantity that 2 per cent. of free acid is present, and then a 10 per cent. solution of silicotungstic acid is added, drop by drop, with stirring; excess of the reagent must be avoided. After standing for 24 hours the precipitate is separated by filtration or in a centrifugal apparatus, washed with 1 per cent. hydrochloric acid, and incinerated. The weight, multiplied by 0·4064, gives the quantity of atropine, to which 0·0048 grm. for each 100 c.c. of the original solution is added as a correction for the solubility of the atropine silicotungstate (the solubility in the wash water may be disregarded). Precipitation may be effected in hot or in cold solutions, but prolonged boiling must be avoided. The method can be used for the determination of atropine in belladonna extract. Some commercial extracts gave by this method an atropine content as much as 55 per cent. lower than that obtained by the volumetric official method (French), but investigation showed that the figures obtained by the silicotungstate method were correct.—A. S.

Aconitine; Determination of —— *by means of silicotungstic acid.* H. Ribaut. Bull. Sci. Pharmacol., 1910, **17**, 634—639. Chem. Zentr., 1911, **1**, 431.

THE author's experiments led him to draw the following conclusions:—The composition of aconitine silicotungstate depends upon that of the solution in which it is formed, the salt containing more silicotungstic acid the richer the solution is in nitric acid or silicotungstic acid. Nitric acid and silicotungstic acid increase the solubility of aconitine silicotungstate, the former acid having a greater influence than the latter in this respect. Under the conditions prescribed in the Codex (French), that is, in presence of a solution containing 2·3 per cent. of nitric acid and 0·5 per cent. of free silicotungstic acid, the factor 0·793, given by Ecalle, yields satisfactory results when used for calculating the quantity of aconitine from that of the silicotungstate. Under the conditions mentioned, a correction for the solubility of the aconitine silicotungstate is unnecessary for practical purposes. Aconitine silicotungstate does not correspond with Bertrand's general formula, $SiO_2,12WO_3,2H_2O,4$ alkaloid $+ nH_2O$ (this J., 1899, 404); whilst a compound of the formula, $SiO_2,12WO_3,2H_2O,3{\cdot}5$ aconitine $+nH_2O$, given by Ecalle, is obtained only under strictly defined conditions with respect to concentration of nitric acid and silicotungstic acid in the solution.—A. S.

Kola extract. Boulanger-Dausse. Bull. Sci. Pharmacol., 1910, **17**, 639—645. Chem. Zentr., 1911, **1**, 419.

An extract containing about 10 per cent. of caffeine, prepared from dried commercial kola nuts (*Cola acuminata* Pal. Beauv.) with two cotyledons, was crumbly and not suitable for manipulation. In its preparation the liquid should not be filtered before concentration. An extract containing 5 per cent. of caffeine, prepared from dried commercial nuts (*Cola Ballayi*) with four cotyledons was of proper consistence, and represented a good preparation. In its preparation, also, filtration of the extract should be omitted. An extract prepared from fresh kola nuts with two cotyledons, sterilised by means of boiling alcohol, contained 5 per cent. of caffeine. An extract prepared from powdered kola nuts sterilised by means of steam contained 7—10 per cent. of caffeine. The extracts obtained by the last two methods (of which the second is the better) are far superior to those obtained from commercial products, but are more expensive.—A. S.

Catalytic reactions at high temperatures and pressures. Influence of foreign substances on the activity of the catalyst. W. I. Ipatiew. J. Russ. Phys.-Chem. Soc., 1910, **42**, 1557—1563. (See this J., 1909, 745.)

The nature of the metal of which the author's high-pressure apparatus is constructed is found to exert an influence on the hydrogenation, in presence of cupric oxide, of compounds containing ethylene linkages. Thus, in an iron tube, amylene (trimethylethylene) is readily converted into isopentane, whilst in a copper tube the reaction is incomplete, an equilibrated mixture of amylene, hydrogen, and isopentane remaining: $C_5H_{10}+H_2\rightleftarrows C_5H_{12}$; in an iron tube and in absence of cupric oxide, no hydrogenation occurs. Similar results are obtained with hydro-aromatic compounds. Further, hydrogenation in an apparatus of phosphor-bronze in presence of reduced copper results in the establishment of an equilibrium, whilst, if iron turnings are also present, hydrogenation proceeds to an end. The slight catalytic activity of reduced copper in copper tubes may be regarded as due to poisoning of the catalyst; or, the use of cupric oxide in iron tubes may result in a conjugated catalytic action.—T. H. P.

Fatty acids; The volatile ——. J. Effront. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. IVa1, 83—85.

At present the only general method for the quantitative determination of volatile fatty acids is that of Duclaux (Traité de Microbiologie III., p. 386), based on the fractional distillation of a solution containing 1 or 2 per cent. of acid. The distillate from 100 c.c. of solution is collected in successive fractions of 10 c.c., each fraction being titrated with alkali. The values obtained, referred to *N*/1-alkali, furnish data for a diagram of which the curvature is characteristic for each acid and also for mixtures of two acids. The method gives excellent results, but is useless for mixtures of more than two acids. The introduction of a new process of fermentation of sugar and distillery residues has led to the placing on the market of large quantities of fatty acids, and in the absence of any method of analysis applicable to complex mixtures of these acids the author suggests the following one, which is tedious, but gives approximate results. It is based on the separation by rectification, of the ethyl esters of the acids: the final fractions obtained are usually individual esters, but sometimes they are mixtures of two, and in such cases they are saponified and analysed by the method of Duclaux. The degree of accuracy attainable by the new method is shown by the following results obtained in analysing a mixture, 100 parts of which contained 20 parts each of formic, acetic, propionic, butyric and valeric acids; the quantities of the acids found were:—formic 18·1 parts, acetic 20·2 parts, propionic 20·4 parts, butyric 19·2 parts and valeric 16·1 parts. The procedure is as follows:—100 grms. of the sample are converted into a mixture of sodium salts, which is dried, powdered, and introduced into a flask fitted to a reflux condenser, and already containing a cold mixture of 110 grms. of alcohol and 100 grms. of sulphuric acid of 60° B. After heating for seven hours in a water-bath, the liquid is distilled first from a water-bath and then in superheated steam. The distillate of mixed esters is decanted and washed with distilled water, and afterwards with a solution of sodium carbonate until exactly neutral. The product is fractionated until the various fractions boil at temperatures constant within limits of 2°—3°. The weight of each fraction (identified by means of its boiling point) is determined, and the corresponding weight of acid calculated. Errors due to impurities in the esters may be corrected by saponifying the separate fractions and determining the acids by the Duclaux method. About 20 per cent. of the total acids of the sample, however, will be found in the liquors used in washing the original distillate of mixed esters, either free, having escaped esterification, or as esters, having been simply dissolved by the wash liquors. In the analysis of the five acids already mentioned, it was found that the free acids of the wash waters consisted of valeric and butyric acids in the proportion of 3 : 1, whilst the esters present were ethyl acetate and propionate. To recover all these the wash liquors are neutralised and distilled. The esters alone pass into the distillate, and after saponification they are distilled from phosphoric acid, and the acetic and propionic acids determined by the method of Duclaux. The residue from the distillation of the neutralised wash liquids is distilled from phosphoric acid and the valeric and butyric acids determined by the Duclaux method. The quantities of the four acids so obtained are added to those found from the original fractionation. The errors due to manipulation should not exceed 2 per cent. of the total acids of the sample.—J. H. L.

Colloidal mercury. Amberger. *See* X.

Synthetic enzyme action. van't Hoff. *See* XVIII.

Determination of nitrogen in certain organic substances [aldoximes and ketoximes]. Fabinyi. *See* XXIII.

Patents.

Alkyl esters of di-iodo-fatty acids of high molecular weight; Manufacture of ——. Ges. f. Chem. Ind. in Basel, Basle, Switzerland. Eng. Pat. 19,350, Aug. 17, 1910. Under Int. Conv., Feb. 3, 1910.

The alkyl esters of di-iodo-fatty acids of high molecular weight are solid at ordinary temperatures and crystallise readily; they are obtained either by esterifying the higher di-iodo-fatty acids or by adding two atoms of iodine to esters of unsaturated fatty acids containing a treble linkage. The methyl, ethyl, and *iso*-amyl esters of di-iodobrassidic acid and the methyl ester of di-iodo-elaïdic acid are described; all are of value therapeutically.—T. F. B.

Menthylated oil of wintergreen. G. Bleiberger, New York. U.S. Pat. 979,416, Dec. 27, 1910.

Menthol and oil of wintergreen are heated together for a considerable time under pressure, in an atmosphere of carbon dioxide, at a temperature slightly below the boiling point of the oil of wintergreen, and the resulting product is distilled under reduced pressure: the distillate is purified by treatment with solid caustic soda and filtration. The product is an oily, transparent, light yellow liquid, soluble in alcohol, ether, chloroform, and fatty acids, and giving a red colouration with ferric chloride.—T. F. B.

Albumin preparations of the disodium salts of guaiacol-4- and -5-sulphonic acids and casein ; Process for producing —— soluble in water. Bauer und Co. Sanatogenwerke. Ger. Pat. 229,183, Feb. 27, 1909.

THE mixture of the disodium salts of guaiacol-4- and -5-sulphonic acids (obtained by sulphonating guaiacol at temperatures below 100° C.) or the concentrated aqueous solutions of these salts, are mixed with aqueous suspensions of casein, and the resulting solutions are evaporated to dryness at a low temperature, preferably *in vacuo*. The products may also be obtained by the action of the disodium salts or their solutions on casein suspended in ether-alcohol or other indifferent organic solvents, and then filtering and drying the products.—T. F. B.

Suprarenal preparations ; Process for producing non-toxic ——. Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pat. 229,281, July 17, 1909.

BY treating suprarenal preparations with expressed juices of the pancreas, spleen, liver, or other suitable organs, or with solutions of peptone or analogous substances, products are obtained which have in a marked degree the property of raising the blood-pressure, and at the same time stimulating the heart and suppressing the activity of the blood-sugar. For example, a solution of 0·8 mgrm. of a suprarenal extract may be treated for at least an hour with 2 c.c. of a 5 per cent. peptone solution.—T. F. B.

Ointments containing inorganic colloids ; Process for preparing ——. C. Amberger. Ger. Pat. 229,306, March 27, 1909.

WOOL grease, or the unsaponifiable substances obtained by treating it with alkalis, is mixed with solutions of metallic salts, and the mixture is agitated with a solution of an alkali hydroxide, carbonate, sulphide, or other salt, whereby the corresponding salt of the metal is precipitated in the emulsion in the colloidal condition ; the colloidal salts of platinum, silver, gold, etc., thus produced can be easily reduced to the colloidal metal if desired. The emulsions obtained are purified by treatment with a suitable organic solvent (ether, chloroform, etc.), which dissolves the wool grease and the sol, leaving undissolved the greater part of the water and the alkali salt ; the solution is dried and evaporated to obtain the ointment. Another method of purifying the products is to wash out the soluble salts with warm water. The solutions of the products produced in this manner appear variously coloured by transmitted light ; the gold solutions are blue to violet, the silver brownish red, palladium brownish black, and mercury red to red-brown ; the mercury solutions appear grey and opaque by reflected light.—T. F. B.

Local immunisation of diseased tissues ; Process for preparing products for the ——. A. Wassermann. Ger. Pat. 229,355, Feb. 9, 1910. Addition to Ger. Pat. 229,131, Nov. 8, 1908 (see Eng. Pat. 25,675 of 1909 ; this J., 1910, 451).

THE micro-organisms causing the disease (or their extracts) are sterilised, mixed with a solution of an indifferent colloid (*e.g.*, a 2 to 4 per cent. solution of gelatin or albumin), and emulsified with a suitable oil, fat, or wax.—T. F. B.

Compounds of guanidine ; Production of ——. S. J. Gelhaar and O. B. Carlson, Mansbo, Sweden. Eng. Pat. 815, Jan. 12, 1910.

SEE Fr. Pat. 412,219 of 1910 ; this J., 1910, 1036.—T. F. B.

Salts of urea ; Production of ——. S. J. Gelhaar, Avesta, Sweden. Eng. Pat. 816, Jan. 12, 1910.

SEE Fr. Pat. 412,220 of 1910 ; this J., 1910, 1036.—T. F. B.

Albumen preparation from albuminoids [casein] and salts of guaiacolsulphonic acids. A. Busch, Brunswick, Assignor to Bauer und Co., Berlin. U.S. Pat. 979,645, Dec. 27, 1910.

SEE Ger. Pat. 229,183 of 1909 : preceding.—T. F. B.

Methylketobutanol. Methylene-ethylmethylketone. G. Merling and H. Köhler, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 981,668 and 981,669, Jan. 17, 1911.

SEE Fr. Pat. 409,403 of 1909 ; this J., 1910, 719.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Diaminophenol developers ; Influence of boric acid in ——. R. Namias. Proc. Seventh Int. Cong. Appl. Chem., London, 1909. Sect. IX, 11—13.

BORIC acid may be used with advantage as a preservative agent for diaminophenol developing solutions : when present to the extent of 50 grms. per litre, it enables the solutions to be used even after several months, without impairing their reducing power to the same extent as do bisulphites. The time necessary for development is only very little greater than when boric acid is absent, and the quality of the images is unaffected ; if potassium bromide be added to the solution, a great decrease in the rate of development is apparent, with consequent increase of contrasts, so that this forms a convenient method of developing over-exposed images.—T. F. B.

Sodium sulphite ; Alteration of —— in presence of developing agents and other substances used in development. R. Namias. Proc. Seventh Int. Cong. Appl. Chem., London, 1909. Sect. IX, 14.

THE presence of alkali hydroxides in solutions of sodium sulphite retards to some extent their oxidation by air, whilst alkali carbonates accelerate it ; sodium bisulphite has no marked effect. In solutions containing quinol and sodium sulphite, the latter is oxidised more rapidly when alkali hydroxide is present, and less so with alkali carbonates and bisulphites. In solutions containing sodium sulphite and either quinol, metol, or glycine, both substances oxidise more slowly than when in solution alone. Diaminophenol in solutions containing sulphite and preservatives, is always completely oxidised by air before more than one-third of the sulphite has been oxidised.—T. F. B.

Gold toning baths containing thioureas. R. Namias. Proc. Seventh Int. Cong. Appl. Chem., London, 1909. Sect. IX, 18.

WHILST gold toning baths containing alkaline substances usually decompose somewhat rapidly after preparation, those containing thiourea or allylthiourea are very stable. It is desirable to add an organic acid, *e.g.*, citric, tartaric, oxalic, or lactic acid, to the bath ; lactic acid is preferable when the bath is to be used as soon as it is made up.
—T. F. B.

Silver images on gelatinobromide plates or films ; Substitution of compounds of lead and other metals for —— and their use as mordants for dyeing. R. Namias. Proc. Seventh Int. Cong. Appl. Chem., London, 1909. Sect. IX, 19—20.

SILVER images are treated with a solution containing potassium ferricyanide and lead acetate, the silver ferrocyanide is removed by means of 10 per cent. sodium thiosulphate solution (which does not dissolve the lead ferrocyanide), and the image is converted into lead sulphate by a solution of sodium sulphate and sulphuric acid ; it can then be dyed by means of basic dyestuffs, and the lead sulphate removed by treatment with thiosulphate. Up to the present, the author has not succeeded in effecting this last fixation without removing a considerable amount of dyestuff.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Blasting explosives; Standardisation of ——. M. B. Lloyd, Proc. Seventh Int. Cong., Appl. Chem., London, 1909. Sect. IIIb, 94—98.

The author proposes that cartridges should be specified by vulgar fractions, the numerator indicating the weight of the cartridge and the denominator the diameter. The figures for weight indicate multiples of 25 grms., or approximately the number of ounces. The figures for diameter would indicate multiples of 11 mm. Under this recommendation a $\frac{2}{2}$ cartridge, for example, would mean one weighing approximately 2 ounces, and slightly under $\frac{7}{8}$ in. in diameter, or, accurately, 50 grms. and 22 mm. diameter. No attempt is made to adhere to existing diameters with the exception of the $\frac{7}{8}$ in. cartridge for gelatinous explosives, which is so commonly in use. The standardising of strength presents difficulties, owing to the fact that the explosives behave differently in different media. The Trauzl block test is excellent for comparing two explosives of similar nature, but gives results which are not borne out in practice when used for comparing, say, gelatinous explosives with ammonium nitrate explosives. The modification of the ballistic pendulum, designed by Captain Desborough for use at the Home Office testing station, gives regular results which show a close agreement with the average of a number of trials in the mine. The Home Office regulations require that blasting gelatin, gelatin dynamite and gelignite, made in Great Britain, should contain, within narrow limits, a fixed proportion of nitroglycerin. This regulation has the effect of a British Government guarantee that, as regards their principal explosive ingredient, these explosives shall be of a standard quality and strength.—G. W. McD.

Guncotton; Analysis of a sample of —— manufactured at Messrs. John Hall and Sons' Works at Faversham in 1847. G. W. MacDonald. Proc. Seventh Int. Cong. Appl. Chem., London, 1909. Sect. IIIb, 46—47.

The sample had been standing in a stoppered bottle for a great number of years. It was in excellent physical condition and had been made from fine cotton wool. The following were the analytical details:—nitrogen, 11·95 per cent.; solubility in ether-alcohol, 89 per cent.; heat test at 170° F., 27 mins.; stability test at 135° C. with 0·25 grm. (faint fumes 11 mins., strong fumes 20 mins., did not explode in 1 hour); ash, 1·22 per cent.; insoluble in acetone, 1·44 per cent.; solubility in ether in Soxhlet, 4·8 per cent.; solubility in cold absolute alcohol, 14·78 per cent.—G. W. McD.

Extinguishing the flame of burning alcohol. Olié. *See* IIa.

Patents.

Explosives; Process of incorporating ingredients of ——. E. du Pont, Assignor to the E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 976,211, Nov. 22, 1910.

Volatile liquid hydrocarbons (benzene, gasolene, etc.), are used in mixing the ingredients of explosives, in order to keep them moist and minimise the danger of friction. The time of incorporation is also shortened. Nitrocellulose (40 parts), trinitroanisol (20), nitroglycerin (30), and charcoal (10 parts) are mixed together. Barium nitrate may also be added. The ingredients are placed in a porcelain barrel containing porcelain balls, and sufficient gasolene is added to bring the mass to a liquid consistency. The incorporation is then carried out in the ordinary manner, and, when completed, the excess of gasolene is separated in a centrifugal, and the incorporated powder is subjected to heat in order to drive off the remaining gasolene.
—G. W. McD.

Explosive. V. L. Bedier, Seattle, Wash. U.S. Pat. 981,969, Jan. 17, 1911.

The explosive consists of potassium chlorate, cane sugar, bolted flour from hard wheat, chrysophanic acid, and curcumin.—G. W. McD.

XXIII.—ANALYTICAL PROCESSES.

Zinc; A method for the separation and determination of ——. P. Pipereaut and A. Vila. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. I, 141—143.

Addition of pure sulphur to a boiling solution of zinc in caustic soda or potash causes precipitation of white zinc sulphide in a dense form, easy to filter and wash. When the added sulphur is in excess, the precipitation of zinc is complete and the sulphide then assumes a pink tint. For analytical purposes this method of separation is much more convenient and rapid than that involving precipitation by sulphuretted hydrogen gas, and the authors have based on it the following method of analysis of minerals and technical products containing zinc. For the analysis of a mineral, 5 grms. of the finely powdered sample are digested with *aqua regia*, until completely decomposed. After removal of the insoluble residue by filtration, the heavy metals are precipitated, and the acid filtrate and washings from these, collected in a graduated flask of 250 c.c. capacity. The liquid is neutralised with caustic soda, the addition of which is continued until the zinc has been precipitated and redissolved. The flask is then filled to the mark with water and shaken, and the contents filtered on a cone of asbestos (*porcelaine d'amiante de Garros*) to remove hydroxide of iron and other insoluble matter. Fifty c.c. of the clear filtrate are largely diluted with distilled water and heated to boiling in a 500 c.c. conical flask, and to the boiling liquid 2—3 grms. of finely powdered sulphur are added. The heating is continued, and after a time sulphide of zinc separates as a dense precipitate. When all the sulphur has dissolved, the flask is filled to about three-quarters with boiling distilled water, and allowed to stand for about fifteen minutes. The upper liquid is then poured off, and the precipitate is washed with hot water by decantation and afterwards thrown on the filter. The washing is finished by allowing about 300—500 c.c. of a boiling, strong solution of ammonium sulphide to flow over the precipitate. The filter and precipitate are dried, and then ignited in a muffle, the atmosphere of which should be as strongly oxidising as possible. After 30—40 minutes, oxidation should be complete. The zinc oxide, after weighing, should be tested to make sure that it contains no sulphide, sulphate or substances insoluble in hydrochloric acid.

For the analysis of a lithopone, the authors agitate the sample (5 grms.) with water and 5—6 c.c. of bromine in the cold, afterwards heating on a sand-bath, and finally digesting with *aqua regia*. The barium sulphate is filtered off and weighed, and the filtrate and washings made up to some convenient volume, an aliquot part of which is taken for the determination of the zinc as described above.
—J. H. L.

Tungsten; Determination of ——. B. Mdivani. Bull. Soc. Chim. Belg., 1911, 25, 41—42.

In order to avoid the tedious evaporations necessary to render the precipitate of tungsten trioxide insoluble, when precipitation has been effected with a mineral acid, the author proposes the use of stannous chloride as a precipitant. He finds that not only does this reagent precipitate the tungsten completely as pentoxide, which after washing, filtration, and drying is ignited to convert it into trioxide, but further, the ignited oxide is free from tin.—W. H. C.

Organic matter; Method of destroying —— in the search for metallic poisons. P. Breteau. Comptes rend., 1911, 152, 199—200.

The finely chopped organs (300 grms.) are placed in a 2-litre Jena flask with 300 c.c. of concentrated sulphuric acid, and a stream of nitrous gases, formed by passing sulphur dioxide through nitric acid, is bubbled through the liquid at such a rate as to keep the atmosphere in the flask coloured. The flask is gently heated at first, and after carbonisation has set in the temperature is raised to slow ebullition; gradually all is decolourised, as in the ordinary

Kjeldahl process. The process takes 4 or 5 hours, but needs no attention once the gas-burner and the stream of nitrogen oxides have been finally regulated.—J. T. D.

Protein substances ; Colour reaction of —— with sodium nitroprusside. V. Arnold. Z. physiol. Chem., 1911, **70**, 300—309.

A number of protein substances give a characteristic colour-reaction with sodium nitroprusside and ammonia, which is effected as follows :—In the case of a protein substance dissolved in water, 1—2 c.c. of the solution are treated with 2—4 drops of a 4—5 per cent. solution of sodium nitroprusside, and then with a few drops of ammonia. The solution immediately acquires an intense purple red colour, which disappears on adding acetic acid. The colour gradually becomes less intense in the course of 15 minutes. In the case of precipitated protein substances, the washed precipitate is spread out on porous paper, and moistened with a few drops of a 4 per cent. solution of the nitroprusside ; after a few seconds, a second piece of porous paper is placed beneath the first in order to remove excess of the reagent, and the precipitate is treated with a few drops of ammonia, whereupon it acquires a purple-red colour. In precipitating the protein substance, an indifferent agent should be used ; sulphates of sodium, ammonium, and magnesium are especially suitable, and the precipitates obtained by treatment with alcohol or phosphotungstic acid also show the reaction. Protein substances coagulated by heating (*e.g.*, boiled meat) show the reaction as well as prior to heating. The author describes the behaviour of various proteins and their decomposition-products in respect of the reaction. The following protein substances do not give the reaction : the ovomucoid of eggs, the protein of blood serum and of organic secretions, and excretions (mucin of saliva, milk casein, proteins of urine). The reaction with nitroprusside cannot be ascribed to the formation of alkali sulphide. Amongst the amino-acids of the protein molecule, only cystein gives the same reaction as protein with nitroprusside, and the author's work bears out the view that the reacting group to which the colour reaction with protein is due, is cystein, and that the varying intensity of this reaction is dependent on the number of reactive cystein groups. By reduction with tin and hydrochloric acid, non-reactive proteins can be rendered reactive.—L. E.

Nitrogen in certain organic compounds [aldoximes and ketoximes] ; Accurate determination of ——. R. Fabinyi. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. IVa1. 171—173.

Aldoximes and ketoximes may be quantitatively converted into the corresponding aldehydes and ketones by the action of ferric chloride.

$$2RHC:NOH + 2Fe_2Cl_6 + 2H_2O =$$
$$2RHC:O + 2Fe_2Cl_4 + 4HCl + 2NOH(N_2O + H_2O),$$

and the author has devised a method on this principle for the determination of nitrogen in such compounds. The apparatus used includes a 200- or 250-c.c. graduated flask fitted with a perforated rubber stopper carrying a glass tube bent at a right angle ; this tube is connected by a short piece of rubber tubing, fitted with a screw-clip, with another similarly bent glass tube, the end of which is immersed in another flask filled with water. A quantity (0·2—0·4 grm.) of the substance to be analysed is introduced into the first flask and treated with 10—12 c.c. of a 10—12 per cent. solution of ferric chloride (the exact concentration of which has been determined iodometrically) and with 1—2 c.c. of dilute hydrochloric acid. The contents of both flasks are heated to boiling ; the nitrous oxide, liberated from the first flask, escapes through the water in the second flask. When the liquid in the first flask has become clear and light in colour, boiling is stopped, communication between the two flasks is cut off, and, after 1—2 minutes, carefully opened again, the boiled water in the second flask being allowed to run into the first flask until the latter is filled to the mark. The perforated stopper of this flask is then replaced by a solid stopper ; the flask is cooled in a stream of water, the contents are made up to volume at the ordinary temperature with boiled water, mixed, and filtered through a dry pleated filter (which is covered with a watch glass) into a burette. A measured volume of this solution (20—25 c.c.) is run into a solution of 2—3 grms. of potassium iodide, the iodine set free by the ferric chloride being titrated with $N/10$ sodium thiosulphate solution. The amount of ferric chloride that has undergone reduction is a measure of the percentage of nitrogen. The method is extremely accurate (the results agreeing to within 0·05 per cent. with careful work), though it is only applicable to aldoximes and ketoximes.—L. E.

Pentosans ; Modification of the furfural-hydrochloric acid method for the determination of ——. K. H. Böddener and B. Tollens. J. Landw., 1910, **58**, 232—237. Chem. Zentr., 1911, **1**, 427—428.

The method described previously (this J., 1901, 396 ; 1902, 875) can be shortened considerably if the precipitation of the furfural phloroglucide be effected in hot instead of in cold solution. The reaction proceeds almost exactly according to the equation : $C_5H_4O_2 + C_6H_6O_3 = C_{11}H_4O_2 + 3H_2O$. The procedure is as follows :—300 c.c. of hydrochloric acid (sp. gr. 1·06) are treated with the furfural dissolved in hydrochloric acid (sp. gr. 1·06) and the phloroglucinol (double the calculated quantity +0·15 grm.) also dissolved in hydrochloric acid is added. The volume of the solution is then made up to 400 c.c. with hydrochloric acid (sp. gr. 1·06). After heating to 80°—85° C. and then allowing to stand at the ordinary temperature for 1½—2 hours, the precipitate is filtered off into a Gooch crucible with the acid of the pump, washed with 150 c.c. of water, dried for four hours at 95°—98° C., placed in a stoppered weighing bottle, cooled in an exsiccator, and weighed. 1 grm. is added to the weight of the phloroglucide, and the amount of furfural is found by multiplying by 0·571. When methyl furfural is present, in addition to furfural, it is preferable to use Kröber's method (*loc. cit.*).—A. S.

Pentosans ; Determination of —— with the aid of Fehling's solution. J. T. Flohil. Chem. Weekblad, 1910, **7**, 1057—1063. Chem. Zentr., 1911, **1**, 428.

The substance is distilled with dilute acid, the distillate is diluted to 400 c.c., and 50 c.c. are made faintly alkaline with sodium hydroxide while being cooled. Fehling's solution is then added, the whole is made up to 100 c.c. with water, boiled for 35 minutes under a reflux condenser, and the separated cuprous oxide determined gravimetrically or the excess of Fehling's solution titrated iodometrically. The reduction of the Fehling's solution is due to furfural, and hence the percentage of pentosans in the original substance can be calculated.—A. S.

Composition of [mineral] lubricating oils. Nastukoff. *See* IIa.

Determination of cellulose. Councler. *See* V.

Note on the Goldenberg-Geromont method for the analysis of tartaric materials. Tobler and Caramelli. *See* VII.

Rapid determination of nickel in steels. Raulin. *See* X.

Platinum and illuminating gas. Mylius and Hüttner. *See* X.

Rapid analysis of Babbitt metal. Walker and Whitman. *See* X.

Direct determination of rubber in vulcanised rubber goods. Huebener. *See* XIV.

Determination of "mineral rubber" and similar products in rubber goods. Becker. *See* XIV.

Analysis of gelatin. Herold. *See* XV.

Electrical bridge for determining soluble salts in soils. Davis and Bryan. *See* XVI.

Proximate analysis of phosphates of calcium. Hardy and Vandormael. *See* XVI.

Analysis of commercial dextrins. Browne and Bryan. *See* XVII.

Malt analysis. O'Sullivan. *See* XVIII.

Some substances present in alcohol which can affect its quality Bauer. *See* XVIII.

Composition and analysis of cocoa. Bordas. *See* XIXa.

Determining formic acid in foods. Fincke. *See* XIXa.

Determination of lithium in water. Lecco. *See* XIXa.

Identification and determination of manganese in drinking water. Klut. *See* XIXb.

Determining nicotine in concentrated tobacco extracts. Ulex. *See* XIXb.

Assay of strophanthus seeds. Haycock. *See* XX.

Determination of atropine. Determination of the alkaloids in belladonna extract. Javillier. *See* XX.

Determination of aconitine by means of silicotungstic acid. Ribaut. *See* XX.

Volatile fatty acids. Effront. *See* XX.

XXIV.—MISCELLANEOUS ABSTRACTS.

Bamboo shoots; Basic constituents of ——. G. Totani. Z. physiol. Chem., 1911, **70**, 388—390.

The author has previously shown, that in addition to the constituents: tyrosine, asparagine, guanine, xanthine and hypoxanthine, found by Kozai, bamboo shoots contain a perceptible quantity of adenine. He now finds that the shoots also contain choline and betaïne.—L. E.

Trade Report.

Russia; Syndicate of Chemical Manufacturers in ——. Board of Trade J., Jan. 26, 1911.

According to the official "Commercial and Industrial Gazette" (St. Petersburg), the Minister of Commerce on 21st December last confirmed the statutes of the Company for Promoting the Development of the Chemical Industry and Trade, with head office at St. Petersburg. Among the founders of this society are twenty-two of the largest chemical manufacturers in Russia, centred in the St. Petersburg, Riga, and Warsaw regions. The aims of the syndicate are the protection and development of the Russian chemical industry in general.

Books Received.

Cane Sugar: A text-book on the Agriculture of the Sugar Cane; The manufacture of cane sugar, and the analysis of sugar house products; together with a chapter on the fermentation of molasses. By Noël Deerr, Sugar Technologist at the Experiment Station of the Hawaiian Sugar Planters' Association, etc. Norman Rodger, Altrincham, Manchester, 1911. Price 20s. net.

Large 8vo volume, containing finely coloured frontispiece, preface, chapter with the literature of the cane (8 pages); 580 pages of subject matter with 280 illustrations, many of them finely coloured plates; and alphabetical indexes of subjects and authors' names. The subject-matter is classified under the following heads:—I. The cane. II. Its composition. III. Range and climate. IV. Varieties of cane. V. Sugar cane soils. VI. Manuring the cane. VII. Its irrigation. VIII. Husbandry. IX. Pests and diseases. X. Harvesting. XI. Extraction of cane juice by mills. XII. Diffusion process. XIII. Clarification and defecation of the juice. XIV. Carbonatation process. XV. Filtration of the juice. XVI. Its evaporation to syrup. XVII. Concentration of the syrup to massecuite. XVIII. Separation of the crystals. XIX. Molasses. XX. Megass as fuel. XXI. The polariscope in sugar analysis. XXII. Optical assay of sugars. XXIII. Determination of reducing sugars. XXIV. Assay of sugar-house products. XXV. The control of the factory. XXVI. Fermentation with special reference to the sugar house. There are 17 compendious tables in the text, and at the end of the work a series of additional notes relating to certain portions of the text.

Kolonial-Handels-Adressbuch 1911. (15 Jahrgang). Mit Karten der Kolonien in Buntdruck. Kolonial-Wirtschaftliches Komitee. Wirtschaftlicher Ausschuss der deutschen Kolonialgesellschaft. Berlin. Unter den Linden 43. 1911. Price M. 2.50.

Large 8vo volume, containing 449 pages of subject-matter, with coloured maps, and illustrations representing various colonial points of interest. There is an alphabetical index of subjects, and the matter generally, is classified under the following heads:—Part I. Colonial government, and Colonial institutes and associations. Part II. Trade and commerce—(i), Trade statistics. (ii). German East Africa. (iii), Cameroon. (iv), Togo. (v), German-South-west Africa. (vi), New Guinea and Insular territory. (vii), Samoa. (viii), Kiautschou. (ix), Spediteure. (x), German companies in various colonies. (xi), German railroad constructive and exploitation-companies. (xii), German companies and Banks abroad centrally represented in Germany. (xiii), German banking-houses for Colonial property. (xiv), Foreign banks in countries in the immediate neighbourhood of the German colonies. (xv), Importers in Germany. (xvi), Exporters into German colonies. (xvii), Manufacturers in Germany. (xviii), German cable companies. (xix), Postal management and direction. (xx), Firms, etc., representing German colonial products, etc. Part III. General. Part IV. General index of German firms and companies.

Chemische Technologie in Einzeldarstellungen. Allgemeiner Teil. Zerkleinerungsvorrichtungen und Mahlanlagen, Von Carl Naske. Otto Spamer's Verlag, Leipzig. 1911. Price in parts (unbound) M. 13.50; bound M. 15.

8vo volume containing 232 pages of subject-matter with 257 illustrations, and an alphabetical index of subjects. The general subject receives the following special classification:—I. Breaking and crushing machinery and apparatus. II. Grinding machinery, etc. III. Mills. (Pulverising and grinding.) IV. Sifting apparatus, and wind sifters, etc. V. Arrangements and apparatus for removal of dusts from air-spaces for work people. VI. Storage and packing arrangements, apparatus, and appliances. VII. Description of the complete mills, works, etc., wherein the apparatus and machinery described in the foregoing sections, are employed.

Caoutchouc et Gutta-Percha. Par E. Tassilly. O. Doin et Fils, 8, Place de l'Odéon. 8. Paris. 1911. Price 5 fr.

Small 8vo volume, containing 380 pages of subject-matter, with 56 illustrations, an alphabetical index of subjects, a bibliographic index, and a table of contents. The subject-matter is classified under the following heads:—I. Historical. II. Preparation of raw rubber. III. Its treatment. IV. Vulcanisation. V. Manufactured articles. VI. Hard rubber or ebonite. VII. Gutta-percha and balata. VIII. Filling ingredients. Colouring agents. Solvents. IX. Regenerated caoutchouc. X. Substitutes, or adulterants. XI. Chemical study of caoutchouc and gutta-percha. XII. Analysis of raw and manufactured rubbers, and of gutta-percha.

A Course of Practical Work in Agricultural Chemistry for Senior Students. By T. B. Wood, M.A., Drapers Professor of Agriculture in the University of Cambridge, etc. The University Press, Cambridge. 1911. Price 2s. 6d net.

Pamphlet form. 8vo size, and containing a table of contents, and 56 pages of subject-matter. The matter of the entire course is subdivided and classified in sections as follows:—I. Soil sampling. II. Mechanical analysis of soils. III. Qualitative composition of plants. IV. Qualitative examination of soil. V. Estimation of nitrogen. Kjeldahl's method. VI. Availability of nitrogen in the soil. VII. Estimation of phosphoric acid. VIII. Estimation of potash. IX. Of phosphoric acid and potash in soil. X. Available phosphoric acid and potash in soil. XI. Estimation of carbonates, lime, and magnesia in soils. XII. Sand. XIII. Humus. XIV. Clay. XV. Sulphate of ammonia. XVI. Estimation of commercial nitrate of soda. XVII. Estimation of nitrogen in nitrates. XVIII. Of organic nitrogenous manures. XIX. Raw phosphates. XX. Bones and guanos. XXI. Phosphoric acid salts. XXII. Examination of superphosphate. XXIII. Basic slag. XXIV. Potash salts. XXV. Analysis of mixed manures. XXVI. Calcium compounds. XXVII. Retention of manures by the soil. XXVIII. Farmyard manure. XXIX. and XXX. Qualitative and quantitative examination of milk. XXXI. and XXXII. Carbohydrates, and their estimation. XXXIII. and XXXIV. Proteins, and their constitution. XXXV. Oils. XXXVI. Concentrated foods, cakes and meals. XXXVII. Analysis of succulent foods—*e.g.* roots. XXXVIII. Cereals generally, and barley.

Abstract of the Report on the American Coal-Dust Experiments Conducted at the Pittsburg Experimental Station, 1908—1909; and on the Explosibility of Coal-Dust. (Abstracted by the "Colliery Guardian" from Bulletin No. 425, issued by the United States Geological Survey.)

Abstract of the Reports on the Austrian Coal-Dust Experiments Conducted at the Rossitz Experimental Station, 1908—1909. By K. K. Oberbergkommissär Dr. Czaplinski and Werksdirektor Jicinsky. (Abstracted and translated by the "Colliery Guardian" from the original German as published in the Oesterreichische Zeitschrift für Berg- und Hüttenwesen.) The "Colliery Guardian" Company, Limited. 30 and 31, Furnival Street, Holborn, London, E.C. 1911. Price 1s. each, net.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

Applications.

2366. Keeble and Keeble. Separation of water and solid substances by the application of pressure. Jan. 30.

2379. Schwerin. Separating finely-distributed substances from coarse or foreign admixtures. [Ger. Appl., Jan. 31, 1910.]* Jan. 30.

2442. Epstein. Extraction and arrangements therefor. Jan. 31.

2800. Merrill. Pressure filters. Feb. 3.

2801 and 2802. Merrill. *See under* X.

2803. Merrill. Treatment of semi-solid material in the containers of filter-presses and removing same therefrom. Feb. 3.

2830. Soc. Anon. des Manuf. des Glaces et Prod. Chim. de St. Gobain. Classifying powdered or fine material. [Fr. Appl., Feb. 10, 1910.]* Feb. 3.

2910. Fawcett, Preston, and Co. (Hatton and Salas). Purifying liquids or separating solids contained in liquids or fluids. Feb. 4.

2925. Robertson. Continuous centrifugal separating machines. Feb. 6.

3102. Merrill. Containers for filter-presses. Feb. 7.

3166. McEwen and Gibbons. *See under* II.

3215. Parouty y Dupont. Distilling apparatus. Feb. 8.

3243. Kent. Apparatus for indicating high temperatures.* Feb. 8.

3326. L'Air Liquide. *See under* VII.

3338. Brüne. Kiln.* Feb. 9.

Complete Specifications Accepted.

2580 (1910). Hill. Tunnel kilns or driers. Feb. 8.

2903 (1910). Bost. Manufacture of heat-insulating compound. Feb. 8.

6215 and 18,962 (1910). Lunt and Hartley. Circular kilns and ovens. Feb. 8.

23,856 (1910). Acetylene Illuminating Co. (Soc. Acetylene Dissous). Filling with porous materials receptacles for containing explosive gases, particularly applicable to dissolved acetylene containers. Feb. 15.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

2581. Holmes and Co., Ltd., and Holmes. Apparatus for washing and scrubbing gases.* Feb. 1.

2588. Bourdos. Manufacture of metal filaments for incandescent electric lamps. Feb. 1.

2705. Garz. Method and apparatus for coking briquettes. [Ger. Appl., July 27, 1910.]* Feb. 2.

2712. Janson. Production of combustible gases. [Belg. Appl., Feb. 2, 1910.]* Feb 2.

2941. Meeze. Production of heat-radiating flame and inflammable gases by fractional combustion. Feb. 6.

3024. Thuman (Chrisman and Taussig). Water-gas apparatus.* Feb. 6.

3109. Lessing, and Gibbons Bros., Ltd. Gas purifying apparatus. Feb. 7.

3166. McEwen and Gibbons. Cooling and utilising the heat of coke or other material discharged from retorts or ovens. Feb. 8.

3197. Fabry. Regenerative coke ovens.* Feb. 8.

3291. Reiter, and Imperial Lamp Works, Ltd. Manufacture of tungsten and like metal filaments for electric lamps. Feb. 9.

3427. Simpson. Vacuum coke retorts. Feb. 10.

Complete Specifications Accepted.

4621 (1910). Burstall. Extraction of tar and other impurities from gases. Feb. 15.

6504 (1910). Summers. Coke ovens. Feb. 8.

9409 (1910). Dempster and Sons, Ltd., and Toogood. Gas retorts. Feb. 15.

10,550 (1910). Cory (Crochet). Briquetting fuel. Feb. 15.

13,327 (1910). Koppers. Separating ammonia from gases. Feb. 15.

14,304 (1910). Soc. Franç. de Matérial Agricole et Industriel. Gas generators. Feb. 15.

14,405 (1910). Koppers. Combined gas generators and gas retort furnaces. Feb. 8.

17,278 (1910). British Thomson-Houston Co. (General Electric Co.). Electrodes for arc lighting. Feb. 8.

23,856 (1910). Acetylene Illuminating Co. (Soc. Acetylene Dissous). *See under* I.

1464 (1911). Fabel. Apparatus for generating products of combustion under pressure. Feb. 15.

III.—TAR AND TAR PRODUCTS.

Applications.

2355. Newton (Bayer und Co.). Manufacture of 1-naphthol-2-sulphonic acid. Jan. 30.

2457. Wyler, Levinstein, and Levinstein, Ltd. *See under* IV.

2496 and 2498. Aylsworth. Phenolic condensation products and method of making them.* Feb. 11.

Complete Specifications Accepted.

2901 (1910). Giesbers. Treatment of tar derived from coal, wood, or mineral oil to obtain a pitch for agglomerating purposes. Feb. 15.

3224, 4701, 9477, and 11,478 (1910). Flürscheim. Nitro-derivatives of aniline. Feb. 8.

3279 (1910). Eaton. Treatment of tar and apparatus therefor. Feb. 8.

11,472 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of anthraquinone and its derivatives. Feb. 15.

1728 (1911) Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of anthranol. Feb. 15.

IV.—COLOURING MATTERS AND DYES.

Applications.

2354. Newton (Bayer und Co.). Manufacture of alizarin. Jan. 30.

2615. Act.-Ges. f. Anilinfabr. Polyazo dyestuffs. [Ger. Appl., March 19, 1910.]* Feb. 1.

2732. Meister, Lucius, und Brüning. Manufacture of brown vat dyestuffs. [Ger. Appl., Feb. 4, 1910. Addition to No. 16,584 of 1907.]* Feb. 2.

2797. Newton (Bayer und Co.). Manufacture of tetrazo dyestuffs. Feb. 3.

2831. Iljinsky, and Wedekind und Co. Process for making acid dyes of the anthracene series. Feb. 3.

2875. Levinstein, Ltd., and others. Acid mordant dyestuffs and their production. Feb. 4.

3457. Levinstein, Ltd., and others. Manufacture of a new derivative of o-aminophenol and of monoazo dyestuffs therefrom. Feb. 11.

3508. Ellis (Chemical Works formerly Sandoz). Manufacture of bromonaphthalene-1-diazo-2-oxide-4-sulphonic acid and of o-oxyazo colouring matters. Feb. 11.

Complete Specifications Accepted.

3093 (1910). Debédat. Colouring substances and process for making same. Feb. 15.

3299 (1910). Imray (Meister, Lucius, und Brüning). Manufacture of vat dyestuffs of the anthracene series. Feb. 8.

6364 (1910). Newton (Bayer und Co.). Manufacture of dyestuffs of the triarylmethane series. Feb. 8.

18,099 (1910). Anilinfarben u. Extract-Fabr. vorm. J. R. Geigy. Manufacture of monoazo colouring matters. Feb. 8.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

2364. Beeman. *See under* XXI.

2463. Wace and Silberrad. Decortication of flax straw and cleaning flax fibres, etc. Jan. 31.

3139. Wohl. Solutions of cellulose esters and their preparation. [Ger. Appl., March 12, 1910.]* Feb. 7.

3181. Dobson. Bleaching cellulose, wood pulp, and other fibrous materials. Feb. 8.

3228. Baudot. Wool-washing and degreasing machines. [Fr. Appl., Feb. 9, 1910.]* Feb. 8.

3363. Kreissl and Seibert. Process for obtaining vegetable fibres. [Austrian Appl., Feb. 16, 1910.]* Feb. 9.

Complete Specifications Accepted.

3105 (1910). La Banque du Radium. Fibres impregnated with actinium and process for manufacturing them. Feb. 15.

20,672 (1910) Mork. Cellulose acetates and process of treating them. Feb. 15.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

2548. Caldwell. Dyeing or bleaching apparatus. Feb. 1.

2700. Johnson (Badische Anilin und Soda Fabrik). Production of brown shades on fibrous materal. Feb. 2.

2837. Mezzera. Dry cleaning and dyeing wool.* Feb. 3.

2912. Wechsler. Preparation of printing colours for printing textiles.* Feb. 4.

3181. Dobson. *See under* V.

3241. Meister, Lucius, und Brüning. Dyeing with certain vat dyestuffs and manufacture of materials therefor. [Ger. Appl., Feb. 28, 1910.]* Feb. 8.

3259. Simpson. Bleaching fibres or textile fabrics. Feb. 8.

3284 and 3285. Hall. Process and plant for bleaching fibrous materials. Feb. 9.

3466. Binns. Apparatus for dyeing, bleaching, extracting, and like processes. Feb. 11.

Complete Specification Accepted.

21,052 (1910). Badische Anilin und Soda Fabrik. Production of discharge or printing effects on fibre which has been dyed with vat colouring matters. Feb. 15.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

2304. Klingbiel. Manufacture of phosphates from potash and ammonia. [Ger. Appl., Jan. 29, 1910.]* Jan. 30.

2525. Schulthess. Process and apparatus for slaking lime.* Jan. 31.

3326. L'Air Liquide, and Claude. Separation of the constituents of gaseous mixtures, particularly air. Feb. 9.

3329. Koller. Treatment of chemicals liable to deteriorate or change in contact with air or moisture. Feb. 9.

3345. Ashcroft. Production of cyanamides and cyanides of the alkali metals. Feb. 9.

Complete Specifications Accepted.

3357 (1910). McCowan. *See under* X.

12,601 (1910). Serpek. Manufacture of nitrides such as that of aluminium. Feb. 8.

13,088 (1910). Serpek. Manufacture of pure alumina from aluminium nitride. Feb. 8.

13,327 (1910). Koppers. *See under* II.

16,368 (1910). Badische Anilin und Soda Fabrik. Manufacture of nitrides. Feb. 15.

16,522 (1910). Serpek. Manufacture of nitrides such as that of aluminium. Feb. 15.

20,186 (1910). Wedekind und Co. Utilisation of the sulphur contained in sulphates, especially in calcium sulphate. Feb. 15.

22,033 (1910). Moffatt. *See under* XIII.

IX.—BUILDING MATERIALS.

Applications.

2347. Jochum. Cooling hot cement clinkers by liquids or gases.* Jan. 30.

2865. Lancel. Kilns for bricks and the like.* Feb. 4.

3303. Kaufmann. Manufacture of a castable artificial stone mass from magnesium hydroxide.* Feb. 9.

3372. Fraser. Artificial stone or composition. Feb. 10.

Complete Specifications Accepted.

5155 (1910). Zehrlaut. Manufacture of artificial marble from self-hardening hydraulic mortars. Feb. 15.

15,713 (1910). Sucher. Hardening and preserving wood. Feb. 15.

17,109 (1910). Gran. Utilising blast-furnace slag for the manufacture of stones or bricks. Feb. 8.

22,308 (1910). Hohrath. Production of artificial granite from blast-furnace slag. Feb. 8.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

2367. Keeble. Treatment of iron sands or other finely divided material. Jan. 30.

2368. Johnson. Crushing auriferous quartz and like substances. Jan. 30.

2383. Nutter, and Minerals Separation, Ltd. Ore concentration. Jan. 30.

2801. Merrill. Precipitating and recovering materials from solutions, particularly metals from hydrometallurgical solutions. Feb. 3.

2802. Merrill. Apparatus for precipitating solutions and filtering the precipitate in connection with hydrometallurgical processes. Feb. 3.

2826. British Thomson-Houston Co. (General Electric Co.). Methods of working refractory metals. Feb. 3.

2882. Bedford. Manufacture of steel. Feb. 4.

3078. Dor-Delattre. Separating the useful from waste products in residues from zinc and other manufactures. [Belg. Appl., Apr. 13, 1910.]* Feb. 7.

3316. Wetter (Maître). Method of coating aluminium and other metals. Feb. 9.

3343 and 3344. Ashcroft. Treatment of sulphide ores or products. Feb. 9.

3361. Mellen and Mellen. Manufacture of aluminium and copper alloys. [U.S. Appl., Feb. 14, 1910.]* Feb. 9.

Complete Specifications Accepted.

2500 (1910). Dick. Treatment of copper and copper ores. Feb. 8.

2759 (1910). British Thomson-Houston Co. (General Electric Co.). Obtaining ductile or malleable bodies of high melting-point metals. Feb. 8.

3357 (1910). McCowan. Extraction of zinc oxide from complex sulphide ores. Feb. 15.

3715 (1910). Haultain and Moffatt. Reduction of metallic oxide ores. Feb. 8.

5691 (1910). Lake (Fabrik Elektrischer Zünder). Production of porous electro-deposits. Feb. 8.

6601 (1910). Ruthenburg. Extraction of metals from ores, &c. Feb. 15.

18,378 (1910). Von der Linde. Recovery of tin from tin plate waste by means of chlorine. Feb. 15.

20,339 (1910). McNitt. Reduction of metals from their compounds. Feb. 15.

21,198 (1910). Edwards. Furnaces for calcining, roasting, and desulphurising ores. Feb. 8.

XI.—ELECTRO-CHEMISTRY.

Applications.

3251. Pauling. Electric furnace for treating gases.* Feb. 8.

3533. Von Schatzl. Electric furnaces.* Feb. 11.

Complete Specifications Accepted.

5934 (1910). Johnson (Chem. Fabr. Griesheim-Elektron). Apparatus for producing and maintaining long electric arcs. Feb. 15.

15,167 and 15,168 (1910). Thomson. Electric furnaces. Feb. 15.

XII.—FATS: OILS: WAXES.

Applications.

2878. Hill. Fuller's earth. Feb. 4.

3515. Kaliwerke Aschersleben. Manufacture of solid emulsions. [Ger. Appl., Feb. 23, 1910.]* Feb. 11.

Complete Specifications Accepted.

2989 (1910). Dubovitz. Manufacture of stearine with acidification of oleic acid. Feb. 8.

12,727 (1910). Stewart and Chard. Crushing or disintegrating seeds or beans to facilitate the extraction of oil. Feb. 15.

XIII.—PAINTS: PIGMENTS: VARNISHES: RESINS.

Applications.

3496 and 3498. Aylsworth. *Se under* III.

3497. Aylsworth. Enamele lacquer or varnish. *Feb. 11.

Complete Specification Accepted.

22,033 (1910). Moffatt. Treatment of barium sulphate for use as a pigment. Feb. 8.

XIV.—INDIA-RUBBER: GUTTA-PERCHA.

Application.

2478. Guiguet. Apparatus for extracting rubber and other gums from plants, etc., and for cleansing crude rubber, etc. Jan. 31.

Complete Specification Accepted.

9686 (1910). Gall. Treatment of indiarubber, gutta-percha, balata, etc. Feb. 15.

XV.—LEATHER; BONE; HORN; GLUE.

Application.

1340. Boehringer Sohn. Process for deliming hides. [Ger. Appl., June 23, 1910.]* Feb. 7.

XVI.—SOILS; FERTILISERS.

Application.

3204. McDougall, McDougall, and McDougall. Insecticides, sheep-dip, etc. Feb. 8.

Complete Specification Accepted.

24,249 (1910). Thorssell and Malmsten. Apparatus for emptying superphosphate chambers. Feb. 15.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

2507. Friedberger. Manufacture of fermentation lactic acid. Jan. 31.

3245. Hoffmann. Process and apparatus for macerating wort.* Feb. 8.

XIX.—FOODS: WATER PURIFICATION; SANITATION.

Applications.

2778. Chitty and Jago. Manufacture of flour and bread. Feb. 3.

3204. McDougall and McDougall. *See under* XVI.

3247. Testrup. Treatment of sewage or the like. Feb. 8.

3250. Otto. Apparatus for sterilising water by means of ozone. [Fr. Appl., Feb. 9, 1910.]* Feb. 8.

Complete Specifications Accepted.

4939 (1910). Lomax. Grain treatment, milling products, and the preparation of food. Feb. 8.

15,959 (1910). Fernbach. Treatment of lemon juice. Feb. 15.

XX.—ORGANIC PRODUCTS: MEDICINAL SUBSTANCES: ESSENTIAL OILS.

Applications.

2344. Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of santalol and menthol ethers.* Jan. 30.

2375. Bloxam (Ornstein). Production of acetylene tetrachloride.* Jan. 30.

2507. Friedberger. *See under* XVIII.

3004. Sefton-Jones (Snoep). Manufacture of saccharin. Feb. 6.

Complete Specifications Accepted.

12,344 (1910). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of albumose silver compounds. Feb. 8.

13,677 (1910). Newton (Bayer und Co.). Manufacture of β-γ-dimethylerythrene. Feb. 8.

14,576 (1910). Muller. Manufacture of compounds of yohimbine. Feb. 8.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

2364. Beeman. Paper or other material having a surface sensitive to light or chemical action. Jan. 30.

XXII.—EXPLOSIVES: MATCHES.

Applications.

2682. Eley Bros., Ltd., and Goodwin. Detonating compositions for cartridges, percussion caps, detonators, etc. Feb. 2.

2820. Macaulay. Reducing or neutralising the noxious fumes from the combustion of nitroglycerin explosives.* Feb. 3.

2834 and 2835. Birmingham Metal and Munitions Co., Ltd., and Barker. Manufacture and handling of propulsive explosives.* Feb. 3.

2836. Cocking, and Kynoch, Ltd. Manufacture of explosives. Feb. 3.

3116. Claessen. Manufacture of tubular smokeless powder.* Feb. 7.

Complete Specifications Accepted.

3214 (1910). Wheelwright. Igniting compositions for the manufacture of matches. Feb. 15.

3907, 4700, 5338, and 10,433 (1910). Flürscheim. Explosives. Feb. 8.

23,145 (1910). Claessen. Manufacture of smokeless gunpowder. Feb. 15.

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Birmingham Section.

Meeting held at Birmingham University on Thursday, October 20th, 1910.

DR. T. SLATER PRICE IN THE CHAIR.

THE PROPERTIES OF SOME CULTURE MEDIA USED IN THE BACTERIOLOGICAL EXAMINATION OF WATER.

BY J. F. LIVERSEEGE, F.I.C.

The following notes are an account of some observations and experiments which have been made to obtain uniformity and definiteness in culture media.

Litmus solution. Commercial litmus was purified before use. It was powdered and extracted in a flask on the top of the water oven for some time with repeated quantities of methylated spirit. After drying the litmus contained 91·6 per cent. of carbonated ash. Ten grms. was steamed with 100 c.c. of distilled water for one hour and filtered. One c.c. of the solution was diluted to 200 c.c. with tap water and the colour observed with a Lovibond tintometer. It was found that 1·6 units of blue and 0·2 unit of red were required to match the diluted solution in a cell 2″. A second similar treatment yielded a solution of which 1 c.c. diluted to 100 c.c. required 1·0 of blue and 0·2 of red to match it. A third treatment gave a solution of which 1 c.c. diluted to 10 c.c. required 0·8 of blue and 0·4 of red. As digestion did not satisfactorily remove the colouring matter, cold percolation was tried. Twenty grms. of the purified litmus was put in a glass tube about a metre long with an internal diameter of 14 mm.; the litmus occupied about 140 mm. The tube was closed with a plug of cotton wool resting upon a cork carrying a short glass tube. The tube was filled up with distilled water and next morning 80 c.c. had percolated. One c.c. of this diluted to 200 c.c. required 6·0 units of blue and 1·4 units of red to match the colour. The next day 55 c.c. more had percolated, this *undiluted* was equal to 2·6 of blue and 1·6 of red, proving that the greater part of the colour is contained in the first fraction. When 200 c.c. of percolate had been collected, making a 10 per cent. solution of litmus, the colour in a 1 : 100 dilution was 5·2 of blue and 1·2 of red. The percolate was neutralised with $N/2$ hydrochloric acid, about three c.c. being required. The neutrality of the final solution was tested by diluting two c.c. with about 100 c.c. of distilled water, dividing between three beakers and adding a little alkali to one beaker and a little acid to another. The three liquids then had distinctly different colours. The neutralised liquid was steamed twenty minutes; it formed only a slight deposit on keeping.

Jelly. To obtain uniformity of reaction Eyre suggested that media should be standardised to a definite amount of acidity, and that the proper amount of acidity was that of a medium that contained acidity equivalent to 1 c.c. per 100 c.c. of normal acid, the reaction being determined in a boiling solution with phenolphthalein. To get constant results, it is necessary to keep the liquid boiling during titration, an unsatisfactory proceeding, particularly as the liquid is concentrating all the time. I found that if 10 c.c. of jelly is added to 100 c.c. of *cold* water and titrated with $N/10$ caustic soda, the reaction is sharp to phenolphthalein, and the result is about 1 c.c. per 100 c.c. less acid than when the titration is done boiling. For example, 10 c.c. titrated cold required 0·9 c.c. of $N/10$ caustic soda, and 2·0 c.c. when boiled. On repeating, the figures were 0·9 and 1·8 c.c. I therefore suggest that the medium should be made neutral to phenolphthalein on cold titration as described. The symbol "OP" might indicate that this has been done. The same reaction of the medium is thus obtained in a much easier way than by Eyre's method.

I now prepare the jelly as follows:—120 grms. of gelatine are soaked all night in a litre of tap water. Then 10 grms. of peptone, 5 grms. each of salt and Lemco, and 3 c.c. of about $10N$ caustic soda are added, and the mixture steamed one hour. The volume is about 1100 c.c. The beaten white of two eggs is added after cooling to about 50° C., it is then steamed half an hour and filtered. 10 c.c. is added to 100 c.c. of cold distilled water and titrated with $N/10$ caustic soda, phenolphthalein being used as indicator. About 0·4 c.c. is required. The volume of the jelly is measured and sufficient normal caustic soda added to render it neutral, in the above case 0·4 c.c. per 100 c.c. For Petri dishes about 12 c.c. is put in tubes ¾ by 5 inches, and for slopes about 5 c.c. in tubes ⅝ by 5 inches. The text-books direct the tubes to be sterilised by steaming for 15 or 20 minutes on three successive days, but I have found this time insufficient.

To count the colonies on Petri dishes I use a small turntable covered with black calico. It makes a systematic survey of the dish easy so that each colony can be seen and marked.

Glucose taurocholate solution. This solution is made of three strengths; triple, for dilution with two volumes of the water to be tested, double, for dilution with an equal volume, and single, for use with one c.c. or less of the water.

I first prepared the triple strength according to the following directions: "Peptone 60 grms., glucose 15 grms. and sodium taurocholate 15 grms., distilled water one litre, litmus solution sufficient to give a decided purple colour. Boil and filter." The final volume, and therefore the strength of the solution, obviously depend on the colour of the litmus solution used. I found that 10 c.c. per 100 c.c. of the 10 per cent. solution of litmus gave a suitable colour for the single strength, or 30 c.c. per 100 c.c. for the triple strength, and now use 700 c.c. of water so that the *final* volume is about a litre.

On diluting the above solution to make double strength, I found that precipitation occurred and the liquid became redder. On diluting to make single strength, further precipitation and reddening occurred, and alkali had to be added. These dilutions were very difficult to filter clear. I also found that on keeping there was a notable deposit in the tubes. These difficulties raised the questions, "Is alkali necessary to dissolve the ingredients?" and "Does heating with alkali act on the ingredients and produce darkening?" To simplify the problem, solutions were made of the three important ingredients separately; one set was made with tap water only, and one with a mixture of 69 c.c. of tap water and 1 c.c. of normal caustic soda solution. In each case the solutions were steamed 45 minutes.

Glucose only.—1·5 grms. in 70 c.c. The solution containing no alkali was almost colourless, but the alkaline solution was red brown after steaming.

Peptone only.—Six grms. in 70 c.c. On titration with phenolphthalein 7 c.c. required:—

1. 2·4 c.c. $N/10$ caustic soda with 23 c.c. of cold water.
2. 2·7 ,, ,, ,, 100 ,, ,, ,,
3. 4.3 ,, ,, ,, 100 ,, of water on boiling.

This shows that dilution increases the acidity of the peptone, and that boiling nearly doubles its acidity. Peptone is therefore an important factor in the alteration of the reaction of jelly on heating. The solution prepared with alkali was similar in appearance to the one prepared with water only.

Sodium taurocholate only.—1·5 grms. in 70 c.c. The solution containing no alkali was turbid and acid, but the solution with alkali was almost clear and very slightly alkaline. The addition of alkali is therefore necessary to dissolve the whole of the salt. Dilution and boiling made no appreciable difference to the titration.

The above experiments show that peptone solution becomes more acid on dilution and that sodium taurocholate is precipitated by acid. A direct experiment proved that peptone solution produced a turbidity in sodium taurocholate solution. The glucose should be added as late as possible as alkali acts upon it on heating.

As a result of these experiments the following method of preparing the solution was adopted. 60 grms. of peptone, 15 grms. of sodium taurocholate, 600 c.c. of tap water, and 70 c.c. of $N/2$ caustic soda are steamed for 30 minutes. 7 c.c. is added to 23 c.c. of distilled water in a porcelain dish, and titrated with $N/10$ caustic soda and phenolphthalein. Sufficient $N/2$ caustic soda is then added to make the solution neutral. The neutrality may be tested by dilution of 7 c.c. to 30 c.c. with distilled water, adding phenolphthalein, dividing into three parts, and adding a trace of alkali to one part and a trace of acid to another. The volume of the solution is then measured, and to it is added 2·15 grams per 100 c.c. of pure glucose, and 43 c.c. per 100 c.c. of 10 per cent. litmus solution. The mixture is steamed 15 minutes, allowed to stand overnight and filtered. For use with 100 c.c. of water 50 c.c. of the triple strength solution is put in a test tube $1\frac{3}{4}$ by 8 inches, containing a test tube 1 by 3 inches; for use with 50 c.c. of water 25 c.c. of triple is put in a test tube $1\frac{1}{2}$ by 7 inches, containing a test tube $\frac{5}{8}$ by 2 inches. Double strength is made by diluting two volumes of triple strength to three volumes with tap water; 10 c.c. of this is put in a tube $\frac{7}{8}$ by 6 inches, containing a test tube $\frac{1}{2}$ by 2 inches; this is used for 10 c.c. of the water to be tested. For single strength one volume of double is diluted with an equal volume of tap water. 10 c.c. of this is put in a tube $\frac{5}{8}$ by 5 inches, with an inner tube $\frac{3}{8}$ by $1\frac{1}{2}$ inches. The tubes are sterilised by steaming for 20 minutes on three successive days, but the steamer must boil rapidly or else the air is not expelled from the inner tubes.

Sugar media.—These are made neutral to phenolphthalein, the titration being done before the addition of litmus solution in the same manner as glucose taurocholate solution.

Milk.—Separated milk is steamed one hour, left till the next day, and decanted from the slight scum. For testing for *B. enteritidis sporogenes* the milk is placed in tubes, and heated for 60 minutes on two days and 30 minutes on the next day. The milk is slightly browned. For litmus milk, Savage recommends that alkali be added to produce a $+1\%$ reaction. If this is done the milk is notably darkened on steaming, and so it is better to use no alkali and mix nine volumes with one volume of 10 per cent. litmus, and steam as above. This gives a good blue milk.

Rebipelagar. (Metropolitan Water Board.)—Soak 20 grms. of cut up agar fibre in a litre of tap water all night, then add 20 grms. of peptone and 5 grms. of sodium taurocholate and steam for 90 minutes. After cooling to about 60° C. the beaten up white of two eggs is added, and the mixture steamed 90 minutes more. After filtration and measurement 1 gram per 100 c.c. of lactose, and 1 c.c. per 100 c.c. of filtered 0·5 gram per 100 c.c. solution of neutral red is added. I tried using powdered agar but found it unsatisfactory, the reason probably being that it contained 9·6 per cent. of ash while thread agar contained 3·1 per cent. of ash. This medium is useful for counting the number of organisms which grow on it at 37° C., and also for preparing pure cultures of *B. coli* by spreading. About 15 c.c. is thoroughly melted in a boiling water bath and poured into a Petri dish, after about a minute it is covered, and put in the incubator. The cover is supported at the sides by small tiles to allow steam to escape. After about two hours at 37° C. the medium is hard enough for use. A loopful of the primary glucose medium which has shown acid and gas is spread by a platinum spatula. After one or two days incubation at 37° there is no difficulty in picking out dark red colonies for sub-cultivation in lactose litmus, etc.

Discussion.

Mr. **Cotterell** said he would welcome any practical instruction as to the method by which the author filled his little tubes with the tauro-cholate.

Mr. **Liverseege** said he steamed for 20 minutes, his steriliser having a burner larger than normal, and the result was effective. In that time even the big tubes would have none or the merest trace of air. Briefly, his answer was—put a bigger burner underneath the steamer.

Canadian Section.

Meeting held at Toronto on Friday, January 13th, 1911.

PROF. W. LASH MILLER IN THE CHAIR.

THE HISTORY OF THE NICKEL INDUSTRY IN CANADA AND THE UNITED STATES.

BY D. H. BROWNE.

Although nickel was discovered in 1751, and has been used in the arts since the beginning of the 19th century, it is only within the last few decades that its production has become a distinct factor in the mineral industry of Canada and the United States. Up to 1870 Norway led in the production of nickel ore. In the next two decades New Caledonia produced from two-thirds to three-fourths of the world's supply. From 1890 to the present date the Canadian mines have taken the lead from New Caledonia, and are now producing the greater portion of this metal. How these Canadian ores came to be worked and how the leadership was wrested from New Caledonia, is the subject matter of this paper.

The history of nickel in Canada is curiously interwoven with the history of three men, none of whom was in the beginning aware of the ideas of the others. These men were S. J. Ritchie, of Akron, Ohio, Robert M. Thompson, of New York, and an Englishman named John Gamgee.

In 1876 John Gamgee was in Washington, D.C., endeavouring to interest the United States Government in his proposals for the cure of yellow fever patients in the Southern States. Mr. Gamgee believed that a low temperature was a specific cure for yellow fever. He proposed to build a large hospital ship, in which a low temperature was to be maintained by ice machines, and this ship was to sail around the Gulf ports taking on board yellow fever patients and keeping them at a low temperature till they recovered.

The Navy Department became interested and promised Mr. Gamgee a liberal appropriation for this ship, provided he could work out the mechanical details in a satisfactory manner. A large shop in the Navy Yard was placed at his disposal and work was begun on his ice machine. One of the difficulties he encountered was that at the pressure he employed, ammonia gas leaked through cast iron. While he was experimenting with various alloys he met Mr. S. J. Ritchie, of Akron, who was then in Washington. During their conversations on this problem the use of an alloy similar to meteoric iron was proposed, and a great deal of experimental work was done —melting nickel with iron and steel. As a result of these experiments many of the remarkable properties of nickel steel were discovered, and it was decided to use this alloy in the ice machine. Unfortunately, Gamgee was unable to agree with the appropriation committee, and the whole affair was allowed to lapse. There were no patents taken out by Gamgee for these alloys, and the only result of these experiments was to leave on Mr. Ritchie's mind a strong impression of the value of nickel steel. As Mr. Ritchie was not at that time in any way connected with the nickel industry this seed lay dormant for many years.

About this same time Mr. Robert M. Thompson and his partner, Mr. W. E. C. Eustis, were developing a deposit of nickel ore in the township of Orford in Quebec. This ore contained small amounts of sulphide of nickel—millerite, distributed in a matrix of calcite, chrome garnet, and pyroxene. Mr. Eustis put up a reverberatory furnace and tried to smelt this ore, but was unsuccessful on account of the refractory nature of the slag. They closed down this mine and transferred their attention to a copper deposit at Capleton in Quebec, which they were able to mine and smelt without much difficulty. There they made a copper matte which they sold to Hunt and Douglas, copper refiners at Phœnixville, Pa. In order to extend their business they decided to build their own refinery in the States, and accordingly built at Constable Hook, New Jersey, a copper smelter, which later took the copper ore from Capleton and finished it to blister copper. This plant was called The Orford Copper Company, after the township of Orford in Quebec. Shortly after the plant was built Mr. Eustis retired from the partnership, taking the Capleton mines as his share of the property and leaving to Mr. Thompson the ownership of the Orford Copper Works at Constable Hook. As Mr. Thompson had no mineral supply he sent agents out to purchase copper ores. Just about this time, 1885, copper was discovered in the Sudbury district of Northern Ontario. So far Mr. Thompson had had no connection with the nickel industry except his early failure to solve the problem of the nickel ore at the Orford Mine in Quebec.

In the year 1882, Mr. S. J. Ritchie became interested with some Cleveland capitalists in the Central Ontario Railway, which was built to open up and develop the iron ores of Hastings County, Ontario. This group of men acquired a large acreage of iron deposits, which unfortunately proved too high in sulphur to be of marketable value. In order to extricate his backers from this unpleasant position, Mr. Ritchie proposed to extend this Central Ontario Railway to meet the Canadian Pacific road, by which move he expected to be able to secure some business in carrying to markets in the United States some of the minerals that had been discovered along the line of the Canadian Pacific Railway. With this intention he visited the Sudbury district in 1885 and found there what appeared to be valuable deposits of high grade copper ore. He took options on these, returned to Cleveland, and organised the Canadian Copper Company, which comprised the same group of capitalists who had a few years before lost heavily in their venture into Hastings County iron ores. The Anglo-American Iron Company, Mr. Ritchie's former company, took up some other copper deposits some twenty miles west of the holdings of the Canadian Copper Company. At that time nothing was known of the occurrence of nickel in the Sudbury ores. We have now the three threads of the nickel industry coming together and uniting. Mr. Ritchie with his Company ready to sell copper ore, which they did not know contained nickel; Mr. R. M. Thompson coming forward to buy these ores, supposing them to contain nothing but copper and being himself prejudiced against nickel by his disastrous experience at the Orford mine; and Mr. Gamgee, who had at this time vanished, but had left on Mr. Ritchie's mind an impression destined to have memorable results.

In 1887, the Canadian Copper Company commenced to nine copper ore. This ore was a chalcopyrite containing yrrhotite and pentlandite. At that time, however, nothing vas known about pentlandite and everything in the ore not opper pyrites was classified as "iron." In 1887, 167 cars f picked copper ore were shipped, part to Nichols' chemical orks on Long Island, opposite New York City on the north, nd part to the Orford copper works, opposite New York ity on the south. It was during the winter of 1887 that ckel was discovered in the Sudbury ores. The Nichols emical Company were unable to make refined copper of these es and turned their shipments over to the Orford Copper mpany. This company also experienced the same trouble, unknown element entering the blister copper, hardening d whitening it and making it worthless. Nickel was disvered to be the interfering element, and a campaign of ication was begun to discover how to treat this element. e first problem, on which the life of two companies depended, s to remove this metal, to slag it out and leave marketable per. The second, and by far the less important problem, how to make nickel and how to make money out of it. t this time there were three interests in control of the el business. The Société le Nickel, owned by the Rothlds, controlled the New Caledonia nickel mines and had factories in France, Germany, and the United Kingdom. New Caledonia ores contained five or six per cent. el in a gangue of magnesium iron silicate. This ore brought from New Caledonia, smelted with um or alkali waste, giving a nickel iron matte, which was treated with blast in reverberatory furnaces or Bessemer converters till the iron was all slagged off and a pure nickel sulphide was left. This required only roasting and reduction to give a pure metal. The Société le Nickel practically controlled the nickel trade of the world, which at that date (1887) amounted to less than 1,000 tons a year.

In England, the Vivians of Swansea produced a little nickel from the nickel copper ores of Norway. They conducted their business with absolute secrecy, having no patents on record. All that was known of their business was that in some way salt cake was one of the ingredients used.

In the United States Mr. Joseph Wharton, of Camden, N.J., had been making nickel since 1862, using ores from the Lancaster Gap Mine in Pennsylvania. Mr. Wharton used a wet process, dissolving up nickel iron matte in hydrochloric acid, precipitating the iron by lime and separating nickel and cobalt by the old method with bleaching powder. Mr. Wharton's industry had in 1882 been crowded to the wall by the Société le Nickel, which with its New Caledonia ores was producing more nickel than the world consumed. Mr. Wharton's ore was low grade, about 1½ per cent. nickel, and he could not compete on even terms with the French Syndicate. He was working in a small way, dealing more with cobalt oxide and nickel salts than with metallic nickel.

In general, it may be said of the nickel business at this time that it was suffering from an over supply, and that its control was very lightly held by the French Company. When, in this condition of the market, a very large supply of ore was thrown into the hands of men who knew absolutely nothing about the technicalities of the business or the condition of the market, the outlook was at the least doubtful and discouraging.

At the outset, as we have said, imperative business-need drove Thompson to devise some way of slagging or separating this nickel from the copper in the Sudbury ores. He had contracted to receive and the Canadian Copper Company had contracted to deliver, several thousand tons of ore containing about 15 per cent. copper. While he was attempting the solution of this problem, his first work was to oxidize the nickel by repeated reverberatory smeltings. In this he was successful, and there was piled up in the Orford yard a large amount of nickel-copper slags. By this means the Orford Company was enabled to market some of the copper, and to keep its contracts. In the meanwhile the problem of nickel was vigorously attacked. The only U.S. patent on the subject was one issued to Tatro, of Hartford, Conn., in 1877. Tatro was dead and his patent had never received any practical application. It consisted in smelting nickel-copper ores with a mixture of 30 parts lime, 30 parts fluorspar, 21 parts saltpetre, 10 parts common salt and 9 parts potash, in the proportion of three pecks of the mixture to a ton of ore. The crucible in which this ore was melted with the flux was allowed to cool off partially, and the supernatant slag said to contain the copper and iron was poured off, leaving a nickel matte chilled on the bottom of the crucible. This patent was purchased by the Orford Company for the purpose of investigating its merits. On examination it proved to be based on the solvent action of a molten alkali sulphide on the sulphides of copper and iron. This idea was in line with the fact that Vivian was known to be using an alkali sulphate.

After many months of patient work the Orford Copper Company discovered that if a copper-nickel-iron matte were melted with carbon and an alkali sulphide, two products were given, first, a "top" or lighter upper portion containing the major portion of the copper and iron with some nickel, and second, a "bottom" or heavier portion containing the major portion of the nickel with some copper and iron. By repeated re-smeltings of these products with more alkali sulphide a comparatively clean separation could be made, copper soda-iron sulphides going one way and nickel soda sulphide going the other way.

During 1887-1888 the Canadian Copper Company continued shipments of picked copper ore. Their market was limited. Freight was a heavy expense, and so in 1888 it was decided to erect a smelter and ship a nickel-copper matte, which the Orford Copper Company was then ready to receive and which might find a market abroad in competition with New Caledonia ore. The first smelter was erected by Dr. Peters in 1888, and blown in on December 23rd of that year. The furnace building was 35 × 40 feet, and contained one small Herreshoff furnace 3 ft. 6 in. × 6 ft. at the tuyeres. The early work on this furnace was a series of desperate struggles against environment, ignorance, and prejudice. That it was successful is due to the untiring efforts of the management and the unbounded confidence of the directors of the Canadian Copper Company. In 1889 the Company produced 8,450 tons of matte, which contained about 1,600 tons copper and 1,200 tons nickel. This was sold in small lots to Wharton, to Vivian and to Tennant, and in large lots to the Orford Copper Company. As in this year the total nickel production of New Caledonia was only 1,332 tons, it was evident that Canada was producing as much nickel as the world could consume.

In order to create a market for this supply, some new use had to be found for nickel. Luckily for the new industry, in May, 1889, Mr. Jas. Riley, manager of the Steel Company of Glasgow made a report to the Iron and Steel Institute on the properties of nickel steel. Mr. S. J. Ritchie, who recalled his own experiences with Gamgee about 12 years before, showed this report to General Tracy, Secretary of the U.S. Navy. General Tracy appointed Lieutenant Buckingham to investigate this subject and at the same time Sir John A. Macdonald appointed Sir Chas. Tupper to look into the matter from a Canadian standpoint. These two gentlemen, with the directors of the Canadian Copper Co., made in 1889 an extended visit to the steel works in Europe and the United Kingdom and became thoroughly convinced of the utility of nickel steel. During this visit both the German and French nickel companies made overtures for the complete control of the Sudbury nickel deposits. These overtures were rejected. Lieutenant Buckingham and Sir Charles Tupper both reported to their respective Governments on their return. As a result of this investigation, General Tracy ordered of the Creusot works in France a nickel steel armour plate and for comparison, of Cammel and Co. a steel plate such as was then used on British armoured vessels. These two plates were tested at the Government proving grounds, at Annapolis, Md., and showed conclusively the superiority of nickel steel armour over any other the world had known. Congress immediately appropriated one million dollars for the purchase of nickel and the industry received the Government support it so urgently needed.

In this year, 1890-91, several other companies had entered the Sudbury district. The Vivians had acquired the Murray mine, had built a smelter and were shipping matte to Swansea. The Dominion Mineral Company opened the Blezard mine and started a smelter about 1890. Half a dozen smaller concerns purchased properties and started mining. About this time the French Nickel Syndicate reduced the price of nickel to 1s. 1d. per pound. The smaller organisations could no longer operate with profit. The Canadian Copper Company had at one time over 9,000 tons matte stored in their smelter yard. The banks refused to accept their overdrafts and it was only the individual action of the directors who pledged their private fortunes to this enterprise that tided the Company over these difficulties. The Canadian Copper Company, organised in 1886, paid no dividends till 1894, at which time the use of nickel steel armour plate had reached such a safe basis that they were able to declare a dividend of eight per cent.

All this time the Canadian Copper Company was simply mining ore and making matte which it sold in the open market. It had no process of its own. The Orford Copper Co. owning no mines, but possessing a valuable asset in the Orford process, was its chief customer. Wharton of Camden was also a purchaser of nickel matte. In order to be independent of outsiders the Canadian Copper Co., in 1890, entered the field of experiment to find if possible a process suitable to its own requirements.

M. Jules Garnier, who in 1867 had discovered the New Caledonia ores and who had erected nickel refineries in France to treat these ores, was engaged, and given *carte blanche.* Garnier erected a Bessemer plant at Copper Cliff to free the matte from iron and erected at Cleveland, Ohio, a plant to make this refined matte into metal and also to treat the Orford nickel oxide and make from it pure shot nickel. Garnier worked on this problem for two years and was at last obliged to give up the endeavour. After his departure Dr. Carl Hoepfner was engaged to work out his electrolytic method of separation of nickel from copper. Dr. Hoepfner built a refining plant in Cleveland and worked about a year at this process without commercial success. After he left the Canadian Copper Co., he was engaged by Canadian capitalists and formed the Hoepfner Refining Co. with a capital of $10,000,000. He built a large refinery at Hamilton, Ontario, but after costly experimenting was obliged to confess failure and the plant was abandoned.

During the year 1897 to 1898, the Canadian Copper Company had its representatives in England investigating the Mond process, on which it had an option. After careful examination it was decided that the Mond process, beautiful as it was, was not adapted to a Canadian climate and environments and the matter was dropped. It took the Mond Nickel Company several years of experimenting to work out the difficulties of their process and place it on a strictly commercial basis.

From 1898 to 1902 the Canadian Copper Co. carried on a long and costly series of experiments in Cleveland. They succeeded in working out an electrolytic process which ran satisfactorily. After the International Nickel Company was formed, it was found that no electrolytic process could compete with the Orford process and so this electrolytic work was abandoned.

During the period from 1889 to 1899 the plant of the Canadian Copper Company had been growing unit by unit till it contained seven Herreshoff furnaces and was producing about 3,000 tons of copper and 3,500 tons of nickel in the form of a 35 per cent matte.

In 1899 another smelting plant on the same lines was built also containing six or seven Herreshoff furnaces. This produced matte up to 1904, in which year the new smelter was built. In 1903 the production had risen to about 3,000 tons copper and 6,000 tons nickel.

In the year 1902 the International Nickel Company was organised. It took in the Canadian Copper Co., miners and smelters of ores; the Anglo-American Iron Co., which besides its holdings in Hastings Co. ironfields, owned some valuable nickel mines, about 20 miles west of Sudbury; the Orford Copper Company, nickel and copper refiners at Constable Hook, New Jersey; the American Nickel Co.; Mr. Wharton's refining plants at Camden, N.J., and the Nickel Corporation of London and the Société Minière Calédonienne, both of which concerns owned valuable nickel deposits in New Caledonia. This organisation brought miners, smelters and refiners to mutual understanding and made the way for many economies that could not heretofore have been effected. The strong competitors of the International Nickel Co. are the old Société le Nickel in France, with its New Caledonia ore deposits and its five refineries at strategic points in England, France, and Germany, and the Mond Nickel Co., with its mines and smelter some 20 miles west of Sudbury and its refinery at Clydach in Wales.

One of the first moves of the International Nickel Company was the gathering of the scattered furnaces of the Canadian Copper Co. into one modern smelting plant. This new smelter was built at Copper Cliff in 1903-4, and was blown in in July, 1904. It contained two blast furnaces and three converter stands. This smelter was modelled after the best copper smelting plants in the United States and to this close resemblance were due many of the difficulties which were found in its operation.

It took two or three years of arduous and continuous labour and study to eliminate from this smelter those features of copper smelting which were not adapted to the requirements of copper nickel ores.

As it stands to-day the Canadian Copper Company's smelting plant contains five blast furnaces 4 ft. × 17 ft. at the tuyeres, and ten converter stands with converters 84 in. × 110 in. At the present time one basic converter 12 ft. diameter and 37 ft. long is being installed, and a reverberatory plant containing two modern reverberatory furnaces, 19 ft. × 112 ft. is in process of erection.

In this plant the Canadian Company is producing some 7,000 tons copper and 15,000 tons of nickel a year, in the form of a Bessemer matte containing 80 per cent. copper nickel. This matte enters the United States duty free and is refined at the Orford Copper Co.'s plant at Constable Hook, New Jersey, where the necessary salt cake, oil, fuel, coal, and chemicals can be obtained at figures very much below their cost in Canada, and where also ocean freights and competing railway connections reduce the cost of shipment to a minimum.

London Section.

Meeting held at Burlington House on Monday, February 20th. 1911.

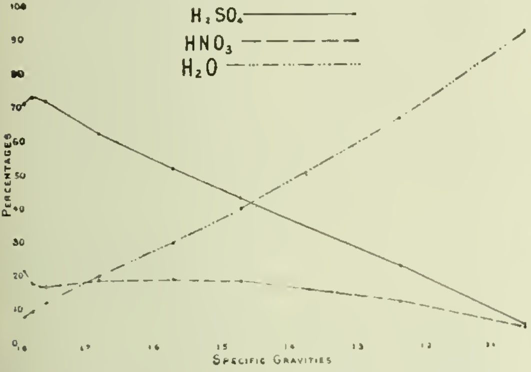
MR. E. GRANT HOOPER IN THE CHAIR.

THE COMPOSITION OF THE ACID FLOWING FROM THE THOMSON DISPLACEMENT APPARATUS FOR THE MANUFACTURE OF GUNCOTTON.

BY GEORGE W. MACDONALD, M.SC.

The details and method of working the Thomson apparatus for the manufacture of guncotton have been fully dealt with by Colonel Sir Frederic L. Nathan in a paper read before the Society (see this J., 1909, 177). For the purpose of following the results to be quoted it is, consequently, only necessary to state briefly, that the cotton waste is immersed in the mixture of sulphuric acid and nitric acid contained in shallow earthenware pans provided with a stop-cock at the lowest point. When nitration is complete, at the end of 2½ hours, this cock is opened, and, as the acid slowly runs away, the water runs in on top at an equivalent rate, and the acid is thus completely displaced from the guncotton. At the Dartford Guncotton Works of Messrs. Curtis's & Harvey, Ltd., the course of the displacement has been followed by analysing samples of acid which were drawn, at fairly frequent intervals, as displacement proceeded. The results are given in the following table :—

Fig I



Details.	Time occupied in collecting acid. (Mins.)	Weight of acid.	Collected between sp. grs.	Specific gravity.	Sulphuric acid.	Nitric acid.	Nitrous acid.	Water.
Original acid as used for nitrating	—	2750 lb. (collected)	—	1·79	70·84	21·26	0·53	7·37
Acid collected for revivification..	145	2033 lb.	— to 1·76	1·778	72·93	17·57	0·56	8·94
Acid to be denitrated and concentrated....................	25	324 ,,	1·76 to 1·7	1·757	71·55	16·46	0·56	11·43
	8	86 ,,	1·7 to 1·6	1·68	61·93	18·26	0·45	19·36
	3	35 ,,	1·6 to 1·5	1·57	51·56	18·86	0·31	29·27
	3	33 ,,	1·5 to 1·4	1·47	42·22	17·99	0·24	39·55
	7	83 ,,	1·4 to 1·1	1·236	21·94	11·83	0·16	66·07
Acid running to waste to drain.	7	71 ,,	1·1 to 1·0	1·050	4·24	3·61	0·15	92·0
	45	589 ,,	until free from acid.	1·005	0·48	0·44	0·10	98·98

In Figure 1 the percentage amounts of sulphuric acid, nitric acid, and water, are plotted against the specific gravities of the samples of acid, commencing with the nitrating acid itself. In Figure 2 they are plotted against time, in minutes, beginning from the point where the acid was shut off from the storage tank for acid to be revivified, and allowed to flow to the storage tank holding the acid which is to be denitrated and concentrated. The interesting point is brought out that sulphuric acid is displaced at a relatively much more rapid rate than nitric acid, and that, for a short time during displacement, the percentage of nitric acid actually rises in the mixed acid. As an explanation it may perhaps be suggested that the guncotton fibre has a selective adsorption for nitric acid, or that a labile nitrate has gradually broken up. The nitrating acid in use at the time that the experiments were carried out had a composition suitable for the preparation of guncotton intended for the manufacture of cordite. Quite similar results, as regards the course of the displacement, have also been obtained where the acids used were intended for the manufacture of cellulose nitrate of a high nitrogen content, and a high solubility in ether-alcohol, and further, a low nitrogen content and total solubility in ether-alcohol. These acids have higher nitric acid and water contents than the acid used for the manufacture of cordite guncotton. Readings were also taken of the temperature of the acid running off during displacement. Table II. gives these results, and, in addition, the specific gravities. It will be seen that the rise of the temperature is very regular—about 1° C. every 15 minutes during the first 150 minutes of displacement. From this point a rise of 3·5 C. takes place during the next 15 minutes, after which the temperature remains constant.

Time from commencement of displacement. (Mins.)	Temperature °C.	Specific gravity.
5	12·5	1·782
15	14·0	1·781
30	16·0	1·780
45	17·0	1·778
60	17·5	1·777
75	19·0	1·776
90	20·0	1·775
105	20·5	1·774
120	21·0	1·774
135	22·0	1·774
150	23·0	1·760
155	24·0	1·74
160	25·7	1·688
165	26·5	1·542
170	26·5	1·300
173	26·5	1·100

From the detailed results we have the following data per set of 4 pans :—Seventy-eight per cent. of the acid collected to be dealt with in the factory was revivified. The ratio of nitrating acid to cotton waste was 34·37 to 1. The rate of flow of the acid to be revivified was about 14 lb. per minute. The loss consisted of, approximately, 6 lb. of sulphuric acid and 5 lb. of nitric acid, (0·4 per cent. of the acid originally used), or only about 0·08 lb. total loss of both acids per lb. of guncotton produced. The amount of acid to be denitrated and concentrated was 4·12 lb. per lb. of guncotton produced. The amount of water consumed during the whole of the displacement was about half a gallon per lb. of guncotton produced. My thanks are due to the Directors of Messrs. Curtis's & Harvey, Ltd., for permission to publish these results.

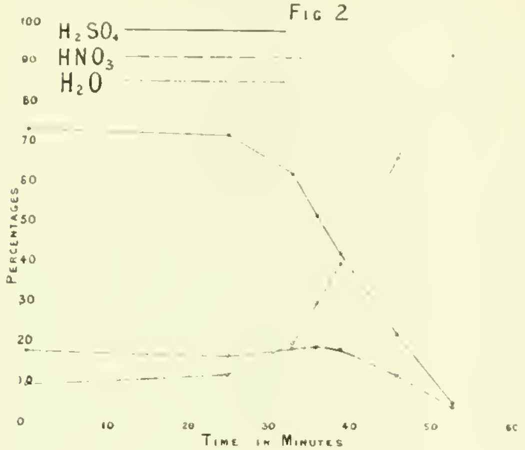


Fig 2

Discussion.

Dr. Robt. Robertson said that on account of the importance of the quantity of acid in the first boiling of guncotton, any information such has had been brought forward regarding the mechanism of the Thomson displacement process was of interest.

As regards the significance of the phenomenon, it seemed that the table might contain the data for deciding if hydrolysis of a higher nitrate of cellulose had taken place, for Benl and Klaye (Zeit. f. d. g. Sch.-u. Spreng, 2, 403) had found that, when they transferred highly nitrated cellulose to an acid bath capable of producing a nitrocellulose of a lower degree of nitration only, a denitration of the former resulted.

He had not found that nitric or sulphuric acids of decinormal strength were markedly adsorbed by nitrocellulose, although alkali of this strength could be adsorbed. Häussermann (Zeit. f. d. g. Sch.-u. Spreng., 3, 121) had shown that with stronger nitric acid, the first stage in the nitration of cellulose was most probably the formation of an adsorption compound. As guncotton was not fully nitrated, there existed the possibility of its adsorption of nitric acid, and the matter might be settled by determining the affect of the addition of guncotton on the composition of mixed acids of the various strengths given in the table.

Mr. Jas. M. Thomson said the author stated that 0·08 lb. of acid per lb. of guncotton ran to waste; and that agreed very well with the results they found at Waltham Abbey, though they allowed 0·12 lb. of acid lost per lb. of guncotton. Objectors to the process found that the nitric acid rose when the displacement reached a point close to where the water joined the acid. They came to the conclusion that the guncotton was highly nitrated at the beginning, and that when the water layer mixed to some extent with the strong acids the guncotton became de-nitrified. That statement became current; but all experiments led to the conclusion that the displacement process gave a better stability than the ordinary process. That had been shown very definitely by Dr. Robertson; and they had found the same thing at Waltham Abbey in doing some experiments. The nitric acid did rise there too, but as many seemed to be afraid of the stability they concluded naturally to draw very little attention to it. At the first he was almost afraid to displace the older process altogether and adopt the new one but, being assured that the stability of the product was excellent, they adopted the displacement process and it had turned out quite satisfactorily. With regard to adsorption of nitric acid by guncotton, that was quite a new theory to him; but it was quite possible that both conjectures might be correct. At any rate it was quite certain that there was a de-nitrification of the guncotton when the acids became reduced in strength. As Dr. Robertson had pointd out, if highly nitrified guncotton was immersed in weaker acid the nitrogen content was reduced, this would to some extent explain the increase of nitric acid at a certain level in the waste acid which came away.

Dr. W. R. E. Hodgkinson said, with regard to adsorption, that something of the kind undoubtedly took place between guncotton and benzenoid (partially nitrated or not) substances when nitrated together. The figures obtained on analysis and general behaviour of the products pointed to it very distinctly.

Mr. E. Hatschek said as far as the adsorption theory went, if there was adsorption it was absolutely abnormal adsorption phenomenon. All normal adsorption proceeded according to the same exponential formula, and the curves would more or less approach an equilateral hyperbola. Unless a small part only of the curve was drawn to a scale which did not shew its nature there was nothing of that sort here. He had also used, not indeed guncotton, but acetic acid collodion gel in adsorption experiments to a considerable extent, and had found that the adsorption always proceeded normally and that the descending curves, which were here straight lines, were invariably in the shape of an equilateral hyperbola.

Mr. G. W. Macdonald in reply, said Dr. Robertson had already referred to the question of the work of Häussermann. Both Knecht and Häussermann had shown the existence of labile nitrates of cellulose under the following conditions:—On immersing cellulose in dilute nitric acid, removing the adherent acid first by pressure and finally by exposing *in vacuo* over freshly burnt lime, a cellulose nitrate of about 7 per cent. nitrogen was produced. On immersion in water, nitric acid was liberated, thus pointing to the breaking up of a labile nitrate and the production of a stable nitrate containing a lower percentage of nitrogen. The symmetrical nature of the curves for water and sulphuric acid appeared to show, conclusively, that there was no adsorption of sulphuric acid by the guncotton fibre. There was probably a considerable breaking up of the cellulose nitrate which caused an increase of nitric acid in the mixed acids. He had had considerable experience with nitrating centrifugals before Messrs. Curtis's & Harvey introduced the Thomson system. A brief comparison of some of the points of the two systems might be of interest. When using nitrating centrifugals the ratio of mixed acids to cellulose was at least 50 to 1, and if a circulating system was employed a very constant composition of the nitrating acid was thus obtained. The total time of contact of the cellulose and acid was less than one hour, and the nitrogen content of the cordite guncotton produced, when using an acid of the same composition as in the displacement process, was from 13·1 to 13·2 per cent., and was thus quite appreciately higher than the nitrogen content of displacement cotton, which averaged practically 13 per cent. Every pound of guncotton from the nitrating centrifugal carried away with it, at least, one pound of adherent acid, which was lost by drowning the guncotton in a very large volume of water. This loss of acid was equivalent—taking the market price of sulphuric and nitric acid—to about £6 per ton of guncotton produced. Consequently, in the question of economy the process introduced by Messrs. Thomson offered a very considerable advantage, since it brought down this loss to about one-tenth of the above amount. One point advanced against the system was the considerable amount of dilute acid which had to be dealt with by denitration and concentration, but this expense was more than counterbalanced by the other economies introduced.

I. AMMONIUM SULPHATE AND ITS INSTABILITY. II. THE HYDROLYTIC DISSOCIATION OF AMMONIUM SALTS.

BY WATSON SMITH.

I. The chemistry of ammonia and its salts has gradually acquired during the last fifty years such enormous importance from a technical point of view that any error as to the properties of ammonium sulphate in the pages of our best text-books and works of reference would be a serious matter. In papers read before this Section in 1895 and 1896, I have shown that ammonium sulphate has no melting point. It will decompose rather than melt. Hence the alleged results of R. F. Marchand given in Gmelin's Handbuch in 1849, and repeated in nearly all the text-books and dictionaries of chemistry from that date to this, and even in the revised edition of the Gmelin-Kraut Handbuch, just published, are wrong. Marchand is alleged to have stated that "ammonium sulphate melts at 140° C. and begins to decompose at 280° C.," also that "on sublimation, besides acid sulphate, nitrogen is obtained and ammonium sulphite formed." These statements are incorrect. Marchand's quoted article is one "On the behaviour of glass to ammonium sulphate" (Pogg. Annalen, 1837, **42**, 556), and I find he *did not* state that ammonium sulphate melts at 140° C., but that it is the acid sulphate (ammonium hydrogen sulphate) that does this. Moreover, Marchand states that it is the *acid sulphate* that decomposes at and above 280° C. "with sublimation of ammonium sulphite and a little sulphate." He also states that ammonium sulphate on heating is converted into the acid sulphate with loss of ammonium. Marchand's German is certainly bad, and Gmelin has clearly misread and so misquoted it, and has misled unwittingly German, English, and French text-book writers during upwards of 80 years, and probably many technical men besides.

Take an instance or two showing how persons may be misled by such matters. Bloxam's Chemistry, 1895, 322, tells us of commercial ammonium sulphate, "The rough crystals are gently heated to expel tarry substances, and purified by recrystallisation." I cannot imagine the possibility of carrying out such a heating process without loss of ammonia and consequent creation of acidity.—Muspratt's Dictionary (1860), p. 192, states that "the sublimation of the crystallised sulphate cannot well be effected"—giving the impression that with means at present at command it has not yet been found feasible. The "Chemiker-Kalendar" of Berlin, in its 1911 edition, on the properties of salts, says of ammonium sulphate—"schmilzt unter Zersetzung bei 140° C."—no doubt quoting the principal authorities for the last 75 to 80 years. Dammer's Handbuch d. anorganischen Chem., 1894, Bd. II. 2 Th. 267, repeats the misquoted statement. Abegg and Auerbach in their large work (1907) (III, 3ter Abt., 290) do the same. Our English works follow suit. Lunge, "Coaltar and Ammonia," 1909, Pt. II, 959, also states respecting ammonium sulphate: "It cannot be sublimed without change"; also "it fuses at 140° C. and begins to decompose at 280° C."—*i.e.*, Gmelin's misquotation of Marchand. Curiously enough, American text-books get nearest the truth. Remsen (1889), 514 (Inorg. Chem.), lays down the law that "an ammonium salt of a polybasic acid, containing also some metal, gives off, on heating, ammonia and leaves an acid salt." Thus, "sodium ammonium sulphate gives off ammonia and leaves monosodium sulphate" (see also Berzelius's Lehrbuch, trans. by Wöhler, 1836, 4te Bd. 208). But I complain that this example leaves the doubt as to whether normal ammonium sulphate does not do something very different. H. C. Jones, of the Johns Hopkins University, U.S.A., in his text-book (edit. 1903) p. 360, says: "When heated, ammonium sulphate yields the acid sulphate and liberates ammonia. It is readily soluble in water and is hydrolytically dissociated by it." The information is scant but accurate. The facts might be concisely stated as follows: Ammonium sulphate (as an impalpable powder) on heating begins to decompose, evolving ammonia, at temperatures even below 100° C. The evolution continues as the temperature rises, and at 300° C. fusion of the residue takes place, this residue now consisting of ammonium hydrogen sulphate. Ammonium hydrogen sulphate melts at 140° C. (as will be found on letting the fully molten mass cool and testing its melting point). To avoid too much disruption, it is best whilst raising the temperature of the mass to the higher points, to pass a gentle current of steam through the apparatus. This limits the reaction almost completely to a separation of ammonia (this J., 1896, 3—4). If no steam be used, as the heat increases, sulphur dioxide and nitrogen escape, the effluent ammonia reducing ammonium hydrogen sulphate (this J., 1895, 630).

With regard to my papers read before this Section in 1895 and 1896, Reik (Monatshefte f. Chem. 1902, **23**, 1033—1056) has repeated the experiments there described, and confirms my results. He says: "Not only does ammonium sulphate not melt, but it decomposes, finally yielding the acid salt, NH_4HSO_4, which melts at the point hitherto attributed to the normal salt. He finds moreover that under diminished pressure, or *in vacuo*, the behaviour is the same, and the normal salt cannot be sublimed, but just passes into ammonium hydrogen sulphate. This acid salt, Reik finds, will melt, but will not distil even if heated with the free Bunsen flame to dull redness.

II. Hydrolytic dissociation of ammonium salts.—Pebal (Annalen, 1862, **123**, 199) was probably the first to show that solid ammonium chloride is dissociated at high temperatures, but Fittig first clearly demonstrated the fact that ammonium chloride solutions on boiling suffer decomposition, in a paper published in the Annalen Chem. u. Pharm. in 1863. This will be referred to further on. J. Meyers (Ber. 1872, **5**, 820) mentions that H. C. Debbits proved the dissociation of certain ammonium salts in solution, and, referring to Fittig, Debbits says that he (Fittig) appeared to think that only ammonia escaped, and not hydrochloric acid as well. If so, adds Debbits, Fittig was wrong, as he had repeatedly detected hydrochloric acid also, more especially in the latter portions of the distillate. I have repeated Debbits' experiment with ammonium chloride, and find this remarkable fact. On distilling an aqueous solution of ammonium chloride in a proportionately large retort, at first small quantities of ammonia escaped, turning red litmus paper faintly blue. On testing the drops of clear liquid that condense with silver nitrate acidified with nitric acid, a slight turbidity is perceptible, so that whilst ammonia predominates there is still a little hydrogen chloride present too (a trace). But when the contents of the retort are concentrated to near the crystallising point of the liquid, a change occurs, and acid begins to predominate in the vapours, and to a much greater extent than the ammonia did previously. Just at the crystallising point or solidifying point of the hot liquid, the acid evolution and predominance are great, and a few drops of the distillate give a decided precipitate with the silver nitrate. The residue in the retort yields a decidedly acid solution. On adding water and again distilling, ammonia first predominates in the escaping vapours, but at or near the crystallising point of the hot liquid, acid again appears in decided predominance in the effluent vapours, and the crystalline residue is strongly acid.* Naumann and Rücker contradict Debbits, for they observed no hydrochloric acid in their distillates. Debbits found also that ammonium sulphate solutions are decomposed on boiling; and he even states that ammonium hydrogen sulphate liberates minute quantities of ammonia thus. I cannot say I am able to confirm this. The salts Debbits tested and found amenable to dissociation, were ammonium chloride, nitrate, sulphate, oxalate, and acetate. (Besides these, the acetates of sodium, barium, lead, and silver were also experimented with, and found to liberate acetic acid on boiling the solutions. Debbits also found that the ammonium salts referred to not only liberated ammonia when their solutions were boiled, but likewise when a current of hydrogen was passed through their saturated solutions at ordinary temperatures, and even at 0° C. But Gernez (Comptes rend. 1867, **64,** 606) precedes Debbits, though he did not so precisely experiment with ammonium salts. He passed a current of an inert gas through a carbonic acid solution of calcium carbonate, driving out the carbon dioxide and precipitating calcium carbonate, and he operated in like manner on the sulphhydrates of the alkali sulphides, on the bisulphites, bi-acetates, etc., with analogous results. He states it as a law that when an inert gas like hydrogen, nitrogen, or air (in some cases) is passed through a salt in solution, or in the fused condition, it causes the liberation of a certain quantity of that one of the constituents which is volatile at the temperature of the experiment. Thus, he found that a solution of potassium bicarbonate even at 10° C., liberated increasing quantities of carbon dioxide. Also nitrates, he found, may be made to liberate a portion of their acid at temperatures far below those ordinarily regarded as their decomposing points. Whilst Gernez does not mention ammonium salts, nevertheless his law includes them, and my experiments in and prior to 1895 are confirmatory. Thus, I found that on heating up ammonium sulphate, if a current of steam be passed through the mass, ammonia is freely given off, and even at 300° C. and above this, it is uncontaminated with sulphur dioxide, so that whilst almost perfectly pure ammonia is obtained, also a fusion of pure ammonium hydrogen sulphate remains. But let the current of steam cease, and at once dense fumes of ammonium sulphite arise. Albert R. Leeds (Amer. J. Sci. and Arts, 1874) carried on Debbits' work and extended it a little. In 1905 some very interesting work has been done on the hydrolysis of ammonium salts, by Veley (this J., 1905, 195), who shows how largely hydrolysis plays a part in this dissociation. One English text-book (that of Caven and Lander, 1906, p. 204) refers to this hydrolytic dissociation, the authors bearing testimony to Veley's work thereon; see also this J., 1905, 195).

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*J. prakt. Chem., 1906, 74, 250.

Naumann and Rücker (J. prakt. Chem. 1906, **74,** 249—275; this J., 1906, 1093) state that whilst the hydrolytic dissociation of ammonium salts at ordinary temperatures is but small, yet on warming, a distinctly acid reaction is developed. The decomposition in the case of the sulphate is greater than in that of the chloride and bromide, and hence the titration of ammonia with hydrochloric acid is preferable to that with sulphuric acid. These authors calculate the percentage degree of hydrolytic dissociation of ammonium salts by observing the amounts of ammonia passing over in the distillates on boiling. By use of this method, determinations of the extent of the dissociation were made at the boiling point with a series of salts. The salts were ammonium chloride, bromide, sulphocyanide, ammonium sodium sulphate, ammonium sulphate, chromate, bichromate, oxalate, ferrous ammonium sulphate, sodium ammonium orthophosphate (microcosmic salt), monoammonium phosphate, di- and tri-ammonium phosphate, and ammonium molybdate. It was found that dissociation increases with dilution, and this was proved by experiments with solutions of the salts mentioned, in various degrees of concentration, some of which exhibit this increase in an astonishing degree. Thus, a solution of sodium ammonium phosphate containing 1 mol. of the salt in grms. per litre, sets free 31·00 per cent. of its ammonia at the boiling point; whilst $\frac{1}{500}$th mol. per litre solution, under like conditions, sets free 79·40 per cent. Again, a 1 mol. per litre solution of ammonium sulphate sets free 0·23 per cent. of ammonia, whilst a $\frac{1}{40}$th mol. per litre solution sets free at the b. pt., 0·59 per cent.

III. Bearing of foregoing on analytical chemistry, and in technology. (A). We have already seen in the conclusions of Naumann and Rücker that direct titrations of ammonia, especially in dilute solutions, should not be made with sulphuric acid, but with hydrochloric acid, because the marked hydrolytic dissociation of ammonium sulphate causes too early an appearance of the acid reaction.

(B) Fittig (Ann. Chem. u. Pharm. 1863, **128,** 189) observed in the course of the analytical work in his laboratory that separations of lime and alumina by Rose's method did not succeed perfectly if the solution containing them and treated with ammonium chloride and ammonia, in excess to precipitate the alumina, were boiled slightly longer than necessary to drive off the excess of free ammonia, for the filtrate in such case was sure to show a tolerably strong acid reaction, and on addition of ammonia gave rise to a further small precipitate of alumina. Fittig attributed this to dissociation of ammonium chloride with volatilisation of ammonia. A blank experiment with dilute ammonium chloride solution confirmed this view. In some recent editions of works on quantitative analysis I do not find any notice taken of Fittig's warning, Rose's method being reiterated without note or comment. On boiling such a solution, as soon as ammonia ceases to come off as such, some will escape through dissociation of ammonium chloride. The precaution to be taken is not only to look out for cessation of ammonia evolution, but for the first symptoms of acidity in the hot liquid, with the aid of a delicate indicator. The same rule applies to Wöhler's method for separating aluminium from magnesium in the analysis of a magnesium aluminate, like *spinelle,* for instance.

(C) In our Journal, 1909, 775—781, there is a paper on "The lime in basic slag," by Jas. Hendrick. In order to determine the amount of lime in slag he proposed to boil a known weight of it with a known weight of ammonium sulphate or ammonium chloride, in solution in water. He found that in every case more ammonia was obtained on distilling with ammonium sulphate than with ammonium chloride, and the explanation he offers is that "probably it is because the lime is largely present as silicates, and sulphuric acid decomposes silicates more effectively than hydrochloric acid. After boiling 1 grm. of slag with 1 grm. of ammonium sulphate for 5½ hours, he states that at the end of that period "ammonia was being slowly liberated in every case." This was also so with ammonium chloride. Up to that period he had assumed that lime was the only base present which liberated ammonia, but now he says "it is probable that this liberation is partly due to the action of other bases present in the slag—possibly to that of a little magnesia, and to that of ferrous and ferric iron. Whilst not disputing Hendrick's statements as to slag composition and possible reactions, it is plain to me that a certain proportion of the ammonia obtained in his experiments by 5½ hours' boiling with ammonium sulphate solution, filling up with water from time to time, was due to simple dissociation of ammonium sulphate, and the method as it stands is unreliable.

(D) The following experiments were tried, indicating the approximate degree of dissociation of the following ammonium salts in aqueous solution:—

(i) Ammonium phthalate, (ii) ammonium arseniate, and (iii) ammonium borate.

(i) It was found that 40 c.c. of normal ammonium phthalate solution (80 grms. to the litre) yielded 32·4 per cent. of its ammonia on distilling just to dryness; a further 18·4 per cent. (total 50·8 per cent.) on dissolving the residue in 40 c.c. of water, and again distilling to dryness; a still further 0·5 per cent. (total 51·3 per cent.) on repeating the process a third time.

(ii) A solution of 10 grms. of arsenic acid, neutralised with ammonia and made up to 100 c.c., contained ammonia equivalent to $(NH_4)_2HAsO_4$. and on distilling evolved 42·5 per cent. of its total ammonia. 50 c.c. of a solution, made by neutralising a 25 per cent. solution of arsenic acid with ammonia, yielded 0·64 grm. of ammonia on distilling off about one-third of its bulk, rising to 0·86 grm. on distilling nearly to dryness. This is equivalent to 21·4, rising to 28·7 per cent. respectively, of the total ammonia.

(iii) A saturated solution of boric acid was used for repeatedly absorbing ammonia, fresh boric acid being added each time when the solution became saturated with ammonia. (This is possible, because ammonium borate is more soluble than boric acid.)

With a saturated solution of ammonium borate (about 96·5 grms. of boric acid in 500 c.c.) it was found that about 59 per cent. of the total ammonia was evolved on simply boiling to dryness, rising to 67 per cent. by boiling to dryness and then steaming the residue for three-quarters of an hour.

(E) *Hydrolytic dissociation of solutions of ammonium salts in the beetroot sugar industry.* Andrlik has a very instructive article on the behaviour of ammonium salts of amino acids in hot aqueous and saccharine solutions (Chem. Zeit. 1902. 26. Rep. 274. This J. 1902, 1339—1340). He shows that when boiled, some sugar juices lose their alkalinity and become acid, not, as formerly supposed, because sugar is decomposed, but because the ammonium salts of the amino-acids suffer dissociation and lose their ammonia. Such acids, he says, are aspartic and glutamic acid, with tyrosine and leucine (amino-caproic acid),* in beet juices. He finds that both aqueous and saccharine solutions of the ammonium salts of the acids named lose ammonia on heating to boiling. The acid-reacting ammonium salts thus obtained cause the inversion of the saccharate in sugar juices, but if the evaporation be *in vacuo*, the inversion is but slight, although ammonia is expelled.

(F) After what I have said about the apparent accumulation of hydrochloric acid on distilling ammonium chloride solutions, whilst ammonia escapes (p. 253), the pertinent remarks of Lunge on evaporation of ammonium chloride solutions in iron pans, and the necessary precautions so as to prevent solution of iron as ferro-ammonium chloride, receive further accentuation. (See Lunge's Coaltar and Ammonia, Pt. II. p. 1113.)

DISCUSSION.

Dr. V. H. VELEY remarked that his experience in examining statements of text books, repeated for a long number of years, was quite in accordance with that of Mr. Watson Smith; evidently writers of such books had not the time, and possibly, in some cases, not even the skill required to confirm their own statements. It had become manifest that the hydrolysis of metallic salts, including those of ammonium, had not received sufficient attention, though this chemical change was of considerable technical importance.

Some time ago he had investigated the hydrolysis of ammonium salts both of inorganic and organic acids at the temperature of the boiling points of their solutions, or in other words the equilibrium constant $K = C_{acid} + C_{base}/C_{salt}$ (Journ. Chem. Soc. Trans. 1905, 26), and this work, at his suggestion, had been further amplified by Hill (*ibid.* 1906, 1273). With regard to the salts alluded to, it had been found that the hydrolysis of ammonium sulphate under the conditions studied was considerably greater than that of the chloride.

Mention had been made of Hendrick's method (this Journal, 1909, 775) for the determination of the free lime in basic slag, which consisted in outline, of distilling the samples with solutions of ammonium chloride or sulphate, collecting the ammonia evolved in $N/10$ acid, and calculating this ammonia in terms of lime. This writer had observed that (1) more ammonia was obtained by distilling with the sulphate than with the chloride, (2) on adding water and repeating the distillation process more ammonia was given off and even after five distillations lasting 5½ hours, ammonia could still be obtained and (3) the amount of ammonia found in this way, was equivalent to many times the amount of free lime as estimated by the sugar extraction process. But, if Hendrick had studied the distillation of aqueous solutions of ammonium chloride or sulphate *per se* without the basic slag he would have put on record observations (1) and (2), and as regards (3) he would have found an amount of ammonia greatly in excess of that which could have been obtained from the proportion of free lime (about 1 per cent.) present in basic slag.

It was greatly to be feared that in cases in which salts were inappreciably hydrolysed at ordinary temperatures, the effects and consequences of such hydrolysis at higher temperatures had been often completely overlooked. The results of Lundèn and himself had shown that the amount of such hydrolysis increased very rapidly with increase of temperature.

Dr. J. LEWKOWITSCH wished to recall the well-known fact that ammonium salts of organic acids were easily dissociated. Even from dilute solutions ammonia was given off on evaporating them on the water bath. This had a practical bearing on the frequently made attempt to prepare ammonia soaps. If neutral ammonium salts of palmitic, stearic, or oleic acid were placed in a desiccator over sulphuric acid they rapidly lost half of their ammonia at the ordinary temperature until an acid salt was formed. The further loss of ammonia then took place much more slowly. That showed the futility of trying to prepare ammonia soaps on a commercial scale.

Mr. G. H. HUNTLY said that Mr. Watson Smith's observations had a direct bearing on a method which had been more than once proposed for the determination of sulphuric acid in standard solutions, neutralisation with an excess of ammonia and drying to constant weight at some temperature over 100° C. Neutral ammonium sulphate was not obtained in this way, and the method was in consequence unreliable.

Mr. W. P. BLOXAM asked if any note had been made of the influence of the glass vessel; because a statement was made many years ago that sulphur boiled with pure water in a glass vessel formed sulphides, polysulphides, and a large number of compounds. He had repeated the experiment and he found he could get a coloured solution, but it was simply due to the action of the water in hydrolysing the glass itself and providing a soluble base on which the sulphur acted. If sufficiently hard glass were used, the dissociating action was reduced to a minimum; and in suitable metal vessels no action at all took place; or with carefully boiled water and the hardest glass procurable it was hardly noticeable. Was it not possible to imagine a considerable degree of action going on progressively on boiling aqueous solutions of these ammonium salts in flasks of soft glass alone with these salts? A man working in the Davy-Faraday Laboratory with chlorates found he got extraordinarily varying results, on the temperature of decomposition under the action of heat; they were quite wide of those stated for the compounds. But on his advice the glass envelope was replaced by a platinum capsule, and the results obtained were entirely different. The influence of the envelope therefore deserved attention. They were told that glass vessels if steamed for a short time were rendered immune from the further action of water; but he did not know whether that was accepted as an absolute fact, or whether the action was in reality going on progressively.

Dr. W. R. E. HODGKINSON said the effect of ammonium salts on glass had been noticed by a great many people. A solution of ammonium phosphate in an ordinary reagent bottle gave indications of free ammonia after a few days. Boiling an ammonium salt for some time in an ordinary common glass vessel had a decided effect on the glass. It was not hydrolysis alone; ammonia was displaced by the soda in the glass.

Dr. VELEY stated that Jena glass flasks were used in his work on the hydrolysis of ammonium salts, and blank experiments made to ascertain any possible source of error from the glass. With regard to the recommendation given in various books to steam out glass vessels before use, his experience had been that this process was worse than useless, as vessels, thus treated, were much more liable to be attacked by reagents. In the course of long experience in electric conductivity and indicator investigations, he had found that the best way of dealing with a glass vessel was to soak it for some hours, preferably over night, in the solution of the same concentration as that with which it was intended to make the final measurements on the next day. The glass thus became seasoned to the particular kind of solution, not only as regards the substances extracted from the glass, but also as regards the solution soaked in by the glass being identical with that, which might be subsequently soaked out.

Mr. WATSON SMITH said that glass had the effect mentioned, especially soft glass. The fact, however, remained that the hydrolytic dissociation referred to could be readily demonstrated in platinum vessels. In 1904 (this J., 1904, 476) he had shown how important a factor the alkalinity of glass was in the action of water on aluminium in glass vessels.

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* Probably p-hydroxyphenylaminopropionic acid.

A STUDY OF SOME REACTIONS IN GELS.

BY EMIL HATSCHEK.

Although diffusion in gels has been studied extensively by a large number of observers, including Pringsheim, Liesegang, Bechhold and Ziegler, and others, and although certain reactions leading to the formation of insoluble precipitates, such as silver chromate, silver chloride, etc., have been constantly used to make the progress of diffusion visible, no special attention appears to have been devoted to the forms in which these insoluble compounds were precipitated. As some experiments, undertaken for a different purpose and involving the precipitation of several insoluble calcium salts in gelatin, showed the formation of unusual aggregates differing very considerably from the precipitates obtained in corresponding aqueous solutions, a systematic investigation of a number of calcium, barium, lead, and silver compounds was undertaken.

The experiments were conducted in groups in the following manner :—A quantity of gelatin or agar solution containing a definite precentage of one of the following salts, viz., calcium chloride, barium chloride, lead nitrate, or silver nitrate, was prepared. The percentage of gelatin was varied in different series from 5 per cent. to 20 per cent., and that of agar from 1½ per cent. to 5 per cent. A number of test tubes were filled to about half their height with each batch of solution, and the latter was allowed to set. The tubes were then filled up with aqueous solutions of various salts or acids, capable of forming insoluble compounds with the salts contained in the gels, including in the appropriate instances, sodium carbonate, sodium sulphate, ammonium chloride, ammonium or potassium bichromate, potassium iodide, potassium ferrocyanide, hydrofluosilicic acid, and oxalic acid. Full particulars of all the various series of gels and of the reacting solutions are given in Table I.

The reaction begins at once at the surface of the gel and proceeds into the latter with a velocity depending on the ratio of the osmotic pressures and on the percentage of gelatin or agar, provided certain conditions are fulfilled. It has been shown by Pringsheim, that when two salt solutions diffuse into a gel in opposite directions, the reaction does not proceed beyond an often extremely thin film which forms at their first contact, if the two solutions are isotonic. If their osmotic pressures are different, the hypertonic solution continues to diffuse into the hypotonic one, and any precipitate formed by their reaction is deposited in the latter. The same condition, if allowance is made for the great difference between the velocities of diffusion in water and in gel, appears to hold good where one salt is dissolved in the gel and the other in water. In this case diffusion may, if the gel is hypertonic towards the aqueous solution, take place into the latter. An instance is recorded in Table I., when a 5 per cent. gelatin gel containing 2 per cent. crystallized barium chloride ($BaCl_2+2H_2O$) was covered with a 2½ per cent. solution of crystallized sodium sulphate ($Na_2SO_4+10H_2O$). The latter solution was therefore hypotonic, as the ratio of barium chloride : sodium sulphate would have to be 244·3 : 322, or about 2 : 2·64 in the case of isotonic solutions. The barium chloride accordingly diffused out of the gel into the sodium sulphate solution and in reacting with the same produced the well-known "myelin" forms. As this effect can be studied much more conveniently by other means, solutions of sufficient strength to diffuse into the gel were used in all other cases.

The first phenomenon to be noted as the precipitate forms in the gel is that it is not continuous, but forms strata separated by more or less clear spaces. The distance between the strata increases as the reaction proceeds into the gel, *i.e.*, as both solutions become more and more dilute. The formation of these strata has been explained by Wilhelm Ostwald on the assumption that layers of supersaturated "metastable" solution are formed (Ostwald, Allg. Chemie, (2. Ed.) II., 778, 780). The influence of the solubility of the precipitate in the soluble product of the reaction—*e.g.*, of ammonium nitrate on silver chromate in the reaction between silver nitrate and ammonium chromate—has been studied by H. Bechhold (Zeits. Physik. Chem., **52**, 185—199), who also draws attention to the extreme interest which these stratifications have for the anatomist and physiologist, as throwing light on the numerous stratified deposits of mineral matter occurring in organisms.

In the present investigation these stratifications received attention only in so far as an obvious connexion exists between them and the sizes and shapes of the particles of precipitate found in them at various depths. A few typical specimens are illustrated in Figs. 1—4. Figs. 1 and 2 show a 5 per cent. gelatin gel containing 5 per cent. of calcium chloride, into which 3 per cent. hydrofluosilicic acid had diffused, after 18 and 30 hours respectively. Fig. 3 shows three test tubes containing a 1 per cent. agar gel with 1½ per cent. calcium chloride, on which had been poured 20 per cent., 10 per cent. and 5 per cent. sodium carbonate solutions. These were photographed at the same time, *i.e.*, after the same length of contact, and illustrate the difference in the velocity of diffusion, as well as the fact that the distances of adjoining strata are the same in the different test tubes at those levels at which the diffusing solutions had presumably reached the same dilution. Fig. 4 shows a test tube containing a 5 per cent. gelatin gel with 2 per cent. crystallized barium chloride, after 21 days' contact with a 10 per cent. solution of sodium carbonate. The strata in this case are extremely numerous and well marked, and a duplicate of this specimem was chosen for a careful microscopic investigation at different depths.

Various methods can, of course, be adopted for such an examination. The cylinders of gel are melted out of the test tubes by dipping into hot water, or by rapid heating in a small flame, and dropped into cold water, to prevent further melting. In the case of gelatin the cylinders may be hardened in formaldehyde and sections can then be cut and mounted. This method is rather laborious while possessing only the one advantage, that the deposits are preserved *in situ*, and their distribution and possible orientation can be studied. It was used in the case of the gelatin gel with barium carbonate particles just mentioned. In all other cases small samples of the gelatin or agar were taken at different levels, placed on the slide and melted. Such preparations can be kept for a short time—sufficient to permit photographing—without any special precautions, or they can be preserved by ringing the cover glass with varnish and thus preventing the gel from drying out. Finally, short pieces of the gel cylinders can be melted and the precipitates allowed to settle ; they are then repeatedly washed with hot water, dried, and finally mounted in some medium suited to their refractive index. Preparations which decompose on boiling, such as silver bichromate, must of course be obtained from gelatin.

Two vertical sections taken through the gelatin gel shown in Fig. 4 approximately at the levels A and B are illustrated in Figs. 5 and 6, magnified 150 dias. Fig. 5 shows two strata and the clear space—a zone of dilution—between them. It will be seen that the strata consist almost excusively of single crystals, whereas in the space between them aggregates—partly sheaflike bundles and partly spherical aggregates—appear. Fig. 5, which shows the section at B, where the dilution had become much greater, includes the edge of a stratum and the clear space below it, and the same arrangement may again be noticed, with the addition that the crystals and especially the aggregates in the clear zone have become very much larger. Fig. 6 finally shows the shape assumed by the precipitate at the bottom of the gel, below the last well-defined stratum, magnified 100 dias. only. The size of these aggregates is very remarkable compared with the size of the particles of barium carbonate precipitated from aqueous solutions of the same strengths.

It may be mentioned at once that this tendency of the precipitates to form large and frequently perfectly spherical aggregates recurs with notable persistence throughout the whole series of experiments. Practically every precipitate produced could be obtained as spherolites by

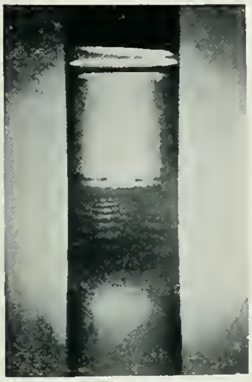


FIG. 1.

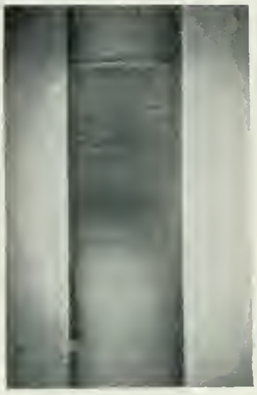


FIG. 2.

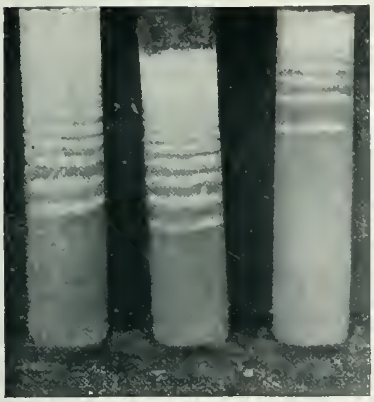


FIG. 3.

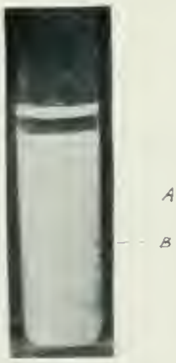


FIG. 4.

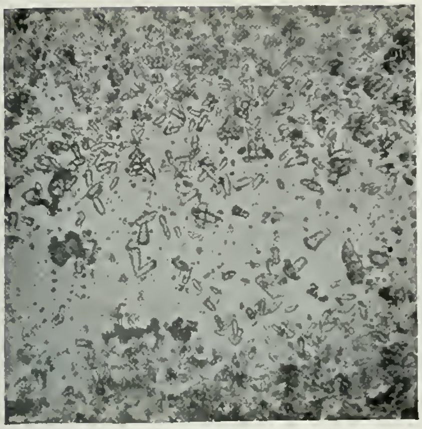


FIG. 5.

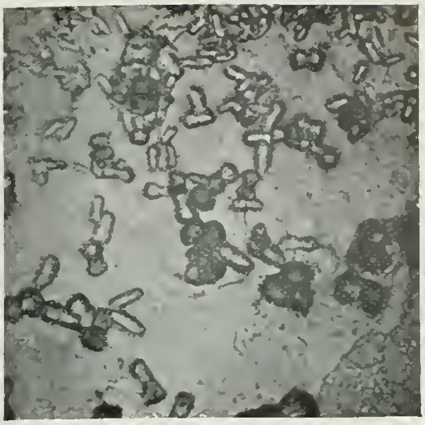


FIG. 6.

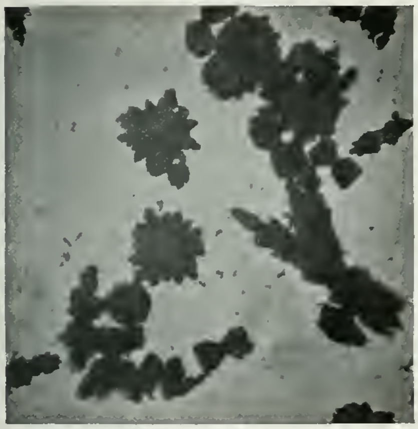


FIG. 7.

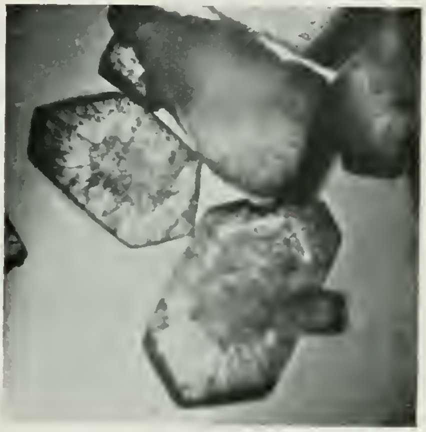


FIG. 8.

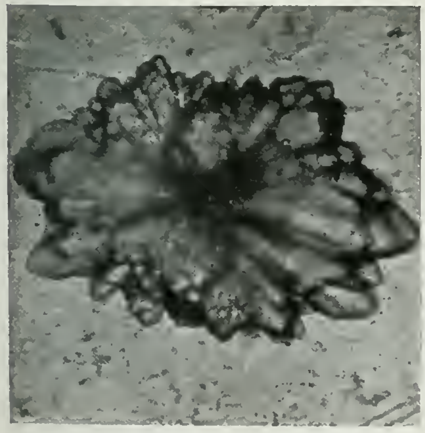


FIG. 9.

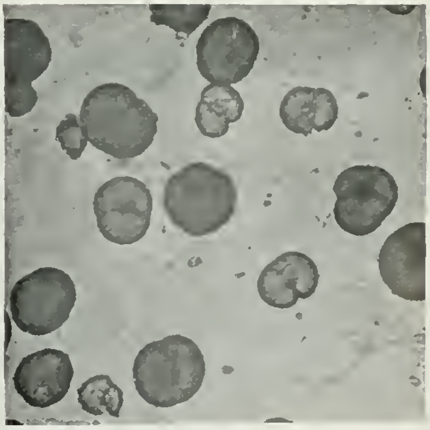


FIG. 10.

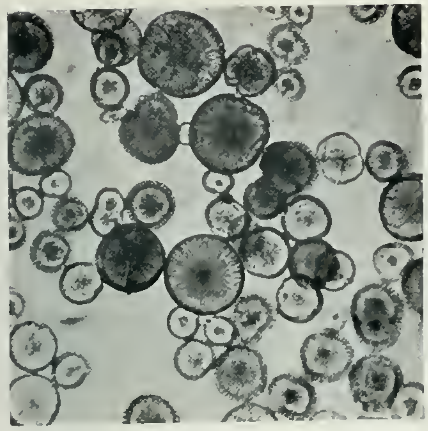


FIG. 11.

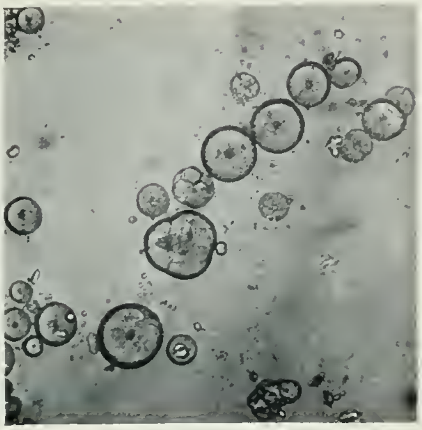


FIG. 12.

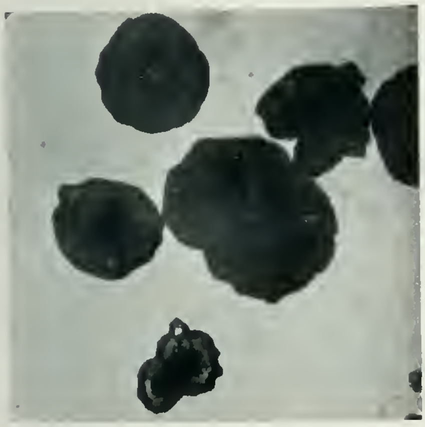


FIG. 13.

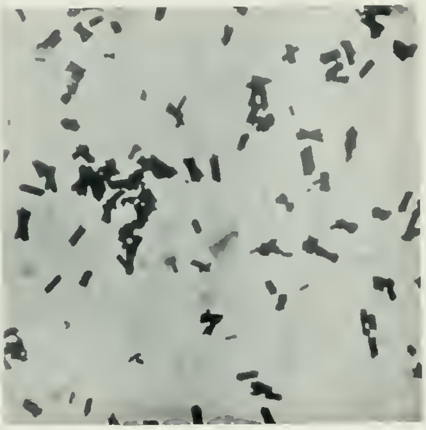


FIG. 14.

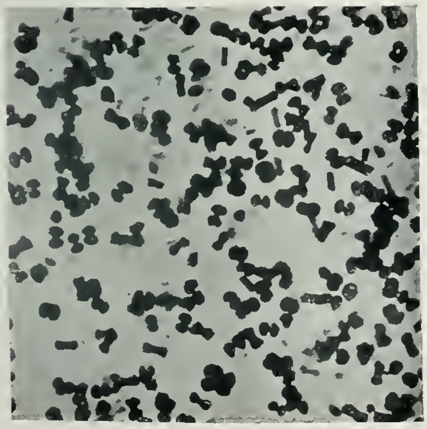


FIG. 15.

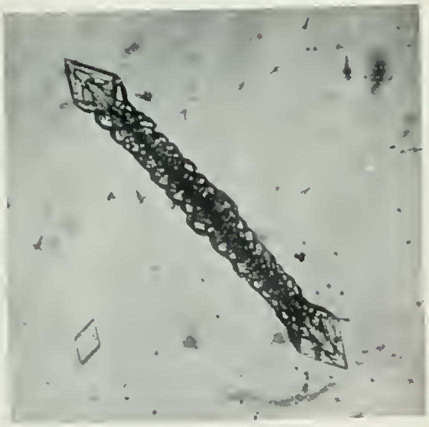


FIG. 16.

choosing suitable concentrations, the strength of the gel itself, *i.e.*, the percentage of gelatin or agar, being evidently the most important factor. The concentration of the salts only affects the level at which these aggregates appear, *i.e.*, a longer or shorter time may elapse before the necessary dilution has been established. Even macroscopic spheres of many precipitates may easily be obtained, and these are particularly striking in the case of the lead compounds, which are precipitated from aqueous solutions in an extremely minute form. Such macroscopic aggregates of lead sulphate, lead chloride, and lead iodide were formed in practically all agar gels; as well as of calcium sulphate, barium oxalate, and of silver bichromate. Spherolites of smaller size, but of extremely perfect shape and high transparence, were obtained by precipitating barium silicofluoride in agar. It is not only the large size of individual crystals or aggregates—which might reasonably have been anticipated from the slowness with which the reaction proceeds—but the practically universal tendency to form spherical bodies which forms the most striking feature brought out by these experiments.

The forms and sizes in which a number of precipitates were obtained are shown in Table II, the concentration of the gel being stated in each instance, as this is undoubtedly the factor which determines both form and size. This has already been pointed out, as well as the fact that the percentage of electrolyte in gel and solution respectively only affects the point at which large aggregates begin to make their appearance. As has been shown in the case of barium carbonate, it is possible, by choosing suitable concentrations, to obtain first simple crystals, and then aggregates approaching more and more nearly a spherical shape.

A number of precipitates are illustrated in Figs. 8—16 which clearly bear out these views. Fig. 8 shows very perfect crystals of calcium sulphate ($CaSO_4+2H_2O$) × 150 dias., from the top layer of a 5 per cent. gelatin gel. The aggregate shown in Fig. 9 × 75 dias.,—by no means one of the largest—is calcium sulphate from a 3 per cent. agar gel. The same compound was finally obtained in almost perfect spherolites in a 10 per cent. gelatin gel, which are shown in Fig. 10, magnified 75 dias. (Still larger aggregates were obtained in 2½ per cent. and 4 per cent. agar gels, some of the latter reaching a diameter of 3 mm.) Figs. 11 and 12 show remarkably perfect spherolites, the former of barium oxalate and the latter of barium silicofluoride, both magnified 75 dias. The last named are perfectly transparent and form a magnificent object for examination in polarized light. (It may be well to mention here that all the other spherical aggregates, while more or less opaque, are still sufficiently translucent to permit examination in polarized light; this has been used in all cases to make certain that they really possess crystalline structure).

Fig. 13 shows lead sulphate with a magnification of 40 dias. only, and the aggregates chosen were particularly small ones, so as to get a number of them within the limits of the illustration. Many of them attain a diameter of one mm. and over. How enormous this size is need hardly be pointed out to anyone familiar with the microscopic appearance of lead compounds precipitated from aqueous solutions. Figs. 14 and 15 illustrate lead bichromate, and at the same time the occurence of both well defined crystals and of more or less spherical aggregates in the same gel, the former having been obtained from the top, and the latter from the bottom layer of a 3 per cent. agar gel.

The only compound which never showed any signs of spherical aggregation in any gel was lead ferrocyanide. The form in which it was obtained in a 3 per cent. agar gel is however even more remarkable, and is shown in Fig. 16, × 75 dias. These rodlike masses of rhombohedra were found throughout the gel, always with two large and very perfect rhombohedra at the extremities, and generally with one or two large ones in exact centre. It would be a matter of some interest to investigate the growth of these aggregates, as it is very difficult to form any conjecture how it proceeds.

The lead ferrocyanide just described forms the only exception encountered in the course of the investigation, and a number of further compounds examined, but not illustrated, all conform to the general rule. Thus lead chloride was deposited in large—macroscopic—masses with smooth rounded surfaces; lead carbonate in small (0·01-0·03 mm.) but very perfect spherolites; calcium carbonate in granules of about the same size, showing faces of two or more rhombohedra; silver bichromate in metallic-looking globules up to 0.7 mm. diameter.

The conditions in these experiments may obviously be varied to an almost indefinite extent, and the series described only covers a very small part of the field of investigation. As far as it goes, it undoubtedly throws light on the formation of concretions of mineral matter in organisms, in which reactions practically always take place in colloidal media, if not actually in gels. They may perhaps also explain to some extent the occurence of large crystals and aggregates of many minerals which are very insoluble and yet can hardly be of igneous origin.

Table I.

A. Gel: 5% Gelatin, 5% calcium chloride.
Solutions: 3% hydrofluosilicic acid, 10% sodium sulphate, 10% sodium carbonate.
B. Gel: 10% Gelatin, 5% calcium chloride.
,, 20% sodium sulphate, 20% sodium carbonate.
C. Gel: 1½% Agar, 1½% calcium chloride.
,, Sodium carbonate, viz., 20%, 10%, 5%.

D. Gel: 5% Gelatin, 2% barium chloride.
,, 2½% sodium carbonate, 10% sodium carbonate, 5% hydrofluosilicic acid.
E. Gel: 3% Agar, 2% barium chloride.
,, 2½% hydrofluosilicic acid, Conc. potassium hydrogen oxalate, 10% sodium carbonate.

F. Gel: 1% Agar, 2% lead nitrate.
,, 20% sodium sulphate, 10% sodium sulphate, 5% potassium ferrocyanide.
G. Gel: 1½% Agar, 2% lead nitrate.
,, 5% sodium carbonate, 5% ammonium bichromate, 5% ammonium chloride.
G. Continued.
,, 5% sodium sulphate, 5% potassium ferrocyanide.
H. Gel: 2% Agar, 4% lead nitrate.
Solutions the same as those used under G.
I. Gel: 5% Agar, 5% lead nitrate.
,, 5% potassium iodide, 5% ammonium bichromate.
J. Gel: 10% Gelatin, 5% lead nitrate.
,, 5% potassium iodide.

K. Gel: 10% Gelatin, 2% silver nitrate.
,, 5% ammonium bichromate, 5% potassium iodide.

Table II.

FORMS AND SIZES OF PRECIPITATES IN DIFFERENT GELS.

A. *Calcium sulphate.*—5% gelatin, crystals of gypsum up to 0·2 mm. long. 3% Agar, large radiating aggregates up to 1 mm. 10% Gelatin, spherolites up to 0·1 mm. 2½% Agar, crystals and twins up to 2 mm. 4% and 5% Agar, spherical masses up to 3 mm. dia.

B. *Calcium carbonate.*—10% Gelatin, spherolitic aggregates showing rhombohedron faces, about 0·03 mm.

C. *Barium carbonate.*—5% Gelatin, small crystals in top layer, spherical aggregates up to 0·1 mm. in bottom layer.

D. *Barium silicofluoride.*—5% Gelatin, large acicular crystals, 3% Agar, very perfect spherolites up to 0·08 mm. dia.

E. *Barium oxalate.*—3% Agar, very perfect spherolites up to 0·12 mm. dia.

F. *Lead sulphate.*—Macroscopic spherical aggregates up to 1 mm. dia. in all agar gels.

G. *Lead chloride.*—Macroscopic aggregates up to 2 mm. in all agar gels.

H. *Lead bichromate.*—1½% and 2% agar gels, very perfect crystals up to 0·05 mm. in top layer, spherical and hour glass aggregates up to 10·03 mm. in bottom layer.

1. *Silver bichromate.*—10% Gelatin, spherolites up to 0·5 mm. dia.

Discussion.

Mr. G. T. **Holloway** expressed his gratification at hearing the paper, as he was himself working on the question of the connection between colloidal chemistry and geology, mineralogy and metallurgy. On that subject Mr. Hatschek's work had an important bearing particularly as regards the origin of agates and other banded concretions or aggregates. The production of barium sulphate through gels was particularly interesting. Those who had carefully examined the extraordinary masses of barium sulphate found at Frizington and elsewhere, would realise that their occurrence could be better explained as produced through the agency of gels that by any other theory. The stalactitic theory was inapplicable, because, although nature might have had time to produce huge stalactites of even so insoluble a substance as barium sulphate, most of the barium sulphate masses which he had seen, possessed peculiarities quite different from those of stalactites. Their production by the gradual meeting of two solutions through the medium of a gel, would explain away many difficulties with which no other theory seemed able to cope.

It was interesting to notice how strongly the pictures cast upon the screen, of the microscopic crystals or aggregates and concretions and of the banded arrangement of the precipitate formed in the gels, resembled the mineral forms which occurred in nature. The twins of calcium sulphate reminded him of the twins of selenite so commonly found in media such as clays which would permit slow infiltration of salts while not interfering with the free formation of the crystals. The markings of agates and the fact that true agates are amorphous forms of silica which forms a gel as easy to work with as those employed by the author of the paper, was especially important in connection with the banded structure shown in the slides. He was himself engaged on some experiments in which gelatinous silicic acid formed the gel.

A NEW STILL WATER CALORIMETER.

BY J. H. COSTE AND B. R. JAMES.

Still water calorimeters, in addition to possessing the advantages of portability and simplicity, can be used with very small quantities of gas, and if the construction is suitable a rational correction can be made for errors due to radiation. The calorimeter described has been designed by one of us (J. H. Coste) with a view to obtaining an instrument of high efficiency in which errors incident to instruments of this class designed for technical purposes should be very greatly reduced in amount and the corrections simplified as far as possible.

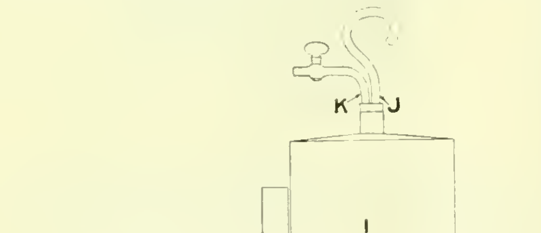


FIG. 1.

The instrument consists of (1) the gas-holder and measure; (2) the calorimeter and burner. These are shown in section in Figures 1 and 2.

The gas-holder, Fig. 1, is constructed on Mariotte's principle. It consists of a glass bottle, *a*, of about 2 litres capacity with a tubulure at the bottom. The neck at the top of the bottle is fitted with a rubber stopper through which pass a water delivery tube, *b*, and a gas delivery tube, *c*, which is preferably branched in T form with a stop-cock on each of the limbs, *d*, and *e*; *d* communicates with the gas supply to be tested and *e* with the calorimeter. A metal rod, *g*, pointed at the end, passes through the stopper to such a depth that the capacity of the portion of the bottle from the level of the point, *g*, up to the bottom of *c* is exactly $\frac{1}{20}$ of a cubic foot. This is the amount of gas which is burnt during an experiment. The water tube, *b*, and the tube at the side neck, *h*, are both connected to a tubulure at the bottom of the water reservoir, *i*. Clips or stop-cocks are arranged so that either *h* or *b* can be cut off from communication with *i*. A tube, *j*, passes nearly to the bottom of *i* and a side tube, *k*, with a stop-cock also passes through the cork, which closes the neck of *i*. The volume of this latter vessel is rather greater than that of *a*. It is filled with water, and placed on a suitable stand and the communication with *h* opened, that with *b* being closed after enough water has flowed through *b* to remove all air from it. If *e* is opened water flows in, displacing the air, until it reaches the level of *c* or if left to itself to the level of *j* in the upright part of *c*. The bottle *a* can now be filled with gas by closing *e* and opening *d* and lowering *i* to below the level of *a*, the tap, *k*, being opened, if it is not already open. When *a* is nearly full *d*, *h* and *k* are closed and *i* is placed on the shelf. When the experiment is actually to be started *l* is opened, *e* is also opened, *i* is raised momentarily, if necessary, to start the flow of water, and gas now flows from *e* through the burner at an absolutely constant rate: it should be lighted at once. A line which gives warning when the operator should be ready to transfer the burner under the calorimeter, passes round *a* below the point *g*. In order that the contact of *g* with the surface of the water may be more easily observed and any loss of time in transference may be minimised, a simple bye-pass is inserted in the rubber tube connecting *b* with the water reservoir, *i*. This device consists of two pieces of brass tube connected by a piece of rubber tubing and also by a very narrow brass tube. When the rubber tube is pinched

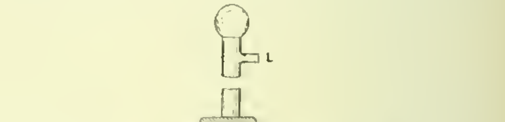


FIG. 2.

by the finger and thumb water can only pass through the small metal tube. This should be done when the line is reached and the burner be swung under the calorimeter just as contact is made by the water with *g*, the finger and thumb being then removed.

The calorimeter, Fig. 2 (showing left half section and right half view of interior) is constructed as far as possible on the sound principles adopted by Berthelot and his followers for minimising uncomputable errors and rendering possible the correction of those which cannot be avoided.

An annular copper vessel (*a*, *a*) holding 7—8 litres surrounds the calorimeter, from which it is separated by an air space of about ¾in. This vessel is polished on the outside and enamelled white inside. It contains water which should, if possible, be of the same temperature as that in the calorimeter. This may be effected either by filling both at the same time or by keeping a supply of water for the calorimeter near the instrument. The conditions of the laboratory will determine this matter for individual workers. The calorimeter and its surroundings are thus prevented from differing seriously from each other in temperature—a very important point—and the effect of the less immediate surroundings is greatly reduced, whilst a small but regular radiation is allowed during the progress of an experiment. This device is altogether preferable to the older method of "lagging" with non-conducting materials.

The calorimeter vessel (*b*, *b*) is constructed of copper and is cylindrical in form, its length being about 1·7 times its diameter. The exterior is nickel plated and highly polished. It is supported within its jacket by small wooden blocks. A central cylindrical chimney c, of stout corrugated copper tubing, rises from the bottom and serves as a combustion chamber. It opens into a flat oval copper box, *d*, *d*, from the ends of which depend two very much flattened corrugated copper tubes *e*, *e*. These tubes and the central chimney are open at the bottom of the calorimeter vessel and with the box form the path through the calorimeter of the gases resulting from combustion. A wooden ring protects the combustion chamber from inleak of the products of combustion, which finally escape through holes in the bottom of the water vessel. Suitable deflectors separate the products from the air passing in to support combustion.

The central chimney passes into the oval cooling chamber, which is pierced on either side by a long narrow water channel *f* separating the side or exit chimneys from the above-mentioned central one. Strips of copper, *g*, *g* depending from the top of the cooling chamber divide the ascending current of air, the branches of which are forced against the metal sides of the chamber and round the water channels to the exit tubes. On the top projecting into the water in the calorimeter are ribs of perforated copper *h*, *h*, which promote a rapid transfer of heat from this place, where the heated gases first strike the metal, to the cooling water.

The calorimeter vessel holds about 2·1 litres of water, the exact amount of which is fixed for an experiment by the coincidence of its surface with a "nickel silver" point *i*, depending from a teak bridge *j*, which rides on the edges of the vessel and, incidentally, carries on one side the thermometer and on the other the bearing for the stirrer, it also fixes the vessel in its place and forms a handle for the whole apparatus. The pointer is central in position and is, therefore, independent of any levelling arrangement.

A double horse-shoe stirrer, *k*, *k*, as large as will pass under the oval box, is used, the two portions of which are separated by a vertical interval of about 2in. and are provided with arrangements for dividing the water into many small currents passing in different directions. The stem *l*, shown behind the pointer *i*, is tubular so as to serve as one limb of a syphon for emptying the water after an experiment. This stem passes through a lignum vitæ bearing in the teak cross bar and is fitted with a wooden handle.

The thermometer must be a good one, as the rise of temperature is purposely restricted to about 3° C. for gas of 140 calories gross calorific power. It should be divided on a fairly open scale to $\frac{1}{10}$ of a degree. It does not appear to us that any advantage is served by a finer division, since $\frac{1}{100}$° can be estimated with accuracy on such an instrument. The range should be from say 0° to 25°. It is seldom that the lower temperature will be approached as it is best that a temperature of about 15° should be aimed at, but the 0° point is useful in verifying the value of the degree. It is important that when the bulb is immersed to a reasonable extent the lowest probable reading should be visible above the wooden bridge. We prefer thermometers constructed on the English or French principle and graduated on the stem, but very excellent instruments are made of the German "enclosed" pattern.

A reading glass or lunette should be used to magnify the divisions and to avoid errors of parallax. We have found that used for Boys' calorimeter suitable for the purpose.

The burner is of porcelain and trumpet shaped. This form favours both the upward reflection of heat and the close passage of cold air currents along its surface. Its low conductivity as compared with metal adds to its suitability. It is fitted on a swinging arm by which it can quickly be swung under the calorimeter into its position in the combustion chamber. The point of ignition is about ½ in. above the bottom of the chamber so that the flame is entirely within it.

Gas can be burnt at the rate found suitable, *i.e.*, about ¾ cubic foot per hour at a working pressure of ⅛ in., the head of water being about 2 in. (*j* to *g*, Fig. 1).

The method of using the holder has been described. A determination is made by filling the calorimeter vessel to the point with water after the thermometer has been put in position, and then stirring continuously, reading the thermometer at intervals of one minute. If the temperature changes, the readings should be noted for 5 minutes (the "initial period" of the Regnault Pfaundler formula. See Huntly, this Journal, 1910, 918).

A very brief cessation of stirring will allow time to light the gas. Stirring is continued and only interrupted for the transfer of the burner to the combustion chamber. Directly this has been effected as described above, the temperature will rise steadily and the rise for each interval can be noted if desired. When the gas is cut off a slow rise will continue. A period of constant temperature follows and is succeeded by one of falling temperature. This marks the point at which the "principal period" may end and a steady fall occurs during the "final period." The method of correcting the observed rise of temperature is given by Huntly (*loc. cit.*).

If the water equivalent calculated from the known weights and specific heats of the parts of the calorimeter be used, the above correction must be made to obtain the best results, but the case for correction can be very much simplified as shown later.

The cooling system affords a very large surface of highly conducting metal and consists, it will be seen, to all intents and purposes of two substances only, namely, copper, the specific heat of which is 0·094 and water, the specific heat of which is (approximately) 1·00. The thermal equivalent of the metal is 4 per cent. of the total: that of the thermometer is less than 0·1 per cent. The only substances touching the cooling system or the base have all a conductivity in absolute units of $0{\cdot}0_33$ or less. The burner has a conductivity of about $0{\cdot}0_22$. The flame, which burns very steadily at the rate adopted, is prevented from any chance of touching the sides of the combustion chamber or chimney by a detachable metal truncated cone fitting in the chimney. It can be observed by means of a mirror during an experiment.

Examination of errors due to various sources. In the instrument above described the unavoidable errors are of small magnitude. Some are negligible and others are amenable to rational correction. We give the results of our investigation of them and an indication of the relation of the results obtained by this calorimeter and other well-known instruments.

The holder.—(i) *The capacity of the holder* can be fixed by either weighing or measuring; $\frac{1}{20}$ cubic foot equals 1416 c.c. or 49¾ ounces. The contact of the water with the pointer is very sharp and the error with a holder of the same capacity but a much greater area of cms. section than that shown was found to be equal to ± ·09 per cent.

of the volume of gas for one experiment. Six deliveries were made through a $\frac{1}{20}$ cubic foot meter kindly lent by Messrs. W. Sugg and Co.

(ii) The magnitude of the sum of *errors due to imperfect observation of the contact and to slowness of transfer* is very small when the bye-pass is used. This reduces the rate of flow by one half. If the burner is *in situ* 2 seconds after the actual time of contact the error is only 0·2 per cent. We find 1 second to be less than the average time of transfer. The error due to this cause is therefore of the order of 0·1 per cent. The reduction of the capacity of the holder due to the flow of water down the side is very small when the bye-pass is used. It is certainly less than 0·2 per cent.

The gas referees allow a meter to be 0·33 per cent. in error and it is doubtful whether greater accuracy can be obtained.

(iii) An error, the amount of which has been estimated as a residual error after all others are corrected, of from 1·2 to 1·7 per cent. is due to *the absorption of constituents of the gas by the water used in the holder.* This error could be removed without giving up the advantages of the Marrotte principle, but, for technical purposes it is better to allow its amount, which is sufficiently well defined, to be included with other errors in an empirically determined water equivalent.

The calorimeter. (i) *Adjustment of the heat value of the system in successive experiments.* The greatest divergence between the weights of water in twelve experiments at a fixed temperature was 2·3 grms., thegreatest divergence from the mean being 1·5 grms.. The mean error of one experiment was 0·8 grm., or less than 0·04 per cent. of the water value of the whole system.

The approximate magnitude of the sum of the errors due to the coefficients of expansion of copper and of water and the variation in the specific heat of water is shown below :—

Temperature	5°.	10°.	15°,	20°,	25°,	30°.
Per cent. error	—·4(3)	—·21	0·00	+·13	+·4(0)	+·4(3)

when the capacity in grms. is determined at 15°.

The uncertainty of these values, owing to the discrepancies in the figures of different workers for the specific heat of water is, except for temperatures very close to 15°, of about the same order of magnitude as the mean error of filling. The adjustment of the amount of water is therefore sufficiently accurate, if the above table is used, for all purposes and without it for any technical purpose.

(ii) *Imperfect mixing of the water.* The ratio of the increments of time and of heat added to the system $\frac{dh}{dt}$ is constant, and therefore the ratio of those of time and temperature, $\frac{d\theta}{dt}$, should also be a constant. This is found to be the case, the curve representing the ratio being a straight line.

Mercurial thermometers placed (1) just below the surface of the water; (2) on the bottom; (3) over the cooling box; (4) between the central and side chimneys, registered the same temperature within a few hundredths of a degree when the stirrer was used. The amount of this error is negligible.

(iii) *The water equivalent.* This was determined for the purpose of examining the instrument by weighing the metal portion of the calorimeter, which is practically all copper with a very little brass and a mere film of nickel and soldered joints. The assumption that it is all copper cannot involve errors of a magnitude worth considering. The value 0·094 was taken for the specific heat of copper.

The calorimeter weighed 898·9 grms.; its water value would therefore be 84·5 grms. The total value of the system is 2·15 kilos. The metal therefore only accounted for 4 per cent. of the whole, and an error of 5 per cent. in its value would only affect the total value to the extent of 0·2 per cent.

(iv) *Radiation, evaporation, conduction and friction of the stirrer.* The losses due to the three former causes can be computed for the principal period of an experiment from the temperature changes occurring during the initial (or preliminary) and final (or cooling) periods. The gain due to the last cause is common to all three periods of the experiment and its effect is therefore eliminated.

The correction for these errors is much simplified by the fact that, as in Julius Thomsen's calorimeter, the increments of temperature and time have a constant ratio during an experiment and also by reason of the fixed duration of the combustion. The heating curve, therefore, assumes in any experiment the form of a right angled triangle on a base of fixed length, adjoining a rectangle (representing the period of slow exchange preceding the cooling period) also on a fixed base and of the same height as the triangle. The area of the figure, which represents the integral of the increments of temperature, is therefore proportional to its height; that is to the rise of temperature. This is the amount to which the correction due to these errors is to be applied. If the correction for a final rise of 1° is calculated then *for all experiments in which the temperature during the initial period is constant* or, say, for all experiments in which the water does not increase more than ·01° during 5 minutes preceding the experiment, the correction becomes simply a factor which can be applied indifferently to either the rise of temperature or the water value; it is more convenient to apply it once for all to the latter by multiplying that calculated by 1 + a where a = the losses occurring under the above conditions for a rise of 1° (a = 0·01 or less).

(v) *Imperfect cooling of the escaping gases.* These obviously cannot at any time be at a temperature below that of the cooling water and may be above it. That their temperature is approximately that of the water the following experiments show: (1) No dew is observed to form on the bright bottom of the calorimeter vessel during an experiment. (2) Readings of a mercurial thermometer with small bulb placed at the gas exit were—within 0·1° or 0·2°—the same as those of the thermometer in the water. (3) Their final temperature, observed after several minutes burning was identical with that observed by plunging the same thermometer in the water at the close of the experiment. (4) Measurements of the difference of potential between the junctions of a copper-constantan couple placed in the water and in the gas exit showed that for heat changes higher than those likely to occur in practice, *i.e.* 1¼° rise per minute, the average temperature of the exit gases was from 0·1° to 0·4° higher than that of the calorimeter. (We take this opportunity of thanking Prof. Silvanus Thompson and Mr. C. R. Darling for enabling us to make these measurements).

The mean temperature of the exit gases may therefore be taken as being the mean temperature of the water in the calorimeter during the combustion, *i.e.* ½ (*initial + final temperatures*) and no appreciable error is due to this cause.

(vi) *Losses of heat in the exit gases* can be estimated, since their temperature has been defined, by ascertaining the ratio of air and exit gases to the amount of gas burnt during an experiment. The following analyses show that for gas of the quality supplied in the Metropolis the volume of exit gases is about 10 times that of the gas burnt and that 10·7 volumes of air pass into the instrument for one volume of gas.

	I.	II.	III.
CO_2	5·7	5·4	5·4
O_2	9·8	11·0	12·7
N_2	84·5	83·6	81·9
Unburnt products	—	—	—
	100·0	100·0	100·0

The heat capacity of the products of combustion of one cubic foot of gas is 0·1 calorie per degree or rather less than twice this for the average rise of temperature observed. The heat lost as latent heat in the water vapour accompanying them will vary according to the degree of saturation of the entering and the actual temperature of the issuing gases. For very accurate work the correction can be made as indicated by one of us (this Journal, 1909, p. 1233). For air ⅔ saturated, which is about the average in this country, the amount of the correction will vary from about 0·6 at 10° to 1·2 at 23°. It is difficult to imagine any other source of serious error besides the above; in fact, we find that results, fully corrected for all directly computable errors except the specific heat of water, etc. (b) (i) differ by a very constant average of 2 per cent.

from those obtained on the same gas with Boys' calorimeter working in the most accurate manner (see this Journal, 1911, p. 67) and with Berthelot's bomb. Part of this error is due to the alteration of the specific heat of water and the remainder, as we have indicated, to the solubility of some of the constituents of gas in water. As this error is very constant, it is most convenient to allow for it with that due to radiation, etc. by using an empirically determined water equivalent, and to reduce calculation to a simple multiplication of the rise of temperature by a constant value.

The instrument has been made by Messrs. W. Sugg and Co., Ltd., who have assisted us materially in perfecting it.

DISCUSSION.

Mr. G. N. HUNTLY said that an instrument of this class would enable small samples to be taken rapidly during the whole period of the make of gas; would enable samples to be taken all over a district for examination at leisure. The instrument, had this advantage over practically every other, that if it could not be carried about the samples could be carried to it. Not many instruments of this type had been described; the only one he had seen was the Hempel, and that he had tried, but did not find very satisfactory. The chief difficulty in that was the very small water equivalent, and the use of a glass containing vessel, and glass was very unsatisfactory for that purpose. As far as could be gathered from the condensed description given, this instrument seemed to have successfully and practically avoided all the troubles of the Hempel calorimeter.

Dr. R. LESSING said that an instrument to which different samples of gas could be brought, and which was independent of the locality of the gas supply, was of great importance. One advantage was the small quantity of gas required—about one-twelfth of a cubic foot in all. In an instrument which he was testing just now, namely, a gas calorimeter devised by Prof. Strache, only 30 c.c. of gas were required, and in this even the use of a thermometer was dispensed with, the temperature being measured by the amount of expansion of air in a tube surrounding the explosion vessel. Some of all the errors mentioned by Mr. Coste appeared to him to be very small, and they could not seriously interfere with the accuracy of the result. The absorption of gas by the sealing water which seemed to be regarded as rather serious might be avoided by using salt or glycerin solution or mercury as sealing liquid.

THE AUTHORS wrote that although the error due to the use of the water seal was of greater magnitude than the other errors, they did not regard it as very serious, as it appeared to be constant. For a technical apparatus they did not consider mercury a suitable confining liquid, although for the very highest class of work (*e.g.*, determination of heats of combustion of pure gases) it should be used. They had used a simple device for getting rid of the error, namely, attaching the tube reaching to the bottom of *i* in Fig. 2 to the gas supply and allowing gas to flow freely into it, the excess being burnt from a side tube. By this means air never came into contact with the sealing water which became saturated with gas. They felt, however, that for most purposes the slight complication thereby introduced was unnecessary. The use of much glycerin would affect the vapour pressure of the water.

Manchester Section.

Meeting held at Manchester, on Friday, January 6th, 1911.

MR. R. H. CLAYTON IN THE CHAIR.

DEPOSITS RESULTING FROM THE LUBRICATION OF ENGINES.

BY JAS. ED. SOUTHCOMBE, M.SC.

It is well known to all engineers that during the working of an engine it frequently happens that appreciable quantities of foreign matter, or, as it is called, "deposit," is formed, which collects in the cylinders, valves, and lubricating pipes. The occurrence of these deposits is not confined to any individual class or type of prime mover, but, whether we are dealing with steam, gas, or petrol in either reciprocating engine or turbine, the same kind of trouble is experienced.

Since these deposits almost invariably contain oil it has usually been assumed that they are solely due to the decomposition of the lubricant, and, although this is in large measure true, the cause of the decomposition is due to a variety of chemical conditions occurring in the engine.

The writer proposes to discuss, first, the conditions of chemical activity in various types of prime movers, and then the influence of these conditions on petroleum oils.

In the steam cylinder one of the most important chemical conditions is the hydrolytic action of the steam on the glycerides of fatty or compounded oils.

The corrosive action of the liberated acids has long been known, and in the case of engines using superheated steam it became so troublesome that engineers hailed with delight the appearance on the market of unsaponifiable cylinder oils. It was soon found, however, with these oils that, although the corrosive action of free acids was no longer a cause of annoyance, yet deposits were still found in cylinders. Worrall and Southcombe showed (this J., 1908, **27**, 308) that the deposits formed in superheated steam cylinders using mineral oils consist of particles of magnetic oxide of iron bound together by an asphaltic substance.

Such deposits had the average composition Fe_3O_4, 86·0 per cent.; organic matter, 14·0 per cent. The organic matter has since been shown by the writer to consist of a mixture of solid bitumens containing apparently no free carbon, but consisting of highly polymerised hydrocarbons containing from 90 to 94 per cent. of carbon and 6 to 9 per cent. of hydrogen.

The authors concluded that the deposit is to be ascribed to oxide of iron formed by the action of the steam on the heated tubes of the superheater being carried forward by the steam and bound together in a coherent mass by the high boiling fractions of the oil. This view has recently been confirmed by S. Peck (Zeits. f. Dampfkessel u. Masch., **31**, 51).

In the crank case of an enclosed type forced-feed lubrication engine there are present, at a temperature of from 120° F. to 180° F., considerable quantities of steam, air, and water which are churned up vigorously with oil in the presence of metallic particles—in short, conditions favouring oxidation. It is well known that certain of the hydrocarbons present in mineral oils can take up oxygen under these conditions, forming resinous and acid bodies.

Considerable quantities of brownish black powder have to the writer's knowledge been formed in the lubricating pipes of forced feed engines using hydrocarbon oils. A typical analysis of such a deposit is the following:—

Unchanged oil (soluble in petrol), 54·0; bituminous matter (soluble in ether), 22·2; bituminous matter (insoluble in ether, soluble in carbon bisulphide), 11·5; organic acids, 4·1; ash 3·8; water and undetermined (by diff.), 4·4 per cent. The ash consists of oxide of copper, 32·0 per cent; oxides of iron, 55·0 per cent.; silica, lime, etc. (by diff.), 13·0 per cent. The acids appear to be combined with the copper and ferrous iron, whilst a small portion is in the free state.

Since it was clear that the acids were formed by the oxidation of the hydrocarbons, experiments were made to see if this reaction could be brought about and quantitatively studied in the laboratory. Hence 100 c.c. of neutral unsaponifiable crank chamber oils from various sources was introduced into the flask, A (Fig. 1), together with 10 grms. of finely divided iron and copper. The flask was maintained at constant temperatures by the oil bath, while air saturated with aqueous vapour by bubbling through water was aspirated through the whole apparatus by the pump.

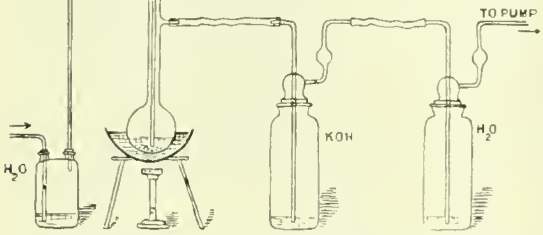
Two Drechsel bottles were placed between the oil flask and the pump, containing caustic potash and water respectively, to retain any volatile acid matter which might be formed.

The oil in the flask was maintained at a mean temperature of 120° C., and the current of air passed for varying periods from 80 to 120 hours. At the conclusion of the experiment it was found that the oil had become thick, black, and had a nauseous odour.

The oil in the flask was dried and treated with three times its bulk of anhydrous petroleum ether (b.pt. 30°—75° C.), allowed to stand for 24 hours, and filtered. The residue on the filter was treated with ether and again filtered, when a portion still remained insoluble. This residue was then further extracted with carbon bisulphide and filtered.

The portion left after extraction was shaken out with dilute hydrochloric acid and ether, and the ether separated off and added to the original ether extract.

The petrol and ether solutions were then shaken with dilute hydrochloric acid, washed and extracted with 2 per cent. caustic potash solution containing a little alcohol, the soaps separated off, acidified, and the acids isolated and weighed. The neutral solutions in ether and carbon bisulphide respectively were taken, the solvent evaporated off and weighed. In this manner three principal products were obtained, viz.: (*a*) Substances soluble in ether; (*b*) substances soluble in carbon bisulphide; (*c*) organic acids.



The following table shows the influence of a current of air and water vapour on 100 c.c. of neutral hydrocarbon oil in the apparatus shown in Fig. 1.

Oil.	Time of blowing.	Temp. of oil.	Soluble in ether (insol. in petrol).	Soluble in carbon bisulphide insol. in ether.	Organic acids.
				Per cent.	Per cent.
A	56 hrs.	150° C.	0·75	0·11	0·25
B	56 hrs.	150° C.	1·0	0·2	0·16
A	94 hrs.	120–130°C.	1·6	0·35	0·4
C	112 hrs.	90° C.	2·5	0·22	0·38

The original oils when dissolved in petrol and allowed to stand 24 hours, gave only a negligible trace of insoluble matter.

The fractions soluble in ether and insoluble in petrol were sticky asphaltic substances almost identical in appearance with the product extracted by this solvent from naturally occurring bitumens; they do not appear to contain oxygen in any appreciable quantity.

The ultimate analysis of a mixture of this fraction obtained from several oils gave: carbon, 94·41 per cent.; hydrogen, 5·50 per cent. The fraction insoluble in ether but soluble in carbon bisulphide is a brittle black substance which contains oxygen. The ultimate analysis gave: carbon, 92·35 per cent.; hydrogen, 6·10 per cent.; oxygen, 1·55 per cent. (by diff.).

The acids are oily substances, are soluble in alcohol, and form soaps with sodium and potassium which are freely soluble in water, and calcium salts which are difficultly soluble in water. The copper salts are appreciably soluble.

Unfortunately it was not possible in the above experiments to obtain a sufficient quantity of the acid for a detailed investigation.

In the author's opinion the mild oxidation of these complex hydrocarbons results in the production of not only acids but also of polymerised hydrocarbons and oxygenated resinous bitumens which are stable towards any mild oxidising agent.

The close analogy of these products to those found in the naturally occurring bitumens and acids of crude petroleum suggests that the latter compounds have been formed in the earth by processes of mild oxidation from hydrocarbons of relatively low molecular weight.

The above described reaction seems to apply very generally to all petroleum oils: even the burning oil distillates exhibit these phenomena to some extent (Steuart, this J., 1899, 239), and C. E. Waters (J. Ind. Eng. Chem., 1910, **2**, 451), finds that mineral lubricating oils oxidise in the presence of air, forming considerable quantities of acid bodies the nature of which he did not examine very fully.

It is probable that this reaction is responsible for the ultimate decomposition of all oils in forced-feed enclosed engines, and turbines in all cases, and the length of time required to bring it about varies greatly with the temperature of the oil, the amount of steam and air in the condenser, and the quantity of metallic particles present.

Deposits are frequently found in the lubricating pipes of steam turbines.

A case recently came before the author where the lubricating pipes had become almost completely choked up by a black gritty deposit. The analysis of this deposit gave: Ether-soluble matter (thick oil), 79·0 per cent.; bituminous matter (soluble in carbon bisulphide), 9·0; organic acids, 1·1; iron and iron oxides (as Fe_2O_3), 4·2; cupric oxide, 1·6; water and undetermined (by diff.), 5·1 per cent.

As is well known, the rotation of a steel shaft in a magnetic field induces an E.M.F. in the shaft, and where one has a turbine coupled up with a generator, the conditions for the production of an E.M.F. are completely satisfied, and if the bearings are not insulated, a current will tend to pass through the oil film to the bearing and thence to the earth.

Adler (Electrician, **65**, 315) has investigated the phenomena of the production of pulsating currents through the shaft and bearing. "These currents," he says, "make themselves chiefly felt by their injurious effects, such as pitting the shaft and bearing, also by making the oil impure."

At the works of the Allgemeine Elektricitäts Ges. in Stadslau it was found that with ordinary soft metallic alloys for the bearing linings harmful effects on the shaft were produced when the current density exceeded 0·15 amp. per sq. cm. of bearing surface. As a result of this pitting action and also probably of the passage of the spark through the oil film, every now and then, for long periods the oil becomes dark in colour and charged up with metallic particles while at the same time the oxidation process described above goes on with formation of acids, which attack these particles and produce soaps which enormously increase the viscosity of the oil, and hence cause the bearing to heat.

Gas engine deposits form two distinct classes:—1. Those in which the lubricant has been decomposed by certain specific causes. 2. Those which are quite independent of the lubricating oil.

In the author's experience the most active source of trouble in the gas engine cylinder is the sulphur vapour and sulphur dioxide contained in the gas. This objectionable constituent attacks the oil, combining with it to form unstable derivatives, and consequently one rarely sees a gas engine deposit which does not contain sulphur in more or less quantity.

A typical analysis of a black amorphous lumpy mass from an engine using producer gas gave the following:—Tarry matter (soluble in ether), 42·6 per cent.; insoluble bitumen and carbon, 12·6; free sulphur (soluble in chloroform), 4·8; combined sulphur, 4·2; oxide of iron, 35·0 per cent. The ether-soluble tarry matter was almost completely volatile in steam, it had a phenolic odour, and gave colourations with ferric chloride, from which it was concluded that the main bulk was gas tar. The bituminous matter contained some sulphur. No acids were detected. Notwithstanding the oft-expressed idea that the excessive high temperature which prevails in the gas-engine cylinder is responsible entirely for the deposit, the fact that an engine will work great lengths of time during which large quantities of oil pass through the cylinder without showing any very material deposit seemed to the author to indicate that high temperature alone is insufficient to account for the bulky deposits often found. This view receives confirmation from the results of analyses of such sulphur containing deposits as is above shown, and thus suggested an investigation into the influence of sulphur vapour and sulphur dioxide on oil.

A known weight of oil was placed in a porcelain boat, which was introduced into a long tube contained in a constant temperature oven. Over this oil, heated to 200° C., known amounts of air and mixtures of air with sulphur dioxide and air with sulphur vapour was passed. The time of heating was in all cases 2 hours and the temperature 200—205° C. The aspiration was at the rate of 2 litres per minute. The following table gives some of the observations made.

Gas.	Loss of weight	Appearance of oil residue.	Content of sulphur.
	per cent.		per cent.
Air	4·5	quite limpid	nil
Air + sulphur dioxide	5	black, very thick pitchy mass, semi-solid	0·15
Air + sulphur vapour	1·5		0·5

Hence it is clear that the sulphur contained in gas can combine in some way with the oil giving rise to compounds which are no longer so resistant to heat as is the original oil; accordingly if a gas plant is working under such conditions that appreciable quantities of free and combined sulphur are passed into the cylinders, trouble must be anticipated although the lubricant may be perfect. Not only is the oil affected, but the cylinder walls and valves suffer. In one deposit examined considerable quantities of ferrous sulphide were found to be present.

The combination of sulphur with iron alone is responsible for much cylinder corrosion and deposit formation.

One cannot but be struck with the fact that the modern lubricants stand these violent chemical conditions so remarkably well. The recent introduction of forced feed lubrication was hailed as a means of economising the oil consumption. But the engineer must remember that this idea can be pushed too far, and that even under the best of conditions the oil will not remain stable beyond a certain maximum period of time. Nevertheless by avoiding as far as possible all unfavourable chemical conditions the life of a lubricating oil may be very considerably prolonged.

The author wishes to thank the proprietors of the Henry Wells Oil Co. for permission to publish an account of these experiments, which were carried out in their laboratory.

Discussion.

The Chairman asked whether Mr. Southcombe had discovered any great difference between the Russian and the American oils with regard to polymerisation. He would also like to know what gas was referred to as being used by the engines. By using pure coal gas only carbon bisulphide would be present, whereas with coke gas, which contained sulphuretted hydrogen, there would be a much greater weight of sulphur.

Mr. Higgins wished to know whether in using a mineral oil in the lubrication of the ordinary journals of a spinning frame any polymerisation of that kind would take place, or whether high temperatures in the cylinder caused the presence of the fatty acids.

Mr. Ogden said that in the case of air compressors working at a pressure of 100 lbs. per square inch, mineral oil being used, they had had an explosion inside the air receiver on one or two occasions. On opening the receiver there were found to be deposits just opposite where the air was received from the cylinder. No doubt it was carbon, and it had been on fire, 7 or 8 pounds in weight having formed, and in his opinion that was the cause of the explosion. On one occasion an explosion occurred which blew away the piston bar entirely. It would be very interesting to know whether sulphur was the cause of the explosion.

Mr. Terry asked whether the oil would attack metallic packing.

Dr. Craig asked what was the behaviour of the lubricant used by the author before it was treated in the apparatus; whether the various solvents completely dissolved it, or whether they left any residue when they were tried separately.

Mr. R. Foster said he had recently had trouble with a gas engine. A deposit containing sulphur was formed from the cylinder piston. The question arose whether the deposit was due to the sulphur from the tar in the gas coming over from the producer. It occurred to him that possibly the sulphur in the gas might have reacted with the oil, and produced the solid sulphur deposit, and that if the sulphur in the gas had been sufficiently reduced the deposit would not have taken place.

Mr. Scott-Taggart asked whether hydrocarbons would form deposits quite apart from the presence of sulphur. Oils could form very large deposits quite apart from the presence of air, or, at any rate, in the sense that the oil was agitated with air. It had been found that a considerable amount of iron came over from the boiler supplying the water, through the chipping off of the inside surface. The same thing took place in all cylinders, and even in gas engines, turbines and force-feed engines. There was another aspect of the case, namely, the presence of dark threads of yarn in cloth. In the spinning of linen yarn large quantities of water were used. That was drawn from the same lodge into which the condenser water from the engine was poured. Most of those present would know that in some corner of those lodges there frequently formed very thick deposits of cylinder oil. That oil was not exactly decomposed oil, but owing to the high temperature it was fractionated, and they got the bitumen and the asphaltic basis present in such deposits. He asked whether it was possible for carbonised substances to absorb the sulphur that came through the gas.

Mr. Southcombe in reply, said that he had observed no marked difference in oxidisability between American and Russian oils, but he would expect that there was a slight difference in degree. The gas used in the engine from which the deposits were obtained was producer gas. Polymerisation took place to some extent in oils which were used for the journals of spinning machines, but it was very small in quantity since the air supply was limited, and the tendency would be rather to the production of non-oxygenated bodies than to that of acid products. With respect to the explosion in an air compressor mentioned by Mr. Ogden, he was of opinion that an abnormally high temperature in the cylinder and tubes had brought about cracking of the hydrocarbons of the oil, giving rise to low boiling and gaseous compounds. The formation of those products from high molecular weight hydrocarbons when subjected to temperatures above 500° C., was a well-known reaction, in which paraffins broke down into lower homologues, olefines, and carbon. These lower hydrocarbons were gaseous at the temperature of the crank chamber, and only required a spark in the presence of air to cause an explosion. No claim for oxidation in steam cylinders was made, the process of deposit formation being purely physical involving a separation of the high molecular weight asphaltic hydrocarbons from the lower derivatives. If it were found that the cylinder walls had been corroded by acids it was an indication that the original oil contained a very large quantity of readily saponifiable fats, but in his experience this corrosive action was very slight and very rarely found, the evils of compounded oils in this respect being very much exaggerated. Considering the relatively short time during which the lubricant was present in the cylinder, and further that in most cases there was only a few per cent. of fatty matter in the oil, it was not to be expected that any very decided saponification went on, and consequently very little acid over and above that originally present was produced. There was, of course, some difference in the rate of oxidation of oils, but the original oils used in this investigation were high class products free from bitumen and gave a clear solution in petroleum ether from which only a negligible trace of precipitate fell out in twenty-four hours. The point he particularly wished to emphasize was—that the reaction described in the paper would necessarily go on to a greater or lesser degree with all oils whatsoever their nature, source, and subsequent treatment. With a reasonably clean producer-gas deposits containing sulphur would not form to any serious extent. The very fact that a gas engine would go on working for months without serious deposit formation must be an illustration that this was so. It was usually through some unforeseen reason which permitted an excessive quantity of sulphur to remain in the gas that those deposits were due. Assuming, however, even a small quantity of sulphur in the gas there would be a cumulative action, the result being in the end a product highly charged with sulphur. Generalising, one might say that the formation of lubricating oil deposits by oxidation was a reaction depending upon all those conditions which determine the velocity of chemical reactions in general such as temperature, the amount of water, steam and air present and the nature of the metallic catalyst. He was of opinion that very little deposit was formed in the actual explosive area of a gas engine, because when temperatures were very high and there was plenty of air, deposits were not formed, the whole carbonaceous mass being consumed.

New York Section.

Meeting held at Chemists' Club on Friday, January 20th, 1911.

DR. C. F. MCKENNA IN THE CHAIR.

PRESENTATION OF THE PERKIN MEDAL TO DR. C. M. HALL.

The CHAIRMAN, in relating briefly the circumstances which led to the foundation of the "Perkin Medal," said that the importance of Sir William's discovery was immediately realised throughout the world, but that was not always the case with chemical discoveries; the full appreciation of the significance of Dr. Hall's experiments in electrolysing a bath of alumina and cryolite was long in dawning. The Perkin Medal gave the chemical fraternity the opportunity to honour one whose modesty had been equalled only by his patience.

In calling upon Dr. Chandler, Senior Past-President of the Society, resident in the United States, he mentioned the fact that Dr. Chandler was one of the oldest living pupils of Wöhler, who first isolated aluminium, the foremost American teacher, and the preceptor who inspired Castner to toil over the smelting of sodium that the smelting of aluminium might follow.

Dr. CHARLES F. CHANDLER, in making the presentation, said: It is my privilege and very pleasant duty to present to Dr. Charles Martin Hall the fifth impression of the Perkin Medal in recognition of his most valuable work in applied chemistry, and particularly his discoveries and inventions in connection with aluminium. This subject has interested me deeply from my student days. In 1854 I listened to Wöhler's account of his discovery of aluminium in 1827, and the following year (1855) I was shown by Rose aluminium which he extracted from cryolite by the action of sodium—that was the first time that cryolite had appeared outside of Greenland in any form, except as a rare specimen. In 1869 I made the acquaintance of Henri St. Claire Deville in Paris, who in 1854 and later prepared aluminium on a manufacturing scale. Then I had among my pupils in the School of Mines, my warm friend, Hamilton Y. Castner, who for two years carried on the manufacture of aluminium by means of his cheap sodium; and finally for the past twenty years I have been very intimate with Dr. Hall, whose electrolytic process at Niagara Falls has produced the metal in such enormous quantities and at such a low price that it has taken the place, for innumerable purposes, of other metals formerly employed.

Sir Humphrey Davy endeavoured to reduce alumina by heating with the aid of 1,000 galvanic couples an iron wire in contact with alumina in an atmosphere of hydrogen. The iron fused, became whiter, and on solution in acid yielded the earth alumina. He evidently produced an alloy of the metals. Nothing further was done till 1827, when Wöhler reduced aluminium chloride with potassium, and obtained aluminium as a grey, metallic powder, and later, in 1845, by acting on aluminium chloride with potassium vapour obtained the metal in tin-white globules.

In 1854 Deville became imbued with the idea of making aluminium a useful metal. He secured the interest of the Emperor Louis Napoleon, and with liberal grants of money was able to work on a factory scale. He employed aluminium chloride and sodium, thus modifying the process of Wöhler by substituting sodium for potassium, and manufactured the metal in what, for those days, seemed very large quantities. Deville first used cryolite as a flux. This mineral was also used experimentally to produce aluminium by the action of sodium in 1855 by both Rose and Percy. Deville's factories continued to produce aluminium on a moderate scale till about 1888; reaching a maximum output of over 5.000 pounds per annum, which represents the maximum production of aluminium in Deville's days. A few other manufacturers established works, but the process of manufacture was so expensive that aluminium was really a precious metal, used chiefly for fancy articles. The price was in 1855, $90 per lb.; 1856, $27 per lb.; 1857, $22.50 per lb.; 1862, $12 per lb.; 1886, $12 per lb., which was the lowest price at which aluminium was sold during the work of Deville and his associates.

In 1886 Hamilton Y. Castner made sodium from caustic soda and iron carbide, and reduced its cost from $1.00 to 25c. per lb.—a very important item for the aluminium industry, as it was never possible to make a pound of aluminium with less than three pounds of sodium. By June, 1888, his works at Oldbury, near Birmingham, had a daily output of 250 lb. of aluminium, which he sold at $5.00 a lb. In 1889 the daily output was 500 lb. at $4.00 a pound; then his manufacture of aluminium came to a sudden end because a new electrical process produced it for $1.00 a pound. (This J. 1899; 901, 986.)

We now come to the achievements of Charles M. Hall, but whatever praise I shall bestow on this great inventor, I do not in the slightest degree disparage that of the other great inventor, Paul L. T. Héroult, whom we have the honour to have with us this evening, who worked on the same problem, at the same time, across the Atlantic; made the same discovery independently, and worked out an analogous process of manufacture, which has played the same important part in Europe, that Hall's process has played in the United States.

Charles Martin Hall was born in Ohio on January 6th, 1863; was educated in Oberlin, and graduated there in June, 1885, when twenty-two years of age. He became interested in the aluminium problem while in college; and made many experiments in the hope of finding a more economical process for its production. Finally his thoughts turned to electrolysis, and in October, 1885, he began to seek a suitable anhydrous solvent for alumina, operative at a practical temperature, which would bring the alumina into a fluid condition, in which it would yield to the electric current. Fluorspar, and the fluorides of magnesium, sodium, potassium, and aluminium were successsively tried; but were found to be too infusible, and to dissolve little, if any, alumina. On February 10th, 1886, Hall tried cryolite, the double fluoride of sodium and aluminium. This fused readily at a moderate temperature, over a Bunsen burner, in a platinum crucible, and rapidly dissolved alumina to the extent of more than twenty-five per cent., a clear and limpid solution being produced. How was it that Deville did not discover that when he used the cryolite as a flux?

It was well known that cryolite could be electrolysed—Deville electrolysed aluminium from molten cryolite—but that was an impracticable process for the manufacture of the metal. Hall proceeded to apply electrolysis to this process, and thus made his first great discovery. He proceeded at once to apply the electric current to this solution. His first experiments with clay crucibles were not successful, but on February 23rd, 1886, he employed a carbon lined crucible and was successful in obtaining aluminium. He had thus achieved success in inventing a process for making aluminium directly from alumina by electrolysis under conditions which promised to revolutionise the industry and furnish the metal at so low a price as to enable it to replace copper, tin, lead, zinc and other metals for an endless variety of purposes.

Hall's age at this time was 22 years (the same as Héroult's at the time of his discovery), and he had discovered and invented what had escaped Wöhler, Rose, Deville, and many of the other world renowned chemists who had occupied themselves with aluminium over a period of half a century, and I might add that in a quarter of a century which has elapsed since that date, no one has succeeded in bettering what they did.

On July 9th, 1886, Hall applied for his broad basic patent which was granted April 2nd, 1889, No. 400,766, claiming:—

1. As an improvement in the art of manufacturing aluminium, the herein-described process, which consists in dissolving alumina in a fused bath composed of the fluorides of aluminium and a metal more electro-positive than aluminium, and then passing an electric current through the fused mass, substantially as set forth.
2. As an improvement in the art of manufacturing aluminium, the herein-described process, which consists in dissolving alumina in a fused bath composed of the fluorides of aluminium and sodium, and then passing an electric current, by means of a carbonaceous anode, through the fused mass, sustantially as set forth.
3. As an improvement in the art of manufacturing aluminium, the herein-described process, which consists in dissolving alumina in a fused bath composed of the fluorides of aluminium, sodium, and lithium, and then passing an electric current, by means of a carbonaceous anode, through the fused mass, substantially as set forth.

He also received four additional patents for modifications of his original process. Hall was obliged to defend in court the originality of his invention, and after an exhaustive discussion the patent was sustained, the court declaring the patent valid and issuing a perpetual injunction against the defendants.

In November, 1888, Hall began work in his factory at Kensington, near Pittsburg, producing 50 lb. of metal a day. Since then his progress has been wonderful. He soon erected larger works at Niagara Falls, as the first consumer of the electricity supplied by the Niagara Falls Power Company. At the present time the Company has three establishments at Niagara Falls, one at Massena, in New York, on the St. Lawrence, and one at Shawinigan Falls in Canada. The total consumption of electricity is 140,000 horse-power, which I believe to be a larger amount of electricity than is consumed by any other electrochemical works in the world. The annual output of aluminium is now 40,000,000 lb. The first metal produced at Kensington was sold on the market at $2.00 per lb.; the price now is about 22c.

Among Hall's other inventions, several of which have been patented, six are for improved methods for preparing pure alumina, one of which is still employed for preparing this material for use in the works. He has also patented methods for making carbon anodes for use in the works.

Hall's achievements certainly entitle him to a place in the front rank of electro-chemists, and his youthful successes must ever prove an encouragement to other young men who develop a love for this branch of applied science, and therefore it gives me great pleasure, as the representative of the affiliated Chemical and Electro-chemical Societies, to place in Dr. Hall's hands this beautiful token of appreciation and affection of your fellow-chemists.

Dr. Charles Martin Hall said: I thank the speaker for his kind remarks and for the medal which he has given me, and for the great honour which it represents, and through him I thank the representatives of the Society of Chemical Industry, the American Chemical Society, the American Electro-chemical Society, the American Institute of Chemical Engineers, Verein Deutscher Chemiker, Society of Brewers' Chemists of the United States, and the Chemists' Club, to whom I am indebted for this honour. I appreciate it the more highly because it is awarded by fellow-workers in the chemical and electro-chemical professions and industries. I am glad to have this medal on account of what it represents and on account of the manner in which it has been given, and I shall treasure it among my most valued possessions.

It is an especial pleasure, also, to receive this medal and this honour from the hand of a man who has been my adviser, helper, and my friend for many years.

My first experiment on the production of aluminium was to try to reduce aluminium from clay by means of carbon at a high temperature. I made a mixture of clay with carbon and ignited it in a mixture of charcoal with chlorate of potassium. Needless to say, no aluminium was produced. I then thought of cheapening the chloride of aluminium then used as the basis for aluminium manufacture, and tried to make it by heating calcium chloride and magnesium chloride with clay, following the analogy by which iron chloride is produced when common salt is thrown into a porcelain kiln. A little later I worked with pure alumina and tried to find some catalytic agent which would make it possible to reduce alumina with carbon at a high temperature. I tried mixtures of alumina and carbon with barium salts, and also the same mixture with cryolite and sodium carbonate, hoping to get a double reaction by which the final result would be aluminium. I remember buying some metallic sodium and trying to reduce cryolite but obtained very poor results. I made some aluminium sulphide but found it very unpromising as a source of aluminium then, as it has been ever since. On a later occasion I tried to electrolyse a solution of aluminium salt in water, but found nothing but a deposit of alumina on the negative electrode. Gradually the idea formed itself in my mind that if I could get a solution of alumina in something which contained no water, and in which the solvent was chemically more stable than the alumina, that this would probably give a bath from which aluminium could be easily obtained by electrolysis; in February, 1886, I began to experiment on this plan. The first thing in which I tried to dissolve alumina for electrolysis was fluorspar, but I found that its fusing point was so high as to be rather discouraging. I next made some magnesium fluoride, but found this also to have rather a high fusing point. I then took some cryolite, and found that it melted easily and melted dissolved alumina in large proportion. I melted some cryolite in a clay crucible and dissolved some alumina in it and passed an electric current through it for about two hours by means of carbon electrodes. When I poured out the melted mass I found no aluminium. It then occurred to me that the operation was interfered with by impurities, principally silica, dissolved from the clay crucible; so I next made a carbon crucible, enclosed it in a clay crucible, and repeated this experiment. This time, after passing the current for a couple of hours, I poured out the material and found a number of small globules of aluminium. I was then quite sure that I had discovered the process that I was seeking.

I then found that I could use, instead of cryolite, other double fluorides, particularly a double fluoride of potassium and aluminium. The most important change, however, which I made at this time, was in the material used as an anode. I wanted to get rid of the burning up of the carbon anodes. I tried a platinum anode, and found that it seemed to work all right, but it was too expensive. Then I discovered that if I used a fusible bath of a potassium double fluoride with a sodium double fluoride, I could use a copper anode, which immediately became coated with a thin film of copper oxide and acted like a permanent platinum anode. This was not a step in advance as I thought it was, as more or less copper gets into the reduced aluminium, and the use of a copper anode led me to use very fusible baths, which on the whole do not work well as the less fusible baths. It is probable that this change delayed a successful result for a year or two.

When worked on a small scale, this process with any of the baths I have mentioned, and with either copper or carbon anodes, is not apparently promising. The ampere efficiency is low, sometimes zero, and the bath, whether composed of sodium or potassium salt, becomes filled with a black substance which accumulates and renders the process very difficult. In spite of the difficulties mentioned, however, I had great faith in the theoretical possibilities of the process, and believed that the practical difficulties could be overcome, so I stuck to it from the start. In the summer and fall of 1886, I worked with some people in Boston with whom my brother had made some financial arrangement. The results there obtained were not satisfactory to them, and in October, 1886, my Boston friends declined to go further; and I returned to my home in Oberlin, Ohio. In December, 1886, I found that a bath composed of a very fusible double fluoride of aluminium and potassium, with copper anodes, worked much better than anything I had before tried.

The Cowles Electric Smelting and Aluminium Company, who were then making aluminium alloys at Lockport, N.Y., were the second set of people who became interested in my invention. They took an option on it, and I spent a year with them, from July, 1887, to July, 1888. They finally gave up their option. The baths which I used at Lockport at first worked well for a few days, but after a time they would become less efficient. I finally worked out a system by which the difficulties were overcome. This was by making a bath consisting partly of calcium fluoride, or fluorspar, and adding three or four per cent. of calcium chloride, and using carbon anodes. I reasoned that chlorine was evolved and destroyed the objectionable compound which spoiled the bath. After finally overcoming the difficulties which I have mentioned, I made several pounds of aluminium in small crucibles, which I showed to Mr. Alfred Cowles, and gave him all the facts in relation to the same, but he was not interested. I then sent a representative to Pittsburgh, who got together the gentlemen who formed the Pittsburgh Reduction Company, now the Aluminium Company of America, and we immediately started in the summer of 1888 to build and operate a commercial plant on Smallman Street in Pittsburgh. We had at our disposal about fifty horse-power in electrical current of 2,000 amperes. It took a few weeks after starting to get the dimensions of our baths and so forth, just right, and then the difficulties which I have referred to disappeared as if by magic. The clogging and spoiling of the bath, which had caused trouble for the last three years, did not occur on a large scale. No calcium chloride was required. It seems that this is a process (unlike a good many others) which works badly on a small scale and well on a large scale. I accounted for this by the fact that on a large scale the electrodes are further separated and there is less circulation between the positive and the negative electrodes, which lowers the efficiency and favours the formation of the clogging black compound. We also found, as I had predicted nearly three years before and had stated in a patent application filed two years before, that on a commercial scale no external heat was required to keep our baths in fusion. This was a great advantage, but I believe that it resulted from a law of nature and not from any invention at the time, as we did not use any excess of current for maintaining fusion, but only the normal current and voltage for electrolytic purposes, and the use of the electric current for fusing and heating in connection with electrolysis was a thing which had been disclosed and published almost a century before.

The business of manufacturing aluminium has now grown to a great commercial business. Many workers have contributed to it, and the credit is to be divided among many. In the commercial development of the business I think the greatest credit is due to our first President, Captain Alfred E. Hunt, and to our present President, Mr. Arthur V. Davis, who has been identified with the business for twenty-two years, and who has been manager and general of our forces for the last eleven years.

In reply to a question, Dr. **Hall** said that calcium chloride and potassium fluoride was a substitute or equivalent for cryolite, but cryolite was the basis of most of the baths, and was in use at the present time.

Dr. P. L. T. **Héroult** said: Twenty-five years ago the aluminium industry employed about ten men; the production was one-and-a-half tons a year, the total value of which was 150,000 francs. Now-a-days the same industry produces 50,000 tons at a value of 100,000,000 francs, or $20,000,000 and employs from fifteen to twenty thousand men. If we take the average consumption of copper at 900,000 tons a year at a value of 13c. per lb., the total value of ingot metal will be $234,000,000 a year comparing with the $20,000,000 for aluminium, say one-tenth.

But 13c. is pretty nearly the rock-bottom price for copper. At 20c. per lb. aluminium presents a great advantage for most uses. Aluminium is slowly wedging its way in the metal market. It looks probable that in a course of ten to fifteen years the consumption of the new metal will be equal to that of copper, and that after the golden age, the stone age, the bronze age, and the iron age, we will have the aluminium age.

I sincerely congratulate Dr. Hall on the award to him of the Perkin Medal.

Professor **Richards** said: Aluminium was only used in 1885 for telescopes and articles of luxury. To-day one of the chief uses of aluminium is in the manufacture of steel. I hardly think there is a steel works in all the world where aluminium is not used to solidify the steel castings. Its use is due to a Swedish inventor. The last thing they put into the ingot is some little pills of aluminium weighing perhaps one ounce to the ton of metal, and this solidifies the steel by removing the gases.

Another use is for electrical conductors. A conductor one mile long, of a given carrying capacity, can be put up more cheaply with aluminium than with copper. Aluminium, section for section, is not quite as good a conductor as copper, but if the section is made 25 per cent. larger in diameter, it gives much more satisfactory results. There are other advantages as well as a few disadvantages, but thousands of tons of aluminium are now being used for long distance transmission lines.

Further, there is a large use of aluminium in the reduction of rare metals. Aluminium has such a great affinity for oxygen that it will reduce the oxides of metals very easily and cheaply; so it is cheaper to use aluminium to reduce these metals. Hans Goldschmidt uses it in his aluminothermic process, by means of which chromium, tungsten, vanadium, molybdenum, and others can be reduced comparatively cheaply.

An interesting application of aluminium is in the welding of iron. If a mixture of aluminium powder and iron oxide is ignited, it burns violently, iron and aluminium oxide are formed, and the heat generated is so great that the iron is liquefied at a temperature above the melting point. The melted iron when poured on the ends of two rails welds them together; that is the Goldschmidt thermo-welding process. In several cases a broken shaft of a steamship has been welded at sea with this mixture, and now all the German warships and German merchant marine vessels must carry it with them in order to repair shafts in case they break.

Another extensive use which will come to mind is its use for culinary utensils. There is no doubt it is an ideal metal for cooking utensils. The ware, if sufficiently thick, is practically indestructible. That use of aluminium is increasing with considerable rapidity. This will ultimately be the largest use of aluminium. Hundreds of thousands of tons will be needed for that purpose when its virtues are known.

In conclusion, I regard the bringing of aluminium into the rank of the cheaper metals, as one of the great metallurgical achievements of the 19th century, and I think the historian of the future will probably class the industrial manufacture of aluminium with the invention of Bessemer steel.

Congratulatory speeches were also made by Dr. W. H. **Walker**, on behalf of the American Electro-chemical Society, Dr. C. **Baskerville** (American Chemical Society), and Dr. **Takayama** (Director of the Japanese Agricultural Department).

Nottingham Section.

Meeting held at Nottingham on Wednesday, January 25th, 1911.

MR. S. J. PENTECOST IN THE CHAIR.

THE BACTERIOLOGY OF THE LEATHER INDUSTRY.

(See this Journal, June 15, 1910, pp. 666—672).

BY J. T. WOOD.

Bibliographic Appendix.

At the request of friends who are interested in the subject, I have been induced to print the following short bibliography of works bearing on the bacteriology of leather manufacture especially in connection with the bating or puering process. It was put together originally with a view to form part of a treatise on the subject, but as the prospect of publishing this is remote, I give the list as it stands in the hope that it may prove useful to other investigators. It does not profess to be complete, but I think includes most of the important works. I shall be glad if those interested will inform me of any omissions, or make additions to the list, which will render it more complete.

For particulars of some of the earlier works (Nos. 1, 2, 4, 5, 6, 7 and 8) I am indebted to Dr. E. Stiasny of Leeds University.

1. La Tannerie et la preparation des Cuirs. (MS.) Desbillettes. 1708.
2. L'art du tanneur. De la Lande. 1764.
3. The art of tanning and currying leather, with an account of all the different processes made use of in Europe and Asia for dying leather red and yellow, collected and published at the expense of the Dublin Society. To which are added Mr. Philipo's method of dying the Turkey leather as approved of by the Society for the Encouragement of Arts, etc., and for which he had a reward of £100, and their gold medal for the secret. Also the new method of tanning invented by the late David Macbride, M.D., London, reprinted for J. Nourse in the Strand, Bookseller to His Majesty. 1780.
4. Lohgerberei, Ignatz Bautsch. Dresden, 1793.
5. Ueber die Bearbeitung der Tierhäute zu allen Gattungen von Leder. K. T. Kasteleyn. German translation from the Dutch. Leipzig, 1797.
6. Chemisch technologische Grundsätze der gesammten Lederindustrie. Hermbstädt. 2 vols. Berlin, 1805 and 1807.
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Scottish Section.

Meeting held at Edinburgh on Tuesday, December 20th, 1910.

PROFESSOR THOMAS GRAY IN THE CHAIR.

THE RECOVERY OF WASTE GASES FROM MINERAL OIL STILLS.

BY NORMAN M. HENDERSON.

In Henderson's continuous system of distillation, which is in general use in the Scotch shale oil manufacture, there is a series of horizontal cylindrical boiler stills, which are worked continuously. There may be two to three or more. The oil flows through the series, traversing each still from front to back, distilling off a light fraction from the first, a heavier from the second, a heavier still from the third, and so on, each still having a condenser for its own fraction. The oil from the last boiler still of the series is run into a residue, or coking, still, with hemispherical cast iron bottom. The residue still receives the oil until it is sufficiently full, when it is disconnected, and another residue still is put on to the series. The disconnected one is then distilled to dryness and coked. A little gas comes from the boiler stills but the great bulk comes from the residue stills. When it approaches coking, and during coking, great quantities of permanent gas are evolved from which some light spirit is obtainable. The greatest quantity of gas is got from the coking stills of the first and of the second distillation. The gases used to be allowed to escape into the atmosphere; now they are caught and utilised for lighting and heating, and the method of recovery put into successful operation at the Broxburn Works in 1907, is the subject of the present paper. In designing the plant the aim was simplicity of construction so as to produce efficiency in working combined with safety. To effect this, the still worm ends are fitted with seal pipes of sufficient depth to withstand the vacuum required. Between the worm end seal pipes and the worm tank is fitted a pipe with two branches in the form of a cross; the bottom branch is fitted with a stop cock for running off the grease which comes at the end of distillation. On the top branch opening there is fitted a two-way stop-cock communicating either with the atmosphere—when the still is not working—or with a pipe for "drawing off" the gases—when the still is working. This latter gas pipe communicates with a hydraulic suction main. This hydraulic suction main is placed near the worm tanks in any convenient position, the full length of the still bench, and gives a uniform suction to all the stills. One end of the two-way stop-cock is connected into this main down through the top by means of a pipe of sufficient length so as to form a water seal in the main. The hydraulic suction main is connected to a vacuum pump, the suction being regulated by a by-pass valve worked by a regulator. The suction in the hydraulic main is generally found sufficient at five inches on the water gauge. From the discharge of the vacuum pump the gas is led to where it is required, or it may be further scrubbed for light spirit, if necessary. During this process a considerable quantity of light spirit caught by the friction through the water, condenses and collects in the hydraulic suction main. At one end of the main a small continuous run of cold water is introduced sufficient to keep the gases cool. The level of the water in the main is regulated by the height of the outlet pipe at the other end which allows the water and the light spirit to escape into a separator from which the light spirit flows into a receiving tank.

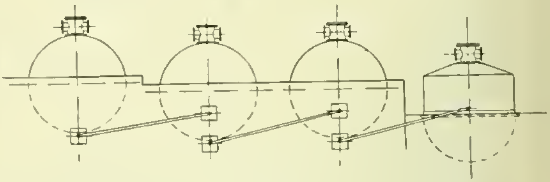

FIG. I.

End elevation of crude stills connected in series.

The illustrations further explain the method. Fig. 1 is an end elevation showing pipes connecting stills in series. Fig. 2 is an end elevation and Fig. 3 a side elevation of a condenser with improved apparatus. A is the outlet of the distillation from the condenser B. C is the seal bend of sufficient depth to prevent insuction of air. The stop-cock, D, is to let off the heavy grease which comes at the end of the distillation, and the stop-cock K is for cleaning the seal pipe, C. E is the two-way stop-cock with pipe G, opening to the atmosphere when the still is not working, and H is the pipe dropping into the main, J, water sealed, by which the gases pass to the vacuum pump. The vacuum is regulated automatically to prevent excess of suction. The level of the water in the main, J, is maintained by the height of the outlet pipe.

Arrangement of still condenser and pipes for recovery of waste gas.

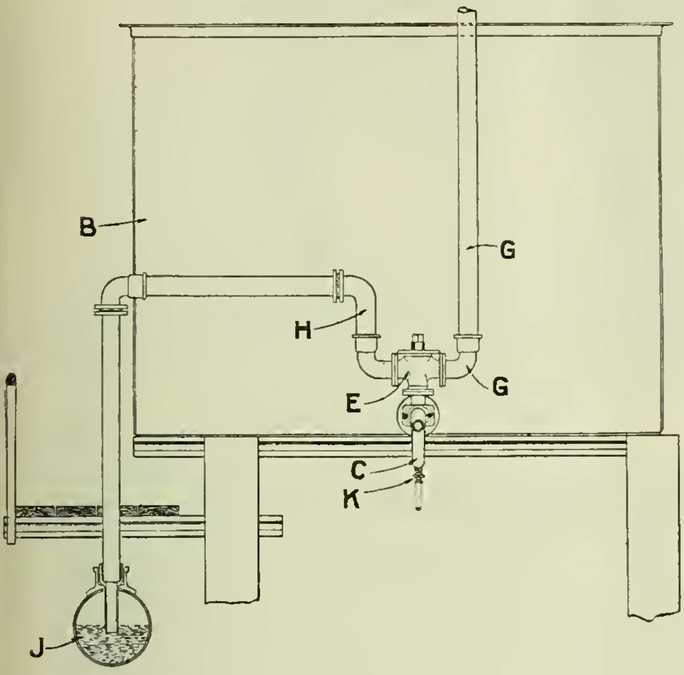

FIG. 3.

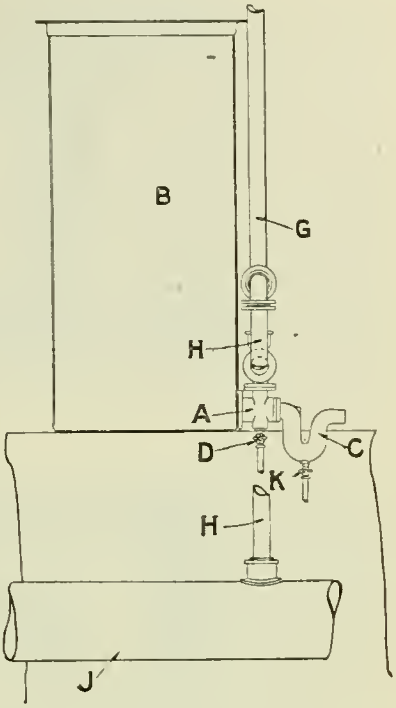

FIG. 2.

The gases recovered are very rich and require to be diluted with a proportion of air for lighting and heating purposes. After this has been done, part of the recovered gases are utilised for heating the stills, and part are sent through oxide of iron purifiers to gas holders and supply gas for the lighting of the works and to the householders of Broxburn and Uphall for lighting and heating purposes.

The specific gravity of the liquid distillate recovered from the waste gases is about 0.717, and this, after being treated with vitriol and soda, is re-distilled and produces motor spirit of very good quality.

I must express my great obligation to Mr. Cuthbertson for his assistance in working out the details of the apparatus.

IMPROVED APPARATUS FOR REFINING PARAFFIN WAX.

BY N. M. HENDERSON.

The object of this paper is to describe an improvement on a previous patent of mine (No. 11,799 of 1891), known as the tray system, and which is in general use all over the world. It was described in the Journal of this Society (Vol. XIII, 1894, page 1042).

In this older system, there are large trays fitted into a chamber, nine deep, and the trays have a wire gauze shelf about two inches from the bottom. The tray is filled with water to half an inch above the gauze shelf, then 3½ inches of melted paraffin are run on the top. This is left to cool and crystallise. The water is then run off, leaving the cake of paraffin lying on the gauze shelf. The doors of the house are shut, heat applied, and the oil and softest paraffin sweats out, leaving behind a wax, freed from colour and of higher melting point.

The improved apparatus consists of a series of cylinders, or cells, made of lead-coated light steel plates, 9 feet high by 17 inch diameter, each fitted with an internal cylinder about 7 inches diameter, open above and below, leaving an annular space for the paraffin wax to be cooled in. On the outside of the internal cylinder there is a draining screen of, generally, three thicknesses of iron wire gauze with false bottom of draining material. The bottom is provided with a discharge pipe.

The cells are arranged in rows in a sweating house of the usual type, and heated by steam pipes. The cells are supported on light steel girders, carried on cross girders with distance pieces. A charging pipe is carried longitudinally over the centre of each three rows of cells, and is fitted with stop-cocks and swivel pipes, each stop-cock and swivel pipe being capable of charging three cells, the stop-cocks being conveniently worked from a platform supported on girders at a suitable height in the sweating house. The draining outlet from the bottom of each cell is connected to longitudinal drain pipes, carried under each row of cells. These pipes are fitted at the run off end, with sluice valves, and connected with a common drain pipe, which leads to the receiving tanks. The draining pipes are connected at the one end by cocks with a water pipe.

Fig. 1 shows a plan, Fig. 2 longitudinal section of a stove containing 72 cylindrical cells. Fig. 4 is a plan and Fig. 3 an elevation on a large scale of the bottom of a single vertical cell, with the draining arrangement.

In operation, three inches of water are run into the bottom of the cells, and the cells are then filled with the wax, which is allowed to cool and solidify. Solidification of the wax takes place first at the outer unscreened sides of the cells, while the oil, soft wax, and other impurities are gradually forced towards the vertical draining screen on the central cylindrical portion, where slower cooling takes place. After cooling and complete solidification of the paraffin wax, the water is allowed to run off. The sweating house is then closed, and heat applied gradually, and the sweating carried on in the usual manner; the oil and other impurities, being next the screens, are first drained away and pass off through the drain outlets to the receiving tanks. Owing to the height of the column of wax, this draining process is much more rapid than when the operation is performed with comparatively shallow trays, due to the pressure developed by the superincumbent weight of the column of wax.

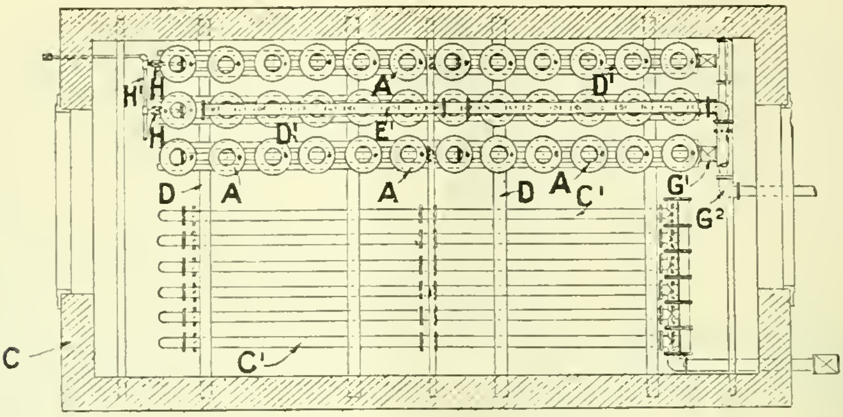

FIG. 1.

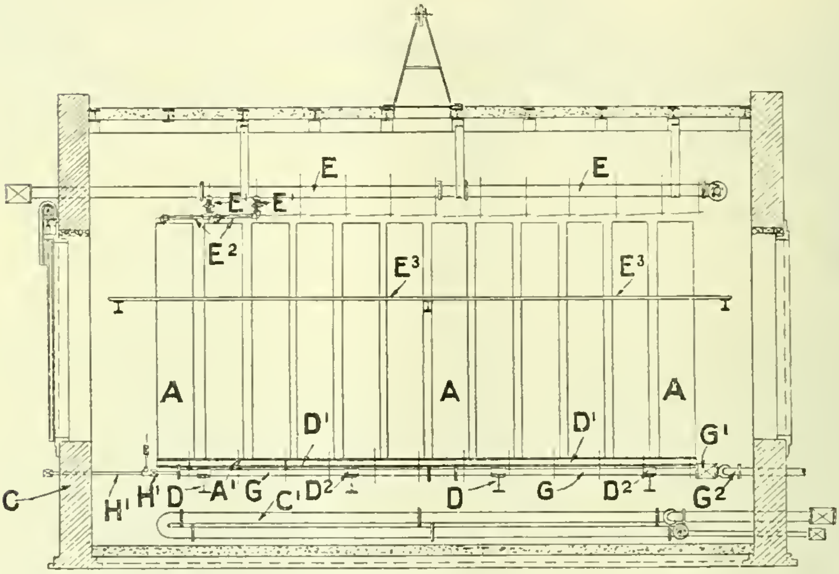

FIG. 2.
Arrangement of cylindrical cells for treating paraffin wax. Henderson's Patent, No. 7630, A.D. 1905.

The advantages of the vertical cell system of refining paraffin-wax over the older system of flat trays, are as follow:—

1. A more complete separation of the oil from the paraffin, as also a better separation of the paraffin into its various fractions.

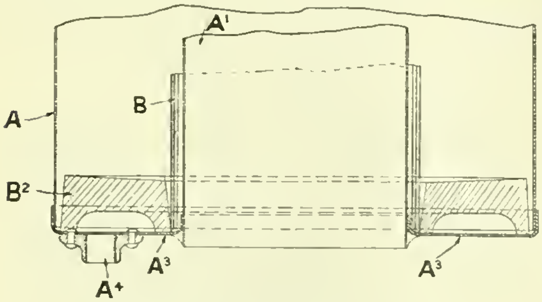

FIG. 3.
Detail of bottom of cylindrical cells.
Henderson's Patent, No. 7630, A.D. 1905.

2. An increased output, as sweating stoves on this system are capable of holding more than double the quantity of material for the space occupied.

3. The time taken for cooling and sweating this double quantity is much the same as for the smaller quantity in the old system of flat trays.

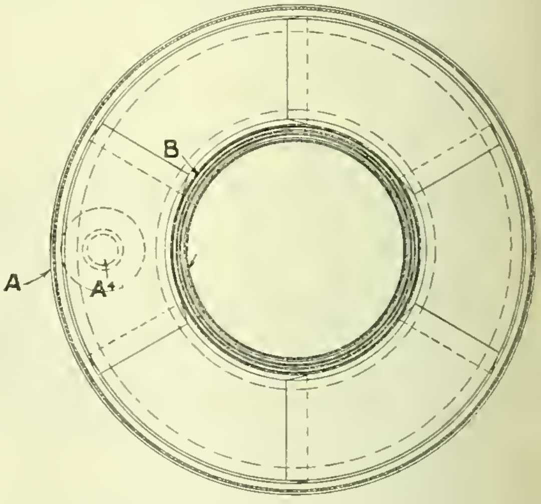

FIG. 4.

4. The cost of a plant on this system, per ton of wax treated, is much less than the tray method. The stoves erected at the works of the Broxburn Oil Company on this system have given most satisfactory results.

This process of paraffin refining also lends itself for the adaptation of water cooling in tropical climates. For this purpose, the cells are enclosed in a steel tank, and after the impure paraffin has been run into the cells, the tank is filled with cold water, to assist in the cooling and solidification of the paraffin. The water is then run off, and sweating proceeds in the usual manner.

I am indebted to Mr. Cuthbertson for his assistance in working out the details of the apparatus.

Obituary.

JULIUS WILHELM BRÜHL.

Prof. J. W. Brühl, whose death occurred at Heidelberg on February 5th, was born at Warsaw in 1850. As a prolific investigator in chemical science, and especially in the domain of physical chemistry, his name has been familiar for over 30 years as among the leaders in the application of physical methods to the study of chemical constitution. He may be said to have been the successor in his own field of the English pioneers, Gladstone and Dale, who were among the earliest to take up that branch of work which was subsequently followed up with such brilliant results by Brühl. The chief outcome of his work has been the establishment of the method of determining chemical constitution by the observation of the refractive power of elements and compounds. His prolonged researches, although at first confined to the purely scientific development of the subject, were soon recognised both by himself and others to be capable of extension so as to be of direct service to chemical industry. The refractivity method has enabled manufacturers, and especially those concerned with the organic chemical industries, to identify or to value many of their raw materials and products. The refractometer has in fact taken its place with the polarimeter, the colorimeter and the spectroscope, as a necessary instrument in technical laboratories. More particularly has Brühl's work in its practical development, been of service in connection with the modern industry of synthetic perfumes. His method of determining by the optical method, the constitution of tautomeric compounds in solution, was one for the solution of a problem which eludes ordinary chemical methods, and this it was, along with other developments of his investigations, which brought him into contact with the researches and also the personality of Sir William Perkin with whom he was in constant communication, and who had the greatest admiration for his work. He was well known in this country, where he had been made an honorary member of the Royal Institution and had received from the University of Cambridge the degree of D. Sc. At the time of his death he was Professor in the University of Heidelberg and the occupant of the chair formerly held by Bunsen.

LEONARD PARKER KINNICUTT.

Prof. Kinnicutt was born in 1854, and the student period of his life was passed successively in the Massachusetts School of Technology, the Universities of Heidelberg and Bonn, and the Johns Hopkins University of Baltimore. Later Dr. Kinnicutt held a junior post at Harvard from 1880 to 1883, since which period he was associated with the Worcester Polytechnic Institute, first as assistant professor and latterly as professor of chemistry. His chief work was that of an expert on sewage disposal and water supply, and he acted as consulting chemist to the Connecticut sewage commission. Professor Kinnicutt has been a member of this Society since 1891.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Separating materials of different specific gravity. P. J. Ogle, London. Eng. Pat. 22,728, Oct. 5, 1909.

The material to be separated is fed on to an endless belt which receives a reciprocating or vanning motion as well as a forward motion. Longitudinal ribs or riffles are formed on the belt so as to form dams to assist in preventing the heavier particles from being washed across the belt with the lighter particles by the stream of water which is directed on to the belt. The belt is carried on rollers in such a way that it can be inclined to a greater or less degree, so that as the heavier particles are carried forward, the "damming back effect" of the riffles is reduced by the greater inclination of the belt, and the heavier particles are washed across into the proper receptacle.—W. H. C.

Furnaces and the like; Production of draughts in ——. G. Schwabach and Ges. f. künstlichen Zug., Ges. m. b. H., Charlottenburg, Germany. Eng. Pat. 477, Jan. 7, 1910.

The draught is produced by passing large volumes of air or steam at a low pressure through a tube or pipe provided with a movable sleeve or nozzle and fixed axially within the flue. A double cone is arranged immediately in front of the movable nozzle, so that by adjusting the latter the size of the aperture through which the air or steam passes can be altered.—W. H. C.

Vacuum plants; Means combined with —— *for the continuous discharge of solids from liquids and for carrying away the solids.* E. V. Chambers, Huddersfield, and H. B. Watson, Ltd., Liversedge, Yorks. Eng. Pat. 581, Jan. 10, 1910.

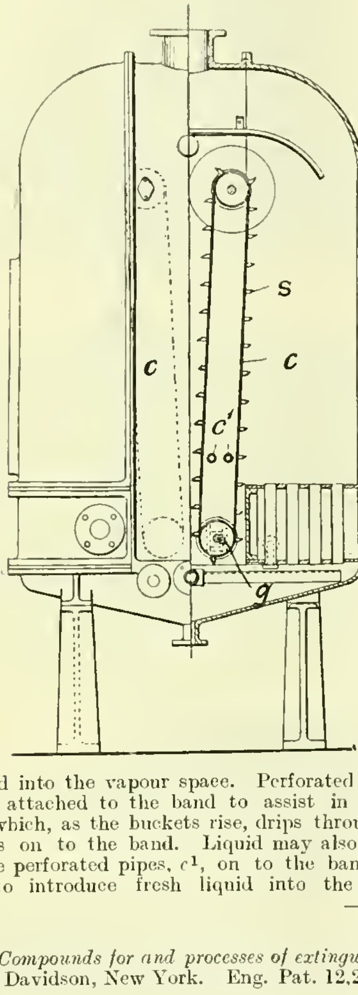
The mixture of solids and liquid is discharged from the lower end of the vacuum pan through a rotating plug-valve provided with pockets, into a vessel having a perforated bottom. The liquid drains through the perforated bottom and the solids are removed from the drainer by a worm conveyor into the boot of an elevator. (Reference is directed to Eng. Pats. 9518 of 1890 and 29,392 of 1904; this J., 1891, 683; 1905, 1216.)—W. H. C.

Compressed or liquefied gas; Containers or cylinders for ——. R. H. Campbell, Edmonton. Eng. Pat. 10,609, April 29, 1910.

The claim is for a valve which can be screwed over the closing cap of a tube or cylinder containing compressed gas and which contains a perforator by means of which the metallic cap which forms the closing device of the cylinder can be perforated.—W. H. C.

Evaporating, drying, distilling or crystallising; Apparatus for ——. Manlove, Alliott and Co., Ltd., and A. J. Liversedge, Nottingham. Eng. Pat. 16,523 of 1909; date of Appl., Jan. 17, 1910.

Endless belts, *c*, which pass over and are driven by the sprocket-wheels, *g*, are provided, within a vacuum pan. The liquid being heated is carried upwards as a film on the band into the vapour space. Perforated buckets, *s*, may be attached to the band to assist in lifting the liquid, which, as the buckets rise, drips through the perforations on to the band. Liquid may also be sprayed from the perforated pipes, c^1, on to the band, to wash it, or to introduce fresh liquid into the apparatus. —W. H. C.



Fires; Compounds for and processes of extinguishing ——. E. M. Davidson, New York. Eng. Pat. 12,233, May 18, 1910.

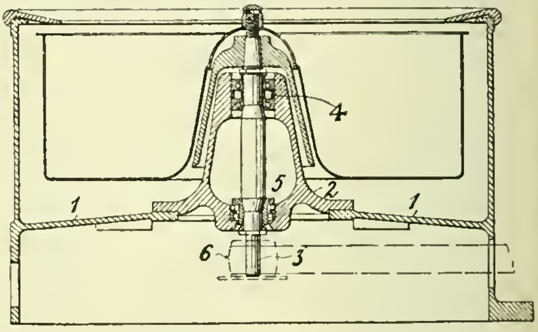
The fire-extinguishing composition consists of carbon tetrachloride saturated with carbon dioxide at, or slightly above, atmospheric pressure. As additional constituents, the liquid may also contain a small quantity of ammonia gas, and—for special purposes—one or more ingredients (such as oil of amber and nitrobenzene) for producing a thick, gummy, electrically-resistant deposit upon the burning material.—W. E. F. P.

Drying purposes; Rotary mould press for ——. O. Riemann, Hamburg, Germany. Eng. Pat. 19,205, Aug. 16, 1910. Under Int. Conv., Aug. 18, 1909.

In a mould press for the continuous treatment of moist materials, such as potato-gratings or pulp, the removal of moisture is effected at first by suction and finally by compression. The rotatory circular table carrying the moulds is arranged round a central, hollow pillar, closed at its upper end and connected with a suction pump at its lower end, and provided with peripheral openings on a level with the lower portions of the cylindrical moulds. In the walls of the moulds are lattice-like openings, covered on the inside by inserted screens. Each mould is surrounded by an enclosed space from which a radial passage extends to the central pillar, communication being made with the interior of the pillar by means of one of the peripheral openings therein; and each mould is provided with a piston operated vertically from below. As during the rotation of the table, each mould successively arrives at those positions in which communication is established between its radial passage and the interior of the pillar, the charge is subjected to the suction of the pump; after which upward compression by means of the piston ensues and the charge is ejected.—W. E. F. P.

Centrifugal machines. J. M. C. Paton, Nottingham. Eng. Pat. 20,945, Sept. 8, 1910.

The basket of the machine is supported by a short spindle, 3, which is mounted in a centre bracket, 2, and provided with an upper bearing, 4, and a lower bearing, 5. The lower end of the spindle projects a short distance below the base plate, 1, of the casing and may be provided with a belt-pulley, 6, for belt driving, attached to the crank disc of an engine for direct steam driving, or to a motor for electric driving. One pattern of centrifugal machine may thus be driven in either of the above-mentioned ways as desired.—W. H. C.



Gases or vapours; Apparatus for subjecting —— *to the action of liquids.* W. Feld, Hönningen-on-the-Rhine, Germany. U.S. Pat. 983,037, Jan. 31, 1911.

The gases are passed through a chamber into which the washing liquid is sprayed by centrifugal action. The spraying device consists of a series of rotating funnels, one within the other, which dip into the liquid in a shallow vessel. The funnels are of different heights, and the outermost one is highest and is perforated near its upper edge.—A. T. L.

Crystallisation of hot salt solutions; Apparatus for the ——. A. Wiese. Ger. Pat. 229,871, Jan. 30, 1910.

The hot solution flows through a long crystallising trough, in which cooling elements are suspended; a cooling liquid flows through the cooling elements in the opposite direction to that of the saline solution in the trough. The bottoms of the cooling elements are rounded and they decrease in cross-section from above downwards, whilst the walls nearer the outlet for the saline solution are made wider. In consequence of the smaller size of the cooling elements at their lower ends and the larger free spaces thus left between the elements, the crystals are able to accumulate until they fall off by reason of their own weight, and a special device for scraping them off is rendered unnecessary.—A. S.

Filling material for reaction towers; Cubical ——. R Pavlitzek. Ger. Pat. 229,999, Jan. 28, 1909.

The cubical filling material claimed has four solid side walls and interior partitions, 9^1, to 9^5 (see Fig. 1), which are provided with corrugations of such form that the raised portions and depressions are successively flatter from right to left and *vice versa*. The backs of the raised portions are provided with projections as shown in Fig. 1. A second form of the filling material is shown in Fig. 2. This is fitted with diagonal partitions, *a*, which are joined to those of adjacent blocks of the filling material by means of projections, a_1, and corresponding notches, whilst communication between the interiors of the different blocks is afforded by the pipes, *b*.—A. S.

Fig. 1.

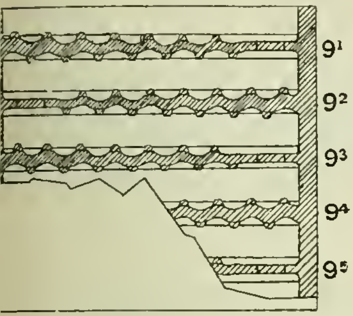
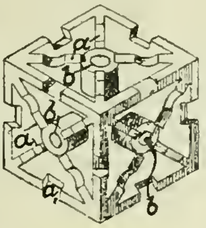


Fig. 2.



Centrifugal [*separating*] *apparatus*. The Hydraulic Separating and Grading Co., Ltd. Fr. Pat. 420,419, Sept. 15, 1910. Under Int. Conv., Sept. 20, 1910.

See Eng. Pat. 21,421 of 1909; this J., 1910, 1239.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Waste-gas purification; Clarification of the water used for ——. W. Petersen. Stahl u. Eisen, 1911, 31, 270.

It is stated that the addition of milk of lime (320 kilos. of lime in twenty-four hours) completely clarified the wash water for 40,000 cub. m. of blast-furnace gas used for heating, and 10,000 cub. m. of engine gas.—A. H. C.

Petroleum field of Maikop. M. v. Glasenapp. Chem-Zeit., 1911, 35, 142—143. (See also this J., 1910, 1364.)

Petroleum deposits appear to be very widely distributed in small quantities throughout the N.W. Caucasus. The first borings in one of the areas up to August, 1910, proved failures, but recently hopes have been somewhat raised by the discovery of petroleum in some places. According to the Maikoper Zeitung (Russian) there appear to be two centres of the petroleum deposits in the Maikop district—*viz.* at Schirwanskaja on the river Tschekoch and to the north of Chadyshinskaja. The few positive results obtained in the borings lead to the conclusion that there are two zones in the deposits, the upper containing chiefly heavy petroleum and the lower yielding products richer in petroleum spirit and lamp oils. The discovery of several fountains in the first of these areas has caused difficulties in the storage of the petroleum, and owing to the lack of iron tanks large quantities of the oil have been stored in pits dug in the earth and surrounded by walls. Some of the petroleum leaked through these and contaminated the river Tschekoch, and, as the result of complaints from the villagers, this river (which contains but little water) has recently been dammed up. The Spies Co. has provided earth reservoirs to receive 8000 tons (metric) of petroleum, whilst the Ssaltykow Co. now has iron tanks with a capacity of 16,000 tons, and has a daily output of about 20 tons. In the second area a petroleum of sp. gr. 0·860 was found at a depth of 130 m.; and the Spies Co. subsequently discovered a fountain. Petroleum wells were also found to the north of Chadyshinskaja. Three English Companies have erected small refineries on the river Pschechá, which are capable of dealing with 50 tons of crude petroleum a day. Refineries are also to be built at Jekaterinodar and at Noworossijk, a Black Sea port, and for this purpose a pipe line (132 kilom.) from Chadyshinskaja to Jekaterinodar is in process of construction, whilst the products will then be forwarded to Noworossijsk in tank-wagons by rail (135 kilom.). The pipe line to a station on the proposed railway line between Maikop and Tuapse, the preliminary surveys for which have already been made by the English Companies, cannot be in working order for 4 years, whilst in its present condition Tuapse is little suited for the export of petroleum products. Although a conclusive judgment as to the value of the Maikop petroleum deposits can only be formed after the results of the borings of the present year are known, it is hardly likely that the exaggerated expectations of the richness of this district in petroleum will be fulfilled.—C. A. M.

New method of filtering gases. Müller. *See* X.

Use of oil [*petroleum*] *for smelting.* Hamilton. *See* X.

Patents.

Coke-ovens and retort furnaces. O. Benninghoff and A. Klönne, Dortmund, Germany. Eng. Pat. 7704, March 30, 1910.

In order to prevent the formation of graphite by the decomposition of the gas in contact with the hot walls of the retort, a single cooling channel is provided immediately above the gas space over the fuel. This cooling channel is either cooled directly by circulating a cooling medium, which may be air or water, through it, or it may be arranged as a gas outlet channel from the oven or retort, in which case auxiliary cooling channels are arranged on either side of and parallel with the gas channel.—W. H. C.

Gas; Process for the manufacture of ——. G. H. Waring, Omaha, Nebr., Assignor to The United Gas Improvement Co., Philadelphia, Pa. U.S. Pat. 982,754, Jan. 24, 1911.

Air is passed through a generator containing incandescent fuel to obtain producer gas and this gas is then burned with a secondary supply of air in a chamber filled with chequer brickwork in order to heat the latter. Oil is passed through the heated bed of fuel and is decomposed into permanent gas and vapours, and the vapours are further decomposed and fixed as gas by passing the mixture through the heated chamber containing the brickwork. The gas is then carburetted with a suitable hydrocarbon oil. Steam is passed at intervals through the generator and fixing chambers.—W. H. C.

Gas purifiers and the like. J. B. Scott, Cowdenheath, N.B. Eng. Pat. 12,296, May 19, 1910.

To facilitate the removal of the purifying material, end doors are provided, the purifier being entirely above the ground level and of such a height that a workman can enter it. A series of shelves are provided in the length of the purifier, and these can be removed one at a time until the opposite end of the purifier is reached. In charging, the space left between the door and the outermost shelves is filled in from a manhole in the roof, or the outermost shelves may be carried on the door. The gas mains pass over the roof of the purifiers, and the inlet mains pass vertically down through the purifiers and act as supporting columns.—A. T. L.

Gas purifiers. R. Dempster & Sons, Ltd., and J. W. Broadhead, Elland, Yorks. Eng. Pat. 12,894, May 27, 1910.

The grids which support the oxide or other purifying material are formed of rows of loose bars resting on bearers. The ends of the bars in each row come between the ends of the bars in adjacent rows and serve as distance-pieces.—A. T. L.

Inflammable spirit for use in internal-combustion engines or in the manufacture of illuminating gas. W. Higgins and G. H. Kemp, London. Eng. Pat. 25,739, Nov. 5, 1910.

The spirit consists of a mixture containing 70 to 90 per cent. of benzene, 30 to 8 per cent. of gasoline or pentane, and about 2 per cent. of carbon bisulphide.—A. T. L.

Coke ovens and the like ; Regenerative ——. J. Kros, Essen-Ruhr, Germany. Eng. Pat. 1906, Jan. 25, 1910. Under Int. Conv., Jan. 27, 1909.

See Addition of Jan. 27, 1910, to Fr. Pat. 391,228 of 1908 ; this J., 1910, 998.—T. F. B.

Coke-ovens. L. L. Summers, Chicago. Eng. Pat. 6504, March 15, 1910. Under Int. Conv., March 19, 1909.

See U.S. Pat. 943,609 of 1909 ; this J., 1910,144.—T. F. B.

Gas producers. Gutehoffnungshütte Aktienverein f. Bergbau u. Hüttenbetrieb, Oberhausen, Germany. Eng. Pat. 1900, Jan. 25, 1910. Under Int. Conv., Feb. 8, 1909.

See Fr. Pat. 411,703 of 1910 ; this J., 1910, 934.—T. F. B.

Gas : Apparatus for producing ——. H. Lage. Fr. Pat. 419,975, Aug. 2, 1910. Under Int. Conv., Aug. 2, 1909.

See U.S. Pat. 959,324 of 1910 ; this J., 1910, 807.—T. F. B.

Gas producers. A. S. Cambridge. Fr. Pat. 420,094, Sept. 6, 1910.

See Eng. Pat. 19,639 of 1909 ; this J., 1910, 1148.—T. F. B.

Methane ; Catalytic synthesis of ——. F. Bedford and C. E. Williams, Sleaford, Assignors to Cedford Gas Process Co., London. U.S. Pat. 983,199, Jan. 31, 1911.

See Eng. Pat. 17,017 and 22,219 of 1909 ; this J., 1910, 1242.—T. F. B.

Apparatus for gas analysis by the absorption method. Ger. Pat. 229,977. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Methyl alcohol ; Distillation of ——. *in aqueous solutions.* H. Bergström. Bihang till Jern-Kontorets Ann., 1910, No. 12. Papierfab., 1911, **9**, 154–155.

The author has determined the composition of the vapours produced by boiling mixtures of methyl alcohol and water of various concentrations. The determinations were carried out in glass flasks with short necks, the apparatus being protected from radiation up to the condenser. The results are given in the following table, with the remark that, owing to a slight dephlegmation taking place on the walls of the distillation vessel, the values for the percentage of alcohol in the vapours may possibly be a little too high.

Percentage of methyl alcohol, by weight		Percentage of methyl alcohol, by weight	
in the solution.	in the vapours.	in the solution.	in the vapours.
0·1	0·6	30·0	72·3
0·5	3·8	35·0	75·3
1·0	7·4	40·0	77·8
2·0	14·8	45·0	81·1
3·0	18·8	50·0	82·3
4·0	23·8	55·0	84·3
5·0	28·6	60·0	86·0
6·0	32·6	65·0	87·8
7·0	36·3	70·0	89·6
8·0	39·7	75·0	91·4
9·0	43·1	80·0	93·0
10·0	46·8	85·0	94·8
15·0	57·0	90·0	96·5
20·0	63·8	95·0	98·3
25·0	68·8	100·0	100·0

—J. F. B.

Arc lamp ; A new —— *with mercury cathode, giving white light.* E. Urbain, C. Scal, and A. Feige. Comptes rend., 1911, **152**, 255—256.

By striking an arc between a tungsten anode and a mercury cathode, 5 mm. apart, in a vacuum or an inert gas, the authors obtain a very bright light, similar in colour to sunlight and very rich in ultra-violet rays. The spectrum is continuous, with the mercury lines superposed. The potential difference *in vacuo* is 12 volts, but this can be greatly increased in the presence of an inert gas. The efficiency is about 0·45 watt per candle-power. The arc has of course a very high temperature, which explains the necessity for using the very refractory metal tungsten as anode.—W. H. P.

Patent.

Incandescence mantles for gas lighting ; Manufacture of —— A. F. Williams, Hyde Park, South Australia. Eng. Pat. 11,459, May 9, 1910.

See Fr. Pat. 415,980 of 1910 ; this J., 1910, 1294.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Stockholm tar. D. McEwan. Brit. and Col. Drug., 1911, **59**, 138.

The B.P. states under Pix Liquida that it is "a bituminous liquid obtained from the wood of *Pinus sylvestris* Linn., and other species of Pinus by destructive distillation. Known in commerce as Stockholm tar."

The tar exported from Stockholm in earlier times, and to which the term Stockholm tar was applied, was brought from the northern part of Sweden and from Finland, where the tar was produced by peasants from dry wood stumps burned in "tjärdålar" or specially made tar-burning ground. On arrival at the Stockholm Tar Court all barrels were "wrecked" before being shipped abroad. The procedure of wrecking was as follows :—After the barrel had been filled with tar it was left standing for some hours, when the water which had accumulated on the surface was drawn off and the barrel refilled with tar. The "wreckers," who were sworn servants of the Tjärhof, issued a certificate, which at that time was required for the export, stating that the barrels contained the regulation quantity and that the tar had been "wrecked." The old Stockholm tar was shipped in barrels of 125 litres. Several tar exporters in the North of Sweden still use barrels, which have been examined by the State Comptrollers as to their capacity, and if found to hold the right measure the barrel is stamped with three crowns. Many importers attach great importance to this mark, and erroneously look upon it as a quality mark. A variety of tars differing very much from one another are imported from Sweden. So-called Stockholm tar is generally shipped in three qualities or grades, viz. : Fine thin (no grains or crystals), middle fine or ordinary (either gluey or thin and fine-grained), thick (very coarse-grained). The name "Umea tar" is applied to similar tar produced in the Umea district, and shipped from the port of Umea. This tar is delivered in "Swedish barrels," containing 27½ gallons, and weighing 167 kilos. gross and 133 kilos. net. "Umea tar" is considered the best in the market. "Skelleftea" and "Lulea" tar are of a similar quality. These three tars are sometimes also shipped as "Stockholm tar." Swedish "Factory tar"—obtained from waste wood in charcoal kilns at the saw mills, and produced as a by-product in charcoal-burning—must not be confounded with "Stockholm" or "Umea" tar. It is easily distinguished by its colour and smell. The genuine tar is yellow-brown or light-brown in colour, and with a turpentine smell, while the factory tar is of a dark-brown or black colour with a strong smoky smell. The tar manufactured by peasants and shipped from Finland (Wasa and Uleaborg) was formerly, and is sometimes now, called "Stockholm tar," but is generally shipped as "Wasa tar."

Until comparatively recent years there were only two kinds of wood tar regularly exported to England, viz., Stockholm tar exported from the Gulf of Bothnia, and Archangel tar from Archangel. The latter was shipped in barrels containing about 112 litres. Then the so-called Russian tar exported from Riga, Libau and Konigsberg came on the market, and has largely taken the place of "Stockholm tar" owing to the scarcity and high price of the latter, and also because the Russian tar is obtainable at all times of the year. Disputes between buyers and sellers as to the real meaning of "Stockholm tar" have arisen since the appearance of the cheap factory tars on the market, and British importers have suggested that the term "Stockholm tar" should be retained for the peasant-made article, as it has been used for centuries, and for the "factory tar" "Swedish kiln wood tar." The Swedish exporters advise that buyers of tar should purchase from samples and insist on a full description of the tar. They much prefer this to a guarantee to sell "genuine Stockholm tar."

Patents.

Tar; Treatment of —— and apparatus therefor. E. Eaton, London. Eng. Pat. 3279, Feb. 10, 1910.

The apparatus consists of two stills, each having a furnace, the flue from each permitting the hot gases to pass once or more round one still and then to the flues of the other still before escaping into the air. The outlet pipes conveying the distillation products from the stills pass through the tar supply tank on their way to the condensers, so as to heat the tar before it is run into the stills. A closed vessel is connected with the stills, in which the residual tar is treated with acid; a flue from this vessel is also connected to a coil in the tar supply tank. The bottoms of the stills and of the last-mentioned vessel may be corrugated to increase the heating area.—T. F. B.

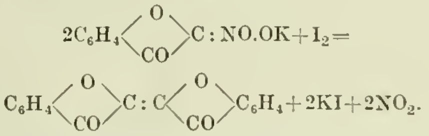
Nitration of m-nitraniline. Manufacture of nitro-derivatives of aniline. B. J. Flürscheim, Fleet, Hants. Eng. Pats. 3224, Feb. 9, 1910; 4701, Feb. 24, 1910; 9477, April 19, 1910; and 11,478, May 9, 1910.

Tetranitro-aniline is obtained by treating one of the following substances, or mixtures or solutions of them, with sulphuric acid and a nitrating agent:—*m*-Nitraniline: compounds derived from *m*-nitraniline by replacing one or more hydrogen atoms by nitro groups or other acidic radicles capable of being replaced by hydrogen or the nitro-group during nitration; such acidic radicles should be attached to the amino group (*e.g.*, —COR or —SO_2Ar), or in the *o*- or *p*-position to it (*e.g.*, sulphonic or carboxyl groups): *m*-nitraniline derivatives in which the amino group is combined with an aldehyde; here, again, one or more acidic radicles may be in the *o*- or *p*-position to the aldehyde-substituted amino group. The following is an example of the process:—One part of *m*-nitraniline and three parts of potassium nitrate are dissolved in 36 parts of concentrated sulphuric acid; the mixture is heated to about 70° C., external cooling being applied to prevent the temperature from rising. When the reaction is ended the solution is heated to 100° C. for a few minutes, then cooled and poured on ice. When recrystallised from nitrobenzene, the tetranitro-aniline is a yellow, crystalline compound, of m. pt. 212° C. with decomposition, and having a sp. gr. of about 1·8. It is easily soluble in acetone, less readily in acetic acid, benzene, and xylene, and almost insoluble in cold water. The nitro group in the 3-position may be readily replaced by other groups (*e.g.*, by the hydroxyl group by heating with sodium acetate solution). It may be used in the manufacture of explosives and dyes.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Oxindigo. R. Stoermer and K. Brachmann. Ber., 1911, **44**, 315—319.

Mielck (Diss., Rostock 1909) found that by treating the potassium salt of *aci*-nitrocoumaranone with acetic acid, a compound (m. pt. 276° C.) was formed, to which Stoermer (Ber., 1909, **42**, 199) ascribed the constitution of leuco-oxindigo, although Mielck could not succeed in showing that it contained hydroxyl groups. It is now found, however, that when bromine or iodine acts on the *aci*-salt the same compound is formed, which must be oxindigo, according to the equation:



$$2C_6H_4\left\langle\begin{matrix}O\\CO\end{matrix}\right\rangle C:NO.OK+I_2=$$

$$C_6H_4\left\langle\begin{matrix}O\\CO\end{matrix}\right\rangle C:C\left\langle\begin{matrix}O\\CO\end{matrix}\right\rangle C_6H_4+2KI+2NO_2.$$

The compound agrees in all respects with the oxindigo recently described by Fries and Hasselbach (this J., 1911, 124).—J. C. C.

Indigo; Imports of —— into the United Kingdom. Chem. and Drug., Feb. 18, 1911. [T.R.]

The President of the Board of Trade has furnished the following statement showing the quantity and value of natural indigo and synthetic indigo imported into the United Kingdom in each of the undermentioned years:—

Year.	Natural Indigo.		Synthetic Indigo.	
	Quantity.	Value.	Quantity.	Value.
	Cwt.	£	Cwt.	£
1906	7,641	111,445	39,042	147,325
1907	11,116	151,297	41,379	158,481
1908	8,644	132.875	37,761	134,052
1909	10,051	139,335	33,494	117,100
1910	3,380	43,054	28,196	101,249

The imports of indigo substitutes are not separately recorded in the trade returns of the United Kingdom.

Identification of food colours. Solubility and extraction of certain colours and the colour reactions of dyed fibre and of aqueous and sulphuric acid solutions. Loomis. See XIXa.

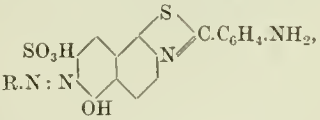
Patents.

Dyestuffs of the anthracene series; Production of ——. P. A. Newton, London. From Farbenfabr. vorm F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 1212, Jan. 17, 1910.

New red dyestuffs for wool are obtained by treating arylaminoanthrapyridones containing an arylamino radical with an unoccupied para-position, or their derivatives, with sulphonating agents in such a way that more than one sulphonic group is introduced into the molecule. Example:—The solution obtained by dissolving one part of 4-phenylamino-1-anthra-N-methylpyridone (obtained from 4-bromo-anthra-N-methylpyridone and aniline; see this J., 1908, 800) in six parts of fuming sulphuric acid (containing 20 per cent. of sulphur trioxide) is heated to 30°—40° C. for 1—2 hours. The mixture is then poured into 60 parts of water and the dyestuff which separates after a short time as vermilion red crystals is filtered off, washed and converted into the sodium salt.
—P. F. C.

Azo dyestuffs; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,172, May 5, 1910.

When dyestuffs of the general formula,



(compare this J., 1905, 1061) are diazotised and the products combined with naphthol-, aminonaphthol- or acidylaminonaphthol-sulphonic acids, new dyestuffs are obtained which dye cotton in shades fast to acids or water. Example: 10·7 parts of o-toluidine are diazotised and the diazo-compound is added to a solution of 37·2 parts of *m*-aminobenzenylthio-2:5-aminonaphthol-7-sulphonic acid containing an excess of sodium carbonate. The dyestuff is collected, diazotised and the product combined with 25 parts of 1-naphthol-4-sulphonic acid in alkaline solution. It dyes cotton in pure yellowish red shades.—J. C. C.

Diazotisable dyestuffs; Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 25,292, Oct. 31, 1910. Under Int. Conv., May 3, 1910.

One mol. of a tetrazotised *p*-diamine of the diphenyl series is combined with one mol. of salicylic or *o*- or *p*-cresotinic acid, and the intermediate compound is combined in acid suspension with 1·8-aminonaphthol-4-sulphonic acid; these dyestuffs are now combined with the diazo compound of an acidyl-*p*-phenylenediamine or of *p*-nitraniline, and the products are saponified or reduced to produce a free amino group. The dyestuff obtained from benzidine, salicylic acid, and *p*-phenylenediamine dyes cotton green shades, which become somewhat darker on diazotising and combining with β-naphthol or *p*-phenylenediamine.—T. F. B.

Anthraquinone dyestuffs: Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst-on-the-Maine, Germany. Eng. Pat. 1807, Jan. 24, 1910. Addition to Eng. Pat. 24,920 of 1909.

Dyestuffs similar or identical with those previously described (this J., 1910, 749, 750, 1002, 1099) can be prepared by heating β-aminoanthraquinone or its substitution products with urea or with half a molecular proportion of an alkyl or aryl ester of chlorocarbonic acid. Similar urea derivatives can be produced by treating β-anthraquinonyl-urea chloride with ammonia or with primary or secondary bases of the aliphatic series. By the action of tertiary bases on β-anthraquinonyl-urea chloride, additive products are obtained which have similar dyeing properties. Further, by the action of 2:6-diaminoanthraquinonyl-urea chloride on aminoanthraquinones or aromatic amines or ammonia, etc., the corresponding urea derivatives are formed. Finally, phosgene may be caused to act on a ββ-diaminoanthraquinone.—J. C. C.

Vat dyestuffs of the anthracene series; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 3299, Feb. 10, 1910.

See U.S. Pat. 975,863 of 1910; this J., 1910, 1450. An oxidising or condensing agent may also be added to the mixture.—T. F. B.

Vat dyestuffs; Manufacture of green to black ——. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst-on-the-Maine, Germany. Eng. Pat. 22,014, Sept. 22, 1910. Under Int. Conv., Oct. 4, 1909.

Green to black dyestuffs of the Indigo series are obtained by introducing alkylthio-groups into the Indigo molecule in the meta position to the nitrogen. This is effected, for example, as follows: 5-amino-1-nitrobenzoic acid is diazotised and treated with potassium xanthate and the product is boiled with sodium ethyl sulphate, whereby 5-ethylthio-1-nitro-2-benzoic acid is produced. On reducing to the amino-acid and treating this with chloroacetic acid, 5-ethylthiophenyl-1-glycine-2-carboxylic acid is obtained, which melts at 230° C. The acid sodium salt of this is boiled with acetic anhydride for some time, the product rendered alkaline with sodium hydroxide and heated, and, by means of a current of air, the dyestuff is precipitated. It dyes cotton and wool from the vat in green to black shades.—J. C. C.

Anthraquinone derivatives applicable as vat dyestuffs; Manufacture of brominated ——. Act. Ges. für Anilin-Fabrikation, Berlin. Eng. Pat. 22,780, Oct. 1, 1910. Under Int. Conv., Dec. 31, 1909.

When the anthraquinone-acridones described in Eng. Pat. 12,653 of 1909 (this J., 1910, 267) are brominated by the usual methods, new dyestuffs are produced which give brighter and stronger shades than the unbrominated substances. Examples are given showing the method of bromination of methylanthraquinone-acridone, anthraquinone-acridone and anthraquinone-diacridone.—J. C. C.

Vat dyestuffs of the anthraquinone series; Process for preparing ——. Act. Ges. f. Anilinfabr. Ger. Pat. 229,465, Oct. 8, 1909.

The diazo compounds of amino-anthraquinones or their substitution products are heated with sulphur chloride in sulphuric acid or nitrobenzene solution. The resulting products dye cotton from the vat in brown to grey shades; they are quite distinct from the products obtained by treating diazo compounds of anthraquinone with thioantimonates or by the action of sulphur chloride on aminoanthraquinones.—T. F. B.

Leuco-compound of the gallocyanine series; Process for preparing a ——. Chem. Fabr. vorm. Sandoz. Ger. Pat. 229,400, Aug. 19, 1908.

Celestine Blue (obtained from nitrosodiethylaniline and gallamic acid) is converted into a new leuco-gallocyanine derivative by heating with a concentrated mineral acid other than nitric acid; ammonia and carbon dioxide are evolved during the reaction. When dyed or printed on textiles, this leuco-compound gives considerably bluer shades than does that of Celestine Blue. The purity of the shade depends on the concentration of the acid employed: the more concentrated the acid, the purer and bluer the shade will be.—T. F. B.

Dyestuffs of the tri-arylmethane series; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 6364, March 14, 1910.

See Fr. Pat. 415,229 of 1910; this J., 1910, 1296.—T. F. B.

Azo dyes. O. Günther and L. Hesse, Elberfeld, and A. Zart, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 982,952, 982,953, and 982,954, Jan. 31, 1911.

See Eng. Pat. 10,462 of 1909; this J., 1910, 685.—T. F. B.

Azo dye. O. Günther, L. Hesse, and H. Schweitzer, Elberfeld, and A. Zart, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 982,955, Jan, 31, 1911.

See Addition of June 6, 1910, to Fr. Pat. 405,928 of 1909; this J., 1911, 17.—T. F. B.

Vat dyestuffs and process for preparing them. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Sept. 20, 1910, to Fr. Pat. 418,344, July 18, 1910. Under Int. Conv., Nov. 4, 1909.

See Eng. Pat. 27,773 of 1909; this J., 1910, 1296.—T. F. B.

Compounds and colouring matters of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 11,473, May 9, 1910.

See Fr. Pat. 416,734 of 1910; this J., 1910, 1369.—T.F.B.

Monoazo colouring matters; Manufacture of ——. Anilinfarben und Extract-Fabr. vorm. J. R. Geigy, Basle, Switzerland. Eng. Pat. 18,099, July 29, 1910. Under Int. Conv., Oct. 1, 1909.

See Ger. Pat. 226,242 of 1909; this J., 1910, 1450.—T. F. B.

Monoazo dyestuff for chrome-mordanted wool. H. Geldermann, Gross-Lichterfelde-Ost, and H. Oster, Charlottenburg, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 983,132, Jan. 31, 1911.

See Eng. Pat. 23,738 of 1909; this J., 1910, 686.—T. F. B.

Monoazo dye. E. Berthold. Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 983,805, Feb. 7, 1911.

See Ger. Pat. 228,258 of 1909; this J., 1911, 17.—T. F. B.

Vat dyestuffs of the anthraquinone series and process for producing them. Act.-Ges. f. Anilinfabr. Fr. Pat. 420,399, Sept. 14, 1910. Under Int. Conv., Dec. 31, 1909.

See Eng. Pat. 22,780 of 1910; preceding.—T. F. B.

Monoazo dyestuff and process of making same. O. Ernst and H. Eichwede, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst-on-Maine, Germany. U.S. Pat. 983,486, Feb. 7, 1911.

See Eng. Pat. 12,426 of 1910; this J., 1910, 1002.—T. F. B.

Azo dyestuff suitable for use in preparing lakes fast to light; Process for making a red ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 420,601, Sept. 20, 1910. Under Int. Conv., Oct. 21, 1909.

See Eng. Pat. 22,289 of 1910; this J., 1910, 1297.—T. F. B.

[*Thioindigo*] *vat dyestuffs; Process for making green to black* ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 420,709, Sept. 14, 1910. Under Int. Conv., Oct. 4, 1909.

See Eng. Pat. 22,014 of 1910; preceding.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Silk; Adulteration of raw ——. Lewitzki. Färber-Zeit., 1911, 22, 42.

The individual fibres of each of several skeins of silk were found to be of widely varying strength, fineness and extensibility. On examination it was found that in addition to 4 per cent. of weighting consisting of soap, fat and glycerin, the silk also contained methyl orange. When the dyestuff was destroyed by treatment with a solution of hydrosulphite, some parts of the silk were stripped to a white, some to a pale yellow and some were unaffected. The silk had obviously been reeled from all sorts of old cocoons and then tinted with methyl orange to give it the appearance of a uniform product.—P. F. C.

Mineral oil stains [*on fabrics*]; *Study on* ——. A. Scheurer. Bull. Soc. Ind. Mulhouse, 1910, 80, 343—348.

The following substances were studied:—Yellow beeswax, m. p. 62° C.; tallow; stearine, m. p. 69° C.; spermaceti, m.p. 49° C.; vaseline; paraffin, m.p. 60° C.; mineral oil containing 1 per cent. of paraffin; indiarubber; gutta-percha; ozokerite; ceresin (½ wax, ½ ozokerite); anthracene, m.p. 213° C.; phenanthrene, m.p. 100° C. *Action of cold water.* The fatty substance was dissolved in benzene to a 1 per cent. solution, and this was dropped on to the fabric (75/26 bleached Alsace). After completely drying in the air the fabric was placed on the surface of water. All the samples were wetted except the spots produced by paraffin, ozokerite and spermaceti. The paraffin resisted the water most completely, and the spermaceti least completely of the three. *Degree of dilution up to which the resistance of paraffin to water is maintained.* Solutions of 1, ½, ¼, etc. to 1/64 per cent. in benzene were used. When the samples were tested the same day, the 1/8 per cent. solution still produced impermeable stains; with 1/16 per cent. the stains were only temporarily impermeable. When samples from the previous evening were tested, only the stains from the ½ and 1 per cent. solutions proved to be impermeable; this fact is probably due to the spreading of the stains. By measuring the area of the stain from each drop of known volume, the concentration on the fibre of the paraffin when impermeability was just obtained was calculated, and was found to be ½ to 1 per cent., calculated on the weight of the cotton. The samples prepared with a 1 per cent. solution of paraffin were submitted to a cleaning process comprising treatment with lime and caustic soda lyes, the latter containing colophony. The stains were removed to the extent of three-quarters of their area, the remainder forming a ring, in the centre of which was a portion which was wetted by water. Stains produced by benzene solutions of tallow and of paraffin of varying strengths were then cleaned with solutions of lime and of caustic soda and colophony. The tallow stains were completely removed by this treatment. Stains produced by paraffin of 5 per cent. strength remained unchanged. Stains were then produced with mixtures of 5 grms. of paraffin with 1, 5, 15 and 95 grms. of tallow respectively, and the samples subjected to a complete cleaning as before. The mixture with 95 grms. of tallow was incompletely removed, whilst those with a less proportion of tallow remained perfectly impermeable. The author points out that mineral oils contain varying quantities of non-volatile substances, and that these are the only source of stains from lubricating oils of any importance. Fresh stains of Scotch petroleum are almost completely removed by cleaning, whilst if the stained fabric has been exposed to the air for some time beforehand, the stains are much less completely removed.—E. F.

Cotton cellulose; Action of water and alkali upon ——. C. G. Schwalbe and M. Robinoff. Z. angew. Chem., 1911, 24, 256—258.

It has already been shown by one of the authors (this J., 1910, 750) that only cellulose which has already been chemically affected by excessive bleaching, etc., undergoes hydrolysis when heated with water to high temperatures. For use in further experiments pure cotton cellulose was prepared by boiling pure unbleached Egyptian cotton with alkaline rosin soap solution, washing with hot water, and very carefully bleaching. The resulting product had a corrected copper value of only 0·04. It was found that in bleaching the cellulose with hypochlorite solution, followed by "souring" with hydrochloric (or acetic) acid, the formation of oxycellulose was promoted by the use of lower strengths of acid. In addition to determinations of the solubility of the cellulose in dilute lyes, the results of which confirmed those previously obtained (*loc. cit.*), the "mucilage values" (*i.e.*, the weight of the flocculent matter precipitated by alcohol after neutralisation of the alkaline extracts) were also ascertained. Above 150° C., much larger mucilage values were obtained, and hence for this value, too, 150° C. appears to be a "critical temperature" in the case of cotton cellulose. A determination of the copper values of cotton cellulose treated with hot lyes, showed that a concentration of 4 per cent. of alkali was (as in the case of cold lyes) the most destructive. The products of hydrolysis formed by the action of 1 and 2 per cent. sodium hydroxide solution appeared to undergo decomposition above 100° C., since there was a decrease in the copper values. In the case of the products formed by lyes of 3 per cent. strength (or over), this decrease (decomposition) did not begin below 135° C. The decrease in the hydrolysis effected by lyes of 5 per cent. strength and over is probably due to the beginning of mercerisation (hydration). There appears to be a difference in these respects between different kinds of cotton, American cotton for instance giving much higher copper values than Egyptian cotton.—C. A. M.

Artificial silk from nitrocellulose; The bleaching and drying of ——. A. Dulitz. Chem.-Zeit., 1911, 35, 189—190.

In the bleaching of denitrated collodion silks, bleaching powder is now totally discarded, since, at the necessary concentrations, it injuriously affects the strength of the threads and gives rise to subsequent discolouration. Various peroxides and per-salts have been tried with some success, but owing to their high cost and to the fact that they produce a hard thread, they have not been generally adopted. Sodium hypochlorite at a concentration of 0·5 grm. of active chlorine per litre, preferably prepared by electrolysis is now in general use, sometimes with the addition of sodium carbonate or Turkey-red oil. Various acids are used for souring: hydrochloric acid is most easily removed by washing and gives the softest thread; nitric and acetic acids give the "scroop" finish of real silk. Treatment with soap or Turkey-red oil, without washing, before immersing in the bleach liquor is advantageous. After souring, washing and final soaping, the skeins are drained in the hydro-extractor; they are then stretched and shaken so as to improve the lustre. In the nitrate stage, when the interior of the threads is still soft, steaming and calendering or stretching improve both lustre and strength. The proper organisation of the drying operation is one of the most important parts of the whole process. The silk is no true cellulose, but a mixture of derivatives and hydrates, oxycellulose being predominant. The irregularities which were formerly attributable to irregular denitration are now extremely rare. The author speaks most highly of the beneficial effects produced by a soap finish before hydro-extraction, particularly in protecting the cellulose from oxidation.—J. F. B.

Bagasse and other West Indian fibres; Utilisation for paper-making of ——. H. Wrede. Wochenbl. Papierfabr., 1911, **42**, 582—584.

THE West Indies, Central and South America are extraordinarily rich in vegetable materials which under proper development are capable of supplementing the supply of paper-making fibres, particularly in the United States. The sugar factories of Jamaica treat 65,000 tons of sugar cane annually, but on account of the absence of local supplies of coal, the bagasse and all other available wastes possessing a fuel value are utilised for steam-raising. This is one of the main obstacles to the establishment of a pulp-making industry. The negative results which have hitherto attended attempts for the utilisation of bagasse, without experienced direction, must not be taken too seriously, since it has been proved that with proper organisation good results are to be looked for. The soda process is evidently unsuitable to the conditions, and the sulphate process shows a much better prospect. Possibly a combination of the sulphate process with a special modification of the sulphite process will provide an ultimate solution of the problem. Besides bagasse, these regions produce enormous quantities of banana stems, containing a most valuable fibre, but the experiments for the recovery and utilisation of this fibre are only in the initial stages. Palms are also abundant and the author states than an excellent printing paper was made from a damaged cargo of palm leaf fans, the material being treated in the same manner as straw. In the Republic of Costa Rica there is a small paper mill manufacturing a very inferior packing paper from bagasse and banana stems by the soda process.—J. F. B.

Wood pulp; Comparison of methods of sampling ——. J. Persoz. Rev. Gen. Mat. Col., 1911, **15**, 40—43.

THE author has carried out comparative investigations on various methods for taking samples from bales of wood pulp for the determination of the moisture. Notably he has compared the "strip" method advocated by himself with the "wedge" method proposed by Sindall and now officially adopted by the British Wood Pulp Association. The "strip" method was tested in four modifications: longitudinal strips, transverse strips, alternately longitudinal and transverse strips, and diagonal strips, strips being 4—5 cm. wide. The "wedge" method consists in cutting triangles with the centre of the sheet as apex, and portions of the various edges of the sheets successively as bases. At the same time as the samples were cut, the remainder of each sheet was weighed and the actual proportion of moisture in the entire sheet was determined. The investigations were then directed towards ascertaining how nearly the percentage of moisture in the samples coincided with that in the entire sheets from which they were taken. From this point of view it was found that the method of cutting diagonal strips gave the best results, with an average divergence of 0·26 per cent. in the case of dry chemical wood pulp and 0·19 for moist mechanical pulp. The "wedge" method showed average divergences of 0·52 and 1·35 per cent. respectively. The author contends that the "wedge" method is based on the fallacious assumption that the percentage of moisture is the same at all the edges of the sheet, whereas it is a known fact that, in pressing the web of pulp on the draining machine, the outside edges of the web are always drier than the middle, so that when the web is slit and cut into sheets the moisture is unevenly distributed. Moreover, according to the exposure of the bales in transit and storage, some edges will be drier than others. The author's results further prove that in order to arrive at the true percentage of moisture in a bale, the number of sheets sampled should be as large as possible (10 at least) and that the number usually selected in practice is far too small.—J. F. B.

Paper; Influence of high temperatures on the degree of hardness of sizing of ——. C. Bartsch. Mitt. K.K. Materialprüfungsamt, 1911, **29**, 53—55.

IN connection with investigations on the disinfection of papers, the author subjected a number of writing and printing papers to the action of dry heat and determined the degree of hardness of sizing before and after the tests. The samples were heated for three hours at 98° C., for 3 hours at 108° C., and for 1 hour at 148° C. As indicated in the tabulated results, practically all the papers showed an improved resistance to ink after heating, an improvement which was greater the higher the temperature of heating. But this improvement lasted only for a short period when the samples were exposed to an atmosphere of 65 per cent. humidity. The hardness of sizing gradually fell off, and after the lapse of a few weeks the samples were no better than in the original state. The reversion took place more slowly in the case of the more strongly heated papers than in those which had not been subjected to so high a temperature. Moreover, this reversion was progressive, and after a few weeks longer the heated papers were inferior in ink-resisting qualities to the originals. The sole exception to the above rule was an animal-sized paper, which was unchanged by heating. The phenomena observed are considered to be the result of a dehydration brought about by heating, whereby the penetration of the ink is impeded; on exposure to moist air the paper becomes re-hydrated and the increased resistance is lost. Hence, as a practical result, it follows that sizing tests made on paper, as it comes hot from the drying cylinders of the machine, should not be regarded as final, since subsequent tests made under ordinary conditions may lead to quite different results.—J. F. B.

Wisconsin cane fibre experiment. See XVII.

PATENTS.

Cellulose from fibrous materials; Process for producing ——. G. H. Marshall, Roanoke Rapids, N.C. U.S. Pat. 982,379, Jan. 24, 1911.

MATERIALS, yielding cellulose, and containing piths or woody stalks, are mixed with water and weak alkali, and steamed under pressure. The material is then washed.
—B. N.

Cellulose products from cellulose solutions; Manufacture of filaments, films and other ——. R. Hömberg, Charlottenburg, Germany. U.S. Pat. 983,139, Jan. 31, 1911.

FORMALDEHYDE is added to the cuprammonium solution of cellulose and the manufacture is completed in the usual manner.—P. F. C.

Cellulose from wood waste, bark, straw, etc.; Process for preparing ——. W. Hellwig. Ger. Pat. 229,390, June 17, 1909.

THE material is digested with a solution of bleaching powder and hydrochloric acid, and also with potassium or sodium carbonate, then removed from the liquid, neutralised, and at once worked up into pasteboard or paper, the non-cellulose matters acting as adhesive for the cellulose.—T. F. B.

Vegetable matter [for preparing fibres]; Process of treating ——. G. D. Burton, Boston, Mass. U.S. Pat. 976,037, Nov. 15, 1910.

The vegetable matter from which the fibres are to be separated is packed in a revolving barrel-shaped vessel, mounted on trunnions and provided with reversing gear. The material is first treated with a soap solution to which an acid, such as oxalic or acetic acid, has been added, and an electric current is passed through the mass during treatment. The material is next subjected to the action of a solution containing animal oil or grease, likewise with the passage of an electric current and the reversible rotary motion of the drum. The material is finally soaped, and then immersed in dilute alcohol, the vapours of which are recovered.—J. F. B.

Paper; Process of preparing fibrous materials for the manufacture of ——. G. D. Burton, Boston, Mass. U.S. Pat. 982,170, Jan. 17, 1911.

Hemp, flax or similar materials are cut up small, and then boiled in a solution of sulphuric acid. Afterwards the material is immersed in a bath containing about one part of sodium chloride to two parts of sodium carbonate and an electric current is passed through the bath during the period of immersion.—J. F. B.

Paper making machines; Apparatus for reclaiming fibre, loading, etc., from the waste waters of ——. S. Milne, Edinburgh. Eng. Pat. 496, Jan. 8, 1910.

The apparatus consists of a series of vertical cylindrical tanks with conical lower portions. Each tank has an annular channel around its upper edge and an overflow spout leading into the next tank. Each tank also has a cylindrical partition extending from the top to a level part way down its interior, and a vibratory filter is situated at the top inside this cylindrical partition. The waste waters enter the annular channel at the top and are distributed around the outside of the cylindrical partition; they are thus caused to travel downwards a certain distance before they can rise to the overflow. The suspended matters are deposited in the conical portion of the tank, whilst the partially clarified water rises through the vibratory filter and overflows into the next tank, where it undergoes a similar treatment. By a system of pipes and loaded valves connected with the bottoms of the tanks, the deposited contents of each tank after the first are automatically discharged when the contents of the first or the preceding tank fall below a predetermined level, thus blending the discharged solid matters in suitable proportions.—J. F. B.

Pyroxyline compounds or compositions and method of manufacturing the same. W. G. Lindsay, Newark, N.J., U.S.A. Eng. Pat. 13,692, June 6, 1910. Under Int. Conv., June 26, 1909.

See U.S. Pat. 961,360 of 1910; this J., 1910, 875.—T. F. B.

Cellulose formates; Process for making ——. Verein. Glanzstoff-Fabriken A.-G. Fr. Pat. 420,856, Sept. 28, 1910. Under Int. Conv., Dec. 20, 1909.

See Eng. Pat. 15,700 of 1910; this J., 1910, 1199.—T. F. B.

Paper from sawdust or wood shavings; Process for making ——. P. A. Sparre. Fr. Pat. 420,640, Sept. 22, 1910. Under Int. Conv., Dec. 13, 1909.

See Eng. Pat. 29,118 of 1909; this J., 1911, 80.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Tussah silks; Bleaching of ——. F. J. G. Beltzer. Rev. Gen. Mat. Col., 1911, 15, 36—38.

The bleaching of tussah silks may be divided into three processes: degumming, decolourisation, bleaching proper. The degumming bath is prepared by dissolving 10 kilos. of cocoanut "Bensoap" in 1000 litres of soft water. "Bensoap" is a soap preparation containing 10 per cent. of benzene; it must be dissolved at a moderate temperature. From 2 to 5 kilos. of sodium perborate are then dissolved in the bath and the hanks of yarn are introduced. The temperature of the bath is cautiously raised until a permanent lather has formed, and the treatment is continued for 3—4 hours at a temperature ranging from 60° to 70° C. The degumming may be performed in two stages, first with a previously used degumming bath diluted to its original volume with water, and secondly with a fresh bath as described above. The preliminary treatment may be effected at 100° C. for 2—3 hours. The goods are drained, cooled, and submitted to the decolourising process with hydrogen peroxide, of 6—10 volumes strength, made slightly alkaline with ammonia and at about 30°—40° C. The silk is then washed and soured with a solution of 1 kilo. of oxalic acid in 1000 litres of water at 70° C. for 3—4 hours. The goods are bleached by means of a solution of sodium hydrosulphite.—J. F. B.

Exposure of dyed and undyed cotton to sunlight and to the light of the quartz-mercury lamp. A. Scheurer. Bull. Soc. Ind. Mulhouse, 1910, 80, 324—331.

The quartz-mercury lamp was suspended in a small dark chamber of sheet-iron at a height of about 40 cm. above the table on which the samples were exposed. The atmosphere of the chamber was kept at the atmospheric temperature by a current of water. Samples of cretonne dyed to a light shade with vat-dyed Indigo Blue were exposed to the light of the mercury lamp for 24, 88, and 176 hours. A series steadily diminishing in colour was thus obtained. When the samples were removed a fairly strong odour of ozone was observed. On prolonged exposure to the light the blue colour was changed to a yellowish shade. Two holes were then made in the roof of the chamber; the current of air then produced, due to the heating effect of the lamp, caused the ozonised air to escape freely, but this produced no appreciable change in the effect produced by exposure for a given time. A sample dyed with Fast Brilliant Benzo-Violet 2 RL, which is very sensitive to the decolourising influence of the light from a mercury lamp, was then exposed, covered in part by quartz crystals. Those parts of the sample which were reached by the light after traversing the quartz crystals were strongly decolourised, whilst those which had been shaded by the edges of the crystals remained relatively unchanged, although in direct contact with the ozonised air of the chamber. Thus the ozonised air alone does not produce the decolourisation. A sample of undyed white cotton was covered in places with thin glass (microscopic cover-slips) and exposed to the radiations for 48 hours, and also for 144 hours. It became light yellow in colour during the first period, and deeper yellow after the longer exposure, thus explaining the cause of the yellow shade finally produced on the indigo-dyed cotton. The fabric had also become tendered and when dyed with Methylene Blue acquired a blue shade, but those portions which had been protected during exposure by the glass remained white, had not tendered, and were only dyed by the Methylene Blue to a much lighter shade. Boiling Fehling's solution deposited a strong layer of cuprous oxide on the exposed portions, indicating that oxycellulose is produced. The experiment was then repeated, a plate of glass and a quartz crystal being placed on the fabric. The glass plate completely prevented the production of the yellow colour, whilst the portion covered by the quartz crystal was as deeply coloured as the uncovered portion. Therefore the effect is due to those radiations which are transmitted by quartz, and absorbed by glass, that is by those of wave lengths 3000 to 1860. A comparison was then made of the effects of normal sunlight and of the light from the quartz mercury lamp on light shades of indigo and on the following benzo dyestuffs:—Brilliant Solid Benzo Blue 4G and 2G, Benzo Violet 2RL, also BL, Light Benzo Bordeaux 6BL, Light Benzo Yellow RL, Solid Benzo Blue FFL, Light Benzo Red 8BL, and Benzo Orange 2RL. After exposure to dispersed sunlight under glass the benzo dyestuffs had scarcely been attacked during a period in which the light indigo shade was almost completey destroyed.

After exposure for 24 hours to the direct action of the quartz mercury lamp, on the other hand, the same benzo dyestuffs were profoundly altered, whereas the light Indigo Blue shade was barely diminished in intensity by 20 per cent. Thus the ultraviolet radiations react with much more energy on the benzo dyestuffs than on Indigo Blue, whilst light which has been freed from ultraviolet rays reacts with much more energy on Indigo Blue than on the benzo dyestuffs.—E. F.

Patents.

Bleaching, washing and treating textile fabrics ; Machine for ——. J. Brierley and S. Melling, Manchester. Eng. Pat. 17,331, July 21, 1910.

In machines which are provided with winces or drums for delivering cloth in the rope form to attendants who guide it on to stillages, there is a danger of the material lapping round the drum, drawing the cloth upwards from below and thus entangling the attendant. To prevent this the machine is provided with suitable bearings for two plates, each pivoted upon its own centre. One of these plates carries two open finger-like projections and the other a single projection which interlocks with the first two when the plates are rotated. The plates are connected with loaded levers which tend to bring the fingers together. The material on being delivered from the drum of the machine is led between the members of this nipping device, and travels downwards freely. An upward pull of the cloth serves to rotate the members and cause the fingers to interlock. This tendency is assisted by the load of the levers, so the device firmly grips the material and arrests it.—P. F. C.

Dyeing pieces of fabric under the level of the dyeing liquid ; A device for —— *and comprising two winding rollers driven by tractional rollers.* H. Eicken, Grevenbroich, Germany. Eng. Pat. 11,182, May 5, 1910.

Two winding-on rollers arranged inside a dye-vat are each frictionally driven by peripheral contact with a tractional roller over which the fabric is guided. These tractional rollers are provided with longitudinal flutings which carry round some of the dye-liquor and press it into the rolls of cloth on the winding on rollers. To hasten the dyeing operation the dye-vat can also be provided with two nips between which the cloth travels during its journey from one winding-on roller to the other, each pair of nipping rollers comprising one fluted roller and one roller having a soft coating.—P. F. C.

Azo dyes on the fibre ; Production of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,139, May 17, 1910.

Acidyl-*m*-aminophenols or cresols can be combined on the fibre with diazo-compounds or diazotised azo colouring matters and the shades produced are fast to washing. Thus diazo-*a*-naphthylamine yields a yellow and diazotised Diazoindigo Blue 2RL a violet on being combined with benzoyl-*m*-aminophenol.—P. F. C.

Colours on the fibre ; Production of new ——. P. A. Newton London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,140, May 17, 1910.

Brown shades are produced on vegetable fibres by padding the material with solutions of chrysoidine mono-sulphonic or mono-carboxylic acids and afterwards treating it with diazotised ortho-, meta-, or para-nitro-anilines. The shades obtained are very fast to washing and can be readily discharged.—P. F. C.

Fast dyeings on the fibre ; Process for producing ——. Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 25,007, Oct. 27, 1910. Under Int. Conv., Jan. 12, 1910.

The leuco-compounds of the triphenylmethane series which are obtained by the action of ortho-substituted aldehydes on ortho-hydroxycarboxylic acids, can be fixed in acid baths on wool and by subsequent treatment of the nearly colourless wool with chromates and acids, the chrome lakes of the carbinols are produced on the fibre, giving dyeings of great fastness. The shades thus obtainable vary from blue to violet.—P. F. C.

Woollen textile fabrics ; Method of and apparatus for finishing ——. E. Gessner, Aue, Germany. Eng. Pat. 18,356, Aug. 3, 1910.

The material, whether steamed continuously or on rollers, is sent in the steamed and heated condition through a cold air-chamber in which it is quickly cooled without losing its moisture by evaporation. The air-chamber is kept cool by driving previously cooled air into it or by fixing pipes inside the chamber and circulating a cold liquid through them.—P. F. C.

Linen waterproof and washable ; Process of rendering ——. W. Brückner, Charlottenburg, Germany. Eng. Pat. 1799, Jan. 24, 1910. Under Int. Conv., Jan. 25, 1909.

The linen, preferably previously prepared with a starch solution to which zinc chloride has been added, is treated with a solution of nitrocellulose in a mixture containing acetone, amyl alcohol, a little acetic acid and zinc chloride. —P. F. C.

Drying yarn and other fibrous materials ; Means or apparatus for ——. A. N. Marr, Thorner, Yorks. Eng. Pat. 1814, Jan. 25. 1910.

In drying machines of the kind described in Eng. Pats. 15,133 and 19,508 of 1905 (this J., 1906, 807 and 924) a pair of endless chains are arranged to travel along the drying chamber, these chains being connected at regular intervals by a number of rods provided at their ends with runners which travel along guides fixed to the sides of the drying chamber. From these rods are suspended cradles having pegs fixed vertically on their upper surfaces to carry the cops, bobbins or spools to be dried. Means are provided for automatically removing the cops from the pegs when dry.—P. F. C.

Bleaching liquors ; Process for producing —— *by treating alkaline lyes with chlorine.* Deutsche Solvay-Werke Akt.-Ges. Fr. Pat. 420,358, Sept. 13, 1910. Under Int. Conv., Dec. 31, 1909.

See Eng. Pat. 21,411 of 1910 ; this J., 1911, 205.—T. F. B.

Dyeing fabrics ; Means for ——. L. Derreumaux-Bulteau, Brussels. Eng. Pat. 15,407, June 27, 1910. Under Int. Conv., July 21, 1909.

See Fr. Pat. 405,290 of 1909 ; this J., 1910, 419.—T. F. B.

Linen ; Process for waterproofing ——. H. Peters. Fr. Pat. 420,127, Sept. 7, 1910. Under Int. Conv., Jan. 12, 1910.

See Eng. Pat. 870 of 1910 ; this J., 1911, 206.—T. F. B.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Pyrites ; Present position of the roasting of —— *in mechanical furnaces.* P. Truchot. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. II, 64—72.

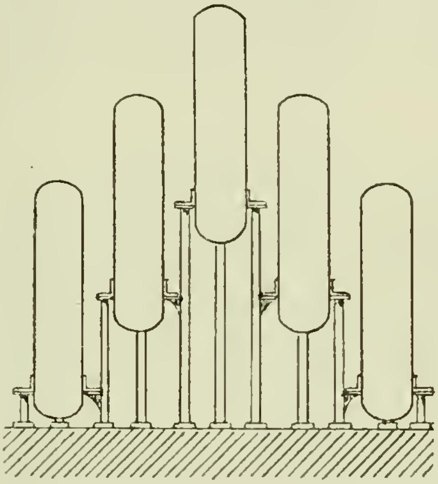
The employment of mechanical furnaces for the roasting of pyrites has extended widely in the past few years, especially in France, Germany, Belgium, Spain, and Italy. The chief advantages are the lower cost of working, the more efficient desulphurisation of the pyrites, and the more uniform composition and higher sulphur dioxide content of the burner gases. The mechanical furnace in general consists of a metal cylinder lined with refractory brick, and provided with a series of superposed circular hearths, communicating alternately at the centre and at the periphery by means of openings. A hollow water- or air-cooled shaft passes through the furnace, and carries arms provided with projections which agitate the pyrites on the hearths and move it from the periphery to the centre, and *vice versa*, on alternate hearths. The author deals more particularly with the Kauffmann furnace which he considers to be the best, especially with regard to simplicity of construction and the length of life of the agitating arms. In a furnace with a daily output of 3250 kilos., which has been in use at Puiseaux, France, the arms working over the upper hearths have lasted for at least 1 year, and the sulphur content of Sain-Bel pyrites has been reduced from 49 down to 0·47 per cent. The latest type of Kauffmann furnace has only three hearths, and the agitating arms work on what is called the "differential" system, that is, the teeth of one half of the arm move the pyrites a certain distance (say 25 mm.) in one direction, whilst the teeth on the other half move it a shorter distance (say 22 mm.) in the reverse direction. By this device, the shaft may be rotated more rapidly, and the furnace with three hearths is able to deal with as large a quantity of pyrites (3000 kilos. daily) as a furnace with five hearths of the old type. When using mechanical furnaces, special precautions have to be taken to prevent loss of heat, as otherwise irregular working of the Glover tower would be caused, since the gases from a set of mechanical furnaces are somewhat cooler than those from shelf-burners of the Malétra type, and are cooled further by the necessary treatment for the removal of dust. Figures are given showing the comparative costs of installation and of working of batteries of 32 shelf-burners of the Malétra type and of 7 Kauffmann furnaces (5 hearths) capable of dealing with 22,400 kilos. of pyrites (50 per cent. of sulphur) per 24 hours. The cost of installation of the set of mechanical furnaces is given as double that of the set of shelf-burners, but after allowing for interest, depreciation, etc., the cost of working is 23·01 francs (18s. 2d.) per 24 hours or 1·027 francs (9¾d.) per metric ton of pyrites in favour of the mechanical furnace, without taking into account the better utilisation of the sulphur and the greater value of the burnt pyrites when using the latter. Moreover, the capital cost of the newest Kauffmann furnace with three hearths is considerably less than that of the older type.—A. S.

Sulphuric acid chambers ; Movement of the gases in ——. K. J. Beskow. Z. angew. Chem., 1911, **24**, 200—206.

With the view of aiding or intensifying the "Abraham" motion of the gases in rectangular chambers (assuming such a motion to exist), the author fitted a chamber with an arrangement for subdividing the entry-pipe for the gases. This was divided into 10, and 5 of these pipes entered the chamber at a cross-section close to the end, 5 at a cross-section nearly half-way along the chamber. At each of these cross-sections two pipes entered at opposite sides near the bottom, so as to deliver gas towards the centre line, two entered by the roof near the sides, delivering gas vertically downwards, and one, entering through the roof at the centre, ended in a ⊥, which delivered gas horizontally outwards. No "intensification" resulted ; the effect of the arrangement could not be detected either in the increased yield of the chamber or in the diminution of nitre-consumption. With this chamber the author experimented, by means of a shorter form of the boats used by him on a former occasion (this J., 1908, 1150), to ascertain whether transverse currents (in the direction of those issuing from the ⊥-pipe) were general in the chamber. A series of 20 sets of four boats, arranged in a horizontal plane on a level with, opposite to, and at different distances along and across the chamber from one of the orifices of the ⊥, each set containing a boat parallel to the length of the chamber, one transverse to it, and two at angles of 45° between these directions, showed that only immediately opposite to the orifice was there any preponderating transverse current, and that everywhere else currents parallel to the length of the chamber preponderated. In a horizontal plane, half a metre lower down, the cross current preponderance broadened out a little, but only a little ; and in a plane another metre lower no preponderance of currents in any direction could be observed. When these same boats were removed to a tangential chamber, they gave the same indications of spiral currents that had previously been observed with the original form of boat. The author concludes that even with the artificial encouragement afforded by the means of entry which he adopted (or with that suggested by Rabe, this J., 1910, 149), no motion of the gases in the chamber such as suggested by Abraham can be produced or maintained, at all comparable in intensity with the currents in a tangential chamber ; and that any natural tendency to the production of such motion must be too slight to exert any influence on the process. No attempt to produce any specific motion of the gases by introducing them in particular directions is likely to be successful unless the shape of the chamber lends itself to that particular mode of circulation.—J. T. D.

Ammonia-soda ; Dieuze system. K. W. Jurisch. Chem. Ind., 1911, **34**, 73—75.

The author describes in detail an ammonia-soda factory erected in 1877 at Dieuze, Lothringen. The ammoniacal brine was carbonated in vertical cylinders with conical bottoms, supported on four columns 1·5 to 2 m. high. Three carbonators were grouped together, each holding 8 cb. m. of liquid. Carbon dioxide was introduced through a distributing pipe at the bottom of the first-charged carbonator, passing thence through the second, and finally through the most recently charged vessel, each carbonator being cooled by the external application of cold water. The finished bicarbonate mud was at once transferred to the vacuum filters. These consisted of sheet iron tanks, 1·5 m. square and 1· to 1·2 m. high, the filtering layer occupying half the height, and two filters being provided for each carbonator. In front of each pair of filters a container was sunk in the ground, to collect the mother liquor and washing water. The mother liquor and washing water were distilled in 5 vertical cylinders, arranged stepwise as in the figure, the highest cylinder serving for preheating the liquor and driving off its free ammonia. After this preliminary treatment the liquor was run into the middle pair of cylinders, where it was mixed with milk of lime, and thence into the lowest pair, where it was completely freed from ammonia. Direct steam in counter-current was used for heating. The plant was intended for an output of 5000 kilos. of sodium carbonate in 24 hours, the loss of ammonia amounting probably to 6—9 kilos. of ammonium sulphate per 100 kilos. of sodium carbonate produced.—O. R.



Lime ; Solubility of —— in aqueous solutions of sugar and glycerol. F. K. Cameron and H. E. Patten. J. of Phys. Chem., 1911, **15**, 67—72.

The authors have determined solubility isotherms at 25° C. for lime in solutions of sugar and glycerol, by direct analysis of the liquid phase. The experiments were limited to comparatively small concentrations of sugar and glycerol by the great viscosity of more concentrated solutions, which delayed equilibrium inconveniently. In the system lime-sugar-water, the solid phase is one of a series of solid solutions, with calcium hydroxide as a limiting case. The solid phase in the system lime-glycerol-water at 25° C. is always calcium hydroxide, and the increased solubility of the lime is directly proportional to the concentration of glycerol.—W. H. P.

Potassium sulphate ; A new mineral [galafatite] and a new source of ——. N. Preus. Eng. and Min. J., 1911, **91**, 261.

Aluminous ores have been discovered in six different provinces of Spain. The most important deposit is near Benahabux, 10 km. (6·2 miles) from Almeria, and mining concessions have been granted covering 1000 hectares (2470 acres). The ore is composed of a new mineral, an aluminium-potassium sulphate, to which the name of *galafatite* (after the name of the discoverer) has been assigned. Several parallel veins 5—6 m. (16·5—19·8 ft.) wide, have been discovered, from which the ore can be extracted at a low cost. The ore, which is quite white when pure, has the sp. gr. 2·75, hardness 3·5. It is treated by calcination, followed by lixiviation with water, whereby a solution of potassium sulphate and a residue of nearly pure alumina are obtained. The calcined ore contains from 65 to 70 per cent. of alumina and 25—30 per cent. of potassium sulphate. It is stated that considerable quantities of the ore will be put on the market this year. —A. S.

Water of crystallisation in hydrated salts ; The constancy of ——. *Part I.* H. Brereton Baker and G. H. J. Adlam. Chem. Soc. Proc., 1911, **27**, 17—18.

The authors have found that telluric acid always contains an excess of water over the calculated amount even when dried by phosphoric oxide for six months in a vacuum. This excess is due to water occluded in the crystals, and water vapour cannot pass through a thin crystal of this substance. Determinations of the atomic weight of tellurium have been made by estimating the weight of water given off in the decomposition of telluric acid, as well as the total loss of weight. The mean of four determinations of the ratio $TeO_2 : O$ gave an atomic weight of 127·49. Experiments have been made with other hydrated crystals to find if such substances can be obtained in such a state as to be available for atomic weight determinations. By keeping the salts in an atmosphere containing a quantity of the partly dehydrated salt, such salts can be completely freed from adherent moisture. One such experiment with crystallised barium chloride ($BaCl_2.2H_2O$) gave 14·772 per cent. of water instead of 14·747. The similar method used by Guye and Tsakalotos (J. Chim. phys., 1909, **8**, 3) gave with the same salt 14·6765 per cent. of water. It was shown that if a salt be completely dehydrated and left in a moist atmosphere, it will take up almost exactly the same amount of water which corresponds with its water of crystallisation. For barium chloride the percentage was 14·750 instead of 14·747. Further, it has been shown that air will not pass through a crystal when the latter is used to close a vacuum tube. Water vapour will, however, pass through hydrated crystals from a moist atmosphere to a dehydrating agent, but a partial dehydration of the crystal on the side nearest to the dehydrating agent seems to be necessary. Water vapour will not pass through anhydrous crystals, and therefore occluded water cannot be removed by placing in a desiccating atmosphere.

Reactions in presence of nickel : (a) incapacity of nitrogen and hydrogen to unite in presence of iron and nickel ; (b) reduction of oxides of nitrogen, sulphur, and phosphorus in presence of nickel. P. Neogi and B. B. Adhicary. Z. anorg. Chem., 1910, **69**, 209—214.

Contrary to Ramsay and Young (Chem. Soc. Trans., **45**, 93), who stated that small quantities of ammonia are formed when a mixture of nitrogen and hydrogen is led over red-hot iron, the authors find that no formation of ammonia from its elements takes place in presence of either iron or nickel, provided the nitrogen used be free from nitric oxide. The most convenient method for the preparation of the nitrogen is to heat a mixture of ammonium chloride and sodium nitrite and remove the greater portion of the nitric oxide from the resulting gas by passing it through ferrous sulphate solution. The gas is then dried and freed from the small quantity of nitric oxide still remaining by passing it over heated metallic copper.

Nitric oxide is reduced to ammonia, sulphur dioxide to hydrogen sulphide, and phosphorus pentoxide to hydrogen phosphide by hydrogen in presence of reduced nickel. The reduction of nitric oxide in this manner is nearly quantitative. The reaction begins at about 300° C., and when once started, the temperature can be lowered to 120° C. without stopping it. On passing nitric oxide alone over reduced nickel, no formation of a nitride, nitrite, or nitrate of nickel was observed, and it is concluded that the nitric oxide is reduced directly by the hydrogen, the nickel acting as a catalyser. Some nickel sulphide is produced by the action of sulphur dioxide alone on nickel, and contrary to the statement in Watts' "Dictionary of Chemistry," Vol. 3, precipitated nickel sulphide is reduced when heated in hydrogen. When phosphorus pentoxide is heated with nickel in absence of hydrogen, nickel phosphide and phosphate are formed.—A. S.

Hydrogen sulphide and sulphur dioxide ; Influence of organic liquids on the interaction of ——. D. Klein. J. of Phys. Chem., 1911, **15**, 1—19.

The author has studied the effect of exposing a well-dried mixture of hydrogen sulphide (2 vols.) and sulphur dioxide (1 vol.) which do not react spontaneously, to various highly purified organic liquids. Water is apparently by no means unique in promoting reaction in this mixture, since ethyl, isobutyl, and isoamyl alcohols, acetone, benzaldehyde and carvone cause immediate reaction, while a large number of other substances (methylethyl ketone, various nitriles, methyl benzoate, propyl and isobutyl acetates and ether) induce the deposition of sulphur after exposure for intervals varying up to 25 mins. Other liquids (carbon bisulphide, ethyl bisulphide, benzene, amylene, chloroform, carbon tetrachloride, ethy, acetyl and benzoyl chlorides and nitrobenzene) are apparently unable to accelerate the action. There is no physical property such as specific inductive capacity, or association in the liquid state, which will account for this classification, so that the explanation is probably to be sought in the formation of intermediate compounds.—W. H. P.

Lithium silicates. II. R. Rieke and K. Endell. Sprechsaal, 1911, **44**, 97—99.

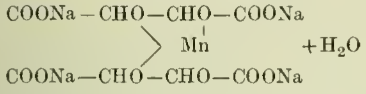
In the previous paper (this J., 1910, 1375) the formation of Li_2O,SiO_2 ; $2Li_2O,SiO_2$; $3Li_2O,2SiO_2$; and $Li_2O,2SiO_2$, was indicated. The present instalment deals with a comparison of the authors' figures with those of Van Klooster (Z. anorg. Chem., 1910, **69**, 135—137). They are given in the following table :—

SiO_2 per cent. by weight.	SiO_2 per cent. molecularly.	Temperature of primary separation according to		Temperature of eutectic separation according to	
		Rieke and Endell.	van Klooster.	Rieke and Endell.	van Klooster.
66·7	50·0 ($Li_2O.SiO_2$)	1180°	1188°	—	—
70·0	53·7	1152°	—	930°	—
71·1	55·0	—	1157–1135°	—	—
75·0	59·8	1080°	1083°	950°	948°
78·0	63·7	1045°	—	955°	—
78·8	64·8	—	1009°	—	947°
79·0	65·1	1005	—	960°	—
80·0	66·5 ($Li_2O.2SiO_2$)	—	—	955°	—
81·0	67·9	960°	—	945°	—
82·0	69·3	[975°]	985°	930°	941°
84·0	72·3	1000°	—	920°	—
85·0	73·7	1040°	—	945°	—
85·2	74·2	—	956°	—	937°
88·1	78·6	—	—	—	948°
90·8	83·1	—	[1081°]	—	940°

Three micro-photographs of the separations are given—those containing 60, 80 (the disilicate) and 84 per cent. of silica respectively.—H. H. S.

Manganitartrate ; A green crystalline ——. A. Job and P. Goissedet. Comptes rend., 1911, **152**, 265—268.

On adding a solution (18 grms. in 20 c.c.) of manganous sulphate to sodium tartrate (450 grms. in 1 litre), the precipitate at first formed dissolves in the excess of tartrate giving a rose coloured solution. This is vigorously agitated in the presence of oxygen, and 100 grms. of sodium hydroxide dissolved in 250 c.c. of water are added, a little at a time. This causes the appearance of green crystals from a red solution, which are obtained larger and better by adding only half the amount of alkali and leaving to stand. Analysis of the product shows one atom of trivalent manganese to two molecules of tartaric acid and five atoms of sodium with eleven molecules of water of crystallisation. The author represents the formula as :



$$\begin{array}{l} \mathrm{COONa-CHO-CHO-COONa} \\ \qquad\qquad\quad > \mathrm{Mn} \qquad\qquad + H_2O \\ \mathrm{COONa-CHO-CHO-COONa} \end{array}$$

The crystals dissolve in water to give a red solution which soon deposits manganic hydroxide. If dissolved in sodium tartrate however the deposition is retarded and as the concentration of sodium tartrate is increased the red colour disappears and slowly changes to green. The author explains these phenomena by assuming that water hydrolyses the green salt to produce sodium tartrate and a red manganitartrate, this action being of course retarded by excess of sodium tartrate. The fact that the green solutions do not deposit crystals is attributed to the removal by hydrolysis in neutral solutions of the alcoholic sodium with the production of a much more soluble substance. —W. H. P.

Copper acetylide ; Constitution of ——. *II.* J. Scheiber and H. Reckleben. Ber., 1911, **44**, 210—223.

As a result of further work (compare this J., 1908, 1180) on the constitution of copper acetylide the authors draw the following conclusions. (1) Copper acetylide exists in the form of a hydrate, C_2Cu_2,H_2O, and an anhydrous compound, C_2Cu_2. (2) As the compound is decomposed quantitatively with the production of acetylene, its constitution must be very similar to that of the gas. (3) No isomerisation of the hydrate takes place under any conditions. Further, humoid substances (compare *loc. cit.*) are not produced from copper acetylide and dilute acids if all traces of oxygen are removed from the reagents. Finally the authors record the fact that acetylene will precipitate copper from an ammoniacal cuprous salt solution in a dilution of 1 : 1,100,000 when no organic salt is present and in a dilution of 1 : 200,000 when ammonium acetate or tartrate is present.—J. C. C.

Uranium salts ; A reaction of ——. J. A. Siemssen. Chem.-Zeit., 1911, **35**, 139.

On treating the solution of a uranium salt with a solution of commercial ethylenediamine there is produced a light yellow crystalline salt, which dissolves on adding an excess of the reagent. Even in the case of very dilute solutions this reaction is plainly visible.—C. A. M.

Use of gas coke in the [*lime-kilns*] *of the* [*beet*] *sugar factory.* Décluy. *See* XVII.

American ammonia production in 1910. W. N. McIlravy. Chem. Trade J., Feb. 18, 1911. [T.R.]

The principal features of the ammonia production of the United States in the year 1910 were a fair increase in volume and an accompanying increase in price. The total recovery of ammonia of all forms reckoned as sulphate of ammonia amounted to about 106,500 tons in the year 1909, and in 1910 is estimated at 116,000 tons. As little increase took place in the coal-gas industry, in so far as the production of ammonia would be affected, and as the small production from other sources was about stationary, the increase must be attributed to the by-product ovens. This view is further supported by the condition of the by-product coke-oven industry. While few of the plants were idle, many of them were operated at only 60 to 75 per cent. of their total capacity for a part of the year ; but, on the other hand, others, and among them those of large capacity, operated at full capacity without interruption. The only new ovens that went into operation during 1910 were the 40-oven addition to the South Chicago plant, although the 50-oven plant at Indianapolis and the 50-oven addition to the Hamilton plant, both of which came in late in 1909, can hardly be considered as effective in ammonia production till 1910.

The prospects for 1911 include a plant of 560 ovens at Gary, Indiana ; 110 ovens at Sault Ste. Marie ; 280 ovens at Ensley, Ala. ; and 60 ovens at Woodward, Ala. The two first-mentioned plants are scheduled to come in during this winter.

The United States imports of sulphate of ammonia for the fiscal year ended June 30, 1910, totalled 62,610 net tons, the figure for the preceding year being 40,192 net tons, and for 1908 34.274 net tons. The consumption in the country of ammonia in all forms may therefore be reckoned as over 178,000 tons of sulphate and sulphate equivalent.

The principal feature of the market for sulphate of ammonia during 1910 was a steady rise. The price of domestic at the beginning of 1910 was 2.70 dollars per 100 lb. By March it reached 2.85 dollars, then receded to 2.80 dollars or a little less. The price was stationary until the end of August, when an upward tendency was again manifest, the end of September bringing 2.89 dollars, and of October 2.97 dollars. For the rest of the year the imported article ruled at 2.83 dollars to 2.90 dollars. It is therefore clear that the market returned to practically the same level as prevailed before the removal of the duty, the only difference being in the larger amounts produced, imported, and consumed. The outlook for future business arising from the recovery plants building and projected in the country is good. The products of the several processes for recovering the nitrogen of the air appeared in some quantity in European markets and to a smaller extent here, but neither the price nor the demand for the better-known article seemed to have been affected thereby.

Cyanide exports from Germany. Oil, Paint, and Drug Rep., Feb. 13, 1911. [T.R.]

The exports of cyanide from Germany for the first ten months of 1910 amounted to 5005 tons, valued at £309,800 ; this is a decrease of more than 1000 tons compared with 1909, when exports were valued at £419,000, but a slight increase over 1908. South Africa bought 1638 tons from Germany, the United States 1098 tons, and Mexico 1065 tons.

Patents.

Lime-hydrating machine. E. E. Lepine, Joliette, Quebec, Canada. U.S. Pat. 982,148, Jan. 17, 1911.

Lime is delivered through a hopper on to a travelling platform, which moves inside and parallel to a downwardly inclined casing. The hopper is provided with a distributing appliance, which delivers predetermined quantities of lime, and a water-spraying apparatus is arranged inside the casing close to the feed opening through which the raw material is supplied.—O. R.

Alkaline silicates containing ferric oxide ; Preparation of soluble ——. Bessler Waechter and Co., Ltd., and T. Rouse, London. Eng. Pat. 2440, Jan. 31, 1910.

Ferric oxide (*e.g.*, 1 per cent.) is added in the preparation of water glass or other soluble alkali silicate, and heating is continued until the mixture is completely "ferrated," the colour changing to a deep red. The ferric oxide thus introduced, does not readily separate when the product is dissolved in water.—F. Sodn.

Pyrites ; Process of utilising —— *for bisulphite of lime manufacture, etc.* V. Drewsen, New York. U.S. Pat. 981,625, Jan. 17, 1911.

Sulphurous gases from pyrites ovens, which are poor in sulphur dioxide, are absorbed as completely as possible by means of water, and the resulting sulphurous liquor is heated by the heat of the pyrites oven gases, to furnish gases richer in sulphur dioxide. These concentrated gases are then mixed with the residual gases, unabsorbed by water in the first absorbing operation, and the mixture is subjected to the action of a counter current of circulating lime water.—O. R.

Persulphuric acid; Process for production of compounds of ——. G. Teichner, Assignor to Consortium für Elektrochem. Ind. Ges. m. b. H., Nuremberg, Germany. U.S. Pat. 981,900, Jan. 17, 1911.

In the process of producing persulphates by electrolysis, the anode is cooled to a temperature below that of the electrolyte.—O. R.

Tetra-phosphorus trisulphide; Manufacture of pure ——. A. Stock, Breslau, Germany. Eng. Pat. 22,506, Sept. 28, 1910. Under Int. Conv., Dec. 7, 1909.

Crude tetra-phosphorus trisulphide is treated with water or steam, or both. The higher sulphides are thus destroyed and the product is rendered more stable.—F. Sodn.

Hydrogen; Composition of matter for and method of generating ——. H. Foersterling and H. Philipp, Perth Amboy, N.J., Assignors to The Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 977,442, Dec. 6, 1910.

An intimate mixture of equal parts by weight of sodium and aluminium silicide ("sical") is prepared by heating the two substances in a kneading machine until all the sodium is molten; the kneading appliance is then put into operation and kept continuously rotating whilst the mixture cools down, after which the latter is transferred to a press and briquetted. 1 kilo. of the mixture, when acted on by water, generates about 700 litres of hydrogen, the reaction being represented by the equation: $Al_2Si_4 + 8Na + 18H_2O = Al_2(OH)_6 + 4Na_2SiO_3 + 15H_2$.—O. R.

Gas [air]; Art of and apparatus for liquefying —— *and separating its elements.* E. F. Gallaudet, Norwich, Conn., Assignor to General Air Products Co., New York. U.S. Pats. 981,755 and 982,225, Jan. 17, 1911.

In an apparatus for liquefying gases, consisting of a liquefier, an expander, and a rectifier, means are provided for regulating the level of the gas condensed in the liquefier, thereby automatically controlling the temperature of the compressed gas supplied through the interchanger to the expander; the exhaust from the expander is discharged upwards through a downward flowing current of liquefied gas discharged from the liquefier, so that currents of upward flowing gas and downward flowing liquid are continuously maintained.—O. R.

Oxygen baths; Process for the production of —— *by catalysis of peroxides, perborates, and the like.* L. Elkan Erben Ges. m. b. H. Ger. Pat. 230,175, Dec. 14, 1909.

In addition to the usual catalyser, an alkali iodide is added to the bath. With a bath containing 300 grms. of sodium perborate to 250 litres of water, for example, to which 12 grms. of potassium iodide and 0·62 grm. of manganese sulphate are added, 96·2 per cent. of the perborate is decomposed in 20 minutes, and the whole in 25 minutes, whilst without potassium iodide, three times the quantity of manganese sulphate would be needed to obtain a similar result.—A. S.

Sulphurous acid; Apparatus for making ——. H. H. T. Burbury. Fr. Pat. 420,596, Sept. 20, 1910.

See Eng. Pat. 8006 of 1910; this J., 1911, 85.—T. F. B.

Nitric acid; Process for concentrating dilute —— *by means of sulphuric acid or other hygroscopic agents.* H. Pauling. Fr. Pat. 420,803, Sept. 26, 1910.

See Eng. Pat. 22,322 of 1910; this J., 1911, 84.—T. F. B.

Nitric acid; Process for concentrating —— *by means of dehydrating agents such as sulphuric acid.* H. Pauling. Fr. Pat. 420,804, Sept. 26, 1910.

See Eng. Pat. 22,320 of 1910; this J., 1911, 84.—T. F. B.

Caustic alkali; Dehydration of ——. P. E. Oberreit, Ludwigshafen, and F. M. Jahrmarkt, Mannheim, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 983,834, Feb. 7, 1911.

See Eng. Pat. 4762 of 1905; this J., 1905, 731.—T. F. B.

Ammonium sulphate; Process and apparatus for preparing ——. E. Henss. Fr. Pat. 420,258, Sept. 7, 1910. Under Int. Conv., Sept. 8, 1909.

See Ger. Pat. 227,946 of 1909; this J., 1911, 85.—T. F. B.

Alkali aluminates; Process for the continuous manufacture of —— *from aluminous minerals and alkali chlorides, with the simultaneous production of hydrochloric acid or chlorine.* D. A. Péniakoff. Fr. Pat. 420,461, Nov. 24, 1909.

See Eng. Pat. 30,324 of 1909: this J., 1910, 1454.—T. F. B.

Phosphorus sesquisulphide; Process for preparing pure ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 420,832, Sept. 27, 1910. Under Int. Conv., Dec. 8, 1909.

See Eng. Pat. 22,506 of 1910: preceding.—T. F. B.

VIII.—GLASS; CERAMICS.

Patents.

Filter-presses [for potters' slip]; Trays for ——. S. Jones, Longton, Staffs. Eng. Pat. 26,231, Nov. 11, 1910.

The patent relates to trays for use with potters' slip-presses, the object being to prevent leakage and to enable the press to continue in operation after one or more of the filter-cloths separating the trays have become ruptured. Each tray comprises an iron or steel plate, square or rectangular, provided with an aperture at a point midway of its width and near its upper end. Two wire screens, rather smaller than the plate and separated from it by strips of flannel at their edges, are clamped to each side of the plate by a wooden frame having zigzag scarfed joints to prevent leakage. The outer screens are of smaller mesh than those adjacent to the plate; and to strengthen and retain the screens in position one or more strips of wood extend from the bottom rail of the wood framing to within a suitable distance of the aperture in the iron plate. By means of vertical channels in the inner side of the bottom rail of each frame, openings for drainage are provided; and, in the event of a filter-cloth breaking, the openings concerned may be closed by the insertion of wood or metal plugs, thus avoiding loss of slip and stoppage of the whole press.—W. E. F. P.

Mica; Mechanical splitting of ——. F. Lilienthal and G. Lauer. Fr. Pat. 420,743, Sept. 24, 1910. Under Int. Conv., Sept. 27, 1909, and Jan. 28, 1910.

See Eng. Pat. 4980 of 1910; this J., 1910, 1383.—T. F. B.

IX.—BUILDING MATERIALS.

Sand-lime ware; Lime for ——. H. Seger and E. Cramer. Tonind.-Zeit., 1911, **35**, 249—250.

The quality of sand-lime bricks and other ware depends largely on the nature of the lime used. It should be carefully sifted so that the finished ware may be free from cracks. Trials were made with mixtures of 90 parts of sand and 10 parts of quicklime, pressed into cubes at 8 atmospheres. When unrefined lime was used the test-piece only resisted a pressure of 30 kilos. per sq. cm. Finely-sifted lime gave a test-piece capable of withstanding 76 kilos. per sq. cm., while a piece made under steam-pressure resisted 196 kilos. per sq. cm. The colour of the lime is important; a black lime is not so good as a white one. The following analyses of a black and a white lime are given:—

	Black.	White.
	per cent.	per cent.
Loss on ignition	3·23	10·93
Silica	1·60	6·93
Alumina	—	3·80
Iron oxide	4·98	1·83
Lime	71·84	75·63
Magnesia	18·39	0·96

It is pointed out that the black limes always contain magnesia as well as iron.—H. H. S.

Brickdust; Hydraulicity of ——. Klehe. Tonind.-Zeit., 1911, 35, 238—241.

The author's experiments on the use of mixtures of brick-dust (1 part) and slaked lime (2·5 parts), approximating in composition to Roman cement, show that such material, when used as a mortar, either neat or with sand, hardens much better under water than in air. Material prepared from lightly burned bricks was found to attain a higher initial strength than that from normal bricks, but in both cases the strength ultimately developed was about the same; with sintered or almost sintered bricks, however, the hydraulic properties were much less marked. The results, showing strengths up to 4 months, are given in the form of tables, and the use of these mixtures is proposed where there is a difficulty in obtaining cement. Very fine grinding of the bricks is not necessary.
—F. Sodn.

Magnesia cement and artificial stone [" *Steinholz* "] *prepared therewith.* O. Schmidt. Tonind.-Zeit., 1911, 35, 180—182.

According to the author, the best practical results in the manufacture of magnesia cement are obtained from a mixture of 1 part by weight of anhydrous magnesium chloride with 3 to 4 parts of magnesium oxide. The disadvantages of the magnesia cement, or artificial stone prepared therewith, are that it is not water-resistant, nor completely constant in volume. Even aqueous vapour at the room temperature makes the material moist and soft after a time. The drawback can to some extent be overcome by adding litharge to the mixture, and treating the hardened product with linseed oil. A material known as "Tekton" consists of "Steinholz" in which wood is embedded. Tekton boards are extremely strong, but the binding material in them is susceptible to the action of water, and the working of the wood itself may be difficult. The so-called xylolith, and strongly compressed xylolith sheets show great strength and some resistance to water. Magnesia cement mixed with fine sand or marble dust can be cast on glass-plates surrounded by iron rims, into wall tiles which resemble glazed clay tiles in hardness, colour, and brightness of surface, but are not water resistant. It is desirable that in testing the raw materials, and the products of this class of manufactures, definite testing processes should be adopted, and the analysis of the magnesite should show the content of magnesia, water of hydration, and carbon dioxide.—W. C. H.

Patents.

Timber; Impregnation of ——. S. Haltenberger, Budapest, and E. Berdenich, Püspökladany, Hungary. Eng. Pat. 24,483, Oct. 21, 1910.

The surface of the timber (telegraph poles, for example) is pierced, before impregnation, in such a way that the wood fibres are displaced, without being cut or removed. "Artificial medullary rays" are thus produced, and the penetration of the impregnating liquid is facilitated, without impairing the strength of the timber. By varying the depth and number of the holes at different zones, the degree of impregnation may also be varied, and a saving (up to 75 per cent.) of the impregnating liquid effected, where different parts of the timber are to be unequally exposed to rotting influences.—F. Sodn.

Stones or bricks; Process for utilising blast furnace slag for the manufacture of ——. B. Grau, Stettin, Germany. Eng. Pat. 17,109, July 18, 1910.

The slag issuing from a blast furnace is granulated by means of a strong steam jet, and allowed to fall in a heap. The heat still retained by the mass of grains, which is allowed to cool slowly, causes the grains to frit or bake together to a greater or less extent. The cooled mass is coarsely ground, moistened, and compressed into the form of bricks or stones, the hardening or setting of which may be accelerated by leaving them, after compression, for 24 to 36 hours in a room charged with steam.—W. C. H.

Bituminous sand-rock; Process of treating ——. H. F. Williams, San Francisco, Cal. U.S. Pat. 983,851, Feb. 7, 1911.

Bituminous sand-rock is reduced to comparatively small pieces which are coated with lime-sludge so as to prevent the adhesion of the pieces. The mass is heated sufficiently to dry it without volatilising any of the hydrocarbon constituents, and the pieces are then pressed into the required form.—W. C. H.

Artificial granite from blast furnace slag; Process for producing ——. W. Hohrath, Hagen, Westphalia. Eng. Pat. 22,308, Sept. 26, 1910. Under Int. Conv., Oct. 28, 1909.

See Fr. Pat. 419,884 of 1910; this J., 1911, 132.—T. F. B.

Cement; Process of manufacturing ——. C. von Forell, Hamburg, Germany, Assignor to The Atlas Portland Cement Co., New York. U.S. Pat. 982,945, Jan. 31, 1911.

See Eng. Pat. 22,314 of 1901; this J., 1902, 257.—T. F. B.

Cement and process of making the same. B. Bruhn, Hamburg, Germany, Assignor to The Atlas Portland Cement Co., New York. U.S. Pat. 983,024, Jan. 31, 1911.

See Fr. Pat. 354,790 of 1905; this J., 1905, 1110.—T. F. B.

Cement; Process of manufacturing ——. R. Tornyay-Schossberger, Budapest. U.S. Pat. 983,521, Feb. 7, 1911.

See Fr. Pat. 396,600 of 1908; this J., 1909, 602.—T. F. B.

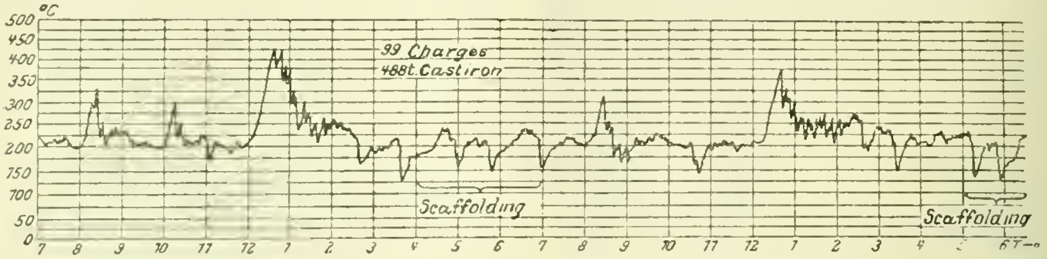
Cement kiln. R. J. Nash, Mitcheldean. U.S. Pat. 983,563, Feb. 7, 1911.

See Eng. Pat. 18,997 of 1909; this J., 1910, 1108.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

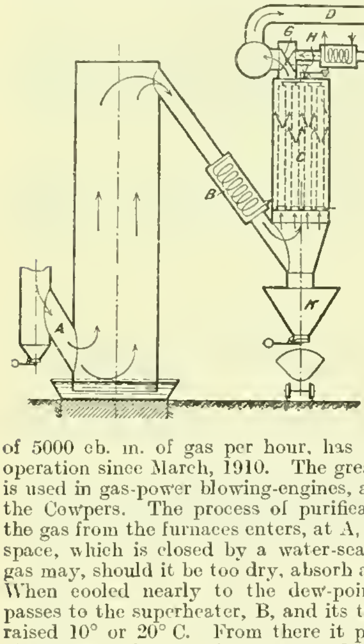
Blast furnace; The rise in temperature of the gases of the —— *during long pauses.* K. Matthiae. Stahl. u. Eisen, 1911, 31, 268—270.

Four temperature curves of the gases issuing from a blast furnace are given (see fig.), each taken during a day's run, with the production of about 500 tons of iron. The temperature remained fairly constant at about 200° C., rising whenever the charge dropped, and when repairs had to be effected it rose rapidly to about 400° C. "Scaffolding" was also clearly shown by a fall of temperature to about 100° C. and it is concluded that repairs should take place frequently instead of at long intervals.—A. H. C.



[*Blast furnace*] *Gases; A new method of filtering* ——. F. Müller. Stahl u. Eisen, 1911, 31, 229—232.

A new method of purifying blast-furnace gases has been introduced at the Halberg Works near Saarbrücken, where an experimental plant, with an approximate capacity of 5000 cb. m. of gas per hour, has been in continuous operation since March, 1910. The greater part of the gas is used in gas-power blowing-engines, and the rest goes to the Cowpers. The process of purification is as follows: the gas from the furnaces enters, at A, (see fig.) the cooling space, which is closed by a water-seal in order that the gas may, should it be too dry, absorb additional moisture. When cooled nearly to the dew-point (50°—60° C.), it passes to the superheater, B, and its temperature is there raised 10° or 20° C. From there it passes to the actual filtering chamber. This is composed of a number of compartments, C, each containing eight to twelve filter-tubes made of a suitable fabric. The length of a tube is 3 m. and its diameter 20 cm. The tubes are fixed at the lower, open end into the bottom of the filter-chamber, and the upper end is closed by a plate. The tubes hang from rods to which a shaking motion can be imparted. The centrifugal fan, E, draws the gas outwards through the walls of the tubes, and the filtered gas then flows through the pipe, D, the fan, E, and the delivery pipe, F. To clean the filter-tubes, every four months or so, the valve, G, is turned into the position indicated by the dotted lines, and the compartment which is to be cleaned is cut out of the whole system. Filtered gas now flows back from the pipe, J, and forces the accumulated dust off the inner surfaces of the filter-tubes. At the same time, the mechanism above referred to thoroughly shakes out the tubes, the dust falling into the container, K, whence it is removed in trucks. On turning back the valve, G, the cleaned compartment again acts. The solid impurities of the gas are reduced by this method from 6 grms. to 0·02 grm. per cb. m., and if this gas is further cooled by spraying, the dust content falls to below 0·01 grm. per cb. m. Steam or waste gases are used for heating the gas. The life of the filter-tubes is about twelve months. The power required is 3 H.P. per 1000 cb. m. per hour. Besides the greater purity of the gas, this system has the advantage of requiring no clarifying tanks, as with spray systems, and the working costs are less than half those of a wet system with fans and settling tanks, in addition to saving in space.—R. W. N.



Steel; Carburisation of —— *with special reference to the action of nitrogen.* J. Kirner. Metallurgie, 1911, 8, 72—77.

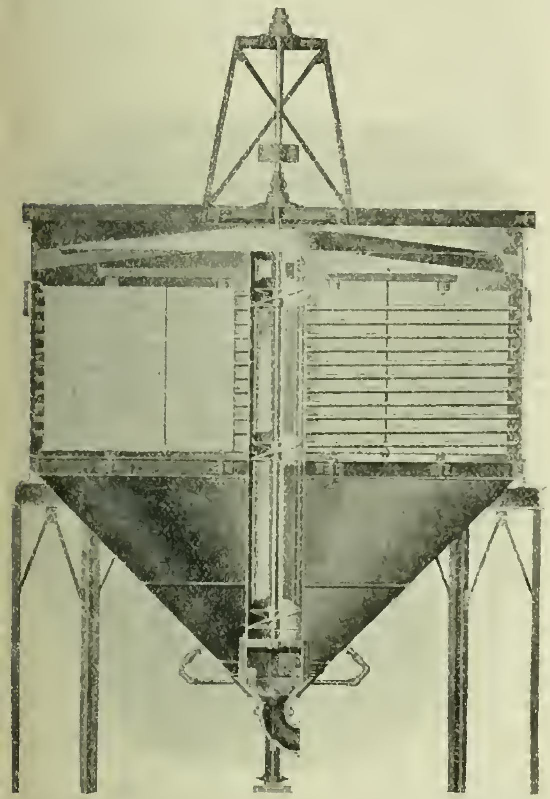
A mild steel containing 0·1 per cent. of carbon was heated at various temperatures in case-hardening materials of known nitrogen content. One material contained no nitrogen, and it was found that carburisation did not take place. With the materials rich in nitrogen at temperatures between 600° C. and 850° C. carburisation took place rapidly; at 900° C. it was irregular and not at the same rate, while at 950° C. it was very rapid again. The outer layer of the steel at 600°—850° C. contained 0·6 per cent. of nitrogen, which amount gradually fell with increasing temperature until, at 1000° C. nitrogen was absent. It is also stated that a constituent, which the author calls "Flavit," was revealed by etching the slowly cooled steels with picric acid, but which was absent in tho quenched specimens and is assumed to have passed into solution. Microphotographs are given showing this constituent. The percentage content of phosphorus, silicon, and manganese was not altered during the process. —A. H. C.

Tool steel direct from the ore in an electric furnace. A. Stansfield. J. Canadian Min. Inst., 1910, 13, 151—162. (See also this J., 1907, 418).

The author gives a description of experiments made by J. W. Evans on the direct production of steel in the electric furnace from magnetite ores containing titanium and traces of vanadium, such as are found in Ontario. In the Orton Mine, Hastings County, it is stated that more than 2,000,000 tons of this titaniferous ore have been proved by means of the diamond drill. The cylindrical experimental furnace used was 18 in. high and 14 in. diam., with two lateral electrodes (1in. square rods of graphite) fed with current at 110 volts; in most cases the current strength had to be kept below 200 ampères. An arc was first produced between the electrodes, but when sufficient metal and slag had been produced, the ends of the electrodes were lowered into the slag and the current passed through the molten metal and slag. By this method the consumption of the electrodes is very high, and in a later type of furnace, short arcs are produced between each electrode and the molten slag in the second period of heating. The ore used contained 51·45 per cent. of iron, traces of sulphur, 7·5 per cent. of titanium, 0·12 per cent. of nickel, and traces of vanadium. The charge consisted of 100 parts of ore, 20 of limestone, and 18 of charcoal, formed into briquettes with 10 parts of molasses and 16 of water. The steel produced was tapped from the furnace without any addition of ferromanganese or other deoxidising agent, and sound ingots (about 3 lb.) were invariably obtained. With non-titaniferous ore, sound steel could not be produced in the furnace. The sound ingots proved in practical tests to be a good quality of tool steel. The total cost for ore, charcoal, limestone, electrical power, and electrodes is estimated to be about 2 cents (1d.) per lb. of steel, but it would probably be considerably less than this on the large scale.—A. S.

Ores; Cyanidation of ——. W. A. Hendryx. Met. and Chem. Eng., 1911, **9**, 82—85.

With reference to silicious ores, only requiring amalgamation and cyanidation, it is preferable to use two rock breakers and deliver to the stamps, which weigh 1050 lbs. each and drop 100 times a minute, a product not larger than one inch. By using a 12—16 mesh screen 8 tons of ore and 32 tons of a solution containing 0·025 per cent. of cyanide are delivered to the stamps per day. It is found that by adding the cyanide at the battery the amalgamation is increased and more gold goes into solution, but this method is not applicable to ores such as sulphides which contain a large percentage of cyanide destroyers. After the plates a dewatering sizer is used and then a storage settler such as the Hendryx combination agitator and filter. This consists of a steel tank (see fig.) with a bottom converging at 45°, at the apex of which is a quick acting discharge valve. Within the tank is a central agitating pump, a series of filter cells, and a coil of pipes for heating the liquid. Over the bottom is fastened a canvas sheet which uniformly distributes the inflowing wash solution, and allows the displacement of the solution in the ground ore either upwards or downwards. The agitating pump consists of a large well within which is a shaft carrying propellers and at the top of which is a distributing and aërating apron which extends nearly to the sides of the tank. The filter cells are placed vertically beneath this apron and consist of a wooden frame lined inside with cocoa matting and enveloped in canvas, the canvas and matting being quilted together at intervals. Two parts by weight of solution to one of ore are collected in the agitator until the tank is filled nearly to the bottom of the distributing apron, the pump is then started and continued until the soluble gold and silver have dissolved, the solution being heated to 90° F. by means of hot water circulating in the coil of pipes. After the solution has been heated, agitated, and aërated for a suitable time it is allowed to filter by gravity until 70—80 per cent. of the original solution has passed through the filter cells and run into the precipitation tank to be treated with zinc dust and yield a "barren solution"; this is utilised for washing by being drawn through the canvas of the agitator and through the filter cells. The cost of precipitation by zinc dust is very low, and almost complete precipitation is possible from a solution containing one pound of cyanide per ton, thus making it possible to use dilute solutions all through the mill. The machine described is capable of agitating and filtering 100 tons of average gold ores per day, requiring only 6 H.P., and the time of treatment is decreased by 25 per cent.—A. H. C.



Amalgam barrels; Danger of explosions of ——. W. R. Dowling. J. Chem., Met., and Min. Soc., S. Africa, 1910, **11**, 238—239.

At times gas is generated in amalgam barrels, creating a high pressure, which, together with the fact that the gas is explosive, has caused accidents. This gas is produced mainly during the treatment of acid material containing partially oxidised pyrite. This, with finely divided iron from the barrel or balls, forms ferrous sulphide, which with an acid charge generates hydrogen sulphide, while the acid acting directly on the iron generates hydrogen, of which the gas from such a charge was found to contain over 40 per cent. The addition of sufficient lime to neutralise the charge prevents such generation of gas, and seems to facilitate the collecting of the amalgam and mercury in the final separation from the sand.—R. W. N.

Matte assay [for gold]; Notes on the ——. L. J. Wilmoth. J. Chem., Met., and Min. Soc., S. Africa, 1910, **11**, 240—242. (See also this J., 1908, 407, 812.)

The author recommends the production of a matte for removing base metals. The method compares favourably with both the scorification and the combination methods. In all experiments on metallic copper the following charge was used. Drillings 10·0 grms., litharge 1 assay-ton (A.T.), sodium carbonate 1·5 A.T., borax 1 A.T., silica 0·5 A.T., charcoal 1·25 grms., sulphur 8 grms., and an iron nail. On this material, in a comparative test, the uncorrected assay results were: matte assay 10·41 per cent. of gold; scorification assay 10·31 per cent. of gold. Results corrected by working up the matte and slags gave: matte assay 10·44, scorification assay 10·31 per cent. of gold. The combination method gave 10·49 per cent. of gold. On another sample tests gave: from lead button 112·64 oz. per 2000 lb., from matte 14·8 dwt. per 2000 lb. of original sample, and from slag 0·24 dwt. per 2000 lb. of original sample. For copper matte containing 25—30 per cent. of copper and some lead, the charge used was: matte 0·5 A.T., sodium carbonate 1 A.T., litharge 1 A.T., borax 1 A.T., silica 1 A.T., sulphur 0·1 A.T., charcoal 1·5 grms., and one nail. The whole of the gold (7·1 oz. per ton) was in the lead button, none being found in the matte or slag, though these retained a small portion of the silver. With litharge dross from the pan furnace carrying 20—30 per cent. of copper, 190 oz. of gold, and 216 oz. of silver, the fluxes were as follows: dross 0·5 A.T., sodium carbonate 1 A.T., litharge 0·75 A.T., borax 1 A.T., silica 0·5 A.T., sulphur 0·25 A.T., charcoal 1·5 grms., and a nail. 99·1 per cent. of the gold and 84·9 per cent. of the silver were obtained from the uncorrected assay. The iron nail prevented lead from passing into the matte, although much sulphur was present. The matte assay gives higher results than the scorification assay on material, such as slags containing much copper and a small amount of gold.—R. W. N.

Monel metal, and its uses. J. F. Thompson. Eng. and Min. J., 1911, **91**, 223—224.

The alloy of nickel and copper (see this J., 1909, 94, 313; also 1910, 1060) made from the nickel-copper ores of Ontario contains about 68 per cent. of nickel and a slight amount of iron. It combines a strength approaching that of steel with the non-corrosive qualities of copper or brass. A wide range of utility has already been found for the rolled metal in such applications as roof-covering, punched screens and pump-rods for the mining industry, etc. The most noticeable recent feature is the introduction of large castings of Monel metal, more especially marine propellers for turbine-equipped ships. A battleship was so fitted, and after a year's service the metal has proved eminently satisfactory. The U.S. Government specify this metal for all future propellers. The use of the alloy for various purposes is increasing also in foreign navies. The cast metal in such propellers has a tensile strength of 82,500 lb. per sq. in., elastic limit 37,500 lb. per sq. in., and elongation 44 per cent. The modulus of elasticity is from 22,000,000 to 23,000,000 lb., as against 30,000,000 lb. for steel and 13,000,000 for manganese bronze. Castings of Monel metal can be produced up to a weight of 30,000 lb. in one piece. The melting-point of Monel metal is 1360° C., its sp. gr. 8·87 (cast). Other properties are: Electrical conductivity: 4 (copper 100); shrinkage: ¼ in. per foot; hardness (cast): 22; do. (rolled): 27, by the Shore scleroscope. With hot-rolled rods, the elastic limit is 58,870 lb. per sq. in., tensile breaking strength 86,900 lb. per sq. in., and elongation 40 per cent., with a reduction of area of 60·5. An important property is the retention of the mechanical properties at a high temperature. At 1000° F., Monel metal retains 80 per cent. of its tensile strength and elastic limit, while steel retains 71 per cent., and manganese bronze only 60 per cent.; copper has at 780° F. already lost 60 per cent. of its strength. This has led to the adoption of the alloy for locomotive fire-boxes in Germany.—R. W. N.

Hydraulic bronze. S. Kern. Chem. News, 1911, **103**, 91.

It is stated that castings capable of holding water and steam under high pressure can be obtained by melting 78 parts of "best" copper and 10 of brass in a crucible of not less than 2 cwts. capacity, provided with a lid, then adding in succession 12 parts of tin, 1·4 of zinc, and 0·12 of cuprosilicon (10 per cent. of silicon), and pouring into the mould.—A. S.

Manganese [in ores and alloys]; Fischer's modification of Volhard's method for the volumetric determination of —— and its comparison with other well-known methods. E. Cahen and H. F. V. Little. Analyst, 1911, **36**, 52—59.

The authors have submitted Fischer's modification of Volhard's method (this J., 1910, 47) to a critical examination with the object of ascertaining its degree of accuracy and of applying it to the determination of manganese in high-grade ores and alloys. As the result of a number of test experiments in which known amounts of manganese salt were employed, it was found that a definite end-point cannot be obtained if the titration be carried out at a boiling temperature: the following method, however, differing very slightly in detail from Fischer's, can be relied upon to give trustworthy results:—The neutral solution of the manganese salt, containing 10 grms. of zinc sulphate, is diluted to 500 c.c. and heated to boiling. One grm. of freshly ignited zinc oxide is then added, and the solution is titrated with permanganate, with frequent heating to boiling, and shaking, until the permanganate is no longer decolourised. The solution is now cooled under the tap for a minute or two, from 1 to 2 c.c. of glacial acetic acid are added, and the liquid is shaken thoroughly. The hot, but not boiling, solution is then further titrated with permanganate, added a few drops at a time, with vigorous shaking for half a minute after each addition, until the supernatant liquid retains its pink colour after being well shaken several times. The end-point of the titration is then reached. In actual practice, where the volume of permanganate required is not exactly known, it is preferable to make a preliminary titration by adding the acetic acid before the permanganate; the result obtained will be too low, but it will indicate the approximate quantity of permanganate necessary. The method was applied to the determination of manganese in several samples of ferromanganese and pyrolusite, and the results obtained were compared with those found by other methods—namely, the bismuthate method, the gravimetric method, and Pattinson's method (this J., 1891, 337); the agreement between the results was very satisfactory.—W. P. S.

Tin; The plasticity of —— at high temperatures. E. Jänecke. Metallurgie, 1911, **8**, 68—72.

By means of a specially designed press, of which figures are given, metallic tin was forced through a hole in a steel plate. The cylinder of the press containing the tin was heated by a suitably wound nickel wire resistance, and the piston was also insulated by asbestos from the metal, and the pressure necessary to extrude a definite quantity was measured. The following table gives the results of some of the experiments which show that with an increasing temperature there is a decreasing plastic pressure.

Temperature, °C.	18°	60°	93°	115°	148°	180°	217°
Plastic pressure in tons	5·45	3·65	2·72	2·26	1·80	1·50	1·15

The results of the experiments are also plotted, and the pressure temperature curve is a continuous one.—A. H. C.

Lead-antimony ores; Smelting of ——. A. W. Hahn. Met. and Chem. Eng., 1910, **8**, 686.

At a small smeltery in Queretaro, Mexico, both of the metals are saved at one operation. The ores formerly treated were clean lead carbonates, but those now smelted are sulphides containing much antimony. The ores are roasted, and afterwards smelted in two 36 × 60 inch water-jacketed furnaces. Fines are briquetted. An average analysis of the bed-mixture was: Silica 30·5, ferrous oxide 24·5, lime 7, alumina 4·8, sulphur 3·7, zinc oxide 4·6, lead 8·3, antimony 3·6, per cent., and 40 oz. of silver. Coke and charcoal, free from breeze, were used as fuel. The furnaces were run slowly, and at a low temperature, the tuyères never being bright. A typical slag analysis showed: Silica 34, ferrous oxide 32, lime 18, alumina 9, zinc oxide 3, antimony 1, lead 1 per cent., and 3 oz. of silver. An unusually clean matte, assaying 13 per cent. of lead and 53 oz. of silver, was obtained, and the bullion contained 26 per cent. of antimony, 70 per cent. of lead, and 240 oz. of silver. This shows that antimony acts as a collector of the precious metals. The lead extraction was 83·7, that of silver 82·3, and that of antimony would appear to be about 70 per cent.
—R. W. N.

Magnesium; Use of —— in deoxidising aluminium alloys. H. M. Lane. Trans. Amer. Brass-founders' Assoc., 1910, 103—116.

The addition of magnesium was tried in order to avoid the oxidation and consequent troubles experienced in melting aluminium. To determine the efficiency of this method, two series of test-bars were made, in one of which the metal was melted several times without any addition of magnesium, and in the other it received at each re-melting an equal addition of metallic magnesium. The loss in melting aluminium being about 1 per cent., one-half of 1 per cent. of magnesium was added at each of the successive re-meltings. The authors give the values of elastic limit, ultimate tensile strength, elongation, and reduction in area obtained by testing the bars. In the series containing magnesium the bars showed an increase of strength after each addition of the latter metal. The other series, melted eight times without magnesium, showed, contrary to expectations, a slight increase in strength after several meltings. The author ascribes this to the zinc absorbed from some chloride of zinc, which was used in the crucibles, as the zinc content increased from 0·015 to 0·085 per cent. after eight meltings. From the ninth melting onwards one-half of 1 per cent. of magnesium was added at each melting to these bars also, and the tests showed similar results to those obtained with bars of the other series. The author states that aluminium can, with care, be remelted, without a deoxidising agent, several times, and yet not give undue trouble, through oxidation or blowholes. The addition of three per cent. of magnesium increases the tensile strength, approximately, from 10,000 lb. to 20,000 lb. per sq. in., but as the magnesium content increases the elongation decreases, and the fracture becomes more crystalline.—R. W. N.

Aluminium alloys; Analysis of ——. T. Smith. Met. and Chem. Eng., 1911, **9**, 85—86.

At the present time there is no method for the direct estimation of high-percentage aluminium alloys, it being ridiculous to suggest that one gram of the alloy can be dissolved in sodium hydroxide, acidified by hydrochloric acid, precipitated by ammonia, and then filtered, washed, and ignited with any pretence to accuracy. It is essential, if even an approximate percentage is desired, to determine it by difference, care being taken in estimating all the other elements in the alloy. The author gives the following methods for these. *Silicon:* Dissolve one gram of the alloy in 30 c.c. of a mixture containing, nitric acid, 1 part; hydrochloric acid, 3 parts; sulphuric acid, 2 parts; and water, 4 parts. When the violent action ceases add 5 c.c. of sulphuric acid and evaporate to white fumes. Allow to cool and add 50 c.c. of cold water, stir, and boil until the sulphates are in solution. Filter at once, wash with hot water containing a little hydrochloric acid, and then with pure water till free from chlorides. Ignite in an unweighed platinum crucible, cool and weigh. To the crucible add 1 drop of sulphuric acid and 10 drops of hydrofluoric acid, evaporate on a hot plate to the drop of sulphuric acid, and then heat on a burner until the sulphuric acid is expelled, blast for five minutes, cool and weigh. There should be no appreciable residue left in the crucible. *Iron:* Instead of reducing the silicon filtrate, 2—5 grams are weighed into a No. 3 beaker and from 10—20 c.c. of equal parts of hydrochloric acid and water cautiously added. When in solution boil for a few minutes, and add a drop of stannous chloride, and then titrate with a *N*/20 permanganate solution, and following some definite method of procedure, standardising the permanganate in a similar manner. *Copper:*—From 1 to 2 grams are placed in a No. 3 beaker with 5 grams of sodium hydroxide and enough water to cover. When the action ceases add 200 c.c. of hot water and boil for five minutes. Filter and wash once with hot water, dissolve the precipitate on the filter with dilute nitric acid, wash and pour on ammonia until the solution is deep blue. To the solution, which should not exceed 125 c.c., add 2 c.c each of sulphuric and nitric acids to make the solution acid, and then electrolyse. *Zinc:* In the presence of copper it is better to dissolve in sodium hydroxide, dilute to 200 c.c., and precipitate the mixed sulphides while hot. Wash once with hot water containing hydrogen sulphide to remove the greater part of the aluminium. Place the filter and precipitate back into the beaker, then add 50 c.c. of hot water and 10 c.c. of hydrochloric acid and boil to dissolve the zinc sulphide and filter, washing with water containing a few drops of hydrochloric acid and a little hydrogen sulphide. Boil off the hydrogen sulphide and add bromine water, to oxidise any possible iron, cool slightly, and add ammonia in excess. Boil and filter, and after making the solution slightly acid with hydrochloric acid add a large excess of ammonium phosphate. Make just alkaline to litmus with ammonia, and then add 1c.c. of glacial acetic acid, warm for a few minutes, and filter and wash by decantation several times before transferring the precipitate to the filter paper. Dry the paper and the precipitate, detach and burn the paper separately, igniting carefully at first and finally at a red heat. In the absence of copper, after solution in dilute hydrochloric acid, make up to 100 c.c., add a few drops of methyl orange, and then sodium bicarbonate until the solution is just a straw colour. Now add 20 per cent. formic acid, drop by drop, until just acid, then add 5 drops in excess, and after precipitation as zinc sulphide proceed as above, using the phosphate precipitation. Manganese by the "bismuthate" method, and tin, antimony, lead, nickel, and titanium may be estimated by the usual well-known methods.—A. H. C.

Bismuth ochres from San Diego Co., California. W. T. Schaller. J. Amer. Chem. Soc., 1911, **33**, 162—6.

It is concluded that the existence of natural bismuth trioxide, Bi_2O_3, has not been established; that natural bismuth ochre (bismite) when pure is more probably a hydroxide; that San Diego bismites are either the hydroxide or vanadate (pucherite) or mixtures; and that pucherite has been found non-crystalline, and determined for the first time in the United States.—H. E. P.

Molybdenite; Analysis of ——. W. Trautmann. Z. angew. Chem., 1911, **24**, 207.

Recent parcels of Norwegian molybdenite have contained 5—7 per cent. molybdenum (exceptionally 14 per cent.) of magnesia, 1—5 per cent. of copper sulphides, 0·5—7 per cent. of metallic bismuth, 0·3—4 per cent. of zinc blende, together with pyrites, quartz, and fractions of a per cent. of arsenic. One sample contained 0·45 per cent. of germanium sulphide. If in analysing such molybdenites Gilbert's method be used, the molybdenum trioxide finally weighed contains nearly all the zinc, copper, and magnesium. These errors are avoided by the use of the author's method, save that arising from zinc. The method consists in fusing 0·3 grm. of the mineral with equal parts of sodium hydroxide and peroxide in a nickel crucible, slowly raising the heat to bright redness. After cooling, the mass is dissolved in hot water, filtered, the filtrate treated with excess of yellow ammonium sulphide, warmed, and slight excess of dilute sulphuric acid added. A stream of air is passed through till all hydrogen sulphide is expelled, the liquid is filtered and the precipitate washed, dried, separated, and heated with the filter ash over a small flame till converted into molybdenum trioxide. In presence of zinc, however, the solution of molybdenum in ammonium polysulphide must be heated to boiling to render the zinc sulphide filterable, and this must be filtered off before acidifying. Moreover, the molybdenum trioxide, after weighing, must be purified. It is fused with potassium bisulphate, dissolved in water and ammonium carbonate with the aid of heat, alumina and silica are filtered off, washed with water containing ammonium nitrate and ammonia, dried, ignited, and their weight subtracted from the gross weight of molybdenum trioxide.—J. T. D.

Uranium; Commercial metallic ——. W. P. Jorissen and A. P. H. Trivelli. Chem. Weekblad, 1911, **8**, 59—62. Chem. Zentr., 1911, **1**, 463.

On exposing commercial metallic uranium to cathode rays a considerable quantity of nitrogen was evolved. Investigation showed that the commercial product contains 13 per cent. of uranium nitride (U_3N_4): it also contains 1·25 per cent. of carbon.—A. S.

Oil [petroleum]; The use of —— *for smelting.* E. H. Hamilton. Eng. and Min. J., 1911, **91**, 224—225.

The author has made use of crude oil in a variety of metallurgical operations, and advocates a large extension of the practice, especially with reverberatory furnaces unfavourably situated as regards coal. Among the applications quoted are the employment of oil in Brown O'Hara roasting furnaces, where perfect control of the combustion was obtained, and, in another plant, the retorting of zinc crusts. In a plant where the ores were roasted in an oil-fired Edwards roasting furnace, and then smelted in reverberatory furnaces burning oil, the author obtained good results. In the reverberatory furnaces about 20 per cent. of the total heat developed is absorbed by the charge, and 50 per cent. by the boilers. The working of the oil-pumps, burners, etc., required about 7 per cent. of the steam generated. The use of oil, injected through the tuyères of a blast furnace as a partial substitute for solid fuel, with good effect, is also mentioned. The author states the calorific value of Californian crude oil to average 18,690 B.T.U. per lb., or 149,150 B.T.U. per American gallon.—R. W. N.

Metals ; Relative basicity of —— as shown by their power to replace one another in chemical compounds. L. Kahlenberg. Trans. Amer. Electrochem. Soc., 1910, 18, 103—107.

In non-aqueous solutions the capacity of metals of replacing one another, or their relative basicity, is different from that observed in aqueous solutions. Moreover, replacement of one metal from a compound by another is independent of electrolytic conduction, for it takes place in non-conducting as well as in conducting media. Numerous experiments have been made with solutions of metallic salts of oleic, palmitic, and abietic acids in different organic solvents, such solutions being non-conducting. From copper oleate dissolved in kerosene, zinc, cadmium, and lead will precipitate copper, while iron, cobalt, nickel, magnesium, bismuth, antimony, tin, and sodium have no action on the solution, even on heating for 3 hours at 100° C. When dissolved in carbon bisulphide, copper oleate is not affected by any of the metals mentioned, even on heating under pressure to about 100° C. In acetone solution copper oleate is unaffected by iron, bismuth, antimony, aluminium, zinc, nickel, tin, cadmium, and magnesium. In carbon tetrachloride solution zinc and lead precipitate copper, but the other metals mentioned have no action. In an amyl nitrate solution of copper oleate, cadmium and lead precipitate copper, bismuth is slightly tarnished, and the other metals produce no change. Ferrous oleate and cadmium oleate dissolved in toluene are not affected by magnesium, manganese, iron, nickel, cobalt, zinc, cadmium, tin, silver, aluminium, copper, antimony, bismuth, or lead, except that lead is tarnished when boiled with the cadmium oleate solution. Lead precipitates copper from copper palmitate dissolved in toluene, and bismuth is slightly tarnished by the solution, but none of the other metals mentioned produces any change. Lead has no action on copper abietate dissolved in pyridine, even on prolonged boiling, but precipitates copper immediately from copper palmitate dissolved in the same solvent. Molten copper oleate or palmitate is decomposed by lead, but molten copper abietate is not. Zinc and cadmium are slightly coated with copper when heated to 100° C. in a solution of copper oleate in aniline, and lead receives a bright red coating, but the other metals are unaffected. From copper oleate in pyridine, lead and cadmium precipitate copper, while the other metals produce no effect. Lead also precipitates copper from copper oleate dissolved in toluene, but none of the other metals does so, even after 7 hours at 100° C. ; sodium does not precipitate copper from this solution even when molten. Boiling solutions of the oleate of manganese, chromium, nickel, cobalt, iron, or cadmium in toluene are not affected by any of the metals mentioned except lead. Metallic magnesium has remained bright for 13 years in a solution of copper oleate in toluene. (See also this J., 1907, 36, 69).—A. S.

Clarification of the water used for waste-gas purification. Petersen. *See* IIa.

Pig iron production of the United States. Times, Eng. Suppl., March 1, 1911. [T.R.]

The official pig iron figures for 1910, as compiled by the American Iron and Steel Association, show a total of 27,298,545 gross tons, an increase of 1,503,074 tons over 1909, or 5·8 per cent. The production for the year is divided as follows :—Bessemer and low phosphorus pig, 11,244,612 tons, an increase, compared with 1909, of 6·5 per cent. ; basic pig (exclusive of charcoal basic pig), 9,084,520 tons, an increase of 10·1 per cent. ; charcoal pig, 394,377 tons, an increase of 18,374 tons ; bituminous coal and coke pig, 26,255,086 tons, an increase of 1,534,049 tons ; mixed anthracite and coke pig, 649,082 tons, a decrease of 49,349 tons ; spiegeleisen and ferro-manganese, 224,431 tons, a decrease of 609 tons ; and anthracite pig alone, 20,503 tons, as compared with 16,048 tons for 1909. The 1910 basic pig figures were the largest on record, and 1909 is the best previous year. The number of furnaces in blast on December 31, 1910, was 473.

Electrical smelting of iron ore, copper, etc., in Norway. Board of Trade J., Feb. 23, 1911. [T.R.]

The "Stavanger Electro-Staalverk A/s," has been formed with a capital of about £25,000, for the purpose of utilising scrap iron and steel for the electrical production of high grade steel. Works are to be erected at Jörpeland, near Stavanger, where the company has secured a supply of 2500 h.p. of electrical energy, which it is said could be increased to 10,000 h.p. The annual output is estimated at 1400 tons of high grade steel billets, 600 tons of cast steel, 300 tons of hammered steel, and 700 tons of scrap for re-smelting. It is proposed to commence operations this year. The directors of the Tinfos paper mills have turned over the electric iron ore smelting undertaking at Notodden to a newly-formed company named the "Tinfos Jernverk, A/s.," Notodden, with a capital of about £55,500. A new undertaking for the electrical smelting of iron, known as the "A/s Arendals Fossekompagni," has been established at Arendal, under the management of Mr. Eyde. It is reported to own the Böile Foss, near Arendal, a waterfall capable of affording 30,000 h.p. of electrical energy, of which it is proposed at first to harness only 12,000 h.p. The company has obtained the right to use the A/s Electrometals Swedish (Grönwall) process, and has also acquired ore deposits near Arendal.

The Ilen Smelting Works, of Trondhjem, is about to commence the electrical smelting of metals, using the process invented by the director of the works, Mr. Tharaldsen. Trial smeltings are being started with a furnace of 1000 h.p., chiefly for copper smelting, with an estimated producing capacity of 2000 tons per annum. A second furnace for iron smelting of 3000 h.p., and capable of producing 9000 tons per annum, is expected to start work in the spring. A consignment of 25 metric tons of pure copper, the first copper produced by electrical smelting in Norway, has recently been exported from the Birtavarra mines, at Kaafjord, near Lyngör. The company has recently considerably extended its works and has adopted a new method of electric smelting. The "Kristianssands Nikkelraffineringsverk," Christiansand, is about to undertake the electrical smelting and refining of nickel and copper. (See also this J., 1911, 31.)

Patents.

Titaniferous iron ores ; Treatment of ——. A. Sinding-Larsen, Christiania, Norway. Eng. Pat. 17,632, July 25, 1910. Under Int. Conv., July 23, 1909.

The crushed and dressed ore is heated, in a horizontal revolving retort, to a temperature below that of fusion and then reduced by some such agent as hydrogen, volatile hydrocarbons or carbon monoxide. As the reduction proceeds, the spongy product, containing the whole of its iron and a portion of its titanium as metal, is passed into a second retort which is heated to about 130° C. It is there exposed to a current of carbon monoxide ; the iron carbonyl which is formed is conducted to decomposition chambers and decomposed at a temperature of 200° C. or more, the carbon monoxide being passed back into the second retort. In this way, by suitably shaping the decomposition chambers, it is possible to obtain mouldings of any form, which however must subsequently be carbonised since the deposited metal is too pure for technical purposes. The residue in the second retort, consisting of titanium oxide and a certain proportion of titanium, may be heated to a high temperature by means of an electric furnace, subjected to the action of reducing gases and finally treated with nitrogen, the nitrides obtained being employed as a manure after any unreduced oxides, such as vanadium oxide, have been extracted by means of chlorine or acid.—C. A. W.

Electrolytic iron ; Process for the manufacture of sheets, bands, wire and the like of ——. Langbein-Pfanhauser-Werke, Akt. Ges., Leipzig, Germany. Eng. Pat. 22,204, Sept. 24, 1910. Under Int. Conv., Sept. 28, 1909.

It has been observed that annealing completely restores electrolytic iron to the condition as regards permeability, etc., which it was in before being subjected to mechanical treatment. It is practicable therefore to manufacture thick plates electrolytically, and afterwards to roll them out at a suitable temperature into thin metal sheets and the like.—T. St.

Tungsten; Treatment of —— to facilitate working. [*Producing ductile tungsten.*] British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 23,499, Oct. 14, 1909.

By repeatedly working a heated body of coherent tungsten, the metal may be obtained in a form which is ductile not only when hot but also at ordinary temperatures. The consolidated rod in fact, from possessing a crystalline structure, is transformed, by repeated rolling, hammering, swaging or drawing, into a form which shows a conchoidal fracture and ultimately becomes very fibrous. If the rod be of small diameter, it may be submitted directly to the drawing operation. The die for this purpose comprises a cylindrical metal piece heated by a circular burner of small gas jets and containing in the centre the actual draw-plate composed of a diamond or a piece of "high-speed" tool-steel. The wire as it goes into the die is passed through a groove in a cylindrical rod which is kept hot by a burner, a third burner being attached to the wire-drawing clamp. The wires may be pointed before introduction into the dies by dipping the ends into fused potassium nitrite, or by making them anodes in a strong solution of potassium cyanide through which a current is passed. The series of dies should differ in size by very small stages; for example a sintered conductor of 25 mm. diameter may be reduced by steps of 0·5 mm. down to 13 mm., from 13 to 4 mm. in steps of 0·25 mm. and subsequently even more slowly. The temperature of working is at first maintained at 600° to 650° C., until a diameter of 18 mm. is reached, when it is reduced to 500° C. Subsequently, for diameters less than 10 mm., it is fixed at 400° C. For larger diameters it may be necessary to employ, in the first place, a swaging machine. In this case, the rod, heated in a tube furnace to about 1300° C., is fed directly into the machine, whilst simultaneously a current of hydrogen is passed through the tube and into the space between the dies. The passage of the rod through the apparatus should be made at such a speed that the swager will never strike two blows in the same place; otherwise the metal may be cooled too quickly. (See also this J., 1910, 825).—C. A. W.

Coating of surfaces with metal, applicable also for soldering or uniting metals and other materials. M. U. Schoop, La Garenne Colombes, France. Eng. Pat. 5712, March 7, 1910. Under Int. Conv., April 27, 1909.

When molten metal is sprayed in the form of minute globules on to surfaces of metal, wood, etc., by means of a highly heated compressed gas, an intimately united layer of very compact and tough structure is formed. To increase the fluidity of the metal and to dissolve thin films of oxide, a flux may be added either to the molten metal or in the state of vapour to the hot spraying gas. The process may be used to weld two pieces of metal together, or, by removing the original supporting material after the metal coating has been applied, to produce seamless metal pipes, etc. It is specially suitable to metals which have relatively low melting points, such as tin, zinc, lead, aluminium, and their alloys.—T. St.

Zinc; Recovery of —— from ores, refuse, and waste material containing same. A. Gutensohn, Southend, Essex. Eng. Pat. 9818, April 22, 1910.

The ore or by-product, such as flue-dust, in a powdered condition and if necessary after roasting, is mixed with carbon and with a "collecting material," and heated in a retort at a temperature at which no other ingredient than zinc is melted. If the oxide be required, air-inlets are provided in the condenser pipes. The "collecting material" is composed of lime, 20 parts, as free as possible from silica; manganese borate, 1 part; and iron borate, 1 part; the proportion employed being one-fifth to one-quarter of the estimated weight of zinc. The amount of carbon used is equal to the estimated weight of zinc.
—C. A. W.

Refractory ores; Desulphurising apparatus and process for reducing and desulphurising ——. C. A. Case, Assignor to Ore Desulphurization Co., New York. U.S. Pats. 982,243 and 982,245, Jan. 24, 1911.

The ore containing volatile minerals is charged through a hopper into the central portion of a funnel-shaped furnace, where it is heated until partial disintegration takes place, the sulphurous fumes being passed into water so that a solution of sulphuric and sulphurous acids is obtained. The material is then subjected to a mixture of superheated steam, oil and air introduced through tuyères, and in this way the elimination of the remaining sulphur is effected. The fumes rising from the furnace are passed through the acid solution, for the extraction of the soluble constituents, and subsequently over metallic iron, when the remaining metals are eliminated. Finally the soluble metals are precipitated from the solution by means of zinc; whilst the ore, from which the sulphur has been eliminated, is discharged through a shoot and carried over discharging drums into a cooling tank below the furnace, where the gangue is disintegrated by water.—C. A. W.

Chromium ores; Process for agglomerating —— by means of a binding agent containing organic matter. R. Tripmacher. Ger. Pat. 230,033, Jan. 13, 1909.

In the preparation of refractory materials for the construction of metallurgical furnaces from chromite, by using organic materials (molasses, etc.) as binding agent, claim is made for the addition of chromic acid to the binding agent. This is stated to increase the strength, without diminishing the refractory nature of the product.
—A. S.

Iron, steel, and alloys of steel; Process for the cementation of articles of ——. E. C. R. Marks, London. From Soc. Anon. Italiana Gio. Ansaldo Armstrong & Co., Genoa, Italy. Eng. Pat. 11,839, May 12, 1910.

See Fr. Pat. 415,985 of 1910; this J., 1910, 1314.—T. F. B.

Iron; Method of protecting —— from rust. A. Lang, Karlsruhe, Assignor to H. Freiherr von Seldeneck, Frankfort, Germany. U.S. Pat. 983,377, Feb. 7, 1911.

See Eng. Pat. 21,638 of 1909; this J., 1910, 1255.—T. F. B.

Oxide ores; Process of and apparatus for reducing metallic ——. H. E. T. Haultain and J. W. Moffatt, Toronto, Canada. Eng. Pat. 3715, Feb. 15, 1910.

See U.S. Pat. 950,595 of 1910; this J., 1910, 434.—T. F. B.

Platinum clad metals. B. E. Eldred, Bronksville, N.Y., U.S.A. Eng. Pat. 4466, Feb. 23, 1910.

See Fr. Pat. 414,724 of 1910; this J., 1910, 1211. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 908 of 1890 and 19,071 of 1891.—T. F. B.

Briquettes for metallurgical or other purposes; Manufacture of ——. W. F. Collins, London. U.S. Pat. 982,796, Jan. 31, 1911.

See Eng. Pat. 17,546 of 1907; this J., 1908, 943.—T. F. B.

Slag; Apparatus for atomising liquid ——. G. Jantzen, Assignor to Buderus'sche Eisenwerke, Wetzlar, Germany. U.S. Pat. 982,964, Jan. 31, 1911.

See Fr. Pat. 410,377 of 1909; this J., 1910, 827.—T. F. B.

Ores: Method of treating —— by the blast-furnace process. F. A. Kjellin, Stockholm. U.S. Pat. 983,453, Feb. 7, 1911.

See Fr. Pat. 408,674 of 1909: this J., 1910, 637.—T. F. B.

Cleaning and polishing silver plate and the like; Electrochemical process for ——. A. M. Kohler, Brixton. U.S. Pat. 983,727, Feb. 7, 1911.

See Eng. Pat. 15,962 of 1908; this J., 1909, 369.—T. F. B.

Alloys; Process for producing —— and for separating metals. P. F. Cowing. Fr. Pat. 420,182, Sept. 9, 1910. Under Int. Conv., Sept. 13, 1909.

See U.S. Pat. 969,773 of 1910; this J., 1910, 1210.—T. F. B.

Alloys of alkali-metals; Process for making ——. R. J. McNitt. Fr. Pat. 420,186, Sept. 9, 1910.

SEE Eng. Pat. 20.519 of 1910; this J., 1911, 33.—T. F. B.

Zinc-lead ores; Treatment of refractory ——. P. C. C. Isherwood. Fr. Pat. 420,510, Sept. 17, 1910. Under Int. Conv., Sept. 21, 1909.

SEE Eng. Pat. 21,584 of 1909; this J., 1910, 1391.—T. F. B.

Magnesium and its alloys; Process for freeing —— from chlorides. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 420.858, Sept. 28. 1910.

SEE Eng. Pat. 23.440 of 1909; this J., 1910, 1315.—T. F. B.

Utilising blast furnace slag for the manufacture of stones or bricks. Eng. Pat. 17,109. *See* IX.

XI.—ELECTRO-CHEMISTRY.

Secondary cell; A new ——. D. J. Block. Trans. Amer. Electrochem. Soc., 1910, **18**, 79—81.

THE cell consists essentially of a zinc jar, acting as cathode, containing an anode of porous charcoal enclosed in asbestos cloth, the space between the anode and cathode being filled with a paste composed of ground or granular carbon, ferric hydroxide, zinc bromide and chloride, and water. The charcoal anode is able to retain within its pores about 200 times its volume (three-quarters of its weight) of gaseous chlorine and a larger quantity of liquid bromine. The reaction on charging is expressed as follows:—

$$15ZnCl_2 + 3ZnBr_2 + 18H_2O + 12Fe(OH)_3 =$$
$$18Zn + 12Fe(OH)_3 + 30HCl + 6HBrO_3.$$

Then the hydrochloric and bromic acids are neutralised by the ferric hydroxide, and the ferric salts produced react with the zinc to regenerate zinc chloride and bromide during discharge:—

$$18Zn + 10FeCl_3 + 2Fe(BrO_3)_3 + 36H_2O =$$
$$15ZnCl_2 + 3ZnBr_2 + 12Fe(OH)_3 + 18H_2O.$$

The first cells of this type, owing to high internal resistance, had an efficiency of but 28 per cent., but recently a cell with an efficiency of nearly 52 per cent. has been constructed. The cells are cheap, and of light weight, one actual horse-power-hour being developed per 15 lb. weight; and no loss of energy due to formation of hydrogen at the cathode can take place. A similar cell with cobalt in place of zinc is also being investigated.—A. S

Arc lamp with mercury, giving white light. Urbain and others. *See* IIB.

Present status of ozone with reference to air purification. Small. *See* XIXB.

Determination of silver by electro-deposition from an ammoniacal solution of the oxalate. Gooch and Teiser. *See* XXIII.

PATENTS.

Lead electrodes of secondary batteries; Process to regenerate and improve the structure of ——. E. H. Naylor, London Eng. Pat. 1558, Jan. 21. 1910.

ELECTRODES of secondary batteries, either prior to use or when totally or partially regenerated, are immersed in a liquid or vapourous bath of disulphur dichloride (S_2Cl_2). The electrodes are then heated in an oven, reduced electrolytically in a bath of dilute acid, washed, and subsequently formed in any usual manner.—B. N.

Graphite article [electrode] and method of making the same. F. J. Tone, Niagara Falls, N.Y. U.S. Pat. 977.984. Dec. 6, 1910.

ELECTRICALLY produced graphite is subjected to a pressure of preferably 10 tons to the square inch and upwards in suitable moulds without the addition of a binding material, with the formation of mechanically strong articles possessing a specific gravity of approximately 2·2.—O. R.

Ozone; Apparatus for producing ——. L. Glaser, Pankow, Germany, Assignor to General Electric Co., New York. U.S. Pat. 982,227, Jan. 17, 1911.

AIR is caused to pass at a high speed against a conductor of the second class, and a resistance with a high, positive temperature coefficient, enclosed in an atmosphere of hydrogen, is connected in series with the conductor, so as to prevent the latter from losing its conductivity on account of the cooling action of the air current.—O. R.

Furnace; Electric —— C. F. J. Forssell, Cleveland, Ohio. Assignor to the National Carbon Co., N.J. U.S. Pat. 982,420, Jan. 24, 1911.

THE furnace comprises electric terminals attached to a tubular body or chamber, having a wall of resister material which is heated by the passage of the current. Suitable rods, or material, are interposed between, but in electrical connection with, the resister wall of the tubular body and the terminals, each rod at some portion having sufficient resistance to generate the heat necessary to prevent loss, by conduction to the terminals, of the heat generated in the resister wall.—B. N.

Electric furnaces; Method of supplying —— with polyphase currents. P. Girod, Ugine, France. U.S. Pat. 983,043, Jan. 31, 1911.

SEE Eng. Pat. 3421 of 1910; this J., 1911, 35.—T. F. B.

Furnace; Electric ——. H. Nathusius, Friedenshütte, Germany. U.S. Pat. 983,303, Feb. 7, 1911.

SEE Fr. Pat. 388,668 of 1908; this J., 1908, 948.—T. F. B.

Iron electrodes for use in alkaline accumulators; Process of manufacturing ——. A. T. K. Estelle, Assignor to Nya Ackumulator Aktiebolaget Jungner, Fliseryd, Sweden. U.S. Pat. 983.430, Feb. 7, 1911.

SEE Fr. Pat. 414,713 of 1910; this J., 1910, 1212.—T. F. B.

XII.—FATS; OILS; WAXES.

Vegetable oils; Refraction constants of ——. J. Klimont. Z. angew. Chem., 1911, **24**, 254—256.

THE specific refraction of 40 samples of vegetable oils determined by Procter's method (this J., 1898, 1023) was found to be nearly constant and to lie very close to 0·51. The mean molecular refraction was also calculated by means of the formulæ

$$(n-1)\frac{M}{d} \text{ or } \frac{n_2-1}{n_2+2}\ \frac{M}{d},$$

where *n* represents the refractive index, *d* the specific gravity at the same temperature, and M the mean molecular weight calculated from the saponification value. The following results are typical of those obtained:—

Oil.	Refractive index.	Mean molecular refraction.	Saponification value.
Linseed ...	1·4705—1·4810	447	193·7
Olive......	1·4670—1·4671	447	191·6
Cotton seed	1·4710—1·4730	435	197·8
Sesame....	1·4725—1·4730	451	188—193
Soya bean .	1·4731—1·4745	450	191·3
Arachis....	1·4700—1·4750	448	192·3
Maize	1·4745	448	192·6

—C. A. M.

Blown fatty oils. J. Marcusson. Mitt. K. K. Materialprüfungsamt., 1911, 29, 50—53.

THE author describes a modification of his method (this J., 1905, 1313) for distinguishing between blown rape oil and blown cottonseed oil in lubricating oils (marine engine oils) having a basis of mineral oil. In such oils blown rape oil is permissible, but cottonseed and other oxidised oils should not be used. According to the improved method, the fatty acids isolated from the mixture are first split up into portions soluble and insoluble in light petroleum spirit, and only the soluble portion is converted into lead soaps. It will then be found that in the case of blown rape oil, the lead soaps of the portion of the fatty acids soluble in light petroleum are completely soluble in warm ether, traces only separating out on cooling. In the case of blown cottonseed oil the corresponding lead salts are only partially soluble in warm ether, and are still less soluble on cooling. Quantitative determinations are therefore not necessary in carrying out the test, and the presence of 25 per cent. of blown cottonseed oil in blown rape oil can readily be detected. The residue of insoluble lead soaps, calculated on the weight of fatty acids soluble in light petroleum taken for their preparation, amounts to 14—18 per cent. in the case of blown cottonseed, fish and bone oils and 8 per cent. in a strongly oxidised linseed oil. Sherman and Falk's method (this J., 1905, 680) for calculating the iodine value of the original oil from that of the blown oil, according to its specific gravity at 15°/15° C., may be usefully applied as a confirmatory test. In the mixtures of blown oils with mineral oils, the specific gravity of the blown oil may be calculated by difference from that of the mixture and that of the isolated mineral oil, allowing for the relative proportions. The iodine value of the blown oil may be found by multiplying that of the isolated fatty acids by 0·9. The average specific gravity of unmodified rape and cottonseed oils may be assumed as 0·919. Hence he calculates the iodine value of the original fatty oil (I) by the formula:

$$\mathrm{I} = \text{Iodine value of blown oil} \times \frac{\text{sp. gr. of blown oil} - 0{\cdot}919}{0{\cdot}001} \times 0{\cdot}8.$$

The iodine value of rape oil ranges between 96 and 106, that of cottonseed oil between 102—111. Sherman and Falk's method therefore does not afford a very decisive distinction between these two, but in conjunction with the author's qualitative test it indicates whether the presence of other fatty oils is to be looked for or not.—J. F. B.

"*Cardamon*" *oil.* Seifensieder-Zeit., 1910, 37, 1425. Chem. Zentr., 1911, 1, 504.

According to a German "Customs Report," there has been introduced into Germany, under the name "cardamon oil," a yellowish white, vegetable fat of the consistence of lard, and having the following characters: Sp. gr. at 20° C., 0·955; free fatty acids (as oleic acid), 4·15 per cent.; saponification value, 202·7; iodine value, 97·6; butyro-refractometer reading at 25° C., 81·5; optical rotation, $[\alpha]_D = +79{\cdot}1$; m. pt. 22°—25° C. It had been suggested that after refining, the fat might be useful as an edible fat (compare against this, this J., 1911, 139). —A. S.

Linolenic acid and linseed oil. A. Rollett. Z. physiol. Chem., 1911, 70, 404—407.

The author adheres to his view (see this J., 1909, 1210) that no adequate evidence of the existence of two isomeric linolenic acids has been brought forward by Erdmann and Bedford (this J., 1909, 530; 1910, 1258). These investigators now admit that linolenic acid regenerated from the liquid bromide yields a small quantity of the solid hexabromide on re-bromination; they obtained 3·2 per cent., whereas the author, in two experiments obtained 9·3 and 11 per cent. respectively, the higher yields being probably due to the fact that the oil was purified by distillation before re-bromination. The fact that when these operations of reduction and re-bromination are repeated, finally no solid hexabromide is produced can be easily explained by the readiness with which linolenic acid undergoes alteration. Erdmann and Bedford appear to assume that the linolic and linolenic acids separated (in the form of ethyl esters) by them were unaltered and in the same ratio as in the original linseed oil. This assumption is manifestly untenable, for their own experimental results show that the iodine value of the unsaturated acids (other than oleic acid) decreased during the process of separation. That this decrease is probably due, at least in part, to partial oxidation and polymerisation of the linolenic acid, is supported by the fact that Bedford (Diss., Halle, 1906) for the linolenic acid separated from the solid hexabromide found the iodine value, 248·4, whereas there is no doubt that this acid has the theoretical iodine value, 273·7; indeed the author, by taking special precautions to avoid presence of air and making the determination immediately after the preparation of the acid, obtained the value, 267·8 (compare also Lewkowitsch, Meyer's Jahrb. der Chem., 1909, 435).—A. S.

Propolis. M. Küstenmacher. Ber. deutsch. Pharm. Ges., 1911, 21, 65—92.

The author's investigations have shown that propolis is derived from the oil or balsam from the outer surface of pollen granules. (See this J., 1911, 102.) If considerable quantities of fresh propolis are melted with the beeswax, the latter is given a more intense colour, but in the case of old propolis the tannin of the balsam will have been oxidised, and will separate in brown flakes from the wax, so that only a small proportion will remain in solution. On the other hand, the balsam will increase the proportion of resin in the wax and cause the m. pt. to be lower. Both the balsam and its tannin may be separated from beeswax by digestion with 60 per cent. alcohol, leaving a white wax. The tannin may be separated by oxidising it with sulphuric acid and a chromate into an insoluble compound, which may be separated by filtration from the wax and balsam. In the fresh condition the propolis is very soft and sticky, has a strong aromatic odour and a bitter taste, and varies in colour from greenish-yellow to brown. Below 15° C. it is brittle. The balsam of the propolis forms a non-irritant stopping for wounds, and is very highly prized as a varnish, since it dries to a brilliant film. Propolis is frequently used to impart a fragrant odour to tobacco, etc., and should prove a valuable perfuming agent for soaps. Its present price as compared with beeswax is as 3 : 4. In the analysis of propolis the insoluble constituents are separated by boiling the sample with five successive portions of twice its weight of 99·8 per cent. (by volume) alcohol, and subsequently, if necessary, extracting the residue with chloroform. The final residue (consisting of wood fibre, débris, etc., and substances introduced by the bee-master) is weighed and microscopically examined. The alcoholic filtrate, on cooling, yields a considerable precipitate, which is washed, first with absolute alcohol and then with 96 per cent. alcohol, until the washings are colourless. The residue (Wax A) is dissolved in boiling 99·8 per cent. alcohol, from which on cooling the bulk separates. The filtrate from Wax A is gradually diluted with water until the liquid has an alcoholic strength of 40 per cent. by weight. The resulting precipitates are immediately filtered off, and washed with 60 per cent. alcohol, to obtain Wax B. If the residue I. after boiling with alcohol is coherent, it is extracted with hot xylene or chloroform, and on cooling the extracts any paraffin wax (ceresin, etc., from artificial combs) separates, and is washed with alcohol, pressed, dried, and weighed. The filtrate invariably still contains large quantities of a yellow wax (C), which, after evaporation of the solvent, is boiled with alcohol and separated from the balsam by fractional dilution as described above. The united alcoholic filtrates and washings from II. A, B, and C, are distilled *in vacuo* (finally after the addition of a little water) until the residue has become completely transparent. The balsam thus obtained is of the consistence of a syrup and appears yellow to orange by transmitted light in layers of 1 mm. in the case of pissoceros and propolis, whilst in thicker layers (about 1 cm.) it is blood-red. The colour of commosis is yellow to yellowish-brown. Any odour of turpentine oil in the balsam indicates that the wax of the artificial comb had been treated with colophony, etc., to render it more transparent, and that these bodies had passed, as in the case of the paraffin wax, into the propolis. On dry distillation the balsam is separated at 160° C. into a nearly colourless essential oil with a pronounced odour of hyacinths, whilst water is split off. If the distillation is continued up to 260° C., cinnamic acid passes over. The essential oil may also be separated from the balsam by means of various solvents. The balsam contains about 10 per cent. of cinnamyl alcohol, whilst commosis balsam contains about 1 per cent. of cinnamic acid. The essential oil, which consists of the cinnamyl alcohol in combination with the resins of the propolis, darkens on keeping, and becomes thick when cooled below 10° C., and a crystalline solid at a lower temperature. The resin, $C_{26}H_{26}O_6$, to which the physical properties of the propolis are due, forms from 60 to 85 per cent. of the total constituents, whilst the tannin, which gives to the balsam its colour, amounts to about 4 per cent. (calculated on the balsam). The resin is left in a pure condition after evaporation of the filtrate from the essential oil and tannin. Samples of propolis examined by the author gave the following results :—

	Insoluble substances.	Wax.	Balsam.
	per cent.		per cent.
Propolis (pissoceros)	5 (pollen only)	trace	95 (red) containing 10 per cent. of cinnamyl alcohol
Propolis ..	5	35	60 (red) ,, 10·7 ,,
Propolis ..	18	22	60 (red) ,, 9 ,,
Commosis ..	17	20	73 (br'n) ,, 9·5 ,,
Propolis from Thuringia	15·2	23·75 (Wax A, 9·6 ; Wax B, 3·64 ; Wax C, 4·83 ; Ceresin, 5·7)	61·04 (Cinnamyl alcohol, 7·32 ; tannin, 2·27 ; resin, 51·44 per cent.)
Propolis from Posen ..	14·7	33·3 (Wax A, 6·60 Wax B, 1·0 Wax C, 21·3 Ceresin, 4·4)	52 (Cinnamyl alcohol, 3·12 ; tannin, 2·08 resin, 46·8)

Propolis balsam is completely soluble (1 grm. to 10 grms. of solvent) in cold methyl alcohol, acetic acid and sulphuric acid ; sparingly soluble in cold acetone, ether, and amyl alcohol ; and nearly insoluble in cold benzene, petroleum spirit, glycerin, and water. In most of these solvents it dissolves, on heating, to form clear solutions.—C. A. M.

Patents.

Palmitin waterproofing compound and process of making the same. E. Mas, New York. U.S. Pat. 982,620, Jan. 24, 1911.

Palmitin, free from "oleaginous substances," is melted and incorporated with a powdered substance, such as hydrated lime or other mineral substance, to obtain a waterproofing compound. Suitable proportions claimed are five parts of palmitin to 95 parts of the powdered vehicle.—C. A. M.

Soap ; Process of and means for the manufacture of ——. A. E. Boardman, Warrington. Eng. Pat. 2266, Jan. 29, 1910.

The liquid soap is transferred from the manufacturing pan into a vat, in which it is agitated and diluted, and coloured if required. It is then led into a trough from which it is removed as a film on the periphery of a heated revolving drum, from which the dried soap is stripped by a scraper. The soap may be led from the vat directly to the drum.—H. E. P.

Stearine ; Process for the manufacture of —— with acidification [sulphonation] of oleic acid. H. Dubovitz, Budapest, Hungary. Eng. Pat. 2989, Feb. 7, 1910.

See Fr. Pat. 412,546 of 1910 ; this J., 1910, 1022. Reference is directed in pursuance of Sect. 7, Sub-Sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 6622 of 1901. —T. F. B.

Solvents ; Process for the manufacture of soluble ——. G. and H. Nauton and G. de Marsac, St. Ouen, and T. F. Tesse, Paris. U.S. Pat. 983,751, Feb. 7, 1911.

See Eng. Pat. 14,725 of 1909 ; this J., 1910, 437.—T. F. B.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Lac resin from Baroda, India. Bull. Imp. Inst., 1910, 8, 371—372.

Two samples of lac (stick lac and seed lac) were examined. They had been collected from the *Inga Saman* (*Pithecolobium Saman*) or "rain tree," which, it was stated, had only recently been used as a host for the lac insect. The stick lac contained only 26·8 per cent. of actual lac and would not be suitable for export to Europe. The seed lac was valued at 55s. to 60s. per cwt. in London (April, 1910), and would meet with a ready sale. It contained 2·7 per cent. of moisture, 2·2 of ash, 6·6 of wax, 12·4 of colouring matter, 8·6 of insoluble matter, and 67·5 per cent. of resin. It had the iodine value 4·5 as received and 3·9 after purification from dust, etc.—A. S.

Red and orange lead ; New regulations as to the smelting of ——. Ch. of Comm. J., March, 1911. [T.R.]

The Home Secretary has issued new draft regulations dealing with dangerous processes in the smelting of materials containing lead and in the manufacture of red and orange lead and of flaked litharge. They are based on the proposals contained in a special report issued by the Home Office last May (see this J., 1910, 631), but certain modifications have been made to meet points raised by manufacturers and others. A Home Office circular calls attention particularly to the following among others :— 1. Exemption from the proposed regulations has been extended to all materials (except zinc ore) containing less than 5 per cent. of lead, instead of 2 per cent., as originally proposed. 2. Materials containing lead only in the form of sulphide of lead have been excluded from the scope of the regulations by amendment of the definition of "lead material." This exemption does not extend to products obtained by treatment of such materials in furnaces. 3. The definition of "efficient exhaust draught" has been modified to meet the difficulty, which may arise where mechanical means of ventilation are not reasonably practicable, in providing a draught (by means of heat alone) which shall be efficient in all conditions of weather. 4. Regulation 1 (b) has been modified so as to allow any effective method of spraying the floor. 5. The limit of 550° C. originally proposed has been omitted, and an efficient exhaust draught will be required if material is heated to any temperature at which lead vapour is given off. 6. As regards the process of sampling, exemption from Regulation 4 has been allowed, in view of the difficulty of preventing the escape of dust. Under Regulation 8, however, overalls will be necessary in certain circumstances. 7. The requirements as to demolition and reconstruction processes have been so far modified in Regulation 8 as to allow these processes to be carried on if any of the following precautions are adopted :— (a) Damping, (b) respirators and overalls, or (c) in demolition, efficient exhaust draught. 8. In consequence of representations which have been made as to the difficulties which the absolute prohibition of the use of tobacco would entail in these industries this requirement has been somewhat modified in Regulation 11, subject to the observance of certain precautions. When made, the regulations will supersede the existing special rules for smelting of lead, and for the manufacture of red and orange lead. The usual intimation that objections on behalf of any person affected must be sent to the Secretary of State within 40 days is appended.

Patents.

Drying white lead, colour powders, and other materials ; Apparatus for ——. A. I. Summers, Bristol. Eng. Pat. 4789, Feb. 25, 1910.

The apparatus comprises a casing containing a rotating cage, from which baskets or shelves, for carrying the material to be treated, are suspended. The cage, with the baskets, is rotated, whilst hot air or the like is caused to flow through the casing, a central drum directing the air over the baskets.—B. N.

Barium sulphate ; Treatment of —— for use as a pigment. A. Moffatt, Indianapolis, U.S.A. Eng. Pat. 22,033, Sept. 22, 1910.

See U.S. Pats. 973,373 and 973,374 of 1910 ; this J., 1910, 1321. The alkali sulphate may be replaced by an alkali chloride.—T. F. B.

Wood; Apparatus for extracting products [turpentine, etc.] from ——. F. Pope, Mount Pleasant, Ga., Assignor to Southern Manufacturing Co., Pittsburg, Pa. U.S. Pat. 982,631, Jan. 24, 1911.

The extraction apparatus contains two compartments (one of which may be placed above the other) communicating with one another, *e.g.* by means of a pipe projecting upwards into the upper compartment. The wood to be extracted is placed in the lower compartment, where means may be provided for carrying out the extraction under pressure, whilst the solvent and extracted products rise into the upper compartment. Here the products are separated, and the solvent is returned to the wood compartment, after being heated on its way back.—C. A. M.

Lead pigment and method of making the same. A. S. Ramage, Buffalo, N.Y. U.S. Pat. 982,992, Jan. 31, 1911.

See Fr. Pat. 419,470 of 1910; this J., 1911, 224.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Parà rubber (Hevea brasiliensis) in Southern Nigeria. Bull. Imp. Inst., 1910, 8, 341—346.

The Para rubber tree can be successfully grown in many parts of the wet zone of S. Nigeria, and plantations are being gradually extended. The results of two series of tapping experiments are given in the present paper.

(1) Trees about 16 years old in the Botanic Gardens at Ebute-Metta. The experiments extended from Sept. 22 to Nov. 18, 1909, the trees being tapped on alternate days. The results are shown in the following table :—

	Number of tappings.	Daily yield of dry rubber.		Total yield of dry rubber.	Average total yield per tree.	Average yield per tree for each tapping.
		Min.	Max.			
(a) Four trees—average girth, 37 ins.	26	1¼ oz.*	4 oz.†	4 lb. 15 oz.	20 oz.	0·8 oz.
(b) Two trees—average girth, 40 ins.........	25	nil*	2½ oz.‡	1 lb. 10¾ oz.	13 oz.	0·5 oz.

(a) Tapped previously in 1908. (b) Tapped for first time
* First tapping. † 20th and 22nd tappings. ‡ 19th tapping.

The rubber obtained in these experiments was of a light brown colour and had very satisfactory physical properties. The results of the chemical examination showed that the rubber is quite equal to plantation Para rubber from Ceylon or Malaya. The rubber from the 1908 tapping was valued at 5s. per lb., with fine hard Para at the same price and fine plantation Para at 5s. 1d. to 5s. 8d. per lb.; the rubber obtained in 1909 was valued at 9s. per lb., with fine hard Para at 9s. 10d. and fine plantation Para at 10s. 1d. to 10s. 6d. per lb.

(2) Eight-year old trees at Orugbo. The experiments extended from Sept. 19 to Oct. 30, 1909, and the tappings were made on alternate days, with the exception that the first group of 50 trees was tapped every day for one week. Tapping was conducted on the half herring-bone system, the vertical channel being 6 feet high and the lateral cuts 6 ins. long. The results are shown in the following table :—

	Number of tappings.	Daily yield of dry rubber.		Total yield of dry rubber.	Average total yield per tree.	Average yield per tree for each tapping.
		Min.	Max.			
(1) 50 trees—average girth, 25 ins.	23	2oz.*	1 lb. 5½ oz.†	20½ lb.	6·5 oz.	0·3 oz.
(2) 50 trees—average girth, 22 ins.	21	2½ oz.*	14½ oz.‡	14 lb. 2¾ oz.	4·5 oz.	0·2 oz.
(3) 3 trees previously tapped**	20	nil*	2 oz.§	1 lb. 2 oz.	6 oz.	0·3 oz.

* First tapping. † 21st tapping. ‡ 15th and 17th tappings. § 15th tapping.
** These three trees gave 9 oz. of dry rubber in 8 tappings in Aug. 1909.

The rubber possessed very good physical properties, but contained more resin (3·7 per cent. on the dry substance) than the best specimens of the Ebute-Metta rubber (1·7 per cent.). A small consignment of 30 lb. was sold for 8s. 10¼d. per lb., with fine hard Para at 9s. 10d., and fine plantation biscuits at 10s. 1d. to 10s. 6d. per lb.—A. S.

Rubber in Nyasaland. Bull. Imp. Inst., 1910, 8, 381—383.

The only district in Nyasaland suitable for the Para rubber tree is West Nyasa, where an estate of 600 acres is doing well. The Ceará (*Manihot Glaziovii*) tree appears to grow better in Nyasaland than any other rubber-yielding plant, and the area under this variety has steadily risen to 4403 acres. Little or no information is available as to the life of Ceará trees, or as to how they stand tapping. Tapping experiments indicate that 3 oz. of dry rubber per tree is a good average yield for trees over four years old. Ceará trees appear to need suitable soil and cultivation in order to be successful. The quality of the rubber is satisfactory, trial parcels having been sold at 8s. 10d. per lb. in London. The exports of rubber, including wild rubber, from Nyasaland in 1909 were 27,000 lb., being an increase of about 10,000 lb. on the figures for the previous year.—A. S.

Rubber of Mascarenhasia elastica. Bull. Imp. Inst., 1910, 8, 346—352.

Mascarenhasia elastica, a rubber-yielding tree discovered in German East Africa in 1898 (see this J., 1900, 1025), has since been found in the East Africa Protectorate, in the island of Pemba, and in Portuguese East Africa. A specimen of the rubber (A) from the East Africa Protectorate was in the form of a ball, 2¼ ins. diam., weighing 3½ oz. It contained a considerable amount of vegetable impurities, but the physical properties of the rubber were fairly satisfactory. The rubber was valued at 3s. 6d. per lb., with fine hard Para at 5s. 2d. per lb. A specimen (B) from Pemba, consisted of six small balls, weighing altogether 8½ oz. The rubber possessed good elasticity and tenacity and was valued at 4s. per lb., with fine hard Para. at 8s. 10d. per lb. Two specimens (C and D) of ball rubber and three (E, F, G) of smoked sheet from Portuguese East Africa were examined. The ball rubbers had satisfactory physical properties, except that C was slightly sticky. They were valued at 2s. 9d.—3s. 3d. per lb., with fine hard Para at 3s. 11½d. per lb. The smoked sheet rubbers exhibited good elasticity and tenacity, and were valued at 3s. 4d.—3s. 9d. per lb., with fine hard Para at 4s. 2½d. per lb. The chemical composition of the samples is shown in the following table:—

	A	B	C	D	E	F	G
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Moisture	10·0	15·8	6·6	1·4	8·4	10·4	8·4
Caoutchouc	69·0	71·7	75·5	90·8	73·4	74·0	74·2
Resin	6·1	7·6	6·0	4·5	7·4	6·4	6·9
Protein	3·5	3·1	3·4	2·4	3·6	3·4	3·5
Insoluble matter	11·4	1·8	8·5	0·9	7·2	5·8	7·0
Ash	2·29	1·09	3·2	1·9	1·8	1·6	1·8

—A. S.

Rubber; Action of chromyl chloride on ——. D. Spence and J. C. Galletly. J. Amer. Chem. Soc., 1911, **33**, 190—194.

Rubbers of different botanical origin gave a definite compound, $C_{10}H_{16}.2(CrO_2Cl_2)$, when treated in carbon bisulphide solution with chromyl chloride. The compound decomposes rapidly in moist air. When decomposed by water an aldehyde appeared to result among other products. A brown powder may also be obtained, which is very insoluble and which appears to contain definite amounts of chromium and chlorine.—H. E. P.

Rubber tetrabromide; Hübener's ——. G. Hübener. Gummi-Zeit., 1911, **25**, 634.

In addition to the points referred to in this J., 1911, 224, the author draws attention to differences between the behaviour of gutta and that of rubber towards various chemical reagents. Ozone attacks solid rubber, but not solid gutta-percha; rubber is readily vulcanised by sulphur, gutta-percha is not; the affinity of gutta-percha for oxygen is much greater than that of rubber. Caspari's gutta-percha bromide had a composition agreeing with the formula, $C_{30}H_{46}Br_{10}$, and was decomposed on heating at 130° C., hydrogen bromide being given off. The author further points out that he early modified his method by first extracting the resins from the sample with acetone, and also that he himself has already drawn attention to the difficulty of dealing with very soft samples. Such would include unvulcanised samples, to which his method was not intended to apply, but only to hot-vulcanised samples.—E. W. L.

Patents.

Rubber; Treatment of waste —— for reforming the same or for the production of vulcanite, ebonite or the like. W. A. Allsebrook and P. A. Docherty, Burton-on-Trent. Eng. Pat. 17,645, July 25, 1910.

The rubber waste is reduced to a fine state of division, the operation being continued till a plasma is obtained. Compounding materials are then added, and the rubber is worked between rollers, one of which is heated to a temperature not above 247° F., and is finally vulcanised. —H. E. P.

Rubber-like gum; Process of separating —— from its vegetable source. W. A. Lawrence, New York, Assignor to Intercontinental Rubber Co. U.S. Pat. 982,373, Jan. 24, 1911.

The vegetable product containing the rubber-like gum is finely divided and rubbed below the surface of water by means of rolling or falling bodies, so that the gum being thus separated rises by reason of its lower sp. gr. to the surface, whilst the other constituents of the vegetable product remain below.—C. A. M.

India-rubber and the like; Manufacture or purification of —— and the obtainment of by-products therefrom. C. Dreyfus and A. Friedl, Manchester, and W. H. Bentley, Irlam, Assignors to Clayton Aniline Co., Ltd., Clayton. U.S. Pat. 983,812, Feb. 7, 1911.

See Eng. Pat. 27,130 of 1909; this J., 1910, 1069.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Tannin solutions; Note on ——. [Detection of tannin.] G. Grasser. Collegium, 1911, 46—52.

When an iodine solution is added to a solution of tannin the iodine is absorbed by the tannin and no colouration is given with starch solution until an excess of iodine is present. The author makes use of this fact as a method for the detection of tannin. A single drop of a dilute iodine solution is added to the tannin solution under investigation, and then the mixture tested by the starch reaction for free iodine. If no violet colouration is produced it is evidence of the presence of tannin. The author investigated the colour produced by the action of iodine on solutions of different tanning materials and found that only in the case of pine bark was a distinct colouration given so that in every other case it would be possible to observe the colour produced subsequently by the iodine-starch reaction. The relative sensitiveness of different reagents for the detection of tannin was determined, the reagents tried being:—(A.) a 5 per cent. solution of tartar emetic; (B.) a 5 per cent. solution of tartar emetic in presence of ammonium chloride; (C.) a solution containing 5 per cent. of tartar emetic and 5 per cent. of ammonium acetate; (D.) a solution containing 5 per cent. of tartar emetic, 5 per cent. of sodium chloride, 5 per cent. of sodium bitartrate and 20 per cent. of sodium acetate; (E.) ammoniacal zinc acetate solution; (F.) *N*/50 iodine; (G.) a solution containing 1 per cent of gelatin and 10 per cent. of salt. The reagents were tested on I, gallotannic acid; II, mangrove infusion; III, solution of tannin rich in non-tanning matters. With gallotannic acid, iodine was sensitive at a concentration of 0·0001 per cent., zinc acetate at 0·0005, and gelatin at 0·01 per cent. With mangrove solution, iodine was the most sensitive, tannin being detected at a concentration of 0·001 per cent. With the liquor rich in non-tannins, the iodine was again the most sensitive, tannin being detected at a concentration of 0·0034 per cent. The author concludes that gelatin is the best reagent to use, zinc acetate is unreliable because it probably precipitates other than tanning matters, whilst iodine is capable of giving good results with care.

A note is added on the mutual precipitation of tan liquors. When tan liquors are allowed to stand it is well known that a deposit is formed. The formation of this deposit when tanning solutions are mixed was investigated. Clear filtered solutions from different materials were taken and mixed in pairs. In no case was a precipitate formed immediately, although on standing a deposit was formed in those cases where valonia and quebracho were used. The author therefore concludes that the tannins have no detannising or precipitating action on one another.—J. R. B.

Patent.

Leather; Process of making sole ——. J. A. Tanner, Boston, Mass. U.S. Pat. 983,005, Jan. 31, 1911.

The hide is immersed in a solution containing chromic acid till partially saturated, then in a solution of a reducing agent, e.g., sodium thiosulphate, till partially saturated, and finally in a tannic acid solution.—H. E. P.

XVI.—SOILS; FERTILISERS.

Soils; Relation of certain non-leguminous plants to the nitrate content of ——. T. L. Lyon and J. A. Bizzell. J. Franklin Inst., 1911, **171**, 1—16, 205—220.

Experiments made with timothy, maize (corn), potatoes, oats, millet, and soy beans showed that on the same soil the amount of nitrate present in the soil was different for each crop. At different stages of growth there was a characteristic relationship between the crop and the nitrate content. During the most active growing period, nitrates were higher in the soil under maize than in the

same cultivated soil bearing no crop; at the same period nitrates were higher under a mixture of maize and millet than under millet alone, though the amount of crop obtained was about the same in the two cases. Apparently nitrification is stimulated by some processes connected with the active growth of plants, particularly of maize. Part of its nitrogen is obtained, however, by the maize plant in some other form than nitrates, and the amount of nitrate was higher at the time when the crop was taking most nitrogen from the soil than in the later stages of growth under both maize and oats, although the nitrates in the uncropped soil were decreasing. Under maize, oats and millet the nitrate failed to increase late in the season when the absorption of nitrogen had practically ceased, although the amount of nitrate in the uncropped soil was increasing rapidly. Apparently plants during their later period of growth exert a retarding influence on nitrification. Changes in the moisture content or in the temperature of the soil under crops during the growing season had but little effect on the amount of nitrate present. On the other hand on uncropped soil a marked increase in nitrates followed an increase of moisture in September. The large differences in the nitrates under the crops studied are attributed to inherent differences between plants of different species in their stimulating or inhibiting influence on nitrification.
—E. F. A.

Soil; Dependence of the formation of ammonia, nitrites, and nitrates upon the moisture in the ——. J. G. Lipman and P. E. Brown. Report of the New Jersey Agric. Coll. Expt. Stat., 1908, 105. Biedermann's Zentr., 1911, **40**, 85—88.

In order to test the effect of moisture on the soil bacteria, boxes were prepared containing the same weight of air-dry soil to which water was added corresponding to 20, 40, 60, 80 and 100 per cent. of that required for saturation. The boxes were sunk in the earth to the ordinary soil level and protected against rain. Samples were withdrawn from time to time, introduced into peptone or gelatin solutions, and the ammonia formed determined after 3 or 4 days. In the peptone solution the increase in the water content of the soil was without influence, except in the saturated soil, where an increase in the amount of ammonia was measured. In gelatin solutions the amount of ammonia formed increased with the moisture in the soil. Similar results were obtained when large quantities of the soils were kept with 0·5 grm. of peptone. Corresponding experiments with urea showed an increase in the ammonia produced only in the saturated soil. The amount of nitrite formed was small; the moister soils contained somewhat less than the drier. The maximum of nitrate was found in the soils about 50 per cent. saturated. The number of bacteria present increased with the moisture up to 80 per cent. and then fell again on the further addition of water.—E. F. A.

Soil bacteria; Culture media and methods for the quantitative determination of ——. J. G. Lipman and P. E. Brown. Report of the New Jersey Agric. Coll. Expt. Stat., 1908, 129. Biedermann's Zentr., 1911, **40**, 82—84.

A medium composed of 1 litre of water, 10 grms. of dextrose, 0·5 grm. of dipotassium phosphate, 0·2 grm. of magnesium sulphate, 0·05 grm. of potassium nitrate, and 20 grms. of agar was found very favourable for soil bacteria and nearly 10 times as many colonies developed as on bouillon agar. Experiments were made substituting for 0·05 grm. of potassium nitrate either 0·04 grm. of ammonium sulphate or 0·05 grm. of peptone: further the slightly acid medium was either one-quarter or one-half neutralised by sodium hydroxide. These nine media were inoculated with the same soils: in every case neutralisation diminished the number of colonies formed. Most were formed when peptone was present and a slaty soil contained more bacteria than a clay soil. This was confirmed by measurements of the nitrogen as ammonia and the nitrogen as nitrate formed by the two soils. A further test of the method was afforded by a soil divided into three portions which received respectively no manure, chalk, and magnesium carbonate: these were used for inoculating each of the nine media. Neutralisation again decreased the number of colonies; potassium nitrate proved the best source of nitrogen.—E. F. A.

Superphosphates and bone-meal; Determination of phosphoric acid in ——. Z. Romański. Chem.-Zeit., 1911, **35**, 163—164.

In the determination of phosphoric acid in superphosphates, if the precipitate, obtained by the addition of magnesia mixture in the presence of ammonium citrate, be washed with alcohol and ether and dried, it is found that the magnesium ammonium phosphate amounts to only 97 per cent., the remaining 3 per cent. consisting mainly of magnesium ammonium citrate, together with small quantities of gypsum, traces of iron, aluminium and other substances. Owing to the presence of the magnesium ammonium citrate the precipitate blackens during heating and can be burnt white only with difficulty. The composition of the white precipitate too is not constant, but varies within narrow limits. If, however, the ammonium citrate and magnesium salt be dissolved in an acid solution and added to the aqueous extract of the superphosphate, the magnesium ammonium phosphate can be precipitated in a crystalline condition and of uniform composition by slowly adding ammonia. The acid magnesia-citrate mixture is prepared by dissolving 300 grms. of magnesium chloride and 400 grms. of ammonium chloride in about 7 litres of water in a 10 litre flask. One litre of 20 per cent. ammonia is poured in, and 1000 grms. of crystallised citric acid are added; the liquid is made up to 10 litres and shaken constantly until the citric acid has dissolved, and is ready for use as soon as it is cool. A 10 per cent. solution of ammonia is also required. In making a determination, 50 c.c. (1 grm. of the sample) of the aqueous extract of the superphosphate are treated with 50 c.c. of the magnesia-citrate mixture, and then 30 c.c. of the 10 per cent. ammonia are run in. The liquids are mixed by stirring with a rod, at first carefully, and then more vigorously and again after an hour. If the liquid becomes cloudy directly the ammonia is added, and an amorphous precipitate is formed, a fresh portion is neutralised with ammonia drop by drop, till the first crystals form, and the rest of the ammonia run in after a few minutes and the whole thoroughly mixed. The next day the precipitate is collected in a Neubauer crucible, washed with ammonia water, then twice with alcohol and finally twice with petroleum benzine (sp. gr. 0·64). It is then dried *in vacuo* and weighed. The weight of the precipitate, multiplied by 28, gives the percentage of phosphoric anhydride in the superphosphate. To obtain the total phosphoric acid, 5 grms. of the sample are dissolved in 10 to 15 c.c. of water and sufficient nitric acid (sp. gr. 1·2) added; 30 c.c. of strong sulphuric acid are added and the mixture boiled till the organic matter has been oxidised and most of the nitric acid evaporated. After cooling, the liquid is made up to 500 c.c. with water, thoroughly shaken and filtered. Of this filtrate, 50 c.c., equal to 0·5 grm. of the sample, are treated with 50 c.c. of the citrate mixture, and enough 20 per cent. ammonia (say 20 to 30 c.c.) to neutralise the acid and leave ammonia in excess. The addition of the ammonia causes the liquid to become hot; it is left at rest to cool, and then, if necessary, more ammonia is added, and the liquid thoroughly mixed, and the precipitate filtered off the following day in a Neubauer crucible. The weight of the precipitate, multiplied by 56, gives the percentage of phosphoric anhydride. The results obtained by this method agree well with those obtained by Wagner's molybdate method; the differences never exceed 0·2 per cent.—W. C. H.

Chromium compounds; Stimulating and toxic actions of —— *on plants.* [*Determination of very small quantities of chromium*]. P. Koenig. Landw. Jahrbb., 1910, **39**, 775—916. Chem. Zentr., 1911, **1**, 498—499.

The author has found that the application of small quantities of chromium compounds, especially chromous acetate, and chromite, has a very favourable action on the germination and growth of plants and on the yield. In larger quantities an injurious effect is produced. which is most marked with soluble chromates; the plants then show typical poisoning phenomena. The root-system is especially sensitive to chromium compounds. The toxic action of chromates can frequently be diminished by addition of an equivalent quantity of lime; in the case of plants (*e.g.* lupins) adversely affected by lime, such addition intensifies the injurious action of the chromates, which however is diminished by addition of salts of silver or lead. The toxic effects of chromium compounds are much greater on sandy soils than on compost soils. Plants rich in silicon are specially resistant to chromium compounds. Alkali bichromates are very efficacious as weed-killers for paths, etc. The chromium taken up by the plants is found more largely in the roots than in parts above the ground. Bichromates, which are the most toxic of the chromium compounds, yield the least chromium to the plants. For the determination of very small quantities of chromium, the author makes use of the disodium salt of 1·8-dihydroxynaphthalene-3·6-disulphonic acid, aqueous solutions of which give an intense red colouration with chromic acid, chromates, and bichromates. Chromium is present in plants in such small quantities that it cannot be detected by the ordinary reagents. For the determination of the chromium, *e.g.*, in plants, 3—5 grms. of the powdered dry substance are incinerated, and the ash is ignited and then fused with 0·3—0·5 grm. of a mixture of 20 parts of sodium carbonate and 5 parts of potassium nitrate. The fusion is dissolved in 5 c.c. of 25 per cent. phosphoric acid and 2—3 drops of hydrochloric acid. (Other metals besides chromium give colourations with the reagent mentioned above, but these colourations, with the exception of that due to chromium, disappear on addition of phosphoric acid). The solution is diluted to 30 or 50 c.c. with water, and 10 c.c. are treated with 1 c.c. of a 0·1-grm.-molecular solution of the sodium dihydroxynaphthalenedisulphonate. The colouration produced in presence of chromium compounds deepens on standing and after standing overnight is compared with standard colourations produced in a similar manner from solutions of plant ashes in which known quantities of potassium bichromate have been dissolved. By this method 0·002 mgrm. of chromic oxide can be detected and 0·004 mgrm. determined quantitatively.—A. S.

Nitric acid in plants; Quantitative determination of ——. K. Krog and J. Sebelien. Chem.-Zeit., 1911, 35, 145—146.

In attempting to determine the content of nitric acid in turnips by the Schulze-Tiemann modification of Schlösing's method (see Lunge-Berl, Chem.-Techn. Untersuchungsmethoden, 6th Ed., 1910, Vol. I, p. 386), the authors obtained results much below the correct values. Further experiments showed that this method cannot be applied to the analysis of materials containing sucrose. The determination was carried out satisfactorily, however, by making use of the "nitron" precipitant for nitric acid (see Busch, this J., 1905, 291). Ten grms. of the dried and powdered root were shaken for three hours with 400 c.c. of water, and after precipitation of the protein matter by means of copper sulphate solution and caustic soda, the solution was made up to 500 c.c., shaken and filtered. 250 c.c. of the filtrate were concentrated and treated with "nitron" according to Busch's method. A cloudiness which developed during evaporation was removed by treating the concentrated liquid with pure animal charcoal, filtering, washing the charcoal, and concentrating the filtrate and washings again. Parallel experiments were carried out, using dilute alcohol (300 c.c. of 96 per cent. alcohol to 200 c.c. of water) instead of water, for the extraction of the root. By this means precipitation of the proteins by copper solution was avoided and the results obtained were equally accurate. Owing to the solubility of the "nitron" nitrate in alcohol, the latter must be completely removed by evaporation before precipitating. Of the following four results, representing percentages of nitric acid (N_2O_5) in a sample of dried turnip, the first two were obtained by the aqueous extraction-method and the others by alcoholic extraction: 1·64, 1·66, 1·62 and 1·64; Schlösing's method gave 1·38 per cent. When the proportion of nitric acid in the root is much less than this, the method of alcoholic extraction is much to be preferred, for if water is used there is formed after addition of the "nitron" reagent, a greyish amorphous precipitate quite different from the crystalline "nitron" nitrate. This formation can be prevented by adding a considerable quantity of sulphuric acid just before the "nitron," but the liquid is strongly coloured in consequence and the nitrate does not separate well. If alcohol is used for extraction this colloidal precipitate does not form at all. When only small quantities of nitric acid are present, it is advisable, before addition of the "nitron," to concentrate not only down to 80 c.c., as recommended by Busch, but even to 20—30 c.c., and afterwards to allow the mixture to stand in ice-water for as long as 1—2 hours. Four estimations carried out in this way gave percentages of nitric acid ranging from 0·60 to 0·63, whilst Schlösing's method failed entirely.

—J. H. L.

Influence of nutriment on the variability of the chemical composition of the beet in the first year of vegetation. Andrlík and Urban. *See* XVII.

Montana phosphate deposits. Oil, Paint, and Drug Rep., Feb. 20, 1911. [T.R.]

The U.S. Geological Survey reports the discovery of extensive phosphate deposits in and near the canyon of the Big Hole River, about 30 miles south-west of Butte. It is thought probable that similar deposits exist over a large part of Western Montana. Sulphuric acid for the conversion of the mineral into superphosphate would be readily obtainable from the gases from the numerous smelters in the vicinity.

XVII.—SUGARS; STARCHES; GUMS.

Beet; Influence of nutriment on the variability of the chemical composition of the —— *in the first year of vegetation.* K. Andrlík and J. Urban. Proc. Seventh Int. Congr. Appl. Chem., London, 1909. Sect. V., 321—330.

The author has investigated the composition of seven beets grown in sand in culture-pots, and supplied with sodium and potassium nitrates and superphosphate in different amounts, but always in excess. The seeds were all derived from the same mother-plant, the root of which contained 19 per cent. of sugar; they were sown in April, 1907. The grown plants, which were gathered early in October, differed greatly in size. The sugar content of the roots ranged from 15·7 to 20·5 per cent., and in only one case was it higher than that of the mother-plant. The variations in the other constituents are shown by the following figures, representing percentages of the fresh roots:—Nitrogen 0·254—0·373, potash (K_2O) 0·245—0·464, soda (Na_2O) 0·021—0·096, phosphoric acid (P_2O_5) 0·056—0·135, total ash 0·841—1·601. The large amount of nourishment supplied, therefore, whilst not raising the percentage of sugar in the roots, increases their ash- and nitrogen-contents, and also gives rise to large individual differences with respect to these values. The view that there is a close relationship between variability and nourishment is thereby confirmed. By increasing the nutriment supplied to beets beyond a certain optimum amount, the roots obtained are less, rather than more, desirable for purposes of sugar manufacture, owing to their high content of ash and nitrogen. Further experiments are in progress.—J. H. L.

Cane fibre experiment; Wisconsin ——. La. Planter, 1911, 46, 39. (Compare also this J., 1910, 1027.)

Further particulars are now given of the experiments on the extraction of sugar from dried cane, shredded in Cuba, and then shipped to the United States for treatment in a beet sugar factory there. At Nipe Bay, Cuba, the wet cane was fed between two circular saws set closely together and revolving in opposite directions, after which the shredded material was dried in a travelling oven to a moisture content of about 7 per cent., the temperature during drying being so regulated that the sugars were not affected. By means of suitable screens the pith was separated from the fibre, then both products were baled and shipped to the Wisconsin (U.S.A.) beet factory. The first attempt to extract the sugar by diffusion having proved a failure (*cf.* this J., 1911, 42), washing in centrifugals was tried, and found to be entirely successful. On arrival from Cuba the baled material was torn up by saws, and passed by a blower to the top of the factory, where it was digested in vats with a suitable amount of water. The resulting "mush" was fed into centrifugals, machined till dry, and washed once. In this way, it is stated, practically the entire sucrose content of the dried cane, amounting to 55 to 60 per cent., was extracted. Subsequently the liquor from the centrifugals was treated by the double carbonatation process, sulphured, and cured in the usual manner. A light yellow sugar was thus made, but on reboiling and machining this a fine white sugar, which was hard and of good lustre, was obtained. It is proposed to utilise the exhausted fibre for the manufacture of paper pulp.—J. P. O.

Use of gas coke in the lime kilns of the beet sugar factory. H. Déeluy. Bull. Assoc. Chim. Sucr., 1911, 28, 490—500.

In place of the more expensive metallurgical coke now generally used for the lime kilns of beet sugar factories in France, the author advocates employing gas coke. Even with a gas coke containing 12·8 per cent. of ash, and a limestone with 3 per cent. of silica, he has found that both gas and quicklime of sufficiently good quality for the purpose of the raw sugar factory can be obtained. In order to arrive at these satisfactory results it is essential that the proportion of carbonaceous matter in the coke to the limestone used should be approximately 10·3 : 100, and also that the charges should be moderate, and made at regular intervals. On analysing the gases at half-hour intervals, when the kiln was working at its best, it was observed that the proportions of carbon dioxide, oxygen, and carbon monoxide were 32·5 : 0·5 : 0·5 per cent. respectively. Regarding the information an analysis of the gases can give on the irregularities of the working of a kiln, the following general rules are stated. If there is excess of oxygen, and the kiln appears to be burning normally, the connection between the kiln and aspirating pump is faulty; but if there is an excess of oxygen, and the kiln appears bright red, then the pump is working too fast. When the gases are too low in carbon dioxide, and the kiln burns normally, there is excess of coke in the charge, or the limestone may be of bad quality. A high content of carbon monoxide, with a dull kiln, means either that the pump is not working sufficiently fast, or that the circulation is defective, or that the limestone is very impure.—J. P. O.

Invert sugar; Loss of —— in the carbonatation process [as applied to cane juices]. W. E. Cross. La. Planter, 1911, 46, 55.

In the manufacture of white sugar in the cane sugar factory by the carbonatation process, the extent of the decomposition of the reducing sugar is dependent upon the amount of lime used, the duration of contact, and especially upon the temperature at which the carbonatation is effected. Using a solution containing 10 per cent. of sucrose and 1·5 per cent. of reducing sugar, the author has investigated the rapidity of this decomposition at temperatures from 30° to 70° C., with 1 and 1·8 per cent. of lime, and periods of contact from 5 to 60 minutes. From the figures given, it is seen that the decomposition is directly proportional to each of the three factors. At temperatures above 50° C. decomposition proceeds steadily, so that any unnecessary delay in carrying out the saturation means loss of sugar and a less valuable molasses. The best temperature at which to effect carbonatation is from 40° to 45° C. If this latter temperature be exceeded, bodies inhibitive to crystallisation are formed, but at lower temperatures the decomposition products of reducing sugar by lime are comparatively harmless in this respect.—J. P. O.

Dry substance, quotient of purity, loss of polarisation during saturation, and amount of non-sugar removed during defecation and saturation; Determination of —— in diffusion and saturation (beetroot) juices. K. Andrlik and V. Stanek. Z. Zuckerind. Böhm., 1911, 35, 257—285.

Claassen and Pellet having expressed conflicting opinions upon the value of the dry substance determination, as ordinarily carried out, for controlling the purifying effect of defecation and saturation, the authors have investigated the question, using the refractometer, the picnometer, and different types of ovens. It was found with diffusion as well as with saturation juices that unless desiccation is carried out rapidly it is impossible to obtain concordant results, owing to the alteration of the solids during drying, a rise in acidity being particularly noticeable. The amount of juice under examination should not exceed 5·0 grms., and it is considered preferable to use pumice, treated with hydrochloric acid, in pieces of about 2 mm. diam. From a comparison of three types of ovens: (1) Soxhlet, (2) the ordinary glycerin oven, and (3) the vacuum oven, using in each case a temperature of 103° C., it was found that the three types were equally efficacious from the point of view of rapidity of desiccation, but although with one and the same oven concordant results could be easily obtained, the results found with different ovens were not always the same, the ordinary and vacuum ovens giving higher results than the Soxhlet, with extreme differences of sometimes 0·2 per cent. It is therefore contended that for a standard method, not only the procedure but also the type of oven must be stipulated. Much higher results were obtained by the picnometer and refractometer, but the values found by these methods are known to be untrustworthy. In the second part of their paper the authors study the important question of the behaviour of the non-sugars before and after defecation and saturation. They show that the amount of non-sugars (calculated on 100 parts of sugar) removed by defecation and saturation, as determined by desiccation, is always higher than that found by a direct experiment in which the non-sugars are determined in the saturation scum. It has, however, been previously shown by the authors that during the processes of defecation and saturation a decrease in the direct polarisation occurs, owing, it is believed, to the action of the lime on certain optically active bodies. Figures are given indicating that if this decrease of polarisation be considered, the difference indicated above no longer exists, it then being possible to account for practically all the non-sugar removed from solution and passing into the scum as the result of defecation and saturation.—J. P. O.

Maple-sap syrup; its manufacture, composition, and effect of environment thereon. A. H. Bryan. U.S. Dept. Agric., Bureau of Chem., Bull. No. 134, 1910.

Distinction should be made between the concentrated sap, which is "maple-sap syrup," and the syrup obtained by redissolving the solid product resulting from boiling down the sap to the point of crystallisation, which is "maple-sugar syrup." In order to obtain sap of good colour and flavour it is of the greatest importance to avoid the influence of micro-organisms in the holes and buckets, especially towards the end of the season (*cf.* this J., 1910, 968). It has been observed that this can best be done by reaming the holes once or twice during the season; by using metal buckets in place of the wooden ones commonly employed; and by frequently and thoroughly cleansing all collecting apparatus. In concentrating the sap, the lightest-coloured syrup is produced when the product is boiled very fast; so that to boil to a thick syrup, thin again with fresh sap, and reboil, always leads to darkened products. In general, the syrup obtained by concentrating in arch or patent evaporators is of a better colour than that from iron kettles; but if the latter be used the syrup should be drawn off before the kettle is recharged, instead of emptying only when a certain amount of syrup is obtained, as is often done. Opinion differs considerably as to the advisability of using clarifying agents. From the large amount of analytical data given it appears that the average figures for 395 samples are as follows: water, 34·19; sucrose (Clerget), 62·6; invert sugar (using the Munson and Walker method; see U.S. Dept. Agric., Bureau of Chem., Bull. No. 107, Revised, p. 241), 1·47; total ash, 0·66; and undetermined matter, 1·08 per cent. Other average figures are: direct polarisation (using 1 c.c. of neutral lead acetate), +60·64° V.; basic and neutral lead acetate numbers, 2·70 and 0·79 respectively on the dry substance; and malic acid value (A.O.A.C. method; U.S. Dept. Agric., Bureau of Chem., Bull. No. 107, Revised, p. 74), 0·84. Figures are also given dealing with the effect of the run on the character of the final product; the effect of clarifying on the character and composition of the syrup; seasonal variations; syrup from covered and uncovered buckets; and the composition of syrup from different states and from Canada.—J. P. O.

Carbohydrates; Photochemical synthesis of —— from carbon dioxide and hydrogen in presence of potassium hydroxide and absence of chlorophyll. J. Stoklasa and W. Zdobnický. Monatsh. Chem., 1911, **32**, 53—75.

The authors have investigated the action of ultra-violet rays on mixtures of carbon dioxide and (1) water vapour; (2) nascent hydrogen; (3) ordinary hydrogen. A mercury vapour quartz lamp, supplied with a 110-volt current of 4 ampères, was used as source of ultra-violet light. The reactions were carried out in a nickel-plated copper dish covered with a plate of quartz or mica; the rim of the dish was fitted with a ring of lead and the cover was screwed down with brass clamps. Carbon dioxide was introduced into the dish by a spiral tube provided with capillary openings; a second tube, terminating about 1 cm. above the bottom of the dish, served for introducing water vapour or a solution of potassium hydroxide, whilst a third tube, terminating 0·5 cm. below the edge of the dish, served to carry away excess of the gases and the gaseous products. To detect formaldehyde amongst the reaction-products, Feder's solution (this J., 1907, 281) was generally used. In the first place, the validity of Baeyer's equation, $H_2O+CO_2=HCOH+O_2$, was examined. It was found that on passing carbon dioxide through water exposed to the ultra-violet rays, no formaldehyde is produced, and the water thus treated contains no organic substance; if, however, carbon dioxide and water vapour are allowed to interact under the influence of these rays and in presence of a solution of potassium hydroxide, small quantities of formaldehyde are produced; no condensation of formaldehyde to carbohydrate was observed, however, although the conditions for such condensation were the same as those in the experiment mentioned below. The authors have also investigated the validity of the equation $2CO_2+2H_2=2HCOH+O_2$. Nascent hydrogen was obtained by acting on a quantity of Devarda's alloy (aluminium 59, copper 39, and zinc 2 per cent.) contained in the dish, with a 7 per cent. solution of potassium hydroxide introduced from a dropping funnel through a capillary tube; the gas thus liberated was allowed to interact with carbon dioxide under the influence of the ultra-violet rays, the experiment in one case being continued for 46 hours. It was found that under these conditions, formaldehyde is produced, and that in presence of potassium hydroxide a condensation of the formaldehyde to one or more sugars occurs; neither formaldehyde nor sugar is formed in absence of ultra-violet rays, nor in presence of these rays if molecular hydrogen is substituted for nascent hydrogen; this latter observation does not accord with that of Berthelot and Gaudechon (this J., 1910, 904). An examination of the sugar-product showed that it is optically inactive and non-fermentable; it yields an osazone-product separable into two fractions melting at 188°—192° and 196°—200° C. respectively. According to various workers (cp. Löb and Pulvermacher, this J., 1910, 893) pentoses are always formed in the synthesis of sugar from formaldehyde, but the sugar product obtained by the authors was not found to give a reaction characteristic of pentoses. According to the data now available, there is full justification for the view that in chlorophyll-containing plant cells formaldehyde is the first reduction product of carbon dioxide, and this view is supported by the fact that no other substance containing one atom of carbon in the molecule is so well adapted as formaldehyde to the production of complex organic compounds. In the process of assimilation in plants, the function of the chlorophyll consists in the absorption of ultra-violet rays. Formaldehyde is produced in the chlorophyll-containing cells not only through reduction of carbon dioxide by hydrogen (the latter being formed by the action of respiration enzymes) but also by the interaction of carbon dioxide and water: both processes go on concurrently under the influence of ultra-violet rays. Various workers have shown that formaldehyde is present in, and is assimilated by the chlorophyll-containing cells.—L. E.

Sugars; Nomenclature of the ——. E. Votoček. Ber. 1911, **44**, 360—361.

A number of sugars are related one to another as glucose is related to mannose, *i.e.*, the configurations of two such sugars differ only in respect of the carbon atoms adjacent to the aldehyde group. The author recommends that in the case of such pairs of sugars, one sugar should be designated by the name of the other with the prefix, "epi-," attached, whilst the isomeric sugars and the relationship should be called "epimers" and "epimery" respectively. According to this nomenclature, mannose would be called "epiglucose." To indicate from which parent sugar (*d*- or *l*-) the epi-sugar is derived, the letter *d*- or *l*- can be placed after the name; thus, the epi-sugar corresponding to *l*-xylose would be named "epixylose *l*-." The names of the polyhydric alcohols, mono- and dibasic acids corresponding to the sugars, would be derived from the names of the sugars. Thus, ribite, ribonic acid, and ribotrihydroxyglutaric acid, would be designated "epiarabite," "epiarabonic acid," and "epiarabotrihydroxyglutaric acid," respectively. With this nomenclature, some important relations amongst the sugars may be shortly expressed. Thus, epimeric aldoses yield the same osazone; on heating with pyridine or quinoline, the aldonic acids are converted into their epimers; by the cyanhydrin-synthesis, each aldose is converted into a pair of epimeric aldoses containing one more atom of carbon, *e.g.*, xylose yields gulose and epigulose (idose).—L. E.

Gums from Northern Nigeria. Bull. Imp. Inst., 1910, **8**, 352—365.

Since the publication of a previous article on the gums of Northern Nigeria (this J., 1908, 583), investigation has shown that in Bornu and Yola provinces, the principal sources of gum are the same species (*Acacia Senegal*, *A. Seyal*, and *A. Sieberiana*) that yield the well-known Sudan and Senegal gums, which constitute the bulk of the gum imported into Europe. In the chief gum-collecting centres, the same species of Acacia often occurs alone over wide areas and it should therefore be possible to obtain large quantities of gum of uniform quality. A number of samples of different kinds of Northern Nigerian gums have been examined and the results are summarised in the following table:—

Source of gum.	Moisture.	Ash.	Matter insoluble in water.	Strength as measured by viscosity.	Colour of mucilage.
	per cent.	per cent.	per cent.		
Bornu Province—					
Acacia Senegal	10·24—11·48	2·87—3·17	1·20—1·94	5·36—6·66	Almost colourless to pale brown
Acacia Seyal	11·19—11·42	2·50—2·66	0·84—1·41	5·86—6·66	Brown.
Yola Province—					
Acacia Suma	13·32—13·56	2·00—2·36	4·10—4·50	14·1—16·7	Colourless to brown.
Acacia Sieberiana	13·63	2·65	0·76	13·3	Pale-coloured.
Sokoto Province—					
Combretum sp.	12·9	2·0	1·2	7·8	Dark brown.

—A. S.

Utilisation for papermaking of bagasse and other West Indian fibres. Wrede. *See* V.

Action of Bulgarian ferment on monobasic acids derived from reducing sugars. Bertrand and Veillon. *See* XVIII.

Sophorin sugar. ter Meulen. *See* XX.

Starch for use as indicator in iodometric titrations. Mathieu. *See* XXIII.

PATENT.

Starch ; [*Insoluble, non-gelatinisable* ——]. B. Herstein, Bayonne, N.J. U.S. Pat. 982,673, Jan. 24, 1911.

An insoluble non-gelatinisable starch is prepared by treating starch or a starch-containing material, at a temperature below its gelatinising point, with an aqueous solution of formaldehyde and an inorganic ammonium salt substantially in the proportions necessary to form hexamethylenetetramine. A solution containing 5—10 per cent. of formaldehyde and 6—11 per cent. of ammonium chloride is suitable.—J. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Yeasts and sugars ; Further fermentation experiments with various ——. P. Lindner. Woch. f. Brau., 1911, **28**, 61—64. (See this J., 1900, 761 ; 1901, 141.)

According to the method of fermentation on a small scale previously described, preparations which show no fermentation in 24 hours are then heated. It is pointed out, however, that in examining the behaviour of a yeast towards a sugar, such as galactose, which is not readily decomposed, the preparation should be kept under observation for several days before heating. It is observed also, that in the case of an assimilable sugar (cp. Lindner and Saito, this J., 1910, 1221), hunger may cause the yeast cells to assimilate the sugar so rapidly that little or no fermentation occurs ; when the yeast has assimilated sufficient sugar, its fermentative activity predominates. The author gives the results of investigations of a number of yeasts and other fermentation fungi by the method of fermentation on a small scale. With melibiose, and especially with galactose, it is found that in those cases where no fermentation occurs in 24 hours, fermentation generally occurs in the course of several days. Practically all beer, distillery, wine, and pressed yeasts only ferment galactose in the course of some days, but the fermentation is then generally fairly vigorous. Hence, to render a yeast capable of fermenting a sugar, the acclimatisation of generations of the yeast to the sugar is not essential ; the protracted action of a small quantity of sugar, in absence of air, on so many cells that no growth can occur, gives the same result. It is also found that the Soy ("Soor") fungus only ferments xylose at high temperatures (38° C.), although it ferments other sugars at 25° C., and therefore contains zymase.—L. E.

Bulgarian ferment ; Action of —— *on monobasic acids derived from reducing sugars.* G. Bertrand and R. Veillon. Comptes rend., 1911, **152**, 330—332.

It has previously been shown that the Bulgarian ferment hydrolyses lactose, and converts the dextrose and galactose thus formed, as well as mannose and lævulose, into lactic acid (cp. Bertrand and Duchäcek, this J., 1909, 668). The authors have now examined the behaviour of the Bulgarian ferment towards the calcium salts of gluconic, galactonic, and mannonic acids, and find that in no case is lactic acid formed ; similarly, neither maltobionate nor lactobionate of calcium yields lactic acid under the influence of the ferment. In the case of mixtures of dextrose or lactose with gluconate, galactonate, mannonate, or lactobionate of calcium, a formation of lactic acid occurs ; the amount of lactic acid produced corresponds only with the weight of sugar present, save in the case of a mixture of lactose and lactobionic acid, in which a much greater quantity of lactic acid is produced, some being formed at the expense of the lactobionate. The transformation of lactobionic acid in presence of lactose is to be explained in that the Bulgarian ferment only produces endolactase when it grows in a medium containing lactose ; the lactobionic acid thus hydrolysed, yields non-fermentable gluconic acid, and galactose which is capable of undergoing transformation into lactic acid.—L. E.

Wines ; Composition of British ——. E. Russell and T. R. Hodgson. Analyst, 1911, **36**, 60.

The following table shows the composition of eight samples of ginger wine purchased from retail shops ; the figures, with the exception of the sp. gr., express grms. per 100 c.c. :—

	1.	2.	3.	4.	5.	6.	7.	8.
Sp. gr.	1027·7	1062·6	1062·5	1088·6	1139·3	1059·4	1060·6	1062·7
Total solids	12·60	21·19	20·80	28·93	43·23	20·09	20·78	21·14
Ash	0·183	0·422	0·128	0·123	0·321	0·317	0·306	0·418
Alkalinity of ash (as K_2O)	0·013	0·026	0·038	0·056	0·024	0·023	0·110	0·042
Volatile acid (as acetic)	0·13	0·09	0·14	0·07	0·05	0·06	0·10	0·07
Fixed acid (as lactic)	0·78	0·47	0·35	0·38	0·64	0·54	0·47	0·41
Reducing sugars (as dextrose)	8·49	16·04	16·68	23·96	29·00	16·74	16·75	17·60
Sucrose	1·12	0·43	0	0	7·31	0·06	1·68	0·68
Alcohol	11·85	9·29	9·98	10·23	11·31	9·93	9·56	10·15
Nitrogen	0·011	0·022	0·013	0·013	0·028	0·027	0·032	0·018
Phosphates	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace
Esters (as ethyl acetate)............	0·070	0·018	0·030	0·019	0·067	0·028	0·046	0·060

Salicylic acid was present in samples Nos. 3, 6, and 7 to the extent of 7·0, 0·35, and 2·0 grains per gall., respectively.—W. P. S.

Value of yeast to the human organism. Völtz and Baudrexel. *See* XIXA.

Denatured alcohol in the United States. U.S. Dept. of Agriculture. Oil, Paint, and Drug Rep., Feb. 20, 1911. [T.R.]

Dr. H. W. Wiley has just prepared a bulletin on industrial alcohol, the following conclusions being drawn as a result of the recent Government investigations :—

It is apparent that the business of distilling alcohol is one which calls for a considerable investment and no small degree of technical skill. It cannot be conducted advantageously from a commercial point of view in very small plants on account of the proportionately high cost of the plant and of labour, and many of the so-called "wastes" which have been suggested as fermentable raw materials are so poor in fermentable substance or so expensive to handle that their availability is thereby impaired. It seems that the business, to be productive of satisfactory returns, must be conducted on a fairly large scale, and that the best success is likely to be attained with raw materials of the general types already in use, namely, maize, potatoes, and molasses. The industry is not suited to every locality, and it is most likely to be successful if carried systematically on a very large farm or if supported by the joint interests of a fairly large community. The alluring statements sometimes made regarding large financial returns to be obtained by making industrial alcohol with waste raw material, unskilled labour and a "cheap" distilling outfit are misleading and can only result in loss if followed.

PATENTS.

Brewing ; Combined mash tun and wort back for use in ——. J. Harrison, Tadcaster, Yorks. Eng. Pats. 1949, Jan. 26, 1910, and 17,025, July 18, 1910.

The mash tun is connected, by means of a pipe issuing from the bottom, with a wort back standing at the same level. The wort back has the form of a vertical standpipe with discharge cocks situated at intervals in its height. By opening one or other of these cocks the pressure under which the wort travels through the false bottom of the tun can be regulated, and too strong a flow, which is the chief cause of "set" mashes, is avoided. —J. F. B.

Culture media for bacteria; Process for the preparation of dehydrated —— in the form of powder. R. Doerr. Ger. Pat. 229,970, Feb. 22, 1910.

The culture medium is liquefied, poured on to sheets of plate glass so as to form a thin layer, dried at exactly 37° C., and then powdered. When required for use the powder is dissolved in 15 times its quantity of water. It is claimed that the dry preparations obtained in this way will keep indefinitely in glass bottles, even in a tropical climate.—A. S.

Sugar juices; Process for extracting —— from vegetable substances producing sugar. J. J. Homans. Fr. Pat. 420,133, Sept. 8, 1910.

See U.S. Pat. 978,451 of 1910; this J., 1911, 102.—T. F. B.

XIXa.—FOODS.

Meats; Determination of inorganic and organic phosphorus in ——. H. S. Grindley and E. L. Ross. J. Biol. Chem., 1911, 8, 483—493.

The authors have investigated the trustworthiness of various methods which have been proposed for the determination of inorganic phosphates in meats and find that the neutral ammonium molybdate method as modified by Emmett and Grindley (this J., 1906, 230), the magnesia-mixture method as proposed by Forbes and others (Ohio Agric. Exp. Stat., Bull. No. 215, 1910, 484), and the barium chloride method of Siegfried and Singewald (this J., 1905, 1258), give practically the same results for inorganic phosphates in cold water extracts of meat. There was no evidence that the coagulation of the protein of the aqueous extracts by heat changed organic phosphorus into the inorganic form to any appreciable extent. The apparent change of organic phosphorus to the inorganic form noticed by certain workers when using the barium chloride method is evidently due to their having employed an insufficient quantity of barium chloride.—W. P. S.

Casein; Fixation of lactic acid by ——. W. Van Dam. Chem. Weekblad, 1910, 7, 1013—1019. Chem. Zentr., 1911, 1, 495.

The author determined, by means of Bredig's ethyl diazoacetate method, the diminution of the hydrogen ion concentration of lactic acid solutions on addition of casein. Using a $N/20$ solution of the acid at 18° C., and quantities of casein ranging from 0·25—1 per cent., it was found that so long as an excess of hydrogen ions was present, the proportion of lactic acid fixed was practically constant, being about 4·25 per cent. of the casein added. With larger quantities of casein the percentage of lactic acid fixed was relatively less. The author concludes from his results that in the casein molecule there are four replaceable hydrogen atoms to one basic group.—A. S.

Gorgonzola cheese. E. Hinks. Analyst, 1911, 36, 61—62.

During the last few years, about one-half of the Gorgonzola cheese imported into this country has been "naturally coated," that is, it is enveloped in a reddish-brown coating which develops during the ripening of the cheese, whilst the remainder has been "artificially coated." The artificial coat is often applied only a few days before shipment, and is at times applied in England; it consists of a mixture of natural mineral barytes and tallow, and is coloured, usually on the outer side only, with oxide of iron. The coating on twenty different cheeses examined amounted to from 16 to 27 per cent. of the whole weight of the cheese. The natural rind may sometimes be found under the artificial coat, though very often the cheese immediately beneath the coat has undergone decomposition with the formation of a glue-like, slimy layer. The composition of the coat of eight samples of cheese was:—barytes, 81·0 to 86·7; fat (tallow), 12·7 to 19·0; moisture, 0·6 to 1·5 per cent. The barytes contained from 91 to 96 per cent. of barium sulphate, together with varying quantities of calcium, strontium, and sodium sulphates, silica, and oxide of iron. The natural rind on Gorgonzola cheese amounts to from 2 to 4 per cent. of the weight of the cheese; it often contains starch and probably barytes, as these substances are dusted over the cheese to dry it if it has "sweated." It may be mentioned that the importation of coated cheese into France is prohibited, whilst the United States allows the coated cheese if labelled as such.—W. P. S.

Yeast; Value of —— to the human organism. W. Völtz and A. Baudrexel. Biochem. Zeits., 1911, 30, 457—473.

Yeast, when deprived of its bitter taste (by exhaustive treatment with dilute sodium carbonate and water) and boiled, can be consumed without inconvenience by man in considerable quantities (100 grms. in the course of one to two hours), and has good nutrient value. The feeding experiments show that the preparation used contained 46 per cent. of digestible protein. Of the heat value of the yeast 88 per cent. was made use of by the organism, whilst from calculations based on the nitrogen equilibrium it appears that 74·8 per cent. of its energy is utilised. It follows, therefore, that yeast is to be considered one of the most concentrated foods, and one of the richest in protein.—R. V. S.

Food colours; Identification of ——. Solubility and extraction of certain colours and the colour reactions of dyed fibre and of aqueous and sulphuric acid solutions. H. M. Loomis. U.S. Dept. of Agric., Bureau of Chem., Circular No. 63, 1911, 1—69.

Details of manipulation are given for extracting dyes from such substances as food, etc.; in most cases it is best to extract the finely divided material with warm alcohol or water, rendered slightly alkaline with ammonia. The extract is then evaporated, water being added to replace the alcohol, and, after acidifying with hydrochloric acid, the colour is dyed on to wool. In the case of cereal products, a preliminary extraction with ether will remove fats and oils and indicate the presence of oil-soluble dyes. Tables are given showing the solubility of different dyes in various solvents and the following analytical scheme for the identification of dyes is proposed. The strength of the aqueous solutions of the dyes should be about 0·01 per cent. in the case of coal-tar dyes and 0·1 per cent. in the case of natural colouring matters. The reagents used are: Tannin, 10 grms. each of tannin and sodium acetate in 100 c.c. of water; hydrochloric acid, 1 : 1; sodium hydroxide solution, 10 per cent.; ammonia solution, about 10 per cent. of NH_3; basic lead acetate solution, sp. gr. 1·25; normal lead acetate solution, 10 per cent. Unless otherwise stated, each test is to be made on a portion of the original solution and not on the solution used for the previous test.

Analytical Scheme for the Preliminary Identification of Colours in Foods.

I. GREEN COAL-TAR COLOURS.

[Mixed blue and yellow generally detected by spot test on filter paper or by fractional dyeing.]

I. To aqueous 0·01 per cent. solution of colour add tannin reagent.

A. No precipitate. Add 10 per cent. sodium hydroxide solution to aqueous colour solution.
  a. Gradually decolourised .... *Acid green* *(S. & J. 435)
  b. Dark blue .... *Cyanole green 6 G*
  c. No change........ *Naphthol green B* (S. & J. 398)

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* "S. & J." refers to Schultz and Julius' Tables (A. G. Green's transl.); the numbers, to the numbered individual dyestuffs in those tables.

B. Precipitate. Acidify aqueous solution with hydrochloric acid and extract with equal volume of ethyl acetate.

a. Colour all extracted .... *Ethyl green*

b. About one-half of colour extracted .... *Malachite green* (S. & J. 427)

II. BLUE OR VIOLET COLOURS.

I. Insoluble in cold water. Treat with 50 per cent. alcohol.

A. Insoluble .... *Indigo* (S. & J. 689)

B. Soluble .... *Litmus*

II. Soluble in cold water. Add tannin reagent to 0·01 per cent. aqueous solution.

A. No precipitate. Treat with zinc dust + hydrochloric acid till decolourised, then filter.

a. Colour of filtrate quickly restored .... *Indigo disulpho-acid* (S. &. J. 692)

b. Colour not soon restored in filtrate. To aqueous solution add sodium hydroxide solution.

1. Solution blue green by transmitted light, pink by reflected light .... *Cyanole F F* (S. & J. 439)

2. No change .... *Tetracyanole S F* (S. & J. 440)

3. Pale magenta .... *Azo blue* (S. & J. 287)

B. Precipitate. Aqueous solution + 10 per cent. sodium hydroxide.

a. Solution magenta.

1. Aqueous solution + hydrochloric acid = yellow .... *Methyl violet* (S. & J. 451)

2. Aqueous solution + hydrochloric acid = green .... *Methylene violet* (S. & J. 585)

b. Solution ; no change .... *Methlyene blue* (S. & J. 650)

III. ORANGE AND YELLOW COLOURS.

I. Soluble in cold water. To aqueous solution add tannin reagent.

A. No precipitate. Apply double-dyeing test to aqueous colour solution.

a. Wool dyed. To aqueous solution add dilute hydrochloric acid.

1. Solution changes from yellow to orange .... *Fast yellow* (S. & J. 8)

2. Pale yellow or white precipitate. Boil aqueous solution with strong solution of potassium cyanide.

α. Yellow brown solution .... *Naphthol yellow* (S. &. J. 3)

β. Wine-red solution. To aqueous solution add dilute hydrochloric acid, allow to stand one-half hour, and filter.

Filtrate colourless .... *Victoria yellow* (S. & J. 2)

Filtrate yellow .... *Picric acid* (S. & J. 1)

3. Solution almost or quite decolourised. Aqueous solution acidified slightly with hydrochloric acid and shaken with equal volume of ether ; two layers separated and ether layer washed twice with 5 to 10 c.c. of water ; to ether layer is added an equal volume of very dilute ammonia ; shake and allow to separate.

α. Aqueous layer bright yellow .... *Naphthol yellow* (S. & J. 3)

β. Aqueous layer uncoloured .... *Naphthol yellow, S* (S. & J. 4)

4. Orange brown precipitate .... *Chrysamine* (S. & J. 220 or 269)

5. No change. To aqueous solution add sodium hydroxide solution.

α. Solution remains yellow. Treat dry colour with ethyl acetate.

1a. Colour insoluble .... *Tartrazine* (S. & J. 94)

2a. Colour quite soluble .... *Quinoline yellow* (S. & J. 667?)

β. Solution becomes redder. Treat dry colour with concentrated sulphuric acid.

1a. Crimson or magenta solution .... *Orange II* (S. & J. 86)

2a. Orange solution. To aqueous solution add 10 per cent. barium chloride solution and allow to stand a minute.

1b. Orange precipitate .... *Ponceau 4 GB* (S. & J. 13)

2b. No *coloured* precipitate (possibly a precipitate of barium sulphate insoluble in hydrochloric acid.

Dry colour brown orange. Aqueous solution + 10 per cent. basic lead acetate solution ; solution turns orange red and orange red precipitate slowly forms .... *Tropæolin O* (S. & J. 84)

Dry colour bright red. Aqueous solution + 10 per cent. basic lead acetate ; no change or slight turbidity only .... *Orange G* (S. & J. 14)

6. Crimson or red. To aqueous solution add sodium hydroxide solution.

α. No change in colour ; pale glistening precipitate. Dry colour + concentrated sulphuric acid.

Purple or violet solution .... *Orange IV* (S. & J. 88)

Brown solution .... *Orange III* (S. & J. 87)

β. Much redder .... *Orange I* (S. & J. 85)

γ. Little or no change and no precipitate. Dry colour + concentrated sulphuric acid.

1. Brown solution .... *Orange III* (S. & J. 87)

2. Crimson or magenta solution .... *Brilliant yellow S* (S. & J. 89)

3. Purple or violet solution. To 10 c.c. of aqueous solution add about 20 drops of sodium hydroxide solution.

α. Colourless glistening precipitate at once or on standing a few minutes .... *Orange IV* (S. & J. 88)

β. No change .... *Metanil yellow* (S. & J. 95)

b. Wool not dyed. To aqueous solution add dilute ammonia.

1. No change. Dry colour + concentrated sulphuric acid = blue or greenish blue .... *Saffron*

2. Darker. Shake aqueous solution with equal volume of ethyl acetate.

α. No colour extracted. Aqueous solution + 10 per cent. ferric chloride solution, yellow brown solution, no precipitate .... *Weld* (S & J. 696)

β. Considerable colour extracted by ethyl acetate. To aqueous solution add 10 per cent. solution of normal lead acetate.

1. Solution turns bright yellow, no precipitate .... *Buckthorn* (S. & J. 700)

2. Brownish precipitate. Add to aqueous solution 10 per cent. alum solution.

α. Solution yellow ; no precipitate .... *Quercitron* (S. & J. 699)

β. Turbidity which is cleared up by a few drops of acetic acid and solution then has decided green fluorescence .... *Fustic* (S. & J. 698)

B. Coloured precipitate. To colour solution add sodium hydroxide solution.

a. Solution decolourised and white precipitate of base. On shaking alkaline solution with ether, solution becomes clear and ether layer turns yellow on adding drop of acetic acid .... *Auramine* (S. & J. 425 or 426)

b. Yellow or orange precipitate. On shaking alkaline solution with ether, solution becomes clear and colour passes mostly into ether layer, which is orange yellow .... *Chrysoidine* (S. & J. 18?)

c. No change .... *Thioflavine*

II. Insoluble in cold water. Treat with 95 per cent. alcohol.

A. Soluble. To alcoholic solution add hydrochloric acid.

1. Crimson or pink .... *Butter yellow* (S. & J. 16)

2. No change or paler. Treat alcoholic solution with zinc dust and a few drops of acetic acid and shake for about half a minute and filter.

α. Filtrate colourless. Dry colour and concentrated sulphuric acid.

Reddish brown .... *Sudan G* (S. & J. 10

Bright red .... *Sudan I* (S. & J. 11)

β. Not decolourised or only partially so. (Distinguish and identify by usual tests.) .... *Turmeric or Annatto*

B. Insoluble. Treat with boiling water.

Soluble .... *Catechu* (S. & J. 703)

Insoluble .... *Colour lakes*

(Identify metallic base by qualitative analysis of ash. Identify colouring matter by dissolving lake in acid and extracting with immiscible solvent or by fixing on fibre.)

IV. RED COLOURS.

I. Soluble in cold water.

A. Dilute aqueous solution fluorescent. Apply double dyeing test of Sostegni and Carpentieri (Bureau of Chemistry, Bul. 107, revised, p. 190).

a. Fibre not dyed .... *Brazil wood* (S. & J. 701)

b. Fibre dyed. Add to aqueous solution a few drops of tannin reagent.

1. Coloured precipitate .... *Rhodamine* (S. & J. 504)

2. No precipitate. Prepare a dilute solution of colour in 95 per cent. alcohol.

α. Solution has green fluorescence .... *Eosin A* (S. & J. 512)

β. Solution has yellow or orange fluorescence .... *Phloxine* (S. & J. 518 or 521)

B. Dilute aqueous solution not fluorescent. Add to solution of colour a few drops of tannin reagent.

a. No precipitate of colour. Apply double dyeing test of Sostegni and Carpentieri (Bul. 107, revised, p. 190). [If, in course of test, fibre or solution becomes purple on addition of ammonia, test directly for *cochineal* by Robin's tests (Bul. 107, revised, p. 200) or *lichen colours* by Tolman's method (J. Amer. Chem. Soc. 1905, p. 213).]

1. Fibre dyed. Make 0·01 per cent. aqueous solution alkaline with ammonia and extract with amyl alcohol.

α Considerable colour extracted by amyl alcohol, which is coloured red. Shake colour solution, acidified with hydrochloric acid, with ether.

γ. Considerable colour passes into ether layer.

1*a*. Aqueous layer colourless; ether layer yellow .... { *Erythrosin* (S. & J. 517)
Rose Bengal (S. & J. 520 or 523)

[Rose Bengal solution is pink: erythrosin is red orange. Can only be distinguished with certainty by testing for or determining both chlorine and iodine in the colour, carefully purified by extraction with ether from acidified solution.]

2*a*. Aqueous layer remains red; ether layer orange or red. To aqueous solution add ammonia.

Brownish-yellow solution .... *Azo eosin* (S. &. J. 71)

No change.

Aqueous solution of colour orange red; + hydrochloric acid, yellow-brown precipitate *Fast red A* (S. & J. 102)

Colour not extracted by ether. Make solution alkaline with ammonia and shake again.

1*a*. Colour passes into ether layer, which is colourless .... *Magenta* (S. & J. 448)

2*a*. Colour does not dissolve in ether layer. Extract acid solution with ethyl acetate.

1*b*. Considerable colour extracted. Treat dyed fibre with concentrated hydrochloric acid.

1*c*. Fibre coloured crimson. Dissolve in neutral amyl alcohol.

Fluorescent .... *Azo eosin* (S. & J. 71)

Not fluorescent .... { *Archil substitute 3VN* (S. & J. 29)
Archil substitute (S. & J. 28)

2*c*. Fibre coloured yellowish. Dissolve in neutral ethyl acetate.

Not fluorescent .... *Erythrosin*

Fluorescent .... *Rose Bengal* (S. & J. 520 and 523)

2*b*. No colour extracted. Treat dyed fibre with concentrated hydrochloric acid.

1*c*. Fibre coloured blue. To dyed fibre add sodium hydroxide solution.

1*d*. Fibre crimson. To 10 c.c. of aqueous solution add 5 drops of hydrochloric acid.

No change .... *Ponceau 4RB* (S. & J. 160)

Dark blue and precipitate .... *Benzopurpurine* (S. & J. 277 or 278)

2*d*. Fibre brown or brown violet. To dyed fibre add concentrated sulphuric acid = green .... *Fast Ponceau B* (S. & J. 163)

2*c*. Fibre coloured magenta .... *Fast red B* (S. & J. 65)

—W. P. S.

Coffee from the East Africa Protectorate and Rhodesia. Bull. Imp. Inst., 1910, **8**, 365—367.

Two samples of coffee from the East Africa Protectorate contained 1·15 and 0·49 per cent. of caffeine and were valued at 54s. and 41s. 6d. per cwt. respectively (Dec., 1909). It was stated that they would command a ready sale. Eleven samples of coffee from Rhodesia were all of promising quality, and though containing rather a large proportion of broken beans, were valued at prices ranging from 35s. to 47s. per cwt. (May, 1910), the prices of some commercial coffees at the time being: Mysore I, 75s.; Mysore II, 78s., and Brazil (Santos) ordinary, 35s. per cwt.—A. S.

Determination of nitric acid in plants. Krog and Sebelien. *See* XVI.

Action of Bulgarian ferment on monobasic acids derived from reducing sugars. Bertrand and Veillon. *See* XVIII.

Patents.

Saffron; Treatment of —— for flavouring or colouring purposes. W. Bennett, Plymouth. Eng. Pat. 1623, Jan. 21, 1910.

One and a half lb. of freshly gathered stigmas of saffron, or 1 lb. of hay saffron, is mixed with 6 lb. of dry castor sugar, and the mixture is dried in a chamber provided with a hot-water jacket. The mixture is then ground to a fine powder and packed into tins, etc. For use, it may be mixed with flour, or dissolved in water and the solution employed in making dough.—W. P. S.

Grain treatment, milling products and the preparation of food from milling products. C. J. Lomax, Manchester. Eng. Pat., 4939, Feb. 28, 1910.

Grains of wheat or other cereal, etc., are treated in the unbroken condition with a solution of phosphoric acid or of a suitable phosphate to obtain a product which when mixed with other grains in the broken or unbroken condition shall yield a mixture containing any desired proportion of phosphoric acid. Thus one part of Kurachi wheat impregnated with phosphoric acid and dried, and then containing 25 per cent. of its weight of phosphoric acid, may be added to say, 1000 parts of untreated wheat. The flour and the bread produced from such mixtures are also claimed.—C. A. M.

Butter; Method of flavouring ——. G. W. Yeoman, St. Paul, Minn. U.S. Pat. 983,854, Feb. 7, 1911.

Alcohol and lactic acid are incorporated with the butter obtained by churning cream and separating the buttermilk. Suitable proportions claimed are approximately 2 oz. of lactic acid and 1 oz. of alcohol to 1000 lb. of butter.—C. A. M.

Emulsified chocolate; Process of preparing ——. Emulsified chocolate product. S. T. Achor, Kennett Square, Pa. U.S. Pats. 982,779 and 983,014, Jan. 31, 1911.

See Eng. Pat. 10,777 of 1909; this J., 1910, 778.—T. F. B.

Coffee beans; Process of cleaning and refining ——. J. Thum, Dresden, Germany. U.S. Pat. 982,902, Jan. 31, 1911.

See Eng. Pat. 21,397 of 1907; this J., 1908, 137.—T. F. B.

Flour; Milling ——. A. E. Humphries, Weybridge. U.S. Pats. 983,719 and 983,720, Feb. 7, 1911.

See Eng. Pats. 13,135 and 17,279 of 1908; this J., 1909, 1059.—T. F. B.

Wheat and other grains; Process for improving —— which have been badly gathered or stored. L. Froment. Fr. Pat. 420,497, Nov. 24, 1909.

See Eng. Pat. 29,866 of 1909; this J., 1910, 1129.—T. F. B.

Protein or albumin ; Soluble —— and process for extracting it from meat fibre or other insoluble protein matter. S. A. Vasey. Fr. Pat. 420,290, Sept. 10, 1910.

See Eng. Pat. 20,766 of 1909 ; this J., 1910, 1224.—T. F. B.

XIXb.—WATER PURIFICATION ; SANITATION.

River water ; Vitality of typhoid bacilli in artificially infected samples of ——. A. C. Houston. Met. Water Board. Sixth Research Report, 1910. (See also this J., 1910, 973, 974.)

This report has special reference to the effect of storage upon the comparative vitality of uncultivated and cultivated typhoid bacilli in raw river water. A sample of the water was inoculated with uncultivated typhoid bacilli—that is, those obtained direct from the human subject. After standing for a week in the dark, the shaken sample showed that there had been a reduction from 770,000 to 4 typhoid bacilli per c.c., and after a second week to *nil*. Twenty-four days after the start, half a pint of the infected water was drunk by the author with no ill effects. A second similar experiment showed that the typhoid bacilli had all disappeared in the first week. In a comparative experiment with typhoid bacilli which had been cultivated in the laboratory, the bacilli did not disappear from the water until after six weeks. It is thus seen that uncultivated typhoid bacilli disappear more rapidly than the cultivated bacilli in the stored water. As it is the former which are present in cases of natural pollution, it may be concluded that "even a week's storage of raw river water is an enormous protection. and less than a month's storage an apparently absolute protection against typhoid fever."—J. H. J.

Ozone ; Present status of —— with reference to air purification. R. D. Small. Trans. Amer. Electrochem. Soc., 1910, **18**, 171—184.

The author describes the properties of ozone and the apparatus used in preparing ozonised air, and gives a *résumé* of published opinions as to the efficacy of ozonised air as an adjunct or supplement to ventilation for the purpose of maintaining a pure supply of air. For air purification purposes, ozonisers in which the air is forced rapidly past the electrodes by means of suction pumps or fans are stated to be the only reliable forms. A low ampèrage and high voltage (8000—12,000) should be used. It is pointed out that according to modern views the danger of polluted air is due not to carbon dioxide but to the organic impurities present, and these latter are rapidly oxidised and destroyed by ozone.—A. S.

Nicotine in concentrated tobacco extracts ; Determination of ——. R. Kissling. Chem.-Zeit., 1911, **35**, 200.

Of all the methods used for determining the nicotine-content of tobacco extracts, that of Ulex is known to give the highest results. A description of this method, which has been in use for about 25 years, has only recently been published (see this J., 1911, 237), and the author points out that, apart from other sources of error, the results must invariably be too high, since it is a well-established fact that tobacco-extract contains other nitrogenous substances besides alkaloids, and these, on distillation with soda-lime, yield ammonia, which would be calculated as nicotine.—A. S.

Patents.

Water supply systems ; Apparatus for destroying bacteria in——[by means of ultra-violet rays]. V. Henri and A. Helbronner, Paris, and M. von Recklinghausen, Bas Meudon, France. Eng. Pat. 1805, Jan. 24, 1910.

The water is circulated through a conduit or chamber containing one or more lamps capable of emitting ultra-violet rays ; these lamps are suspended near the surface of the water, and means are provided for causing all the water to come within the sphere of action of the rays. Means are also provided for preventing the formation of and removing ripples from the surface of the water. An electro-magnet connected with the lamp circuit actuates a valve so that the supply of water to the tank is stopped should the lamp break, and a trap is provided for the purpose of catching débris in case of breakage of a lamp. Forms of apparatus are described for application under various circumstances and conditions, as is also a device for tilting the lamp in order to operate it at starting. (See also Eng. Pats. 25,509, 27,798, and 28,067 of 1909, 25,883 and 14,128 of 1910 ; this J., 1910, 1470 ; 1911, 46, 106, 151 ; and Fr. Pat. 415,842 of 1910 ; this J., 1910, 1329.)—W. P. S.

Water ; Method of, and apparatus for, purifying ——. W. B. Bull, Assignor to Chloride Process Co., Chicago, Ill. U.S. Pats. 982,704 and 982,705, Jan. 24, 1911.

The process consists in producing by electrolysis a solution of caustic soda and a solution which is a solvent of iron, subjecting iron in a separate chamber to the action of the latter solution, adding the iron solution to the water to be purified and precipitating the iron in the form of hydroxide, together with the impurities, by means of the caustic soda solution. The apparatus consists of an electrolytic cell, divided into anode and cathode chambers, and a chemically inert anode, separately producing an anode reagent capable of dissolving a metal to form a solution capable of coagulation and a cathode reagent capable of producing such coagulation. It also includes a receptacle for containing the water to be treated and a container in this receptacle for holding the metal from which the reagent is to be prepared. Means are provided for introducing the reagent prepared in this container and the reagent produced in the cathode chamber to the water in the receptacle.—J. F. B.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

Opium of commerce and its definition in the [French] Codex. L. André and Leulier. J. Pharm. Chim., 1911, **3**. 162—166.

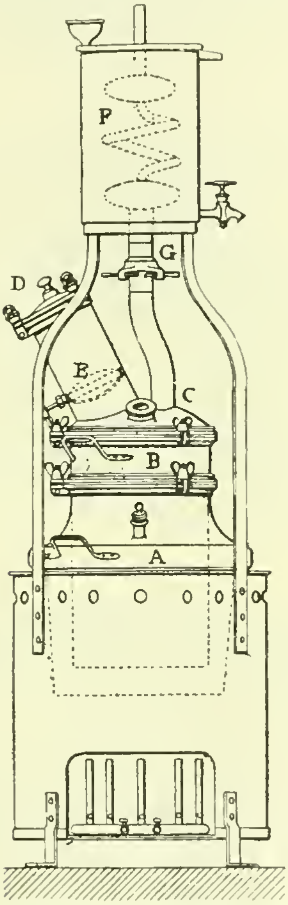
The requirements of the French Codex for opium are that when dried at 60° C. it should contain at least 10 per cent. of morphine, and that it should yield about 42 per cent. of aqueous extract. The latter should contain all the morphine—that is, at least 20 per cent. The drying at 60° C. cannot be completed within three days, and it is not possible to extract all the morphine from opium by means of water. In order to overcome these objections and to prevent adulteration, the author recommends the following prescription in place of that of the Codex. When dried at 100° C., official opium should contain at least 12 per cent. of morphine, and should not yield more than 7 per cent. of ash on ignition. It should yield about 50 per cent. of aqueous extract containing 18 per cent. of water and at least 20 per cent. of morphine. —F. Shdn.

Sinigrin ; Hydrolysis of ——. M. Gonnermann. Pflüger's Arch. Physiol., 1911, **137**, 453—469. Chem. Zentr., 1911, **1**, 553—554.

No other hydrolytic enzyme besides myrosin has the power of decomposing sinigrin (a glucoside of black mustard) with formation of allyl isothiocyanate. The characteristics of pure sinigrin are given by the author as follows : easily soluble in water, slightly soluble in 96 per cent. alcohol, soluble in 130 parts of 85 per cent. alcohol at 60° C., insoluble in amyl and isobutyl alcohols, ether, acetone, and chloroform, somewhat soluble in warm methyl alcohol ; melts and becomes brown at 130° C. ; gives a white precipitate with basic lead acetate in presence of ammonia ; gives a yellowish red colouration but no evolution of mustard oil when boiled with 33 per cent. potassium hydroxide solution; when decomposed by acids and alkalis it yields crystalline products.—A. S.

Fresh plants with boiling alcohol; Treatment of ——. E. Bourquelot and H. Hérissey. J. Pharm. Chim., 1911, **3**, 145—149.

In order to extract fresh, and in some cases entire, plants with boiling alcohol, a special apparatus has been devised.



It consists essentially of a tin-lined copper vessel, B, resting in a water-bath, A. The lid, C, of the vessel has two pieces of glass let into it for viewing the contents. A tube leads from the lid and is connected with the reflux condenser, F, by a bayonet joint, G. The charging aperture, D, is 12—15 cm. in diameter and is provided with a lid which can be clamped on, and a throttle valve, E. Rubber bands are used to secure tight joints between the covers and the vessel. The vessel, B, is filled with alcohol, which is heated to the boiling point. When this takes place the valve, E, is closed, and the plants introduced. The lid is fastened on and the valve opened, causing the plants to fall into the hot alcohol. In this way fresh plants can be extracted rapidly with boiling alcohol without any serious loss of the latter.
—F. Shdn.

Medicinal plants; Sterilisation and drying of ——. E. Bourquelot. J. Pharm. Chim., 1911, **3**, 149—161.

The extraction of a living plant may withdraw soluble enzymes, which can continue their hydrolysing or oxidising action in the extract, thus altering its character. Moreover, during the drying, especially if it be slow, the enzymes may still continue their activity to a greater or less degree. The activity of these enzymes may be destroyed by a rapid sterilisation. This may be carried out by dropping the plant in portions into boiling water or alcohol. Thus sambunigrin can be isolated from the leaves of elder which have been treated with hot water. Drying at 120°—140° C. has been found useful in certain cases. But treatment with boiling 90 per cent. alcohol is the most satisfactory method of sterilising plants. By the aid of the latter process sucrose has been identified in 142 different species of mushrooms. In the same way gaultherin has been obtained from *Monotropa hypopythis* and from the root of *Polygala*, also by the agency of a special enzyme, *géase* there has been obtained géin, the glucoside of dextrose and eugenol, from *Geum urbanum* L., and gentianose and gentiopicrin from fresh gentian root. A cold alcoholic extract of kola gives a dark extract from which caffeine can be extracted by chloroform. A hot alcoholic extract of fresh kola gives a nearly white extract which yields no caffeine to chloroform. A comparison of the alkaloidal or glucosidal content of the extracts of certain plants was made, the extraction being made on the fresh sterilised plants and on the dried plants. In the following cases there was a diminution in the amount of active substance obtained from the dried plant as compared with that from the sterilised plant. With the leaves of *Aconitum napellus* L. the decrease was 31 per cent., the leaves of *Digitalis purpurea* L. 21·7 per cent., aconite root 10 per cent., colchicum bulbs 26·4 per cent. With a number of other plants the changes were smaller or not apparent. Extraction with hot alcohol in many cases gives a more stable extract. As the amount of sucrose in many roots increases on keeping, a determination of its amount in a given specimen may afford some criterion as to whether the drying has been effective or otherwise.
—F. Shdn.

Zygadenus intermedius; Analysis of ——. I. F. W. Heyl and L. C. Raiford. J. Amer. Chem. Soc., 1911, **33**, 206—211.

These poisonous plants (death camas) have caused heavy stock losses, especially among sheep. The paper contains the results of the proximate analyses of different parts of the species available in Wyoming. The alkaloid in the leaf was determined by different methods.—H. E. P.

Sophorin sugar. H. ter Meulen. Van Bemmelen Festschrift, 1910, 411—415. Chem. Zentr., 1911, **1**, 496.

Sophorin is a glucoside present in the so-called Chinese "yellow berries," the flower buds of *Sophora japonica*. It can be extracted by grinding the berries and then boiling with a large quantity of water. It crystallises from water in yellow microscopic needles, and is easily soluble in boiling alcohol and boiling water, and slightly soluble in cold water. When the aqueous solution is boiled with acid, insoluble *sophoretin* separates. By the action of the enzyme, rhamninase, isolated by Tanret from the fruit of *Rhamnus infectoria* (this J., 1900, 79), the glucoside is decomposed, with formation of the trisaccharide, *rhamninose*, $C_{18}H_{32}O_{14}$. (See also this J., 1892, 453; 1895, 384, 458.)—A. S.

Terpenes and essential oils; Contributions to our knowledge of ——. *Parts* 103 *and* 104. O. Wallach. Annalen, 1911, **378**, 182—215, and 215—261.

These two investigations are devoted to the following subjects: I. The hydrocarbon C_9H_{16} from fencholic acid and its derivatives, etc. II. Δ^6-methyl (1)-isopropyl-(5)-cyclohexenone-(2) [so-called "isocamphor"] and methyl (1)-isopropyl-(5)-cyclohexanone-compounds and derivatives.

Isopropyl alcohol and trimethylcarbinol; Boiling temperatures of aqueous solutions of ——. A. Doroszewski and E. Polianski. J. Russ. Phys.-Chem. Ges., 1910, **42**, 1448—1452. Chem. Zentr., 1911, **1**, 465—466.

Tables are given showing the boiling temperatures of mixtures of water with isopropyl alcohol and with trimethylcarbinol at 700, 760, and 800 mm. respectively.
—A. S.

Pepsin; Determination of ——. Comparison of the methods of different Pharmacopœias. E. Herood and T. Maben. Schweiz. Woch. Chem. Pharm., 1911, 49, 17—23. Chem. Zentr., 1911, 1, 590—591.

When pepsin is allowed to act for a long time on albumin or fibrin, the proportions of syntonin and proteoses in the product decrease continuously, whilst the proportion of peptones increases, but at different speeds according to the ratio of acid to pepsin. The differences in the conditions prescribed in the methods of the various Pharmacopœias are shown in the following table.

Pharmacopœia.	Acid content of solution in % HCl.	Ratio of acid to pepsin.	Temperature of digestion.	Duration of digestion.	Duration of boiling of albumin.	Duration of drying of albumin.	Activity of pepsin.
			°C.	hours.	mins.	mins.	
Belgium	0·25	250 : 100	40	1	10	10	1 : 100
England	0·20	5000 : 100	40·5	6	15	12	1 : 2500
Germany	0·125	125 : 100	45	1	10	10	1 : 100
Italy	0·09	90 : 100	38—40	1—2	—	—	1 : 100
Switzerland	0·20	200 : 100	40	1—2	5	15	1 : 100
United States	0·30	3500 : 100	52	2½	15	16	1 : 3000
France	0·25	150 : 100	50	6	—	—	1 : 25

Note.—In the French method fibrin is used, and in the others albumin.

The author recommends that in order to obtain reliable and uniform results the following conditions should be prescribed: acid content of solution, 0·25 per cent.; ratio of acid to pepsin, 250 : 100; temperature, 52° C.; duration of digestion, 2 hours; duration of boiling of albumin, 10 mins.; duration of drying of albumin, 15; activity of pepsin, 1 : 2000.—A. S.

Distillation of methyl alcohol in aqueous solutions. Bergström. *See* IIb.

Stockholm tar. McEwan. *See* III.

Propolis. Küstenmacher. *See* XII.

Patents.

Santalol and lactic acid; Process for the production of a compound of ——. F. S. Mason, New York. Eng. Pat. 7721, March 30, 1910.

A lactate of santalol, adapted for medicinal uses, is obtained by heating 80 parts of lactic acid (sp. gr. 1·2) with 55 parts of sandalwood oil, containing 90 per cent. of santalol, at a temperature not above 140° C., and under reduced pressure. It may also be prepared by heating lactic acid (U.S.P.) above 100° C. to remove some of the water, and then adding one-third to one-half the weight of sandalwood oil and heating at 130° C. for 6 to 8 hours. The product is washed with hot water, sodium bicarbonate solution, and dilute hydrochloric acid solution, and finally dried. It is a reddish brown liquid of sp. gr. 1·03—1·04, soluble in alcohol, ether, chloroform, etc., but insoluble in water.—T. F. B.

β-γ-Dimethylerythrene; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 13,677, June 6, 1910.

Good yields of β-γ-dimethylerythrene are obtained by distilling pinacone with acid salts of sulphuric acid or of di- or poly-sulphonic acids. For example, two parts of pinacone are heated with three parts of potassium bisulphate to 140°—150° C.; the distillate consists of two layers, the upper one of which is dried over calcium chloride and fractionated; the fraction boiling between 65° and 97° C. is distilled over sodium, when the fraction passing over at 68°—69° C. consists of dimethylerythrene, $CH_2 : C(CH_3).C(CH_3) : CH_2$.—T. F. B.

Yohimbine; Manufacture of compounds of ——. F. Müller, Charlottenburg, Germany. Eng. Pat. 14,576, June 16, 1910. Under Int. Conv., March 12, 1910.

Yohimbine is combined with at least one mol. of a neutral nitrogen compound which contains both basic and acidic groups, *e.g.*, urethanes, amino-acids, acid amides, ureas, or imino compounds such as caffeine. The compounds are prepared either by treating yohimbine with a salt of one of the nitrogen compounds, or by acting on a yohimbine salt with the free nitrogen compound, in presence of a suitable solvent. The products are applicable to medicine. —T. F. B.

Therapeutic preparations; Manufacture of ——. Kalle und Co., Akt.-Ges., Biebrich on Rhine, Germany. Eng. Pat. 21,414, Sept. 14, 1910. Under Int. Conv., Sept. 14, 1909.

The bacteriolysis of tuberculose and other bacilli can be effected by means of neurine and choline, as well as by lecithin (see Ger. Pat. 212,350; this J., 1909, 1062). Neurine and choline rapidly dissolve even acid-resisting bacteria, neurine being the more active.—T. F. B.

Acetic anhydride from calcium carbide; Manufacture of ——. L'Oyonnithe Soc. Anon. Fr. Pat. 420,346, Sept. 12, 1910.

Acetylene, prepared by the action of water on calcium carbide, is purified by means of caustic soda and iron salts, and then passed into a solution of a mercuric salt other than the iodide. In the case of mercuric chloride, a trichloromercuri-acetaldehyde, $(ClHg)_3 \vdots C.CHO$, is formed. When this is boiled with a dilute acid, aldehyde and a mercuric salt are formed. The aldehyde is now partly converted into acetyl chloride by treatment with chlorine, and partly into acetic acid by oxidation. Finally the acetyl chloride and acetic acid (in the form of its sodium salt) are brought together to produce acetic anhydride. —T. F. B.

Acetylene tetrachloride; Process for making ——. G. Ornstein. Fr. Pat. 420,489, Sept. 10, 1910. Under Int. Conv., Oct. 6, 1909.

Chlorine and acetylene are passed simultaneously into acetylene tetrachloride in presence of a non-volatile, solid catalytic agent, such as iron. No other solvent is used. The acetylene, not being readily soluble in acetylene tetrachloride, is passed into the vessel at a point below the point of entry of the chlorine, which is readily soluble. The solution is kept cool during the reaction. In place of the solid catalyst, it is possible to use chemically active rays to effect the combination.—T. F. B.

Monochlorhydrin; Process for preparing ——. Deutsche Sprengstoff-A.-G. Ger. Pat. 229,536, Jan. 30, 1910. Addition to Ger. Pat. 201,230, Jan. 11, 1906 (See Fr. Pat. 370,224; this J., 1907, 278).

The crude product obtained by the action of sulphur dichloride on glycerol, is treated with a comparatively large amount of water, from which it is then mechanically separated, and freed from water, hydrochloric acid, and dichlorhydrin by heating for a long time in a vacuum at 40°—100° C.—T. F. B.

Diacetonyl alcohol from acetone; Process for preparing ——. A. Hoffmann. Ger. Pat. 229,678, June 23, 1909.

Acetone is passed (in the liquid form) over a catalytic agent, such as slaked lime, in granular or powdered condition: the mixture of diacetonyl alcohol and acetone is then neutralised and fractionated, the unchanged acetone being again led over the catalytic agent.—T. F. B.

Oxalic acid esters of the lower aliphatic alcohols; Process for preparing normal ——. R. Scheuble. Ger. Pat. 229,679, Dec. 12, 1909.

Oxalic acid is heated, if necessary under pressure, with an aliphatic alcohol (methyl or ethyl alcohol) until equilibrium is reached, the pressure is reduced to less than that of the atmosphere, and the water and unaltered alcohol are distilled off, the heating of the mixture being then continued under reduced pressure. Nearly theoretical yields of methyl and ethyl oxalates are said to be obtained.
—T. F. B.

Albumose silver compounds; Manufacture of ——. A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 12,344, May 19, 1910. Addition to Eng. Pat. 4564, Feb. 24, 1909.

See Addition of June 20, 1910, to Fr. Pat. 400,627 of 1909; this J., 1911, 49.—T. F. B.

Tannin-silver-albumen compound. R. Weil, Frankfort on Maine, Germany. U.S. Pat. 982,910, Jan. 31, 1911.

See Ger. Pat. 218,728 of 1908; this J., 1910, 592.—T. F. B.

Bromodiethylacetylurea. J. Callsen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 983,425, Feb. 7, 1911.

See Eng. Pat. 2888 of 1910; this J., 1910, 1332.—T. F. B.

Allyl ester of salicylic acid and process for making it. Act.-Ges. f. Anilinfabr. Fr. Pat. 420,602, Sept. 20, 1910.

See Eng. Pat. 22,779 of 1910; this J., 1910, 1332.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Colour screens applicable for colour photography. O. S. Dawson, C. L. Finlay, and The Thames Colour Plate, Ltd., London. Eng. Pat. 4208, Feb. 19, 1910.

To produce successively any number of colour screens which will register mutually, it is proposed to employ a glass negative image of a series of dots on a transparent ground, from which each series of spots is printed.—T. F. B.

Photographic prints in graduated relief; Producing coloured ——. F. E. Ives, Weehawken, N.J. U.S. Pat. 980,962, Jan. 10, 1911.

A sensitised colloid surface containing a non-actinic colouring matter (*e.g.*, a dyestuff soluble in water) is exposed to light beneath a negative, treated with an alkaline developer to discharge the colouring matter, and the relief print then treated with chromic acid or other hardening and mordanting agent, and finally dyed.
—T. F. B.

Photography of colours; Process for making transparent screens with coloured elements for the ——. L. Dufay. Second Addition, dated Nov. 17, 1909, to Fr. Pat. 388,616, June 4, 1907.

The screens described in the principal patent and first addition (see Eng. Pats. 11,698 and 18,744 of 1908; this J., 1909, 383 and 1105) may be prepared with yellow, red, and blue elements, instead of green, violet, and orange. If such elements are so prepared that each admits two-thirds of the solar spectrum, the photographs obtained by their aid exhibit the colours of the original when supported on paper, etc., and viewed by reflected light.
—T. F. B.

Photography in colours; Process of ——. A. J. B. Tauleigne and E. Mazo. Fr. Pat. 420,584, Nov. 27, 1909.

A photographic silver positive is bleached in a 5 per cent. solution of cupric chloride, and the image is converted into silver iodide by means of a 1—2 per cent. solution of potassium iodide. It is now stained with a dyestuff of the desired colour (fuchsine, auramine, methylene blue, ethyl green, etc.), washed, and the dyestuff fixed by means of a 3 per cent. solution of tannin. After washing, the silver iodide may be removed either by a solution of sodium thiosulphate or of potassium cyanide, or the iodide may be again reduced to silver by means of a suitable developer.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Explosives for fiery and dusty mines; Report on ——. Dautriche. Mém. Poudres et Salpêtres, 1910, **15**, 164—170.

The French Commission on explosives decided, in 1888, that no explosives which, on detonation, yielded products incompletely oxidised (hydrogen, carbon monoxide, and carbon) should be allowed to be used in fiery or dusty mines. Recent work (this J., 1910, 1333; 1909, 260) having shown the beneficial influence of the presence of certain alkali salts as regards the lowering of the temperature on explosion, the Commission decided to re-investigate the matter. Charges of 50 grms. of explosive were detonated in a closed vessel of 10 cb.m. capacity. The following salts were experimented with when mixed with nitrocellulose (12·8 per cent. of nitrogen), collodion cotton (12 per cent. of nitrogen), and trinitrotoluene: sodium carbonate and bicarbonate, potassium nitrate and sulphate, calcium carbonate, magnesium carbonate, lead nitrate, and barium nitrate. The conclusions arrived at were as follows: The addition of small quantities of salts of potassium and sodium (5 per cent.) to explosives, which, on detonation, produce products incompletely oxidised, is sufficient to render these products non-combustible. The addition of alkali salts produces a greater margin of safety in fiery mines, and makes the explosive more powerful and more sensitive. The lowering of temperatures, due to the addition of these salts, is equivalent to about 300° C. As a result of these experiments, the Minister of Public Works is considering the question of the alteration of the regulations as to the employment of incompletely oxidised explosives in fiery and dusty mines.—G. W. McD.

Explosives for use in fiery and dusty mines; Report on ——. Dautriche. Mém. Poudres et Salpêtres, 1910, **15**, 171—174.

As calculated from the heats of formation the following figures are given as to the heat developed by 100 grms. of nitrocelluloses, of varying nitrogen content, under the conditions mentioned.

Nitrocellulose.

		Percentage of nitrogen.			
		13·5	12·78	11·98	11·13
		Calories.			
Water liquid	Simple detonation	107	96	85	74
	Complete combustion	230	242	252	264
	With combustion of hydrogen	159	153	148	142
Water gaseous	Simple detonation	98	87	77	67
	Complete combustion	217	227	237	247
	With combustion of hydrogen	145	138	132	125
	Percentage of combustible gas produced by simple detonation ..	46	52	58	64

Trinitrotoluene may be considered as decomposing, on detonation, according to the three following equations:—

(a) $2C_7H_5N_3O_6 = 12CO + 2C + 5H_2 + 3N_2$.
(b) $2C_7H_5N_3O_6 = 11CO + 3C + 4H_2 + H_2O + 3N_2$.
(c) $2C_7H_5N_3O_6 = 10CO + 3C + CO_2 + 5H_2 + 3N_2$.

The heat developed under the conditions mentioned will be as follows :—

		Formula.		
		(a)	(b)	(c)
		Calories.		
Water liquid	Simple detonation	56	66	66
	Complete oxidation	354	354	354
	Oxidation of carbon and hydrogen	173	188	204
	Oxidation of hydrogen ..	132	127	142
	Oxidation of carbon	97	128	128
Water gaseous	Simple detonation	56	63	66
	Complete oxidation	342	342	342
	Oxidation of hydrogen and carbon	161	176	192

—G. W. McD.

Trinitrophenol and trinitrocresol ; The metallic salts of ——. H. Kast. Z. ges. Schiess- und Sprengstoffw., 1911, **6**, 7—9, 31—34, 67—70.

The author has prepared and investigated the salts formed by the commoner metals with trinitrophenol and trinitrocresol. Tabulated results of considerable length are given showing the relative sensitiveness of these salts to the shock of a falling weight.—G. W. McD.

Mercury fulminate ; Manufacture of ——. D. O. Hagen. Z. ges. Schiess- und Sprengstoffw., 1911, **6**, 4—7, 28—31, 44—49.

The following methods are employed in V. Alder's fulminate factory near Vienna. Fifteen 5-litre glass bottles are used, and in each is placed 35—40 grms. of granulated zinc and 4·5 kilos. of nitric acid of sp. gr. 1·38. When the zinc has dissolved, 500 grms. of mercury are added. Heat is, if necessary, applied until the mercury is dissolved. The contents of each flask, at a temperature of 20°—25° C., are then transferred to a 50-litre retort containing 4·5 kilos. of 91 per cent. alcohol, denatured with turpentine, and 30 grms. of copper nitrate solution. Evolution of gas begins almost immediately ; the temperature then rises, a white fume fills the retort, and mercury fulminate is precipitated. The reaction is allowed to proceed until the white fume has almost disappeared, and gas of a yellowish red colour fills the retort. The tubes of the retorts are connected with a series of earthenware towers. The contents of the retorts are cooled and transferred to a glazed earthenware jar, into which cold water is poured, to completely precipitate the fulminate, which is washed first, in a funnel with 82—85 per cent. alcohol, until the filtrate shows no turbidity on addition of water, and then with water, until the filtrate is neutral to litmus. The fulminate is then transferred to a large glass tube, 25 cm. wide and 20 cm. long, closed at one end with silk gauze of 100 meshes to the sq. cm. This is moved about in an earthenware vessel holding 30 litres of water until the fulminate passes through, leaving foreign matter such as small pieces of wood, etc., behind. The fulminate, in quantities of 1·5 kilos., is converted into a fine powder by rubbing it for ½ hour with a wooden pestle, in the moist state, in a porcelain dish 30 cm. in diameter and 15 cm. deep. The finely divided fulminate is then collected in earthenware jars. The mouths are covered with parchment paper and the jars are placed in underground magazines. After standing for 2 days the fulminate has settled down so well that the excess of water can be decanted off, leaving the explosive with a very constant moisture content of about 15 per cent.—G. W. McD.

Explosives ; Reports on ——. Dautriche. Mém. Poudres et Salpêtres, 1909—1910, **15**, Nos. 3 and 4.

The following explosives were examined and passed : 1. Alteration in the composition of Cugny Dynamite No. 2, pages 119—120. 2. Two new types of Dynamite called Carbonite Grisoutine A and B, pages 120—122. 3. Grisoutine containing potassium and sodium nitrates, manufactured by the Soc. Française des Explosifs, pages 189—190. 4. Grisoutines containing potassium nitrate, manufactured by the Soc. anon. d'Explosifs de Prodnits chimiques, pages 190—192.

The following were examined and refused : 1. New composition for explosives of type N, pages 143—148. 2. Explosive O. No. 3 compressed (Prometheus), pages 148—150. 3. Explosive type N, manufactured by the Soc. anon. d'Explosifs et de Produits chimiques, pages 150—152. 4. Chlorate explosive (Street), type 60 N, containing sodium chlorate, pages 122—124. 5. Granulated explosive (Prometheus), pages 130—132. 6. Chlorate explosive (Street) 60 N modified containing sodium chlorate, pages 135—137. 7. Explosives Sebomites, pages 137—140. 8. Explosive (Steelite), pages 181—185. 9. Chlorate explosives manufactured by Davey, Bickford, Smith, and Co., pages 212—247.—G. W. McD.

Patents.

[Explosives.] Process for producing fumes corresponding with the theoretical maximum charging density. Westfälisch-Anhaltische Sprengstoff Akt.-Ges. Ger. Pat. 229,103, July 16, 1909.

A block of metal, charcoal, cement, stone, or other suitable material, provided with a borehole, is fixed inside an explosion bomb, the explosive, contained in a cartridge of parchment paper, is forced in the borehole, the bomb is closed, and the explosive is fired. The bomb may be exhausted, if desired, before the explosion is produced. The composition of the gases produced from picric acid at charging densities of 1·601, 1·532, 0·01, and 0·02, and of trinitrotoluene at charging densities of 1·454, 1·522, 0·01, and 0·02 respectively, is given.—A. S.

Explosive ; Safety ——. The Continental and Colonial Explosives, Ltd. Fr. Pat. 420,679, Sept. 23, 1910. Under Int. Conv., Sept. 28, 1909.

See Eng. Pat. 22,095 of 1909 ; this J., 1910, 1178.—T. F. B.

Igniting composition for matches and match boxes. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 420,653, Sept. 22, 1910. Under Int. Conv., Sept. 23, 1909.

See Eng. Pat. 21,931 of 1909 ; this J., 1910, 842.—T. F. B.

Manufacture of pure tetra-phosphorus trisulphide. Eng. Pat. 22,506. *See* VII.

XXIII.—ANALYTICAL PROCESSES.

Platinum triangle ; A good substitute for the ——. R. C. Benner. J. Amer. Chem. Soc., 1911, **33**, 189.

Wire of a nickel-chromium alloy, "nichrome," was found to be very resistant to ignition.—H. E. P.

Starch for use as indicator in iodometric titrations. L. Mathieu. Ann. Chim. Analyt., 1911, **16**, 51—52.

In determinations requiring the use of very dilute iodine solutions—such as the estimation of sulphurous acid in wines—the end-point of the titration is frequently indefinite when ordinary starch solution is employed, this being largely due to the presence of dextrins and of undissolved starch grains in the indicator. As the result of experiments with starch prepared by various methods, the author finds that the soluble starch described by Fernbach and Wolf (Compt. rend., March 4, 1907) affords greater precision in titration than any other. In the preparation of this material the fecula is allowed to remain in contact with very dilute hydrochloric acid (1 : 1000) for some time, after which it is washed with distilled water, dried at 30° C. and finally heated in an oven for several hours at a temperature above 100° C. The acid treatment removes alkalis and alkaline earths and converts neutral into acid phosphates, while during the subsequent dry

heating the fecula is gradually converted into soluble starch. This material keeps perfectly in the dry state, and the indicator is prepared from it by boiling 1 grm. with 100 c.c. of water and filtering. It is stated that the solution so obtained is very sensitive to iodine, the change from colourless to blue, and *vice versa*, being very sharp.
—W. E. F. P.

Silver ; Determination of —— by electro-deposition from an ammoniacal solution of the oxalate. F. A. Gooch and J. P. Feiser. Amer. J. Sci., 1911, **31**, 109—111.

A solution of silver nitrate standardised by weighing the silver chloride on asbestos, was used for a series of twenty-four experiments. The silver oxalate completely precipitated by ammonium oxalate from 20 c.c. of a solution of the silver nitrate, was dissolved in a slight excess of ammonia, diluted to 100 c.c., and electrolysed by a current of 0·25—1·5 amp. and 4—7 volts using cathodes rotating about 450 times a minute. The deposited silver was cautiously dried over a low flame, and then ignited to a low redness giving results which are tabulated, and which show an average error of —0·1 per cent. of the silver taken, the electrolysis occupying about thirty minutes. A low current density (3·3—1·7) gave the best adhering deposits. Stationary cathodes were unsuccessful. Five experiments using a solution of precipitated silver chloride in ammonia and ammonium oxalate gave equally good results.
—A. H. C.

Mercury compounds ; Decomposition of —— by contact with organic matter. W. Brunetti. Z. Unters. Nahr. Genussm., 1911, **21**, 92—94.

It is sometimes of importance, when the presence of mercury has been detected during the course of a toxicological analysis, to ascertain in what form the mercury has been introduced into the organs under examination, and the author has made a number of experiments with the object of determining how far it is possible to identify mercury compounds after the latter have been in contact with animal matter. The mercury compounds used in the experiments were mixed with portions of raw beef-juice (prepared by extracting beef with cold water) and, after 10 days' contact at the ordinary temperature, the mixtures were acidified with tartaric acid and submitted to steam distillation for three hours, the quantity of mercury, if any, in the distillate being then determined. It was found that metallic mercury, mercuric sulphide, and mercury cyanide are not reduced by organic matter, and do not distil over with steam. Mercurous iodide is not reduced, but a small quantity (about 1 per cent. of the amount present) is found as such in the distillate. Red mercuric iodide is likewise not reduced, but about 18 per cent. of the quantity present is found in the distillate as yellow mercuric iodide. In the case of mercury ointment a portion of the metal distils, but the quantity found in the distillate depends on the fineness of the particles in the ointment. The following compounds were all reduced by the organic matter and yielded metallic mercury in the distillate ; the percentage quantity of the volatile mercury, calculated on the total amount present, is given in parentheses :—Mercuric peptonate (39·15) ; mercuric albuminate (32·45) ; mercuric chloride (30·68) ; mercurous chloride (19·11) ; mercurous nitrate (15·26) ; mercury ammonium chloride, white precipitate (15·01) ; mercuric acetate (11·34) ; mercuric oxide (8·73) ; and mercuric nucleinate (trace).—W. P. S.

Comparison of methods of sampling wood pulp. Persoz. *See* V.

A reaction of uranium salts. Siemssen. *See* VII.

Notes on the matte assay [for gold]. Wilmoth. *See* X.

Fischer's modification of Volhard's method for the volumetric determination of manganese. Cahen and Little. *See* X.

Analysis of aluminium alloys. Smith. *See* X.

Analysis of molybdenite. Trautmann. *See* X.

Refraction constants of vegetable oils. Klimont. *See* XII.

Blown fatty oils. Marcusson. *See* XII.

Propolis. Küstenmacher. *See* XII.

Huebener's rubber tetrabromide. Huebener. *See* XIV.

Note on tannin solutions. [Detection of tannin.] Grasser. *See* XV.

Culture media and methods for the determination of soil bacteria. Lipman and Brown. *See* XVI.

Determination of phosphoric acid in superphosphates and bone meal. Romanski. *See* XVI.

Stimulating and toxic actions of chromium compounds on plants. [Determination of very small quantities of chromium]. Koenig. *See* XVI.

Determination of nitric acid in plants. Krog and Sebelien. *See* XVI.

Determination of inorganic and organic phosphorus in meats. Grindley and Ross. *See* XIXa.

Identification of food colours. Solubility and extraction of certain colours and the colour reactions of dyed fibre and of aqueous and sulphuric acid solutions. Loomis. *See* XIXa.

Determination of nicotine in concentrated tobacco extracts. Kissling. *See* XIXb.

Determination of pepsin. Hercod and Maben. *See* XX.

Patent.

Gas analysis by the absorption method ; Apparatus for ——. Erste Süddeutsche Manometerbauanstalt und Federtriebwerkfabrik. J. C. Eckardt. Ger. Pat. 229,977, Dec. 8, 1907.

In the apparatus claimed, the gas-inlet pipe, the measuring vessel, and the absorption-vessel all communicate with a chamber provided with hydraulic valves, which are operated mechanically so as to place the measuring vessel and the absorption vessel alternately in communication with the gas inlet and with one another. The vessel containing the valves is closed by a hydraulic seal, and means are provided for operating the valves without breaking the seal. Means are also provided for varying the depth to which the hydraulic valves are immersed, so that any difference in the quantity of gas collected in the measuring vessel, due to variations of pressure in the gas inlet, can be equalised, and a greater or smaller quantity of the gas contained in the valve used for making up the volume of gas in the measuring vessel.—A. S.

XXIV.—MISCELLANEOUS ABSTRACTS.

Crystallisation through membranes. J. H. Walton, jun. J. of Phys. Chem., 1911, **15**, 45—53.

The author extends the work of a previous publication (J. of Phys. Chem., 1909, **13**, 490) in which it was shown that if a supersaturated solution or undercooled liquid be divided into two parts by a membrane of collodion, parchment, or goldbeater's skin, the crystallisation produced by the inoculation of one part, may be transmitted through the membrane to the other part. He now finds that the crystallisation of undercooled liquid phosphorus cannot be transmitted through rubber or goldbeater's skin. Rubber membranes which are impervious to water and to aqueous solutions do not allow the transmission of the crystallisation of supersaturated aqueous solutions even when the membrane is so distended as to make it only 0·0003—0·0004 in. thick. Contact with the solid phase is apparently necessary. In the case of membranes (parchment and collodion) which are pervious to water there is a minimum limit of supersaturation, depending on the solution and on the membrane, below which the crystallisation is not transmitted.—W. H. P.

Chemi-luminescence ; A lecture experiment for the demonstration of ——. A. Heczko. Chem.-Zeit., 1911, **35**. 199—200.

The author has found that by the action of moist air on phenylmagnesium bromide dissolved in anhydrous ether, an intense greenish luminescence is produced, eminently suitable for demonstration purposes. The ethereal solution of the phenylmagnesium bromide is placed in a stoppered flask, and the stopper is raised for a time and some moist air blown in. On now rotating the flask so as to distribute the solution over the inner surface of the glass, the luminescence becomes distinctly visible. It disappears after some time, but can be reproduced by blowing in some more moist air, and so on until the whole of the phenylmagnesium bromide has been consumed. The luminescence can also be shown by allowing the ethereal solution to flow down an inclined board, preferably of black wood, when the effect is produced by water vapour absorbed from the air. The luminescence is as intense as that observed in the previous experiment, but does not last so long.—A. S.

Tribo-luminescence ; Notes on ——. W. S. Andrews. Trans. Amer. Electrochem. Soc., 1910, **18**, 279—281.

An artificial product exhibiting the property of tribo-luminescence—*i.e.*, of emitting light when rubbed or scratched—can be easily prepared by mixing together 70 parts of finely powdered zinc carbonate and 30 parts of "flour sulphur," and making the mixture into a thick cream with distilled water in which a small particle of manganese sulphate has been dissolved. After thorough trituration in a mortar, the mass is dried at a gentle heat in a shallow dish, then finely powdered, packed tightly in a porcelain or Battersea crucible with a tight cover, and heated to bright redness for twenty minutes. The resulting stone-like product emits minute sparks showing a yellowish light when scratched with a knife blade ; the sparks will not ignite an inflammable vapour.—A. S.

Books Received.

Physico-Chemical Tables for the use of Analysts, Physicists, Chemical Manufacturers, and Scientific Chemists. In two volumes, each compete in itself. By John Castell-Evans. Lecturer in Inorganic Chemistry and Metallurgy at the Finsbury Technical College. Vol. II. Physical and Analytical Chemistry. Chas. Griffin and Company, Limited, Exeter Street, Strand, London. 1911. Price 36s. net.

8vo volume, containing 1227 pages of subject matter, and an alphabetical index of subjects. It will be remembered that volume I. appeared in 1902 (this Journal, 1903, 51), and contained tabulated matter referring to chemical engineering and physical chemistry. In the present volume the subject of Physics is continued, and the following arrangement of groups is observed :—I. Molecular dynamics. II. Molecular speeds. III. Molecular volumes, etc., of liquids. IV. Influence of temperature on surface tension, etc. V. Capillarity constants of solutions. VI. Cryoscopic or lowering of freezing point method. VII. Vapour tension, and ebullistic or boiling point method. Analytical Chemistry. I. Table for computing results of analysis. II. Alcoholimetry. III. Specific gravities of glycerin solutions. Refractive powers of aqueous solutions of glycerin. IV. Specific gravities of solutions of cane sugar. Weight of sugar per litre of various solutions at 15° C. Sugar contents of boiled extract of grains, syrups, etc. Starch in potatoes. Water and starch. Weights of various sugars corresponding to weights of cupric oxide precipitated from Fehling's solution, etc. V. Supplementary tables, weights and measures.

An Introduction to Bacteriological and Enzyme Chemistry. By Gilbert J. Fowler, D.Sc., Lecturer in Bacteriological Chemistry in the Public Health Department, Victoria University, Manchester. Edward Arnold, 41 and 43, Maddox Street, Bond Street, London, W. 1911. Price 7s. 6d. net.

Small 8vo volume, containing 311 pages of subject matter, with 28 illustrations, and followed by a useful bibliography of text books, scientific papers, and reports. The work ends with an alphabetical index of subjects. The text is classified under the following heads :—I. Characteristics of chemical action in living matter. II. Outlines of bacteriological technique. III. Some leading conceptions in organic chemistry. IV. Space-isomerism and the chemistry of the sugars. V. Hydrolysis of starch by amylase. VI. Conditions of formation of amylase in the living cell. VII. Invertase and maltase. VIII. Alcoholic fermentation of grape sugar. IX. Acid fermentation of alcohols and carbohydrates. X. Fermentation of cellulose and allied bodies. XI. Miscellaneous fermentations, fat-splitting enzymes, oxydases, clotting enzymes. XII. Outlines of the chemistry of albumins or proteins. XIII. The nitrogen cycle. XIV. The sulphur cycle. XV. Fermentation of indigo, tea, cocoa, coffee and tobacco. XVI. Bacteriological and enzyme chemistry in relation to agriculture. XVII. Chemistry of sewage purification.

Alcoholic Fermentation. By Arthur Harden, Ph.D., D.Sc., F.R.S., Head of Biochemical Dept., Lister Institute, Chelsea. Longmans, Green and Co., 39, Paternoster Row, London. Also New York, Bombay and Calcutta. 1911, Price 4s. net.

8vo volume, containing 113 pages of subject matter with 8 illustrations, and a complete bibliographic index to the literature of the subject, this being followed by the alphabetical index of subjects forming the conclusion of the work. The text of the work is subdivided and classified as follows :—I. Historical introduction. II. Zymase and its properties. III. Function of phosphates in alcoholic fermentation. IV. The co-enzyme of yeast-juice. V. Action of some inhibiting and accelerating agents on the enzymes of yeast-juice. VI. The by-products of alcoholic fermentation. VII. The chemical changes involved in fermentation. VIII. The mechanism of fermentation.

Fibres Used in Textile and Allied Industries. By C. A. Mitchell and R. M. Prideaux. Scott, Greenwood and Son, 8, Broadway, Ludgate Hill, London, E.C. 1910. Price 7s. 6d.

Demy 8vo volume containing 190 pages of subject matter with 66 illustrations, and an alphabetical index of subjects. The text is subdivided and classified as follows :—I. Wool. II. Camel's hair, alpaca, llama hair, mohair, cashmere, goat's hair, cow hair, horsehair, rabbit's hair, human hair, etc. III. Silk. IV. Cotton. V. Mercerised cotton. VI. Artificial silks. VII. Linen and ramie. VIII. Jute and other fibres. IX. Brush fibres. X. Vegetable downs and upholstery fibres.

Hydrocarbures, Alcools et Ethers de la Série Grasse. Par P. Carré. Professeur à l'Ecole des hautes Etudes Commerciales, etc. O. Doin et fils, 8, Place de l'Odéon, 8. Paris. 1911. Price 5 fr.

Small 8vo volume containing 391 pages of subject matter, 12 pages of bibliographic index, and an alphabetical index of subjects. The text is classified as follows :—I. Hydrocarbons. II. Halogen derivatives of the hydrocarbons. III. Alcohols. IV. Ether-oxides of the mono-atomic and poly-atomic alcohols, etc. V. Esters derived from mineral acids. VI. Organic derivatives of sulphur, selenium, and tellurium.

Modern Brickmaking. By Alfred B. Searle. Scott, Greenwood and Son, 8, Broadway, Ludgate Hill, London, E.C. 1911. Price 12s. 6d. net.

Large 8vo volume containing 428 pages of subject matter, with 260 illustrations and an alphabetical index of subjects. The text is subdivided and classified according to the following arrangement :—I. Nature and selection of clays. The colour and characteristics of various bricks, etc. II. General manufacture of bricks. III. Hand-brickmaking processes. IV. Plastic moulding by machinery. Wire-cut bricks, etc. V. The stiff plastic process. VI. The semi-dry or semi-plastic process. VII. The dry or dust process. VIII. Kilns. Setting and burning. IX. Vitrified bricks for special work. X. Fire-bricks and blocks. XI. Glazed bricks. XII. Perforated, radial, and hollow bricks and blocks, etc. XIII. Moulded and ornamental bricks. XIV. Drying raw clay. XV. Sources of difficulty and loss.

A Classbook of Chemistry. By G. C. Donington, M.A., Senior Chemistry Master, City of London School. Macmillan and Co., Limited. St. Martin's Street, London. 1911. Price 3s. 6d.

Small 8vo volume, containing 393 pages of subject matter, and an alphabetical index. There are 112 illustrations, and numerous exercises and questions are set on the contents of the various chapters.

The Cement Industry of the United States. By E. F. Burchard. U.S. Geological Survey, Washington.

The Production of Mineral Paints in 1909. By E. F. Burchard. U.S. Geological Survey, Washington.

Bulletin of the Imperial Institute. Vol. VIII. No. 4. Price 1s.

This issue of the Bulletin contains the results of investigations in connection with Para rubber (*Hevea brasiliensis*) in Southern Nigeria, the rubber of *Mascarenhasia elastica* found in various parts of East Africa, gums from Northern Nigeria, coffee from the East Africa Protectorate and Rhodesia, maize from Nyasaland and the Gambia, and lac resin from Baroda ; also notes on cotton and rubber in Nyasaland, the poisonous properties of immature sorghum, the production and use of coca leaves, the distribution and utilisation of chromium ores (Part II.), etc. An index to Vol. VIII. is included.

*New Books.

Adressenbuch der Papier, Halbstoff- u. Pappenfabriken Österreich-Ungarns. Hrsg. unter Mitwirkg. v. Frz. Krawany v. Adf. Hladufka. XI. Aufl. (238 S.) gr. 8°. Wien. 1911. (Leipzig, G. Hedeler.) Cloth M. 6.

Anschütz, R., et G. *Schroeter* : Traité de chimie organique, trad. par H. Gault. T.I. Série acyclique. 8°. Paris, Ch. Béranger. 1911. 25 fr.

Arber, E. A. N. : The Natural History of Coal. Roy. 16mo, pp. 174. Camb. Univ. Press. London. 1911. Net 1s.

Barr, Ja. A. : Testing for metallurgical processes. 216 p., il. San Francisco. Mining and Scientific Press. 1911. $2.

Baskerville, C., and L. J. *Curtman* : A Course in Qualitative Chemical Analysis. 8vo. Macmillan. London. 1911. Net 6s.

Bayley, W. Shirley : Elementary crystallography, being part one of general mineralogy. 8°, XII, 241 p., il., diagrs. New York, McGraw-Hill. 1911. $2.

Bayliss, W. M. : The Nature of Enzyme Action. 2nd Ed. Roy. 8vo. Longmans, London. 1911. Net 3s. 6d.

Bertelsmann, Dr. Wilh. : Lehrbuch der Leuchtgasindustrie. (In 2 Bdn.) 1. Bd. Die Erzeugg. des. Leuchtgases. (XVIII, 581 S. m. 401 Abbildgn. u. 12 Taf.) Lex. 8°. Stuttgart, F. Enke. 1911. M. 20 ; half calf M. 22.

Biltz, H. : Introduction to Experimental Inorganic Chemistry. Translated by W. T. Hall and J. W. Phelan. 1909. Cr. 8vo. Chapman and Hall. London. 1911. Net 5s. 6d.

British South African Commercial, Industrial, Mining, Agricultural Import and Export Register (Colonial and Continental Mercantile Register), 1911. Including Cape of Good Hope, Transvaal, Orange River Colony, Natal and Rhodesia. 4to, pp. 412. Low, London. 1911.

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Carré, P. : Hydrocarbures, alcools, et éthers de la série grasse, in-18. O. Doin et fils, Paris. 1911. Cart. 5 fr.

Chemical Manufacturers' Directory of England, Wales and Scotland, with some of the Firms in Ireland, 1911. 8vo boards. Simpkin, London. 1911. Net 2s. 6d.

Collins, Henry F. : The Metallurgy of Lead. 2nd Ed., thoroughly revised and enlarged. 8vo, pp. 558. C. Griffin, London. 1911. Net 21s.

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Gehe's Codex der Bezeichnungen v. Arzneimitteln, kosmetischen Präparaten u. wichtigen technischen Produkten, m. kurzen Bemerkgn. üb. Zusammensetzg., Anwendg. u. Dosierg. Novbr. 1910. (VI, 392 S.) gr. 8°. Dresden, (v. Zahn & Jaensch) 1910. Cloth M. 4.

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Jones, Harry Clary: The electrical nature of matter and radioactivity. 2d. ed. completely rev. N. Y., Van Nostrand, 1910, [1911]. 9+210 p., 8°, $2.

Jörgensen, Alfred: Micro-Organisms and Fermentations. 4th ed., completely revised. 8vo. pp. 502. C. Griffin, London. 1911. Net 15s.

Julian, H. Forbes, and Edgar *Smart*: Cyaniding gold and silver ores. 2nd Ed., reprinted. 8vo, pp. 484. C. Griffin, London. 1911. Net 21s.

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Radford's cyclopedia of cement construction; a general reference work on up-to-date practice in the manufacture and testing of cements, etc., etc. In 5 v. Chic., Radford Architectural Co., 1911. c. 1910. il. pls. (partly fold.) pors. diagrs., 8°, $12.80.

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Thiele, Mart.: Ueber die allotropen Modifikationen des Arsens. (Diss.) gr. 8°, 59 S. Berlin, E. Ebering. 1911. M. 1.50.

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Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

APPLICATIONS.

3600. Dexter. Drying machines. [U.S. Appl., Feb. 17, 1910.]* Feb. 13.

3602. Early, Christiansen, and Farringdon Works and Pontifex and Sons, Ltd. Recovery of volatile liquids. Feb. 13.

3605. Dexter. Drying machines. [U.S. Appl., Feb. 19, 1910.]* Feb. 13.

3733. Harlock. Centrifugal drying machines. Feb. 14.

3886. Koller. Extractor and saturator. Feb. 15.

4161. Von Forell. Recovery of heat in furnaces. Feb. 18.

4171. Rousseau. Regenerative furnaces.* Feb. 18.

4410. Fasting. Separation of granular or pulverised substances. [Appl. in Denmark, Feb. 24, 1910.]* Feb. 21.

4489. Imray (Spiegel). Apparatus for removing nebular particles from gases and vapours.* Feb. 22.

4515. Chevalet. Distilling apparatus. [Fr. Appl., March 1, 1910.]* Feb. 22.

4774 and 4775. Tate and Wyllie. Liquid heating, concentrating, or evaporating apparatus. Feb. 25.

COMPLETE SPECIFICATIONS ACCEPTED.

29,879 (1909). Collard. Apparatus for recovering byproducts contained in the state of vapour in the atmosphere of works. March 1.

3820 (1910). Mathesius. Apparatus for treating solid bodies with gases. Feb. 22.

4362 (1910). Bone, Wilson, and McCourt. Steam generation, feed-water heating, and the heating of liquids generally. March 1.

12,471 (1910). Hendryx. Apparatus for separating solids and liquids. March 1.

14,591 (1910). Köhn and Münster. Method and apparatus for vaporising the volatile constituents of liquids. Feb. 22.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

APPLICATIONS.

3564. Thomas. Manufacture of artificial fuel. Feb. 13.

3848. Kruse. Treatment of peat. Feb. 15.

4038. Cowper-Coles. Continuous manufacture of smokeless fuel briquettes. Feb. 17.

4047. Lewis and True. Manufacture of gas in retorts. Feb. 17.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding list can be obtained.

4227. Warr. Preventing coal dust explosions in coal mines, and laying dust on roads. Feb. 20.

4280. Sackett. Treatment of cokes. Feb. 20.

4427. Armstrong. Manufacture of coke and gas and by-products. Feb. 22.

4556. Smith and Atkinson. Gas producers. Feb. 23.

4558. Beilby. Manufacture of fuel briquettes. Feb. 23.

4684. Testrup and Soderlund. Treatment of wet-carbonised peat. Feb. 24.

Complete Specifications Accepted.

4482 (1910). Leach, Lang, and Fawcett, Preston, and Co. Manufacture of heating gas. Feb. 22.

4613 (1910). Sadler, and Ashmore, Benson, Pease, and Co. Apparatus for purifying gas. March 1.

5010 (1910). Felizat. Manufacture of a combustible agglomerate of wood charcoal. March 1.

6759 (1910). Ely and Rollason. Apparatus for treating fuel. Feb. 22.

8341 (1910). Cervenka. Incandescence filament or body and its manufacture. March 1.

11,150 (1910). Still and Sons, Ltd., and Adamson' Manufacture of incandescent gas mantles. Feb. 22.

14,013 (1910). Roelofsen. Recovery of ammonia from coal gas and other distillation gases. Feb. 22.

14,390 (1910). Marks (Porges, Singer, and Steinschneider). Apparatus for distilling under high vacuum oils from the petroleum, tar, and like industries. March 1.

18,148 (1910). Burstall. Treatment of carbonaceous substances. Feb. 22.

19,681 (1910). Felizat. Furnaces for making wood charcoal. Feb. 22.

21,835 (1910). Ward. *See under* XXIII.

III.—TAR AND TAR PRODUCTS.

Application.

4819. Simpson. Separation of water from tar and other distillates. Feb. 25.

Complete Specification Accepted.

14,390 (1910). Marks (Porges, Singer, and Steinschneider). *See under* II.

IV.—COLOURING MATTERS AND DYES.

Applications.

3980. Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of phenylglycine salts.* Feb. 16.

4065. Meister, Lucius, und Brüning. Manufacture of vat dyestuffs of the anthraquinone series containing sulphur. [Ger. Appl., March 5, 1910.]* Feb. 17.

4158. Act.-Ges. f. Anilinfabr. Manufacture of acidylated sulphurised anthraquinone derivatives. [Ger. Appl., April 23, 1910.]* Feb. 18.

4608. Newton (Bayer und Co.). Manufacture of vat dyes of the anthracene series. Feb. 23.

4609. Newton (Bayer und Co.). Manufacture of vat dyestuffs. Feb. 23.

4650. Naef and Thévenaz. Manufacture of halogenated derivatives of indigo. Feb. 24.

4651. Naef and Thévenaz. Manufacture of products by condensing diazo and tetrazo compounds with formaldehyde. Feb. 24.

Complete Specifications Accepted.

12,423 (1910). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of a yellow azo dyestuff. March 1.

26,677 (1910). Newton (Bayer und Co.). Manufacture of dyestuffs. Feb. 22.

28,678 (1910). Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of disazo dyestuffs for wool. March 1.

404 (1911). Act.-Ges. f. Anilinfabr. Manufacture of vat dyestuffs of the anthraquinone series. Feb. 22.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

3973. Ellis (Chem. Fabr. von Heyden). Production of artificial silk and other formed material from fatty acid esters of cellulose.* Feb. 16.

4079 to 4081. Muller, and Gebr. Franke. Apparatus for spinning artificial threads. Feb. 17.

4409. Feuillette. Steeping or retting flax, hemp, etc. [Belg. Appl., Feb. 25, 1910.]* Feb. 21.

4551. Jackman. Preparation of silk for the production of yarns or threads. Feb. 23.

4744. Koller. Cellulose compounds. Feb. 25.

Complete Specifications Accepted.

29,991 (1909). Schwalbe. Process for refining wood cellulose. March 1.

7042 (1910). Millspaugh. Paper making. Feb. 22.

26,180 (1910). Dobler. Apparatus for impregnating paper and the like. Feb. 22.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

3724. Mendess. Waterproofing process. Feb. 14.

4082. Schnck. Rendering the surfaces of linen and its substitutes capable of being washed. [Ger. Appl., Feb. 18, 1910.]* Feb. 17.

4595. Johnson (Badische Anilin und Soda Fabrik). Dyeing yarn with colouring matters of the indanthrene class. Feb. 23.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

3846. Sulphates, Ltd., Thwaites, and Ralph. Treatment of liquors to obtain iron, zinc, and cobalt compounds. Feb. 15.

3871. Evans (Riedel A.-G.). Production of hydrated alumino-silicates or artificial zeolites. Feb. 15.

3992. Bollo and Cadenaccio. Treatment of alkaline and alkaline earth carbonates to obtain the peroxides and oxides or hydrated oxides. [Ital. Appl., April 16. 1910.]* Feb. 16.

3999. Hall. Treatment of galvanisers' pickle and other waste liquors. Feb. 16.

4072. Bollo and Cadenaccio. Treatment of carbonates of barium, strontium, sodium, and potassium to obtain the peroxides and oxides or hydrated oxides. [Ital. Appl., April 25. 1910.]* Feb. 17.

4268. Phillips and Bulteel. Obtaining oxides of nitrogen or ozone or products formed by their action on other bodies. Feb. 20.

4281. Sackett. Production of ammonium compounds. Feb. 20.

4680. Schwarz. Apparatus for distilling ammoniacal liquors. Feb. 24.

4795. Gerlache. *See under* VII.

Complete Specifications Accepted.

7472 (1910). King's Norton Metal Co., and others. Treatment of ammoniacal solutions used for dissolving cupro-metallic fouling from the bores of guns and rifles. March 1.

13,086 (1910). Serpek. Manufacture of aluminium nitride and other metallic nitrides. March 1.

14,013 (1910). Roelofsen. *See under* II.

19,562 (1910). Chem. Werke vorm. Dr. H. Byk. Process for dehydrating perborates. Feb. 22.

22,586 (1910). Bueb. and Deutsche Continental-Gas-Ges. Manufacture of ammonium carbonate. Feb. 22.

23,548 (1910). Consort. f. Elektrochem. Industrie. Manufacture of persulphuric acid. March 1.

24,138 (1910). Drehschmidt. Apparatus for making ammonium sulphate with impure acids. Feb. 22.

25,872 (1910). Kinzlberger und Co. Manufacture of anhydrous hydrosulphites. March 1.

VIII.—GLASS; CERAMICS.

Applications.

3618. Cowper-Coles. Process for gilding glass. Feb. 13.

3620. Burckhardt. Manufacture of fused quartz. Feb. 13.

3902. Peyton and Govan. Application of carborundum. Feb. 16.

4642. Jones, Jones, and Jones. Continuous kilns for burning pottery, bricks, or the like. Feb. 24.

Complete Specification Accepted.

18,508 (1910). Bateson and Bateson. Glass furnaces. March 1.

IX.—BUILDING MATERIALS.

Application.

227. Warr. *See under* II.

Complete Specification Accepted.

14,844 (1910). Cassel. *See under* XII.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

3571. Solomon. Smelting and refining metals and the like. Feb. 13.

3750. Simpson and Oviatt. Production of iron and steel direct from iron oxide ores. Feb. 14.

3981. Ridge. Muffled roasting furnaces. [Ger. Appl., July 1, 1910.]* Feb. 16.

3999. Hall. *See under* VII.

4071. Hodgkinson. Carburising iron and steel and alloys thereof. Feb. 17.

4126. Dunne and Courvy. Hardening copper. Feb. 18.

4159. Hyde. Preparation of ductile molybdenum and articles therefrom.* Feb. 18.

4702. Ranson. Extraction of zinc from ores. Feb. 24.

4719. Günther. Extracting and lixiviating ores, metallic residues, etc.* Feb. 24.

4795. Gerlache. Process of dissolving metal compounds. Feb. 25.

Complete Specifications Accepted.

29,796 (1909). Johnson (Chem. Fabr. Griesheim-Elektron). Cutting, soldering, and autogenous welding of metals. March 1.

1341 (1910). Wintle (Laszczynski and Stoeger). Recovery of metals in complex or low grade ores. March 1.

3819 (1910). Mathesius. Reduction of metallic oxides. Feb. 22.

7472 (1910). King's Norton Metal Co., and others. *See under* VII.

8530 (1910). Johnson. Manufacture of steel alloys. Feb. 22.

8531 (1910). Johnson. Reduction of metallic ores or oxides. March 1.

8650 (1910). Sulman and Picard. Selective separation of metals from complex ores or products. March 1.

10,929 (1910). Hoover, and Minerals Separation, Ltd. Ore concentration. Feb. 22.

13,009 (1910). Murex Magnetic Co., and Lockwood. Separation of ores or the like. March 1.

25,401 (1910). Johnson. Treatment of ores, particularly ores of tungsten and like metal. Feb. 22.

XII.—FATS; OILS; WAXES.

Applications.

3604. Fraser. Treatment of oils and the like. Feb. 13.

3880. Haddan (Thorne). Detergent compound.* Feb. 15.

4111. Thompson (Groeben). Washing compositions or detergents. Feb. 18.

4262. Oga. Extracting oil and manufacturing oil cakes.* Feb. 20.

4586. Joehlinger. Manufacture of soap.* Feb. 23.

4660. Rathbone and Lawton. Cleansing preparations. Feb. 24.

Complete Specification Accepted.

14,844 (1910). Cassel. Crude oil soap or soap lye, applicable as a detergent or for street sprinkling. Feb. 22.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

3864. Hemmer and Pagenstecher. Paints and the like. Feb. 15.

4696. Rappard. Manufacture of paint for protecting iron, wood, etc., from sea growths. Feb. 24.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

3561. Bailey and others. *See under* XV.

4309. Browne. Composition for use as a substitute for vulcanite. Feb. 20.

4743. Blair. Reclaiming rubber waste. Feb. 25.

Complete Specifications Accepted.

4080 (1910). Plinatus. Manufacture of a caoutchouc-like substance or mass. March 1.

5854 (1910). Cockerill. Production of indiarubber. March 1.

7153 (1910). Bary. Regeneration of vulcanised rubber. Feb. 22.

9636 (1910). Scammell. Artificial indiarubber. Feb. 22.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

3561. Bailey, McDowell, and Deighton. Manufacture of a substitute for leather and rubber compounds. Feb. 13.

4548. Williamson. Preparation of leather for mechanical purposes. Feb. 23.

4687. Winter. Manufacture of glue and gelatin. Feb. 24.

Complete Specifications Accepted.

26,231 (1909). Lehmann. Manufacture of a vegetable glue. Feb. 22.

7438 (1910). Dickerson. Production of tanning agents from waste liquors. March 1.

XVI.—SOILS; FERTILISERS.

Application.

3734. Aysh, Nye, and Co., Ltd., and Nye. Fertilisers. Feb. 14.

XVII.—SUGARS; STARCHES; GUMS.

Application.

4519. Steffen. Extraction of the juice of sacchariferous plants. [Belg. Appl., Feb. 26, 1910.]* Feb. 22.

Complete Specification Accepted.

3415 (1910). Kantorowicz. Manufacture of adhesive substances from flaked starch-containing matters. Feb. 22.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

3751. Sureties, and Scott and Son, Ltd. Treatment of substances made from brewers' by-products. Feb. 14.

4530. Epstein. Fermentation or the like. Feb. 23.

4589. Radcliffe. Treatment of distillation residues. Feb. 23.

Complete Specifications Accepted.

10,818 (1910). Berry. Brewing beer and other fermented beverages. March 1.

12,993 (1910) Hotblack, and Kidd and Hotblack, Ltd. Separation of ores or the like. March 1.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

3766. Vasey. Soluble protein or albumen and its production from meat fibre or other insoluble protein matter. Feb. 14.

3870. Evans (Riedel). Softening water. Feb. 15.

4127. Otto. Production of the sterilising agents in liquid sterilising or purifying plants. [Fr. Appl., March 5, 1910.]* Feb. 18.

Complete Specifications Accepted.

4289 (1910). Goslar. Preparation of a foodstuff from blood. Feb. 22.

4795 (1910). Urbain, Feige, and Seal. Use of metals in the electric arc for sterilising liquids. March 1.

8936 (1910). Mongrell. Manufacture of extracts of meat and meat powders. Feb. 22.

17,787 (1910). Siemens Bros. and Co. (Siemens und Halske A.-G.). Apparatus for purifying water by ozonised air. Feb. 22.

26,094 (1910). Permutit Filter Co. Softening water and relieving it of iron and manganese. Feb. 22.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

3594. Newton (Bayer und Co.). Manufacture of pharmaceutical products. Feb. 13.

3847. Imray (Meister, Lucius, und Brüning). Manufacture of derivatives of oxyarylarsinic acids. Feb. 15.

4648. Naef. Manufacture of compounds by the action of formaldehyde on organic bases in sulphuric acid. Feb. 24.

4650. Naef and Thévenaz. Manufacture of substances by condensing formaldehyde with bodies of the terpene and allied series. Feb. 24.

Complete Specifications Accepted.

4001 (1910). Silberrad. Manufacture of isoprene. March 1.

25,696 (1910). Folmer. Manufacture of organic compounds of calcium. Feb. 22.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Complete Specification Accepted.

27,818 (1909). Tauleigne and Mazo. Process of photography in colours. March 1.

XXII.—EXPLOSIVES; MATCHES.

Applications.

3568. Silberrad. Explosives. Feb. 13.

3879. Mallet. Increasing the efficiency of explosive charges. [Fr. Appl., Feb. 17, 1910.]* Feb. 15.

4099. Fairweather (Du Pont de Nemours Powder Co.). Explosives.* Feb. 17.

4782. Silberrad. Explosives. Feb. 25.

Complete Specification Accepted.

26,239 (1909). Nobel's Explosives Co., and others. Explosives. Feb. 22.

XXIII.—ANALYTICAL PROCESSES.

Complete Specifications Accepted.

3551 (1910). Towell, and Heywood, Ltd. Indicating or testing colour values. Feb. 22.

21,835 (1910). Waid. Apparatus for indicating or recording the percentage of carbon dioxide in flue gases, etc. Feb. 22.

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Official Notice.

ANNUAL GENERAL MEETING, 1911.

In accordance with the provisions of By-law 64, notice is hereby given that the Annual General Meeting will be held in the Montgomery Hall, Sheffield, at 10.30 a.m., on Wednesday, July 12th, 1911. A programme of the proceedings will be issued later.

Under Regulation 5, all elections to the Committees and all elections of officers of Local Sections, with the exception of those to fill up unforeseen vacancies, must take place so that they can be reported to the Council in time to be considered at the meeting held under By-law 24 not less than two months prior to the Annual General Meeting. This meeting will be held on April 24th next.

Charles G. Cresswell,
Secretary.

Birmingham Section.

Meeting held at Birmingham University on Thursday, February 16th, 1911.

DR. T. SLATER PRICE IN THE CHAIR.

THE BACTERIOLOGY OF WATER: ITS PRESENT POSITION.

BY PERCY F. FRANKLAND, LL.D., F.R.S.

Already 40 years ago the more enlightened chemists engaged in water analysis were fully aware that in making determinations of organic matter, ammonia, nitrates, etc., with a view to ascertaining the fitness or otherwise of water for drinking purposes, they were testing only for the concomitants of the living poisons of zymotic disease and not for the morbific matters themselves, which were still more or less hypothetical entities. They were indeed quite alive to the fact that the living poisons themselves must be explored by biological and not by purely chemical methods.

The attitude of chemists about the year 1870 is well illustrated by the following passage from a paper by the late Mr. Heisch (Chem. Soc. Journ., 1870, 23, 371), who was at the time Lecturer on Chemistry at the Middlesex Hospital, London:—

"*On organic matter in water.*—In common with most chemists, I have for many years directed my attention to this subject, and in common with many I have long since come to the conclusion that the mere *quantity* of organic matter, nitrogenised or not, forms a very poor basis on which to found an opinion as to the wholesome character of any sample of water. Believing, as I do, that the deleterious nature of organic matter is dependent on its containing living germs, which grow and set up a fermentative action within the body, I feel convinced that if only a few of such germs be swallowed, they may increase, under proper conditions, to a number to be injurious, and that therefore their original number is a matter of comparatively small importance. My attention has therefore been directed principally to discovering the presence of such germs, and determining their characteristic properties and appearance. I was first led to a means of doing this by being called on to assist a large manufacturer of lemonade, who some years ago almost suddenly found it impossible to make lemonade that would keep. After a day or two it became turbid, and its odour anything but agreeable. On examining the liquid under the microscope, I found it full of small spherical cells, with, in most cases, a very bright nucleus, and after a few days the odour of butyric acid was unmistakable. After examining all the materials employed, I found that the water was in fault. *On putting a few grains of the purest crystalline sugar I could procure into some of the water, it became turbid in a few hours, and the same cells were distinctly to be seen with an* $\frac{1}{8}$ *inch object glass;* . . ." (the italics are mine). "This led me to try all the samples of water I could procure, in the same manner; and in every case where diarrhœa or other mischief could with any kind of certainty be traced to the use of a certain water, when that water was treated with sugar, these small cells made their appearance, usually within 24 hours, if the temperature were kept up to between 60° and 70°, and plenty of light admitted to the bottle in which the sample was contained."

We have here introduced in a very primitive form the idea of biologically examining water by a process of *cultivation*, as distinguished from mere *microscopy*, and although the culture-medium employed was a highly defective one for various reasons into which I have not time to enter, the experiments constitute a very early attempt to reveal the presence of living organisms by encouraging their increase and multiplication, which principle is at the bottom of the modern methods of bacteriological examination.

Liquid and solid media.

The classical investigations on bacteria by Pasteur, Tyndall, Lister, Nägeli, Cohn, Fitz, Schloesing, Muntz and others prior to 1880 were practically all made with liquid culture media only. Such culture media labour under several serious disadvantages:—

(1) Facility with which they become contaminated with bacteria and other organisms from the air and other surroundings;

(2) The competition which arises between the different microbes present may lead to the entire suppression of some through the overwhelming multiplication of others;

(3) The great difficulty of obtaining pure cultivations of specific micro-organisms.

It has been well said that "*the history of a science is the history of its methods,*" and this is certainly true in the case of bacteriology, for the introduction of solid culture media by Koch at the beginning of the eighties, in the last century, led to the most astounding developments in this branch of science. An immense variety of investigations were now rendered possible which had long been awaiting attack.

These new methods of bacteriological study were at once applied to the identification of the specific micro-organisms of numerous diseases, and to the investigation of the bacteria present, in *air*, *water*, *soil* and all our other surroundings, a large number of enthusiastic workers being attracted into this new and fascinating field of scientific inquiry.

By means of *gelatine-plate-culture*, which is now I suppose familiar to everyone here, it became possible to ascertain the number and the nature of most bacteria present in any material. Thus in the case of water the number and nature of the bacteria present in any sample could be determined, and by this means it was possible to ascertain the effect of any treatment or process of purification on the bacteria present in water. Thus it was applied by me in 1885 to the study of the removal of bacteria from water by artificial and natural *filtration*, by *subsidence*, and by *precipitation*.

The results obtained in investigations of this kind led to a great modification of the opinions which had previously been entertained with regard to the value of these processes in removing the zymotic dangers of water. Thus it was found that bacteria could be almost wholly removed from water by the process of sand filtration which had a comparatively insignificant effect on the organic matter and other ingredients discoverable by chemical analysis.

Similarly these methods of bacteriological investigation enabled such processes of water purification to be readily controlled. Thus if the safety of a water-supply depends on the efficiency with which the removal of bacteria by filtration is carried out, it is obvious that this efficiency should be continually controlled by bacteriological examination, so that any defect in the working of the filters may be at once detected and rectified. The waterworks authorities in this country have, with a few exceptions, been very tardy in adopting such control, for our so-called practical men are full of insular prejudices, they are racially conservative even when they profess to be liberal in politics, and they are as a body utterly ignorant of science, and only too often they actually boast of their ignorance. On the Continent, however, the systematic control of waterworks by bacteriological examination has been very widely carried out with great benefit to the communities concerned.

With the discovery of the specific bacteria of cholera, of typhoid fever, and of many other diseases, attempts were naturally made to find these specific pathogenic bacteria in contaminated water-supplies. The chance of such discovery by the ordinary method of plate-cultivation is of course hopelessly remote, because a single pathogenic organism must almost inevitably be accompanied in water by a host of non-pathogenic individuals, and amongst these multitudes of harmless forms the few harmful ones will under ordinary circumstances be overlooked, whilst, in the small quantities of water operated on, the pathogenic forms may be absent although present in a larger bulk.

To surmount these difficulties, the natural device was to provide conditions which would be favourable to the particular pathogenic form being sought for and less favourable or even antagonistic to the multitude of non-pathogenic forms with which it would be accompanied. We may call the provision of such conditions the method of *enrichment or preferential culture.*

Already a number of years ago such a method of enrichment was very satisfactorily applied by Koch to the discovery of the *cholera-bacillus* in the water of the Elbe at Hamburg during the epidemic of 1892. If 90 c.c. of the water under examination be incubated for 18 hrs. at 37° C. with 10 c.c. of a solution containing peptone 10 per cent., and sodium chloride 10 per cent., cholera bacilli will be found in the thin surface pellicle, and from this cultures are made.

We are, however, fortunately not often concerned with cholera in Western Europe, but typhoid fever we have ever with us as a disease which may no doubt be frequently water-borne. An enormous amount of labour and ingenuity has been devoted in recent years to the discovery of the bacillus of this disease in water. That the problem is a very difficult one may be gathered from the fact that until recently *its detection even in the discharges of typhoid patients was very frequently abortive.*

The special difficulty attending the discovery of the typhoid bacillus depends on the circumstance that even in the intestine of the typhoid patient it is enormously outnumbered by other bacteria and especially by the *Bacillus coli communis*, which, discovered by Escherich in 1886, has in recent years achieved the very greatest celebrity in the bacterial world.

Now practically all conditions which are favourable to the typhoid bacillus are equally or even still more favourable to the *B. coli*, and for a long time all methods of favouring the typhoid bacillus at the expense of the *B. coli* proved futile. Much interest was, therefore, excited when in 1903 Roth announced that the *B. coli* was more disadvantageously affected than the typhoid bacillus by solutions of caffeine.

Experiments made by Kloumann[*] in 1904, however, showed that the differential effect on the two bacilli was only very slightly in favour of the typhoid bacillus, as will be seen from the following table, in which the results obtained with three different strains of each organism are exhibited :—

Effect of caffeine on B. coli and B. typhosus.

c.c. of 1% Caffeine Solut. added to 10 c.c. Agar	0 0%	1 10%	2 20%	3 30%	4 40%	5 50%	6 60%	7 70%	8 80%	9 90%	10 100%
B. Typh.	+ + +	+ + +	+ + +	+ + +	+ +	+ +	+ +	+	—	—	—
B. coli.	+ + +	+ + +	+ +	+ +	+	+	—	—	—	—	—

+ indicates that growth took place, and — that there was no growth.

A method of testing for typhoid bacilli in water and other liquids was elaborated by Hoffmann and Ficker in 1904 ; it was also based on the inhibitory action of caffeine and of crystal-violet on the *B. coli.* The method will be best understood by the following description of the manner in which it was successfully employed by Jaksch and Rau (1904) to detect typhoid bacilli in the drinking water supplied to Prague :—

900 c.c. water from a service tap were added to the *Hoffmann and Ficker culture-medium*, consisting of 10 grams nutrose, 5 grams caffeine, and ·01 gram crystal-violet, in 100 c.c. water.

The mixture was then incubated at 37° C. for 13 hours, by when it was to be presumed that any typhoid bacilli originally present would have extensively multiplied. Loopfuls of this large cultivation were then withdrawn and spread on the surface of *Drigolski and Conradi Plates* (Agar, meat extract, peptone, nutrose, lactose, sodium chloride, crystal violet and litmus), which were then incubated at 37° C. for 24 hours. On these plates the *B. coli* colonies are red (acid litmus) and non-transparent, whilst those of the typhoid bacillus are blue with a violet tinge, transparent, resembling dewdrops, and smaller than the *B. coli* colonies. In the Prague experiment these plates gave only a few red colonies, the majority being blue and transparent. The latter were sub-cultured, and, according to Jaksch and Rau, gave results in the most varied tests (including agglutination, toxicity, and immunisation) which were identical with those obtained with the true typhoid bacillus.

Of other solid media which have proved themselves of great value in distinguishing between coli-like and typhoid-like colonies are Loeffler's malachite-green agar, and McConkey's bile-salt-neutral-red agar, both of which I shall have occasion to refer to again in the course of the evening.

By far the most extensive, interesting, and systematic search which has ever been made for the typhoid bacillus in natural waters is that recently carried out by Houston in the waters of the three rivers—Thames, Lea, and New River—from which the greater part of the London water supply is obtained. As this investigation illustrates the most approved methods which are now available to the bacteriologist, I propose to consider it in some detail.

Two hundred and ninety-four experiments in 8 series were made with 156 samples of raw river water (52 Thames, 52 Lea, and 52 New River) during the 12 months ended July 31st, 1908. The total volume of water dealt with was 294×100=29,400 c.c. The total number of bacteria in this volume of water (as ascertained by gelatine-plate cultivation for 3 days at 20—22° C.) was 135,687,500. The total number of colourless (or nearly colourless) colonies sub-cultured from the Drigalski or similar plates was 7,329. These 7,329 selected colonies form but a small fraction of the millions of bacteria which were excluded owing to the temperature of incubation, the composition of the media employed, and the fact of their appearing on the plate-cultures as coloured colonies.

The following tabular summary indicates the method adopted in this exhaustive investigation :—

Direct Plating on Solid Media.

Series I. 100 c.c. of the sample of water were centrifuged and the resulting deposit spread over a number of plates consisting of *malachite-green* (1 *in* 5,000), *saccharose, dulcite, salicin, neutral-red, bile-salt, peptone, lactose, agar.* The plates were incubated at 40—42° C. for 24 hours, and the colourless colonies sub-cultured into special media, as described in the next table.

Series II. Same as Series I, but the proportion of malachite-green was 1 in 10,000.

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[*] Kloumann, Centralbl. f. Bakteriologie, **36**, (1904), p. 312.

Series III. Same as Series I, but the medium used in the plates contained no malachite-green.

Series IV. Same as Series I, hut the proportion of malachite-green was 1 in 20,000; 1 in 40,000, and I in 80,000.

Primary Liquid Cultures followed by Plating on Solid Media.

Series A. 100 c.c. of the sample of water were added to *bile-salt-glucose-peptone medium containing malachite-green* in proportion of 1 in 1,000, 1 in 2,000, 1 in 4,000. This liquid was incubated at 40—42° C. for 24 hours, and then plated on the same medium as was employed in Series I, 10 colourless colonies were in each case sub-cultured and tested as described.

Series B. Same as Series A, but malachite-green in the liquid medium was in proportion of 1 in 8,000, 1 in 16,000, 1 in 32,000. Subsequently plated on same medium as that used in Series II.

Series C. Same as Series A, but the liquid culture medium consisted of meat-broth only without malachite-green or any other additions. Subsequently plated on same medium as that used in Series I.

Series D. Same as Series C, but instead of cultivating 100 c.c. of water in one portion, 10 cultures of 10 c.c. each were made.

The following table shows the behaviour of 32 strains of the typhoid bacillus, on the one hand, and of the 7,329 suspicious colonies isolated from the raw waters, on the other. *It will be seen that not one out of all these 7,329 different microbes, although suspicious in certain features, gave reactions agreeing in their entirety with those of the typhoid bacillus.*

Verification Tests for Typhoid Bacillus.

	Test 1.	Test 2.	Test 3.	Test 4.	Test 5.	Test 6.
Description of Microbe.	Proskauer's and Capaldi's No. 2 medium* (with inner tube).	Lactose-saccharose-dulcite-salicin-medium (with inner tube).	Proskauer's and Capaldi's No. 1 medium† modified (with inner tube).	Glucose-neutral red broth cultures (with inner tube).	Peptone-water medium.	Gelatine-sugar media:—galactose, glucose, laevulose, maltose, and mannite respectively.
Results characteristic of Typhoid Bacillus.						
32 Strains of Typhoid Bacillus from a number of different Laboratories.	Acid, no gas.	No visible change. (no acid, no gas.)	No visible change. (no acid, no gas.)	Purplish tint. (no gas, no fluorescence.)	No indol.	Acid, but no gas with all five sugars. No liquefaction.
Results which exclude, as not Typhcid Bacillus, the suspected microbes.						
7,329 colourless (or nearly colourless) colonies, sub-cultured.	No acid, or acid and gas.	Acid or gas-formation.	Acid or gas-formation, or decided growth.	Gas or fluorescence. (Absence of purplish tint.)	Indol.	Gas formation in one or all of the sugar media. (Liquefaction).

* Solution of peptone and mannite.

† Solution of asparagine, mannite, glucose, galactose, lævulose, maltose, magnesium sulphate, sodium chloride, calcium chloride, potassium hydrogen phosphate, and litmus.

From the very nature of this investigation—the search for a specific microbe in a natural water which at some period of its history is practically certain to have received this microbe in comparatively small numbers—it is impossible to make it really exhaustive. Houston has, however, more recently amplified his previous investigation in a very suggestive manner. Realising that the objection might be raised that the method adopted may not be capable of detecting a very small number of typhoid bacilli in the presence of a very large number of other microbes, he devises a mode of procedure which enables him to affirm that in each particular sample of water examined there are *not more* than a certain definite number of typhoid bacilli in a given volume. The method adopted was this:—

Each sample of raw river water was divided into two equal portions of 500 c.c. (A and B). The A sample was inoculated with a very small number of typhoid bacilli. The B sample was not so infected, and was, therefore, normal raw river water. The subsequent procedure was exactly the same in each case, both samples A and B being treated exactly alike. The 500 c.c. of water were centrifuged and the resulting deposit spread over 16 plates prepared with solid medium of the following composition:

Agar, 2 grms.; peptone, 2 grms.; bile-salt, 0·5 grm.; lactose, saccharose, adonite, raffinose, and salicin, each 0·2 grm., made up with water to 100 c.c. and tinted with 0·4 c.c. of a 1 per cent. solution of neutral red. In some of the experiments malachite-green was added to the above, in the proportion of either 1 to 10,000, or 1 to 5,000 of the medium.

Of the 24 experiments, 14 were carried out with raw Lea, and 10 with raw Thames water. These waters contained on an average 62,688 bacteria per 1 c.c. (gelatine at 20—22° C., 3 days' incubation). The worst sample contained 760,000 and the best sample 1,200 bacteria per 1 c.c. Thus in the 12 litres (500 c.c. + 24) of raw water (B samples) examined for typhoid bacilli there were 752,256,000 bacteria present.

The total number of colonies selected for study was 5,451 from the infected A samples and the same number (5,451) from the non-infected B samples. The average number of typhoid bacilli artificially added to the A samples was 2·242 per 1 c.c. or 1,121 per 500 c.c. The average number of typhoid bacilli isolated from the A samples was 14·54 per 500 c.c. of sample. It may be argued fairly, therefore, that if only $\frac{1}{14{\cdot}54}$ of the above number of typhoid bacilli had been present in the infected sample this microbe would still have been detected by the method of investigation adopted; but $\frac{1}{14{\cdot}54} \times 2{\cdot}242 = 0{\cdot}154$ typhoid bacillus per 1 c.c., or 1 typhoid bacillus in 6·5 c.c. would have been detected.

From the uninfected B samples, out of the 5,451 colonies selected for special study *one, and only one, consisted of bacteria which resembled the typhoid bacillus very closely.*

It will be instructive to record the observations which were made on submitting this typhoid-like microbe (*Lee W 694. ? B. typhosus, Houston*) to the several tests used in the diagnosis of typhoid bacilli.

Characterisation of typhoid-like bacillus from raw river water (Lea W. 694 ? B. typhosus Houston).

Morphology.—A motile multiflagellate bacillus. The rods seemed shorter than most strains of *B. typhosus.*

Gelatine and agar slope-cultures.—Possibly the growth was slightly less filmy in character than that of the true *B. typhosus.*

Glucose-bile-salt agar-slope (neutral red).—The streak somewhat brighter and cleaner red than most strains of *B. typhosus.*

Lactose-bile-salt agar slope (neutral red).—Colourless streak.

Potato.—No visible growth (5 days at 37° C.).

Nitrate-broth.—Reduces nitrates to nitrites.

Peptone-water at 55° *F.*—No visible growth after 5 days; on transferring tube to incubator at 37° C. growth occurred within 24 hours.

Indol test.—No indol formation (5 days at 37° C.).

Liquid peptone (1 per cent.) *media* containing separately 1 per cent. of the substances stated and tinted with litmus. Sorbite and inosite are only used in 0·2 per cent. solution.—Acid but no gas in sorbite, mannite, glucose, lævulose, galactose, and maltose respectively (2 days at 37° C.). No change in inulin, inosite, saccharose, salicin, adonite, lactose, dulcite, and raffinose respectively (5 days at 37° C.).

Gelatine glucose medium tinted with litmus.—Acid but no gas formation.

Voges and Proskauer's reaction.—Negative result, 5 days.

Gelatine.—No liquefaction after one month at 20° C.

Litmus milk.—Slight acid but no coagulation (5 days at 37° C.).

Glucose-neutral-red-broth cultures.—No gas, no fluorescence, characteristic purplish tint.

Lactose-saccharose-dulcite-salicin-peptone medium tinted with litmus.—No change (2 days at 37° C.).

Proskauer and Capaldi's Medium No. 1 (*modified*).—No change (2 days at 37° C.).

Proskauer and Capaldi's Medium No. 2.—Acid but no gas.

Agglutination experiments and tests for pathogenicity.

Anti-typhoid serum:—Microscopically, 1 : 200 almost instantaneous clumping, 1 : 800 very fair clumping, 1 : 2000 little or none. *B. typhosus* tested with the same serum gave very similar results but appeared to be clumped slightly more rapidly and in slightly higher dilutions. The difference, however, if any, was not well marked.

Serum of an animal immunised with the suspected microbe (*Lea W.* 694*? B. typhosus Houston*):—Microscopically, 1 : 200 very rapid and satisfactory clumping; 1 : 2000 good, but not quite complete clumping within half-an-hour.

B. typhosus tested with the same serum gave very similar results, but was perhaps clumped a little more slowly and in slightly lower dilutions. The difference, however, if any, was not well marked. Macroscopically, the titre limit was about 1 : 8,000 (18 hours) and was practically the same for both microbes.

Pathogenicity:—2 c.c. of a broth-culture injected subcutaneously into a guinea-pig produced a swelling and illness with recovery. A guinea-pig intraperitoneally inoculated with 5 c.c. of a broth-culture died in less than 24 hours.

On the results of this colossally laborious investigation, which had extended over more than two years, and which had been conducted with the most meticulous care and regardless of the expenditure of time and money, Dr. Houston very cautiously remarks:—"*If this microbe had been isolated from a case of typhoid fever (or from a suspected case) I do not think any serious hesitation would have been felt in describing it as B. typhosus.*"

I do not think it would be possible to produce more eloquent testimony than the above as to the enormous and almost prohibitive trouble which a systematic and conscientious search for the typhoid bacillus in a natural water entails. Unfortunately sensational announcements as to the presence of typhoid bacilli in water-supplies are sometimes made on evidence of the most slender and inadequate character. An instance of this kind came under my notice only a few years ago in which the water-supply of a large town was impugned by a bacteriologist who asserted that he had discovered in samples of the water in question a bacillus which was indistinguishable from that of typhoid, and on the strength of this announcement the Health Committee had the town posted with notices warning the inhabitants of the danger attending the drinking of the water in an unboiled state. Having been requested to inquire into this matter myself, I obtained a cultivation of the organism which had given rise to such consternation and was able within a few days to show that it was easily distinguishable from the true typhoid bacillus by the profoundly different appearances to which they respectively gave rise when cultivated in neutral-red-glucose-broth. In this medium the typhoid bacillus gives a characteristic purplish tint, because it produces acid from the glucose, whilst the bacillus under suspicion gave a yellow colour owing to its production of alkali.

Comparative unimportance of searching for the typhoid bacillus in water.—The almost hopeless nature of the search for the typhoid bacillus in natural waters is of the less importance as the anxiety to detect this microbe in water is, as I have on many previous occasions emphasised, for the most part based upon an entire misconception of the objects of water examination. The object of a water examination is in general not to determine whether the particular sample of water contains typhoid bacilli and is, therefore, capable of carrying typhoid to the consumer, but to discover whether the water is likely *at any time* to contain such infective material.

Now any water which receives sewage matters must be regarded as a *possible* carrier of typhoid infection, for at any time these sewage matters may be derived from persons suffering from typhoid. Thus any sewage-contaminated water is a potential carrier of typhoid unless it has been subjected to conditions which would ensure the removal of the possibly present typhoid bacillus. Thus the all-important thing is to ascertain whether a given water has been contaminated with sewage, in what proportion such contamination has taken place, and whether the water since such contamination has been submitted to conditions which would remove or destroy typhoid bacilli should they have gained access with the sewage matters.

Firstly, as regards the detection of sewage contamination. Excremental contamination if sufficient in amount can be revealed with more or less certainty by chemical analysis, which can indeed even distinguish between whether such pollution is recent or remote in point of time, but in order to ascertain the fate of bacteria gaining access to water we must have recourse to biological methods. If there were bacteria absolutely characteristic of sewage, the determination of their presence would be sufficient to prove the danger of a water. Unfortunately we do not know of any bacteria which satisfy the condition of being *absolutely* characteristic of sewage, so we must be satisfied with a second best qualification for diagnostic purposes by those which are *very* characteristic of sewage.

The microbe which is most characteristic of the intestinal discharges of man and the higher animals is, as its name implies, the *B. coli communis*, and an enormous amount of time and ingenuity has in recent years been devoted to its accurate and expeditious discovery in water and other materials. The labour bestowed on this now classical microbe has been of wider scientific interest than its mere hygienic significance, for through its study highly important information concerning the biology of bacteria in general has been obtained.

In identifying a particular organism, whether plant or animal, we depend on recognising in the individual a certain group of specific characters which are more or less arbitrary. The botanist at first tried to classify and distinguish bacteria by external appearances alone; he measured the length and breadth of these minute organisms; he counted the number of flagella with which some of them are provided; he was very careful to observe whether they were square or round at the ends, and so forth.

When, however, the study of bacteria was taken up by real experimentalists the fatuousness of attributing an overwhelming importance to the artificialities of morphology was soon apparent, and an amusing story is told in this connection of Pasteur.

M. Duclaux relates how an able morphologist came to Pasteur's laboratory one day and explained to him in the most courteous terms that a particular organism which he (Pasteur) had described as a *micrococcus* was in reality a *small bacillus,* which information only evoked the brusque reply, "*Si vous saviez combien cela m'est égal!*" This remark clearly shows how this great *savant* was in the habit of separating the essential from the unessential, and these words reveal his impatience at a man mistaking the vain and empty pedantry of nomenclature for science.

These morphological characters have, however, long been recognised as inadequate for purposes of identification, since organisms exhibiting the closest morphological similarity have been found to differ enormously in other respects.

After the introduction of Koch's methods much attention was then directed to the macroscopic appearances to which the organisms give rise when grown on a variety of solid media, by which means microscopically similar bacteria can often be differentiated.

Some twenty years ago, I commenced distinguishing bacteria, which were similar in form and in cultural appearances, by differences in the chemical changes which they could bring about in certain media. Thus I found that the capacity to reduce nitrates to nitrites was in some cases a valuable means of distinguishing between otherwise similar bacteria.[*] This reduction of nitrates has more recently been extensively used for diagnostic purposes, more especially by American bacteriologists. Somewhat later I devoted much attention to the fermentation of carbohydrates, polyhydric alcohols, and hydroxyacids by means of pure cultivations of micro-organisms, and showed how capricious is the power possessed by different bacteria in this respect. Thus perhaps one microbe will ferment glucose, mannite, and glycerine, but not dulcite or glyceric acid, another will ferment glucose, mannite and dulcite, etc.

This mode of differentiating between otherwise very similar forms of bacteria has been enormously extended within recent years, and it will be my next endeavour to give you some idea of the manner in which this chemical method is applied to the detection of the *B. coli*, whilst I have already pointed out its use in the search for and in the identification of the typhoid bacillus.

There are, however, many bacteria which more or less simulate the characters of the typhoid bacillus on the one hand, and of the *B. coli* on the other, such forms exhibit almost every degree of approximation to one or other of these two types, from which they can only be distinguished by applying a number of tests. Such forms are designated as *atypical,* and what their relationship to the typical typhoid and coli bacteria may be is a matter of uncertainty. Possibly in some cases they may have been typical forms originally, but under the particular conditions to which they have been submitted they have lost some of their characters. Thus it is often found that the *B. coli* on prolonged artificial culture may lose either or both its indol-producing and milk-curdling properties.

The following classification of the Typhoid-coli group of bacteria into seven sub-groups has been attempted.

Typhoid-coli group.

Sub-groups.	Glucose.		Lactose.		Dulcite.		Saccharose.	
	Acid	gas.	Acid	gas.	Acid	gas.	Acid	gas.
I.								
B. Typhosus	+	—	—	—	—	—	—	—
B. dysenteriæ	+	—	—	—	—	—	—	—
B. fæcalisalcaligenes	—	—	—	—	—	—	—	—
II.								
B. enteritidis (Gaertner)	+	+	—	—	+	+	—	—
B. paratyph	+	+	—	—	+	+	—	—
B. paracoli	+	+	—	—	+	+	—	—
III.								
Bacillus from urine	+	+	—	—	—	—	+	+
IV.								
B. acidi lactici (Hueppe)	+	+	+	+	—	—	—	—
V.								
B. coli (Escherich)	+	+	+	+	+	+	—	—
VI.								
B. pneumoniæ (Friedländer)	+	+	+	+	+	+	+	+
VII.								
B. capsulatus (Pfeiffer)	+	+	+	+	—	—	+	+
B. lactis aërogenes (Escherich)	+	+	+	+	—	—	+	+
B. cloacæ (Jordan)	+	+	+	+	—	—	+	+

It is obvious that by increasing the number of biochemical tests we may discover many further variations of a given type of organism, and, for the purpose of more precisely defining a particular microbe, bacteriologists have introduced biochemical tests involving the use of a perfect arsenal of organic compounds—more especially carbohydrates, polyhydric alcohols, and glucosides. These tests generally consist in ascertaining whether an organism under investigation gives rise to acid or gas, or both, or neither, in a suitable nutritive medium containing one of these substances. The following list of substances employed by one bacteriologist will give you some idea of the degree to which these biochemical tests have been complicated in recent years:—adonite, asparagin, dextrin, dulcite, erythirite, galactose, glucose, glycerin, glycol, isodulcite, lactose, lævulose, maltose, mannite, mannose, nutrose, raffinose, saccharose, salicin, sorbite, and starch. It is difficult to see where this multiplication of tests is to end, for the above list, formidable as it is, by no means exhausts the number of organic substances which are acted on by bacteria, and by means of which, therefore, differences can be established. So greatly has the demand for some of these out-of-the-way compounds been increased by the modern bacteriologist that some of them, like dulcite, are now hardly procurable in the market.

Although such tests are extremely useful for the more precise definition of particular micro-organisms, they must be employed with discrimination, for as I have long ago pointed out these fermentations as well as other characters of bacteria are liable to be lost through conditions of environment, and I have shown how in some cases they may be restored by resorting to particular methods of culture and training.

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[*] In this connection it may be interesting to quote from a letter which I received from the late Professor Huxley on the occasion of his communicating my paper dealing with this matter to the Royal Society. It is dated Bournemouth, Feb. 14, 1888.

"Dear Dr. P. Frankland, I am sending your paper to the Royal "Society. In establishing physiological differences of a definite "chemical character between organisms which are so much alike "morphologically I think you have got held of a very important "point. My best wishes to your colleague.[*] I am always ready "to vote for the admission of ladies to the Royal Society Fellowship. "With our united kind regards, ever yours very faithfully,

"T. H. Huxley."

[*] Mrs. Percy Frankland was joint-author of the paper in question.

It is obvious that it would be impracticable to resort to such numerous tests in the ordinary bacteriological examination of water in which we are concerned with the detection of sewage or excremental contamination, unless some very great advantage should result from such multiplication of tests, and this is not the case at present.

Quantitative determination of B. coli in water.—If we regard the *B. coli* provisionally as the best indicator of contamination with the living bacteria of animal refuse, we shall obviously view its presence with the more suspicion the larger the numbers in which it is discovered in a given volume of water. I will, therefore, at once proceed to describe the manner in which its presence and numerical abundance are most conveniently and expeditiously determined.

I will pass over the numerous methods which have from time to time been devised for detecting *B. coli*, and describe only the one which in this country at any rate has superseded all others.

An important departure in practical bacteriology was the introduction by McConkey and Hill ("Bile-salt broth. A simple test for fæcal contamination." Thompson-Yates Laboratories Report, 1901, 4 (i) 151), of a medium for the preferential culture of the *B. coli* and allied microbes from mixtures of micro-organisms. The essential ingredients of this medium are sodium taurocholate (bile-salt), 5 grms., glucose, 5 grms., peptone, 20 grms., water (tinted with litmus), 1000 c.c. Incubated in this liquid at 37°—42° C. bacteria of the *B. coli* group give acid and gas in 48 hours. Some bacteriologists use lactose instead of glucose, thus restricting the gas production to *B. coli* and its still closer allies. With this liquid medium in Durham fermentation-tubes cultivations of the water are made in the following quantities:—100 c.c., 10 c.c., 1 c.c., 0·1 c.c., 0·01 c.c., 0·001 c.c., 0·0001 c.c., 0·00001 c.c. The concentration of the medium should in all cases be approximately the same as that given above. In order, therefore, that the volumes of liquid incubated may not be inconveniently large, the 10 c.c. and 100 c.c. of water are introduced into correspondingly stronger McConkey media.

A positive reaction, *i.e.* the production of acid and gas, in any of these culture-tubes signifies that *at least one* coli-like microbe must have been introduced with the portion of water added. Thus, if acid and gas had been obtained, in a particular case, with all the tubes from 100 c.c. to 0·1 c.c., this would mean the "*presumptive*" presence of at least one *B. coli* in 0·1 c.c., and its absence in 0·01 c.c. and smaller volumes of water.[*]

In order to ascertain whether the "presumptive" *B. coli* is typical or not, the tube containing the smallest portion of water which has given rise to acid and gas in the McConkey medium is plated on a solid medium of the following composition:—Agar, 20 grms., peptone, 20 grms., sodium taurocholate (bile-salt), 5 grms., lactose, 10 grms., neutral red (1 per cent. solution), 4 c.c., made up to 1000 c.c. with water. After 12 hours' incubation at 37° C., the colonies will be distinctly visible, and those which are most likely to be *B. coli* will have a strong red colour owing to the acid produced by this microbe in the medium. Five of the most typical red colonies are separately inoculated into 5 glucose-litmus broth tubes, which are then incubated at 37° C. Any of these 5 tubes which develop acid and gas are then each further inoculated into tubes of the following media which are then incubated at 37° C.:—

(*a*) Neutral red broth to be examined for fluorescence.

(*b*) Litmus lactose-broth to be examined for *acid and gas.*

(*c*) Ordinary broth to be examined for *indol.*

(*d*) Litmus-milk to be examined for *acid and coagulation.*

(*e*) Gelatine to be examined for *non-liquefaction.*

The above glucose-tubes from which these inoculations have been made are also microscopically examined to see whether the microbe possesses the characteristic form and motility of the *B. coli.*

A microbe fulfilling these conditions has been designated by Houston as "*Flaginac*" *B. coli*, from Fl=fluorescence in neutral-red broth, ag=acid and gas in lactose, in=indol in peptone broth, ac=acid and coagulation in litmus-milk.

The typical *B. coli* from human fæces gives these reactions, but of course it is possible to further differentiate between coli-bacteria by superadding further tests, such as fermentation of saccharose, dulcite, mannite, etc., but at present there would not appear to be any advantage in such multiplication of tests in the ordinary examination of water.

It is, moreover, often impossible to compare the results obtained by different observers owing to no agreement having been arrived at amongst bacteriologists—as to what reactions and characters are to entitle an organism to be designated as "*typical B. coli.*" Under present circumstances it is highly desirable that a positive reaction in the McConkey-solution (glucose-peptone-bile-salt-litmus) should be recorded as "*presumptive B. coli,*" and that the further confirmatory tests employed should be stated and the results obtained with them given. Unless such a course is adopted endless confusion is inevitable, as the number of such confirmatory tests employed by different bacteriologists is being annually multiplied.

The following table summarises an interesting investigation made by Houston on the proportion of "Flaginac" *B. coli* found amongst the coli-like microbes obtained from different sources:—

Flaginac B. coli.

Source.	Number of specimens of *B. coli* or Coli-like microbes on which percentage is based.	Percentage of Flaginac *B. coli.*
Milk	343	61
Human fæces	101	85
Sewage	several hundreds	65—85
Oysters	464	43
Estuarial waters	183	66
Water-cress	81	40
Washings of cress	52	52
Water in which cress grown	42	76
London filtered water	232	31

In the following table are recorded the results of some very suggestive pioneering experiments made by McConkey (1905), undertaken with the object of ascertaining whether there is any marked difference in the types of *B. coli* found in the excreta of man and some of the common domestic animals respectively. Should it be possible to establish such a difference, an important means of distinguishing between human and animal excrementitious contamination of water would be obtained.

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[*] There is one element of uncertainty connected with such tests made in liquid media which appears to be tacitly ignored by all bacteriologists who make use of them, and that is that the particular microbe sought for may in the process of cultivation in the liquid medium become hopelessly outnumbered or even suppressed by the much more abundant proliferation of some other microbe or microbes present in the mixture.

Thus the McConkey medium may be taken as specially favourable for the proliferation of bacteria of the *B. coli* type, but the water-bacteriologist is in general restricting his search to those bacteria which are sufficiently like typical *B. coli* as to produce acid *and* gas in the medium. Is it not possible that the bacteria capable of producing both acid and gas may be so greatly outnumbered by microbes not giving this reaction that the more typical *B. coli* forms may be so much kept in abeyance that no acid and gas reaction is obtained? Under these circumstances he would obviously draw the conclusion, and quite erroneously, that acid and gas producing microbes (and, therefore, *B. coli* amongst them) were absent. This is a matter which requires much further investigation before the conclusions as to *absence* of *B. coli* generally drawn can be justified.

B. coli from human and animal excreta (McConkey).

Group.	Fermentation of		Number of lactose-fermenting Coli-form microbes isolated and experimented with.			Results in Percentages.		
	Saccharose.	Dulcite.	Human.	Animal.*	Total.	Human.	Animal.	Average.
I.	—	—	83	37	120	34	15	25
II.	—	+	93	85	178	38	36	37
III.	+	+	36	74	110	15	31	23
IV.	+	—	29	43	72	12	18	15
.			241	239	480	100	100	100

* Twenty-five samples of animal excreta, of which 5 were from horses, 6 from cows, 3 from rabbits, 1 from a monkey, and 14 from a cat.

Source.	*B. coli.*	*Streptococci.*	*B. enteritidis sporogenes* spores.
	Approximate number per 1 gram. of excreta.		
Horse No. 1	Over 1 million	$\frac{1}{10}$ to 1 million	10 to 100
Horse No. 2	$\frac{1}{10}$ to 1 million	Over 1 million	100 to 1,000
Horse No. 3	1,000 to 10,000	Over 1 million	100 to 1,000
Cow No. 1	$\frac{1}{10}$ to 1 million	10,000 to 100,000	100 to 1,000
Cow No. 2	10,000 to 100,000	$\frac{1}{10}$ to 1 million	10 to 100
Cow No. 3	1 to 10 millions	Over 10 millions	10 to 100
Cow No. 4	1 to 10 millions	$\frac{1}{10}$ to 1 million	100 to 1,000
Pig No. 1	Over 100 millions	Absent	$\frac{1}{10}$ to 1 million
Pig No. 2	10 to 100 millions	Absent	10,000 to 100,000
Pig No. 3	70 millions	Absent	1,000 to 10,000
Sheep No. 1	10 to 100 millions	1 to 10 millions	10 to 100
Sheep No. 2	10 to 100 millions	10 to 100 millions	10 to 100

Such an investigation would have to be enormously extended before results capable of being used for diagnostic purposes could be obtained.

An attack on the same important problem was also made by Dr. Wm. G. Savage (1904–5) in an extremely laborious investigation, which he has summarised in the foregoing table.

The absence of streptococci in the fæces of the pig is extremely remarkable.

It is convenient to classify waters tentatively according to the results of the examination for *B coli*, thus :—

Classification of Water by B. Coli Test.

(1 c.c. sewage is assumed to contain 100,000 *B. coli.*)

Class.	Volume of water examined.	*B. coli* per 1 c.c.	Pollution in Sewage.
	c.c.		per cent.
I	— in 100	0	—
II	+ in 100	·01	·00001
III	+ in 10	·1	·0001
IV	+ in 1	1	·001
V	+ in ·1	10	·01
VI	+ in ·01	100	·1
VII	+ in ·001	1000	1
VIII	+ in ·0001	10,000	10
IX	+ in ·00001	100,000	100 (pure sewage)

Birmingham Water Supply. (P. F. Frankland.)

Averages for 1910.

	Number of bacteria.				*Bacillus coli* (typical).						
	Gelatine at 20° C.		Carbolic gelatine at 20° C.	Tauro-cholate agar at 37° C.	100 c.c. —	100 c.c. +	10 c.c. +	1·0 c.c. +	0·1 c.c. +	0·01 c.c. +	0·001 c.c +
	2 days.	7 days.	7 days.	4 days.							
					per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent
Whitacre—											
Unfiltered	3300	—	167	1232	—	—	—	8·3	16·7	58·3	16·7
Filtered	12	87	0	5	75·0	25·0	—	—	—	—	—
Frankley—											
Inlet	37	237	0·7	13	18·2	45·5	36·4	—	—	—	—
Reservoir	54	258	1·6	40	41·7	33·3	25·0	—	—	—	—
Filtered	5	38	0	3	91·7	8·3	—	—	—	—	—
City mains	19	59	0·03	5·5	78·4	16·2	5·4	—	—	—	—

London Water Supply. (Houston.)
Averages for 1908–9 *and* 1909–10.

		Bacillus coli (typical).									
	No. of bacteria gelatine at 20°—22° C. 3 days.	100 c.c. —	100 c.c. +	10 c.c. +	1·0 c.c. +	0·1 c.c. +	0·01 c.c. +	0·001 c.c. +	0·0001 c.c. +	0·00001 c.c. +	0·000001 c.c. +
Raw River Waters—		per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Thames at Hampton, 1908–9	2,558	—	2·1	10·3	40·1	36·6	10·4	0·4	—	—	—
ditto 1909–10	5,268	0·5	0·5	6·3	26·9	52·9	12·8	—	—	—	—
Lea at Ponder's End, 1908–9	8,794	—	0·8	5·2	34·9	38·8	15·5	3·9	0·8	—	—
ditto 1909–10	37,071	—	0·5	6·3	31·4	39·7	13·2	7·3	0·5	0·5	0·5
NewRiver at Hornsey 1908–9	1,118	2·1	9·1	40·9	38·8	8·2	0·8	—	—	—	—
ditto 1909–10	2,801	0·9	8·3	41·7	36·8	9·8	2·4	—	—	—	—
Filtered Waters—											
Thames, 1908–9...........	89	83·4	11·8	3·9	0·7	0·06	—	—	—	—	—
ditto 1909–10..........	55	81·8	14·6	2·7	0·7	0·09	0·02	—	—	—	—
Lea, 1908–9..............	163	85·1	10·1	4·1	0·7	—	—	—	—	—	—
do. 1909–10..............	237	88·1	8·9	2·3	0·6	—	—	—	—	—	—
New River, 1908–9........	7	88·3	9·4	2·0	0·07	0·07	—	—	—	—	—
ditto 1909–10.......	16	82·6	14·1	2·9	0·3	—	—	—	—	—	—
Deep Wells—											
Kent, 1908–9	6	92·3	4·7	1·2	1·7	—	—	—	—	—	—
do. 1909–10............	8	96·2	3·3	0·4	—	—	—	—	—	—	—
Lea Valley, 1908–9	19	79·1	13·6	2·7	4·5	—	—	—	—	—	—
ditto 1909–10.......	16	89·0	8·8	2·1	—	—	—	—	—	—	—

A City Water Supply. (P. F. Frankland.)
Averages for three years ending 1910.

	Number of bacteria.				*Bacillus coli* (typical).						
	Gelatine at 20° C.		Carbolic gelatine at 20°C. 7 days.	Taurocholate agar at 37°C. 4 days.	100 c.c. —	100 c.c. +	10 c.c. +	1·0 c.c. +	0·1 c.c. +	0·01 c.c. +	0·001 c.c. +
	2 days.	7 days.									
Source A.					per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Cultivated land and pasture :											
Unfiltered reservoir	205	—	8	76	—	7·7	15·4	53·9	23·0	—	—
Filtered	15	91	0·2	4	53·9	15·4	30·7	—	—	—	—
Source B.											
Cultivated land and pasture :											
Unfiltered reservoir	185	—	2	74	—	23·1	38·5	23·0	15·4	—	—
Filtered	7	48	0	1·5	76·9	15·4	7·7	—	—	—	—
Source C.											
Mountain sheep run :											
Practically unstored.....	194	—	8	49	4·0	20·0	20·0	32·0	24·0	—	—

This classification must not, however, be interpreted too rigidly, as it is based on the assumption that *B. coli* is always derived from fæces and that this microbe is incapable of multiplication under any circumstances after incorporation in what is known as "sewage."

In the three preceding tables are recorded the results of the ordinary bacteriological examination of a number of typical waters. The tables sufficiently explain themselves.

Storage of water.—Already in 1886 ("Water Purification, its Biological and Chemical Basis." Trans. Inst. Civil Engineers, 1886), I pointed out the great importance from a theoretical point of view of storage for the purification of surface waters. In 1892, again, I gave in evidence, before the Royal Commission on Metropolitan Water Supply, the results, which I had obtained at several of the London Water Works, illustrating the influence of storage on the bacteriological purity of the river waters abstracted for supply, and showed that there is a most striking reduction in the number of suspended micro-organisms during storage in large reservoirs.*

The great importance of storage from the hygienic point of view was further manifest from the experiments made on the fate of pathogenic bacteria introduced into natural waters, and which showed that the duration of life of these bacteria under such conditions is generally very short.

This inquiry was pursued by several investigators very soon after the introduction of Koch's cultivation methods, and, in my communication to this Society in 1887, I gave the results of my own experiments on this subject which were made with the anthrax bacillus, the vibrio of cholera, and the streptococcus obtained from cases of erysipelas. The behaviour of these microbes was determined in distilled water, in filtered Thames water, and in London sewage. As at that time the methods of successfully detecting a particular organism in a mixture of which it formed only a very small part had not been developed, all these experiments were made by adding the pathogenic microbes to water previously sterilised. The experiments made under these artificial conditions, being necessarily of a preliminary character, I will not dwell upon them further here.

In 1891–4, I had the opportunity of greatly extending my observations on this subject, as I was requested by a Committee of the Royal Society to make, in conjunction with the late Professor Marshall Ward, F.R.S., a special inquiry into the vitality of pathogenic bacteria in potable waters. The results of our investigations are recorded in three Reports to the Committee and are published in the Proceedings of the Royal Society. Our experiments were restricted to the study of the behaviour of the anthrax bacillus (and its spores), the typhoid bacillus, and the *B. coli communis*, and the potable waters employed were those of the Thames, Loch Katrine, and deep-well water from the chalk, these being fairly typical of the different kinds of water used for drinking purposes in this country. Experiments were made with these waters in their natural and also in a sterilised condition.

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* Appendices to Minutes of Evidence, Roy. Commission on Metropolitan Water Supply, 1893, 469—475. See also "Micro-organisms in Water," P. Frankland and G. C. Frankland, London, 1894, pp. 99, 126, 131—142, 184.

There are only a few points in these investigations to which I would refer here :—

(1) Unsterilised water infected with anthrax bacilli containing spores was still virulent after being kept for seven months.

(2) Anthrax bacilli taken directly from an animal dead of anthrax and, therefore, free from spores died rapidly (mostly in five days) when introduced into unsterilised water kept at low temperatures (5° C. and 13° C. in these experiments), but when introduced into the same waters and kept at 19° C., the bacilli formed spores and the latter were still present in enormous numbers even 42 days later, and doubtless for a much longer period still. This remarkable difference in behaviour is accounted for by the fact, previously discovered by Koch, that anthrax bacilli do not form spores below 16° C.

With regard to my experiments on the typhoid bacillus, I would call attention to the following results which were obtained by introducing typhoid bacilli from one and the same cultivation and in the same numbers into each of the waters at one and the same time :—

Unsterilised water.	Life of typhoid bacilli.
Thames water (Oct. 19, 1893) 9°—12° C.	Between 9 and 13 days.
Loch Katrine water (,,) 9°—12° C.	Between 19 and 33 days.
Deep well water (,,) 9°—12° C.	Between 33 and 39 days.
In two other separate experiments with unsterilised Thames water, I found (May 11, 1893) the typhoid bacilli alive	Between 25 and 34 days.
and (Jan. 16, 1894)	Between 20 and 27 days.

In all these experiments only 1 c.c. of water was examined for typhoid bacilli, and the method of search, the best known at the time, was that due to Parietti, in which the water is cultivated in a phenol-broth medium at 37° C., which on becoming turbid is submitted to plate-cultivation, the colonies obtained being then examined in detail for identification.

It is particularly interesting to compare with the above results those recently obtained by Houston in a perfectly similar inquiry and making use of all the most modern developments of bacteriological technique. Dr. Houston made 18 experiments on raw Thames, Lea, and New River waters, infecting them with typhoid bacilli (the number added being in all but three experiments very large, see table below). The presence of the bacillus was tested for at weekly intervals in 1 c.c. by means of a medium containing *Agar-bile-salt-dulcite-lactose-saccharose-salicin-peptone-neutral-red-malachite green*, and which is specially designed to favour the growth of this microbe whilst repressing that of most others. The results may be summarised in the following statement :—

In 3 experiments the typhoid bacillus was undiscoverable in 1 c.c. in 1 week.

In 10 experiments the typhoid bacillus was undiscoverable in 1 c.c. in 3 weeks.

In 16 experiments the typhoid bacillus was undiscoverable in 1 c.c. in 4 weeks.

In 18 experiments the typhoid bacillus was undiscoverable in 1 c.c. in 5 weeks.

Thus, notwithstanding the great advances made in the technique of testing for the typhoid bacillus, the results obtained by Houston are essentially similar to mine of 15 years previously. Houston has, however, extended the investigation in an interesting manner by ascertaining the length of time required before even 100 c.c. of the infected water gave a negative result on being tested by the most modern methods for the presence of the typhoid bacillus. The whole of Houston's investigation (both for 1 c.c. and for 100 c.c. of water tested) is instructively summarised in the table below.

This table shows, on the one hand, that whilst in each case nearly all the typhoid bacilli are destroyed by a single week's residence in these raw river waters a few individuals persist for a much longer period of time. This illustrates in a very interesting and instructive manner a principle, which I emphasised some 16 years ago, "that one of the factors determining the longevity of pathogenic bacteria placed in water, or for the matter of that placed in any unfavourable surroundings, is the absolute number in which they are present. In other words, amongst, for instance, 1,000 bacteria taken from a given source there may be *some individuals* which will resist a particular adverse influence, whilst amongst 10 bacteria taken from the same source there may be *none* capable of resisting the adverse influence in question." (P. F. Frankland, Proc. Roy. Soc. 1894, **56**, 486).

I cannot leave the subject of the behaviour of the typhoid bacillus in water without referring to some extremely interesting and ingenious experiments made by the American bacteriologists, Jordan, Russell, and Zeit, in 1903. These investigators endeavoured to imitate natural conditions more closely than has been done in any other experiments by placing the typhoid-infected waters in

Description of water.	Initial No. of typhoid bacilli in 1 c.c. of infected water.	Number of typhoid bacilli in 1 c.c. of infected water after						Number of weeks required for destruction of typhoid bacillus in 100 c.c. of infected water.
		1 week.		2 weeks.	3 weeks.	4 weeks.	5 weeks.	
			(percentage reduction).					
Thames (I)...............	40	0	100	—	—	—	—	5
Lea (I).................	40	0	100	—	—	—	—	5
New River (I)...........	40	0	100	—	—	—	—	6
Thames (II)	170,000	9	99·9	2	0	—	—	6
Lea (II)................	170,000	53	99·9	2	0	—	—	5
New River (II)	170,000	40	99·9	2	0	—	—	6
Thames (III)	470,000	480	99·9	31	5	0		8
Lea (III)	470,000	850	99·8	11	7	2	0	7
New River (III)	470,000	1,430	99·7	14	7	0	—	7
Thames (IV)	8,000,000	3,000	99·9	30	4	0	—	8
Lea (IV)	8,000,000	2,900	99·9	29	5	0	—	8
New River (IV)	8,000,000	400	99·9	22	2	0	—	9
Thames (V)	525,000	12	99·9	1	0	—	—	8
Lea (V).................	525,000	32	99·9	2	0	—	—	7
New River (V)	525,000	29	99·9	3	0	—	—	5
Thames (VI)	475,000	210	99·9	12	2	1	0	9
Lea (VI)	475,000	80	99·9	11	2	0	—	8
New River (VI)	475,000	30	99·9	3	0	—	—	7

permeable sacs made of celloidin and parchment, and then by submerging these in river, canal, or lake water, their contents were exposed to the influence of the dialysable substances present in the water under natural conditions.

Zeit experimented with Lake Michigan water and Chicago river water, the natural bacterial contents of which varies between 68 and 2,000 microbes per 1 c.c. in the case of the Lake, and between 80,000 and 1,500,000 microbes per 1 c.c. in that of the river water. Parallel experiments were made with infected water placed in ordinary bottles and in permeable sacs respectively. The typhoid bacilli introduced varied between 500 and 2,000,000 per 1 c.c. The destruction of the typhoid bacillus was taken as complete when negative results were obtained on cultivating 5 c.c. of the water, the death of the typhoid bacillus being generally confirmed by the subsequent cultivation, a few days later, of much larger volumes, sometimes as much as 800 c.c., of the water. Nine experiments were made with the Michigan Lake water, *the typhoid bacillus being never found after the eighth day.* Five experiments were made with the Chicago River water, *the typhoid bacillus being never found after the third day.*

Jordan experimented with the water of the Chicago Drainage Canal, which usually contains from 100,000 to 400,000 bacteria per 1 c.c. This water was infected with from 180 to 857,000 typhoid bacilli per 1 c.c. In these experiments, however, the maximum volume submitted to cultivation appears to have been only 1 c.c., and from negative results with even smaller volumes the death of the typhoid bacillus seems to have been concluded. Twenty-eight experiments were made in permeable sacs submerged in the canal, *the typhoid bacillus being never detected after the second day, excepting in one experiment in which it was still found on the tenth day.*

Russell's experiments were made with the Illinois River water, which contains from 1,800 to 4,000 bacteria per 1 c.c. This water was infected with 540 to 20,000 typhoid bacilli per 1 c.c. However, in these experiments, again, 1 c.c. appears to have been the maximum volume of water cultivated for the detection of the typhoid bacillus. Fourteen experiments were made in permeable sacs submerged in the Illinois River, *the typhoid bacillus being never found after the third day, excepting in one case in which it was detected on the ninth day.*

Within the last few months, again, Houston has published the results of some further interesting experiments which he has made on the vitality of typhoid bacilli in river water. In this investigation he has taken typhoid bacilli not from cultivations but from the human subject and introduced them into raw Thames water. He found that such bacilli perished very rapidly—much more quickly in fact than had been his experience with cultivated strains of the microbe.

The uncultivated typhoid bacteria were obtained from the urine of a "typhoid carrier," and on Aug. 9, 1910, the centrifugalised deposit (3·5 c.c.) from 389 c.c. of urine was added to 5000 c.c. of raw Thames water; the number of typhoid bacilli was determined as follows:—

At time of mixture, 770,000 typhoid bacilli per 1 c.c. of river water.

After 1 week, 4 typhoid bacilli per 1 c.c. of river water.

After 2 weeks, 0 typhoid bacilli in 100 c.c.

On the 24th day from the commencement of the experiment half-a-pint (about 284 c.c.) of the infected water was drunk, this quantity of water having *originally* contained 218,680,000 typhoid bacilli. Similar amounts were drunk with impunity on the 25th, 26th, 27th, and 28th days after the beginning of the experiment.

On August 19th, 1910, the experiment was repeated with a fresh sample of urine, the number of typhoid bacilli per 1 c.c. of river-water being 1650. A week later no typhoid bacilli could be found, and on the 23rd, 24th, 25th, 26th, and 27th day from the beginning half-a-pint of the infected water was drunk each day without any ill-effect. (Sixth Research Report, Metrop. Water Board, Nov. 1910, p. 7.).

If this drinking part of the experiment is to prove anything it would be necessary for Dr. Houston to follow it up by drinking a similar number of *fresh* typhoid bacilli from the same patient and contracting the disease, for without this last act we have no certainty that Dr. Houston is susceptible to this malady and, therefore, a fit *corpus vile* on which to make this crucial test.

It is a matter of no surprise to me that typhoid bacilli coming directly from the human subject should be less resistant than typhoid bacilli from cultivations, for some 16 years ago I showed that typhoid bacilli could by a judicious system of cultivation be actually educated to multiply in potable water. In this connection I would quote from my Third Report to the Royal Society Water Research Committee (Proc. Roy. Soc., 1894, **56**, 538):—

"In none of the experiments recorded above was any multiplication of the typhoid bacillus observed, although these experiments have been made with waters varying from the deep well water of the Kent Company, which is almost wholly destitute of organic matter, to the peaty water referred to on p. 223, which contains about the maximum amount of organic matter met with in water used for drinking purposes.

"Some previous observers, on the other hand, record the multiplication of the typhoid bacillus in potable waters with which they have made similar experiments; whilst others, again, have found no multiplication. It appears to me highly probable that in most, if not all, cases in which multiplication has been observed, it has been occasioned through the introduction of an appreciable amount of food-material along with the typhoid bacilli; for, as already pointed out, most investigators have exercised very little care in respect of this highly important factor.

"But although the typhoid bacilli taken directly from an ordinary cultivation and plunged into potable water may not be able to proliferate in the latter, it appeared to me quite possible that if the environment of the typhoid bacilli were gradually, instead of suddenly, changed, the requirements of the bacilli might perhaps be thereby so far modified as to enable the bacilli to undergo multiplication in the aqueous medium. For by gradually changing the surroundings, it would be anticipated that those individuals most capable of flourishing under the altered conditions would be propagated, and that each successive generation of typhoid bacilli would thus become more adapted to the new medium.

"To ascertain whether this process of education could be actually accomplished, the following experiments were made:—

"*Education of Typhoid Bacilli for Aquatic Life.*—A gelatine-culture of the typhoid bacillus was, in the first instance, inoculated into sterile broth of the ordinary strength, and kept at 18—20° C.; turbidity ensued in twenty-four hours. From this broth cultivation an inoculation was made into 50 per cent. broth (broth mixed with its own volume of water); this also became turbid in twenty-four hours at 18—20° C. From the 50 per cent. broth cultivation an inoculation was made into 10 per cent. broth; this liquid only became visibly turbid in two and a half to three days. After four successive generations of cultivation in this 10 per cent. broth medium had been carried on, the time elapsing between the inoculation and the appearance of turbidity gradually diminished until with the fifth generation, turbidity already set in in twenty-four hours. From this 10 per cent. broth, inoculation was then made into 1 per cent. broth (1 vol. of broth mixed with 99 volumes of water); this became turbid in 24 hours. Continuous cultivation of this 1 per cent. broth medium was then carried on for a period of two months, after which it was employed for infecting steam-sterilised Thames water, thus:—

"On January 31, 1894, 2 drops of a 1 per cent. broth cultivation (3 days old) of the typhoid bacillus were added to 600 c.c. of steam sterilised Thames water, which was, on the day of infection and on several subsequent occasions, submitted to plate cultivation with the following results:—

Date.	No. of Typhoid Bacilli per 1 c.c.
31.1.1894	4,895
2.2.1894	15,372
5.2.1894	11,184
12.2.1894	6,558
23.2.1894	5,795
6.3.1896	6,068
10.3.1894	4,093

"These figures show that unquestionable, although not very extensive, multiplication of the typhoid bacilli took place in the water thus infected; but in order to ascertain whether this proliferation was effected at the expense of the very small quantity of culture-material necessarily introduced along with the bacilli, or at the expense of the organic matter pertaining to the Thames water itself, the following further experiments were made:—

"On February 23, 1894, 10 c.c. of the above infected water, which on that day contained 5795 typhoid bacilli per 1 c.c., were added to 20 c.c. steam-sterilised Thames water, and the latter was then and several times subsequently submitted to plate-cultivation with the following results:—

Date.	No. of Typhoid Bacilli per 1 c.c.
23.2.1894	1830
26.2.1894	1842
2.3.1894	375
6.3.1894	268

"From these figures it is equally evident that in this case no multiplication but only numerical decline of the typhoid bacilli took place. If, however, the typhoid bacilli can proliferate at the expense of the organic matter belonging to the Thames water, they should have multiplied in the above experiment as they were imported into a quantity of water, the organic matter of which had not since sterilisation been exposed to bacterial life, but from the fact that they did not multiply, but on the contrary, only fell off in numbers, it becomes almost certain that the distinct multiplication observed in the former experiment was effected at the expense of the small quantity of food material originally introduced into the water along with the typhoid bacilli.

"Another experiment was made on similar lines to the first half of the above experiment, to see whether the multiplication there observed could be confirmed, thus:— On March 27, 1894, 4 c.c. of a 1 per cent. broth cultivation (3 days old) of the typhoid bacillus were put into 50 c.c. of steam-sterilised Thames water, the mixture being violently shaken up for 15 minutes; 2 c.c. of this mixture (equivalent to $\frac{1}{27}$ c.c. of the original 1 per cent. broth culture were then added to 200 c.c. of steam-sterilised Thames water, which was then submitted to plate cultivation as follows:—

Date.	No. of Typhoid Bacilli per 1 c.c.
27.3.1894	37,515
29.3.1894	61,566
31.3.1894	50,935
4.4.1894	27,818
11.4.1894	20,130

"In this case again, therefore, there was a small but distinct multiplication.

"From these experiments it appears that typhoid bacilli which have undergone a prolonged and gradual training in more and more aqueous culture-media do exhibit distinctly more vitality in potable water than bacilli which are at once transferred into water from highly nutritive solid media like agar or peptone jelly. On the other hand, there is considerable reason for believing that the slight but distinct multiplication, which these trained bacilli undergo in potable water, is effected at the expense of small quantities of food-material introduced along with them at the time of infection, and not at the expense of the organic matter belonging to the water itself."

Vitality of the Spirillum of Asiatic Cholera in Potable Water.—Experiments have recently been made by Houston with the cholera spirillum on exactly the same lines as those which he had previously adopted in the case of the typhoid bacillus in raw Thames, Lea, and New River water. The principal conclusions arrived at may be summarised as follows (4th Report on Research Work, Metrop. Water Board, June 1909):—

"(1) Cholera vibrios die very rapidly in *raw* Thames, Lea, and New River water as the result of storage in the laboratory. At least 99·9 per cent. perished within one week, and in none of the experiments could any cholera vibrios (recognisable as such) be found even in 100 c.c. of water three weeks after its infection. In more than half the experiments the results were negative by the second week.

"(2) The isolation of cholera vibrios from *artificially* infected *raw* river water presents no insuperable difficulties even when the number artificially added is very small, both actually and relatively to the bacteria nominally present in the river water.

"(3) On the other hand, microbes liable (after careful study) to be mistaken for true cholera vibrios were not found in comparable, but non-infected, river water samples examined under precisely similar conditions."

Thus the cholera vibrios are much more perishable in these raw river waters than are the typhoid bacilli under similar conditions.

The comparatively short duration of life of pathogenic bacteria when introduced into natural waters and more especially into surface waters, which these numerous and independent investigations establish, clearly show that the process of storage in large reservoirs must form a very important safeguard against the water-carriage of zymotic diseases. This safeguard, which is supplementary to and quite independent of that of filtration, has the great advantage of being under perfect control and much less liable to accidental disturbances than are most other methods of water-purification. It is, however, unfortunate that many reservoirs attached to water works have not been designed so as to secure the maximum advantages of storage, and their rearrangement with this object in view is generally a matter of great expense and sometimes almost impracticable. It is to be hoped that in future engineers will be more careful to arrange for such a circulation of the water that each particle of water entering shall remain as long as possible in the reservoir before passing out.

The influence of storage on the bacteriology of surface waters has recently been made the subject of very extended and interesting investigations by Houston in connection with the London water supply. The advantages which are secured by the storage of surface waters are summarised by Houston in the following terms, which I can fully endorse:—

(1) Reduces the number of bacteria of all sorts.

(2) Reduces the number of bacteria capable of growing on agar at blood heat.

(3) Reduces the number of bacteria capable of growing in a bile-salt medium at blood heat.

(4) Reduces the number of coli-like microbes.

(5) Reduces the number of typical *B. coli*.

(6) Alters certain bacteriological ratios for river-waters, *e.g.*, it reduces the number of typical *B. coli* to a proportionately greater extent than it reduces the number of bacteria of all sorts.

(7) If sufficiently prolonged, it devitalises the microbes of water-borne disease (*e.g.*, the typhoid bacillus and the cholera vibrio).

(8) Reduces the amount of suspended matter.

(9) Reduces the amount of colour.

(10) Reduces the amount of ammoniacal nitrogen.

(11) Reduces the amount of oxygen absorbed from permanganate.

(12) Usually reduces the hardness and may reduce (or alter the quality of) the albuminoid nitrogen.

(13) Alters certain chemical ratios for river-waters; *e.g.*, the colour results improve more than the results yielded by the permanganate test.

(14) Has a marked "levelling" effect on the totality of water delivered to the filter-beds.

(15) Tends generally to lengthen the life of the filters (only under exceptional conditions is the contrary true).

(16) An adequately stored water is to be regarded as a "safe" water, and the "safety change" which has occurred in a stored water can be recognised by appropriate tests.

(17) The use of stored water enables a *constant* check to be maintained on the safety of London's water *antecedent* to and irrespective of filtration.

(18) The use of stored water goes far to wipe out the gravity of the charge that the chief sources of London's water supply are from sewage polluted rivers.

(19) The use of adequately stored waters renders any accidental breakdown in the filtering arrangements much less serious than might otherwise be the case.

(20) The habitual use of stored water would lighten the grave responsibilities of the Water Board, as regards the safety of the London water supply, and would tend to create a sense of security amongst those who watch over the health of the Metropolis. (Houston, Report on the Examination of the Lond. Waters for the 12 months ended March 31, 1910, pp. 17 and 18.)

This catalogue of the virtues of storage reads not unlike an advertisement, but it is quite excusable in view of the extreme difficulty of making any impression on the British public in scientific matters however important.

The experimental basis for many of the above statements with regard to the benefits of storage will be found in the following tables (Houston, Annual Report, March 31, 1910, p. 52):—

London Water Supply.

Influence of storage shown by samples collected during 12 months ending March 31, 1910 (Houston).

	No. of bacteria per 1 c.c.			*B. coli* (typical).									
	Gelatine 20—22° C. 3 days.	Agar 37° C. 2 days.	Tauro-Agar 37° C. 2 days.	c.c. 100 —	c.c. 100·0 +	c.c. 10·0 +	c.c. 0·1 +	c.c. 0·1 +	c.c. 0·01 +	c.c. 0·001 +	c.c. 0·0001 +	c.c. 0·00001 +	c.c 0·000001 +
				%	%	%	%	%	%	%	%	%	%
Raw Thames water before storage	5,268	495	63	0·5	0·5	6·3	26·9	52·9	12·8	—	—	—	—
Thames water after storage at Staines Reservoirs .	240	88	3	21·4	47·1	25·7	4·3	1·4	—	—	—	—	—
Thames water after storage at Chelsea Reservoirs .	442	63	8	41·3	28·0	21·3	9·3	—	—	—	—	—	—
Thames water after storage at Lambeth Reservoirs	354	54	8	20·8	43·0	31·9	4·2	—	—	—	—	—	—
Raw Lea water before storage	37,071	837	86	0·0	0·5	6·3	31·4	39·7	13·2	7·3	0·5	0·5	0·5
Lea water after storage at Walthamstow Reservoirs	121	21	4	60·0	30·6	8·0	1·3	—	—	—	—	—	—

Fæcal Streptococci in Water.—Attempts have been made to supplement the indications of fæcal contamination yielded by the presence of *B. coli*. The most recent and noteworthy of these is the examination of water for the presence of certain streptococci which are usually very abundant, sometimes even more abundant, in human fæces than is the *B. coli*. This matter has been engaging the attention of Dr. Houston since 1898, and he has recently (June, 1910) given a special account of the results, which he has obtained up to the present time.

At the outset I should point out that these streptococci are not peculiar to human excreta, but are also abundantly present in those of the higher animals, many of Houston's experiments having been made with streptococci obtained from cow-dung. The study of these micro-organisms does not, therefore, at present put us in possession of that all important desideratum—a means of distinguishing between contamination due to the excrement of man and that which is due to the lower animals.

According to Houston, human fæces contain, roughly, 100,000 streptococci per 1 gram. On the other hand, in some stools streptococci are either absent or present in such small numbers relatively to those of other bacteria that search for them is useless. Their presence in water has hitherto been ascertained by spreading 1 c.c. of the water on a Drigalski-Conradi plate, on which medium, after incubation at 37° C., the streptococci give rise to very minute colonies, which can then be sub-cultivated for determination of their biochemical characters.

Of 100 different cultures of streptococci obtained by Houston from sewage works fæces: (*a*) 100 produced acid in lactose and in raffinose media, and all of them clotted milk. (*b*) None reduced nitrates to nitrites. (*c*) Only four produced acid in a mannite medium. (*d*) 97 produced acid in a salicin medium. (*e*) 49 produced acid in a saccharose medium.

The grouping of these properties is best indicated by means of a convention similar to that employed in the case of *B. coli*, in which syllables are made to represent definite biochemical reactions, thus:—

la =acid in a *la*ctose medium.
ma = ,, ,, *mannite* ,,
mi =clot ,, *milk* ,, ,,
ra =acid ,, *raffinose* ,,
sac = ,, ,, *saccharose* ,,
sal = ,, ,, *salicin* ,,

The 100 streptococci examined may then be thus classified:—

la-mi-ra-sal	49	la-ma-mi-ra-sac-sal	4
la-mi-ra-sac-sal	44	la-mi-ra-sac	1
		la-mi-ra	2

Thus 97 per cent. clotted milk, and produced acid in lactose, raffinose, and salicin media, and of these 48 produced acid and 49 no appreciable acidity in a saccharose medium.

During the year 1909, Houston examined the raw (unfiltered and unstored) Thames, Lea, and New River waters for streptococci, employing 1 c.c. of each sample on Drigalski plates as above, with the following results:—

	No. of Times Streptococci were found in 1 c.c.
52 weekly samples of Thames Water	13
52 weekly samples of Lea Water	13
52 weekly samples of New River Water .	2

As regards the types of streptococci found in the above 28 samples of the 71 sub-cultures of streptococci examined the following combinations were found:—

	Thames.		Lea.		New River.
La-ma-mi-ra-sac-sal	1	..	2	..	0
La-ma-mi-sac-sal	1	..	3	..	0
La-mi-ra-sac-sal	9	..	17	..	0
La-ma-sac-sal	0	..	1	..	0
La-ma-mi-sac	0	..	3	..	0
La-mi-sac-sal	4	..	9	..	0
La-mi-ra-sac	2	..	10	..	0
La-sac-sal	0	..	1	..	2
La-mi-sal	0	..	1	..	0
La-mi-sac	2	..	0	..	0
La-ra-sac	0	..	3	..	0
Total	19	..	50	..	2

The above results are especially interesting as showing that the two impurer waters (Thames and Lea) contained streptococci much more frequently than the far purer water (New River), and further, that the streptococci actually discovered in the latter were of a type more remote from that of those which are usually discovered in fæces.

Bearing in mind that, on an average, upwards of 90 per cent. of the raw, Thames and Lea samples and about 50 per cent. of the raw New River samples contain typical

B. coli in 1 c.c. or under, whilst in only 25 per cent. of the raw Thames and Lea samples and in only 3·8 per cent. of the raw New River samples were streptococci found, it follows that the streptococci are a far less delicate index of contamination than the *B. coli*. The absence of streptococci in 1 c.c. of a water cannot, therefore, be regarded as any criterion of its purity. The relative scarcity of streptococci in waters which have undoubtedly received a considerable amount of sewage matters is accounted for by the fact, established by Houston, that streptococci very rapidly die off when placed in water. This circumstance points, of course, to the presence of streptococci serving as an indication of very recent contamination.

Recent Bacteriological Methods applied to other processes of water purification.—From the evidence which I have already brought forward it appears that confidence in the purification which can be effected by storage and sand-filtration, under favourable conditions, has been distinctly strengthened by the application of the more recent developments of bacteriological water examination—search for *B. coli* and other microbes more or less connected with sewage contamination.

I will now briefly consider certain other processes of water-purification which are employed on the large scale.

Mechanical filters.—The use of mechanical filters originated in America, and their employment in our own country is becoming more and more common. I do not propose to discuss the relative merits of these two different processes of filtration. They each possess their advantages and disadvantages; they can each be made to yield good and bad results according to the manner in which they are employed. The following results may serve as an illustration of the very high degree of purification which *can* be secured by means of mechanical filters, which in this instance were employed to further purify a river water, which was being very imperfectly purified by some defective sand-filters.

Purification of River Water by Mechanical Filters.

	Number of Bacteria in 1 c.c.				*B. coli* (typical) in			
	Gelatine at 20° C.		Carbolic gelatine at 20° C. 7 days.	Bile-salt agar at 37° C. 4 days.	100 c.c.	10 c.c.	1·0 c.c.	0·1 c.c.
	2 days.	7 days.						
Raw river water	3,700	—	35	19	+	+	+	+
Ditto after passing sand filters	130	405	2	2	+	+	0	0
Ditto after further passing mechanical filters	8	33	0	0	0	0	0	0

Clark's process of softening.—Already in 1885 I showed that in softening water with lime, a very large proportion of the bacteria are carried down with the precipitated chalk. but that if the latter is allowed to stand in contact with the softened water bacteria again pass from the precipitate into the water. In the softening process this removal of bacteria may under favourable conditions amount to upwards of 90 per cent.

Recently I had occasion to deal with a chalk well water, which was causing anxiety in consequence of its frequently containing *B. coli* in rather small volumes. The most obvious and unobjectionable method of purification which suggested itself was softening with lime, inasmuch as the water contained plenty of bicarbonate of lime in solution. The following table shows the results obtained in a number of small scale experiments in which this water was treated with lime, and sometimes with aluminoferric, and in which the softened water was sometimes decanted, sometimes filtered through paper without disturbing the precipitate ("clear filtration" in the table), and sometimes filtered after deliberately disturbing the precipitate ("turbid filtration" in the table):—

Purification of Water by Lime and Aluminoferric.

	Gelatine.		*B. coli* in				
	No. of bacteria per 1 c.c.	Days incubated at 20° C.	100 c.c.	50 c.c.	10 c.c.	1·0 c.c.	0·1 c.c.
Raw well water	10 259	2 7	+	+	+	0	0
Ditto after filtration through sterile paper	7 236	2 7	+	+	+	0	0
Ditto + lime water, filtered through sterile paper after 1 hour's subsidence	0 90	2 7	+	+	0	0	0
Ditto + lime water and aluminoferric, filtered after 1 hour	0 39	2 7	+	0	0	0	0
Ditto + lime water; clear filtration after 3 hours	1 74	2 7	+	0	0	0	0
Ditto + lime water and aluminoferric; clear filtration after 3 hours	1 44	2 7	+	+	0	0	0
Ditto + lime water; turbid filtration after 3 hours	0 41	2 7	+	+	0	0	0
Ditto + lime water and aluminoferric; turbid filtration after 3 hours	0 41	2 7	0	0	0	0	0
Ditto + lime water; clear filtration after 25 hours	3 96	2 6	+	+	+	0	0
Ditto + lime water and aluminoferric; clear filtration after 25 hours	0 14	2 6	+	0	0	0	0

A great many further experiments were made in addition to those recorded above, but always wiht the same disappointing result, that notwithstanding a large percentage reduction in the total number of bacteria taking place, it was only in rare cases that the *B. coli* was banished from 100 c.c. of the water by the precipitation process. It must be remembered that the demands now commonly made on a purification process with regard to the removal of *B. coli* are much more stringent than with regard to the removal of bacteria in general. Thus, should an untreated water contain 1000 bacteria per 1 c.c., if by treatment the number were reduced to 50 per 1 c.c., this would represent a purification of 95 per cent., and the water would be regarded as quite satisfactory from the point of view of the total number of bacteria present. But, if an untreated water contained the *B. coli* in 0·1 c.c., and after treatment this microbe were not present in less than 10 c.c., this would signify a removal of 99 per cent. of the *B. coli* present in the original water. But so high is the standard of purity at present often demanded in respect to freedom from *B. coli*, that the water which had thus been purified to the extent of 99 per cent. might still be regarded as of a questionable degree of purity.

Ozone Treatment of Water.

	Gelatine.		*B. coli* in						
	No. of bacteria per 1 c.c.	Days incubated at 20° C.	100 c.c.	50 c.c.	10 c.c.	1·0 c.c.	0·1 c.c.	0·01 c.c.	0·001 c.c
Chalk well-water + 4 per cent. polluted canal-water	7,000 10,000	2 7	+	+	+	+	+	+	+
Ditto after treatment with 5 times its volume of ozonised air during 2 hours; cultivations made 2 hours later	0 0	2 7	0	0	0	0	0	0	0
Chalk well-water + 4 per cent. polluted canal-water	4,000 7,000	2 7	+	+	+	+	+	+	+
Ditto after treatment with its own volume of ozonised air during 24 minutes; cultivations made 1 hour later. (The ozonised air contained 0·23 per cent. ozone)	0 3	2 7	0	0	0	0	0	0	0

Purification of Water by treatment with Bleaching Powder.

Untreated Chalk Well Water.							Chalk Well Water after Treatment with Bleaching Powder.						Millions of parts of water treated per 1 part of available chlorine used.
No. of bacteria gelatine at 20° C.		*B. coli* in					No. of bacteria gelatine at 20° C.		*B. coli* in				
2 days.	7 days.	100 c.c. +	50 c.c. +	10 c.c. +	1·0 c.c. +	0·1 c.c. +	2 days.	7 days.	100 c.c. +	50 c.c. +	10 c.c. +	1·0 c.c. +	
						First	Series of	Experi	ments.				
98	640	+	+	+	0	0	17	83	+	+	0	0	1 part chlorine per 1 million
13	260	+	0	0	0	0	0	5	0*	0	0	0	1 part chlorine per 1 million
20	356	+	+	+	0	0	0	33	0*	0	0	0	1 part chlorine per 2 million
22	202	+	+	+	0	0	0	1	0	0	0	0	1 part chlorine per 2 million
13	539	+	+	+	0	0	0	9	0	0	0	0	1 part chlorine per 2 million
18	528	+	+	+	0	0	0	1	0	0	0	0	1 part chlorine per 2 million
9	315	+	+	+	+	0	0	4	0	0	0	0	1 part chlorine per 2 million
16	794	+	+	0	0	0	0	5	0	0	0	0	1 part chlorine per 4 million
9	152	+	+	0	0	0	0	2	0	0	0	0	1 part chlorine per 4 million
12	80	+	+	0	0	0	0	9	0	0	0	0	1 part chlorine per 4 million
14	115	+	+	0	0	0	0	10	0	0	0	0	1 part chlorine per 4 million
54	350	+	+	+	0	0	9	63	0	0	0	0	1 part chlorine per 8 million
17	116	+	+	+	0	0	12	37	0	0	0	0	1 part chlorine per 8 million
17	567	+	+	+	0	0	10	22	0	0	0	0	1 part chlorine per 8 million
—	—	—	—	—	—	—	8	38	0	0	0	0	1 part chlorine per 8 million
Av. 24	358						Av. 4	21					
						Second	Series of	Experi	ments.				
6	79	+	+	0	0	0	1	4	+	+	0	0	1 part chlorine per 1 million
1	105	+	0	0	0	0	0	3	0*	0	0	0	1 part chlorine per 2 million
6	353	+	0	0	0	0	0	0	0	0	0	0	1 part chlorine per 4 million
3	305	+	0	0	0	0	0	1	0	0	0	0	1 part chlorine per 4 million
1	129	+	+	0	0	0	0	3	0	0	0	0	1 part chlorine per 4 million
4	181	0	0	0	0	0	1	1	0	0	0	0	1 part chlorine per 4 million
5	244	+	+	0	0	0	0	0	0*	0	0	0	1 part chlorine per 4 million
0	111	+	+	0	0	0	0	9	0	0	0	0	1 part chlorine per 8 million
5	102	+	+	+	0	0	0	3	0	0	0	0	1 part chlorine per 8 million
1	181	+	+	0	0	0	0	15	0	0	0	0	1 part chlorine per 8 million
2	157	+	+	0	0	0	—	—	—	—	—	—	
9	289	+	+	0	0	0	0	1	0	0	0	0	1 part chlorine per 8 million
0	316	+	+	0	0	0	0	0	0	0	0	0	1 part chlorine per 8 million
1	120	+	0	0	0	0	0	6	0	0	0	0	1 part chlorine per 8 million
2	80	+	0	0	0	0	0	0	0	0	0	0	1 part chloride per 8 million
Av. 3	183						Av. 0	3					

* *B. coli* found absent even in 500 c.c.

Ozone Treatment.—The bactericidal properties of ozone ave been long demonstrated,* but it is only in quite recent ears that it has been used on a large scale for the sterilisaion of town water-supplies. In France the drinking waters of the towns of Nice, Chartres, and Cosne are being ubjected to ozone treatment, whilst a plant for the treatment of 10 million gallons of water will, I understand, be hortly erected in connection with the Paris waterworks. n Germany there are installations at Paderborn, Schiertein, and Hermannstadt.

I have recently made experiments with ozone in conection with the practicability of purifying the chalk well-water to which I have just referred above. The xtraordinary efficacy of this agent will be apparent from he foregoing results obtained in experiments in which the mpurity of the chalk well-water was enormously exaggerted by the addition of 4 per cent. of polluted canal-water.

Bleaching-powder treatment.—The bactericidal action f hypochlorites, again, has been long known, and bleaching powder is one of the oldest and commonest of disinfectants. The use of hypochlorites for the sterilisation of water-upplies was first brought into prominence in this country by Houston, who used "Chloros" which is an electrolysed olution of common salt, for the treatment of the Lincoln water-supply during the memorable epidemic of typhoid which occurred in that city in 1904-5.†

I have recently had occasion to investigate the efficiency f the bleaching-powder treatment on a chalk well water, he experiment being made with a large experimental plant.

From the results given above it will be seen what a high degree of purification is obtained by this simple and inexpensive method of treatment, even when extremely small quantities of bleaching-powder are added to the water. Thus the only occasions on which *B. coli* was found even in 100 c.c. of the treated water was on the first day of each of the two series of experiments and thus when the apparatus had presumably not yet been completely washed out with treated water. On several occasions even 500 c.c. of treated water was examined for *B. coli*, and this microbe was on each such occasion found to be absent even in that large volume.

Similar results have been obtained by Sims Woodhead, Thresh, Hehner, Rideal, and others.

Treatment with ultra-violet light. — The known bactericidal action of the ultra-violet rays has been applied by Victor Henri to the sterilisation of water on a large scale. The rays are supplied by a Cooper-Hewitt mercury lamp. The lamp is worked with 3 ampères at 220 volts, and is placed in the bend of a semicircular trough through which the water is passed. At Marseilles the process has been tried with a plant yielding 130,000 gallons per 24 hours, and using 120 watts per 1,000 gallons. The crude water always contained some *B. coli* and the total number of bacteria varied between 30 and 300 per 1 c.c., whilst, in the treated water, *B. coli* was absent and the total number of bacteria was reduced to an average of 1 per 1 c.c. ("Modern Methods of Water Purification," Don and Chisholm, London, 1911.) See also W. Clemence, Engineering, Jan. 27 and Feb. 3, 1911.

Conclusions.—During the 25 years that the systematic bacteriological examination of water has been practised an enormous amount of work has been carried out by a large number of investigators, but notwithstanding the immense multiplication of results it must be admitted that no very surprising novelties have been brought to light since the year 1895. By then all the salient features in the bacteriology of water had been mapped out, and the past 15 years have more especially been occupied in filling in countless details and in confirming over and over again what had already been broadly established before.

Thus, already in the earlier period, the methods of bacteriology had been successfully applied to a determination of the value of the most varied processes of water purification, natural and artificial, filtration, storage, precipitation, sedimentation, etc. It had been shown how such processes should, in the interests of public health, be continuously watched over and controlled by bacteriological examinations made at frequent intervals. Again, the vitality in water of the principal bacteria associated with water-borne zymotic disease had been investigated, and the results then obtained were substantially the same as those which have been arrived at by the most recent developments in bacteriological technique. In a word, these most recent developments in the methods of bacteriology have served to confirm and emphasise the conclusions which had been generally arrived at by the less perfect methods of the earlier period.

The all-important questions which the water-examiner has to answer are the same to-day as they have been all along :—(*a*) has the water been contaminated with the excreta of man ? and (*b*) if such contamination has taken place, has the water in its subsequent history been subjected to conditions which would insure the destruction or removal of the pathogenic bacteria which may at any time be present in such human refuse ?

To the first of these questions bacteriology cannot give a categorical answer even to-day, because we are not acquainted with any microbes which are absolutely characteristic of human excreta. The greatly increased facilities for the detection and quantitative determination of the *B. coli*, however, have undoubtedly placed us in a position to readily ascertain whether and to what extent a water has been contaminated with excremental matter irrespectively of whether the latter is of human or animal origin, but it is obvious that this will not in general carry us very far, inasmuch as practically all surface water *must* be more or less so contaminated.

To the second question a similarly qualified answer, again, can be readily given. If the water is free from *B. coli* in a large volume, it may safely be concluded that *a fortiori* it is free from the typhoid bacillus in a similar volume. But should the *B. coli* be found in a small volume, it does not follow that the water may at any time be liable to contain typhoid bacilli, because the discovery of the *B. coli* does not prove that the water has been contaminated by man at all.

Thus with regard to both questions, it is obvious that we are in a much stronger position in the matter of exculpating than in that of incriminating a water. However, the inference that a water free from *B. coli* in a large volume is, therefore, necessarily a safe one, requires a slight qualification in view of the remarkable and interesting revelations which have in recent years been made with regard to what are known as "*typhoid carriers.*" Some of these persons suffering from ambulatory typhoid discharge typhoid-bacilli in the urine, and it is thus possible that water may actually become contaminated with typhoid bacilli without at the same time receiving any *B. coli*. Although this is not likely to be of frequent occurrence, still its possibility, especially in the case of men working in wells, filter-beds, and service reservoirs, should on no account be disregarded.

Certainly one of the most important advances made in bacteriology during recent years is the careful characterisation of bacteria by means of biochemical tests, and the isolation of particular types of bacteria from such mixtures as are present in water by means of special culture-media liquid and solid. However, until bacteriologists have agreed upon uniform tests for each particular microbe it is unavoidable that there should be much confusion and that the results obtained by different observers should be difficult to compare. Under these circumstances the interpretation of results by the individual observer is a matter of the greatest importance, and it is needless to say that unless the individual observer has a wide personal experience and a thorough knowledge of the factors affecting the purity of water-supplies of different kinds his interpretation of the results obtained will not only have little practical value but may easily lead to very serious mistakes.

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* Ohlmüller, Arbeiten a. d. Kaiserl. Gesundheitsamte, 1892, 229 ; van Ermengem, Ann. de l'Inst. Pasteur, 1895, 673 ; Ohlmüller and Prall, *loc. cit.* 1902, 417 ; Proskauer and Schüder, Zeits. f. Hygiene and Infectionskrankheiten, **41**, 227, 243 ; **42**, 293 ; Calmette, Ann. de l'Inst. Pasteur, 1899, **13**, 344.

† In that epidemic there were as many deaths (119) from typhoid in six months as had occurred from the same cause during the previous eighteen years.

Thus, whilst the outstanding achievement in bacteriological water examination during the past 15 years is the systematisation of tests for detecting the presence in water of specific bacteria, especially *B. coli*, Streptococci, and the spores of *B. enteritidis sporogenes, the different possible sources of these bacteria, and their different hygienic significance according to source* render any hard and fast application of standards based on the presence of these microbes impossible without liability to serious errors of judgment being committed.

There is always a tendency to make idols of such standards and in my time I have seen many of them elevated on to pedestals only to be thrown down and replaced by others equally impotent, and I would caution the younger generation of bacteriologists against pinning their faith to the standard of *no typical B. coli. in* 100 c.c., which is attracting the largest number of devotees at the present day. Commonsense, independent judgment, experience, and a knowledge of all the circumstances must invariably be employed in interpreting the specific results of any water examination, whilst standards must only be used for general guidance and illustration.

Time has not permitted me to refer in detail to the spores of *B. enteritidis sporogenes** as an index of faecal contamination. I have, however, brought forward figures showing how much less abundant in faeces are these spores than is the *B. coli communis*. They do not, therefore, form such a delicate test for sewage contamination as does the *B. coli*, and their final identification is much less certain. The water-bacteriologist should, however, not neglect a search for these spores, but should regard the evidence which their presence or absence affords as supplementary to that which is furnished by the *B. coli* results.

In conclusion I should like to say a word with regard to the relative value of the chemical and bacteriological examination of water. At the present time it is often supposed that the chemical has been entirely superseded by the bacteriological examination, and that the chemical analysis of drinking water can be dispensed with. In reality the two methods of examination supplement each other. In those cases in which the source and general characters of a water supply are well known, the variations in purity from day to day or from week to week can undoubtedly be more satisfactorily watched by means of bacteriological examination. On the other hand, it is often desired by means of a single examination to ascertain the fitness or otherwise of a water for domestic use, and in such cases the omission of a chemical analysis may lead to an entirely erroneous opinion being formed. The ingredients detected by chemical analysis—organic matter, ammonia, nitrates, chlorides, etc.—on which an opinion as to hygienic quality is based, are all much more permanent and uniform features in the composition of the water than are the amount and the nature of the bacterial life which it may contain. The chemical analysis will, therefore, if skilfully interpreted, enable a much better idea of the potentiality of the water to be obtained than would be possible from a single bacteriological examination.

There are so many factors and considerations which have to be taken into account if an opinion of any real value as to the hygienic quality of water is to be formed, that no knowledge or information which can be gained either by chemical, or by bacteriological examination, or by inspection of source, or by any other available means whatsoever should be neglected, for in the bacteriology of water, indeed, the old maxim is true: "a little knowledge is dangerous."

Manchester Section.

Meeting held at Manchester on Friday, February 3rd, 1911.

MR. R. H. CLAYTON IN THE CHAIR.

CONTRIBUTION TO THE STUDY OF CHEMICAL DISINFECTANTS.

(SECOND PAPER.)

BY PROF. S. DELÉPINE, M.B., C.M., M.SC.

Comparison of the chief methods that have been used in the study of the action of chemical disinfectants.

The chief methods used in the testing of disinfectants may be summed up as follows:—

A.—*Action of various agents in solutions of various strengths upon organic fluids that had undergone spontaneous putrefaction or fermentation.*

This method had been used as far back as 1750 but Baxter was the first observer who conducted his experiments with sufficient care. I will, therefore, refer only to his work to indicate the nature of the method.

Dr. Baxter* describes his method as follows:—"A known quantity of the agent under investigation was added to a liquid teeming with septic microzymes. A test solution (Cohn's solution without calcium phosphate) previously sterilised by heat was then inoculated with a minute drop of the disinfected liquid. If it continued barren the successful destruction of the septic germs was proved, in the event of their incomplete destruction the test liquid was found crowded with their progeny."

The detailed description given by Dr. Baxter shows that he conducted his operations very much in the same way as we conduct them at the present time when we test disinfectants by the suspension method, but it is remarkable that so keen an observer should have stated that "the time during which the microzymes were exposed to the action of the disinfectant did not appear to matter." He, however, adds "intermixture having been thoroughly accomplished the work was done."

In all cases he kept his cultures under observation for one week. It will be noticed that Dr. Baxter tested the action of disinfectants upon microbes growing in a medium free from proteid matter (Cohn's fluid), and the results obtained by this cultivation method differed considerably from those he had obtained with vaccine lymph and other morbid products. He was surprised to find that "the microzymes which swarm in Cohn's solution" were completely deprived of reproductive power by:—

Chlorine, when in the proportion of 0·0008 per cent. or more, *i.e.*, a $\frac{1}{125000}$ dilution.

Potassium permanganate, when in the proportion of 0·007 per cent. or more, *i.e.*, a $\frac{1}{14285}$ dilution.

Sulphur dioxide when in the proportion of 0·123 per cent. or more, *i.e.*, a $\frac{1}{813}$ dilution.

Carbolic acid, when in the proportion of 1 per cent. or more, *i.e.*, a $\frac{1}{100}$ dilution.

Davaine's observations on the effects of dilution upon the resistance of anthrax blood to disinfection led Baxter to suspect that the differences between the results of his new and of his previous experiments were due to the absence or presence of albumen in the septic fluid to which the disinfectant had been added. To test this view he divided his cultures into two equal sets, to one of which he added 90 per cent. of egg albumen, and to the other 90 per cent. of water. He then tested as before the action of the disinfectants on the albuminous and non-albuminous cultures. His results may be tabulated as follows :—

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* Klein, Local Government Board; Medical Officer's Reports, 1897–8, 1898–9, 1901–2; Klein and Houston, ibid., 1899—1900; Hewlett, Trans. Jenner Institute, Series II, 70; Journ. State Medicine (1904), **12**, 108.

* Report of the medical officer of the Privy Council and Local Government Board. New Series, No. 1875. Appendix, pp. 216—256.

Disinfectant.	Quantity of disinfectant of material disinfected.	Albuminous culture.	Non-albuminous culture.
	per cent.		
Potassium permanganate ..	0·0125	turbid	clear
	0·00625	turbid	clear
	0·003125	turbid	clear
Chlorine	0·1954	clear*	clear*
	0·065	turbid	clear*
	0·033	turbid	clear*
	0·016	turbid	clear*
	0·008	turbid	clear*
	0·004	turbid	clear*
Carbolic acid	2·0	clear	clear
	1·0	clear	clear
	0·5	turbid	turbid
Sulphur dioxide	1·5	clear	clear
	0·77	clear	clear
	0·194	clear	clear

* N.B.—Free chlorine was found in all the disinfected cultures, but none was found in those which had not been disinfected.

It is interesting to note that quite recently it has been suggested that the use of pure cultures for the purpose of testing the action of disinfectants was not so essential as Koch had been inclined to believe. Several observers have latterly suggested that recent or dry faeces of average character might be substituted for pure cultures. This is clearly a reversal to one of the oldest methods.

B.—*Action of various agents upon specific morbid products, viz., vaccine lymph, exudation from cases of septic peritonitis, glanders pus, and blood from animals dead from anthrax ;* the effect of the exposure to disinfectants being tested by the *inoculation of suitable animals.*

The inoculation method has been used by several observers to ascertain the value of several chemical disinfectants. Among the first investigations of this kind Dr. Baxter's are the most important. His experiments and conclusions are recorded in his "Report of an Experimental Study of Certain Disinfectants,"* In this report due mention is made of the previous work of Mecklenburgh (Berlin. klin. Wochenschrift, 1869) regarding the action of chlorine, acetic acid and commercial carbolic acid upon vaccine lymph. Reference is also made to Dr. John Dougall's observations (Glasgow Medical J., 1872—1873), who found that vapours of carbolic acid, camphor, chloroform, sulphuric ether and iodine had little or no effect upon the activity of lymph, but that lymph acted upon by chlorine, sulphur dioxide, nitrous acid, glacial acetic acid and hydrochloric acid proved absolutely barren. Dr. Dougall noticed that lymph which had retained its infective power, was either alkaline or neutral, while in every case in which it had been successfully disinfected its reaction was decidedly acid.

Dr. Baxter's work was conducted with great care.

(1) *Experiments with vaccine lymph.*—In making comparative experiments he always made use of lymph obtained from one vaccinifer. "Four capillary tubes having been charged from one vaccinifer, the contents of two of these were diluted with an equal volume of ½ per cent. saline solution, the lymph contained in the other two was mixed with an equal volume of a disinfectant of known strength. The diluted and disinfected liquids were sealed up in separate tubes and employed for vaccinating healthy infants, the former being inoculated in three places on the left arm, while the latter was introduced in an equal number of places on the right arm."

Dr. Baxter describes at length how he measured the fluids so as to ensure that the quantities were exactly the same in all experiments. He tried upon the liquid lymph the action of a number of accurately prepared solutions of definite quantities of permanganate of potash, chlorine and carbolic acid. I may summarise his results as follows :—

	Proportion of disinfecting agent.	
	Rendering lymph inactive.	Not rendering lymph inactive.
	per cent.	per cent.
Chlorine	0·1623 *i.e.* $\frac{1}{612}$	0·1421 *i.e.* $\frac{1}{703}$
Potassium permanganate	0·50 $\frac{1}{200}$	0·1 $\frac{1}{1000}$
Carbolic acid	2·0 $\frac{1}{50}$	1·5 $\frac{1}{66}$

(2) *Experiments with exudation from cases of septic peritonitis.*—In this set of experiments Dr. Baxter employed exudation obtained from the peritoneum of guinea-pigs inoculated with material obtained from previous cases of septic peritonitis. From the description he gives there can be little doubt that the peritonitis was due to streptococcic infection, it is probable that in some cases he had to deal with mixed infection. In his description of the virus he clearly states that :—"It was always crowded with microzymes in the form of spheroids, dumb-bells, and necklaces, few or no rod-like bacteria were observed, and none of the organisms exhibited movements of translation." The quantity of infective material used was not always the same but "in each individual series of experiments, virus from the same source, diluted to the same extent, and in exactly the same dose, was injected into each of the animals. Further, in each series the virulence of the unmodified liquid was established by a control experiment." As in the experiments on vaccine lymph the infective material was mixed with various dilutions of the disinfectant tested, and the proportion of the disinfectant in the mixture accurately estimated. After an interval of from thirty minutes to three hours the mixtures were injected subcutaneously into guinea-pigs.

(3) *Experiments with glanders nodules.*—Glanders nodules obtained immediately after death from the lungs of a horse suffering from acute glanders were crushed in a mortar and mixed with saline solution. The emulsion so obtained after being filtered through muslin was used in the same way as the vaccine lymph or the septic exudation had been in the previous sets of experiments, with that difference, that in order to test the effects of disinfection, donkeys were inoculated with treated and untreated emulsion.

Since 1881, under the influence of Koch's work, the use of pure cultures has been adopted almost by every worker, and although this has not altered materially the views held regarding the relative value of disinfectants used up to 1881, there can be no doubt as to the advantage of using pure cultures when accurate comparisons have to be made.

I will refer only to some of the methods which have been introduced since 1881.

C.—*Koch's method.**—The essential features of the method adopted by Koch are as follows :—He employed *small quantities of pure cultures* of test organisms and *large quantities of the disinfecting fluid* the action of which was tested after various intervals. Having recently introduced solid media he was under the impression that the use of these solid media was almost essential when one wished to work with pure cultures. His procedure was generally as follows :—He prepared cultures of *B. anthracis* which he incubated for three days in order to obtain spores, he then impregnated short silk threads with these spores, dried the threads, placed them in disinfecting solutions of known strength from which the threads were removed after various intervals and sometimes transferred directly to some solid medium, or, when he thought that minute traces of disinfectant might hinder the growth of the organism he washed the threads with water or some other indifferent fluid before transferring them to the solid culture medium.

Koch used also as test organisms non-sporing anthrax bacilli in the blood of an animal dying of anthrax, the bacillus prodigiosus and the bacillus pyocyaneus. These two chromogenic organisms he generally employed in the form of dried potato cultures.

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* *Loc. cit.*

* Mittheil. a. d. Kaiserl. Gesundheitsamte, 1. 1881.

From this description it will be seen that it is not accurate to give Koch's name to the "Thread Method" as at present used. The thread was obviously a matter of quite secondary importance to him.

Fraenkel* and Behring†, instead of transferring the infected threads (which had been exposed to the action of disinfectants) to solid media, as Koch had done, transferred them to peptone bouillon, being rightly of opinion that the bacteria often carried enough disinfectant with them even after washing to prevent their growth on solid media.

Another modification of Koch's method was that introduced by Krönig and Paul‡ in 1897. Their method is often known as the "garnet method." They prepared agar cultures of *anthrax bacilli* which they incubated for three days, in order to obtain spores, they made emulsions of these spores with water, and filtered this emulsion. Instead of threads they used sterilised small Bohemian garnets of uniform size which were shaken in the filtered emulsion from which they were removed and rapidly dried. These observers also loaded garnets in the same way with the *Staphylococcus pyogenes aureus*. A certain number of these loaded garnets were then immersed in the disinfecting solutions which had to be tested. After exposures of definite durations they were washed in water and then transferred to some neutralising reagent for the purpose of removing or neutralising the last traces of the disinfectant. After this the garnets were washed again in sterile water, then transferred to a measured small quantity of water in which they were shaken to separate as far as possible the bacteria from the garnets, the contents of the tubes were then mixed with melted agar at 42° C. with which plates were made. The colonies growing on agar were counted after incubation for one, two and three days respectively. The number of surviving bacteria was taken to indicate the amount of action which had taken place. It will be noticed that Krönig and Paul used bacteria obtained from agar cultures and suspended in water to infect their garnets. The bacteria were therefore practically free from extraneous organic matter.

From a theoretical point of view their observations are of great interest and led them to compare the action of disinfectants upon bacteria to a chemical reaction between the bacterial protoplasm and the disinfectant. The rate of disinfection would, therefore, like chemical reactions, be influenced by time of contact, temperature, concentration and composition of the reacting substances. In the case of solutions of metallic salts, and more especially of salts of mercury, the degree of dissociation appeared to be a matter of importance. The disinfecting power of metallic salts would depend on the specific influence of the metallic ion, but it would also be influenced, though to a lesser extent by the other ions. It will be noticed that these observers assumed that all the bacteria of the same species used by them had the same resistance to disinfectants. This is an unjustifiable assumption, more specially in the case of the anthrax cultures which they used and which were only three days old. Some subsequent workers, who have followed Krönig and Paul in this line of inquiry have made the same mistake.

It is obvious that in researches of this kind it is of the utmost importance to employ reacting substances as free as possible from adventitious products, hence the necessity of using washed or naked bacteria.

Sternberg's observations.—Sternberg, who had since the year 1879, paid special attention to methods of disinfection, and published in 1888 an important report upon disinfection and disinfectants, gives in his classical manual of bacteriology§ a general review of the subject. The method he recommends for testing disinfectants resembles closely that used by Dr. Baxter, with that difference that Sternberg employed pure cultures, and paid more special attention to the duration of exposure, and to several other factors influencing the action of disinfectants.

He describes as follows the method which he adopted in 1880:—

"The time has been constant—usually two hours—and the object has been to find the minimum amount of various chemical agents which would destroy the test organism in this time. . . . A certain quantity of a recent culture, usually 5 c.cm., has been mixed with an equal quantity of a standard solution of the germicidal agent. Thus 5 c.cm. of a 1 to 200 solution of carbolic acid would be added to 5 c.cm. of a recent culture of the typhoid bacillus, for example, and after two hours' contact one or two loopfuls would be introduced into a suitable nutrient medium to test the question of disinfection. In the case in question the results obtained would be set down as the action of carbolic acid in the proportion of 1 to 400."

Sternberg prefers the cultivation method to the inoculation of animals, he also states clearly the conditions which should be observed when experiments are made to test the disinfecting value of various agents: (*a*) the difference in resisting power of different species of bacteria; (*b*) the presence or absence of spores; (*c*) the number of bacteria to be destroyed; (*d*) the nature and quantity of associated material; (*e*) the time of exposure; (*f*) the temperature at which the exposure is made; (*g*) the degree of dilution of the disinfecting agent.

Wynter Blyth, in* 1886, *replaced ordinary culture by emulsions of bacteria made with distilled water,* thus reducing the amount of associated organic matter to a minimum. Measured quantities of such emulsions were then added to known quantities of disinfecting solution of known strength, and after a given time a drop of the mixture was transferred to melted gelatine. The drop method was in 1903 modified by Rideal and Walker,† who substituted to nutrient gelatine, peptone bouillon of stated composition and reaction, and indicated an arrangement for making parallel series of exposures of the *Bacillus typhosus* to the action of various dilutions of two disinfectants, one of which (carbolic acid) was taken as standard.

Rideal and Walker's method as described by these two chemists in their original communication is conducted as follows:—"To 5 c.c. of a particular dilution of the disinfectant in sterilised water add 5 drops of a 24 hours blood-heat culture of the organism in broth, shake and take subcultures every 2½ minutes up to 15 minutes. Incubate these subcultures for at least 48 hours at 37° C. Allowing 30 seconds for each act of medication and the same time for making each subculture, four different dilutions of the disinfectant under examination, together with one standard control may be tested against the same culture, under conditions which make the results strictly comparable. If preferred, the field may be extended and divided into intervals of five minutes, but we contend that no table is complete which does not show a positive result in the first column, and a negative result in the last. The *strength of efficiency of the disinfectant* is expressed in multiples of carbolic acid performing the same work, *i.e.*, when we have obtained a dilution of the disinfectant which does the same work as the carbolic acid dilutions, we divide the former by the latter, and so obtain a ratio which which we call the "Carbolic acid co-efficient."

It will be noticed that Wynter Blyth's method is to Sternberg's method what Krönig and Paul's method is to Koch's method. In the methods used by pathologists and bacteriologists the media in which the bacteria have developed are allowed a share in the tests. The methods proposed by the chemists (viz., Krönig and Paul, Wynter Blyth, Rideal and Walker) exclude as far as is possible this associated material. Rideal and Walker do not remove associated matter as thoroughly as W. Blyth or Krönig and Paul, but they reduce it so considerably as to deprive it of its importance. Biologists would hesitate in accepting as *normal* bacteria suddenly transformed from an organic medium to distilled water for this induces osmotic changes which sometimes affect cellular contents very considerably. This however is not a serious objection when the tests are used for other purposes than the hygienic purpose.

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*Fraenkel, Zeits. f. Hygiene, vol. 6, 1889.

†Behring, Zeits. f. Hygiene, vol. 9, 1890.

‡Krönig and Paul, Zeits. f. Hygiene, vol. 25, p. 1, 1897.

§G. M. Sternberg, "A Manual of Bacteriology," New York, 1893, p. 156.

*Blyth, Proc. Royal Soc., 1886.

†Rideal and Walker, "The Standardization of Disinfectants," J. Royal Sanit. Inst., vol. 24, 1903.

When I began to study the disinfection problem in 1889 several of the publications to which I have alluded had not yet appeared. I was guided chiefly by Baxter, Koch, and Jalan de la Croix's work. One of the first practical problems I had to deal with early in 1892 was that of the disinfection of rooms infected by tuberculous patients. The question was therefore to test the value of disinfectants that were available for the disinfection of dried tuberculous sputa. This naturally led me to use dry tuberculous sputa and dry cultures of tubercle bacilli as test objects. For convenience sake I dried measured quantities of sputa and cultures on sterilised paper, equal quantities of these test papers were then exposed to the action of various disinfectants for definite periods at definite temperatures, and the action of the disinfectants was tested by inoculation of guinea pigs. Dried cultures or organisms growing readily in ordinary culture media were also employed. But with these organisms inoculation of animals were not necessary, and I tested the effects of the exposure by transferring the test objects (after removing as far as possible the unused disinfectant) to peptone bouillon. I was at the same time engaged in testing steam produced in various ways as a disinfecting agent, and found it a great advantage to employ a method, such as the thread method, which was capable of general application in comparative studies.

In making these experiments I used whenever possible fluid cultures as well as dried cultures, but the latter were the only ones that could be employed in all my series of comparative experiments.

I also found that although paper was most suitable for the purpose of preparing test objects with morbid products, threads were more convenient when small measured quantities of emulsions of pure cultures had to be used. I published very few of my results in these early days, and the first papers were rather summaries of results than discussions of methods,* they are, however, sufficient to show that the factors in the problem have received my attention for many years. Full accounts of my methods were given at the time in my reports to several authorities and firms but for various reasons these full reports were not published.

I will now describe briefly the two methods which I have generally used, and upon which I place the greatest reliance, these I call for the sake of convenience the suspension and the thread methods. In my first paper I have given tables of results obtained by these two methods.

1. *The suspension method.*—This resembles closely some of the methods used by Baxter and by Sternberg.

The test bacteria are grown in peptone bouillon prepared according to the formula originally given by Loeffler. During the first few years the reaction of the culture medium was made just alkaline to litmus by the addition of carbonate of sodium. Soon after the publication of Schultz's paper (1891) I adopted his method of titration of media and since then have used media having a reaction of + 5 according to the notation at present in use.

The duration and temperature of incubation was determined by the organism used, thus the *Bacillus Typhosus* and *Bacillus coli communis* were usually incubated at 36° or 37° C. for 24 h. and in some cases for 48 h.

The *Staphylococcus pyogenes aureus*, which grows more slowly, was always kept for 48 h. at that temperature. The *Baccillus pestis*, which I used in later experiments, was grown for 3 days at a temperature of 30° C.

To obtain anthrax spores practically free from nonsporing bacilli, the cultures were kept for 7 days at least at 37° C. It is not easy to obtain in a short time anthrax cultures entirely free from non-sporing bacilli. I may say at once that cultures used for the preparation of threads were obtained under the same conditions, with the difference that the bouillon was jellyfied by the addition of gelose (agar). The characters of the organism were tested from time to time.

Cultures which did not yield organisms having normal morphological, cultural, and physiological characters were rejected. The resistance of the organisms to heat was also frequently tested, as well as their resistance to some of the best studied disinfectants. Phenol was almost always used as a control.

Having obtained pure, typical cultures of a definite age, these are used to test the disinfectants in the following manner :—

A. Dilutions of the disinfectant are accurately prepared. B. 9 c.c. of each of the dilutions are accurately measured in a series of sterilised capped glass capsules of equal capacity and diameter. C. 1 c.c. of the test culture is added to the contents of the capsule by means of a pipette with a long stem, the disinfectant and culture are thoroughly mixed by shaking. D. After an interval of time, *the same for all the dilutions*, 2 loopfuls of the thoroughly shaken mixture are removed and transferred to corresponding glass capped tubes containing 6 c.c. each of peptone bouillon (+5). E. The bouillon tubes are then incubated at the same temperature as that at which the original cultures had been incubated for 48 hours. F. At the end of 24 hours and of 48 hours the tubes are examined for evidence of growth. F. When the growth is not typical, or the sterility of some tubes appears doubtful, plate cultures are made with part of the contents of the doubtful tubes, this, however, is seldom necessary. I found it desirable originally to apply this control when I tested the reliability of the method. I used also to keep the culture tubes under observation for 2 weeks.

It is best to adopt a constant exposure time which is neither too short, because this tends to cause experimental errors, nor too long to avoid unnecessary waste of time and the collection of results which might not have great practical value. Exposures of 10 minutes, 20 minutes, and 30 minutes are all suitable, but in order to obtain with various organisms lethal dilutions that are easily comparable, it is best to resort to short exposures of say, 5 to 10 minutes in the case of bacteria that are rapidly killed, *e.g.*, the *Bacillus pestis*, and proportionally longer exposures for bacteria like the *Bacillus typhosus*, *B. coli communis*, and *Staphylococcus pyogenes aureus* that are more resistant, 20 or 30 minutes are suitable for the latter organisms.

By means of this method it is possible to compare accurately the relative value of any two disinfectants, by carrying two series of tests at the same time, the exposures being of the same duration.

I have, as far as possible, always used cultures the resistance of which was normal, and based my estimate of the germicidal power upon series of experiments, from which maxima, minima, and averages could be ascertained.

The amount of bacilli may be altered by diluting the original culture with peptone bouillon.

The amount of organic matter may be reduced by diluting the original culture with water, the bacteria may even be washed in water before the test suspension is prepared, this is done whenever one wishes to employ naked bacteria.

Various products may also be added to the cultures before the test suspensions are prepared.

In every case it is easy to estimate accurately the proportion of bacteria, of associated matter, and of disinfectant.

In the apparatus which I employ I have rigidly excluded cotton wool, and all my tubes or capsules are covered with glass caps. As far as possible the apparatus is made of Jena or resistance glass.

All the experiments should be conducted at temperatures not falling below 15°5 and preferably 18° C., but the influence of slight variations of temperature is so marked that I have thought it advisable to have in my

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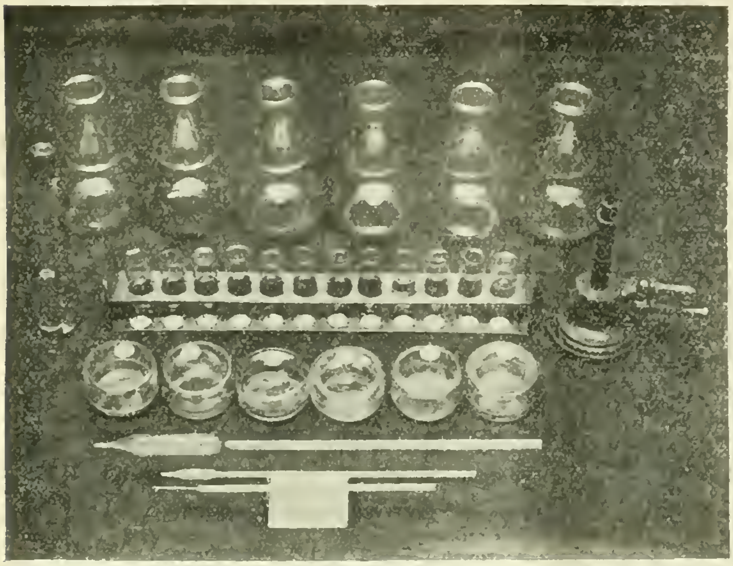
* Brit. Med. Journal, Nov., 1893, and Feb., 1895, Medical Chronicle, May, 1894, and Sept., 1895.



Flasks with glass caps in which dilutions have been prepared

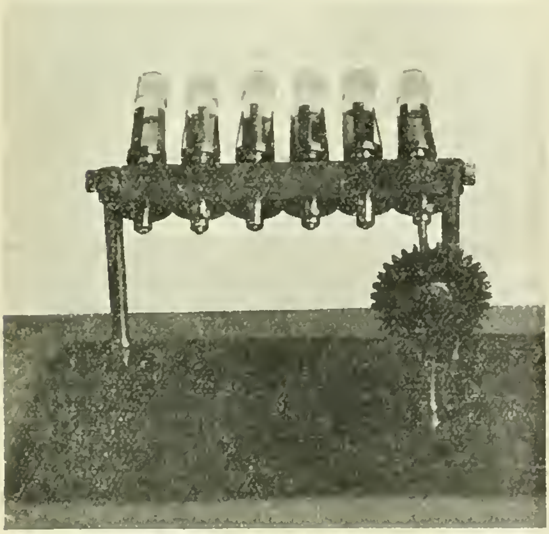
Culture tubes with glass caps in which the bacteria are membrated after treatment.

Covered capsules containing dilution for treatment of test bacteria.

Pipettes and platinum loop. The large pipette is used for measuring the dilutions, the small pipette to measure cultures.

Apparatus used for testing disinfectants by the suspension method.

laboratory, a small internal double-walled chamber kept by automatic regulation at a temperature of 19° to 20° C. for work on disinfectants. All the apparatus and solutions kept in that chamber acquire a uniform temperature. To ensure thorough admixture I use an apparatus in which the experimental tubes, placed in an oblique position, rotate upon their axis. This allows of all the operations being carried out while the fluids are in motion.



Rotating tubes used for the purpose of conducting experiments on disinfectants while the fluids are in a state of constant agitation (the motor is not shown). The tubes may be easily opened and closed while the fluids are in motion.

2. *The Thread Method.*—I have described this method fully in the Journal of the Royal Sanitary Institute (Vol. 28, 1907). The chief difference between the thread method and the suspension method is in the state of the test bacteria.

I will describe the method as carried out when the *Bacillus coli communis* or the *Bacillus typhosus* is used as the test microbe.

A sloped agar tube is inseminated with 1 loopful of an actively growing culture of bacillus giving all the reactions characteristic of the organism. The loopful of material is spread all over the surface of the agar. The culture is incubated for 48 hours at a temperature of 37° C.

At the end of this time the surface of the agar should be covered with an abundant growth; 2 c.c. of bouillon are poured over the culture, and with a sterilised platinum needle the growth is scraped off carefully (without damaging the surface of the medium) and mixed with the bouillon. The tube is then shaken until a homogeneous emulsion is produced. (Good cultures of these bacilli should not produce flocculent emulsions).

A stock of closely twisted silk threads*, a little less than

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* When certain disinfectants, *e.g.*, strong solutions of chlorinated lime, are tested it is necessary to use cotton or flax thread, but, for general purposes, silk is preferable.

At first I employed loosely twisted surgical silk, but of late years I have found closely twisted silk more convenient. Lister's super quality No. 12 white buttonhole silk is very suitable as it contains very little extraneous matter, being of good quality; the thread is composed of 3 closely twisted strands, its diameter is about 0·4 millimetre, and 1 metre of it thoroughly dried weighs on an average 0·072 grm.

Originally I submitted the silk to a thorough washing in dilute hydrochloric acid, followed by a second washing in dilute caustic soda and a final washing in distilled water until all trace of alkalinity had disappeared. Afterwards I treated the silk by a mixture of hot alcohol and ether, after which it was washed in distilled water. Further experience showed me that these precautions were unnecessary. The threads prepared with silk washed in acid and alkaline solutions, behaved exactly like those which had been simply sterilised by steam. Those washed with alcohol and ether seemed to be a little more resistant than those not so treated, but the effect was very slight and doubtful. The silk which I have selected is almost free from adventitious products and is very pure. Two specimens of it examined for me by Mr. H. Heap gave the following results :—

		grm.		per cent.
A. Weight of 1 metre new reel of Lister silk	before drying	0·0990	moisture	5·752
			inorganic ash	0·121
	after drying at 100° C.	0·0933	volatile combustible matter	94·127
B. Weight of 1 metre old reel of Lister silk (5 years old)	before drying	0·0700	moisture	5·428
			inorganic ash	0·114
	after drying at 100° C.	0·0662	volatile combustible matter	94·458

½ millimetre in diameter and 2 cm. long having previously been prepared, 50 of these threads are placed in a small covered capsule about 3 cm. in diameter. They are then sterilised by saturated steam at 115° C. for ½ hour. When the capsule is cool again, 2 c.c. of the freshly prepared emulsion are poured into it and the threads are stirred thoroughly with a sterilised needle until they are all equally soaked. After a contact of ½ hour duration the threads are removed *one by one* by means of sterilised *fine pointed forceps* and arranged in parallel rows on the bottom of shallow sterilised glass capsule. (A Petri dish is very convenient). The threads must not touch each other and must be moved about as little as possible.

The threads are then dried rapidly at a temperature of 37° C. The drying should be completed in less than 3 hours. (The capsule must remain covered, but the lid should be raised slightly so as to allow evaporation.)

When the threads are dry the capsule is closed again and transferred to a dark cupboard at the ordinary temperature of a living room. During all the previous operations exposure to direct sunlight and even to strong diffuse sunlight must be avoided.[*]

Ten c.c. of each of the dilutions[†] of the disinfectant to be tested are poured into glass capsules 4 to 4½ cm. in diameter and of about 20 c.c. capacity. (The depth of the fluid should be the same in each capsule.) Two impregnated threads are then placed in each dilution. A series of dilutions can thus be infected successively at intervals of ½ minute. Each thread is picked from the capsule in which it has been dried, by means of sterilised fine[‡] pointed forceps and waved three or four times in the disinfectant before being allowed to sink on it.

After two threads have been added to each of the disinfecting solutions the glass capsules containing them should be slightly shaken two or three times, this is specially important in the case of emulsions which have a tendency to produce a sediment. It is preferable to keep the fluid constantly in motion by using the apparatus which I have previously alluded to.

If phenol is used as standard of comparison, and the strongest solution of phenol is of the strength of 1 in 50, the following times are the shortest that can conveniently be adopted:—5 minutes for the *Bacillus pestis*, 10 to 20 minutes for the *Bacillus typhosus*, 20 to 30 minutes for the *Bacillus coli communis* and the *Staphylococcus pyogenes aureus*.

In current work I prefer exposures of not less than 20 minutes. Exposures of ½ hour or 1 hour's duration have the advantage of giving more steady results. The threads are exposed to each dilution for an equal length of time. In other words, the time is constant and only the dilution is variable.

Sporing bacteria cannot be conveniently used when *phenol at ordinary temperature* is taken as standard. In my routine work I have used chiefly the *Bacillus coli*, frequently also the *Bacillus typhosus*. Other organisms have been used more rarely.

Experiments should be conducted at temperatures ranging between 15·5° C. and 18° C. (60° F. to 65° F.), which are easily obtainable in living rooms. The effects of a marked rise of temperature are greater in the case of some disinfectants than in that of others and comparative experiments carried at various temperatures do not give comparable results. It is for this reason that I prefer working in a room kept at a nearly constant temperature of 20° C.

To arrest the action of the disinfectant as rapidly as possible and at the same time wash the threads, *i.e.* free them from the disinfectant, a number of covered glass capsules similar to those containing the disinfecting solution are used, in each of which 10 c.c. of sterilised water have been measured. At the end of the exposure each thread is taken separately by means of sterilised fine pointed forceps out of the disinfectant and transferred to the corresponding capsule of distilled water; the threads are waved two or three times in the water before being deposited. The threads are left for 10 minutes in the water, during which time the capsule is shaken from time to time. When the use of neutralising agents such as sulphuretted hydrogen solution, alkaline solutions, alcohol, etc., is needed, the threads are treated by those solutions, according to the same method and washed in water afterwards.[*]

At the end of 10 minutes the threads are transferred from the water to capped tubes containing 5 or 6 c.c. of peptone bouillon.

The loaded tubes of bouillon are then incubated at 37° C. They are examined at the end of 24 hours and again at the end of 48 hours and any evidence of growth noted each time.

Each experiment is controlled by means of threads belonging to the same batch as that used for testing. These threads are left in 10 c.c. of sterilised water for a period of time equal to that of the exposure plus that of the washing before they are transferred to the bouillon. When a neutralising reagent is used the control threads are also treated with it like the threads that have been exposed to the disinfectant.

When in a series of 6 or 12 tubes corresponding to dilutions of gradually increasing strength one finds among the sterile tubes a stray tube showing some growth or vice versa, among the non-sterile tubes, some showing no evidence of growth, some error must have been committed.

In a series of several hundred sets of experiments I have not observed such accidents in more than 2 or 3 sets out of each hundred sets.

With reasonable care it is easy to conduct a very large number of experiments without accidental contamination, *provided covered vessels are invariably used.*

Ordinary culture tubes and capsules are quite sufficient for the purposes of such experiments, but to avoid waste of time and confusion leading to accidents I have found it convenient to use capsules, capped tubes, and pipettes of the shape shown in the accompanying photographs. Vessels closed with cotton plugs are objectionable on

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[*] The threads so prepared retain a fairly constant amount of dry bacilli, the following weighings taken during the course of 1 year show the amount of variation:—

		grm.
Bacillus coli communis ...... (2 days old culture)	maximum weight of culture retained....	0·00032
	minimum	0·00020
Bacillus typhosus	maximum	0·00033
(2 days old culture)	minimum	0·00025
Bacillus anthracis sporing .... (7 days old culture)	....	0·00038
Bacillus pestis................ (3 days old culture)	....	0·00043
Weight of each 2 cm. long thread,	maximum (1910)	0·00187
without bacteria	minimum (1906)	0·00140

These threads offer the maximum degree of resistance to disinfection during the first 2 or 3 days, after drying. Their resistance diminishes very slowly and gradually during the following months. The *Bacillus typhosus* becomes less resistant more rapidly than the other microbes (see first part of paper).

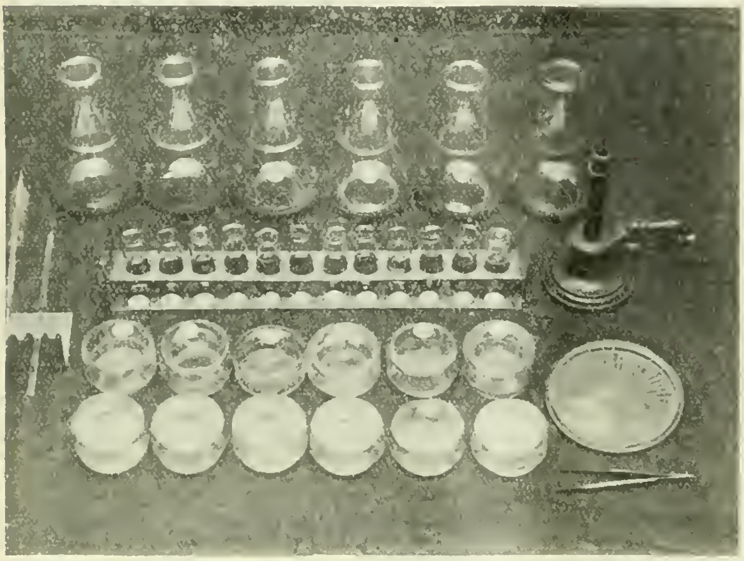
[†] The preparation of the dilutions is, in this, as in all other methods, a matter of the utmost importance. The original material used in the preparation of the dilutions is weighed and not measured by volume. A first dilution of the strength of 1/50 or 1/100 being accurately prepared by weight, the higher dilutions may be prepared from it by volume without material error. In estimating the relative cost of various disinfectants the weights may afterwards be reduced to volumes, when necessary. The chances of serious error in the preparation of the solutions are greatly diminished when fairly large quantities are made. In the case of products such as phenol, chlorinated lime, etc., the solutions should be titrated. The remark as to weighing applies to commercial products which cannot be accurately titrated.

[‡] The flame used for sterilising the forceps must be placed sufficiently far from the row of capsules to prevent some of the capsules being heated. A a distance of 8 or 10 inches a Bunsen) burner may cause a material rise of temperature (up to 5° C. in 20 minutes.

[*] When high dilutions are tested, the time of exposure must be increased. No investigation can be considered complete, unless the time which dilutions in practical use take to kill the test microbe is ascertained. For practical purposes dilutions which are germicidal in a fairly short time are of little importance. (Disinfectants when diluted beyond a certain point cease to have any lethal action within prolonged periods of time. In my opinion a disinfecting solution which has no material effect within 1 hour is of very little use for most purposes. It is very important therefore to determine what degree of dilution will render a disinfectant useless within a maximum standard of time—say 1 or 2 hours, Longer exposures sometimes yield interesting experimental results (see first paper).

account of the fact that it is difficult to prevent some of the cotton fibres falling into the contents of the flasks or tubes.

Culture tube racks upon which notes can be entered opposite each tube are of great convenience and reduce the time needed to keep accurate records of the work.



Flasks containing the dilutions in bulk.

Tubes in which the treated threads are incubated.

Capsules in which threads are washed after exposure.

Capsules in which the threads are exposed to the action of various dilutions. (Dish containing test threads on the right.)

Apparatus used for testing disinfectants by the thread method.

All the vessels employed for making dilutions, storing sterilised water or culture media should be of glass, such as the Jena or Resistance glass, the solubility of which is very slight.

This description of my thread method was prepared at the request of the Committee appointed by the Royal Sanitary Institute, and it is *for that reason that reference was made to the way in which it can be used for the purpose of comparing disinfectants with carbolic acid taken as a standard.* It has not, however, been my practice to record my results by means of coefficients as Rideal and Walker have done. I have generally simply stated the quantity of disinfectant which in a certain time, at a certain temperature and under definite conditions, was capable of causing the death of test bacteria prepared and treated in the ways which I have described, and the resistance of which to other disinfectants had been ascertained and proved to be normal. The power of each disinfectant was estimated, not by single tests, but by series of tests. It is, therefore, not correct to say, as has been said, that the thread method as used by me is a modification of the Rideal-Walker's method. There would be perhaps more justification for a statement having the opposite meaning, for results obtained by my method had been published several years before the drop method was introduced. This opinion, would, however, be also incorrect, for there is an essential difference between the two methods apart from that due to the amount of organic matter.

In the *thread as well as in the suspension method used by me* there is in each set of tests *only one variant*, which is the strength of the disinfecting solution, all the other factors including the time of exposure are rendered as constant as possible.

In the *Rideal-Walker method two variants are essential*, *viz.*, degree of dilution and time of exposure. It might of course be said that in the drop method a series of five suspension tests are carried out simultaneously, but this would not be a true interpretation of the purpose of the method because the coefficient is based upon a comparison of *any one of a series* of dilutions of the disinfectant tested with any dilution of carbolic acid that produces the same effect in the same time within a range of 15 minutes.

I think that the complication introduced by Rideal and Walker is unnecessary, and that the suspension method is preferable even for the purpose of obtaining a ratio or coefficient when a numerical estimate of this kind is wanted. All that is needed, to make the suspension method suitable for standardising purposes, is a general agreement among bacteriologists and chemists as to the adoption of easily cultivated test organisms that can be kept in a state of fairly constant resistance, the conditions under which the cultures are prepared, the quantity of bacteria and nature of the fluid used to make the suspension, the amount of suspension, the amount of disinfectant, the temperature and the duration of exposure. What I say of the suspension method is equally true of the thread method, with that exception that the thread method involves the addition of a definite amount of proteid matter (the fibroin of silk and some bacterial products clinging to the unwashed bacteria) to a definite amount of dry bacteria. If one desires to employ bacteria free from associated organic matter, the suspension method is more suitable, because the bacterial suspension can easily be made with washed bacteria. Garnets or small rods of glass may be used instead of silk, to carry washed bacteria, but they are inconvenient. Both the suspension and the thread methods are well adapted for the purpose of studying the action of associated matter, as I have shown in the first part of my paper.

The thread method is the only one that can conveniently be used to test practically the value of disinfectants intended for the disinfection of surfaces or of articles contaminated with dry infectious products. Finally, the thread method is the one indicated for the study of the action of gases, vapours and sprayed fluids when the primary association of water with the test organism would vitiate the results, by introducing an element which is not present in actual practice.

These are among the reasons why in my opinion the thread method is preferable to others for general purposes.

Next to the thread method I consider the suspension method as described by Sternberg or as described in this paper as the most generally useful.

The Rideal-Walker method has no marked advantage over the suspension method and has the disadvantage of favouring the occurrence of experimental errors. I do not wish to say that this method is necessarily attended with experimental error, but I contend that few observers are able to obtain invariably by that method consistent results and I do not think that they can be blamed for this. I believe that very short exposures do not yield satisfactory results, and considerably increase the risks of experimental error. Longer exposures of, say, 20 minutes to half an hour or 1 hour duration can be conducted more accurately and should be preferred. I do not think that the simultaneous exposure of the test organism to phenol and to the product investigated, is a guarantee that the results obtained one day will be comparable with the results obtained another day if the resistance of the test organism to phenol is allowed to vary as much as may be the case with cultures of the *Bacillus typhosus* or of the *Bacillus coli*, when their resistance is not kept constant by careful cultivation and selection of suitable strains and sub-cultures. Cultures of variable resistance should not be used even for the purpose of obtaining the Rideal-Walker carbolic coefficient, because the ratios between the lower and the higher dilutions that are compared together, alter considerably when the lower lethal dilutions are not kept within very narrow limits.

Objects of standardisation of disinfectants.

The standardisation of disinfectants may be considered from a purely chemical or from a hygienic point of view.

I will consider first the *chemical aspect of the question.*

1. An investigator while engaged in studying the *properties of various derivatives of some chemical product*, may wish to ascertain exactly how they differ in their disinfecting power. If all these products have a fairly comparable action upon proteid or other organic substances usually associated with bacteria, it may be a matter of convenience to employ washed or naked bacteria for these comparative tests.

For the purpose of ascertaining whether the bacteria have a normal resistance it is convenient to use a comparatively stable disinfectant—such as carbolic acid, to test them. It is also convenient to express the results of comparative tests by a figure or "coefficient" indicating the relative power of the product tested and of phenol upon the test bacterium. It is obvious that it is desirable in work of this kind to exclude every element that would unnecessarily complicate the test.

2. A chemist may be asked to test from time to time samples of a disinfectant in order to ascertain whether *various consignments have the same value.* Many of the disinfectants at present on the market are of such a nature that chemical analysis does not yield the information wanted, because the disinfecting value is often due as much to the physical state of certain products as upon their chemical composition. Then also the exact composition of the active elements of a certain mixture not being accurately known it is impossible to rely upon ordinary methods of chemical analysis or assay.

In such cases the biological method is not only useful but probably the only one available.

The *biological tests take here the place of a chemical assay*, the value of the sample being ascertained simply by its effect upon a definite quantity of bacteria.

It is for such purposes that the Rideal-Walker method is specially applicable, but in my opinion the suspension method is preferable.

The results of the tests may be conveniently expressed by a figure indicating the relative value of the disinfectant and of carbolic acid, this figure may be called a coefficient if it is understood that the word means nothing more than what I have just explained, the word "ratio" would be less misleading.

I must now refer to the *hygienic point of view.*

3. When a hygienist compares various disinfectants what he wishes to know is how these various disinfectants would act if *used for the purpose of preventing infection.*

I have brought before you the results obtained as far back as 1875 by Baxter, results which have been confirmed by many observers including myself. These results show that when bacteria are in presence of various organic and inorganic substances, they are fully acted upon by certain disinfectants only after a large proportion of the disinfectant has been used up in its action upon the associated dead matter. In other words the amount of disinfectant must be in excess of what may be taken up by the dead matter. In addition to this there are certain disinfectants which form by combination with proteid matter insoluble products which for a time prevent their rapid diffusion.

It is therefore *as important to estimate the amount of disinfectant which is thrown out of action by the matter associated with bacteria* in products that have to be disinfected *as to estimate the action of the disinfectant upon the bacteria themselves.*

The action of the disinfectant upon various kinds of associated matter may be tested separately so as to find how much of a disinfectant is used up by a definite quantity of each kind of associated matter, and in practice this should be added to the amount necessary to obtain disinfection of naked bacteria.

A simpler way is to add to definite quantities of the test bacteria definite quantities of the associated products which are capable of entering into combination with or to act otherwise upon the various types of disinfectants. Serum or egg albumen, faeces, sputa are the products which are most commonly associated with bacteria and the presence of which affects most unequally various chemical products. In view of the ways in which disinfectants are sometimes used it would also be well to ascertain the effects of admixture with hard water, sea water, soapy and fatty-slop water. These products should therefore have a place in any method of testing disinfectants for hygienic purposes.

This however is not all for the way in which the disinfectant has to be used in practice must also be considered. To make clear what I mean I will give only one example. When we take a solution of chlorinated lime, giving a value of 3 per cent. available chlorine, and apply it as a thin layer upon a board or wall covered with dry blood, considerable effervescence takes place and a strong smell of hypochlorous acid and other oxychlorine products is noticeable. If instead of spreading the blood on a surface, it is introduced in bulk into a vessel full of chlorinated lime of the same strength gas is also evolved but this gas has very little smell and consists chiefly of nitrogen.

Conclusions.

In conclusion I submit :—

1. That for the purpose of estimating the relative bactericidal powers of various substances without consideration of their actual value in hygienic practice, the use of naked bacteria is sometimes advantageous.

2. That the methods known as the drop (or Rideal and Walker method) and the suspension methods are suitable for the purpose of testing this bactericidal value, and that in my opinion the suspension method is the better of the two.

3. That the results obtained by these methods may be expressed by a figure indicating the bactericidal value of a disinfectant under investigation, carbolic acid being taken as a standard, but that this figure indicates only a ratio obtained under conditions not necessarily occurring in practice and that the term "coefficient" as applied to this ratio should not be understood to indicate the hygienic value.

4. That the hygienic value of a disinfectant can be ascertained only by means of a series of tests in which the conditions occurring in practice are represented as closely as is possible.

DISCUSSION.

The CHAIRMAN said that manufacturers of any trade which was based upon incomplete data must of necessity be unsatisfactory to the manufacturer. The Rideal-Walker test was the first standard which they had had to work upon. Disinfectants, however, should not be sold on one test alone ; the presence of organic matter should be taken into consideration. A committee of chemists and bacteriologists should be able to evolve a series of tests which would cover a great many of the points brought forward. In former times carbolic acid was regarded as the principal disinfectant and cresylic acid was more or less neglected. Now cresylic acid was being sold in some cases at a higher price.

Mr. W. H. COLEMAN asked if it were possible to distinguish the effect of disinfectants on varying organisms. Were they to take it that a disinfectant with a certain value against the *bacillus typhosus* had a corresponding value against the *bacillus coli*, the bacillus of anthrax or the germs of diphtheria ? There was a great danger in laying down an arbitrary test for a disinfectant; the public were liable to think that a certain disinfectant was best in all cases. He trusted they would receive a good deal more information on this point from biologists.

Mr. William Thomson said that it had been stated that potassium permanganate had a greater effect in sterilising lymph than carbolic acid. His experience had been that ordinary putrefactive bacteria swam about and appeared quite happy in a strongly coloured solution of potassium permanganate, whereas a very minute quantity of carbolic acid would arrest their movements immediately. Some disinfectants coagulated part of the medium which contained the bacilli; the action of these might be largely mechanical. When potassium permanganate was added to lymph it became reduced, and the manganese dioxide precipitated might possibly entangle itself with the bacteria, and, as it were, anchor them, and thus apparently act as a steriliser. Had Prof. Delépine made experiments with aluminium hydroxide to find if the bacilli became entangled with the alumina precipitate, so that it might act in the same way as an antiseptic or disinfectant? It seemed remarkable that potassium permanganate should have four times more effect than carbolic acid in the experiments described. He had tried many experiments with chlorine as compared with carbolic acid, and had noticed that whatever happened at first, if the chloride of lime were left in contact with substances that decomposed, it prevented the decomposition for some little time, but afterwards the substance so treated decomposed to a much greater extent than the original untreated material. He had also observed that by testing equal weights of two antiseptics comparatively with the same organic substance, such as flour-paste or egg albumen, and leaving them for some time, one antiseptic prevented the development of bacilli or fungi for a longer time than the other in one experiment, and the reverse result was obtained on repeating the experiment. There were antiseptics which would act upon the outside surface of certain organic materials such as sputa, but might not be able to penetrate the mass. Possibly formaldehyde might be found to penetrate the mass more easily for instance than mercuric chloride.

Mr. R. E. Crowther asked if the stimulant action of minute quantities applied to all disinfectants? Also could a more highly resistant bacillus be produced from a similar species less resistant; did the bacillus adapt itself to its environment?

Dr. Gilbert J. Fowler said it had been discovered that certain bacteria possessed the power not only of resisting carbolic acid, but actually of consuming it. The whole question required a great deal of investigation. His own impression was that, like the *bacillus coli*, they would find in this case a great number of varieties coming under the same general head, but all of them differing in their chemical aptitude. He referred to a report of Major Clemisha, the Sanitary Commissioner for Bengal, with regard to certain experiments made at Madras concerning the resistance of various organisms to sunlight and other natural conditions. As a result of these experiments, Major Clemisha was able to ascertain whether a particular body of water, such as a lake, had been sunned, or whether it had been recently polluted. In a country like India that information was of very great importance, because practically all drinking water in India contained some variety of *bacillus coli*. Water which had been exposed to the sun for a certain length of time contained only highly resistant organisms. There was also a difficulty in sterilising sewage in the presence of soap. It was, of course, very much easier to kill a naked bacillus than one which was in the simultaneous presence of organic matter. He ventured to say it was not always simply sewage matter that inhibited the action of the disinfectant. The action of chloride of lime, for instance, had the effect of producing lime soaps, which would form a fairly hard integument covering the organisms. Although solutions might smell quite strongly of chlorine, yet on incubating a growth would be eventually formed. That was probably due to the presence of small particles of calcium stearate.

Mr. A. W. Duncan asked if any special precautions had been taken to prevent dust getting into the tubes? He had himself had great trouble with dust. Several of the advertised disinfectants had differed widely in the results he had obtained.

Mr. E. Ardern thought the importance of Prof. Delépine's paper lay in the conclusion. It was undoubtedly necessary to adopt some such process if disinfectants were to be reliably standardised. There seemed to be a considerable divergence of opinion as to the relative disinfectant value of electrolytic chlorine and chlorine in the form of bleaching powder. Had any experiments been undertaken for the purpose of comparison in this direction?

Dr. F. W. Skirrow said it had been stated that carbolic acid in solution had not the same action as when it was emulsified. He would like to know if that was correct. One general point which seemed to be indicated by the papers was that disinfectants should be tested in specific ways for specific purposes.

Prof. Delepine in reply said that he agreed with the opinion expressed by the chairman, and pointed out that various scientific investigations conducted several years ago had shown that cresylic acid had a greater value than phenol for general disinfecting purposes. Mr. Coleman's remarks with regard to the relative resisting power of various bacilli were quite justified by facts. As he had pointed out in his paper, the difference between sporing organisms and non-sporing organisms was considerable. Some kinds of disinfectants had no apparent action on spores, which might remain for days or weeks in the disinfectant without being killed, while weak solutions of the same disinfectant would be capable of bringing about the death of various kinds of non-sporing organisms. There were also wide differences between non-sporing organisms. In testing disinfectants some observers thought it sufficient to use organisms of low resistance, because many diseases such as typhoid fever, tuberculosis, etc., were caused by bacteria that did not form spores. The ideal, from a hygienic point of view, was not only to attack the weak, but also the strong pathogenic organisms. Unfortunately some of the strongest disinfectants had properties which were objectionable. Many of them also entered into combination with organic matter, making soluble or insoluble compounds which limited their action. A weak disinfectant like carbolic acid sometimes became by comparison a strong disinfectant on account of its power of mixing with organic matter without losing much of its activity. This was even more true of cresols than of phenol. The remark made by Mr. Thomson regarding the contradictory results obtained with carbolic acid and permanganate of potash showed that observers had not always paid sufficient attention to the part taken by organic matter. As to the case of apparent sterilisation followed by further development of bacteria and decomposition, this was observed specially when impure cultures and mixtures of sporing and non-sporing bacteria were used. Experiments had been made by Tyndal, showing that disinfection by heat might appear to be complete, and yet several days afterwards there might be growth in the apparently disinfected fluid. This was due to the presence of spores in the fluids submitted to the action of heat. The mechanical action of aluminium hydroxide was well-known. The precipitation of bacteria by alumina, and by other coagulants had been taken advantage of, especially in America, for the purification of water by precipitation in combination with mechanical filtration. This mechanical action was not, however, properly speaking, a disinfecting action. A further point had also been raised by Mr. Thomson with respect to the irregularity of action between two antiseptics added to the same organic material, say egg albumen or paste. Sometimes one acted as a deodoriser and sometimes the other. In experimenting with substances exposed to contaminations from the air one could not expect regular results. The coagulating action of certain disinfectants, such as perchloride of mercury, limited their action by making their penetration beyond the superficial layers of the material treated impossible or very slow. That should always be kept in mind. Schill and Fischer in 1884 recommended that, for the disinfection of tuberculous sputa, perchloride of mercury should not be used on account of its coagulating action, for that purpose they recommended the use of carbolic acid. The stimulation by disinfectants was a general phenomenon. Brewers had for many years used hydrofluoric acid, sulphuric and lactic acid, salicylic acid, and other antiseptics for the purpose of stimulating the growth of yeast. By causing bacilli to pass from a weaker solution of disinfectant, which had an inhibiting effect, to a stronger solution, the bacteria might be trained to live in the stronger solutions, this had been done by Dr. Ward in the speaker's laboratory. The bacteria so treated altered more or less in their cultural characters; thus the *bacillus coli* might lose for a time the property of causing a gaseous fermentation of glucose. Pasteur took advantage of the fact that some bacteria grow better in some media than in others to isolate certain bacterial ferments. Some bacteria would not grow in a jelly of silica, for instance, whilst certain others would. The same thing applied to starch and other substances. The observations of Major Clemisha upon the effects of light upon bacteria were very interesting and in agreement with what had been previously ascertained; he had made a very ingenious application of the phenomenon to the investigation of water supplies. The power which bacteria had to grow and multiply abundantly in media containing phenol, and to which Dr. Fowler alluded, had been referred to briefly in the first part of the paper; that point was, however, one which would be discussed fully when Dr. Ward published an account of the research which he had conducted at the Public Health Laboratory.

In reply to Mr. Duncan, in his own work he had always protected his reagents, media, etc., from dust and extraneous bacteria. No cotton wool was used by him partly in order to avoid extraneous matter. As to the relative value of electrolytic chlorine and of chlorinated lime or hypochlorite of soda, it was chiefly a question of cost.

Yorkshire Section.

Meeting held at Leeds on Monday, February 20th, 1911.

MR. F. W. RICHARDSON IN THE CHAIR.

NOTE ON THE USE OF THE ROLAND WILD CALORIMETER.

BY WM. MCD. MACKEY AND JAMES MILLER.

In the instructions for use with the Roland Wild calorimeter the following paragraph occurs:—"The sample of fuel to be tested should be ground to pass a 60 mesh sieve and dried at 220° F. for one hour. This is necessary as all calorimetric determinations should be made on the dry coal."

This calorimeter being of the sodium peroxide type, the precaution of drying the coal is most probably suggested to eliminate the error due to heat evolved by the combination of the sodium peroxide with the water in the coal; obviously, however, for practical purposes the calorimetric value should not be reported on the dry coal, but on the coal as received. The following are some results obtained by the Roland Wild calorimeter using dried and undried (as received) coal.

Boiler fuel containing 6·75 per cent. water.

	dried.	as received.	as received, calculated from dried
	lb.	lb.	lb.
Weight of water evaporated from 212° F.	11·73	11·11	10·94

Pea slack, containing 7·32 per cent. water.

	dried.	as received.	as received, calculated from dried
	lb.	lb.	lb.
Weight of water evaporated from 212° F.	13·54	12·75	12·55

Coal containing 13·88 per cent. water.

	dried.	as received.	as received, calculated from dried
	lb.	lb.	lb.
Weight of water evaporated from 212° F.	14·63	12·82	12·60

It will be noted that there is a decided difference between the *dried* and *as received*. The results obtained on the coal as received, when compared with those calculated from the dried coal, are not outside the limits of experimental error. Therefore it seems that it is unnecessary to dry such coals as these in order to determine the calorimetric value by the Roland Wild calorimeter.

When testing undried coal, care must be taken that the temperature is constant before firing the mixture; this usually takes about ten minutes. It is our practice to get the temperature constant for at least two minutes before firing. After firing, the maximum temperature is reached in about six minutes.

As the above coals had been also tested in the Wm. Thomson oxygen calorimeter we give the results, to compare with those of the Roland Wild.

	Wm. Thomson. as received.	Roland Wild. as received.
	lb.	lb.
1. Boiler fuel. Weight of water evaporated from 212° F.	10·43	11·11
2. Pea slack. Weight of water evaporated from 212° F.	12·15	12·75
3. Coal. Weight of water evaporated from 212° F.	12·91	12·82

The boiler fuel and pea slack have given a lower value by Thomson's oxygen calorimeter. The results in the case of No. 3 are practically alike.

It is generally found that Thomson's oxygen calorimeter tends to give low results owing to incomplete combustion.

Discussion.

Mr. F. W. **Richardson** said that the Roland Wild calorimeter was a great improvement on Lewis Thomson's. The Mahler bomb was of course the best, but there was no comparison between the cost of the two calorimeters.

Mr. J. W. **Cobb** asked whether the heat of evaporation of the contained moisture was allowed for in calculating the calorimetric value of the dry coal from the observed value for the wet coal.

Mr. T. **Fairley** noted that the proportion of material to be tested was very small compared with the amount of sodium peroxide used. He understood that the use of 0·73 grm. of coal was to allow for the heat evolved from the sodium peroxide on decomposition. This calorimeter had the usual defect of all similar calorimeters, viz., the oxidising mixture gave out heat on its own account. Thus if potassium chlorate were heated with a little manganese dioxide, evolution of oxygen occurred, causing something similar to explosive conditions accompanied with rapid rise of temperature. The William Thomson calorimeter came nearer to ordinary conditions of combustion and in many ways was, he thought, preferable. The difficulty of the Lewis Thomson calorimeter was that some unburnt matter frequently remained dispersed throughout the fused mass, necessitating tedious and complex corrections. With regard to the Mahler bomb, Prof. Bone had informed him that the use of platinum or enamel for the coating of the inside of the bomb could be avoided and the interior surface restored by burning a reducing mixture in it.

Mr. C. P. **Finn** asked if the moisture in the coals had been determined on the coarse sample as received or on the ground sample. The numbers under the two different conditions were not the same. He usually calculated calorific values from the elementary analysis by means of Dulong's formula and believed this gave results as good as with any of the calorimeters. He would like some information about the Darling calorimeter.

Dr. L. L. **Lloyd** said that the Darling calorimeter was unpleasant to work with owing to difficulties in igniting hard coals and the length of time taken for burning. Some unburnt coal was nearly always left and with bituminous coals some tarry matter is volatilised. By use of the Roland Wild calorimeter anthracite and coke could easily be burnt if in a sufficiently finely divided state. It was unnecessary to make any correction for heat lost in evaporation of moisture from the combustible mixture because the sodium peroxide absorbed this moisture, giving caustic soda. The heat of this reaction was automatically allowed for in the initial adjustment of temperature before the combustion. It usually took at least half an hour to fit a bomb calorimeter together and get a constant temperature, and if the current was kept on long, as in the cases where it was difficult to start the combustion, serious errors were probable.

Mr. G. A. Bracewell asked if the combustible mixture could not be ignited by an electric spark instead of with the red-hot nickel wire.

Mr. F. W. Richardson said that the use of electricity was no advantage. The combustion did not take place satisfactorily under these conditions, whereas the nickel wire method was quite satisfactory provided the wire was heated to a suitable temperature (*i.e.*, about red hot, but not white hot).

Mr. J. Miller, in reply, said that in the calculated results given no allowance was made for the evaporation of water. They had found the Roland Wild calorimeter to give complete combustion and the results were concordant.

SOME NOTES ON LINSEED AND OTHER OILS.

BY HARRY INGLE, D.SC., PH.D.

In the course of laboratory work examining many thousands of samples of linseed and other oils the writer has had occasion to determine the relationship between the iodine value (Wijs), specific gravity, and the yield of hexabromides in oils of various origin.

The hexabromides were estimated in the following manner:—1 to 1·5 grms. of oil were weighed out and dissolved in a weighed flask in 40 c.c. of ether (sp. gr. 0·720) to which 5 c.c. of glacial acetic acid was added. Bromine was then run in until there was an excess as shown by the colour of the solution. The mixture was allowed to stand several hours and more bromine added if required.

After 6 hours the precipitate was collected on a tared filter, washed four times with 10 c.c. of ether, and after drying both the flask, in which some of the precipitate remained, and the filter paper in the water oven the weight of the precipitate was determined.

The following results were obtained with linseed oils of undoubted purity:—

Oil.	Iodine value.	Sp. gr. at 15°.	Hexabromides.		M. pt.
			1	2	
Baltic oil	197	0·9357	48·1	47·5	140—5° C.
Calcutta oil	185	0·9322	39·1	39·3	140—5° C.
Dutch crushed ordinary	181·5	0·9322	36·9	—	140—3
English crushed ordinary	185	0·9332	40·0	—	140—3
Plate oil	179·5	0·9315	35·3	33·7	140—5
Menhaden oil	182	0·9328	61·8	—	decomposes
Tung oil	168	—	nil.		

The results with linseed oil above recorded are not at all in agreement with those of Hehner and Mitchell, to whom the method is due, although the melting points of the products were practically identical with those recorded in their paper (this Journal, 1899, 78). Mitchell (Analyst, 1902, 238) states that he examined a linseed oil yielding 42 per cent. of precipitate in this way but the origin of the oil was unknown.

Several experiments were made to see if the time of standing in contact with the bromine-ether solution made any difference, but no difference in the results was observed.

Baltic oils.—Iodine value limits, 190 and 204. I have occasionally met with Baltic oils giving as low an iodine value as 187, but have generally had to suspect adulteration with Steppe linseed or Samara seed. A good Baltic oil should never give an iodine value below 195.

Indian oils.—180-189. My experience has been that Bombay oils usually give the highest iodine value, but that these vary from year to year with the crop and season.

La Plata oils.—175-186. Of late years these oils have much improved in quality. Nowadays it is not uncommon to find Plate oils giving an iodine value up to 186, while in the earlier years of this century I have often met with oils as low as 174, indeed, even as low as 168, and very rarely did they rise above 182.

Black Sea oils.—176-182. For several years there has not been much of this oil on the British market, and the numbers above given refer to the crops of some 6 years ago.

North American oils.—Iodine value, 177-188. My experience with Duluth and other North American oils has been that their iodine value is very variable.

Morocco, Dutch, and Turkish oils.—Their iodine values generally vary between 185 and 192.

In all the above the important point is the exact method of determining the iodine value.

Wijs' method is usually employed, but the same results are obtained by the use of Hübl's method as modified by the author, after 18 hours' interaction. (See this Journal, 1902, 587). The greatest care must be taken to ensure the purity of all the reagents used. The purity of the acetic acid used in the preparation of Wijs' solution should be tested. It should also be as free from water as possible to ensure the stability of the solution. The chloroform or carbon tetrachloride should not reduce a bichromate sulphuric acid solution. Commercial carbon tetrachloride often contains carbon bisulphide; this is best removed by treating it with alcoholic potash, warming, then shaking out with water, drying over calcium chloride, and redistilling on the water bath. It should, of course, not liberate iodine when treated with potassium iodide. Chloroform is purified by treatment with bichromate sulphuric acid, washing with water, dilute potassium iodide and then dilute caustic soda. It is then dried over calcium chloride. If freshly prepared it may be safely used, but in a short time it produces phosgene and hydrochloric acid; it then acts upon potassium iodide solution and, of course, cannot be used. The addition of 1 per cent. of absolute alcohol will correct this, but it is better to use only carbon tetrachloride, which is permanent when once purified.

Oils from compound cakes.—In making "compound" or "oil cake" the crusher uses as admixtures some materials which may contain a non drying oil, as in the case of a cake to which Rangoon rice meal or bran had been added. On examination this meal was found to yield 15 per cent. of a greenish semi-solid grease with an iodine value of 100.

Other additions such as locust beans, millet seed extracted rape seed meal, wheat, bran and other offals have little or no effect upon the iodine value of the oil. Soya beans, if added to the linseed, would reduce the iodine value of the expressed oil. There are two chief varieties of soya beans, a yellow and a greenish bean yielding iodine values of 136 and 158, respectively. These values are higher than those given in the text books.

Action of heat upon linseed oil.—It is well known that the yield of hexabromides decreases when a linseed oil is heated for some prolonged time. This is brought out by the results given in the following table, and obtained with a sample of linseed oil, which was heated in an enamelled pan over a flame at a temperature of 195—200°C.

	Iodine Value.	Specific gravity.	Hexabromides.
Original oil	179·5	0·9315	35·3
After 2 hrs. at 195—200...	175·5	0·9350	30·7
After 4 hrs. at 195—200...	170	0·9383	27·4
After 6 hrs. at 195—200...	165	0·9418	26·2
After 11 hrs. at 195—200..	154	0·9501	16·0
After 15½ hrs. at 195..200.	145	0·9583	10·5
After 43 hrs. at 195—200..	121	0·9800	0·9

Discussion.

Mr. F. W. Richardson suggested that the rise in the refractive index might be useful in showing the progress of polymerisation. It was curious that Dr. Ingle got higher results than Hehner and Mitchell. He had always got lower values, and he felt there was a great need for a standard method of determining iodine values so as to make the results of different workers comparable. The bromide process was only useful, he thought, to give comparative values for those who were continually using it.

Mr. W. Keighley Walton asked if Dr. Ingle found any special difficulty in the filtration of the bromides. He had always had difficulty in the case of fish oils. He had also found that oleic dibromide and linolic tetrabromide exerted a solvent action on the hexabromides.

Mr. G. A. Bracewell said that the iodine values usually given in text books for soya bean oil (120—127) were misleading, as he had found values usually above 130.

Mr. B. T. Vickers stated that two distinct soya bean oils were met with in commerce, *viz.*, oil from crushed seeds and extracted oil. There must be some material difference between them, since certain trades always demanded crushed oil. Some soap makers objected to extracted oil because it gave a different odour in their soaps from that of the crushed oil. This might be the cause of varying iodine values. A good deal of oil from the far East (China and Japan) was used, and the varying conditions of extracted, such as the heating of the beans, the moisture added in the kettles, etc., might cause variation in properties.

Mr. F. W. Richardson said that undoubtedly if the mode of extraction caused a variation in the proportion of liquid and solid fatty acids in the oil, a difference in chemical properties would result. It would be interesting to include the amount of liquid fatty acids in the figures of the paper.

Mr. G. F. Holdcroft said he found much lower iodine values for a soya bean oil than Dr. Ingle. He had used extracted and crushed oil and no doubt crushed oil contained a great deal more mucilage. Albuminoid matter in soya beans was in the form of casein.

Mr. J. W. Cobb asked whether, if oxidation by air was prevented by conducting the boiling in a neutral atmosphere and so tended to restrict the change to polymerisation, the results were the same as when free access of air was allowed or ensured.

Dr. H. Ingle, in reply, agreed that fish oils caused difficulty owing to the formation of an oily material which would not filter easily. There was, however, no difficulty with linseed oils. His experience of soya bean oils was that iodine values as high as 158 were given by genuine samples. He believed that mixed glycerides were present in linseed oil, and not separate simple glycerides as usually supposed. It was uncertain where the double linkages in the carbon chain in linolenic acid occurred. He held the view, for which he had a certain amount of evidence, that one of them was at the end of the chain farthest from the carboxyl group, while another was in close proximity to it (this Journal, 1902, 594). The position of the third double linkage was unknown. The residue, after boiling to rubber-like consistency and extracting with ether gave a fairly constant iodine value of about 53, and he suggested that condensation occurred within the glycerides with the production from the double linkages of closed-chain compounds of the hydrated benzene type. The thickening of oil by boiling was therefore not due to oxidation, but to polymerisation, and he had found that the blowing of air through the oil while boiling did not materially affect the final result.

Obituary.

EMIL JACOBSEN.

Dr. Emil Jacobsen was born at Dantzig, in the year 1836. By his death, which occurred at Berlin on February 11th, the "Verein zur Wahrung der Interessen der Chemischen Industrie Deutschlands" loses one of its few remaining founders. From 1877 to 1891, he was a member of its Council, and until 1894 edited its Journal "Die Chemische Industrie." For upwards of thirty years he also compiled and published the "Chemisch-technisches Repertorium," a journal which enjoyed a wide circulation in its time. His "Industrieblätter" also for a long time proved of much value in the chemical manufacturing world. As an investigator Jacobsen did good service, and in his laboratory the dyestuff "Quinoline Yellow" was first prepared. He also discovered some pigment-colours for artists, which he termed "Aquarellfarben." In his researches on coal tar derivatives, he discovered "Thiol," a substance serving as a substitute for ichthyol. As scientific adviser to the Chemische Fabrik auf Aktien vorm. E. Schering he effected important improvements in the preparation of salicylic acid. When a journal for this Society was contemplated, the late Dr. Ludwig Mond recommended as a model "Jacobsen's Chemische Industrie," with its "*Journal und Patent-Literatur*" modified as to classification, so as to be more in accord with the order followed in the English Patent Office Journal.

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I.—GENERAL PLANT; MACHINERY.

Crystallisation in supercooled liquids; Mechanical stimulus to ——. S. W. Young. J. Amer. Chem. Soc., 1911, 33, 148—162.

The results of the author's work go to show that Ostwald's assumption of a metastable condition of undercooled liquids or supersaturated solutions is untenable. Ostwald's view, which has been widely accepted, is that when a liquid is cooled below its melting point (or a solution below its saturation temperature), it first passes through a range of temperature (the metastable state) within which crystallisation can never take place spontaneously, even under the influence of stirring or jarring, but only when a crystalline fragment of the solid phase is introduced. When cooled further, the liquid, at a definite temperature, passes into the unstable state, and then crystallisation must take place spontaneously sooner or later, and may usually be hastened by agitation, etc. In some preliminary experiments with distilled water in an ordinary Beckmann apparatus, it was observed that the amount of undercooling possible varied with the kind of stirrer used, being less with a platinum stirrer than with a glass one, and still less with a copper one. It was also found that when the liquid was agitated by means of a current of oxygen or hydrogen gas, remarkably concordant results were obtained for the amount of undercooling. Further experiments were then made in which the liquid was agitated by means of hydrogen gas, and the effect of friction between different materials in the liquid was studied. The results obtained, led the author to the conclusion that the effects observed were due to the series of mechanical impacts of which friction may be supposed to consist. An apparatus was devised in which a small anvil was mounted in the tube containing the liquid under examination, and a small stamp, which could be loaded to different degrees, was caused to make a series of regular impacts on the anvil. The results with many of the materials tried, were irregular, owing to the rapid change in the character of the impact surfaces, but concordant results were obtained by the use of surfaces of tool steel hardened by mercury. It was found that although the transition from a condition of slight sensitiveness to shock is very rapid, it is nevertheless continuous, and within the whole range of what has previously been regarded as the metastable and unstable fields, crystallisation can be induced by mechanical shock. In some cases a very severe shock is required. Another fact brought to light was that in the case of a solution supersaturated with respect to two solid phases, either the one or the other may be caused to separate as desired, according to the impact given. For example, using a solution of Glauber's salt saturated at 25° C., and cooled to a temperature below 6° or 7° C., moderate shocks will cause the crystallisation of the heptahydrate, whilst more severe ones will lead to the separation of Glauber's salt (decahydrate). —A. S.

Patents.

Heat-insulating compound [from small wood charcoal]. W. D. A. Bost, Paisley. Eng. Pat. 2903, Feb. 5, 1910.

The compound consists of carbonised wood sawdust, turnings, shavings, planings, or the like, admixed with paper pulp, with or without a waterproofer such as aluminium resinate. Preferably 4 parts of charcoal are used with 1 part of pulp.—H. H.

Kilns or ovens ; Circular ——. J. Lunt, Stoke-upon-Trent, and J. W. Hartley, Stone, Staffs. Eng. Pats. 6215, March 12, 1910, and 18,962, Aug. 12, 1910.

An annular kiln has a slot formed in the top, through which the carriers for the material to be dried are passed, these carriers being suspended within the kiln by rods or chains from radial arms projecting from a central shaft independent of the kiln. The arms are rotated in a horizontal plane and the carriers are caused to travel slowly through the annular kiln. On each side of the slot a trough filled with sand is arranged, into which plates, attached to the suspension chains, dip, in order to form, a seal.—W. H. C.

Tunnel-kiln. A. Ramén. Fr. Pat. 420,234, Aug. 27, 1910. Under Int. Conv., Aug. 30, 1909.

In kilns of the type having moving floors, upon which the material to be heated is carried through the kiln from end to end, the iron sides of the moving floor are protected from excessive heat (1) by providing recesses in the side walls of the kiln, so that whilst these walls overhang the floor, the internal width of the kiln is less than that of the floor, (2) by arranging hollow chambers in proximity to the sides of the floor through which a cooling medium can be passed. Similar cooling chambers are arranged in proximity to the rails upon which the moving floor travels. The overhanging walls of the kiln are supported upon transverse hollow beams which in turn are supported upon the hollow cooling chambers. These transverse beams are similarly cooled.—H. H.

Grinding of ores or other materials ; Apparatus for the fine ——. A. F. Crosse, Johannesburg, Transvaal. Eng. Pat. 11,375, May 7, 1910.

An outer cylinder or drum is mounted horizontally on spring bearings and rotated by suitable gearing. Within the drum a muller or roller of less diameter than the drum is suspended so that it rolls round the inner periphery of the drum. The muller is free to move laterally and a lateral reciprocating motion is imparted to it. The outer drum is provided with an adjustable outlet for the ground pulp.—W. H. C.

Mixing and grinding mill. C. Köchling, Hagen, Germany. Eng. Pat. 11.453, May 9, 1910.

The mill has a rotatable grinding disc mounted eccentrically beneath the rollers or crushing wheels which are also mounted eccentrically with respect to the vertical shaft passing through the disc. A reciprocal motion in a straight line is imparted to the rollers which only change direction at each quarter turn of the shaft.—W. H. C.

Separating dust from air and gases ; Apparatus for ——. E. H. Spencer, Ossett, Yorks. Eng. Pat. 15,076, June 23, 1910.

The apparatus consists of a casing of metal the upper part of which is cylindrical while the lower part consists of a conical collecting hopper with a sliding door at the bottom for the removal of the solid matter. In the cylindrical portion, six sectional tubes of canvas, worsted cloth or other appropriate material capable of resisting the action of acids and of allowing the air to escape, are placed vertically. The air or gases enter tangentially at the top and pass down the interiors of the filtering tubes, the dust deposits on the tubes, whence it is removed and caused to fall into the hopper by internal revolving brushes ; the clean air or gas passing through the tubes. —B. G. McL.

Dust from burner- and other gases ; Filter with granular filtering material for the separation of ——. Ges. der Tentelewschen chem. Fabr. Ger. Pat. 230,585, April 11, 1909.

The gas passes downwards through the filtering material and when the latter requires cleaning, water is forced through it, under pressure, in an upward direction. The outlet for the washing water is placed at a higher level than the gas inlet, so that the closing and re-opening of the gas inlet and outlet are performed automatically by the washing water.—A. S.

Purifying, cooling and mixing gases ; Apparatus for ——. H. Theisen. First Addition, dated Sept. 27, 1910 (Under Int. Conv, Sept. 29, 1909), to Fr. Pat. 404,336, June 23, 1909 (this J., 1910, 201).

The improvements claimed consist in the substitution of conical for cylindrical casings ; enclosing the vanes by a supplementary casing placed equidistant from the vanes and obliquely with regard to the central disc of the apparatus, in order to change the radial direction of the gas into one which is perpendicular to the casing ; and the turning up of the edges immediately in front of the perforations in the walls of the rotating drums.—W. H. C.

Evaporating apparatus ; Multiple-effect ——. S. M. Lillie, Philadelphia, Pa. U.S. Pat. 984,226, Feb. 14, 1911.

Four evaporators are connected in series by means of valve-controlled passages between the steam-chambers and the vapour chambers, in such a way that they can be used as a quadruple-effect apparatus, or as a combined triple-effect and a single-effect apparatus, and so that the apparatus can be reversed. The valves are controlled automatically by the pressure of the steam or vapour. —A. T. L.

Evaporating solutions ; Method of ——. S. M. Lillie, Philadelphia, Pa. U.S. Pat. 984,822, Feb. 21, 1911.

The solution is sprayed downwards and comes in direct contact with an ascending current of hot combustion gases. It is next collected, again converted into spray, and delivered on to the outer surface of pipes through which the combustion gases pass before meeting the first-mentioned spray. The heated solution is finally delivered to a multiple-effect apparatus, where the evaporation is completed by means of the vapours evolved in the first stages of the process. Apparatus for carrying out the process is described in U.S. Pat. 980,108 of 1910 (this J., 1911, 118).—A. S.

Distillation or evaporation of liquids ; Simple or multiple effect apparatus for the ——. L. B. Castets. Fr. Pat. 420,826, Sept. 27, 1910.

The heating coils of the apparatus are placed near the surface of the liquid to be evaporated, in order to avoid overheating and boiling over. In the case of single effect apparatus the coil is supported on floats, so that no matter at what height the liquid stands in the pan, the coil is always at the same distance from the surface.—W. H. C.

Liquefying gases ; Apparatus for ——. A. C. Wood, Philadelphia, Pa., Assignor to General Air Products Co., Dover, Del. U.S. Pat. 984,875, Feb. 21, 1911.

The apparatus comprises an insulated chamber in which is placed a turbine on a vertical shaft connected with an external dynamo placed on the top of the chamber. In the annular space surrounding the turbine is a series of coils ; the previously cooled gases pass to the turbine on the outside of the coils, means being provided for collecting the liquefied gases and returning them through the coils. —B. G. McL.

Compressed gases ; Process for cooling —— *before expansion and liquefaction.* G. Hildebrandt. Fr. Pat. 420,903, Sept. 29, 1910.

The expansion pipe and that portion of the compressed gas coil immediately preceding it, are placed in intimate metallic contact with the expansion valve, so that at the moment of expansion the gas surrounds the coil and valve and cools the gas passing through the coil.—W. H. C.

Collodion filters. Soc. anon. Les Établissements Poulenc Frères and F. C. Billon. Fr. Pat. 420,319, Nov. 20, 1909.

Collodion filters are prepared by spreading thin films of collodion over a meshed or perforated support, such as light tulle or other network of fibrous or metallic filaments. The films may be produced either by pouring or dipping, and filters of any desired shape, of infinitesimal thickness and capable of withstanding considerable pressure are thus manufactured.—J. F. B.

Filter press. J. B. Beisson. Fr. Pat. 420,373, Sept. 13, 1910.

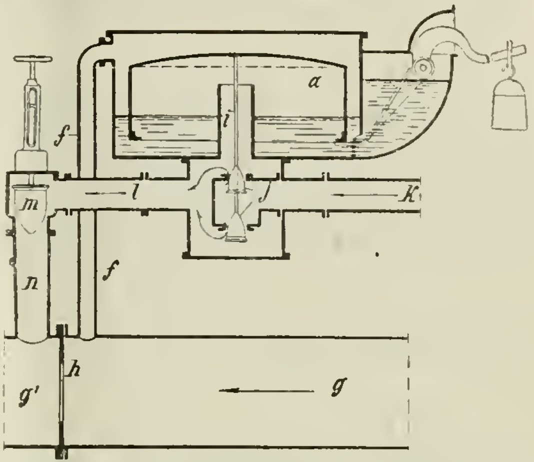
The filtering medium consists of a long bag or sack held in an upright position, upon which a number of circular boards having slots in them are threaded, the bag being held flat for the purpose. As each successive board is threaded on, the bag is bulged out as much as possible so as to form folds between the boards. The liquid is then run in and the uppermost board pressed down by means of a screw so that the liquid in the material between the folds of the bag is pressed out.—H. H.

Chemical reactions ; Apparatus for conducting continuous ——. Soc. Rocca, Tassa, et de Roux. Fr. Pat. 420,340, Sept. 12, 1910.

An apparatus for mixing measured quantities of reacting liquids in successive small amounts, as for example in neutralising acids or bases or in saponifying fatty substances, consists of a mixing vessel into which the liquids are forced by small measuring pumps operated from a common crank shaft. The pumps are preferably of the valveless type, the liquid entering the barrel through a port near the middle, past which the piston travels at every stroke. By varying the mean position of reciprocation of the pistons, by means of suitable adjusting gear, the quantity of liquid delivered by each pump can be varied as desired.—H. H.

Measuring apparatus for mixing two fluids in predetermined proportions and measuring their volumes. Comp. pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. Fr. Pat. 420,733, Dec. 1, 1909.

The constriction, *h*, in the main, *g*, through which one of the fluids flows causes a difference of pressure on the two sides. This difference varies with the quantity of gas flowing through the main. The variation of pressure is transmitted through *f* to the upper side of the bell, *a*, the lower side of which is exposed to the variation of the pressure in the tube, *i*. The pressure in *i* varies with the volume of the other gas flowing through the conduit, *k*, and the pressure transmitted through *n*, *l*, from *g'*. The adjustment of the relative volumes is made by the valve, *m*, and then all variations in the volume of flow through *g* are followed by similar variations in the volume flowing through the equilibrium valve, *j*, actuated by the float, *a*. —W. H. C.



Solid bodies ; Apparatus for the treatment of —— *with gases.* W. Mathesius, Charlottenburg, Germany. Eng. Pat. 3820, Feb. 16, 1910.

See Fr. Pat. 411,969 of 1910 ; this J., 1910, 997.—T. F. B.

Vapourising the volatile constituents of liquids ; Method of and apparatus for —. C. H. Köhn and E. Münster, Leipzig, Germany. Eng. Pat. 14,591, June 16, 1910.

See Fr. Pat. 417,209 of 1910 ; this J., 1911, 15.—T. F. B.

Evaporator. J. Dinckels, Mainz, Germany. U.S. Pat. 984,265, Feb. 14, 1911.

See Fr. Pat. 419,373 of 1910 ; this J., 1911, 119.—T. F. B.

Evaporating apparatus. F. H. Eijdman, Ryswyk, Holland. U.S. Pat. 984,754, Feb. 21, 1911.

See Eng. Pat. 11,422 of 1909 ; this J., 1910, 932.—T. F. B.

Gas-liquefying apparatus for demonstration purposes. W. P. Schneider, Assignor to G. H. Ryberg, Hamburg, Germany. U.S. Pat. 984,030, Feb. 14, 1911.

See Eng. Pat. 11,461 of 1910 ; this J., 1910, 1290.—T. F. B.

Crystals from solutions of different kinds ; Process for producing large well-formed ——. J. Bock, Radebeul, Germany. U.S. Pat. 984,645, Feb. 21, 1911.

See Ger. Pat. 222,830 of 1907 ; this J., 1910, 867.—T. F. B.

IIa.—FUEL ; GAS ; MINERAL OILS AND WAXES.

Sulphur in illuminating gas ; Use of perhydrol [hydrogen peroxide] in the determination of total ——. M. Dickert. J. Gasbeleucht., 1911, 54, 182—183.

The author comments on the inaccuracies caused by the absorption or evolution of sulphurous gases by the containing liquid in the wet meter used in the combustion process. When a fairly concentrated solution of sodium hydroxide is treated with perhydrol (concentrated hydrogen peroxide) a thick crystalline precipitate of the composition, $Na_2O_2,8H_2O$ is formed, which has strong oxidising properties, converting carbon oxysulphide, hydrogen sulphide, and mercaptan quantitatively into sulphuric acid; thiophene, which is usually present only in minute traces, alone resists oxidation. To 10 c.c. of perhydrol, 75 c.c. of 24 per cent. sodium hydroxide solution (sp. gr. 1·263) are added. The liquid containing the crystals suspended in it is placed in a Drehschmidt absorption flask and the gas passed through it; with one absorption flask the oxidation is complete at speeds up to 100 litres of gas per hour. After acidification with hydrochloric acid, and boiling, the sulphuric acid may be determined either gravimetrically as barium sulphate or volumetrically by Holliger's method (this J., 1907, 116; 1909, 357). The accuracy of the process is shown by a series of comparative tests made against the Winkler method. The advantages of the method are rapidity and its applicability to non-combustible gases and to gases under diminished pressure. (See also Fairley, this J., 1892, 419—420).—B. G. McL.

Petroleum deposits on the Coast of the Gulf of Suez. Les Matières Grasses, 1911, 4, 2129—2130.

THE existence of petroleum deposits in the peninsula of Sinai and on the West Coast of the Gulf of Suez has long been known, but until recently they were regarded as unimportant. Some years ago borings were commenced at Jebel Zeit, but proved unsuccessful. During the last two years, however, fresh borings have been made in the peninsula of Jemsah, about 165 miles from Suez, by an English company, and at the depth of 1265 feet a fountain throwing up a column of oil 100 feet high has been struck. Analyses of this oil show that it is of good quality, containing a large proportion of petroleum spirit (benzine), and that it is free from water. A second well sunk at Jemsah is yielding a stream of oil estimated at 600 tons per day. The close vicinity of these wells to the sea-coast will facilitate their working, which will, it is anticipated, begin in 1912. The company which has acquired the rights in the Djemsah area is constructing reservoirs and refining works at Port Tewfik, near Suez. Experimental borings are also being made at Jebel Zeit, in the islands of Gaysum and Taouila, and at Abou Zenima, at a point that is only 60 miles (nautical) from the coast. The latest syndicate is also investigating the same area of Abou Zenima. Concessions have also been granted in the island of Jubal.—C. A. M.

Petroleum; A secondary heptane contained in Roumanian ——. N. Costachescu. Ann. scient. Univ. Jassy, 1910, 6, 294—301. Chem. Zentr., 1911, 1, 682.

THE fraction of Colibasi petroleum distilling between 90° and 100° C. was further fractionated, and the portion boiling between 87·5° and 93·5° C. was found to contain 2-methylhexane (b. pt. 91·5°—92·5° C., sp. gr. 0·7116 at 0°/0° C.), together with small quantities of isomeric secondary heptanes and dimethylpentamethylene (dimethylcyclopentane).—A. S.

Benzine and other inflammable liquids; Storage of ——. T. Rosenthal. Z. angew. Chem., 1911, 24, 289—290.

IN the presence of sufficient oxygen, spontaneous ignition of benzine by sparking is liable to occur whenever the liquid has been subjected to friction of any kind (as in its passage through pipes on its way to a storage tank), on account of the electric charge accumulated in consequence of its non-conducting character. The addition of a soap, in order to render the benzine a conductor, as employed in dry cleaning (compare this J., 1904, 368), is not generally applicable, and it is considered that benzine can only be stored with safety, if the air in the tank be replaced by an inert gas, such as nitrogen or carbon dioxide. The indifferent gas is preferably supplied by means of some automatic device, and the arrangements should be such that any defect in the apparatus is at once apparent. The proportion of gas absorbed by benzine and other inflammable liquids is so small that their value for burning purposes is in no way affected.—F. SODN.

Carbonylferrocyanides. Extraction, analysis, applications. Lecocq. *See* VII.

PATENTS.

Gas retorts. R. Dempster and Sons, Ltd., and H. J. Toogood, Elland, Yorks. Eng. Pat. 9409, April 19, 1910.

IN settings for vertical gas retorts, the whole of the regenerator flues are arranged at one side of the furnace or producer, such producer and regenerator flues being built up to the same height as the setting. By this means ground space is economised, and loss of heat between the regenerator and the furnace is lessened.—H. H.

Gas-generators and gas-retort furnaces; Combined ——. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 14,405, June 14, 1910. Under Int. Conv., July 15, 1909.

IN order to prevent the choking of the flues of gas-heated furnaces by dust contained in the generator gases, the latter are first employed to generate steam for use in the generator, the gases being cooled and washed in the process. The cool dust-free gases then enter the recuperative heater and are finally burned in the furnaces or retorts.—H. H.

Gas producers. G. Bertrand and M. Johannet. Fr. Pat. 420,316, Nov. 19, 1909.

IN order to enrich the gas supplied to a gas engine during periods of heavy demand, a suitable hydrocarbon is injected into the hottest part of the producer from a closed reservoir subject to the pressure of the exhaust. Air and water vapour are introduced into the producer through a double-walled tuyère consisting of an outer cylindrical pipe having a number of air inlet-holes with a movable sleeve for regulating the quantity of air admitted through them, and an inner conical tube through which air is also admitted, and into which the water supply pipe leads. When the current of air through the conical tube is slow, the water drops upon the inclined surface and runs to waste, but when the current is rapid the water is all carried forward into the producer. The outer sleeve serves to regulate the speed of the air current in the inner tube, which also varies according to the demand of the engine. —H. H.

Gases; Method of and means for extracting tar and other impurities from ——. F. W. Burstall, Birmingham. Eng. Pat. 4621, Feb. 24, 1910.

IN order to extract lighter tars or tar oils from gases which have previously been treated in a wet process machine for the extraction of the heavier tars, the gases are passed through one or more thin sheets of flowing water, the pressure or velocity of the water being high as compared with the pressure or velocity of the gas. The sheet of water is caused to flow across a constricted portion of the pipe through which the gases are passing, the effect being that the gases bubble through the sheet of water without causing any thorough break.—H. H.

Gas scrubbers and washers; Rotary ——. S. Chandler, London, and R. Cort and Son, Ltd., Reading. Eng. Pat. 19,207, Aug. 16, 1910.

IN gas scrubbers of the type comprising a rotary drum divided into a number of radial compartments, each containing a bundle or series of segmental plates which dip into the washing liquid as the drum rotates, and through which the gas to be scrubbed is passed in an axial direction, (1) the edges of the plates are turned up to form louvre-like deflectors, and (2) the plates are slotted, the edges of the slots being separated so as to present cutting edges opposed to the direction of flow of the gas, whereby a more thorough churning action is secured.—H. H.

Coal gas; Process for eliminating hydrogen sulphide from ——, *by passing it over natural or artificial hydrated peroxide of iron.* K. Burkheiser. Fr. Pat. 420,806, Sept. 26, 1910. Under Int. Conv., Sept. 27, 1909.

THE gas is purified by passing it over hydrated peroxide of iron from which only a part of the combined water has been driven off, the drying of the peroxide being stopped at the point at which the yellow variety begins to change into the red. The spent material is re-oxidised without being removed from the purifying chambers, which are of such a form that the heat generated during the oxidation can readily escape, thus preventing complete dehydration of the iron peroxide. Cooling pipes passing through the centre of the mass are also employed for this purpose if necessary. The re-oxidised material is washed with an ammoniacal solution to remove free acid and soluble sulphates, and finally dried as indicated above.—H. H.

Receptacles for containing explosive gases; Method of filling with porous materials ——, particularly applicable to dissolved acetylene containers. Acetylene Illuminating Co., Ltd., London. From Soc. dite Acétylène dissous et Applications de l'Acétylène, Paris. Eng. Pat. 23,856, Oct. 14, 1910.

In order to prevent the settling or sinking of the porous material introduced into acetylene containers, etc., for the purpose of preventing explosions, suitable strengthening devices are provided to hold the porous material in place, such, for example, as metal filaments within the porous substance, an adhesive material for holding the porous substance to the sides of the container, or ribs projecting from the container walls.—H. H.

Elaterite; Process of treating ——. J. C. Ross, Colorado Springs, Colo. U.S. Pat. 984,240, Feb. 14, 1911.

The ground mineral is mixed with a liquid fuel, and allowed to burn with free access of air, leaving a melted product which solidifies on cooling at 125° C.—A. T. L.

Fuel; The briquetting of ——. J. Cory, London. From O. Crochet, Alais, France. Eng. Pat. 10,550, April 29, 1910.

See Fr. Pat. 413,803 of 1910; this J., 1910, 1095.—T.F.B.

Gas generators. Soc. Franç. de Matériel Agricole et Industriel, Vierzon, France. Eng. Pat. 14,304, June 14, 1910. Under Int. Conv., June 14, 1909.

See Fr. Pat. 414,232 of 1909; this J., 1910, 1193.—T. F. B.

Water-gas; Apparatus for the production of ——. H. E. Smith, London. U.S. Pat. 984,447, Feb. 14, 1911.

See Eng. Pat. 24,893 of 1908; this J., 1909, 876.—T. F. B.

Distilling shale and other bituminous substances; Apparatus for ——. J. Noad, East Ham. U.S. Pat. 985,053, Feb. 21, 1911.

See Eng. Pat. 18,334 of 1909; this J., 1910, 1448.—T.F.B.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Ammonia; Separating —— from gases generated by dry distillation or gasification of combustibles. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 13,327, June 1, 1910.

In order to obtain the fixed ammonia (ammonium chloride, etc.) from distillation gases without the use of lime, the gases are washed with hot water at a temperature near the dew-point (about 80° C.), whereby the fixed ammonia is dissolved, while the free ammonia passes on with the gas. The fixed ammonia solution may be converted into ammonium sulphate by the addition of sulphuric acid, and the solution so produced may be passed into the saturator used for separating the residual free ammonia. —H. H.

Electrodes for arc lighting. The British Thomson-Houston Co., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 17,278, July 20, 1910.

Electrodes for arc lamps are composed of about 35 per cent. of titanium carbide, about 30 per cent. of calcium or barium fluoride, about 15 per cent. of cryolite, and 20 per cent. of carbon. The material may either be used as a core for a carbon electrode, or may be mixed with a further quantity of carbon to form an electrode of uniform composition throughout.—H. H.

Vacuum [in mercury vapour lamp bulbs]; Means for producing a ——. P. H. Thomas, East Orange, N.J., Assignor to Cooper Hewitt Electric Co., New York. U.S. Pat. 981,141, Jan. 10, 1911.

A bulb or other vessel which is to be used as a mercury vapour lamp or current-rectifier, is freed from all other gases or vapours by evaporating in it first a liquid more volatile than mercury, such as water, and then volatilising the mercury until the vapours of the more volatile liquid are expelled.—A. T. L.

Incandescence body for lighting; Manufacture of ——. P. Lecacheux. Fr. Pat. 420,522, Sept. 17, 1910. Under Int. Conv., Oct. 28, 1909.

Fragments or clippings obtained in the manufacture of mantles are burned in a crucible into which oxygen is led, so as to obtain the oxides free from collodion. The oxides are mixed with twice the weight of a solution containing 20 grms. of white sugar, 2 grms. of thorium nitrate, and 0·61 grm. of sulphuric acid per litre, and the paste so prepared is moulded to the required shape. The excess of the solution is removed by pressure and the moulded object is calcined at a high temperature.—A. T. L.

High-temperature furnace for calcining incandescence bodies for lighting. P. Lecacheux. Fr. Pat. 420,839, Sept. 27, 1910. Under Int. Conv., Oct. 28, 1909.

A small furnace, suitable for calcining one incandescence body at a time, comprises a hollow metal casing filled with fragments of old mantles and lined with a tube of refractory material such as thoria. At the base of the furnace there are two ring-shaped metal chambers, the upper one being supplied with cooling water and the lower one forming a gas-distributing box provided with burner orifices. The furnace is clamped on a vertical support by means of thumbscrews. The body to be heated is supported on a vertical rod which can be raised by means of a lever.—A. T. L.

Filaments for electric incandescence lamps; Manufacture of ——, using an auxiliary metal. Siemens und Halske Akt.-Ges. Fr. Pat. 420,891, Sept. 29, 1910. Under Int. Conv., Nov. 29, 1909.

Filaments formed from an alloy of a refractory metal and a volatile metal which is expelled from the filaments by heating, are made of non-circular section in order to increase the surface relatively to the mass of the filaments and facilitate the removal of the volatile metal. The object may also be effected by forming the filament of a number of thinner filaments twisted together.—A. T. L.

Ammonia from coal gas and other gases obtained in the dry distillation or carbonisation of coal and other carbonaceous materials; Process and apparatus for recovering ——. J. A. Roelofsen, Middlesbrough. Eng. Pat. 14,013, June 9, 1910.

See U.S. Pats. 969,906 and 969,907 of 1910; this J., 1910, 1204.—T. F. B.

Wood charcoal; Furnaces for making ——. L. Felizat, Bouches-du-Rhone, France. Eng. Pat. 19,681, Feb. 28, 1910.

See Fr. Pat. 409,916 of 1909; this J., 1910, 806.—T. F. B.

Heat-insulating compound [from small wood charcoal]. Eng. Pat. 2903. *See* I.

Obtaining ductile or malleable bodies of high melting-point metals. Eng. Pat. 2759. *See* X.

III.—TAR AND TAR PRODUCTS.

Patents.

Tar derived from coal, wood, mineral oil, or the like ; Process of and apparatus for treating —— for the purpose of obtaining a pitch for agglomerating purposes. J. G. F. Giesbers, Paris. Eng. Pat. 2901, Feb. 5, 1910.

To obtain pitch for agglomerating purposes, almost entirely soluble in benzene, etc., and free from hard carbonised matter, the tar is heated with a mixture of either sulphurous and nitric acids or sulphuric and nitric acids, to 60°—100° C., according to whether a soft or hard pitch is desired. A mixture of 3 to 4 per cent. by weight of sulphurous acid and 0·8 to 1 per cent. of nitric acid on the one hand, or 6 to 10 per cent. of a mixture of 98 parts of sulphuric acid and 2 parts of nitric acid, have been found suitable. It is stated that the tar oils produced are free from nitro- and sulpho-compounds. The process may be carried out in an ordinary closed vessel provided with a stirrer, or in a specially designed apparatus, in which the heated tar and the acids are brought simultaneously into the intake of a centrifugal fan, where they are intimately mixed ; they then fall into a vessel provided with a heating coil, where the heating is continued until the process is complete.—T. F. B.

Anthranol ; Manufacture of ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 1728, Jan. 23, 1911.

Anthraquinone may be reduced to anthranol by suspending it in water or acetic acid and treating it with ferrous chloride, or with iron and hydrochloric acid, or with iron and ferrous chloride. For example, 50 parts of anthraquinone, 10 parts of iron, and 1000 parts of a 50 per cent. aqueous solution of ferrous chloride are heated in an autoclave to 200° C. until a test portion of the product dissolves in caustic soda to a yellow solution ; when cool, the solid product is separated from the liquid, dissolved in caustic soda, and precipitated by hydrochloric acid. When the anthranol is to be subsequently treated in acetic acid solution, as in the preparation of dianthrone, it is recommended that the reduction be carried out in acetic acid suspension, in which case isolation of the anthranol is unnecessary.—T. F. B.

o-Chlorobenzo-trichloride : Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 229,873, March 6, 1910.

o-Chlorobenzo-trichloride is obtained by chlorinating, at 150°—180° C., *o*-chlorobenzylsulphochloride ; this may be prepared by the action of phosphorus pentachloride on *o*-chlorobenzylsulphonic acid.—T. F. B.

1·4-*Dichloronaphthalene*-6-*sulphonic acid and* 1·5-*dichloronaphthalene*-3-*sulphonic acid ; Process for preparing ——.* Badische Anilin und Soda Fabrik. Ger. Pat. 229,912, March 22, 1910.

The mixture of the two sulphonic acids, obtained by the sulphonation of a mixture of 1·4- and 1·5-dichloronaphthalenes, is readily separated by aid of the alkali, alkaline earth, or magnesium salts of the acids, those of 1·4-dichloronaphthalene-6-sulphonic acid being much less easily soluble in water than those of the isomeric acid.—T. F. B.

Acenaphthenone ; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 230,237, Oct. 23, 1909.

Acenaphthenone may be obtained by the action of aluminium chloride on the chloride or bromide of *a*-naphthylacetic acid, with or without the aid of a solvent or diluent. The *a*-naphthylacetyl chloride when purified by careful distillation *in vacuo*, is a yellowish pungent oil, of b. pt. 188° C. under a pressure of 23 mm.—T. F. B.

Anthraquinone ; Manufacture of —— and of derivatives thereof. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 11,472, May 9, 1910.

See Fr. Pat. 416,735 of 1910 ; this J., 1910, 1368.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Hydroxyazo dyestuffs ; Fastness to light of methylated ——. N. Woroshzow. J. Russ. Phys.-Chem. Ges., 1910, 42, 1458—1465. Chem. Zentr., 1911, 1, 650—651.

When hydroxyazo dyestuffs are methylated by means of dimethyl sulphate in alkaline solution, new dyestuffs are produced which are faster to light than the substances from which they are derived.—A. S.

Patents.

Colouring substance and process for the manufacture of the same. X. Debédat, Bordeaux, France. Eng. Pat. 3093, Feb. 8, 1910.

See Addition of Dec. 24, 1909, to Fr. Pat. 401,559 of 1909 ; this J., 1910, 939. Tannin-containing plants, other than heather, may also be treated by the same process. —T. F. B.

Anthraquinone derivatives [*Arylaminoanthraquinones*] ; *Production of ——.* Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Sept. 17, 1910 (Under Int. Conv., Oct. 28, 1909) to Fr. Pat. 362,140, Jan. 3, 1906 (this J., 1906, 752).

Dyestuffs analogous to those described in the chief patent are prepared by condensing aminoanthraquinones with halogen derivatives of diphenyl. Example : 2 parts of *pp*-dichlorodiphenyl are heated with 5 parts of 1-aminoanthraquinone, 5 parts of anhydrous sodium acetate, 0·5 part of copper chloride and 40 parts of naphthalene until the mass has acquired a bluish red colour which does not increase in intensity. Alcohol is then added, the dyestuff collected and washed with water. It gives an orange brown vat from which cotton is dyed in fast violet shades. A table is given in the patent showing the properties of other dyestuffs produced similarly.—J. C. C.

Azine dyestuffs ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 230,456, Dec. 7, 1909.

New azine dyestuffs, which dye wool green shades from acid baths, are obtained by oxidising amino-1·3-diarylnaphthylenediamines or their sulphonic acids. Atmospheric oxygen may be used as the oxidising agent, with or without the aid of an oxygen catalyst or another oxidising agent.—T. F. B.

Azo dyestuffs ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 230,595, April 12, 1910.

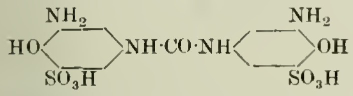
Nitrobenzoyl halides are condensed with aminobenzoyl-2-amino-5-naphthol-7-sulphonic acid, and the products are reduced and combined with diazo compounds of aromatic amines. The products dye cotton clear orange-red to bluish-red shades fast to light. By diazotising on the fibre and developing with *β*-naphthol, etc., the shades become yellower and fast to washing.—T. F. B.

Anthraquinone vat dyestuffs. Badische Anilin und Soda Fabrik. Fr. Pat. 420,267, Sept. 9, 1910. Under Int. Conv., July 11, 1910.

When *o*-halogenbenzoyl-2-aminoanthraquinones are treated with alkaline reagents in the presence of a catalyst, fast vat dyestuffs are obtained. Example : 10 kilos. of *o*-chlorobenzoyl-2-aminoanthraquinone are boiled with 25 kilos. of nitrobenzene or naphthalene, 0·2 kilo. of copper chloride and 3 kilos. of sodium carbonate until the formation of the dyestuff is complete. This is collected, washed and dried in the usual way. It dyes cotton from the vat in orange red shades. Similar dyestuffs are produced starting from 2 : 6- or 2 : 7-diaminoanthraquinone or from 2-amino-6-chloro- or 2-amino-6-hydroxyanthraquinone.—J. C. C.

Disazo dyestuffs dyeing on a chrome mordant ; Production of new ——. Act. Ges. für Anilinfabr. Fr. Pat. 420,330, Sept. 12, 1910. Under Int. Conv., Nov. 22, 1909.

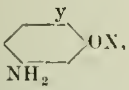
By the action of phosgene on 2-nitro-1 : 4-aminophenol-6-sulphonic acid and subsequent reduction of the nitro-groups, a compound is obtained having the formula



This, when tetrazotised and combined with components, gives dyestuffs which when chromed on the fibre are very fast to milling and light. The dyestuff obtained, for example, from the tetrazo-compound and β-naphthol dyes wool brownish red which on chroming becomes violet black, and when 1-phenyl-3-methyl-5-pyrazolone is used, the resulting dyestuff dyes wool in orange shades which turn red on chroming.—J. C. C.

Ortho-aminoazo-dyestuffs ; Production of new ——. Act. Ges. für Anilinfabr. Fr. Pat. 420,364, Sept. 13, 1910. Under Int. Conv., Dec. 15, 1909.

Diazo compounds are combined with compounds of the general formula,



where X denotes an alkyl group or the $CH_2.CO_2H$ group and *y* denotes an alkyl, oxyalkyl, acidylamino-, halogen or sulphonic group. The combination is effected in acid solution and the diazo group enters the molecule in the position ortho to the amino-group and para to the oxy-group. In this way dyestuffs are obtained which dye wool from an acid bath and can be subsequently chromed, or which dye cotton directly, the shades being afterwards diazotised and developed on the fibre. The product obtained from diazotised sulphanilic acid and 1-methoxy-5-amino-2-*p*-toluenesulphaminobenzene dyes wool in orange shades, that from diazotised picramic acid and *o*-cresyl-*m*-aminoglycollic acid ($CH_3 : O.CH_2.CO_2H : NH_2=1:2:4$) dyes wool in the presence of chrome mordants, olive, that from diazotised 1 : 8-aminonaphthol-3 : 6-disulphonic acid and *o*-chloro-*m*-aminophenyl methyl ether ($O.CH_3 : Cl : NH_2=1:2:5$) dyes wool in violet shades, that from tetrazotised benzidine and *m*-amino-*o*-cresyl methyl ether (1 mol.) and 2-naphthol-3 : 6-disulphonic acid (1 mol.) dyes cotton in violet red shades which become redder when diazotised and developed with β-naphthol, and that from tetrazotised diaminostilbenedisulphonic acid and *m*-amino-*o*-cresyl methyl ether dyes cotton in brownish red shades which when diazotised and developed with β-naphthol turn brown.—J. C. C.

Dyestuffs dyeing cotton direct ; Production of new ——. Act. Ges. für Anilinfabr. Fr. Pat. 420,423, Sept. 15, 1910. Under Int. Conv., Dec. 15, 1909.

Azo dyestuffs are obtained by combining two molecular proportions of a diazo compound with *mm'*-diaminophenylurea and subsequently converting the amino-groups into acetylamino- or benzoylamino-groups. The dyestuff prepared by the use of diazotised *m*-aminobenzoic acid and subsequent acetylation dyes cotton in yellow shades, that from 1 : 4-naphthylaminosulphonic acid and subsequent benzoylation dyes cotton in orange shades, and that produced from diazotised sulphanilic acid and *mm'*-diaminotolylurea with subsequent treatment with *m*-nitrobenzoyl chloride dyes cotton in reddish yellow shades.—J. C. C.

Monoazo dyestuff ; Process for preparing a yellow ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 229,641, June 11, 1909. Addition to Ger. Pat. 229,242, April 30, 1909 (see Fr. Pat. 410,639 of 1909 ; this J., 1910, 809).

By combining the diazo-compound of *p*-chloro-aniline-*m*-sulphonic acid with o-chlorophenylmethylpyrazolone, a dyestuff is obtained which dyes wool from acid baths in fast, bright yellow shades, decidedly greener than those produced by the dyestuff prepared according to the principal patent.—T. F. B.

Anthraquinone vat dyestuffs ; Production of new ——. Act.-Ges. für Anilinfabr. Fr. Pat. 420,530, Sept. 17, 1910. Under Int. Conv., April 23, 1910.

Anthraquinone vat dyestuffs containing the thiazole group and a free amino-group are converted into new dyestuffs by treatment with acidylating agents. Example : 35 parts of the dyestuff prepared by heating monobenzylidene-2 : 6-diaminoanthraquinone with sulphur are boiled with 50 parts of acetic anhydride under a reflux condenser. The new dyestuff gives a violet red vat from which fibres are dyed in clear yellow shades. A dyestuff of similar properties is obtained when benzoylation instead of acetylation is effected.—J. C. C.

Vat dyestuffs of the anthraquinone series ; Manufacture of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 404, Jan. 6, 1911. Under Int. Conv., May 12, 1910.

By the action of amino-anthraquinones on monobromoanthraquinone-acridone (see Eng. Pat. 22,780 of 1910 ; this J., 1911, 276), condensation products are obtained, which dye cotton fast brown shades from hydrosulphite vats. In an example, the condensation is effected by the aid of sodium carbonate and copper powder in presence of nitrobenzene.—T. F. B.

Dyestuffs of the gallocyanine series ; Process for preparing ——. Farbwerke vorm. L. Durand, Huguenin, und Co. Ger. Pat. 229,708, Feb. 7, 1909.

The products described in Ger. Pat. 206,465 (this J., 1909, 305), prepared by condensing aromatic amines with the gallocyanine from nitrosodiethylaniline and gallamic acid (containing no carboxylic groups), are converted by sulphonation into similar products, but somewhat greener in colour.—T. F. B.

Isatin from indigo ; Process for preparing ——. F. R. Diez und Co. Ger. Pat. 229,815, Dec. 2, 1909.

Yields of 90 per cent. of isatin are stated to be produced by oxidising indigo with nitric acid containing chromic anhydride, the mixture being preferably cooled during the process. The nitric acid serves to oxidise the indigo, whilst the chromic anhydride re-oxidises the nitrous acid to nitric acid.—T. F. B.

Dyestuffs from pyridine sulphurous ester ; Process for preparing ——. Kalle und Co., A.-G. Ger. Pat. 230,865, April 8, 1909.

Pyridine sulphurous ester is treated with an alkali or alkaline agent, and then condensed with a primary or secondary amine, with or without the aid of a condensing agent.—T. F. B.

Naphtho-anthraquinone-azines ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 230,005, Feb. 26, 1910.

Naphtho-anthraquinone-azines are obtained by condensing azo derivatives of anthraquinonyl-β-naphthylamine, *e.g.*, by means of 80 per cent. sulphuric acid. The azine from benzene-azo-α-anthraquinonyl-β-naphthylamine gives a blue vat with sodium hydrosulphite, from which cotton is dyed pale yellow shades.—T. F. B.

3·6-*Diamino-acridine; Process for preparing* ——. L. Cassella und Co. Ger. Pat. 230,412, March 11, 1910.

3·6-DIAMINO-ACRIDINE is obtained by heating *o.p.o′.p′*-tetra-aminodiphenylmethane in acid solution in presence of salts of tin. It is more soluble than its homologue, Acridine Yellow.—T. F. B.

[*Triphenylmethane*] *dyestuffs; Manufacture of* ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 26,677, March 14, 1910.

SEE Fr. Pat. 419,902 of 1910; this J., 1911, 125.—T. F. B.

Monoazo dyestuff and process of making same. H. Geldermann, Gross-Lichterfelde-Ost, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 984,900, Feb. 21, 1911.

SEE Fr. Pat. 410,639 of 1910; this J., 1910, 839.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Paper-making raw materials in Java; Investigation of certain —— [*rice-straw*]. H. G. Havik. Papierfabr., 1911, **9**, 245—247.

THE author has studied on behalf of the Government of the Dutch Indies the question of the utilisation of rice straw as a raw material for papermaking. His report has been issued by the Department of Agriculture. The area under rice cultivation in Java is over three million acres. Two kinds of straw are harvested: paddy straw, that which is collected with the unhusked rice, amounting to about 10 per cent. of the weight of that product, and field-straw, which is left on the fields, amounting to about 1·4 times the weight of the raw paddy. The production of paddy straw may be estimated at 465,840 tons and the production of field straw at about 6½ million tons. The cost of paddy straw including transport to the mill is estimated at about 9s. 6d. per ton, that of field straw at about 7s. 9d. per ton. In the author's experiments the straw was chopped into small pieces and the knots were sorted out as far as possible. The digestion of paddy straw was carried out with 8 per cent. of its weight of sodium hydroxide under a pressure of 2—3 atmospheres for 2—3 hours. The yield of unbleached half-stuff amounted to 45 per cent., and the material bleached readily with sodium hypochlorite equivalent to 1—2 per cent. of active chlorine. The digestion of field-straw required more severe conditions, with the use of 11 per cent. of sodium hydroxide under a pressure of 4 atmospheres for 4 hours. The yield was only 32 per cent., and in the bleaching process 3—4 per cent. of active chlorine were consumed. The sulphate process, as applied to European straws would probably be suitable for rice straw. The abnormally high percentage of silica (9—15 per cent.) in rice straw makes it very doubtful whether a recovery of the soda would be profitable. The estimated cost of manufacturing unbleached straw half-stuff at a local mill, at the rate of 10 tons per day, without soda recovery, is calculated at £8 2s. per ton from paddy straw and £11 9s. per ton from field straw.
—J. F. B.

Sulphite wood-pulp; Prevention of resin deposits in ——. Frohberg. Wochenbl. Papierfab., 1911, **42**, 668—669.

THE presence of accumulations of resin in badly manufactured sulphite wood pulp leads to serious troubles in the manufacture of paper therefrom. The resin may be detected by pulping up some of the cellulose with about 500 times its weight of water, carefully stirring and decanting off the fibres. At the bottom of the vessel small globules of resin will be found, which, if allowed to get into the paper, would produce specks, and other faults. The best way to avoid the accumulation of resin is to select only sound wood of the right quality, rejecting all logs which appear to be abnormally resinous. Wood which has been injured during growth is particularly liable to secrete resin; deficiency of moisture and air also promote the secretion, as also do light and warmth. Those trees are more resinous which are felled in the hot and dry season of the year, also those which grow on rocky and dry ground with southern exposure. The best wood is grown on moist plains in thickly planted forests. Unfortunately a pulp mill can rarely afford to be particular in the selection of its wood; the object then to be aimed at is the most perfect draining of the digested pulp whilst the lye is still hot and holds the resin in the liquid form as an emulsion. Washing with hot water is useless unless its temperature be above the melting point of the resin, in which case it is too costly. Perfect draining whilst hot, if possible under pressure or suction, is the best means of removing the resin. The drained pulp should then be washed from above downwards by a powerful spray of cold water which will expel the residual lye rapidly. The chilling of the partially drained charge with cold water immediately deposits the solid resin in the pulp, and must be avoided. The use of petroleum or similar adjuncts in the washing process is quite futile; also an attempt to skim off the resin from the surface of the liquid pulp by strips of felt is more likely to do harm than good. The lumps of resin can be separated by sand-tables only if the pulp be extremely dilute (1 : 1000) and its speed of travel low.—J. F. B.

Paper; Substitution of magnesium sulphate for aluminium sulphate in the sizing of ——. P. Klemm. Wochenbl. Papierfab., 1911, **42**, 666—667.

THE substitution of magnesium sulphate for a portion of the aluminium sulphate in the sizing of paper has recently been advocated on grounds of economy. The functions of aluminium sulphate in sizing may be stated under three heads: the neutralisation of the soda of the resin soap and consequent precipitation of the combined rosin, the neutralisation of the alkalinity of the water, the neutralisation of the basic impurities of the pulp. Of these functions only the first, the precipitation of the rosin soap, can be efficiently performed by magnesium sulphate, and the consumption of aluminium sulphate under this head may be only a fraction of the total quantity required. Consequently the substitution of magnesium sulphate can only be partial, and considerable quantities of aluminium sulphate, varying in each particuar case, will still be required. Nevertheless, it is possible to calculate the quantity of magnesium sulphate required to interact with the quantity of soda in the rosin soap employed, and it is also possible to calculate what quantity of aluminium sulphate may be omitted in making this substitution. In making the latter calculation it must be borne in mind that only two-thirds of the sulphuric acid in aluminium sulphate are available for the purposes of neutralisation or interaction, the last one-third remaining in combination with the alumina in the form of an insoluble basic sulphate.
—J. F. B.

Paper; Tests with loading materials in ——. J. Vestergren. Papierfabr., 1911, **9**, 217—223.

ONE of the most important tests to be made on a loading material is the yield or "carrying quality" on the paper machine. The losses occurring may be determined from the following data: α=percentage of ash in the dry substance of the stuff in the chest; β=percentage of ash in the dry substance of the paper; γ=percentage of ash in the dry substance of the backwaters discharged from the circulation of the system; f=percentage of ash in the dry fibre of the pulp. Hence, the loss of fibre on the machine $=100\frac{\alpha-\beta}{\gamma-\beta}\cdot\frac{100-\gamma}{100-\alpha}$, and the loss of loading $=100\frac{\alpha-\beta}{\gamma-\beta}\cdot\frac{\gamma-f}{\alpha-f}$, expressed as percentages of the dry fibre and dry, ignited loading materials employed. Sedimentation tests, made by preparing a uniform suspension of the loading material in distilled water and noting the velocity of settling in a vertical cylinder, and the volume and nature of the deposit, are also of considerable importance. The formation of stratified deposits indicates inequality of grain; in the case of clays the suspension clears from the surface downwards, whereas in the case of talc a pronounced deposit is first formed, while the suspension becomes more dilute and only begins to show a clear layer at a later stage. In determinations of yield on the paper machine, the results are considerably influenced by various conditions with the same loading material. For instance, "wet" beaten pulps show a very much higher yield of loading than "free" beaten pulps, other things being equal. Thicker papers retain the loading better than thinner papers. The percentage loss of loading is greater as the proportion added to the pulp is increased. The increased losses due to increased proportions of loading are very pronounced in the case of thin papers, but become inconsiderable in thicker substances, *e.g.*, above 85 grms. per sq. m. An increase in the dilution of the pulp flowing on to the paper machine produces a marked increase in the loss of loading materials. Asbestine generally shows a better yield than other loading materials, mainly on account of its fibrous structure. The view generally entertained, that the finest loadings and the most plastic clays give the highest yields, is only correct within certain limits. For instance, in testing a series of clays, the maximum losses were registered with the samples showing the poorest and the best results in the sedimentation tests. This anomaly is explained thus: In so far as the retention of loading depends on colloidal adsorption, *i.e.*, the mutual attraction between the fibres and mineral particles, the materials having the finest particles, remaining longest in suspension, show the best yields. But after the adsorption affinities are saturated, an excessive proportion of fine particles causes an increased loss, owing to their ready passage through the filtering layer.—J. F. B.

Liability of wool oils to gum on oxidation. Gill and Shippee. *See* XII.

Patents.

Plastic material [*celluloid substitute*]. A. Chanard. First Addition, dated Nov. 25, 1909, to Fr. Pat. 406,624, Dec. 11, 1908 (see Eng. Pat. 28,598 of 1909; this J., 1910, 483).

The addition provides for the admixture, with the mass described in the original patent, of various substances having multiple effects, *i.e.*, colours, solvents, loading or hardening materials such as chromium and aluminium compounds, tannin, acids, etc. The various substances are finely powdered, intimately mixed with the mass, then moistened with water to which turpentine or other resin solvent may have been added. Homogeneity is obtained by means of heat and pressure. In the case of certain starchy materials, nitrogen-containing substances may be added in order to increase the nitrogen content. —E. W. L.

Celluloid in any form; Process of rendering —— non-inflammable. G. Chandon de Briailles. Fr. Pat. 420,044, Nov. 11, 1909.

The process, particularly applicable to developed cinematograph films, celluloid in any form and artificial silk, depends on denitration under conditions designed to prevent shrinkage and deformation. The operation is conducted in an autoclave by the action of a solution of ammonium sulphide, ammonia and gelatin of suitable concentration and temperature. The liquid is forced into the material under high pressure, *e.g.*, 10 atmospheres, developed by means of sulphuretted hydrogen gas. When strips of films have to be treated they are wound in a spiral on a plate carrying metal pegs surrounded by glass tubes, which hold the films apart from each other. The gelatin takes the place of the camphor and nitro derivatives removed by the treatment and thus prevents shrinkage. It is subsequently converted into an insoluble form. Artificial silk is subjected to an after-treatment with boric acid.—J. F. B.

Celluloid and similar materials having a basis of pyroxylin; Means for rendering non-inflammable ——. J. Nigro and P. C. A. Hollande. Fr. Pat. 420,212, July 8, 1910.

A solution of 1 part of celluloid or similar material in 10 parts of acetone is mixed with a solution of 1 part of powdered magnesium chloride in 3 parts of alcohol. A homogeneous paste is formed which is then dried and subjected to the ordinary industrial processes employed in the manufacture of celluloid articles.—J. F. B.

Nitrocellulose; Recovery of solvents (alcohol and ether) used in the treatment of ——. J. M. de Sauverzac. Fr. Pat. 420,086, Nov. 12, 1909.

Materials of a nitrocellulose basis containing solvents are subjected to the action of a liquid which absorbs these solvents. A suitable liquid is composed of 400 parts of water, 600 parts of alcohol and 200 parts of aluminium chloride or other chloride. Alternatively carbon tetrachloride may be employed pure for the same purpose. The solvents are subsequently recovered by the fractional distillation of the liquid.—J. F. B.

Paper-making. W. H. Millspaugh, Sandusky, Ohio, U.S.A. Eng. Pat. 7042, March 21, 1910. Under Int. Conv., Oct. 7, 1909.

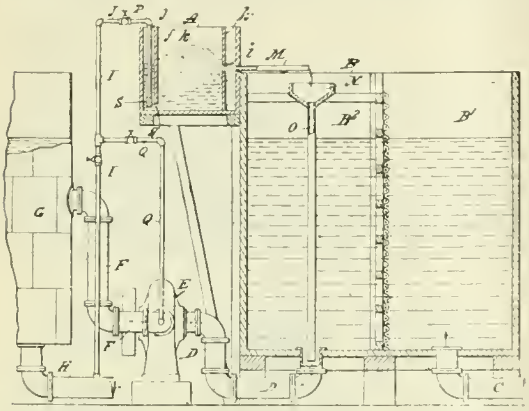
The pulp is formed into a sheet on a wire, which is free from pressure appliances for squeezing out water from the sheet, and a suction-roll is in contact with and drives the wire. By means of a positive-acting rotary vacuum pump connected with the suction chamber or chambers of the suction-roll, a constant high-tension vacuum is maintained in the latter, so that large volumes of air are drawn uniformly through the sheet as it passes over the suction-roll, and air may be also drawn through the pulp, whilst on the wire, by means of a flat suction-box. Before passing to the drying rolls, the sheet may be passed over or between smoothing rolls, or the sheet may be smoothed by a roll in contact with the suction-roll, and by means of a type-carrying roll the paper may be watermarked at this point. A hood, to which heated air is supplied, may be arranged opposite the suction-roll, so that hot air is drawn through the sheet. Colouring, sizing, or waterproofing substances may be sprayed on to the sheet, whilst in contact with the suction-roll, the liquid thus permeating it uniformly. The sheet may be passed over or under additional suction-rolls before passing to the drying-rolls, and a hot air chamber may be arranged between a pair of such suction-rolls, so that the sheet may be transported over the chamber by a wire cloth passing over the suction-rolls. Air is thus drawn through the sheet as it passes over the first roll, then hot air is blown from the chamber through the sheet, and hot air finally drawn through the sheet as it passes over the second suction-roll.—B. N.

Impregnating paper or the like. F. Dobler, Paris. Eng. Pat. 26,180, Nov. 16, 1910. Under Int. Conv., Nov. 18, 1909.

Paper is impregnated with substances, either in solution or in the form of emulsion, by passing it between a pair of horizontal rollers, the axes of which are not in the same vertical plane; the lower roller is partially immersed in the solution, and the upper roller sprinkled with the liquid. The vessel containing the solution may be moved away from the lower roller, and the upper roller is adjustable, so that it may be lifted off the lower one. The pressure of the upper roller on the lower one may be regulated by means of sliding weights on levers, which are attached to the axis of the upper roller.—B. N.

Alum solution for paper-makers' use; Apparatus for providing ——. S. Hardman, Holyoke, Mass. U.S. Pat. 979,482, Dec. 27, 1910.

The alum solution is prepared in the box, A, which is separated by partitions, *f* and *h*, into three compartments. Water is delivered at a rate regulated by the valve, P, through the pipe J, and a screen, S, to the bottom of the compartment, *j*, passing through the solid alum in the inner compartment, *k*, and overflowing through the slit, *i*, and the tube, M. The saturated solution of alum passes into the funnel, N, and through the vertical tube, O, to the pipe, D. The water, for use in the paper mill is obtained from a convenient supply, such as a canal or reservoir,



and delivered through the pipe, C, into the compartment, B¹, of a screen-box, B, passing through a screen and grating to the compartment, B². By means of a pump, E, the water and alum solution are drawn through the suction pipe, D, and forced through the pipe, F, into a filter, G, and then discharged for use through the pipe, H. Filtered water may be supplied through the pipe, I, to the alum box, A, or, if sufficient filtered water is not available, unfiltered water may be taken for this purpose from the pipe, F, through the tube, Q.—B. N.

Fibres impregnated with actinium and process of manufacturing them. La Banque du Radium, Soc. Anon., Paris. Eng. Pat. 3105, Feb. 8, 1910. Under Int. Conv., Sept. 28, 1909.

SEE Fr. Pat. 418,455 of 1909; this J., 1911, 79.—T. F. B.

Fibrous plants; Mechanical treatment of —— for obtaining fibre suitable for spinning. E. Nowitzki, St. Petersburg. Eng. Pat. 14,395, June 14, 1910.

SEE Fr. Pat. 417,422 of 1910; this J., 1911, 19.—T. F. B.

Proteid composition [for making threads]; Process of obtaining soluble and coagulable ——. H. J. L. Chavassieu, Lyon, France. U.S. Pat. 984,539, Feb. 21, 1911.

SEE Addition of July 31, 1909, to Fr. Pat. 395,402 of 1907; this J., 1910, 1371.—T. F. B.

Cellulose acetates and process of treating same. H. S. Mork, Boston, U.S.A. Eng. Pat. 20,672, Sept. 5, 1910. Under Int. Conv., Feb. 10, 1910.

SEE Fr. Pat. 416,752 of 1910; this J., 1910, 1371.—T. F. B.

Collodion filters. Fr. Pat. 420,319. *See* I.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Sulphuric acid in textile materials dyed with sulphide dyestuffs; The presence of free ——. L. Monin. Rev. Gen. Mat. Col., 1911, 15, 65—67.

THE author finds that the free sulphuric acid, which is formed from the sulphide dyestuff, is largely neutralised and completely eliminated during the dyeing operations, and that tissues dyed with Sulphide Black are not altered after five months exposure under varying conditions.—B. N.

PATENTS.

Bleaching straw by means of hydrosulphites; Process of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 420,725, Sept. 23, 1910. Under Int. Conv., July 22, 1910.

A SOLUTION is prepared containing 1 kilo. of powdered sodium hydrosulphite, 500 grms. of crystallised sodium phosphate and 300 grms. of anhydrous sodium carbonate in 100 litres of cold water. The straw is introduced into this bath and the temperature of the solution is then gradually raised to 60°—70° C. This temperature is maintained for about 12 hours and then allowed to fall slowly. When cool, the goods are removed from the bath, are thoroughly washed and further treated for 2—3 hours in a bath of oxalic acid containing 2 grms. in a litre at a temperature of 30°—40° C. The straw is finally washed and dried.—P. F. C.

Mercerising machine. G. E. Drum and J. H. Skitt, Assignors to R. P. Smith and G. E. Drum, Philadelphia, Pa. U.S. Pats. 983,542 and 983,543, Feb. 7, 1911.

THIS apparatus comprises a tank containing the mercerising liquid, a yarn frame which can be lowered into or raised from the tank by means of a rotatable screw, and a water pipe for washing the yarn after the frame has been raised from the tank. In order to prevent the washings from falling into and diluting the mercerising liquid, a plate, pivoted to one wall of the tank, can be moved into such a position underneath the raised yarn frame that it catches the washings and delivers them into a trough. The yarn frame consists of fixed supporting rollers and stretching rollers which are so arranged that the distance between them and the supporting rollers can be varied at will by means of an adjustable screw. This device permits the yarn, which is carried by the rollers, to be mercerised under tension. P. F. C.

Wool, silk and hair; Use of oxidation products of phenols and especially quinones for the treatment of ——. L. Meunier. First Addition, dated Nov. 19, 1909, to Fr. Pat. 418,797, Oct. 9, 1909 (see Eng. Pat. 4557 of 1910; this J., 1910, 1199).

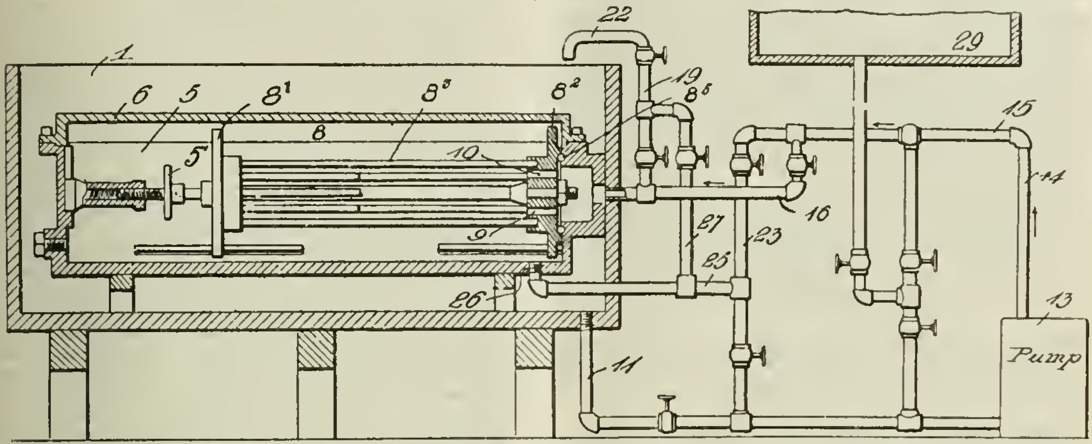
THE material to be treated is hung in a closed chamber on the floor of which are dishes containing quinone, which can be heated by a current of air to a temperature of about 40° C. The quinone volatilises, fixes itself on the material and dyes it a violet-rose colour. The goods are then withdrawn from the chamber and allowed to age in air for several days.—P. F. C.

Dyeing loose material; Apparatus for ——. W. Berger, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 983,530, Feb. 7, 1911.

THE opened-out material is taken between two endless travelling bands, which carry it through the liquor contained in a dye-vat. During the first part of its traverse the material is pressed between two sets of nipping rollers. The travelling bands then diverge and pass one on either side of a rapidly rotating toothed roller by means of which the material is thoroughly opened. The bands then come together, again seize the loosened material, carry it over and under a series of tension rollers which are arranged at points along the traverse, and finally deliver the dyed material from the machine. The squeezing and opening of the material are both carried out under the surface of the dye-liquor.—P. F. C.

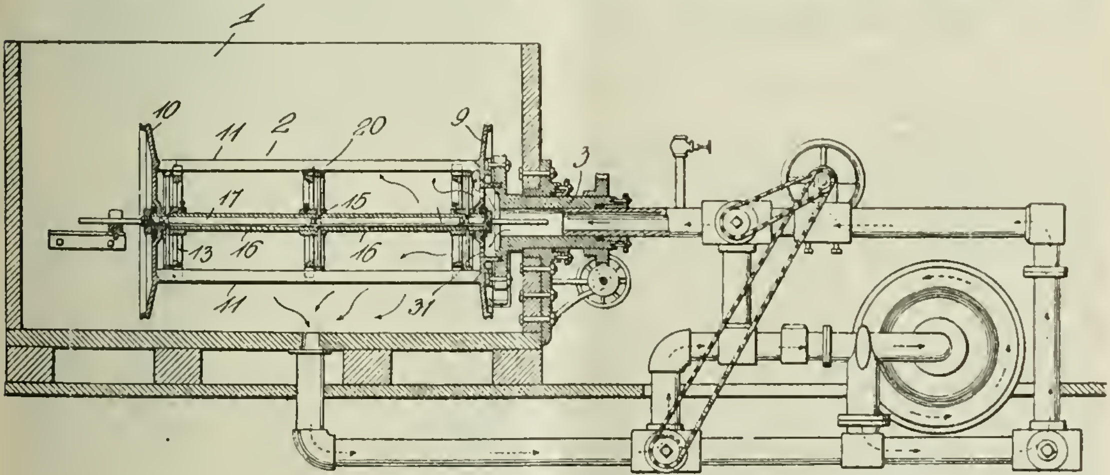
Dyeing yarn; Apparatus for ——. J. M. Payne, Phœnix, and G. G. Wallace, Girard, Ala., Assignors to E. W. Swift and J. P. Kyle. U.S. Pat. 976,830, Nov. 22, 1910.

THE apparatus comprises a vat, 1, and a casing, 5, provided with a cover, 6, disposed horizontally within the vat, the casing having a chambered end, 7. A warper beam, 8, comprising ends, 8¹ and 8², and spaced rods, 8³, for supporting the yarn, is disposed horizontally within the casing, and is provided at one end with openings, 9 and 10, adapted to register with the chambered portion, 7, of the casing. The beam is secured in a rigid position by the jack screw, 5^1, which thus compresses the packing ring, 8^5, between the adjacent ends of the beam and casing. By means of a pump, 13, the dye liquor, supplied from the tank, 29, may be forced through the pipes, 14, 15, and 16, through the openings, 9 and 10, to the interior of the beam, then through the yarn, and withdrawn from the casing by the pipes, 25, 27, 19, and 22, into the vat, 1. The direction of flow may then be reversed, and the liquor passed through the pipes, 11, 14, 15, 23 and 25, and through the opening, 26, into the casing, then through the yarn to the interior of the beam, and out through the pipes, 16, 19, and 22, back into the vat, 1.—B. N.



Dyeing yarn on a rotatable drum or roller ; Machine for ——. F. M. Morton. Fr. Pat. 420,311, Sept. 12, 1910.

Inside a dye-vat, 1, is arranged a rotatable drum, 2, carrying the yarn to be dyed. This drum which is connected with a hollow trunnion, 3, has circular ends, 9 and 10, joined by bars, 11, which are also supported by notches in the peripheries of wheels, 13 ; the notches being of such a depth that the bars do not fill them. The wheels, 13, are centred round a hollow sleeve, 16, fixed to the heads 9 and 10, and through this sleeve is inserted an axle, 17, movable longitudinally and provided along its length with a number of V-shaped slots, 15. In order to keep the drum at its maximum diameter whilst the yarn is being wound on to it, the bars, 11, are forced outwards by means of split elastic rings, 20, provided with spokes which pass through slots in the sleeve, 16, and rest on the inner axle, 17. By moving the axle, 17, longitudinally, the inner ends of the spokes can be brought opposite to the V-shaped slots in the axle and made to slip into them, thus reducing the diameters of the split rings and allowing the drum of bars to contract radially and reduce the tension of the yarn wound on them. This reduction in the diameter of the drum, 2, is effected after it is immersed in the dye-liquor in order to allow the liquor free access to all parts of the yarn, and so produce even dyeings. The head, 9, is provided with perforations, 31, for the passage of the dye-liquor from the interior of the trunnion, 3, into the drum and outwards through the yarn wound on it, or, if desired, in the reverse direction. Means are provided for circulating the dye-liquor and for reversing the direction of flow.—P. F. C.



Dyeing hairs, furs, etc. ; Process for ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 230,630, April 6, 1910. Addition to Ger. Pat. 226,790, Oct. 24, 1909.

In the process described in the principal patent (see Eng. Pat. 5134 of 1910 ; this J., 1910, 1103), the *m*-diaminoanisol or *m*-diaminophenetol is replaced by *m*-aminodimethyl-o-toluidine or by monomethyl-2.4-diamino-anisol (see also Eng. Pat. 18,921 of 1910 ; this J., 1910. 1301). —T. F. B.

Discharge, or printing effects on fibre which has been dyed with vat colouring matters ; Production of ——. Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 21,052, Sept. 9, 1910. Under Int. Conv., Jan. 31, 1910.

Discharge effects may be obtained by treating the fibre with reducing agents, such as grape sugar and stannous oxide, other than a formaldehyde sulphoxylate, a formaldehyde hydrosulphite, or a hydrosulphite, as described in Eng. Pat. 30,505 of 1909 (see Fr. Pat. 414,937 ; this J., 1910, 1247), in the presence of an ammonium compound containing an aralkyl residue.—B. N.

Textile piece goods; Steaming and cooling of ——. T. Schofield and H. Sagar, Sowerby Bridge, Yorks. Eng. Pat. 6441, March 15, 1910.

The fabric is passed in continuous form, either with or without wrappers, over the perforated surface of a chamber through which steam is forced, and then immediately over the perforated surface of a second chamber, in close proximity to the first, through which cold air is drawn. The steam and exhaust connections are interchangeable, so that the fabric may be passed in the reverse direction through the machine.—B. N.

Vegetable fibres dyed with vat dyestuffs; Process of bucking and bleaching——. F. C. Theis, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 983,951, Feb. 14, 1911.

See Ger. Pat. 218,254 of 1908; this J., 1910, 419.—T. F. B.

Bleaching composition. A. Stiegelmann and E. Dehnel, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 984,312, Feb. 14, 1911.

See Eng. Pat. 2522 of 1909; this J., 1909, 535.—T. F. B.

Calico-printing; Process of ——. F. Davis, Wiswell, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 984,545, Feb. 21, 1911.

See Eng. Pats. 17,713 of 1908 and 2437 of 1909; this J., 1909, 1031.—T. F. B.

Ramie and other fabrics; Process of rendering —— water-repellent and colouring the same. A. M. Hart, London. U.S. Pat. 984,665, Feb. 21, 1911.

See Eng. Pat. 13,020 of 1908; this J., 1909, 472.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphuric acid and sulphates; New method for determining ——. V. Auger and M. Gabillon. Comptes rend., 1911, **152**, 441—443.

A long-necked flask of about 50 c.c. capacity, with a lateral delivery tube, is used; a second tube, extending to the interior of the flask, serving for the passage of dry carbon dioxide throughout the operation. The lateral tube is joined to a glass tube, 1 cm. wide and 25 cm. long, which is filled with iodine for a length of 3 cm. and, in the remaining part, with calcium iodide. This tube is connected with a washing vessel containing about 5 c.c. of a solution of hydriodic acid of concentration higher than that corresponding to HI+7*aq*, this solution being rendered colourless by addition of phosphorous acid. The apparatus is completed by two washing vessels, which together contain about 100 c.c. of a 2·5 per cent. solution of zinc acetate. About 20 grms. of phosphoric acid (acid of 60° Baumé diluted in the proportion of 5 : 6), 2 grms. of phosphorous acid, 3 grms. of powdered potassium iodide, and 0·2 grm. of the finely powdered sulphate, are introduced into the flask. When the apparatus is filled with dry carbon dioxide, the flask is heated in an oil- or sulphuric acid-bath. The decomposition of the sulphate begins at about 80° C. and is completed at about 110° C., the average duration of heating being 20—25 minutes. The iodine liberated in the reaction, $H_2SO_4+8HI=H_2S+4H_2O+8I$, is converted into hydriodic acid by the phosphorous acid. The hydrogen sulphide entrains some iodine and hydriodic acid, and these are removed by the calcium iodide and the solution of hydriodic acid respectively; any phosphine that is formed is removed by the layer of iodine. The hydrogen sulphide is absorbed by the solution of zinc acetate, the sulphide formed being determined iodometrically. The limit of error in the above method is about 1 part in 300; only for one sulphate—barium sulphate, which is not decomposed with sufficient rapidity—is the method not to be recommended. L. E.

Sulphuric acid in Russia. Chem. Trade J., March 4, 1911. [T.R.]

The production of sulphuric acid during the past ten years has not been particularly satisfactory; one reason being that use has not been made of Russian raw material. The Russian chemical industry, notwithstanding the wealth and extent of the deposits of sulphur pyrites in Russia, depends more and more on foreign raw material. During the last ten years, the importations of raw material for the production of sulphuric acid rose threefold. Thus, 25,000 tons of sulphur pyrites in 1897 is registered, and 78,500 tons is the figure given for 1908. The production of pyrites in the interior has fallen from 31,000 tons in 1900 to 20,000 tons in 1907, though there has been a slight increase since then. The importation of sulphur has grown from 19,000 tons in 1897 to 21,000 tons in 1907; but it dropped again to 15,000 tons in 1908. Since then the production of the article has almost completely stopped in the interior. Sulphuric acid is imported in increasing quantities, though not by a great deal. There have been large importations of sulphates and superphosphates. The particular regions in Russia where sulphuric acid is produced are as follows:—St. Petersburg Government, 34,500 tons; Moscow Government, 34,500 tons; Kingdom of Poland, about 31,000 tons; Baltic Province, 39,000 tons; Eastern Provinces, 16,000 tons; and Southern Provinces about 16,000 tons. There are 60 or 65 sulphuric acid factories in Russia, including those factories where the acid is produced as a by-product, such as in petroleum refineries, colour works, gunpowder works, etc.; they are divided as follows:—Baltic Provinces, 6 factories; Warsaw Government, 11 factories; Eastern Government (Viataka, Kazan, Perm), 3 factories; Caucasus, 7 factories; Moscow, 21 factories; St. Petersburg, 6 factories; and the Southern Governments, 4 factories.

Sicilian sulphur production. Oil, Paint, and Drug Rep., Feb. 27, 1911. [T.R.]

Shipments of sulphur from Sicily to all ports during 1910 aggregated 395,959 metric tons, against 364,901 tons in the preceding year, or an increase of 31,058 tons.

Stocks from 646,711 tons in 1909 were reduced to 640,711 in 1910, and the total output of Sicilian mines in the year past was of 395,836 tons, as against 402,354 in 1909.

Exports from Sicily during 1910 and 1909 were as follows in tons of 1,000 kilos:—

To—	1910.	1909.
France	93,230	90,240
Italy	63,200	50,180
Germany	30,230	28,540
Austria-Hungary	29,800	26,570
Russia	25,870	21,620
Greece, Turkey	21,090	16,310
Scandinavia	20,210	15,540
United Kingdom	19,085	19,870
Spain, Portugal	18,760	19,620
Belgium	14,315	16,380
South Africa	12,830	11,370
United States	12,060	14,700
Holland	9,730	11,090
Australia	8,200	1,870
South America	6,350	6,450
British Colonies	4,380	4,615
Other countries (Balkans, Egypt, Canada, Switzerland, etc.)	6,780	9,935
Totals	396,120	364,900

Tartaric acid; Study on the determination of ——. A. Heczko. Z. anal. Chem., 1911, **50**, 12—21.

In the determination of tartaric acid by the Goldenberg method (this J., 1908, 245) it is essential that litmus paper be used as indicator in the titration of the potassium hydrogen tartrate (see this J. 1909, 490); slightly different results are obtained when litmus tincture is employed. The results obtained by the method are also influenced to a small extent by the calcium salts present, as these are not completely precipitated by potassium carbonate in the presence of tartrates. Further, the insolubility of the potassium hydrogen tartrate depends on the temperature and concentration of the solution from which it is precipitated, and it is recommended that the alkali solution used for the titration should be standardised against a definite quantity of pure potassium hydrogen tartrate after the latter has been submitted to the precipitation process of the method. It is advisable to use approximately the same amount of potassium hydrogen tartrate for the standardisation as is present in the portion of the sample under examination.—W. P. S.

Calcium carbide; Decomposition of —— by heat. G. Erlwein, C. Warth and R. Beutner. Z. Elektrochem., 1911, **17**, 177—179.

When commercial calcium carbide is heated it shows signs, below 1000° C., of blackening, and the product produces much less acetylene than the original carbide. This transformation takes place in the absence of air or nitrogen, and is not accompanied by any change in weight. It is greatly accelerated by the addition of certain foreign substances, particularly calcium fluoride. In one experiment, a sample heated to 1260° C. for three hours with 10 per cent. of calcium fluoride, lost all power of reacting with water. If the apparatus has been air-tight, the product is free from nitrogen, but it still retains the power to absorb nitrogen at high temperatures forming cyanamide. The authors suggest that the carbide is converted, on heating, to a subcarbide with the separation of carbon. This subcarbide is probably an intermediate product in the formation of cyanamide, a process which is also accompanied by separation of carbon $CaC_2+N_2=CaCN_2+C$.—W. H. P.

Iron bisulphide; Formation of —— in solutions and some reactions of the thionates. [Determination of sulphurous acid, thiosulphate, and polythionates.] W. Feld. Z. angew. Chem., 1911, **24**, 290—294. (See Hemingway's Eng. Pat. 9432 of 1899, this J., 1900, 442.)

The production of iron bisulphide by the treatment of ferrous thiosulphate, or a mixture of ferrous sulphate and sodium thiosulphate solutions, with hydrogen sulphide (Feld; this J., 1910, 754, and Carpenter and Linder; Ann. Report on Alkali etc. Works, 1900 and 1901) is considered to take place in two stages:—(1) $FeS_2O_3+3H_2S=FeSHOH+4S+2H_2O$ and (2) $FeSHOH+S=FeS_2+H_2O$. Ferric salts react with thiosulphate to give tetrathionate, as, for example, in the reaction: $2FeCl_3+2Na_2S_2O_3=2FeCl_2+2NaCl+Na_2S_4O_6$, but a solution of ferrous thiosulphate, especially in presence of sodium thiosulphate, is very stable; it is oxidised slowly by the air, in accordance with the equations: $4FeS_2O_3+3O=2FeS_4O_6+Fe_2O_3$ and $4FeS_2O_3+3O=2FeS_3O_6+Fe_2O_3+2S$. Ferrous thiosulphate, free from sodium salts, is conveniently obtained as follows:—A solution containing about 150 grms. each of ferrous sulphate and sodium thiosulphate per litre is subjected to prolonged treatment (24 hours) with hydrogen sulphide, at the ordinary temperature, and the precipitate of sulphur and iron sulphide thus produced is washed and is then mixed with cold boiled water and added, drop by drop, to about 100 c.c. of cold boiled water, saturated with sulphur dioxide, a current of this gas, diluted with hydrogen, being meanwhile led through the liquid, and the concentration of the sulphur dioxide in the gaseous mixture reduced as the reaction proceeds. The following changes occur:—(1) $2FeS+3SO_2=2FeS_2O_3+S$, (2) $FeS+3SO_2=FeS_4O_6$, (3) $FeS+3SO_2=FeS_3O_6+S$, and, in the presence of an excess of iron sulphide, (4) $FeS_4O_6+FeS=2FeS_2O_3+S$ and (5) $FeS_3O_6+FeS=2FeS_2O_3$. When all the iron sulphide has been added, hydrogen is passed through the mixture for about 2 hours, and it is then tested for free sulphurous acid and polythionates as described below. If polythionates be present, they are reduced by means of hydrogen sulphide, in accordance with the reactions:

(1) $FeS_4O_6+H_2S=FeS_2O_3+H_2S_2O_3+S$,
(2) $H_2S_2O_3+2H_2S=3H_2O+4S$, and
(3) $FeS_4O_6+3H_2S=FeS_2O_3+5S+3H_2O$.

When a permanent darkening of the sulphur precipitate occurs, the current of gas is stopped and the mixture allowed to stand, with frequent shaking, until the odour of hydrogen sulphide has disappeared, when the solution is filtered. The determination of sulphurous acid, thiosulphate, and polythionate is carried out as follows:—10 c.c. of the (ten times) diluted liquor are mixed with 4*N* ammonium chloride solution (sufficient to prevent the precipitation of ferrous hydroxide during subsequent titration) and are titrated, first with *N*/10 iodine and then with *N*/10 sodium hydroxide, using methyl orange as indicator. The amount of alkali used shows the free sulphurous acid present, and half this number subtracted from the iodine number gives the content of thiosulphate. Another 10 c.c. of the liquor are added to 15—20 c.c. of a cold saturated solution of mercuric chloride (a larger volume is required if the precipitate formed be not white), and, after heating for 15—20 minutes, the precipitate is allowed to settle, an excess of 4 *N* ammonium chloride solution is added, as before, and the solution is titrated with sodium hydroxide, in the presence of methyl orange. The acid thus found is produced in accordance with the equations:

$$(1)\ Na_2S_2O_3+2HgCl_2+H_2O=Na_2SO_4+Hg_2Cl_2+2HCl+S,$$
$$(2)\ Na_2S_3O_6+2HgCl_2+2H_2O=Na_2SO_4+Hg_2Cl_2+H_2SO_4+2HCl+S,$$
$$(3)\ Na_2S_4O_6+2HgCl_2+2H_2O=Na_2SO_4+Hg_2Cl_2+H_2SO_4+2HCl+2S,$$

and, after deducting that corresponding to the thiosulphate already determined, is a measure of the polythionates present.—F. Sodn.

Carbonylferrocyanides. Extraction, analysis, applications. E. Lecocq. Bull. Soc. Chim. Belg., 1911, **25**, 72—80.

An examination of the residues obtained in the purification of coal gas has shown that carbonylferrocyanides are rarely present when bog iron ore has been employed, but are nearly always present, to the extent of 0·4—1·10 per cent. of ferric carbonylferrocyanide, in the residues from Laming's mixture. Pure carbonylferrocyanide may be prepared by evaporating the filtrate, separated from the potassium calcium ferrocyanide obtained in the usual process of ferrocyanide manufacture, to 30° B., when a granular precipitate is produced. This precipitate contains all the carbonylferrocyanide as the double potassium calcium salt, which is insoluble in strong solutions of calcium salts, though soluble in water; it is treated with hot water, and from the aqueous extract the double salt, $CaKFeCO(CN)_5,5H_2O$, crystallises in straw-coloured tablets; the potassium salt is prepared by treating the double salt with potassium carbonate. A solution of this salt gives, in addition to reactions previously known, white precipitates with solutions of zinc, mercuric, or silver salts, a dirty blue precipitate with vanadium salts, and a white precipitate, rapidly darkening, with mercurous salts. The anhydrous double salt is endothermic, the heat of combustion of one gram of the crystallised salt being 2152 cals. Carbonylferrocyanides may be determined in purification residues, etc., by the following process:—100 grms. of dry material, free from ammonium salts, are mixed with 10 grms. of quicklime, and the mixture, after standing 4—5 hours in a slightly warm situation, is mixed with 250—300 c.c. of water and shaken at intervals for half a day; it is then filtered and the residue washed with hot water. The filtrate is evaporated to 100 c.c., 30—35 grms. of calcium chloride and 2—3 grms. of potassium chloride are added, the mixture is allowed to stand for an hour, and the precipitate formed is filtered off and washed with 50—100 c.c. of hot water. The filtrate, which contains all the carbonylferrocyanide, is evaporated to about 25 c.c., any deposit being rejected, and then 10 c.c. of potassium hydroxide (10 per cent.) and 1—2 c.c. of potassium carbonate solution (10 per cent.) are added; the calcium carbonate, thus precipitated, is filtered off, and the filtrate is made up to 100 c.c. This solution is then compared with a standard (5 c.c. of 20 per cent. sulphuric acid being added to each), by titration with copper sulphate solution (12—13 grms. per litre), as in Knublauch's method for titrating ferrocyanides, the violet stain with the ferric indicator developing more slowly, however, than the blue stain with ferrocyanides. The result, in terms of the double salt, multiplied by the factor 0·706, gives the corresponding quantity of ferric carbonylferrocyanide. The standard solution is prepared by dissolving 0·5 grm. of twice recrystallised potassium calcium carbonylferrocyanide in water, making up the volume to 100 c.c., and slowly adding 25 c.c. of this solution to a hot and slightly acid solution of ferric chloride; the precipitate produced is allowed to settle for 2—3 hours on the water bath and is then filtered off and washed with hot water; filter and precipitate are shaken with 10 c.c. of 10 per cent. potassium hydroxide solution for 15 minutes, and the volume is made up to 125 c.c. and the mixture finally filtered. In all cases of carbonylferrocyanide determination, the above process may be used after first precipitating the double potassium calcium salt by means of calcium chloride. Stoecker's statement (this J., 1904, 488), that all the carbonylferrocyanide is included in the result when cyanogen is determined in spent oxide by Knublauch's method, is regarded by the author as incorrect. The application of ferric carbonylferrocyanide as a pigment is suggested, since it has been found very resistant towards the action of light.—F. Sodn.

Sulphur dioxide [*and thionyl chloride*]; *Action of —— on ammonia.* F. Ephraim and H. Piotrowski. Ber., 1911, **44**, 379—386.

The formation of red substances in the interaction of sulphur dioxide and ammonia is not always due, as stated by Divers and Ogawa (this J., 1900, 245) to decomposition of the primary reaction products by heat, for working at temperatures not above the boiling point of liquid ammonia (—38° C.), the authors find that with excess of ammonia, either white ammonium aminosulphite, $NH_2SO_2.NH_4$, or a red substance of the same molecular composition is obtained. This red substance was identified as the triammonium salt of iminodisulphinic acid, $(NH_4)N(SO_2NH_4)_2$ (compare Divers and Ogawa, this J., 1900, 569; 1901, 716); it yields a red silver salt, $AgN(SO_2Ag)_2$. Sulphur dioxide when present in excess unites with ammonia to form aminosulphinic acid, $NH_2.SO_2H$.

When thionyl chloride is dropped into liquid ammonia and the red liquid produced, is evaporated, a dark red residue is obtained. This can be freed from ammonium chloride by digesting with alcohol at −5° C., and when the alcoholic solution is evaporated *in vacuo*, a residue is left which yields with ammoniacal silver nitrate solution, silver iminodisulphinate (see above). The author concludes that by the interaction of thionyl chloride and ammonia, the diamide of iminosulphinic acid is first produced:

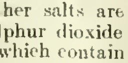
$$2SOCl_2+7NH_3=4NH_4Cl+NH(SO.NH_2)_2.$$

The diamide dissolves in the excess of ammonia to form the corresponding ammonium salt, and this when treated with the silver nitrate solution undergoes hydrolysis, with formation of triammonium iminodisulphinate:

$$(NH_4)N(SO.NH_2)_2+2H_2O=(NH_4)N(SO_2NH_4)_2.$$—A. S.

Hydrazine; Action of sulphur and sulphur compounds on ——. F. Ephraim and H. Piotrowski. Ber., 1911, **44**, 386—403.

Sulphur dioxide and anhydrous hydrazine interact vigorously, with the production of the hydrazine salt of the hitherto unknown hydrazinedisulphinic acid: $2SO_2+3N_2H_4=N_2H_2(SO_2N_2H_5)_2$. This salt is stable when dry and dissolves in water without much decomposition, the solutions having only a faint smell of sulphur dioxide When barium chloride, lead nitrate, or other salts are added to the solution, a strong odour of sulphur dioxide is developed, and precipitates are produced which contain a larger proportion of base than the original salt. The precipitate produced with barium chloride has a composition corresponding with the formula,



$Ba\left\langle\begin{matrix}N\cdot SO_2\\ \dot{N}.SO_2\end{matrix}\right\rangle Ba$.

The salts of hydrazinedisulphinic acid, especially the silver salt, lose ammonia on keeping. Thionyl chloride and hydrazine interact vigorously, a reddish liquid resembling the so-called "sulphammonium" being produced. No evidence of the formation of a definite compound could be obtained; the reddish liquid is probably a colloidal solution of sulphur in hydrazine. A solution prepared directly by dissolving sulphur in hydrazine possesses entirely similar properties. On standing, with complete exclusion of air, it decomposes completely according to the equation:

$$N_2H_4+2S=2H_2S+N_2.$$

The hydrogen sulphide produced remains dissolved in the excess of hydrazine, and experiment showed that hydrazinium sulphide, contrary to earlier statements, is stable at atmospheric temperature; it can be obtained in the form of crystals, which are stable in an atmosphere of hydrogen sulphide. The crystals, owing to occlusion of liquid hydrazine, yield less hydrogen sulphide than corresponds with the formula, N_2H_4,H_2S. Sulphuryl chloride and hydrazine interact to form the dihydrazide of sulphuric acid, $SO_2(NH.NH_2)_2$ (see Ephraim and Lasocki, Ber., 1911, **44**, 395). Sulphur trioxide is reduced by hydrazine, the colour of the product changing from brown to green, and later to blue. The product resembles the so-called sulphur sesquioxide, but is probably a solution containing colloidal sulphur. Hydrazine appears to possess a remarkable power of converting crystalloids into colloids. Besides the colloidal solution of sulphur already mentioned, yellow phosphorus dissolves in hydrazine with an intense dark brown colour, and also in hydrazine hydrate; metallic arsenic also dissolves in hydrazine, giving a coloured solution, from which a reddish-brown, non-metallic, flocculent precipitate separates.—A. S.

Sulphammonium, and its relations to nitrogen sulphide. O. Ruff and L. Hecht. Z. anorg. Chem., 1911, **70**, 49—69.

The authors have examined, in the case of solutions of sulphur in liquid ammonia, the relation between freezing-point and concentration, and the relation between saturation-concentration and temperature; and in the case of solutions of nitrogen sulphide in ammonia the relation between their colour and transparency and their content of hydrogen sulphide. They have also compared spectroscopically some of the last solutions with solutions (having equal sulphur-contents) of sulphur and hydrogen sulphide in ammonia. From the curves representing the results of these determinations it is deduced that two compounds exist of formulæ $[S(NH_3)_6]_2$ and $[S(NH_3)_3]_2$. The first melts at −81·7° C., and even at that temperature partially dissociates into the second and ammonia; the second melts at −84·6° C. The dissociation-pressure of ammonia from these compounds, at temperatures above −80° C., is almost equal to that of liquid ammonia; for a slight lowering of the pressure below that of liquid ammonia, or a slight rise of temperature above that of ammonia of the same pressure, results in dissociation of the compound into sulphur and ammonia. The liquids are miscible at −80° C. with ether, alcohol, or chloroform, without losing their colour, but rapidly decompose if the temperature be raised. Besides these two compounds, solutions of sulphur in liquid ammonia contain small amounts of the ammonia-compounds of hydrogen sulphide and nitrogen sulphide, and are identical with solutions prepared by dissolving one molecule of nitrogen sulphide and 6 molecules of hydrogen sulphide in liquid ammonia. The reaction between these latter substances, however, passes through several intermediate stages before producing sulphammonium, and with more hydrogen sulphide there are further intermediate stages of reaction, till finally ammonium polysulphides are formed.—J. T. D.

Lithium-imide. O. Ruff and H. Goerges. Ber., 1911, **44**, 502—506.

According to Dafert and Miklauz (this J., 1911, 24) lithium nitride combines with hydrogen to form "trilithium-ammonium" (Li_3NH_4), which at 340°—480° C. loses a molecule of hydrogen, yielding "trilithium-amide" (Li_3NH_2). The view of the authors is that "trilithium-ammonium" is a mixture of one molecule of lithium-amide and 2 molecules of lithium hydride ($LiNH_2$+2LiH), and that "trilithium-amide" consists of lithium-imide and lithium hydride (Li_2NH+LiH). The authors show that at 340°—480° C. lithium-amide is decomposed into lithium-imide and ammonia, and they consider that in the reaction observed by Dafert and Miklauz the liberated hydrogen results from the interaction of the ammonia with lithium hydride, lithium-amide being also formed. The authors have prepared lithium-amide (containing as the only impurity 2·7 per cent. of lithium carbide) by dissolving lithium in liquid ammonia. It is a white crystalline substance, the specific gravity of which, determined under toluene, was found to be 1·178 at 17·5° C. When heated in a sealed tube, it melts without visible decomposition at 373°—375° C. When heated *in vacuo*, decomposition begins at about 240° C. In the preparation of lithium-imide, the amide was heated in a silver crucible enclosed in a glass tube which was connected with a mercury pump. The temperature was kept below 360° C. until no more ammonia was evolved, and then it was slowly raised to 450° C. By this means loss due to frothing of the fused mass was avoided. A quantitative yield of pure lithium-imide was thus obtained, the carbide impurity in the amide also yielding the imide by reacting with the liberated ammonia. The lithium-imide thus perpared consisted of a white sintered mass. When heated in a closed tube to 600° C. it did not melt, but became yellow, the white colour returning when the substance became cold again. At a higher temperature, the blue lithium-ammonia compound separated leaving a white powder (possibly the nitride). The specific gravity of lithium-imide, determined under toluene, was found to be 1·303 at 19° C. Lithium-imide was found to be insoluble in toluene, benzene, ether, and ethyl acetate; it formed alcoholates with ethyl and amyl alcohols, with evolution of ammonia; it decomposed chloroform; and it reacted with pyridine, aniline, and quinoline, with brisk liberation of ammonia.—T. St.

Vanadium chlorides. O. Ruff and H. Lickfett. Ber., 1911, **44**, 506—521.

The authors have worked out methods for the preparation of the chlorides and oxychlorides of vanadium. These methods are given with full working details, and the reactions involved are studied. *Vanadium oxytrichloride* ($VOCl_3$). Three methods are given, the simplest and most convenient being to pass a slow current of dry oxygen over vanadium trichloride heated to 500°—600° C., in a combustion tube. The product condenses in an ice-cooled receiver as a lemon-yellow liquid, which distils without decomposition at 127° C. The product is pure and the yield quantitative. The other methods given are to pass chlorine over vanadium pentoxide and over a mixture of vanadium pentoxide and sulphur respectively. *Vanadium tetrachloride* (VCl_4) is obtained pure by passing chlorine over either vanadium carbide or vanadium trichloride. The air in both cases must be driven out of the tube by means of carbon dioxide. When the trichloride is used, this must be heated to 600° C. The carbide reaction begins by itself, with evolution of heat. Moisture and oxygen must be rigorously excluded, or vanadium oxychloride will be formed. The resulting tetrachloride condenses in an ice-cooled receiver to a dark-brown liquid. It distils with partial decomposition at 153·7° C., about 10 per cent. remaining behind as trichloride. *Vanadium trichloride* (VCl_3) is prepared by heating vanadium tetrachloride or vanadium oxytrichloride with sulphur in a flask provided with a reflux condenser. The mixture of vanadium tetrachloride, vanadium oxytrichloride, and sulphur chloride, obtained by passing chlorine over a mixture of vanadium pentoxide and sulphur, may also be used. After suitable heating, volatile products are distilled off, and the remaining vanadium trichloride and sulphur are, after being powdered, transferred to a porcelain boat. This is then placed in a combustion tube, and the sulphur is distilled off at 380°—420° C. in a slow current of carbon dioxide. Vanadium trichloride dissolves readily in water with evolution of heat, and is extremely hygroscopic. In its preparation, therefore, the greatest care must be taken to protect it from moisture. It dissolves in absolute alcohol to a green-blue, and in ether to a green solution. *Vanadium oxychloride* ($VOCl$) is prepared by heating vanadium trichloride in a current of carbon dioxide. The temperature is raised gradually to 700° C., and then after about 4 hours to a bright-red heat. The residue, which is brown in colour and crystalline, consists of the oxychloride. It is soluble with difficulty in water, but dissolves easily in nitric acid. *Vanadium dichloride* (VCl_2) is prepared by heating vanadium trichloride to about 900° C. in a slow current of nitrogen which has been purified from moisture and oxygen. The residue, consisting of the dichloride, is green in colour, and usually consists of loose glistening leaves. It sublimes with difficulty at about 1000° C. Exposed to the air, it slowly absorbs moisture and oxygen, going into a brown solution. It floats on water, dissolving very slowly.—T. St.

Lead oxide; Oxidation of —— by light and air. G. Kassner. Arch. Pharm., 1911, **249**, 22—30.

Lead oxide was heated to 200° C. and spread on the sides of a flask. A small open tube of phosphorus pentoxide was also placed inside and the flask sealed. The whole was placed in a south window for seven years. On opening there was found to be no change in the appearance of the lead oxide nor in the composition of the enclosed air. Lead oxide heated to 200° C. and sealed in a glass tube has been found to be oxidised to red lead when exposed to the light (Arch. Pharm., 1903, **241**, 696). The oxidation of lead oxide by light can only take place in the presence of a small amount of moisture. A theoretical explanation of the phenomenon is given.—F. Shdn.

Silver nitrite; Decomposition of —— by heat. M. Oswald. Comptes rend., 1911, **152**, 381—384.

In addition to the resolution of silver nitrite into metallic silver and nitrogen peroxide by heat, secondary reactions can take place. The primary reaction takes place when the nitrite is heated above 250°—300° C. in a vacuum produced by a mercury pump. A tube containing solid nitrogen peroxide at —80° C. was sealed to another tube containing silver, and the whole exhausted. The red colour of the peroxide gradually disappeared, silver nitrite and nitric oxide being formed. When silver nitrite and iodine are placed in a tube which is exhausted and sealed, and the substances mixed, silver nitrate and iodide and nitric oxide are formed at a temperature of 40°—50° C. When solid nitrogen peroxide at —80° C. and silver nitrite are placed in a tube which is exhausted and allowed to return to the ordinary temperature, nitric oxide and silver nitrate are formed.—F. Shdn.

Iodides; Exact determination of small quantities of —— alone or in presence of other substances. R. Bernier and G. Péron. J. Pharm. Chim., 1911, **3**, 242—248.

The method of estimation depends on a principle which has already been applied by Longi and Bonavia (Gaz. chim. ital., 1898, **28**, I, 325). The iodide is oxidised to iodate by being boiled with potassium permanganate in the presence of sodium hydroxide. The excess of permanganate is destroyed by addition of alcohol, and the liquid is then cooled and treated with acetic acid and a solution of potassium iodide. The liberated iodine is estimated by means of $N/10$ or $N/100$ thiosulphate, with the use of starch if necessary. The method is exact, and is suitable for the estimation of minute quantities of iodide; for example, in a trial 0·0001295 grm. of iodine (as iodide) was taken, and 0·0001280 grm. was found. It may be employed in the presence of chlorides and bromides. When chlorates or bromates are present, they must be reduced by means of sodium hydrogen sulphite; cyanides are removed by boiling with acetic acid, for with permanganate they form nitrites which react with the iodide subsequently added. Ammonium salts must also be destroyed by boiling with alkali.—R. V. S.

Hydrogen sulphide; Action of —— on the alkyloxides of the metals. Part I. Sodium and potassium ethoxides. A. Rule. Chem. Soc. Proc. 1911, **27**, 60.

The action of hydrogen sulphide on the alkyloxides of sodium or potassium was found to result in the formation of the pure anhydrous hydrosulphides of these metals, the compounds being precipitated from alcoholic solution on the addition of ether or benzene. The reaction provides a very simple and rapid method for the preparation of the anhydrous hydrosulphides, and the yields are practically quantitative. The behaviour of hydrogen sulphide towards the solid ethoxides of sodium and potassium was also investigated. Reaction was found to take place at the ordinary temperature, and resulted in the formation of the hydrosulphides of the metals and evolution of alcohol.

Nitrification by ultra-violet rays. Berthelot and Gaudechon. *See* XVI.

Patents.

Kessler apparatus for the concentration of sulphuric acid. P. Vialleix and F. Perrin. Fr. Pat. 420,563, Sept. 20, 1910.

In the modified Kessler apparatus described, the "saturex" consists of a single central channel and two side channels, through which the hot gases are aspirated, and the regenerator is made to contain a number of superposed hollow trays, arranged so that the acid overflows from one to another in a zig-zag path; contact between the heated gases and the acid is secured by means of transverse ribs which reach from the under surface of each tray to the level of the acid below, these ribs serving also to strengthen the trays. Lava or stoneware is used in the construction of the channels and trays, instead of the pumice and porcelain hitherto employed, and the apparatus is said to effect more thorough and economical concentration, and, at the same time, to be simpler and more durable than existing types.—F. Sodn.

Sulphuric acid from plaster (calcium sulphate); Process of manufacture of ——. J. Anzies. Fr. Pat. 420,675. Sept. 20, 1910.

A mixture of gypsum and ferric oxide (408 parts to 148, for example) is calcined, preferably at 800°—1500° C., and the sulphur dioxide and oxygen, thereby evolved, are made to unite by passing them over the oxides of manganese (MnO_2 or Mn_2O_3), tungsten (WO_3 or W_2O_3), molybdenum (Mo_2O_3), or thorium (ThO_2), the oxides being heated to a temperature above 200° C., in order to start the reaction.—F. Sodn.

Sulphuric acid; Continuous preparation of anhydride and monohydrate by distillation of fuming ——. O. Niedenführ. Ger. Pat. 230,533, Sept. 6, 1908.

The process consists essentially in heating the fuming acid rapidly to the distillation temperature, and then continuously adding fresh acid to make up for the quantity evaporated. The heating may be effected by passing burner gases directly into or over the fuming acid, any sulphur trioxide in the burner gases being thus recovered. Apparatus for carrying out the process is described. In one form (see Fig. 1), a vessel is divided into two chambers, *a* and *b*. The fuming acid is fed into *a*, through the pipe, *d*, and passes over into the distilling chamber, *b*, by means of the siphon, *g*, as the distillation proceeds. The vapours pass away through *c*, and the residual monohydrate acid flows away through *f*. In another form (see Fig. 2), a vessel is divided into a distilling chamber, *a*, and a heating chamber, *b*, in order that by heating from one side, small portions of the surface liquid may be distilled off.—A. S.

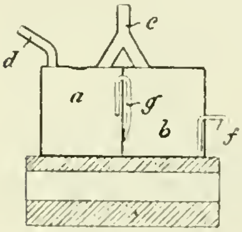


Fig. 1.

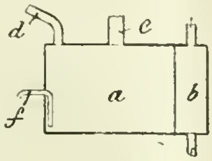


Fig. 2.

Sulphuric acid; Process for the manufacture of —— *according to the chamber principle.* O. Wentzki. Ger. Pat. 230,534, April 21, 1910.

The reacting gases are passed through a series of horizontal rotating cylinders, provided inside with longitudinal ribs (straight or curved), and are thus brought into intimate contact with sulphuric acid or nitrous vitriol flowing through the cylinders in the opposite direction.—A. S.

Nitric or other oxynitrogen acid and metallic peroxide; Process of making ——. H. S. Blackmore, Mount Vernon, N.Y., Assignor to R. E. Robinson and D. C. Spruance, New York. U.S. Pat. 982,466, Jan. 24, 1911.

Barium nitrate is exposed to the action of superheated steam and oxygen, with the formation of barium peroxide and nitric acid.—O. R.

Formic acid or acetic acid; Process for concentrating ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 230,171, Aug. 21, 1909.

Aqueous formic or acetic acid is treated with anhydrous copper sulphate, and the concentrated acid is separated and distilled, the copper sulphate being regenerated by heating. The process may be applied, for instance, to the preparation of concentrated formic acid from alkali formates and dilute sulphuric acid.—T. F. B.

Concentrating soda lyes and other liquids by evaporation. J. Matter. First Addition, dated Sept. 9, 1910, to Fr. Pat. 406,997, Sept. 14, 1909 (this J., 1910, 546).

A quantity of plaster of Paris is added to the soda lyes to precipitate the organic impurities and to clarify the lyes. In order to prevent the formation of sodium sulphate, a small proportion of lime is added to the lyes after the addition of the plaster.—W. H. C.

Nitrogen oxides and ammonia from air; Production of ——. W. A. Phillips and J. G. Bultcel, London. Eng. Pat. 23,976, Oct. 19, 1909.

Air and powdered fuel, such as coal or peat, are blown through a tangential opening into the lower part of a cylindrical furnace, the centre of which contains a cylindrical core, which reduces the combustion space to a narrow annular chamber. It is claimed that the gyratory motion imparted to the burning fuel raises the temperature to such a degree as to induce a considerable amount of combination of atmospheric nitrogen and oxygen, with the formation of nitrogen oxides, or of ammonia in the presence of aqueous vapour.—O. R.

Nitrogen oxides; Process of obtaining —— *by the explosion of gaseous mixtures containing nitrogen and oxygen.* F. Häusser. Fr. Pat. 420,112, Sept. 7, 1910.

A mixture of gases, such as coal gas and air, is exploded at constant volume in a bomb, and the pressure produced by the explosion is maintained for as long a period as possible, as for instance by the use of large bombs, by compressing the mixture before explosion, by covering the bomb with a heat-insulating medium, or by the application of external heat. In this way it is possible to obtain products of combustion containing 1·3 to 1·7 per cent. of nitric oxide, whereas the concentration of the latter at the moment of thermal equilibrium would be only about 0·1 per cent.—O. R.

Nitrogen oxides; Process of producing —— *from air, or other mixtures of nitrogen and oxygen, and apparatus therefor.* Salpetersäure Ind.-Ges. m. b. H. Fr. Pat. 420,252, Sept. 3, 1910.

A furnace, constructed of fused magnesia or the like, is divided into two compartments by means of a median wall, an opening at the upper extremity of which affords communication between the two divisions. Air is raised to a temperature of about 2000° C. in the one compartment, and the pressure in the other is reduced to at least 400 mm. of mercury by means of an air-pump. The upper portion of the second compartment is provided with some form of compensating heating appliance, such as an electric arc playing between water-cooled platinum electrodes, so that the sudden expansion of the highly heated nitrogen oxides takes place adiabatically, and the lower portion of the compartment is provided with a refrigerating appliance, so as to prevent dissociation of the nitrogen oxides formed.—O. R.

Nitrides such as that of aluminium ; Manufacture of ——. O. Serpek, Paris. Eng. Pat. 12,601, May 24, 1910.

Nitrogen is passed over alumina and carbon, which are heated in a rotary, electrical resistance furnace, in which the resistance is independent of the materials under treatment. It consists either of a tube, or of a series of rectilinear, helicoidal, or other bars, fitted into the casing of the furnace and extending for its whole length ; the resistances are connected at each end with the terminals of the electrical supply. The furnace is preferably slightly inclined, so as to feed the materials slowly forward, and at the same time subject them to energetic stirring by contact with the resistances, whereby a suitable, constant temperature is maintained, equally distributed throughout the mass under treatment.—O. R.

Nitrides such as aluminium nitride ; Apparatus for the manufacture of ——. O. Serpek. Paris. Eng. Pat. 16,522, July 11, 1910. Addition to Eng. Pat. 12,601, May 24, 1910. (See preceding abstract.)

At each end of the revolving resistance furnace, described in the main patent, the resistances are fitted into a carbon cap carrying teeth, which project through openings formed in the metal casing of the furnace. The teeth are connected by a grooved, metal ring, over which passes a metal cable, or a number of strips of metal foil, connected with the current leads.—O. R.

Alumina ; Process of manufacturing pure —— from aluminium nitride. O. Serpek, Paris. Eng. Pat. 13,088, May 30, 1910.

Aluminium nitride is substituted for bauxite in the Bayer process of manufacturing alumina, for which purpose the impure nitride is treated at the boiling point with sodium aluminate lye concentrated to 20°—21° B. The alumina, which is dissolved by the sodium aluminate, is separated by "auto-precipitation," and the residual liquor, which continuously retains the necessary degree of concentration, is used for attacking fresh quantities of aluminium nitride. The impurities in the latter, chiefly ferrous compounds, form heavy residues, from which the lye can be separated by decantation, and the small amount of silica, present in the nitride, is practically insoluble in the comparatively dilute sodium aluminate lye.—O. R.

Nitrogen compounds ; Preparation of ——. E. H. Meyer and J. M. A. Stillesen, Niagara Falls Centre, Canada. U.S. Pat. 982,288, Jan. 24, 1911.

Calcium carbide is treated with nitrogen and carbon dioxide, the latter inducing the removal of free carbon by oxidation.—O. R.

Lime nitrogen ["nitrolim"] ; Preparation of ——. J. M. A. Stillesen, Niagara Falls Centre, Canada. U.S. Pat. 982,311, Jan. 24, 1911.

Calcium carbide is treated with nitrogen at a high temperature, free carbon is eliminated, and carbon dioxide is passed over the resulting product at such lower temperature as will allow free lime to be converted into calcium carbonate.—O. R.

Gases of high oxidising efficiency ; Production of ——. C. Hornbostel, New York. U.S. Pat. 984,221, Feb. 14, 1911.

Air is led at the ordinary temperature into contact with an alkali manganate, manganese dioxide, sulphuric acid, and sodium chloride, with the formation of oxygen, ozone, and chlorine.—O. R.

Hydrogen peroxide ; Manufacture of stable, solid mixtures, yielding —— on treatment with water. Chem. Werke vorm. H. Byk. First Addition, dated Aug. 20, 1910, to Fr. Pat. 401,911, April 9, 1909 (this J., 1909, 1198). Under Int. Conv., Aug. 21, 1909.

The perborates used (*loc. cit.*) are dehydrated by heating at or above 50° C., preferably under reduced pressure and in a current of air.—F. Sodn.

Peroxides and oxides, or hydrated oxides ; Process for obtaining —— with the help of alkali and alkaline-earth carbonates. V. Bollo and E. Cadenaccio. Fr. Pat. 420,293, Sept. 10, 1910. Under Int. Conv., April 16, 1910.

The process consists in heating an intimate mixture of an alkali or alkaline-earth carbonate with a small proportion of one or several catalysts, at a comparatively low temperature, in the absence of air ; carbon monoxide is thus evolved and a peroxide directly obtained, further heating in the same furnace yielding the oxide. The catalyst may be added in solution, as a salt (from which the corresponding hydrated oxide or oxide is subsequently precipitated or produced by heating), or catalysing oxides or metals may themselves be added, and the catalytic action may be further increased by a small admixture of carbon or organic matter, or by reducing gases (introduced after heating, has commenced), or by means of steam. The furnace employed may be of the electric resistance type, or an arc furnace may be used, in which case an oxide, instead of a peroxide, is produced.—F. Sodn.

Peroxides and oxides or hydrated oxides ; Process for obtaining —— with the help of the carbonates of barium, strontium, potassium, and sodium. V. Bollo and E. Cadenaccio. Fr. Pat. 420,470, Aug. 11, 1910. Under Int. Conv., Oct. 27, 1909. (Compare preceding abstract.)

The carbonate is intimately mixed with a small quantity of an iron salt (*e.g.*, 0·2—0·5 per cent.), preferably in the presence of water, and the hydrated oxide or carbonate of iron is then precipitated (unless the iron salt be converted into the oxide at a relatively low temperature); or, iron oxide is added to the mass instead of being precipitated within it. A small proportion of carbon (1—2 per cent.) or organic matter is also added, and the mass is dried and heated in a furnace (or a reducing gas is introduced after the heating has commenced), the operation being further facilitated, if desired, by a jet of steam. The carbon reduces the iron oxide to the metal, which acts catalytically, giving carbon monoxide and the alkali or alkaline-earth peroxide. The preparation of barium peroxide by this method is specially referred to.—F. Sodn.

Barium salts ; Process of obtaining ——. Soc. pour l'Utilisation de l'Air et de ses Dérivés. Fr. Pat. 420,498, Nov. 24, 1909.

Crude barium sulphate is dissolved in fused calcium chloride, and the material, after removing impurities, is run into water. A solution of calcium and barium chlorides is thus obtained and a residue of the corresponding sulphates. Barium chloride is separated from the solution by crystallisation, the calcium chloride being recovered by evaporation, and pure barium sulphate is obtained from the residue by treating it with hot dilute hydrochloric acid, to dissolve the calcium sulphate, which latter crystallises on cooling, leaving the acid to be used again. The barium chloride may be converted into carbonate by treatment with calcium carbonate or ammonium carbonate (obtained by distilling a mixture of ammonium chloride and calcium carbonate), so that calcium chloride is regenerated.—F. Sodn.

Barium sulphate ; Process of purifying ——. Soc. pour l'Utilisation de l'Air et de ses Dérivés. Fr. Pat. 420,536, Nov. 25, 1909.

Barium sulphate is purified by dissolving it (without previous crushing) in fused sodium chloride or other molten salt, and, after removing impurities, running the fused material into water; the mixture is then passed through a sieve, and the purified barium sulphate is subsequently separated from the solution, which is evaporated to recover the salt.—F. Sodn.

Copper matte; Process of treating —— and its application for the manufacture of copper sulphate. Soc. des Cuivres de France. Fr. Pat. 420,899, Sept. 29, 1910.

A jet of molten copper matte is made to impinge tangentially against a jet of water, whereby it is converted into a spongy, granular form, and the material is then subjected to the combined action of sulphuric acid of 50° B. strength, steam, and air, the reaction being represented by the equation: $Cu_2S+H_2SO_4+5O=2CuSO_4+H_2O$.—O. R.

Mercuric sulphide in solid, colloidal form; Process for obtaining preparations containing ——. Chem. Fabr. von Heyden. Ger. Pat. 229,706, Nov. 24, 1909.

Solid, colloidal mercuric sulphide preparations are obtained either by preparing solutions of colloidal mercuric sulphide by the aid of a colloid, or by adding a colloid to aqueous mercuric sulphide hydrosols, and in either case evaporating or precipitating with alcohol, with or without previous dialysis. For example, 50 parts of mercuric chloride are dissolved in 2000 parts of water, 100 parts of gum arabic or dextrin and 500 parts of water are added, then caustic soda solution until the mixture is alkaline, when hydrogen sulphide is passed through it until it is saturated; the solution is now dialysed and evaporated to dryness.
—T. F. B.

Oxalates; Process for preparing —— by heating alkali formates. C. F. Boehringer und Söhne. Ger. Pat. 229,853, Sept. 17, 1908.

Alkali formates are converted into oxalates by heating, in presence of not more than 5 per cent. of boric acid or an alkali borate, to 360°—410° C. For example, a yield of 88 per cent. was obtained by addition of 1 per cent. of an alkali borate.—T. F. B.

Saturator for gases, especially for the manufacture of ammonium sulphate. Berlin-Anhaltische Maschinenbau-A.-G. Ger. Pat. 230,825, Dec. 11, 1909.

The saturator is provided with a bell or hood dipping into the liquid and movable up and down. By means of gearing connected with a float or with a counterbalance device, the bell can be adjusted at any desired height according to the prevailing pressure.—A. S.

Hydrogen gas-producing apparatus; Construction and method of operation of ——. H. Lane, Birmingham. Eng. Pat. 11,878, Jan. 29, 1910.

The excess of water-gas, or other reducing medium, which issues unchanged from the reducing retorts, described in Eng. Pat. 17,591 of 1909 (this J., 1910, 1057), is purified so that it can be re-admitted to the retorts for the reduction of further quantities of ferric oxide. For its purification the gas is passed into a cooler and washer, which removes mechanical impurities, and thence into a compressor. From the latter it passes under a pressure of several atmospheres into a strong receiver. The latter contains coke or the like material, down which cold water is distributed by means of a pump or other forcing device. The compressed gas, coming into contact with cold water, is freed from such impurities as sulphur dioxide, hydrogen sulphide, carbon dioxide, etc., either by solution or by condensation, being at the same time deprived of the greater part of its moisture.—O. R.

Graphitising; Process and method of ——. C. F. J. Forssell, Lakewood, Ohio, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pats. 983,887 and 983,888, Feb. 14, 1911.

(1) Carbon articles and magnesia are heated in an electric furnace above the temperature at which magnesium carbide can be formed. (2) Carbon articles and sodium carbonate are heated in an electric furnace above the temperature at which sodium carbide can be formed; carbon monoxide is evolved and sodium is volatilised, and on cooling below the temperature of the first reaction the carbon monoxide is reduced, with deposition of graphite.—O. R.

Carbon; Method of crystallising ——. C. Tellier. Fr. Pat. 420,869, Sept. 28, 1910.

It is claimed that carbon is soluble in liquid carbon dioxide. The method of effecting solution and evaporation consists of introducing carbon into a suitable, pressure-resisting digester, exhausting the latter as completely as possible so as to eliminate all gases contained by the carbon, and forcing liquid carbon dioxide into intimate contact with the exhausted material. After a suitable period of digestion, the liquid carbon dioxide is aspirated by the help of a compressor, "isothermal if possible," and the residue of the evaporation consists, it is claimed, of "crystalline carbon, *vulgo* diamonds."—O. R.

Nitrides; Manufacture of ——. Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 16,368, July 8, 1910. Under Int. Conv., July 9, 1909.

See Fr. Pat. 418,425 of 1910; this J., 1911, 86.—T. F. B.

Perborates; Process for dehydrating ——. Chem. Werke vorm. Dr. H. Byk, Charlottenburg, Germany. Eng. Pat. 19,562, Aug. 20, 1910. Under Int. Conv., Aug. 21, 1909.

See Addition of Aug. 20, 1910, to Fr. Pat. 401,911 of 1909; preceding.—T. F. B.

Sulphur contained in sulphates, especially in calcium sulphate; Process for the utilisation of the ——. R. Wedekind und Co., m. b. H., Uerdingen-on-Rhine, Germany. Eng. Pat. 20,186, Aug. 30, 1910. Under Int. Conv., April 12, 1910.

See Fr. Pat. 419,871 of 1910; this J., 1911, 210.—T. F. B.

Ozone; Apparatus for generating ——. C. Knips and E. Ey, Charlottenburg, Assignors to Siemens und Halske A.-G., Berlin. U.S. Pat. 983,907, Feb. 14, 1911.

See Ger. Pat. 225,923 of 1909; this J., 1910, 1454.—T.F.B.

Tungsten dioxide; Process of manufacture of ——. A. Lederer, Vienna, Assignor to Westinghouse Lamp Co. U.S. Pat. 984,143, Feb. 14, 1911.

See Eng. Pat. 18,922 of 1907; this J., 1908, 22.—T. F. B.

Nitrogen and carbon dioxide from gaseous products of combustion; Method of producing ——. M. Reichel and H. Braun, Assignors to Nitrogen-Ges. m. b. H., Berlin. U.S. Pat. 984,605, Feb. 21, 1911.

See Ger. Pat. 215,608 of 1908; this J., 1910, 25.—T. F. B.

Electrolytic decomposition of alkaline salts; Process and apparatus for the ——. J. Greenwood, London. U.S. Pat. 984,905, Feb. 21, 1911.

See Eng. Pat. 25,208 of 1908; this J., 1910, 163.—T. F. B.

Oxidising nitrogen of the air by means of electric discharges; Process of ——. K. Kaiser, Wilmersdorf, Germany. U.S. Pat. 984,925, Feb. 21, 1911.

See Fr. Pat. 415,976 of 1910; this J., 1910, 1306.—T. F. B.

VIII.—GLASS; CERAMICS.

Bunzlau brown. A. Berge. Sprechsaal, 1911, **44**, 127—130.

The manufacture of Bunzlau ware is spreading over Silesia into Saxony and Bohemia. The body, made of 2 parts of lean clay to 1 part of plastic clay, melts at cone 30. More care is being taken in the sifting of the raw materials, and the shape and decoration of the ware have been modernised. The glaze, obtained from loams rich in fluxes, has the molecular formula: FeO 0·13, CaO 0·43, MgO 0·21, K_2O 0·23, Al_2O_3 0·6, SiO_2 4·5. The best effects can be obtained by adding 5 per cent. of iron oxide and 1 per cent. of rutile to the glaze of formula: CaO 0·4, MgO 0·12, K_2O 0·48, Al_2O_3 0·7, SiO_2 4·8. Many natural loams contain titania but when used as glaze they do not burn brown but dark green. The presence of rutile is favourable, if not necessary, to the development of the brown in a reducing atmosphere. If the brown outer layer of the glaze be scraped away, dark green ferrous silicate is found below. The best brown is given by addition of 5 per cent. of iron oxide and 1 per cent. of rutile. In greater quantities crystalline effects are obtained. It is essential in burning that the flame should reach the top of the kiln, or the brown colour will not be obtained, but only black spots on a dark green ground.—H. H. S.

Black enamel or lustre on Italo-Grecian pottery; Production of ——. A. Verneuil. Comptes rend., 1911, **152**, 380—381.

Many examples of ancient Greek and Italian pottery possess a fine black enamel or lustre on a terra-cotta biscuit. Although the art must have been widely distributed at one time, it has been lost for many centuries. The pieces have evidently been fired in an oxidising furnace, but the characteristic black colour of the enamel can only be approached by using fluxes containing magnetic oxide of iron in a reducing furnace. A black enamel appearing green by reflexion like the ancient enamel, can be produced by grinding iron filings with a flux composed of sodium carbonate and the calcareous clay of the ware itself, and firing the articles coated with this in an oxidising furnace.—F. Shdn.

Patents.

Glass window panes and the like; Process of manufacturing a substitute for ——. B. Borzykowski. Fr. Pat. 420,555, Sept. 19, 1910.

As a substitute for glass the patentee claims a mass, which he describes as "composed chiefly of vegetable cellulose."—O. R.

Glass tiles, sheets, blown or moulded glass; Process of decolourising, changing the tint of, and reheating ——. A. Samuel. Fr. Pat. 420,745, Sept. 24, 1910.

Glass articles are heated in a bath of molten lead, or other metal capable of forming colourless or decolourising silicates.—O. R.

IX.—BUILDING MATERIALS.

Plaster standards committee; Report of German ——. German Plaster Association's 1911 Meeting in Berlin. Chem.-Zeit., 1911, **35**, 222.

Working in conjunction with delegates from Switzerland, Hungary, and Russia, the committee propose the following standard tests:—*Sifting.* 4—5 kilos. of the material are sifted with a sieve 35 × 60 × 12 cm., with mesh 2 mm. wide, 16 meshes going to the square centimetre. Soft lumps may be gently crushed through. *Gauge* is the amount of plaster required to bring 100 c.c. of water to perfection of slip. A glass beaker is weighed and filled with 100 c.c. of water. The plaster is then slowly added till it floats and the water mirror is no longer visible for a few seconds. The process should take about 2 minutes. The beaker is then again weighed. *Slip.* On a fresh sample the time taken from gauging to stiffening should be noted. The slip is poured from a rubber cup on to a glass plate in pools 6 mm. deep and 11 mm. in diameter. A knife with edge of 2 mm. is then passed through these clots, being carefully cleaned each time, till it ceases to cut its own way. This time is noted. *Time of setting* is the period from beginning of gauge till the plaster ceases to stretch. As in the previous test, pieces 2 mm. thick are cut off at intervals of a minute until they become granular and friable under the knife. *Fineness* is estimated by putting 100 gms. through a sieve 60 × 35 cm. in area, containing 900 meshes to the square inch, each mesh being 0·22 mm. in width. A fine plaster leaves less than 10 per cent. of residue: medium, from 10—20: and coarse, 20—30 per cent. *Tensile strength.* Trial pieces of transverse section 5 sq. cm., octagonal in shape, are subjected to the usual tensile tests after one day and after 28 days. The Michaelis apparatus is used for this purpose, and also for the rigidity tests, which are done on pieces 16 × 4 × 4 cm. after one day and after 28 days.—H. H. S.

Plaster dust; Influence of —— on health. R. Bieling. German Plaster Association, 1911 Meeting, Berlin. Chem.-Zeit., 1911, **35**, 223.

Five years ago it was supposed in Germany that plaster dust might have a healing influence on certain diseases such as tuberculosis. But it was experimentally proved in France that the dust gave rise to bronchial affections and conjunctivitis. Sommerfeld states that German factories are freer from dust owing to the sacks being filled under a shaft and not with the shovel. In the French works were found on the average 0·075—0·4 grm. of plaster dust per cubic metre of air, in the workroom 0·8, and above an uncovered sieve 1·128 grms. per cb. m. In the course of a day a workman does not inhale more than 1·5 grms. of plaster. The author states that the plaster is retained in the nasal passages and throat. He considers that tuberculosis patients may assimilate calcium salts at the high rate that anæmic ones assimilate iron. In the discussion Cramer suggested that the influence of plaster on tuberculous germs should be observed outside the animal system.—H. H. S.

Lime mortars; Influence of the porosity of building materials on the hardening of ——. H. Burchartz. Tonind.-Zeit., 1911, **35**, 290—294.

Mortar, which was made out of 1 part by volume of slaked lime paste and 4 parts by volume of Freienwald sand, was laid between pairs of ordinary bricks, roofing-tiles, sand-lime bricks, and glass plates respectively. One-third of each test pair was kept (a) exposed to the air of a room, (b) without access to air, and (c) in air rich in carbon dioxide, and the mortar was tested for carbon dioxide after varying periods under the several conditions. It was found that: (1) The absorption of carbon dioxide by the mortar in the case (a) proceeded equally for all the test pairs, the amount of carbon dioxide contained at the edges of the mortar after one year being practically the same in each of the samples; (2) mortar absorbed only a very small amount of carbon dioxide when there was no access of air, and this amount was the same whatever the materials between which the mortar was set; (3) mortar kept in an atmosphere rich in carbon dioxide also behaved in a similar manner in the case of each of the various materials: it absorbed carbon dioxide at a uniform rate, and the limit of absorption was reached in each case after about 16 weeks. From these experiments the author concludes, contrary to the view expressed by Michaëlis, that the porosity of building materials is without influence on the carbonation, *i.e.* hardening, of the mortar used in conjunction with them.—O. R.

Shaft sinking against water in fissured ground by cement injection. A. L. Shrager. Inst. Min. and Metall., Feb. 22, 1911. [Advance proof.]

The author describes the method of cement injection which is now replacing to some extent the Poetsch freezing process for the sinking of shafts in water-bearing ground (see this J., 1910, 818). Around the proposed site of the shaft a number of bore-holes are sunk at equal intervals, and a mixture of cement and water is injected through these boreholes by means of a force-pump. The mixture penetrates the ground surrounding each hole, filling all the cavities and crevices, so that eventually, when the cement sets, the site of the shaft is enclosed by a cemented watertight wall, which prevents trouble from water during the subsequent sinking of the shaft. The cost of sinking is only about one-third that of the Poetsch process, the apparatus needed being small and inexpensive as compared with that required for making an ice wall, whilst when once the cement wall is made, the process is finished, whereas in the Poetsch process, the machinery has to be kept at work until the shaft has been sunk and lined. Details are given of the application and cost of the process in the case of a shaft (15 ft. 6 in. diameter), sunk in the Pas-de-Calais (France) coal-field, where the pervious strata extended to a depth of 213 ft.—A. S.

Cement clinker; Heat effect in the production of ——. D. Tschernobaeff. Z. angew. Chem., 1911, **24**, 337—341.

The heat-effect during the production of clinker was determined in two ways—by burning small amounts of cement-making materials in different proportions, with coal of known calorific value, in a calorimeter, and by burning similarly the materials, and an equivalent amount of the cement actually made from them on the industrial scale, with coal and silica, so as to obtain the same final product in both cases, the difference between the heat effects so observed measuring the effect due to the production of the clinker. There was always an evolution of heat (after allowance was made for the absorption due to dissociation of the calcium carbonate employed) which (calculated per gramme of calcium carbonate used) diminished as the basicity of the mixture increased. For cement mixtures of ordinary composition, containing about 75 per cent. of calcium carbonate, the heat-evolution is about 115—118 cals. per gramme of calcium carbonate. The actual heat-change (when no allowance for dissociation of calcium carbonate is made) is an absorption of about 320 cals. per gramme of calcium carbonate in the mixture. —J. T. D.

Portland cement testing; Recent developments in ——. Engineering, 1911, **91**, 285—286.

The rate of hardening of Portland cement is apparently unaffected by that of setting, although in most cases the two are in inverse ratio, slower-setting cements generally hardening more quickly than quicker-setting cements. Tables are given showing the great variations in hardening qualities of different cements. In the case of two samples of cement which both showed an initial set of 3—4 hours and which passed all the tests of the British standard specification, the resistance of test-pats, 24 hours after gauging, to penetration by a rotary drill under identical conditions was as 250 : 40 in the two samples. It is pointed out that in the Le Chatelier test contraction instead of expansion may take place, and the conflicting opinions as to the value of this test may be due to neglect of this fact. Contraction may be detected by filling a tapering ring mould (105 mm. diam. at top, 102 mm. at bottom, 38 mm. deep) with cement mixed with water in the same proportions as for a setting test; and then, after 48 hours, tapping the mould, when if contraction has taken place, the cement will protrude at the bottom of the mould.—A. S.

Cement and concrete; Behaviour of certain liquids towards ——. E. Donath. Chem. Ind., 1911, **34**, 123—125.

Since concrete is now used for the construction of conduits for liquids such as drainage water, gas liquor, etc., experiments were made to determine the action on concrete of the substances present in these liquids. Pieces of broken concrete were immersed in the liquid or solution in a closed vessel for 3 months, and the liquid then examined. Free carbonic acid, which is present in drainage water dissolves from concrete not only lime, as is already known, but also alumina. Ammonium sulphide, present in gas liquor, converts the iron in concrete into sulphide throughout the mass, and ammonium carbonate dissolves a small quantity of the iron. Concrete pipes or tanks may however be used safely for gas liquor if they are kept full of the liquid, so that the iron sulphide formed in the concrete is not exposed to air. Sugar solutions dissolve iron, calcium and aluminium from concrete and become discoloured. The action of glycerin is similar but the iron is not acted on. —A. T. L.

Patents.

Tunnel kilns or dryers [*for bricks*]. A. Hill, Llandudno. Eng. Pat. 2580, Feb. 2, 1910.

The bricks to be burned are placed in the upper end of an inclined tunnel-kiln, the inclination of the floor being such that the bricks slide forward by their own weight and are dried and burned by hot furnace-gases which pass upwards through the kiln. In order to facilitate the forward motion of the bricks the floor of the kiln is formed of transversely placed rollers for such a portion of its length as the temperature will permit of this being done, and of transverse corrugations for the remainder of its length. —W. H. C.

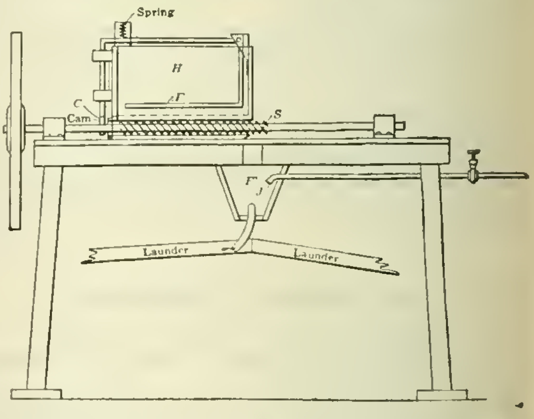
Wood; Process of hardening and preserving ——. E. Sucher, Versailles, France. Eng. Pat. 15,713, June 30, 1910.

Wood is immersed for 4—7 hours at 60°—80° C. in a bath composed of 990 parts of pine or vegetable tar, 5 parts of sodium carbonate, and 5 parts of a "fixing agent," prepared as follows: 80 parts of sawdust, 16 parts of sodium carbonate, and 4 parts of potassium carbonate are mixed with 900 parts of water, and macerated for 48 hours, during which time the liquid is twice boiled for periods of 4 and 2 hours respectively, after which the solution is decanted off and 5 per cent. of "sodium silicate" and 0·1 per cent. of "normal concentrated nitric acid" are added to it.—O. R.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Zinc-dust feeder [*for gold precipitation*]; *An improved* ——. C. T. Rice. Eng. and Min. J., 1911, **91**, 361—362.

In view of the defects of a belt feed for zinc-dust, B. A. Bosqui has devised a screw feed (see Fig.) which gives an even and continuous delivery. The moving arm, F, controlled by the cam, C, and the spring, as shown, prevents the dust from packing in the hopper, H, and facilitates its passage through the slot in the pipe enveloping the screw, S. The latter is one and a half inches in diameter, with a half-inch pitch. The emulsifier, E, is a box, with a jet, J, of barren solution, under a pressure of 40 lb. per sq. in., directed at the point on which the zinc-dust falls. The emulsification is good. From the emulsifier, the zinc-dust is led into either of the launders, according to requirements. These launders lead to a small sump-box in the gold-tank, with which the suction-pipe of the pump supplying the press at the head of the mill is connected. An intimate mixture of the zinc particles with the solution is thus effected. The rate of feed is regulated by a set of cone pulleys driven from the main shaft driving the zinc-press feeding-pump. The speed is regulated according to the assay of the tail solution from the zinc-press. After a clean-up the rate of feed is gradually cut down as the precipitate accumulates in the press.—R. W. N.



Copper blast furnaces; Tops for ——. N. H. Emmons. Trans. Amer. Inst. Min. Eng., Feb., 1911, 119—134.

The remodelling of the tops of the blast furnaces has been necessitated by the utilisation of the sulphur dioxide for the production of sulphuric acid. Four furnaces were fitted successively with different forms of tops, improvements being introduced as suggested by experience. Finally a simple inexpensive top was adopted. This has cast-iron corner posts and dividers, and the walls and ends are laid up with firebrick, the 13-in. wall being unsupported by tie-rods or angles of any description. The semicircular top is supported on 20-in. I-beams resting on the columns, and all metal parts are as far as possible exposed to the cooling action of the air. The flues are made of $\frac{1}{4}$-in. boiler plate, and 1·5 in. magnesia blocks lie between the firebrick lining and the boiler plate. The doors open inwards and are operated by a simple "railroad two-throw weighted switch-stand." Photographs and descriptions of all the furnace tops are given as well as the charts from recording pyrometers which give the hourly variations of the temperature of the gases in the flue and at the base of the Glover tower. Attention is called to the record of a higher temperature at the Glover than in the flue from the furnace, and it is suggested that the furnace gases contain some carbon monoxide or unburnt sulphur, the combustion of which in the dust chamber produced the observed elevation of temperature.
—A. H. C.

Copper; Exact electrolytic assay of refined ——. 1. *Standard method.* 2. *Rapid assay by rotation of the electrolyte in a solenoid.* G. L. Heath. J. Ind. Eng. Chem., 1911, 3, 74—78.

Good samples of a casting of refined copper may be obtained by drilling holes halfway through from the top, side, and bottom, after removal of the surface oxide by starting the holes with a slightly larger drill. The drillings are freed from dust, tested with a magnet, and kept in tightly closed bottles. *Standard method.* A quantity of 5 grms. is used, so that the analysis may be finished in 16 to 18 hours without risk of oxidation or absorption of hydrogen. The assay is started in the evening, with a current of 1 ampère per 100 sq. cm., and in the morning, when the liquid is colourless, the current is reduced to 0·5 ampère, whilst when the electrolysis has lasted more than 18 hours the current should be still further reduced to 0·25 ampère to prevent oxidation or absorption of hydrogen. The sample is weighed into a 300 c.c. beaker together with a mixture of 7 c.c. of pure nitric acid (sp. gr. 1·42), 10 c.c. of sulphuric acid (sp. gr. 1·84), and 25 c.c. of water, and the beaker is covered and heated on a steam plate just below the boiling point until solution is complete. The liquid is then diluted to 120 c.c. and electrolysed, the foil cylinder cathode used being preferably open on one side and having an area (including both sides) of 100 sq. cm., and a stem extending 12·5 cm. above the cylinder. This can be readily withdrawn from the solution and dropped into a beaker of water. When deposition is thought to be complete, 1 c.c. of the solution is tested on a white tile with a few drops of a freshly prepared solution of hydrogen sulphide, any trace of copper in excess of 0·000005 grm. being thus immediately detected, and readily distinguished from arsenic, the yellow precipitate of which would appear later. The proportion of acids used for dissolving the metal is that which has been found to prevent any deposition of arsenic at the end of the electrolysis, provided that the total amount of acid is increased in proportion to the arsenic. Thus 5 grms. of metal containing less than 0·03 per cent. of arsenic would require 40 c.c. of the acid mixture ("Stock solution"); with 0·03 to 0·10 per cent. of arsenic, 50 c.c.; and with 0·11 to 0·50 per cent. of arsenic, 60 c.c. When the deposition is complete, the cathode is washed with water, and the water removed by means of 94 per cent. alcohol, the last traces of which are eliminated by cautiously burning it away. When the copper contains more than traces of antimony, selenium or tellurium, special methods for the preliminary purification of the solution must be employed. Duplicate determinations should agree within 0·01 per cent. *Rapid assay by rotation of the electrolyte.* The type of solenoid used by the author is made in two patterns, one to take the ordinary 300 c.c. assay beaker, and the other, for larger quantities of copper, up to 50 grms., to take a beaker with a capacity of as much as 750 c.c. The best results have been obtained by wrapping a copper cylinder, $\frac{3}{32}$ inch thick and of somewhat larger diameter than the beaker, with 500 turns of No. 13 B. and S. gauge magnet wire, and soldering the cylinder, to form water-tight joints, to plates of soft $\frac{3}{32}$ inch steel at the top and bottom, so as to complete the spool. A hole of the diameter of the inside of the cylinder is bored in the upper plate, and a hole 1 inch in diameter in the lower plate, for ventilation or the introduction of glass tubes for water-cooling. To obtain good results it is necessary to use a wire gauze cathode weighing 16 to 17 grms. and having about 40 meshes to the inch. A cylinder open at one side and having a total area of 100 sq. cm. may be used. The copper is prepared for the electrolysis in the same way as for the standard method, but not more than 50 c.c. of the "stock solution" of acid may be used, since otherwise the heat and strength of the current will cause some of the metal to be redissolved from the cathode. The wire coil may be used in the same system as the assay current, or an independent current of about the same ampèrage may be transmitted through a series of connected coils. In the case of 5 grms. of the metal the deposition will be complete in two hours with a current of 6 ampères per 100 sq. cm., the current being reduced to 2 ampères as soon as the solution becomes colourless and the cathode shows some polarisation (about 70 minutes). It is preferable, however, to use a current of only 4·5 ampères, and to continue the electrolysis for $2\frac{1}{2}$ hours with the same density of current, so as to prevent heating and risk of oxidation. A further precaution against oxidation is to remove the cathode as soon as the last trace of copper has been deposited. For very accurate results with metal rich in arsenic, the deposit may be redissolved (any platinum being separated by filtration) and the deposition repeated from fresh acid solution. *Rapid assay of copper in furnace slags.*—Two and a half grms. of waste slag or 1 to 2 grms. of richer slag are boiled for one minute with 15 c.c. of strong nitric acid in a porcelain basin to effect decomposition, after which 10 c.c. of strong sulphuric acid are added, and the mixture evaporated nearly to dryness, the evaporation being stopped just before the sulphuric acid begins to fume. A trace of nitric acid will then be left in the residue, and in the presence of excess of iron there will be a good deposition of copper from a rotating solution in 30 minutes with a current of 4·5 ampères per 100 sq. cm. (including both sides of the cathode). A gauze cathode will not be required, except in the case of rich slags requiring an electrolysis of over 30 minutes. The residue in the porcelain basin is treated with water while hot, and washed, without filtration, into the assay beaker. Chilled waste slags containing much lime but little iron oxide may frequently be rapidly decomposed by boiling them for a few minutes with 60 c.c. of the acid "stock solution," whereas certain exceptional slags may require treatment with *aqua regia* and fusion of the residue.—C. A. M.

Arsenic and antimony; Determination of —— *in copper.* G. L. Heath. J. Ind. Eng. Chem., 1911, 3, 78—82.

After summarising the chief methods of determining arsenic and antimony used in American foundries, etc., the author describes a rapid method of directly titrating the electrolyte from an assay of the copper, or of titrating a solution of the precipitated sulphides of metals of the arsenic group. In the case of copper containing less than 0·01 per cent. of arsenic and no antimony, the metal is dissolved in nitric acid, and the metals of the arsenic group precipitated by means of excess of ammonia in the presence of a large excess of ferric sulphate (oxidised ferrous sulphate), the precipitation being repeated once or twice. The precipitate is dissolved in hot dilute sulphuric acid containing 5 per cent. by volume of hydrochloric acid, and the arsenic, etc., with the last traces of copper precipitated in the cold by means of a current of hydrogen sulphide which is continued for 15 minutes. After allowing the beaker to stand over night, and a final saturation of the liquid with hydrogen sulphide, the mixture is filtered, and the precipitate is digested with the smallest possible quantity of hot sodium sulphide solution, and washed with slightly alkaline hydrogen sulphide solution ; the solution is treated with 0·2 grm. of sodium hydroxide and evaporated to dryness on a steam plate, and the residue digested with about 20 c.c. of concentrated (fuming) nitric acid until all sulphur has dissolved. After this 25 c.c. of strong sulphuric acid are added, and the solution evaporated (after the addition of 3 grms. of solid potassium bisulphate free from chlorides to retain the arsenic) until white fumes of sulphuric acid have been given off for 5 minutes. The liquid is then cooled, washed into a Kjeldahl flask, and again heated until it fumes for 5 minutes, this second treatment ensuring the complete removal of the nitric acid, upon which the success of the method depends. After the contents of the flask have cooled to some extent, 0·5 grm. of tartaric acid is added, and the flask occasionally rotated until the liquid becomes colourless, after which the solution is transferred to a beaker, diluted, rendered only just acid to litmus (one drop of dilute sulphuric acid in excess), and titrated with iodine as described below. The method of electrolysis followed by reduction and titration is the most rapid for control work, but involves the removal of antimony when present in more than traces. In the case of copper containing less than 0·1 per cent. of arsenic, portions of 10 grms. of the drillings are dissolved in a slight excess of nitric acid (sp. gr. 1·42), and the solution treated with 17 c.c. of strong sulphuric acid and evaporated to dryness, after which 12 c.c. of nitric acid and sufficient water to cover the electrode are added, and the liquid electrolysed under the conditions described in the preceding abstract. The electrolyte from which all copper has been removed is treated with 3 grms. of potassium bisulphate and sulphuric acid, and evaporated twice, to expel all nitric acid, as described above. It is not possible to use the "stock solution" of acid for dissolving the drillings in the first place, since unless all arsenic is oxidised to arsenic acid there appears to be some loss during the electrolysis. When the copper contains more than 0·1 per cent. of arsenic, two 5 grm. portions of the drillings are taken, 15 c.c. of sulphuric acid used, and a final addition of 10 c.c. of nitric acid made. In the case of copper containing 0·2 per cent. of arsenic, each of the portions is boiled down, reduced, and separately titrated, whilst if less arsenic is present they may be combined and evaporated together. Similarly two portions of 10 grms. may be united when the amount of arsenic lies between 0·01 and 0·05 per cent. If selenium or tellurium is present, the dry residue of copper sulphate is diluted with water, and the liquid reduced by means of a rapid current of sulphur dioxide at 40° C., filtered, and allowed to settle before adding the nitric acid. For very rapid working the copper may be separated from a rotating electrolyte (as described), the space between the beaker and cylinder being cooled by means of water, but the results for arsenic are not so accurate as when the copper is separated more slowly. It involves precipitation of the arsenic from dilute (2 : 1) hydrochloric acid to separate the antimony and the trace of platinum which, under the influence of the strong current, is continuously dissolved from the anode by the nitrous acid. The iodine solution for titrating the arsenic is prepared by dissolving 3·5 grms. of pure sublimed iodine and 7 grms. of potassium iodide in water, diluting the solution to a litre, and allowing it to stand, protected from light, for at least 24 hours before use. It is standardised upon pure arsenious acid, 0·06 grm. of which is dissolved in cold water containing 1 grm. of potassium hydroxide, and the solution diluted to 300 c.c. and rendered slightly acid to litmus with sulphuric acid. It is then made alkaline with ammonia, again acidified with one drop of the acid in excess, and, after the addition of 2 to 4 grms. of sodium bicarbonate and 3 drops of 10 per cent. potassium iodide solution, it is titrated with the iodine solution, with starch solution as indicator. In titrating the electrolyte solution it is advantageous to use a much larger excess (12 grms.) of sodium bicarbonate. The starch solution is prepared by soaking the starch for 24 hours in very dilute hydrochloric acid, then washing and drying it, and heating it for 3 hours at 100° C. Two c.c. of a solution of such starch give a very sharp end-reaction in the presence of the 3 drops of potassium iodide solution, and in blank experiments they consume only 0·04 c.c. of iodine (1 c.c. = 0·001 grm. of arsenic). The results obtained in blank determinations with ordinary untreated starch indicator are much higher (0·09 c.c.).

—C. A. M.

Roasted blendes ; Influence of lime on the content in sulphur of ——. E. Prost. Bull. Soc. Chim. Belg., 1911, **25**, 103—115.

In a series of experiments on the roasting of blendes, to which known proportions of lime were added, it was found that in all cases there was an increased retention of sulphur, corresponding almost with the lime used, and further addition to the charge of silica, lead oxide, or iron oxide had no appreciable effect in bringing about the decomposition of the calcium sulphate produced. Furnace experiments confirm those carried out in the laboratory and indicate that nearly all the calcium present in the charge must appear as sulphate after roasting.—F. Sodn.

Electrolytic galvanising. O. Hildebrand. Elektrochem. Zeits., 1911, **17**, 304—305.

The difficulties in the way of electrolytic galvanising are caused by (1) the inconvenience of having entirely to surround the article to be treated (as cathode) with the zinc anode, and (2) the poor adherence of the deposited zinc. In the so-called "regenerative method" the anode is of lead and the electrolyte zinc sulphate acidified with sulphuric acid. The solution is continuously circulated through the cell and then through a regeneration vat containing zinc dust before it returns to the cell. Rapid neutralisation takes place in the vat owing to the good contact with the finely powdered material. In such a cell the zinc deposit is very pure, adherent, and uniform.

—W. H. P.

Tin exports from the Federated Malay States. Board of Trade J., March 9, 1911. [T.R.]

The "Federated Malay States Government Gazette" of 3rd February publishes the following statement of the weight (in tons of 2000 lb.) of block tin and tin contained in ore (tin exported in the form of ore being taken at 70 per cent. of the gross weight of the ore) exported from the Federated Malay States during the years 1909 and 1910 :—

State.	1909.			1910.		
	Tin.	Tin contained in tin ore.	Total.	Tin.	Tin contained in tin cre.	Total.
	tons.	tons.	tons.	tons.	tons.	tons.
Perak	7,692	23,086	30,778	7,334	20,764	28,098
Selangor ...	3,268	13,799	17,067	2,893	13,119	16,012
Negri Sembilan	302	2,902	3,204	8	2,305	2,313
Pahang.....	777	2,032	2,809	862	1,849	2,711
Total ..	12,039	41,819	53,858	11,097	38,037	49,134

Refractory tin ores ; Simple method of decomposing ——. H. Y. Loram. Chem. Soc. Proc., 1911, **27**, 60.

The mineral (2 grams, or more if desired), crushed to a "sixty-hole powder," is fused for about an hour in a covered silver crucible at a temperature well below its melting point, with about six or seven times its weight of potassium hydroxide, to which is added potassium cyanide equal to the weight of tin ore taken. The mass, on cooling, is extracted with water, when the whole will dissolve in dilute hydrochloric acid, and after boiling to destroy any cyanide still remaining, the tin can be estimated by any of the usual methods.

Mineral output in Transvaal. Board of Trade J., March 9, 1911. [T.R.]

The Transvaal Mines Department Statistical Report for December contains the following particulars of the values of some of the more important minerals produced in the Transvaal :—

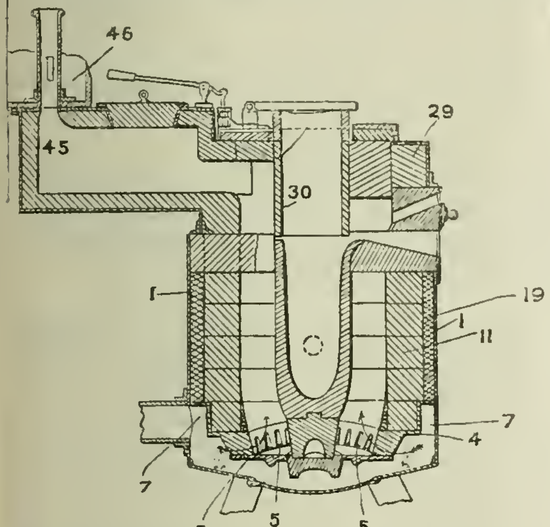
—	Year ended 30th June.		July—Dec., 1910.
	1909.	1910.	
	£	£	£
Gold	30,985,966	31,044,753	16,464,722
Silver	87,457	86,323	45,742
Diamonds	1,295,296	1,317,479	596,109
Coal*	851,150	970,367	494,783
Copper ore	49,027	71,914	29,627
Galena	25,432	5,943	26
Tin ore	148,336	303,210	150,358

* The quantity of coal sold was 3,312,413 tons in 1908–9, 3,876,764 tons in 1909–10, and 1,980,502 tons in the last six months of 1910.

Patents.

Crucible furnaces ; Portable ——. M. Harvey, Walsall. Eng. Pat. 2166, Jan. 28, 1910.

The furnace proper consists of a cylindrical iron casing, 1, lined with firebrick, 11, the two portions being separated by a non-conducting material, 19, such as asbestos. The firebrick lining and the crucible-stand are carried by an annular plate, 4, with radial blast passages, 5. A suitable number of vertical passages (not shown) in the firebrick lining communicate from the blast-chamber, 7, with tangentially arranged tuyères (not shown) situated about halfway up the furnace. The furnace is carried on trunnions and can be tilted to pour slag and metal, a spout brick with a suitable groove being fitted to the top of the lining. Fitting on the top of this portable body is a feed-heater cylinder, 30, enclosed in a firebrick lining, 29, corresponding with that of the furnace proper. The cylinder fits just over the crucible in the furnace. Unmelted metal and fuel can be charged from above into the feed-heater and the annular space around it respectively. A tubular arm in the feed-heater forms a flue, 45, for the passage of the products of combustion to the chimney, 46. The feed-heater as a whole is carried on trunnions by a bracket fastened to the wall. It can thus be swung clear to allow the portable furnace to be tilted. The furnace may be worked by the natural draught of the chimney, by forced draught, or, by delivering a jet of steam up the chimney, by induced draught.—T. St.



Furnaces for calcining or roasting mineral ores and desulphurising the same. T. Edwards, Ballarat, Australia. Eng. Pat. 21,198, Sept. 12, 1910.

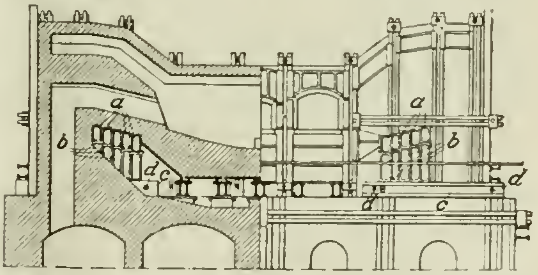
The patent relates to improvements in roasting furnaces—chiefly in those of the type described in Eng. Pat. 28,464 of 1903 (this J., 1904, 1150)—whereby the same may be operated as muffle, reverberatory, or combined muffle and reverberatory furnaces. The invention, as applied to twin furnaces of the kind referred to, is illustrated by a series of twelve drawings. The ore, propelled towards the discharge end of the working hearth by rotating rabbles (as described in the prior patent), passes through a shoot to an inclined cooling hearth below, along which it is similarly propelled, being also sprinkled with water (or a suitable chemical solution) during its passage. By means of a mechanically operated device situated between the two hearths, the dust raised by the fall of the ore is prevented from returning to the working hearth and is conveyed to a dust collector. Having a very low arch, the working hearth practically forms the base of a central, horizontal flue which is provided with dampers. Two separate flues, situated one above and the other below the working hearth, to which they are parallel, communicate with a chamber at the discharge end of the apparatus ; while at the feed end all three flues communicate with a similar chamber. The outlets from these two chambers are connected externally by a horizontal pipe, from which a branch passes to the upper flue ; the latter also communicates with the working hearth (at a point nearer to the discharge end of the apparatus) by means of an opening controlled by dampers. Firing furnaces for the heating flues being provided, the mode of working of the apparatus is determined and controlled by the manipulation of the various dampers disposed throughout the system.
—W. E. F. P.

Smelting-furnace. C. W. Munson, Toledo, Ohio. U.S. Pat. 983,833, Feb. 7, 1911.

A conical heap of ore is maintained upon the hearth of a vertical blast-furnace having sectional, water-jacketed side walls. The latter are contracted at a short distance above the hearth, so that a limited and confined air space is formed around the base of the heap. The tuyères, which have laterally wide and vertically narrow mouths, are placed close together, thus forming practically one narrow tuyère extending entirely round the furnace, from which a thin stream of air is directed at the base of the heap of ore.—W. E. F. P.

Martin furnace, with hollow metal cooling devices for the crown. Poetter Ges. m. b. H. Ger. Pat. 224,198, Aug. 11, 1909.

The cooling elements, *a*, act as supports for the crown of the furnace ; they project beyond the furnace-walls, and rest on the supports, *b*, which are arranged stepwise. The supports, *b*, rest on strong iron girders, *c*, which are connected at the ends by the pieces, *d*. By the arrangement described the arch of the regenerator is relieved of the weight of the crown of the furnace.—A. S.



Furnaces ; Preheater and reducer for electric smelting ——. A. Stansfield, Montreal, Quebec. Assignor to J. W. Evans, Belleville, Canada. U.S. Pat. 984,308, Feb. 14, 1911.

The furnace communicates with a chamber by means of an inclined shoot, and above the chamber is a combustion space containing one or more perforated pipes. Air is admitted into the combustion space around the pipes, to support the combustion of the gases passing from the inside of the pipes through the perforations. Ore is admitted at the tops of the pipes, and, by means of a pusher in the lower part of the chamber, is delivered through the shoot into the furnace. The shoot may, if necessary, be closed by a suitable door or damper.—B. N.

[Electric] Furnace for metallurgical purposes. W. Rodenhauser, Völklingen, Germany, Assignor to The Gröndal Kjellin Co., Ltd., London. U.S. Pat. 984,970, Feb. 21, 1911.

The furnace, for melting metals, comprises an electric arc for heating the surface of the charge contained in a melting chamber, and independent electric conductors forming a portion of the lining or wall of the chamber below the surface of the charge. By means of the conductors an electric current may be led to the body of the charge, whereby a substantially uniform heat may be maintained in it.—B. N.

Furnace; Induction —— for the manufacture of steel, with horizontal heating channels and arrangements for preventing the slag from penetrating into the heating channels. Ges. für Elektrostahlanlagen m. b. H. Fr. Pat. 420,749, Sept. 24, 1910.

The internal height of the heating channel corresponds approximately with the height of the bath of metal in the hearth of the furnace. The channels are completely covered, so that when the furnace is charged, any slag which enters the channels readily makes its escape into the hearth of the furnace.—B. N.

Furnace; Electric —— for the treatment of [zinc] ores or secondary metallurgical products. Soc. di Monteponi. Fr. Pat. 420,922, Sept. 30, 1910. Under Int. Conv., Oct. 9, 1909.

The furnace is specially designed for the distillation of zinc from its ores or by-products, and consists of a muffle, of non-conducting refractory material, closed at one end and heated by resistance. The receptacle, containing this muffle, is mounted so as to turn in a vertical plane, and is prolonged beyond the mouth of the muffle, so as to form a chamber into which the condenser for the zinc is introduced. A portion only of the receptacle may be prolonged, the chamber for the condenser in this case being completed by a movable tile.—B. N.

Copper and other ores; Treatment of ——. F. B. Dick, Hampton, Middlesex. Eng. Pat. 2500, Feb. 1, 1910.

In certain non-flotation processes of concentration, substances ("selectors") having a selective action upon certain particles are employed to effect the separation of such particles from the crushed ore by agglomeration or other means. According to the present invention, ores not suited to concentration by such "non-flotation selector processes" are rendered amenable thereto by subjection to a preliminary heating under reducing conditions. —W. E. F. P.

Copper; Process of hardening ——. R. A. Hamilton and J. Henry, Connellsville, Pa. U.S. Pat. 984,137, Feb. 14, 1911.

The molten copper is incorporated with a proportion of the product obtained by heating a mixture of metallic aluminium and iron pyrites.—W. E. F. P.

Metals; Method of obtaining ductile or malleable bodies of high melting-point ——. The British Thomson-Houston Co., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 2759, Feb. 3, 1910.

The unsintered wires, filaments, etc., prepared by the usual methods from powdered molybdenum or tungsten, are electrically heated, under suitable conditions, to a temperature approaching the melting-point of the metal. The sintering is continued until the metal becomes thoroughly homogeneous, the temperature required being higher than that which would give the maximum mechanical strength if the metal were suddenly cooled. The wires, etc., are then cooled very slowly, and it is claimed that when cold the metal is ductile and malleable. —W. E. F. P.

Zinc oxide; Extraction of ——, from complex sulphide ores. W. McCowan, London. Eng. Pat. 3357, Feb. 11, 1910.

The ore is subjected to a sulphating roast and leached with water (or with weak liquors subsequently obtained), the lixiviation being accompanied by a rise of temperature varying with the amount of zinc present in the ore. The solution is cooled to allow as much as possible of the zinc sulphate to crystallise out, and the mother liquor is used for the lixiviation of another charge of roasted ore. After dehydration the crystallised zinc sulphate is heated to redness in a furnace, basic zinc sulphate being thus produced together with sulphurous and sulphuric anhydrides—which latter are collected in water or weak liquors and used for the recovery of the remaining zinc oxide from the leached ore residue. After the expulsion of the sulphurous gases, water-gas is passed into the furnace containing the basic sulphate which is thus converted into a mixture of oxide and sulphide of zinc. The latter is subsequently converted to oxide by means of hot air and steam; and the product from the furnace is finally washed with water to remove any remaining zinc sulphate, the wash-water being utilised for leaching, etc., as already described. —W. E. F. P.

Zinc; Process for obtaining —— from sulphide or oxide ores by the precipitation process. A. Zavelberg. Ger. Pat. 230,395. Jan. 3, 1908.

The metal (iron) used to effect the reaction is melted on the hearth of a reverberatory furnace, and then flows by gravity into the closed reaction-chamber containing the ore-charge. The reaction-chamber and the reverberatory furnace are combined in a single structure, and the gases from the reverberatory furnace are utilised to heat externally the closed reaction-chamber.—A. S.

Aluminium; Treatment of objects of —— for soldering them with each other or with other metals. A. Butikofer, London. From L. Maitre, Prédame, Switzerland. Eng. Pat. 3439, Feb. 11, 1910.

The aluminium object is first coated electrolytically with a thin layer of iron and then immediately plunged into boiling water and subsequently into cold water. It is afterwards reheated until the deposit has acquired a blue colour, and again immersed, while still hot, in cold water or in any other liquid suitable for hardening steel. This second treatment has the additional effect of causing the deposit to adhere more strongly to the underlying metal. The thin film of oxide having been removed with fine emery paper, the object is ready for soldering by the ordinary compositions to iron or to any piece of aluminium or other metal which can be treated in a similar manner, cast iron being of course excepted. (Reference is directed to Eng. Pat. 3668 of 1898; this J., 1899, 375.)—C. A. W.

Porous electro-deposits; Process for producing ——. W. E. Lake, London. From Fabrik Elektrischer Zünder, Ges. m. b. H. Eng. Pat. 5691, March 7, 1910.

Porous metallic deposits, *e.g.*, of copper, are produced by utilising the cataphoretic property of colloidal or suspended substances in order to deposit simultaneously with the metal a non-metallic substance, such as gelatin, calcium carbonate, etc., the non-metallic substance being afterwards partly or completely removed by dissolving, washing, melting, burning, or by other means. The pores thus produced may then be filled with some other substance, such as enamel, etc.—B. N.

Etching by electrolysis on relief or intaglio; Process of ——. A. D. Lapointe, Assignor to Bastian and Lapointe, Sioux City, Iowa. U.S. Pat. 984,011, Feb. 14, 1911.

The positive pole of an electric current is applied to the prints on copper, zinc, or brass plates in a solution of the nitrate of the metal used; and the negative pole is connected with a suitable electrode in the solution.—B. N.

Alkali or alkaline-earth metals ; [*Electrolytic*] *Process of manufacture of* ——. The Nitrogen Co. Fr. Pat. 420,744, Sept. 24, 1910.

An alloy of the alkali metal with a heavy metal is formed by electrolysis at a temperature approaching a red heat, and this is used as the anode for electrolysing a bath of a compound, such as an alkali cyanide, having a melting point lower than the temperature required to form the alloy. The temperature of the bath is kept at a point approaching that required to form the alloy, the alkali metal combining with the anions to form a stable compound, whilst the heavy metal is incapable of forming a stable compound with the anions at the temperature of the operation.—B. N.

Metals ; Extraction and recovery of —— *from ores and other materials.* M. Ruthenburg, London. Eng. Pat. 6601, Mar. 16, 1910.

The patent relates to the extraction or recovery of metals such as tin, antimony, lead, zinc and bismuth, which—either as oxides or in metallic form—are soluble in one or other of the fused salts of the alkali metals. From such solutions the dissolved metal is precipitated by the addition of carbon in the form of powdered or granular coke. Claim is made for the extraction of tin from stannic oxide, and for the recovery of the same from tinned scrap, by treating the material with fused sodium hydroxide and precipitating the metal in the manner described.—W. E. F. P.

Ore concentration. T. J. Hoover and Minerals Separation, Ltd., London. Eng. Pat. 10,929, May 3, 1910.

In order to introduce air or other gas into an ore pulp for the purpose of effecting the flotation of certain particles, the mixture is brought into contact with a porous medium such as brick, coke, or some fibrous material through which the gas is forced in fine streams which come into intimate contact with the particles and rise to the surface in the form of a froth. For this purpose, the crushed ore, mixed with water and possibly with an acid and with a soluble or insoluble frothing agent, may be passed over a flotation table provided with a porous top ; or, alternatively, it may be introduced into a "spitzkasten" through a conduit which possesses walls partly made of porous material and surrounded by a jacket to which compressed air is supplied. The supply of compressed air may be obtained by the flow of the pulp itself, the liquid being made to fall through a narrow tube ; whilst, finally, in place of air, it is possible to employ furnace gases, carbon dioxide or a gas, such as formaldehyde or carbon bisulphide vapour, which has a selective as well as a frothing action.—C. A. W.

Metalliferous ores ; Process of and apparatus for concentrating ——. H. E. Wood, Denver, Colo. U.S. Pat. 984,633, Feb. 21, 1911.

In order to separate the metalliferous values from the gangue, the well dried and finely powdered ore is fed uniformly on to a surface of water contained in a tank or on to the stream which flows over an inclined plate across the main body of water in the tank. In any case the slowly moving upper layer is caused to discharge, with surface film unbroken, over the edge of the receptacle, the column of water being directed upon a perforated screen which is set obliquely in the path so as to split off the surface film. In this way the particles supported by the film are collected and delivered into a suitable receptacle, whilst the water and constituents passing through the screen are received upon a deflecting plate.
—C. A. W.

Ores and minerals, particularly certain fluoriferous blendes ; Separation of —— *from their gangue and impurities.* R. Delplace. Fr. Pat. 420,008, Nov. 10, 1909.

The finely crushed and screened ore is immersed in some suitable liquid, such as water or very dilute acid, in which bubbles of gas can be produced by chemical or electrical means, or by heating the liquid to a temperature of, say, 45° C. The gaseous bubbles, of hydrogen suphide, carbon dioxide or air, as they rise to the surface of the liquid, carry with them one of the two constituents—generally the ore, the gangue being left at the bottom of the receptacle. Thus, in the case of a blende containing calcium fluoride, the blende alone is collected at the surface, whilst the fluoride is left on the bottom. The vessels in which the ore is treated may be constructed in several forms. In one modification, the receptacle is provided internally with two inclined partitions, constructed in the form of semi-cones which are joined so that an opening is left in the side between the upper and the lower apex. The ore is charged through a hopper passing to the bottom of the receptacle, the particles of blende are carried by the gaseous bubbles towards the apex and thence into the outer vessel through the opening at the side ; when, finally, they fall through the liquid and settle on the top of the partition. An opening is provided in the bottom of the receptacle, above the diagonal partition, for the removal of the purified blende. Alternatively, the ore may be fed into conical vessels filled with water or dilute acid and supported over a furnace flue. These vessels, of which a whole series may be employed, open at the top into a narrow channel through which a current of liquid is continually circulated ; so that the blende, rising to the surface of the vessel, is carried away by the current and finally deposited in a receptacle at the bottom of the channel. In the third modification, an elongated trough is fitted with a rotating shaft which carries a series of blades arranged, in the two halves of the vessel, at opposite angles. The ore, introduced in the middle, falls to the bottom and is slowly pushed by one series of blades towards the heated part of the receptacle. The blende is carried to the surface, seized by the current of liquid and conveyed to the opposite end, whence it is removed from the vessel. As a final alternative, the ore may be charged on to a band which is made to travel along the bottom of a trough. The particles of blende, as they are carried to the surface, are caught by a second band which moves in the reverse direction, this upper band being composed of a series of small perforated pockets which permit the particles to pass upwards and catch them as they fall back in the liquid.—C. A. W.

Tantalum metal ; Process for the manufacture of tubes of ——. Siemens und Halske A.-G., Berlin. Eng. Pat. 19,962, Aug. 26, 1910. Under Int. Conv., Oct. 7, 1909.

In order to form tantalum tubes, a hole of rectangular or circular section is drilled in the block of metal, and into this hole a rod of iron, steel or any other material of low elasticity but high tensile strength, is inserted. The block may then be treated by drawing or rolling until a tube of the desired section has been obtained ; when, finally, the inserted rod may be withdrawn, and this the more easily since the greater elasticity of the tantalum will have caused the outer tube to draw away from the insertion when the pressure is released. In this way, very fine tubes of tantalum may be obtained. In some cases, the inserted rod might be removed afterwards by melting or by means of chemical treatment.—C. A. W.

Metals ; Reduction of —— *from their compounds.* R. J. McNitt, Niagara Falls, U.S.A. Eng. Pat. 20,339, Aug. 31, 1910. Under Int. Conv., Sept. 9, 1909.

The metal of the compound to be reduced (*e.g.*, an alkali metal) is dissolved or alloyed with another less volatile metal, and the solution or alloy is treated by the process described in Fr. Pat. 419,830 of 1910 (this J., 1911, 220).
—T. F. B.

Alkali metal ; Separation of an —— *from its alloys and combinations.* R. J. McNitt. Fr. Pat. 420,288, Sept. 10, 1910.

In order to separate the alkali-metal from a lead-sodium alloy by distillation, it has been found necessary to conduct the operation in a vacuum or to heat the bath to a temperature much higher than the boiling point of sodium, the yield at the lower temperature being comparatively insignificant. It is now proposed to heat the alloy to low redness, that is below the boiling point of sodium, and to effect the distillation by introducing a current of inert gas heated to the necessary temperature and at a relatively high pressure, the condenser being modified in order to obtain the additional cooling which is necessary. For the distillation, an iron receptacle, which may be heated externally, may be employed, the gas being distributed through the bath so that a frothy mass is obtained.—C. A. W.

De-tinning and de-galvanising scrap. A. S. Ramage, Newark, N.J., Assignor to J. H. Maugham. U.S. Pat. 983,931, Feb. 14, 1911.

In a cyclic process for the recovery of lead, tin and zinc from the respective waste products of these metals, the lead product is first dissolved in sodium hydroxide. The addition of tin scrap to this solution results in the precipitation of spongy lead and the formation of sodium stannate. On treating the latter with galvanised (zinc) scrap, the tin is precipitated and sodium zincate formed. The partial electrolysis of the zincate solution results in the deposition of metallic zinc and the production of a liquor containing sodium zincate and hydroxide which is employed for the treatment of a further quantity of lead scrap.—W. E. F. P.

Antimony ores; Treatment of auriferous ——. J. Jones and H. S. Bohm, Mount Morgan, Australia. U.S. Pat. 984,090, Feb. 14, 1911.

The powdered (sulphide) ore is heated and agitated with hydrochloric acid, the plant comprising a generator for hydrochloric acid gas and an absorption tower for effecting its solution. The solution is filtered, freed from hydrogen sulphide and treated electrolytically for the recovery of the antimony. The hydrogen sulphide produced by the decomposition of the ore, and the chlorine arising from the electrolysis, are collected (the amount of the latter being augmented from a chlorine generator) and are separately conveyed, in the correct proportions, to a chamber for the regeneration of hydrochloric acid. The liquid from which the antimony has been deposited is passed back to the absorption tower for strengthening and re-use, but is purified when required by forcing air through it while heated under reduced pressure. The insoluble residue of the ore is treated by any known method for the recovery of its valuable constituents.
—W. E. F. P.

Calcium; Producing ——. W. C. Arsem, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 984,503, Feb. 14, 1911.

Calcium carbide is heated, in an inert atmosphere under reduced pressure, or in a vacuum, to a temperature of about 1500° C., the resulting calcium vapour being collected and condensed by suitable means.—W. E. F. P.

Iron; Process of purifying and refining ——. J. B. Nau, New York. U.S. Pat. 984,590, Feb. 21, 1911.

The purification of the pig-iron is effected in an electrically heated furnace comprising a crucible, an ore-shaft above the crucible and a conduit at the bottom which slopes upwards and communicates with a fore-hearth or separate covered chamber. The furnace having been filled to a certain height with an excess of iron ore in pieces, the molten metal is introduced and allowed to percolate through the mass until it forms a bath at the bottom, the particles of ore being retained in position by the weight of the excess in the shaft and by the pressure of the roof over the crucible. The bath is kept for some time at a certain depth in contact with the ore, the necessary temperature being maintained by means of the electric current, until, finally, the purified molten iron is separated from the oxidising material and forced into the fore-hearth, where it comes into contact with a flame which plays over its surface.—C. A. W.

Precious metals; Apparatus for obtaining ——. J. R. Parks, Spokane, Wash. U.S. Pat. 984,842, Feb. 21, 1911.

The apparatus, employed for obtaining precious metals from their solutions electrolytically, comprises a series of extraction pans supported at different levels, so that the liquid can flow by gravity through the pans in succession, an alternative route being provided through the remaining receptacles when any one pan has to be cleaned out. Each pan comprises a fixed cathode and a removable anode, which can be connected when necessary with a hoisting mechanism and so raised from the receptacle. The liquid may then be discharged through an aperture at the bottom, the pan being tilted in order to facilitate the operation; when, finally, the deposited metal can be removed.—C. A. W.

Precious metals such as silver and gold; Treatment of chemically pure iron in order to obtain ——. M. Roux. Fr. Pat. 420,535, Nov. 25, 1909, and First Addition, dated Nov. 27, 1909.

The claim relates to a method by which, it is said, chemically pure iron may be transformed into silver, and the silver into gold, the two transmutations being effected in one operation when the conditions are favourable and the temperature is sufficiently high. The chemically pure iron, reduced by hydrogen, is ground to an impalpable powder (25 parts) and mixed intimately with calcined native silica (975 parts). A small quantity of the mixture is introduced into a crucible so that the latter, of a few cubic centimetres capacity, is three-quarters filled. The air having been exhausted, the crucible is hermetically sealed and heated for ten to fifteen minutes in the centre of the electric arc, a current intensity of 40 to 50 ampères and a tension of 60 to 80 volts being employed. After the necessary cooling, it may then be opened; when a quartzose mass is obtained, in which, it is said, the silver will be found disseminated in fine crystalline veins. The metal is afterwards separated by amalgamation. Similarly, employing chemically pure silver in extremely fine scraps, in place of the iron, gold may be obtained; or, finally, when any member of the iron family, such as nickel, cobalt, manganese, chromium, molybdenum, tungsten or uranium, is treated in a similar manner, each one is transformed into a different metal.—C. A. W.

Air; Enrichment in oxygen of the —— *destined for the blowing of blast-furnaces and other furnaces.* Soc. Anon. d'Ougrée Marihaye and Soc. pour l'Utilisation de l'Air et de ses Dérivés. Fr. Pat. 420,537, Nov. 25, 1909.

In mixing an excess of oxygen with the air supplied to a blast-furnace, it is advisable to employ some arrangement by which the amount of oxygen added may be made to vary proportionally with the total quantity of air introduced, a quantity which fluctuates considerably in consequence of the variations in the back-pressure of the furnace. To this end, the piston-rod of the air-compressor may be extended through the end of the cylinder, and made to drive the piston in a smaller cylinder which serves to compress the oxygen. If turbo-compressors be employed, a constant ratio between the outputs may be obtained in some similar manner. The air and oxygen are forced into a conduit provided with baffle-plates, and in this way they are intimately mixed. Finally, in order to vary the clearance in the oxygen cylinder, and thus alter the proportion of oxygen added to the air, an arrangement is provided by which the bottom of the oxygen cylinder may be displaced relatively to the piston. In the case of a cylinder with double action, the same object must be attained by decreasing the thickness of the piston equally on both sides.—C. A. W.

Steel alloys; Manufacture of ——. C. M. Johnson, Avalon, Pa., U.S.A. Eng. Pat. 8530, April 8, 1910. Under Int. Conv., Nov. 15, 1909.

See U.S. Pat. 964,869 of 1910; this J., 1910, 1015.—T.F.B.

Metallic oxides ; Process for the reduction of ——. W. Mathesius, Charlottenburg, Germany. Eng. Pat. 3819, Feb. 16, 1910.

See Fr. Pat. 411,965 of 1910 ; this J., 1910, 1016.—T.F.B.

Tin-plate waste ; Recovery of tin from —— *by means of chlorine.* C. von der Linde, Crefeld, Germany. Eng. Pat. 18,378, Aug. 3, 1910.

See Fr. Pat. 419,280 of 1910 ; this J., 1911, 136.—T. F. B.

Ores, particularly the ores of tungsten and like metal ; Treatment of ——. C. M. Johnson, Avalon, Pa., U.S.A. Eng. Pat. 25,401, Nov. 1, 1910. Under Int. Conv., Jan. 31, 1910.

See U.S. Pat. 964,870 of 1910 this J., 1910, 1015.—T.F.B.

Ores yielding a volatile metal : Apparatus for smelting ——. W. M. Johnson, Hartford, Assignor to Continuous Zinc Furnace Co. Reissue No. 13,208, Feb. 14, 1911, of U.S. Pat. 964,268, July 12, 1910.

See this J., 1910, 959.—T. F. B.

[Smelter] fumes or smoke ; Method of treating corrosive gaseous ——. C. B. Sprague, Salt Lake City, Assignor to U.S. Smelting, Refining, and Mining Co. U.S. Pat. 984,498, Feb. 14, 1911.

See Fr. Pat. 397,268 of 1908 ; this J., 1909, 799.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

High-voltage machines ; Chemical action in the windings of ——. A. P. M. Fleming and R. Johnson. Times Eng. Suppl., Feb. 22, 1911.

The authors have investigated the cause of the failure of high-voltage machines owing to chemical corrosion of the insulation. From investigations of a number of machines differently insulated, they arrive at the general conclusion that the destruction of the insulation is not necessarily due to direct action of nitric acid. No case of chemical action has been observed on windings with a lower voltage than about 3500 to ground. The primary action only occurs where air pockets are found, and then only when the voltage is sufficient to cause a discharge. The gases produced may, however, pass to other portions of the insulation and promote further action. This action is generally one of oxidation or peroxidation on the insulating material. Cellulose materials, for instance, disintegrate and lose their fibrous structure ; oils and gums, especially linseed oil, yield organic acids ; asphaltum compounds are scarcely affected, while paraffin wax and mica are not affected at all. The cements used in building up mica insulation are liable to attack on the exposed parts. Where nitric acid is actually produced, the corrosion is always greatly accelerated, while the final disintegration of materials coated with varnish is hastened by the released organic acids. The progress of the oxidation is of course checked if the air in the cavities is not replaced by "breathing." The actual failure of the machine is usually caused by a short circuit between the windings, and not through breakdown of the slot insulation between windings and ground. Under high electrical stress, deterioration may be produced without chemical action, if an insulator of low specific inductive capacity is present. It is therefore advisable to avoid the use of materials of high and of low specific inductive capacity in conjunction, as the insulation value of the latter may be destroyed. The authors recommend that careful attention should be given to the average electrical stress in relation to the size and number of conductors which regulates the methods of grouping and insulating. Special precautions should be taken to fill all interstices, and to select suitable materials such as mica where the pressure is to be high. It must also be noted that the ordinary pressure tests do not indicate the safety of a winding against chemical action, as this takes place usually at a much lower stress than that required for disruption of the insulation.—W. H. P.

Surface effects between mercury and certain solutions, and an electrochemical method of estimating dissolved oxygen. S. W. J. Smith and W. F. Higgins. Faraday Soc. Mar. 14, 1911. [Advance proof.]

The authors have pursued the investigation of the considerable change in the difference of potential between mercury and dilute solutions of various electrolytes, which takes place when small quantities of sodium sulphide are added. As the quantity of sulphide is increased, the potential difference increases at a roughly proportional rate, but at a critical concentration lying near 0·0004 *N* sodium sulphide, there is a sudden and considerable increase. This effect is only temporary and disappears in about a day, but a similar leap at a higher concentration (about 0·00055*N*) is permanent so long as atmospheric oxygen is excluded. The second effect is due to the oxidation of the sulphide in solution to thiosulphate ($2Na_2S+4O+H_2O=Na_2S_2O_3+2NaOH$) by the dissolved oxygen of the water. The dissolved oxygen under ordinary conditions is from 0·00105 to 0·0012 gram-equivalent per litre which will require half as much sodium sulphide (i.e. 0·0005 to 0·0006). The method may thus be used as a measure of the dissolved oxygen, by adding varying quantities of sodium sulphide and noting the concentration at which the sudden rise in potential occurs. A very slight excess of sodium sulphide is sufficient to increase the potential difference by more than half a volt. The first and temporary increase at 0·0004*N* sodium sulphide is more difficult of explanation, but it is probably due to some form of selective adsorption of sodium sulphide at the mercury surface. This view is supported by the fact that tarnishing of the electrode (which is only caused by sulphide, not by thiosulphate) appears to take place more rapidly in a solution of concentration 0·0004*N* than in solutions of higher or lower concentration. The progress of the tarnishing especially in solutions of this dilution is very similar to the appearance of "oxidation tints" on tempered steel.—W. H. P.

Patents.

Electrodes for secondary batteries or storage cells ; Manufacture of ——. S. B. Apostoloff, London, and V. de Karavodine, Billancourt, France. Eng. Pat. 66, Jan. 1, 1910.

Lead sulphate, either alone or mixed with a suitable proportion of ammonium sulphate, is made into a paste with ammonia solution or water, and moulded into the required shape. If water is used the material is afterwards subjected to the action of gaseous ammonia, or an ammonia bath. The lead sulphate is then converted into spongy lead by the action of the electric current in an alkaline electrolyte, consisting of a saturated solution of ammonium sulphate and approximately 5 per cent. of ammonia. If required for positive plates, the spongy lead is converted into peroxide in the usual manner.—B. N.

Electrolytic cell. F. H. Briggs, Elyria, Ohio. U.S. Pat. 981,371, Jan. 10, 1911.

The cathode, of suitable conducting material, is formed with slanting sides terminating at a point at the upper part of the electrode, the point being placed approximately at the upper surface of the electrolyte. The electrode may be solid or hollow, but in the latter case the bottom is closed. The shape of the electrode allows the hydrogen, formed in the production of chlorates, hypochlorites, etc., to escape more freely, thus avoiding polarisation.—B. N.

Long electric arcs ; Production and maintenance of ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 5934, March 9, 1910.

Gas currents issue from two rows of outlets in two parallel tubes at any angle with the axes of the tubes, the two rows of currents meeting at a point adjacent to, and at an angle to the axis of, the arc.—B. N.

Furnace; Electric ——. H. I. Wood, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 984,119, Feb. 14, 1911.

The furnace comprises a chamber which is exhausted, within which is a tubular graphite resistance heater, subject to disintegration by heat at the normal operating temperature of the furnace. Within the heater, and separated therefrom by an annular gap which is exhausted, is a closed charge-protecting envelope, the latter consisting of material capable of uniting chemically with such carbon vapour as crosses the gap. The envelope may, for example, be constructed of a refractory compound of a refractory metal having a high affinity for carbon, and yielding a reduction product stable at the temperature at which carbon begins to disintegrate.—B. N.

Furnace; Electric —— of great power for endothermic reactions in gases. Soc. anon. Le Nitrogène. Fr. Pat. 420,524, Sept. 17, 1910. Under Int. Conv., Sept. 20 and Nov. 27, 1909.

The furnace comprises vertical tubes constituting chambers of reaction, which are united above in a collecting chamber. Each tube is provided below with two vertical electrodes connected in series. The current of gas is divided into parallel currents, which pass through the arcs. The gas may be aspirated and maintained under diminished pressure in the interior of the apparatus, or may be forced by a suitable pump through the tubes, but in the latter case the lower parts of the tubes with the electrodes are surrounded by a chamber of distribution. The exterior or interior of each tube may be cooled, or the interior or exterior of the electrodes may be so treated, or again the gas may be heated before passing into the arc. The head of each electrode may be made movable, so that it may be easily dismounted.—B. N.

Refractory bodies which are good conductors of electricity; Manufacture of ——. Gebr. Siemens und Co. Fr. Pat. 420,183, Sept. 9, 1910. Under Int. Conv., Oct. 4, 1909.

A fundamental mass which may be a carbide of silicon, clay, etc., is mixed with finely powdered silicon, and moulded to the shape required. It is then strongly heated in an atmosphere containing carbon monoxide or dioxide, thus forming a chemical compound of silicon, carbon and oxygen.—B. N.

Insulating layers of oxides or salts; Production of —— on wires, ribbons or coils usually of aluminium or aluminium alloys. Specialfabr. für Aluminium-Spulen und Leitungen. Ges. m. b. H. Fr. Pat. 420,269, Sept. 9, 1910. Under Int. Conv., Oct. 14, 1909.

In order to produce insulating layers of oxides or salts upon metallic wires or tapes, unworked or wound into coils, the metal, freed from adherent impurities, is submitted to the action of a gaseous oxidising body such as oxygen, air rich in oxygen, ozone, acid or alkaline vapours, halogen gases or steam. It is preferable to employ the gases in a moist condition or mixed with water vapour; in some cases, in fact, superheated steam or steam at a high pressure may be employed. The oxidising gas and the metal under treatment may be either hot or cold and at the same or different temperature, but in any case it is advisable to heat the wires or coils at the conclusion in order to remove all traces of the agent. In some cases, the operation may be effected in a partial vacuum or under a high pressure, whilst, finally, an augmented effect may be obtained by artificially producing a fall of temperature or pressure.—C. A. W.

Furnaces; Electric ——. J. Thomson, New York. Eng. Pat. 15,168, June 23, 1910. Under Int. Conv., Sept. 1, 1909.

See U.S. Pat. 950,881 of 1910; this J., 1910, 436.—T. F. B.

Furnace; Electric ——. H. Hoff, Assignor to Eisenhütten-Act.-Ver., Düdelingen, Luxemburg. U.S. Pat. 984,371, Feb. 14, 1911.

See Fr. Pat. 405,911 of 1909; this J., 1910, 827.—T. F. B.

XII.—FATS; OILS; WAXES.

Oil analysis; Interpolation method of ——. J. J. Kessler and G. K. Mathiason. J. Ind. Eng. Chem., 1911, 3, 66—72.

From the results of the analysis of mixtures of different oils given in tabular form and plotted as curves, the conclusion is drawn that the Maumené test, flash test, fire test, and viscosity (and possibly other physical tests) do not follow the additive law of mixtures, and that, in consequence, deductions as to the composition of the mixtures obtained by interpolation of these values will be erroneous, the error in certain cases being considerable. On the other hand, the saponification value of mixtures of oils agrees with the calculated value, even when a large amount of unsaponifiable oil is present. The Maumené figure, if used for calculating the composition of a mixture of two oils, is shown to be incapable of giving results from which quantitative deductions can be drawn by the interpolation method, at all events in the form in which the test is ordinarily employed.—C. A. M.

Wool oils; Determination of unsaponifiable matter in ——. A. H. Gill and A. E. Shippee. J. Ind. Eng. Chem., 1911, 3, 72—73.

The unsaponifiable matter in wool oils is usually determined by extraction with petroleum spirit (gasoline), or by a method in which the combined fatty acids calculated into olein are added to the free fatty acids, the sum deducted from 100, and the difference taken as the unsaponifiable matter. The sources of error in the first method are the incomplete extraction of the unsaponifiable matter, the solubility of soap in the solvent, difficulty of removing the solvent completely, and loss of volatile constituents; whilst in the differential method the main source of error lies in the assumption that all the fatty acids in the oil consist of oleic acid. The results obtained by these methods with six typical samples of wool oils and oleines (containing from 35 to 75 per cent. of saponifiable matter) are given in tabular form, and it is shown that except in the case of one sample (where the proportions of unsaponifiable matter were 58·5 and 56·6 per cent. by the respective methods) the average difference between the figures given by the two methods is less than the difference between duplicate determinations by either of the methods. Hence the second method may be regarded as sufficiently accurate for technical purposes, and, owing to its greater rapidity, is to be preferred to the extraction method.—C. A. M.

Wool oils; Liability of —— to gum on oxidation. A. H. Gill and A. E. Shippee. J. Ind. Eng. Chem., 1911, 3, 73—74.

A method of ascertaining the gumming tendency of wool oils when exposed to the air (*e.g.*, upon fibres) has been based upon a determination of the increase in their viscosity after exposure to a current of air in a hot oven. The apparatus used for this purpose was that devised by Richardson and Hanson (this J., 1905, 315) for cylinder oils. Ten c.c. of the wool oils were introduced into the tray (which was made of iron 1/16 inch thick), so that every part of the bottom was covered with a layer of oil about 0·06 cm. in depth, and from 3 to 5 cubic feet of air at 100° C. were drawn over it for four hours. In each experiment the tray was placed in exactly the same position in the oven. The viscosimeter consisted of a tube about 80 cm. in length and 3 mm. in diameter, which was surrounded by an ordinary condenser jacket. The lower end of this tube was drawn out to a capillary of about 0·3 mm. in diameter, and two marks 25 cm. apart (and the lower 25 cm. from the capillary) were made upon it. The tube was filled by suction to about 10 cm. above the upper mark, and water at 25° C. was made to circulate through the condenser jacket. The time in seconds required for the oil to drip from the capillary in falling between the two marks was then measured until duplicate determinations gave results agreeing within two-fifths of a second. The following values were thus obtained in the examination of different kinds of wool oils :—

Oil.	Viscosity in seconds.		Decrease in viscosity.	Iodine value.	Unsaponifiable matter.	Free fatty acids as oleic acid.	Flsh-point.
	before heating.	after heating.					
			per cent.		per cent.	per cent.	°F.
Scotch wool	12·0	16·2	35·0	38	65·5	12·8	306
Wool oil	14·4	15·0	4·2	27	91·0	3·3	340
Oleine, 42 per cent. saponifiable	17·2	24·8	44·2	58	57·5	41·3	325
English oleine, 42 per cent. saponifiable	19·2	26·2	36·4	51	59·3	40·7	335
Wool oleine, 75 per cent. saponifiable	13·4	24·6	83·5	140	31·1	65·2	346
Wool oleine, 35 per cent. saponifiable	14·4	21·6	49·3	46	65·3	32·6	327

These results indicate that the increase in viscosity is not proportional to the amount of saponifiable matter in the oils, but that oils with the higher iodine values show the greater increase in viscosity. Hence, other conditions being equal, the preference should be given to a wool oil with the lowest iodine value. It is suggested that under these conditions only the unsaturated constituents of the oils might have been oxidised, whilst the unsaponifiable matter remained unchanged. If so, increasing the temperature or prolonging the oxidation might produce a greater increase in the viscosity, but it would then be necessary to employ a different method of measuring the viscosity.—C. A. M.

Curd soap; Composition of the layers obtained in the manufacture of ——. H. Okada. Chem.-Zeit., 1911, **35**, 230.

In manufacturing curd soap upon a large scale, three layers separate from the soap solution, *viz.*, an upper layer of soap of mottled appearance, a middle layer of soap, which on cooling appears homogeneous, and the bottom layer of lye. Analyses of the two top layers thus obtained in the manufacture of soap from tallow, horse fat, arachis oil and cocoanut oil and soda lye gave the following results :—

Soap.	Water.	Total alkali as Na_2O.	Free alkali as Na_2O.	Total fatty acids.	Saponification value of fatty acids.	m. pt. of fatty acids.
	per cent.	per cent.	per cent.	per cent.		° C.
Top layer	28·5	7·8	0·6	62·7	210·0	43—44
Middle layer	72·3	3·4	1·2	19·2	211·7	43—44

From these results it appears that the composition of the fatty acids in both layers is the same, and that the homogeneous nature of the middle layer, as compared with the upper layer, must be attributed to its containing a higher proportion of water and free alkali.—C. A. M.

Drying of linseed oil. Sabin. *See* XIII.

Antiseptic mercury soaps. Schrauth. *See* XIXB.

Errata.

This Journal, Feb. 28, 1911, page 222, col. 1, lines 1, 11 and 13 from top, in each case for "hours" read "days."

Patent.

Seeds or beans; Method and apparatus for disintegrating —— *to facilitate the extraction of oil.* R. Stewart, Croydon, and G. M. Chard, London. Eng. Pat. 12,727, May 25, 1910.

The seeds or beans, particularly soya beans, are broken into small particles in one or more pairs of rolls having serrated surfaces, and rotating at different speeds, the oil cells being ruptured by passing the particles thus obtained through one or more pairs of rolls, also rotating at different speeds, but having smooth surfaces.—J. A.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Resins; Colour reactions of certain —— *with Halphen's reagent for colophony.* E. F. Hicks. J. Ind. Eng. Chem., 1911, **3**, 86—87.

Halphen's reagent, which was used by Foerster (this J., 1909, 151) as a sensitive test for colophony, also gives characteristic colourations with other resins. *Dammar resin* slowly gives a brown to lilac-brown colour, which gradually changes to reddish-brown (maroon). *Elemi* gives an immediate permanent indigo blue colour, which slowly darkens and sometimes assumes a purplish hue. *Kauri copal* produces an azure-blue tint, changing rapidly through violet to purple. At the point most distant from the bromine vapour the colour is olive green. *Manila gum* (spirit soluble) slowly gives a faint brownish-green, which gradually changes to violet and finally to purple. A chocolate brown colour is usually obtained at the point most remote from the bromine vapour. *Mastic* yields a reddish brown colour, which approaches carmine in the vicinity of the bromine vapour. At the most remote point the colour is coffee-brown. *Sandarac* immediately gives a permanent violet colour, but at the point furthest from the bromine vapour the colour changes to violet and finally to violet-brown. *Shellac*, when pure, gives no colourations *Zanzibar copal* slowly gives a light brown colour, changing to brownish-violet and finally to chocolate-brown with a violet tint. The intensity of the colourations varies with the concentration of the resin solution, and the presence of any considerable amount of water, alcohol, or ether interferes with the sensitiveness of the test. Valuable indications are also obtained in the case of mixtures, but when colophony is present, the reaction is so intense as to mask the other colour reactions. The colourations should be compared with those given by samples of known purity.—C. A. M.

Carbonylferrocyanides. Extraction, analysis, applications. Lecocq. *See* VII.

Patents.

[*Resinous*] *condensation products* [*from phenols and formaldehyde*]; *Manufacture of insoluble* ——. F. Pollak. Fr. Pat. 420,404, Sept. 14, 1910. Under Int. Conv., Sept. 15, 1909, and Feb. 24, 1910.

Condensation products, capable of being used as substitutes for ivory, celluloid, ebonite, etc., are produced by the interaction of phenol and formaldehyde in the presence of small quantities (not exceeding 1·5 per cent. of the final product) of acid. These hard, insoluble, products are, however, not the primary products of the reaction, and it has been found possible to isolate intermediate products, consisting of soluble or partly soluble resins, which are transformed by the action of formaldehyde and heat into insoluble products. Further, there are two classes of soluble intermediate resins produced, those of the first class being transparent, of an oily nature, and not capable of transformation into insoluble resins by heat (cf. Fr. Pat. 361,539 of 1905; this J., 1906, 939), whereas those of the second class are opaque, or nearly so, and are of a more plastic nature, going over into insoluble resins on heating. Several examples of the method of manufacture are given. To prevent reddening of the surface of the products by oxidation, the operations may be conducted in an inert atmosphere. The intermediate product may be mixed with various substances, such as asbestos, graphite, sand, tar, etc., before hardening. 95 per cent. carbolic acid may be used instead of phenol. Acid salts, or substances transformed into acids by the action of heat, may be used instead of free acids.—E. W. L.

Ferro-ferric hydrate; Process for blackening browned ——. J. T. Carrick, Johannesburg (E. S. Hutchinson and R. G. Ralston, exors.). U.S. Pat. 984,075, Feb. 14, 1911.

SEE Eng. Pat. 13,848 of 1909; this J., 1910, 33.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber trees; Explanation of "wound-reflex" in the tapping of ——. E. Fickendey. Z. Chem. Ind. Kolloide, 1911, **8**, 157—158.

THE term "wound-reflex" is used to describe the fact that in tapping rubber trees, comparatively little latex may be obtained from a single cut, but a greater quantity if the cut be re-opened after some days, or a fresh cut made near the first. The phenomenon is most pronounced in the case of *Hevea brasiliensis* trees, less so in Manihot trees, and is not observed at all in the case of *Kickxia elastica* trees. The author gives the results of a few tapping experiments with 15-year old Hevea trees, and 8-year old Kickxia trees, the water-content and "freezing point depression" of the latex being determined. In the case of the Hevea trees, whilst the water-content of the latex increased continuously from the beginning, the "freezing-point depression" fell at first, but later rose again until it exceeded the original value. In the tests with the Kickxia trees, the water content of the latex increased, and the yield of latex and the "freezing point depression" fell after the first tapping, and then remained tolerably constant. It is concluded that the increased flow of latex attributed to wound-reflex is due to osmotic effects, since the comparatively small increase of concentration of osmotically-active dissolved substances in the Hevea latex, corresponding with the increase of "freezing point depression," would mean a considerable increase in the osmotic pressure available for forcing out the latex from the laticiferous cells. The substances which cause this increase of osmotic pressure are not inorganic, for the ash-content of the latex remains approximately constant throughout.—A. S.

Para rubber; The carbohydrate constituents of ——. *Separation of l-methylinositol.* By S. S. Pickles and B. W. Whitfeild. Chem. Soc. Proc., 1911, **27**, 54.

DURING the examination of various specimens of smoked plantation rubber from the Malay Peninsula, the presence of a crystalline, sugar-like substance, melting at 191°—192° C. was detected in all cases. The amount of this constituent present in the different specimens varied considerably, being in some cases as high as 2·5 per cent. Analysis yielded figures indicating the formula, $C_6H_{11}O_5 \cdot OCH_3$. This substance is lævorotatory; a 10 per cent. aqueous solution gave $a = -8°$, whence $[a]_D = -80°$. It does not reduce Fehling's solution, and is scarcely affected by prolonged boiling with moderately concentrated sulphuric or hydrochloric acids. Hydriodic acid decomposes it with the formation of methyl iodide and *l*-inositol (m. pt. 237° C.). The compound is thus *l*-methylinositol, and is identical with that isolated from quebracho bark by Tanret (Compt. rend., 1889, **109**, 908, also this J., 1890, 202), and designated quebrachite. Its presence has also been previously observed in the acqueous portion of the latex of *Hevea brasiliensis* which remains after the coagulation of the rubber, by de Jong (this J., 1906, 326). The authors have also confirmed this observation by the examination of specimens of the latex of *Hevea brasiliensis* from the Botanic Gardens at Singapore, and have found that this substance (*l*-methylinositol) constitutes the greater portion of the carbohydrate constituents of the latex. They also find that the occurrence of *l*-methylinositol (quebrachitol) is quite general in rubbers from *Hevea brasiliensis*, and have isolated it, not only from those of Asiatic origin, but also from "fine hard Para" rubber from South America. S. S. Pickles stated further, that, although probably the *l*-methylinositol in the latex was not directly connected with the formation of rubber, its presence was worthy of note, and there was the possibility that under the influence of enzymes it might be converted into products which could be utilised by the plant for the construction of the rubber hydrocarbon.

Rubber; Action of litharge in the hot vulcanisation of ——. *I.* E. Seidl. Gummi-Zeit., 1911, **25**, 710—713.

THE author first shows that the accelerating action of litharge is not due to its high thermal conductivity, since although litharge and zinc oxide possess equal conductivities, both lower than that of aluminium bronze, yet on vulcanisation of similar mixings, that containing litharge was more highly vulcanised than either of the other two. The combined sulphur was estimated after extraction with acetone for 22 hours. In the mixings containing litharge, the sample was then heated in a pressure flask with xylene for 3 hours. The xylene solution was decanted through a filter and washed in a separating funnel with 20 per cent. hydrochloric acid, hot water, 10 per cent. potash, and again with hot water till the alkaline reaction ceased. The collected aqueous washings were washed with petroleum ether. After washing with water, these were added to the xylene solution, which was then distilled in steam. The residue was taken up with ether, dried and concentrated. The rubber was precipitated by alcohol and dried *in vacuo* till constant in weight. The sulphur was then determined by the Carius' method. A contact experiment with the zinc oxide mixing showed that in this case the result for combined sulphur agreed favourably with that obtained by simple extraction with acetone. It was found that the temperature of the mixing containing litharge was higher than that of the surroundings. The reaction between litharge and sulphur, although exothermic, was found insufficient to explain this. It was shown that lead sulphate was formed. At vulcanising temperatures no perceptible evolution of heat occurred when molten sulphur was poured on to litharge, except when certain organic bodies were present, such as phenol or aniline.—H. E. P.

Rubber; Action of lead oxide in the hot vulcanisation of ——. *II.* E. Seidl. Gummi-Zeit., 1911, **25**, 748—751.

EXPERIMENTS with aniline, sulphur, and litharge showed that at 140° C., considerable heat was evolved, much more than that which was observed in the reaction between aniline and sulphur alone. The reaction between litharge and sulphur will not furnish sufficient heat to account for the difference. It was found that by the action of hydrogen sulphide on litharge, considerable heat was evolved. This led to the conclusion that in the mixture of aniline, sulphur, and litharge the large heat effect is due mainly to the oxidation of the aniline and also to the action of the hydrogen sulphide on the litharge. This last reaction assists the first, accelerating it by removing the hydrogen sulphide. Having shown that rubber, litharge and sulphur give out heat at 140° C., it was found that the resin was behaving in a similar way to the aniline (quoted above). Accordingly mixings were made of (1) washed Para rubber, (2) Para rubber extracted with acetone, (3) Para rubber extracted with acetone, dissolved in petroleum ether and precipitated by alcohol, (4) as (2) with the addition of the oily product of the dry distillation of blood-albumin (which was found to behave similarly to Para resin with litharge and sulphur alone); to each of these mixings litharge and sulphur were added. A fifth mixing was made of ordinary Para, sulphur, and zinc oxide. These samples were wrapped round thermometers and heated to about 140° C., when it was found that in the case of the mixings (3) and (5) very little rise of temperature occurred, while with mixings (2), (4) and (1) the temperature was greater than that of the oil bath, being highest in (1) and lowest in (2). Samples were also vulcanised in the press (30 mins. at 3 atmos.); the combined sulphur was as follows:—(1) 2·425, (4) 2·060, (2) 1·730, and (5) 1·630 per cent. Vulcanisation was thus greatest in the samples which showed the highest temperature-rise. The sample (3), in which pure Para was used, was quite light grey, while the others containing litharge were very dark. Sodium peroxide behaved similarly to litharge. It is concluded that the effect of the addition of litharge is due to the fact that it raises the temperature of the sample, owing to a stimulation of the reaction between sulphur and resin.—H. E. P.

Rubber exports from the Federated Malay States. Board of Trade J., March 9, 1911. [T.R.]

The Federated Malay States "Government Gazette" of 23rd December publishes the following particulars of the exports of cultivated rubber from the Federated Malay States during the twelve months ending December, 1909 and 1910:—

—	Jan.–Dec., 1909.	Jan.–Dec., 1910.
	lb.	lb.
Perak	973,738	2,541,756
Selangor	4,235,478	8,241,388
Negri Sembilan	878,533	1,423,453
Pahang	66	5,929
	6,087,815	12,212,526

Patents.

India-rubber, gutta percha, balata, etc.; Process for the treatment (deresinification) of ——. J. B. Gall, Eltham, Kent. Eng. Pat. 9686, Apr. 21, 1910.

The rubber, etc., in a non-gelatinised condition, is masticated or kneaded, in presence of a solvent, (*e.g.*, alcohol, or acetone), which dissolves resin, but not rubber, etc., until a test portion of the solvent shows no increase of dissolved resins. The solvent is then drained off, as completely as possible, and what remains is distilled off. Alternatively the solvent in the masticator may be continuously renewed until a test portion is found to contain no resin.—E. W. L.

Caoutchouc and other plastic materials; Manufacture of mixtures of ——. H. Dogny and V. Henri. Fr. Pat. 420,321, Nov. 22, 1909.

The method consists in subjecting mixtures of caoutchouc with other plastic materials, such as cellulose—in the form of viscose or paper pulp—gelatin, casein, starch, gums, dextrin, albumin, etc., after such mixtures have been thoroughly dried, to vulcanisation, preferably by means of sulphur chloride. This renders the mixture resistant to the action of water. The vulcanisation is effected by means of a 2 to 3 per cent. solution of sulphur monochloride in petroleum spirit, and is followed by washing in a boiling or hot 5 per cent. solution of sodium carbonate, or other alkaline solution of equivalent strength.—E. W. L.

Rubber; Processes for regenerating vulcanised ——. C. P. Bary, Paris. Eng. Pat. 7153, March 22, 1910.

See Fr. Pat. 415,213 of 1909; this J., 1910, 1322.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Tanning materials; Consumption of —— in the United States. Oil, Paint, and Drug Rep., Feb. 27, 1911. [T.R.]

Tan bark and tanning extracts were consumed in the United States during the calendar year 1909 to the value of $21,904,927, as against $21,361,719 in 1908 and $21,205,547 in 1907. Of these totals the outlay for extracts formed 49·2 per cent. during 1909, 49·4 per cent. in 1908, and 45·5 per cent. in 1907.

The average cost per cord of barks has advanced steadily from $9.52 in 1907 to $9.58 in 1908 and $10.31 in 1909. This increase has been accompanied or followed by a corresponding decrease in the quantity annually consumed during the same period, the total for 1908 being 7·2 per cent. less than that for 1907, and that for 1909, 4·3 per cent. less than that for 1908. The most marked decrease in consumption is shown for hemlock, which was the bark used in greatest quantity in all three years.

The average cost per pound of extracts of all kinds consumed during 1907 was $0.0264, while in 1908 it was $0.0269 and in 1909 $0.0278.

The most marked increase among the leading extracts was in chestnut extract, the reported consumption of which in 1909 exceeded that of 1908 by 24·5 per cent. and that of 1907 by 35·6 per cent. Following are the statistics as to consumption:—

Bark, wood, etc.

[In cords of 2,000 pounds.]

1909.

Kind.	Quantity.	Value.
Hemlock bark	698,365	$6,434,848
Oak bark	324,070	3,533,862
Mangrove bark*	18,925	514,169
Chestnut wood*	18,527	65,152
All other	19,023	577,719
Totals	1,078,910	$11,125,750

1908.

Kind.	Quantity.	Value.
Hemlock bark	810,231	$7,203,206
Oak bark	307,817	3,325,908
All other	9,352	274,323
Totals	1,127,400	$10,803,437

1907.

Kind.	Quantity.	Value.
Hemlock bark	815,840	$7,016,915
Oak bark	374,052	3,933,038
All other	24,509	605,921
Totals	1,214,401	$11,555,874

Tanning extract.

[In pounds.]

1909.

Kind.	Quantity.	Value.
Chestnut	182,818,961	$3,579,929
Quebracho	147,109,443	5,877,989
Oak	38,419,398	737,220
Hemlock	10,862,540	276,436
Gambier*	2,641,001	133,765
Mangrove	1,401,008	43,566
Quermos*	1,084,174	43,757
Sumac*	350,535	16,167
Valonia*	243,536	18,022
All other	1,887,299	52,326
Totals	386,817,895	$10,779,177

1908.

Kind.	Quantity.	Value.
Chestnut	146,818,963	$2,853,045
Quebracho	143,174,614	4,934,475
Oak	21,705,775	460,124
Hemlock	40,808,723	1,043,311
Mangrove	14,520,361	386,144
All other	25,072,651	881,183
Totals	392,101,087	$10,558,282

1907.

Kind.	Quantity.	Value.
Chestnut	134,819,100	$2,560,007
Quebracho	145,324,677	4,995,807
Oak	30,830,291	639,938
Hemlock	40,133,524	968,041
All other	13,791,943	485,880
Totals	$364,899,535	$9,649,673

* Not shown separately prior to 1909.

Ossein; Manufacture of —— by the sulphurous acid process. V. Cambon. Les Matières Grasses, 1911, 4, 2117—2118.

Until quite recently the drawbacks attending the use of sulphurous acid prevented its application in the extraction of ossein from bones. Thus in order to prevent the surface of the bone becoming coated with a layer of tribasic calcium phosphate it was necessary to keep either the liquid or the bones in continual motion. In addition to this, the air of the factory became impregnated with the gas, and the collection of the separated calcium phosphate was very difficult. In the Bergmann process, which has now been adopted in two French and two German factories and is being tried in Belgium and the United States, these difficulties are obviated by causing a solution of sulphur dioxide to circulate through a battery of closed tanks containing the bones, this solution being continually enriched by sulphur dioxide as it is neutralised by the calcium phosphate. When the sulphurous solution has thus traversed four tanks, it is still sufficiently acid to retain in solution the whole of the extracted phosphate. The gas for enriching the solution is derived from a cylinder of liquid sulphur dioxide. The resulting saline liquid is a solution of acid (monobasic) calcium phosphate in calcium bisulphite solution. In order to separate the calcium phosphate in the form of dibasic calcium phosphate and to recover the sulphurous acid, this liquid is heated by means of steam in a leaden autoclave termed the "digester." This liberates from the calcium bisulphite a portion of its sulphur dioxide, which is then conducted back to the acid tanks. At the same time one equivalent of the calcium bisulphite reacts with the monobasic calcium phosphate to form dibasic calcium phosphate, which falls to the bottom of the boiling liquid, and normal calcium sulphite. In order to decompose the latter, an exactly measured quantity of hydrochloric acid is introduced into the digester. The liberated sulphur dioxide is also returned to the acid tanks, whilst the aqueous liquid containing calcium chloride in solution and dibasic calcium phosphate in suspension is now withdrawn, decanted, and filtered, and the separated phosphate drained on a porous surface and dried. It is very white and extremely pure, and is completely soluble in ammonium citrate solution, which is not the case with the phosphates separated by the usual methods. In a well-managed factory the loss of sulphur dioxide ought not to exceed 5 per cent. by weight of the bone. The ossein thus freed from phosphate is white and of better quality than that obtained by any other method. The usual treatment of the bones with hydrochloric acid tends to make the ossein yellow, and renders it very difficult to prepare from it colourless gelatins.—C. A. M.

Patents.

Glue, gelatin and ossein; Process for refining ——. L. and J. Lefranc. Fr. Pat. 420,726, Dec. 1, 1909.

The impure, coloured solution is first of all subjected to the action of oxygen liberated in the solution itself from hydrogen peroxide, either by catalysis, or by the action of certain oxides,—such as lead peroxide, manganese dioxide, etc.,—or by that of certain salts such as potassium manganate and permanganate. The solution may be either acid or alkaline. About 50 grms. of oxygen are necessary for 100 kilos. of dry material. The solution is next treated with sulphurous acid in presence of 1 to 2 per cent. of zinc powder, one half of the latter being added before sulphiting, the other afterwards. Finally, the solution is clarified by the addition of approximately 1 per cent. hydrofluoric acid, the free acid exactly neutralised with an oxide or carbonate of an alkaline earth, which is capable of forming insoluble compounds with both of the acids present (*e.g.* barium carbonate with or without calcium carbonate), the insoluble matter filtered off, and, in the now pale-coloured filtrate, any traces of metallic base or carbonate present removed by the addition of phosphoric acid.—E. W. L.

Plastic masses; Manufacture of —— from carbohydrates and alkali albuminates. J. G. Jurgens and H. Timpe. Fr. Pat. 420,164, Sept. 8, 1910.

The products described consist of albuminate esters of carbohydrates and are suitable for employment as substitutes for ebonite, horn, ivory, etc. The alkali albuminates, formed by the action of dilute alkalis upon albumins, are precipitated from solution by means of dilute acids, from which they are subsequently freed as completely as possible by washing. Three parts by weight of albuminate are then mixed with one part of carbohydrate, prepared by treating cellulose hydrate or starch with very weak caustic alkali, so as to obtain a stiff product. The mixture is rendered alkaline with a very small quantity of alkali, in order to induce solution and facilitate the reaction, and is then vigorously worked and kneaded; under this treatment it first liquefies but afterwards progressively hardens. When a compact block is obtained it is allowed to dry and is then compressed into sheet, blocks, etc. If an excess of albuminate has been used this must be rendered insoluble by the action of formaldehyde.—E. W. L.

Horn; Preparation of a material similar to ——. A. Bartels. Fr. Pat. 420,543, Sept. 19, 1910.

100 kilos. of dry ground casein are mixed with 25 kilos. of water, and the mixture is thoroughly kneaded until perfectly homogeneous, when it is moulded to the desired shape and heated under a high pressure. The product is hardened by means of formaldehyde and dried. The pressure required may be as high as 300 atmospheres or more. Various substances may be added to the casein, *e.g.* gluten, starch, various albuminoids; inorganic materials such as barytes, kaolin, etc.; or, in order to obtain a softer product, acids (lactic) or alkalis (ammonia), or glycerin. In order to harden the mass metallic salts may be added.—E. W. L.

Glue; Processes of manufacturing a vegetable ——. F. Lehmann, Berlin. Eng. Pat. 26,231, Nov. 12, 1909.

See Fr. Pat. 408,240 of 1909; this J., 1910, 580.—T. F. B.

XVI.—SOILS; FERTILISERS.

Hydrolysable salts and some colloids; Action on higher plants [barley and beetroot] of some ——. A. Grégoire. Bull. Soc. Chim. Belg., 1911, 25, 85—103.

In continuation of work previously described (this J., 1910, 642), experiments have been made on the growth of barley and beetroot in culture solutions, to which were added hydrated silica, aluminium hydroxide, straw gum ["gomme de paille"], calcium laurate, calcium palmitate, calcium humate, calcium carbonate, analcime, or heulandite. The results with barley were very similar to those previously obtained with rye, hydrated silica, analcime, heulandite, and perhaps alumina, exerting a favourable influence, whilst the effect of calcium humate or calcium carbonate was very harmful. With beetroot, on the other hand, calcium humate, alumina, and, in a less degree, calcium carbonate gave favourable results, and silica and unstable silicates were harmful. Straw gum, calcium laurate, and calcium palmitate had a deleterious effect on both plants. Cereals, of which the ash is acid, would appear to behave very differently from beetroot, which yields an alkaline ash, the former only developing normally in solutions containing colloidal silicic acid and being extremely sensitive to the presence of certain organic substances, especially humic acid; and the latter requiring the presence of humic acid and suffering considerably in that of silicic acid. The assimilation of silicic acid by the barley plants was not in proportion to the stimulating effects of the various solutions, and the hypothesis previously advanced is regarded as confirmed, that certain hydrolysable salts, which cannot be regarded as nutritive elements, exert a special action on development. The results of the investigation explain the harmful effect of farmyard manure, often noticed, when applied to cereals in springtime, calcium humate being formed under these conditions, and this would also account for the excellent results obtained with farmyard manure on the sugar beet, and by adding humic substances to the soil. The favourable action of ammonium sulphate, as compared with sodium nitrate, on cereals is considered due to the effect produced by the former salt on the silicic acid in the soil.—F. Sodn.

Essential oils; Comparative toxicity of —— to the higher plants. H. Coupin. Comptes rend., 1911, **152**, 529—531.

Experiments were made with wheat seedlings about 2 cm. high, which were exposed to the vapours of volatile oils in a moist atmosphere under a shade. In the control experiments after 10 days the plants had grown to 20 cm. The essential oils tested are divided into 5 classes: (1) Those which immediately kill the plants—aniseed, star-anise, cajuput oil; (2) those which kill the plant after some growth has taken place—thyme, serpolet (wild thyme) sassafras, lavender, wormwood, bergamot, aspic, neroli, etc.; (3) those which retard growth and attack the plants—lemon, cinnamon, sweet fennel, ylang-ylang, violet, wintergreen, peppermint, angelica, mandarin, bitter orange, etc.; (4) those which only retard growth—citronella, bitter fennel, cumin, origanum, santal, iris; (5) those without effect—clove, patchouli, vetiver. The majority of the essential oils have therefore an adverse effect. —E. F. A.

Germination; Influence of acidity on ——. G. Promsy. Comptes rend., 1911, **152**, 450—452.

The author has investigated the influence of various acids on the germination of seeds; in some cases, the seeds were steeped in the dilute (*e.g.*, 0·1 per cent.) solution of the acid for 24 or 48 hours and then grown in sand, whilst in other cases, the sand itself was watered with the acid solution. Organic acids (citric, malic, and oxalic acids) were found to increase the quotient and intensity of respiration of most of the seeds investigated, rice being an exception; mineral acids (sulphuric and hydrochloric acids) do not modify the respiration quotient. The weight of the young plants also, both in the fresh and in the dried states, is increased by organic acids (citric, tartaric, malic, acetic and oxalic acids); with mineral acids, the weight of the fresh plant is increased but that of the dried plant remains the same. The influence of organic acids on germination varies with different seeds (being sometimes, but not often, nil), and for each kind of seed it varies with the kind of organic acid used.—L. E.

Nitrification by ultra-violet rays. D. Berthelot and H. Gaudechon. Comptes rend., 1911, **152**, 522—524.

Solutions were exposed, at a temperature of 35°—50° C., for from 3 to 9 hours at a distance of 3—6 cm. from a lamp of 110 volts. Under these conditions the ultra-violet rays oxidised solutions of ammonia in presence of pure oxygen or of air to nitrites. Nitrates were in no case formed. Ammonium salts were also oxidised to nitrites, the reaction being slower in the cases of the sulphate and chloride than in that of the carbonate. Urea was also converted first into ammonia and then into nitrite. Other organic nitrogen compounds, *e.g.*, ethyl- and methylamine, guanidine, hydroxylamine, acetamide, acetonitrile, etc., behaved similarly. Stress is laid on the close analogy between the effects of the rays and of enzymes. The rays are further able to convert nitrates into nitrites, and they decompose concentrated solutions of ammonium nitrite with liberation of nitrogen.—E. F. A.

Patents.

Superphosphate chambers; Apparatus for emptying ——. C. T. Thorssell and N. K. E. Malmsten, Malmo, Sweden. Eng. Pat. 24,249, Oct. 19, 1910.

The chamber is constructed with a movable end. By means of four horizontal screws and suitable gearing, this end can be moved through the length of the chamber, pushing the superphosphate before it. By reversing the gearing, the end of the chamber is brought back to its original position.—G. W. McD.

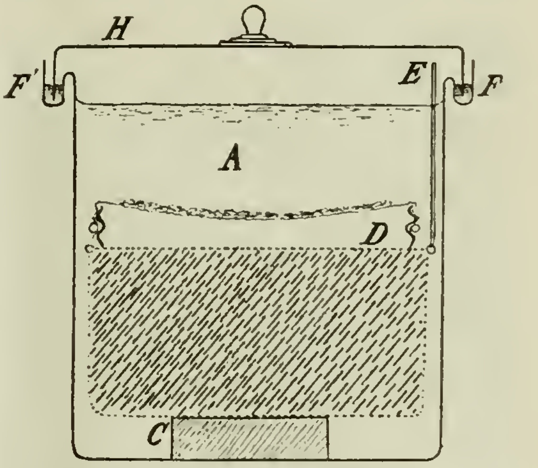
Phosphatic fertilisers; Electrochemical production of ——. G. Levi, Rome. U.S. Pat. 984,769, Feb. 21, 1911.

See Eng. Pat. 18,433 of 1909; this J., 1910, 441.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Dehydration of [beetroot and other] substances by means of ether. V. Stanek. Z. Zuckerind. Böhm., 1911, **35**, 311—315.

For the dehydration of beetroot and other substances, with which desiccation by heat or in presence of air is not permissible, the author states that he has used ether with excellent results. The apparatus employed, is in principle a desiccator in which ether instead of air is the dehydrating medium. In the figure, A, is a glass vessel, 2 to 3 litres in capacity, C is a support on which rests a cage filled with sticks of sodium hydroxide; and D is a sieve forming the top of the cage, to which is soldered the wire, E, serving as a handle. The substance to be dried is spread on filter paper and placed on a wire sieve, or preferably it is spread on silk gauze stretched over a piece of metal cylinder 15 to 20 mm. high. Before use, the vessel is filled with ether to about 3 cm. from the top, and closed by the cover, H, which is provided with the mercury seal, FF′. By means of this apparatus it was found possible to dry 52 grms. of beet pulp, containing 22 per cent. of dry substance, to 95 per cent. of dry substance in 24 to 36 hours. It is important that the substance should be placed in a sufficiently loose condition, and for this reason pulps should be pressed through a coarse sieve; whilst substances containing a very large amount of water should previously either be pressed or mixed with an absorbent material such as kieselguhr.—J. P. O.



Juice-heater; Scaling of the —— in using the defecation-sulphitation process. J. J. Hazewinkel. Archief Suikerind. Neder.-Ind. (Java), 1911, **19**, aflev. 3, 70—72.

When combining sulphitation with the ordinary defecation process used in cane sugar factories, scaling of the juice-heater takes place, causing much trouble. At one time this was considered to be caused by carrying the sulphitation too far, so that calcium bisulphite was formed, and calcium sulphite deposited on the tubes of the apparatus on reheating. According to the author this hypothesis is no longer tenable, for he has noticed that limed, sulphited juice, although it may have a distinctly alkaline reaction, gives a precipitate on being heated to boiling point. The reactions taking place during the process may therefore be represented as follows: (1) In liming: potassium salt + lime = calcium salt + 2KOH. (2) In sulphitation: calcium salt + 2KOH + SO_2 = residual calcium salt + $K_2SO_3+H_2O+CaSO_3$. (3) On reheating: calcium salt + K_2SO_3 = $CaSO_3$ + potassium salt. In order to examine the influence of the metal composing the tubes of the juice-heater, comparative experiments were made with brass and iron. It was found that, although there was a distinct scaling in both tubes, with the former the deposit was very loose, whereas in the case of the latter it could be detached only with difficulty. Brass, therefore, presents an advantage over iron, so far as the cleaning of the juice-heater is concerned. In regard to means of preventing the precipitation of the calcium sulphite before the juice is passed into the heater, it is pointed out that injection of steam, although from the chemical point of view it may appear effective, is not practical, on account of the large dilution of the juice thereby caused. It is, however, suggested that the determination of the minimum temperature at which complete precipitation takes place in a crystalline form may afford a means of separating the calcium sulphite outside the juice-heater. Knowing this temperature the separation might be effected by adding a certain proportion of well heated juice to unheated juice, and allowing precipitation to take place, previous to passing the whole through the heater. In Java, the author has found that the scaling in question contains 67—70 per cent. of calcium sulphite, and 9·4 to 11 per cent. of calcium sulphate.—J. P. O.

Clarification; Experiments on —— [*of cane juices, using the carbonatation process*]. W. E. Cross. Modern Sugar Planter, 1911, 41, 2—6.

Although hitherto it has been found impossible to apply the carbonatation process of clarification to Louisiana cane juices, owing to their high content of reducing sugar, the author has now elaborated a modification of this process, which is stated to have given very satisfactory results on the small scale. It was found that if the cane juice be limed at temperatures below 45° C., little decomposition of reducing sugar takes place, the liquors have a good colour, and no dark-coloured products are formed (*cf.* Cross, this J., 1911, 299). At this temperature, however, clarification is not complete; and in order to effect the maximum purification the author was led to try the double carbonatation method, as practised in the beet industry. It was then found that, whereas ordinary single carbonatation gave an increase of purity of 2·4, with double carbonatation it was 4·8 with 1 per cent. of lime, and 6·2 with 2 per cent. of lime. In order to reduce these large quantities of lime, aeration was used; and with this system of double carbonatation, combined with aeration, the most satisfactory results, from the point of view of sufficient clarification as well as from that of economy of fuel, were obtained. In a factory trial the procedure followed in the first carbonatation was to heat the raw juice to 40° C., temper with 0·6 per cent. of lime, aerate for 5 minutes, and saturate to 1·5 c.c. of alkalinity; whilst for the second carbonatation the juice was filtered, reheated to 40° C., retempered with 0·06 per cent. of lime, and finally saturated to neutrality. In this way an increase in the quotient of purity of 4·8, and a decrease in the glucose ratio of 2·8, was effected. The massecuite was pleasant in flavour, and the sugar a good light-coloured product. No difficulty in evaporating the syrup to massecuite was experienced; and the new method was found to be more easily operated, and to give a brighter syrup and a better massecuite, than the sulphitation process in vogue at present in Louisiana. As possible disadvantages, the extra cost of lime and carbon dioxide is admitted; but the opinion is expressed that this expense would be small in comparison with the greater profit resulting from the production of a better grade product. To decide this point a long series of sugar house trials will be made during the next grinding season.—J. P. O.

Dry substance [*of sugar factory products*]; *Determination of the* ——. K. Urban. Z. Zuckerind. Böhm, 1911, 35, 318—340.

Koydl, having observed that when sand is used in the determination of the dry substance of syrups, high results are obtained owing to the inversion of sucrose, has advocated the use of sugar crystals as the means of increasing the evaporating surface (Centr. Zuckerind. 1908, 181). Freist (Centr. Zuckerind., 1909, 884), on the contrary, maintains that whether sand or sugar crystals be used the results are the same. On repeating Koydl's experiments, the author was unable to obtain concordant results by either method, sand sometimes giving a higher, and sometimes a lower figure, than sugar crystals. In explanation of these uncertain results, it is suggested that when sugar is used a certain amount of the crystal is dissolved in the syrup, thus decreasing the evaporating surface, and giving a larger amount of syrup. In the case of the sand, it is shown by means of experiments with pure sucrose solutions that inversion does occur, even when the sand has previously been treated with hydrochloric acid, and that the amount of inversion is more with coarse than with fine grain sand. Powdered glass, however, shows these irregularities to a less degree; and it was found possible to obtain reliable results with finely pulverised limestone in the proportion of 10 : 1·5 of dry substance. Trustworthy results are also obtainable by the use of sand which has previously been boiled successively with sodium hydroxide solution and hydrochloric acid, then well washed with water and ignited. As means of hastening the desiccation, the use of methyl alcohol, and a preliminary drying for 3 hours at 60°—75° C., with stirring from time to time, before raising the temperature to 100° C., give the best results. Increasing the amount of sand has not much influence in this respect, the most suitable proportion being 10 of sand : 1 of dry substance in the syrup under examination.—J. P. O.

Sugars [*sucrose and lactose*]; *Adsorption of* —— *in aqueous solution*. G. Wiegner and F. Burmeister. Z. Chem. Ind. Kolloide, 1911, 8, 126—133.

100 c.c. of solutions of sucrose and lactose, of different concentrations, were shaken for three hours, at 20·5° C., with about 5 grms. of purified blood charcoal; two different specimens of charcoal were used. The results (see following table) can be expressed by the usual adsorption formula: $\frac{x}{m} = \beta c^{\frac{1}{p}}$, where c is the concentration of the solution, $\frac{x}{m}$ the quantity of sugar adsorbed per grm. of charcoal, and β and p are constants:—

Lactose.				Sucrose.			
Charcoal, I.		Charcoal, II.		Charcoal, I.		Charcoal, II.	
c, in millimols per c.c.	$\frac{x}{m}$	c, in millimols per c.c.	$\frac{x}{m}$	c, in millimols per c.c.	$\frac{x}{m}$	c, in millimols per c.c.	$\frac{x}{m}$
0·1588	1·050	0·2641	1·118	0·3835	1·098	0·3856	1·065
0·0621	0·928	0·1675	1·084	0·1747	1·054	0·1784	1·049
0·0145	0·772	0·0664	1·020	0·0669	0·944	0·0723	0·972
0·0024	0·502	0·0182	0·893	0·0194	0·803	0·0194	0·852
0·0003	0·276	0·0005	0·641	0·0029	0·600	0·0013	0·716

Lactose is also adsorbed from milk by charcoal, but to a considerably smaller extent than from aqueous solution.
—A. S.

Raffinose; Isolation of —— from beet sugar products. H. E. Zitkowski. Amer. Sugar Ind. and Beet Sugar Gaz., 1911, **13**, 8—10.

For isolating raffinose from the molasses of a Colorado beet factory, good results were obtained by a method, based on the precipitation of lead sucrate by boiling with litharge. Thirty pounds of the molasses were diluted to 50° Brix, 3 lb. of litharge added while boiling, and the liquid filtered. Sufficient of the filtrate was mixed with another 3 lb. of litharge to form a thin paste, and this was stirred in the cold until the formation of lead sucrate commenced, and the mass became stiff. After 24 hours the remainder of the filtrate was boiled, and the lead sucrate meanwhile added in small portions at a time. Boiling was continued for 30 minutes, and the mixture filtered. The lead compound thus separated was washed, decomposed by carbon dioxide, and the liquid filtered and evaporated to a thin syrup. After treating this syrup with blood charcoal and filtering, it was further evaporated, and set aside until crystallisation was complete. The crystals were washed with alcohol of increasing concentration, redissolved in water, reprecipitated with alcohol, filtered, washed first with weak then with strong alcohol, and finally air-dried. In this way it is stated an extraction of 50 per cent. of the raffinose assumed to be present in the molasses was obtained.—J. P. O.

Manninotriose and its derivatives; Enzymes which decompose ——. H. Bierry. Comptes rend., 1911, **152**, 465—468.

Tanret has found that stachyose (this J., 1903, 888) may be hydrolysed in two stages (*loc. cit.*, 1902, 1033); in the first stage (which may be effected by yeast-invertase, or by dilute acetic acid), manninotriose, $C_{18}H_{32}O_{16}$, and lævulose are formed, and in the second stage (effected by hot, dilute sulphuric acid), the manninotriose is converted into two molecules of galactose and one of dextrose. The author has now investigated the action of the gastro-intestinal juice of *Helix* on manninotriose and finds that whilst the end-products of hydrolysis consist of galactose and dextrose, a biose (glucose-galactose) appears to be formed as an intermediate product. Further experiments show that this biose which has not yet been obtained in a crystalline state, is not lactose. Manninotriosazone and manninotriose-urea are both hydrolysed by the juice of *Helix*; in both cases, galactose is formed, a fact which bears out Tanret's observation that the free aldehyde group of manninotriose is localised in the glucose residue (*ibid.*).—L. E.

Errata.

This Journal, Feb. 15, 1911, page 145, col. 2, 17th line from the top, the formula should read:

$$f = 100 - \frac{100m}{100-b}$$

20th line from the bottom, the formula should read:

$$\frac{100 \text{ Polarisation of bagasse}}{(100-l) \text{ Purity of residual juice}}$$

18th and 19th lines from bottom, Omit, "W=the weight of bagasse plus solution, from 100 grms. of bagasse, and."

Patents.

Sugar; Manufacture of ——. H. A. J. Manoury, Paris. U.S. Pat. 984,578, Feb. 21, 1911.

See Fr. Pat. 416,726 of 1910; this J., 1910, 1402.—T. F. B.

Starch soluble in cold water; Process of manufacturing ——. J. Kantorowicz, Breslau, Germany. U.S. Pat. 984,483, Feb. 14, 1911.

See Fr. Pat. 365,834 of 1906; this J., 1906, 998.—T. F. B.

Adhesive substances from flaked starch-containing matters; Manufacture of ——. J. Kantorowicz, Breslau, Germany. Eng. Pat. 3415, Feb. 11, 1910. Under Int. Conv., May 21, 1909.

See Ger. Pat. 227,430 of 1909; this J., 1910, 1468.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Yeast-fermentation without sugar. I. C. Neuberg and A. Hildesheimer. Biochem. Zeits., 1911, **31**, 170—176.

Pyruvic acid in the form of soluble salts, but not in the free state, is fermented by yeast with production of carbon dioxide. The authors give the results of tests carried out in Schrötter fermentation-tubes, holding in the long limb 10—11 c.c. The salts of pyruvic acid tested were those of ammonium, sodium, potassium and calcium, in solutions containing 3—5 per cent. The quantity of yeast employed was 1—2 grms. for 15 c.c. of solution, and the temperature of fermentation was about 36° C. During the first 8—10 hours very little gas was evolved, but after this "period of incubation" the fermentation became more vigorous and by the end of 24 hours the volume of carbon dioxide given off amounted to 7—11 c.c. With the exception of carbon dioxide, the products of fermentation have not yet been identified, but no trace of ethyl alcohol has been detected. Three yeasts were employed, one a commercial product and the others culture-yeasts (bottom-yeast K and top-yeast A) from the Institut für Gärungsgewerbe in Berlin; in all three cases the results were similar. The authors have also carried out qualitative tests on *d*-tartaric acid, fermentation lactic acid, (*d*+*l*) alanine, (*d*+*l*) isoserine, (*d*+*l*) serine, (*d*+*l*) glyceric acid and *l*-cystine, from which it appears probable that, under certain conditions, several of these may undergo fermentation by yeast in the absence of sugar. Towards cystine and the potassium salt of glyceric acid, the three kinds of yeast employed exhibited marked differences in fermenting power, which may prove to be of value in distinguishing different kinds of yeast.—J. H. L.

Enzymes; Chemical composition and formation of ——. III. H. Euler and S. Kullberg. Z. physiol. Chem., 1911, **71**, 14—30. (See this J., 1910, 1403; 1911, 230.)

Earlier experiments on the influence of monosodium phosphate on the invertase-activity of yeast have yielded conflicting results (this J., 1911, 230). It is now found that if yeast is treated (1) with water, (2) with a dilute (0·67—1·0 per cent.) solution of monopotassium phosphate or of the same salt rendered neutral to litmus, (3) or with a dilute solution of monosodium phosphate, and the yeast is then pressed and dried *in vacuo*, there is no great difference between the invertase-activities of the products. With more concentrated (10 per cent.) solutions of monophosphate, the invertase-activity of the pressed and dried product is considerably weakened, and to an increasing extent with the duration of the phosphate-treatment. It is found that treatment with a dilute solution of monopotassium phosphate increases the fermenting power of fresh yeast, but decreases the fermenting power if the treated yeast is dried *in vacuo*; if neutralised monopotassium phosphate is used, the fresh and the dried yeasts do not present this difference. It is clear, from these and other results, that the properties of permanent preparations of yeast and of the corresponding fresh yeast, are not invariably affected in the same way. It is found that the hydrolysis of sucrose by living yeast is a unimolecular reaction, and that the velocity constants for 8 and 16 per cent. solutions of sucrose stand in the ratio of 2·55 : 1. The effect of the concentration of the sucrose on the velocity is usually attributed to combination of the sucrose with the enzyme to form the true active molecule; and as the ratio of 2·55 : 1 found by the authors, agrees well with that (2·6 : 1) found by interpolation from the results of Hudson's experiments with a preparation of invertase, it would appear that the invertase of living yeast is bound to the same extent as the isolated enzyme, by sucrose. The velocity constants of fermentation of 8 and 16 per cent. solutions of sucrose by living yeast stand in a ratio of about 2 : 1, so that with increasing concentration of sucrose between these limits, the rate of fermentation by living yeast falls more slowly than the rate of hydrolysis. The velocity constants for the hydrolysis of sucrose by living yeast at 20° and 30·6° C. stand in the ratio of 2·04 : 1, the temperature-coefficient for the invertase of living yeast being very nearly the same as that for invertase preparations. The invertase-action of the yeast cells is not weakened by chloroform or only to a slight degree; hence, although according to previous experiments (*loc. cit.*), the zymase, or at least the bulk of it, is combined with the protoplasm, the bulk of the invertase appears to be independent of the protoplasm. It is found that in the action of 0·25 grm. of Stockholm brewery yeast on 25 c.c. of an 8 per cent. solution of sucrose, the velocity constants of hydrolysis and fermentation stand in the ratio of 170 : 1; with a 16 per cent. solution of sucrose, the ratio is 90 : 1. The ratio is found to be nearly independent of the nature of the previous treatment of the yeast, but it differs widely with different races of yeast. If yeast is suspended in sucrose solution, and subsequently removed by filtration, the rotatory power of the filtrate does not suffer any appreciable further decrease, *i.e.*, the invertase does not pass from the yeast into the solution. Comparison of the hydrolytic activity of a very active preparation of invertase (this J., 1910, 1324) with that of yeast, shows that only a fraction of the former consists of the active enzyme itself.—L. E.

Ultra-violet light; Action of —— on enzymes. H. Agulhon. Comptes rend., 1911, **152**, 398—401.

PREPARATIONS of diastase and other enzymes in quartz tubes were exposed to ultra-violet light, the source being a quartz mercury lamp using 2—3 ampères at 110 volts. The tubes were about 15 mm. diameter and 1 mm. thick, and were placed 15—20 cm. from the source. Tubes of glass of these dimensions were not penetrated by light of a wavelength less than 3022 Angström units. Tubes of glass and quartz containing preparations of the same materials were exposed to the light from a half to six hours, and the relative activity of the contents examined. The activities of sucrase, amylase, emulsin, pepsin, rennet, and catalase were all reduced by the light which could permeate quartz but not glass. Laccase and tyrosinase are attacked when their solutions in glycerol are diluted with water. Peroxydase of malt is rapidly attacked under the same conditions.—F. SHDN.

Bulgarian ferment. J. Effront. Comptes rend., 1911, **152**, 463—465.

IT has been observed by Bertrand (Comptes rend., 1910, **151**, 1161) that the chemical action of the bacterium isolated by the author from the "lactobacilline" used medicinally (*loc. cit.*, 1007) differs from that of the Bulgarian ferment studied by himself (this J., 1909, 668). The author confirms this observation. He also finds that whereas Bertrand's Bulgarian ferment produces a high total acidity and a relatively low volatile acidity in milk, and decomposes the casein very incompletely, lactobacilline (in the form of powder, paste, and bouillon) and other medicinal Bulgarian ferments, produce a high proportion of volatile acids in milk, and a very extensive decomposition of the casein. An investigation of the medicinal products shows that they do not contain Bertrand's ferment; they all contain the proteolytic ferment (enzyme) and most of them behave like pure cultures. The difference observed between the action of Bertrand's ferment and that of the medicinal ferments is not due to different ferments (enzymes), but rather to a biochemical variation occasioned by the conditions of culture. The Bulgarian ferment retains all its properties when cultivated in normal milk, but it is considerably modified according to the degree of aeration and alkalinity of the liquid. Seeded in a medium containing peptone, calcium carbonate, and dextrose, Bertrand's ferment behaves like a lactic ferment until all the sugar has disappeared; if the culture is then left for a fortnight, a film forms on the surface of the liquid, the bacteria composing the film sporulate, and, at this stage, the culture produces an action absolutely identical with that produced by the lactobacilline. These observations are especially interesting in respect of the therapeutic application of the Bulgarian ferment. In the clinical experiments which have been made, not with Bertrand's cultures, but with the medicinal preparations referred to above, the effects observed are not attributable to lactic acid (which, according to the conditions, is formed only in small quantity or practically not at all), but rather to the proteolytic action which is always constant.—L. E.

Bacillus lactis aërogenes; Action of —— on glucose and mannitol. II. Investigation of the 2 : 3-*butanediol and the acetylmethylcarbinol formed; the effect of free oxygen on their production; the action of B. lactis aërogenes on fructose.* G. S. Walpole. Roy. Soc. Proc., 1911, **83B**, 272—286.

IT has already been shown (see Harden and Walpole, this J., 1906, 490) that when *B. lactis aërogenes* is grown anaërobically in a medium containing 1 per cent. of Witte peptone and 2 per cent. of dextrose in the presence of chalk, part of the dextrose is converted into a neutral liquid product—"crude butylene glycol." This is now shown to consist, to the extent of over 90 per cent., of an optically inactive 2 : 3-butanediol, which boils at 180°—181° C., exists as a hard white mass at ordinary temperatures, and forms a diphenylurethane melting at 199·5° C. There is probably present also, a second inactive 2 : 3-butanediol which gives a diphenylurethane melting at 157° C. By increasing the amount of dextrose in the medium to 5 per cent., as much as 8 grms. of the crude glycol may be obtained from 50 grms. of the sugar. If the fermentation is carried out under aerobic conditions, oxygen being bubbled through the medium, the yield of butanediol is diminished and that of acetylmethylcarbinol increased. The latter substance is also formed in considerable amount when the bacillus is grown in a medium containing Witte peptone and butanediol in presence of oxygen. Fructose is decomposed by the bacillus in a similar manner to dextrose.—J. H. L.

Wines and fermented liquors; Rapid determination of the volatile acidity of ——. P. Malvezin. Bull. Assoc. Chim. Sucr., 1911, **28**, 560—561.

THE author has obtained correct results by the following procedure:—22 c.c. of the sample are distilled from a conical flask of 115 c.c. capacity, until 20 c.c. of distillate have been obtained. Caramelisation of the residue is prevented by fixing the distilling flask some distance above the wire gauze, so that it is heated only by hot air. The distillate is titrated with $N/10$ alkali in presence of phenolphthaleïn. The number of c.c. of alkali required by 10 c.c. of the distillate, multiplied by 0·61, gives the volatile acidity of the wine in grms. per litre.—J. H. L.

Determination of tartaric acid. Heczko. *See* VII.

PATENTS.

Yeast; Zymogenic apparatus for sterilising suitable culture media and multiplication of pure wine ——. L. J. Roos. Fr. Pat. 420,706, Sept. 8, 1910.

THE apparatus includes a boiler, a heater containing a hollow prism-shaped vessel with a corrugated surface, a supplementary vessel, a regenerator, a culture vessel and an air-pump. The interior of the hollow prism is in communication with the boiler and with a cock leading to the external air. All parts of the apparatus that come into contact with the culture liquid are made of tinned copper. The apparatus is first sterilised by a current of steam from the boiler. The culture liquid is then introduced into the heater where it is heated to the temperature requisite for sterilisation: is subsequently passed through the supplementary vessel (the function of which is merely to prolong the action of the high temperature) to the regenerator, where it serves to heat a further portion of liquid, and thence to the culture vessel where it is inoculated with the yeast. The multiplication of the yeast is accelerated by aeration as required; to effect aeration, the air is withdrawn from the upper part of the culture vessel by the pump, and is replaced by filtered air introduced through the culture liquid.—L. E.

Distillation; Apparatus for ——. E. Gazagne. Fr. Pat. 420,666, Sept. 22, 1910.

THE apparatus includes a vessel containing a number of tubes, the interior surfaces of which are provided with a detachable metallic network; these tubes contain pieces of some inert substance. The alcoholic vapours are introduced from the distilling column into the bottom of the aforesaid vessel, and, ascending through the tubes, are subjected to a very thorough fractionation therein. The liquid used to cool the tubes is introduced at the lower part of the fractionating vessel, and passes from the top of this vessel to a cistern above, the function of which is to allow the free expansion of the liquid; from the cistern, the liquid descends through a cooling vessel, and thence back to the fractionating vessel; owing to difference in density, caused by variations of temperature, this liquid is maintained in circulation. To cool this liquid in the cooling vessel, the must destined for distillation may be used, an economy of heat being thus effected. A regulator is used to control the supply of must, through the cooling vessel, to the distilling column. This regulator comprises a vapour-chamber communicating with the distilling column; the vapour-chamber envelopes an air-chamber communicating with a cistern of mercury; the latter communicates with a vessel containing a float and the float controls a valved inlet through which the must passes to the bottom of the cooling vessel. By means of a valve, any quantity of air may be introduced into, or withdrawn from the air-chamber without interrupting the work of the apparatus.—L. E.

Beer; Process for preparing ——. H. Holzer, Frankfort on Maine, Germany. U.S. Pat. 983,998, Feb. 14, 1911.

See Eng. Pat. 7829 of 1910; this J., 1910, 1174.—T. F. B.

XIXa.—FOODS.

Flour; Determination of the water-absorbing power of ——. A. A. Besson. Chem.-Zeit., 1911, 35, 245—246.

As the result of many experiments with varying quantities of flour and methods of adding the water, the author recommends the following procedure for determining the quantity of water which a specimen of flour will absorb. The results obtained enable one flour to be compared with another for the purpose of bread-making, but do not show the amount of water which it is necessary to add to the flour in order to make bread, as, in actual practice, more water is added and the dough produced is much more "sticky." A weighed quantity of 150 grms. of the flour are mixed with 75 c.c. of water; one-half of the flour is, first of all, mixed with the whole of the water in a porcelain basin by means of a glass rod. The rod is then cleaned with the fingers and the remainder of the flour is kneaded into the paste by hand. More water is added, if necessary, until a dough is obtained which can just be cleaned from the hand. This dough is weighed in order to obtain the quantity of added water, then cut in two parts with a spatula, and kneaded again. Care must be taken that the dough is kneaded thoroughly in order that the inner portions are not more moist than the outer. With practice, it is possible to determine the absorption power of a flour within 1 unit per cent. The quantity of moisture in the sample affects the results obtained in proportion to its amount, and, for the sake of precision, the results obtained ought to be expressed in terms of the dry flour. From a practical point of view, this is not required, as a baker simply desires to know the properties of one flour as compared with those of another irrespective of the amount of moisture in the same.—W. P. S.

Canned foods; Determination of tin in ——. H. Schreiber and W. C. Taber. U.S. Dept. of Agric., Bureau of Chem., Circular No. 67, 1911, 1—9.

The following alkali-fusion method is recommended as being preferable to the method described by Buchanan and Schryver (this J., 1909, 322), as it is simple in manipulation and permits a large quantity of the sample to be used for the determination. The sample of meat, etc., in which tin is to be determined is passed through a mincing machine and 100 grms. of the mass are mixed in an iron crucible with 10 grms. of magnesium oxide. After the addition of 50 c.c. of a solution containing 150 grms. of sodium hydroxide and 100 grms. of sodium carbonate per litre, and about 75 c.c. of alcohol, the mixture is evaporated on a water-bath. The crucible is now placed on a hot-plate until its contents are thoroughly dry, the final ignition being carried out in a muffle-furnace. When all the carbon has been destroyed, the contents of the crucible are cooled, taken up with water, and transferred to a beaker. Forty c.c. of dilute sulphuric acid (1 : 1) are added, the crucible being rinsed out with 10 c.c. of the acid, and, after the addition of 50 c.c. of concentrated sulphuric acid and 30 c.c. of concentrated nitric acid, the mixture is heated until sulphuric acid fumes are evolved. The mixture is then diluted to a volume of about 400 c.c., treated with ammonium sulphide, acidified with sulphuric acid, diluted with boiling water to a volume of 1 litre, and treated with hydrogen sulphide. After the lapse of about 16 hours, the precipitate is collected on a filter, washed with a solution containing acetic acid and ammonium acetate, then dissolved in potassium hydroxide solution, and filtered. The filtrate, together with the washings, is neutralised with hydrochloric acid, 1 c.c. of concentrated hydrochloric acid is added in excess, the mixture is heated for 20 minutes on a water-bath, and placed aside overnight. The precipitate is then collected, washed with the ammonium acetate solution and water until free from chlorides, ignited, and weighed as stannic oxide.—W. P. S.

Cheese; [Non-] Transformation of proteins into fats during the ripening of ——. *(Preliminary communication).* M. Nierenstein. Roy. Soc. Proc., 1911, **83**B, 301—304.

The author has investigated the ethereal extract of a four-year-old Cheddar cheese in order to ascertain whether other substances besides fats were present. He has succeeded in isolating cholesterol, cadaverine, putrescine, and a substance melting at 246°—251° C., the composition of which corresponds to aminovaleric acid. Preliminary quantitative experiments show that the amount of these substances present is sufficient to account for the increase in the weight of the ether-extract, which has been observed by many investigators to occur during the ripening of cheese, and which has generally been interpreted as due to an increase of fat at the expense of proteins.—J. H. L.

Patents.

Food for diabetics [from soya beans]. E. Lampe, Frankfort on Maine, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 980,292, Jan. 3, 1911.

Soya beans are treated with boiling water and 0·5 per cent. of sodium bicarbonate until the carbohydrates and other water-soluble substances are removed. The residue, after being dried and pulverised, is a yellow powder containing the nutritive fatty and albuminoid constituents of the beans.—J. A.

Milk; Process for obtaining perfect conservation and immunisation of —— *without injury to the flavour or production of a brown colouration after sterilisation.* M. Labouré. Fr. Pat. 420,582, Nov. 27, 1909.

The milk is caught in vessels maintained at 3° C., the vessels employed being, preferably, double-walled cans containing a cooling mixture between the inner and outer walls. The milk is transferred from the cans to a sterilised collecting vessel in which its temperature is maintained at 3° C.; this vessel is then exhausted of air, and the milk is transferred to an exhausted sterilising vessel wherein its temperature is raised as rapidly as possible to 100°—105° C. The milk passes from the sterilising vessel to an exhausted cooling chamber in which it falls, in the form of a shower, on a metal plate, the external surface of which is traversed by a stream of cold water. During this operation, the sulphur dioxide (used for sterilisation) is liberated from the milk, and is withdrawn from the chamber by any convenient method. The milk is then transferred to sterilised bottles, this operation also being executed *in vacuo*.—L. E.

Extracts of meat and meat-powders; Manufacture of ——. L. Mongrell, Paris. Eng. Pat. 8936, April 13, 1910.

See Fr. Pat. 403,507 of 1909; this J., 1910, 106. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 4307 of 1875, and 28,379 of 1897.—T. F. B.

Lemon juice; Process of treating ——. A. Fernbach, Paris. Eng. Pat. 15,959, July 4, 1910. Under Int. Conv., July 3, 1909.

See Fr. Pat. 415,067 of 1909; this J., 1910, 1267.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

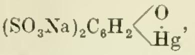
Oxygen; Determination of dissolved ——. L. W. Winkler. Z. angew. Chem., 1911, **24**, 341—343.

The chlorine derivative of quinol sold for photographic purposes as "Adurol" may be used to estimate oxygen dissolved in waters, for it gives with it a brown-yellow colour, changing after a few minutes to reddish-brown. Two 50 c.c. stoppered flasks are filled to half-way up the neck, one with the water to be tested, the other with the same water which has been shaken with air so as to saturate it with oxygen. To each is added a pinch of "Adurol," then 0·5 c.c. of a 10 per cent. solution of ammonia containing dissolved about 20 per cent. of ammonium chloride; the flasks are now filled up, stoppered, well shaken, and after ten minutes compared as to colour: thus an estimation of the proportion of the oxygen in the sample to that in the saturated water is obtained. If the waters are turbid, 2 or 3 drops of 10 per cent. solution of aluminium chloride are added before the "Adurol" and ammonia: the precipitated alumina carries down with it the suspended matter, and after standing the clear supernatant liquors can be compared. For many purposes a saturated solution of sodium chloride forms a convenient liquid for comparison; the author has determined iodometrically the oxygen it contains when saturated—the results, in c.c. of gas per litre of water, are expressed by the formula $n=1{\cdot}27-0{\cdot}01t$, where t is the temperature in degrees C. When this liquid is used, ammonium bromide must be substituted for the chloride in the ammonia solution, to obtain a liquid of greater density than the salt solution. $N/1$ and $3N$-salt solutions can also be used as comparison liquids: saturated with oxygen, a litre of each contains at 760 mm. pressure,

	$N/1$ c.c.		$3N$ c.c.
At 0° C.	6·50	..	3·14
5°	5·80	..	2·84
10°	5·25	..	2·59
15°	4·77	..	2·41
20°	4·39	..	2·25
25°	4·06	..	2·13
30°	3·76	..	2·01

To collect samples in still water, the author fastens the bottle in a sheet metal clip attached to the lower portion of a brass rod, which is bent at right angles just below the bottom of the bottle, the arm so formed projecting slightly beyond the bottle. Cords are attached to the ends of the rod, and the bottle, filled with brine, is lowered to the required depth in a vertical position, then inverted by pulling the slack cord and slacking the other. The shape of the rod secures that the inverted bottle remains slightly inclined to the vertical, and in this position ten minutes is ample time to ensure the complete displacement of the dense brine by the water under investigation. The bottle is now brought right side up and raised to the surface.—J. T. D.

Mercury soaps; Antiseptic ——. W. Schrauth. Seifensieder-Zeit., 1910, **37**, 1276—1277, 1323—1324. Chem. Zentr., 1911, **1**, 695. (See also this J., 1910, 1328).

According to the author only those organic mercury compounds which contain the mercury combined directly with the carbon of the organic nucleus, are suitable for the manufacture of disinfecting soaps. The most effective compounds are the alkali salts of hydroxymercury-carboxylic acids, and it is stated that certain halogen-substituted hydroxymercury-benzoic acids are superior to all of the common disinfectants. "Hermophenyl,"  $(SO_3Na)_2C_6H_2\left\langle\begin{matrix}O\\ \vdots\\ Hg\end{matrix}\right.$, although it contains 40 per cent. of mercury, possesses practically no disinfecting power, probably owing to the presence of three acid groups in the benzene nulceus. "Afridol," the sodium salt of hydroxymercury-o-toluic acid, $C_6H_3(CH_3)(HgOH)(COONa)$, on the other hand, possesses disinfecting power, owing to the presence of the HgOH-group and to the alkyl-substitution of the benzene nucleus (compare Schrauth and Schoeller, Medizin. Klinik, 1910, 1405).—A. S.

Saponins; Use of —— for the préparation of insecticidal emulsions. G. Gastine. Comptes rend., 1911, **152**, 532—534.

When destroying insects it is of importance to ensure a close adherence of the toxic wash or sprayed liquor. The addition of a small quantity of an alkaline soap has been suggested to facilitate this, but it is now shown that the saponins are still more effective, are more widely applicable, and have no action on the vegetation. The fruit of *Sapindus utilis*, a tree which has been cultivated for a considerable time in Algeria, is very rich in saponin. Two grms. of the powdered sapindus fruit in 10 litres of water will produce a very fine emulsion with 700 grms. of tar oil. Preferably a heavy tar oil (sp. gr. 1·045) and a lighter oil (sp. gr. 0·950) are mixed in such proportions that the density of the mixture is about that of water. The surface tension of the saponin solution is lowered by the addition of the mixture of oils and the final mixture has a marked wetting power. Copper salts may be added without increasing the surface tension. A very efficient mixture is water 10 litres, sapindus powder 20 grms., normal copper acetate 100 grms., mixture of oils (sp. gr. 1) 200 c.c.—E. F. A.

Influence of plaster dust on health. Bieling. *See* IX.

Surface effects between mercury and certain solutions and an electrochemical method of determining dissolved oxygen. Smith and Higgins. *See* XI.

Patents.

Water or other liquid; Treatment of —— under pressure. W. Paterson, London. Eng. Pat. 25,568, Nov. 3, 1910.

The patent relates to a method of introducing into the liquid a small quantity of a soluble substance, as for example in the treatment of water with aluminium sulphate. The sulphate in the form of a stick or rod is held adjustably in a casing mounted on the water conduit, so that the end of the rod projects into the current of water. The end of the rod may be enclosed in a wire cage.—A. T. L.

Water; Apparatus for sterilising —— by ultra-violet rays. T. Nogier. Fr. Pat. 420,281, Nov. 18, 1909.

The apparatus includes a sterilising vessel consisting of two chambers connected by a narrow orifice. This orifice is traversed by the horizontal tube of a mercury vapour lamp, so that the water, in passing from one chamber to the other, comes into close contact with the tube, which is made of quartz or other substance transparent to rays of short wave-length. The flow of water through the sterilising vessel is controlled by a device intercalated in the electric circuit. This device includes a cylinder provided with an inlet and an outlet for the passage of the water, and with a piston. A rod with a conical end projects downwards from one side of the piston, and a pillar of soft iron projects upwards from the other side of the piston. When the electric current is switched off, a spring, acting on the piston, presses the conical end of the piston-rod into the funnel-shaped mouth of the inlet so that the flow of water to the sterilising vessel is arrested. When the electric current is switched on, the piston is drawn upwards by an electro-magnet of soft iron situated directly above the pillar before-mentioned, and the water then flows, at a rate which is proportional to the intensity of the electric current, to the sterilising vessel.—L. E.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Atropine; Detection of —— in presence of physostigmine and pilocarpine. J. Pohl. Therap. Monatsh., 1910, [12]. Pharm. J., 1911, **86**, 297.

The presence of pilocarpine in eye drops containing that alkaloid in admixture with physostigmine and atropine, impairs the delicacy of the characteristic Vitali's reaction for atropine. To overcome this source of error, the author recommends that the solution should be made alkaline and shaken out with carbon bisulphide. The atropine, being the only one of these alkaloids soluble in the carbon bisulphide, can thus be separated from them, and Vitali's test applied to the residue after evaporation of the solvent.

Corydalis alkaloids. Corycavidine, a new alkaloid of the corycavine series. J. Gadamer. Arch. Pharm., 1911, **249**, 30—39.

A new alkaloid, *corycavidine*, has been isolated from corydalis tubers. The free bases were converted into the thiocyanates and the latter were crystallised from alcohol, being separated into portions with difficulty, and easily soluble therein. Corycavidine was isolated from the portion readily soluble in alcohol. The base has the composition, $C_{22}H_{25}NO_5$, and crystallises from chloroform with one molecule of the solvent. It melts at 212°—213°C. and has $[\alpha]_D = +203{\cdot}1°$ in chloroform. The molecule contains two methoxyl, and one *N*-methyl grouping. On exhaustive methylation it yields a methine base, m. pt. 141·5°—142·5° C., then an unsaturated substance containing no nitrogen, and trimethylamine. When corycavidine is heated it is converted into an optically inactive base, melting at 193°—195° C. after crystallisation.—F. Shdn.

Papaveraceae; The alkaloids of the perennial ——. Papaver orientale, P. lateritium. J. Gadamer. Arch. Pharm., 1911, **249**, 39—42.

A specimen of *Papaver orientale* grown at Breslau yielded 0·5 per cent. of total alkaloid reckoned on the dried plant. This proved to be a phenolic base. Protopine was not found. *P. lateritium* yielded 0·33 per cent. of total alkaloid, which was phenolic in character, but showed no other resemblance to the principal alkaloid of *P. orientale*.
—F. Shdn.

Isosparteine; Preparation of ——, and the action of methyl iodide thereon. C. Moureu and A. Valeur. Comptes rend., 1911, **152**, 386—387.

When the dihydrochloride of *α*-methylsparteine (this J. 1907, 1292) is heated to 220°—230° C. in a current of hydrogen chloride, methyl chloride and isosparteine dihydrochloride in good yield, are obtained. Isosparteine methyl iodide, $C_{15}H_{26}N_2{,}CH_3I$, formed by the direct action of methyl iodide is a mixture. The *α*-methiodide of isosparteine has $[\alpha]_D = -16{\cdot}8°$ and the *α′*-methiodide has $[\alpha]_D = -33{\cdot}3°$. The methiodide group is attached to the same nitrogen atom in each case. The hydriodide of the *α*-methiodide dissolves in 0·4 part of water at 10° C., whilst the *α′*-hydriodide requires 18 parts of water.
—F. Shdn.

Gelseminine and other constituents of gelsemium. L. E. Sayre. Proc. Amer. Pharm. Assoc., 1910. Pharm. J., 1911, **86**, 242—243.

A soft alcoholic extract was prepared from gelsemium root and extracted with dilute sulphuric acid. The acid extract was shaken with chloroform, made alkaline and shaken out with ether-chloroform mixture (5 : 1). The ethereal solution was extracted with dilute hydrochloric acid, and the extract concentrated. After crystallising out the gelsemine hydrochloride by means of alcohol, gelseminine hydrochloride was left behind as a reddish gummy mass. It could not be obtained pure or crystalline, and appeared to be a mixture, for, when treated with ammonia, a portion of the base dissolved, the remainder being insoluble. The two fractions of gelseminine, soluble and insoluble in ammonia respectively, are less toxic than gelsemine. The hydrochloride of the latter substance has the composition, $C_{14}H_{15}NO.HCl$. (Compare C. W. Moore, this J., 1910, 1330.)—F. Shdn.

Withania somnifera; The constituents of ——. F. B. Power and A. H. Salway. Chem. Soc. Proc., 1911, **27**, 53.

The material employed for this investigation represented the entire plant of *Withania somnifera*, Dunal (Nat. Ord. *Solanaceae*), and was obtained directly from South Africa. Both the roots and the portion of the plant above ground responded to the tests for an alkaloid, and they were separately examined. The investigation has shown that a number of substances present in the root are likewise contained in the leaves and stems of the plant. These substances, besides small amounts of an essential oil and a sugar yielding *d*-phenylglucosazone, were as follows: hentriacontane, $C_{31}H_{64}$; a phytosterol, $C_{26}H_{46}O$; palmitic, stearic, cerotic, oleic, and linolic acids; and ipuranol, $C_{23}H_{38}O_2(OH)_2$. From the root there were obtained, furthermore, a new monohydric alcohol *withaniol*, $C_{25}H_{33}O_4{\cdot}OH$, decomposing at 305° C., and having $[\alpha]_D = +91{\cdot}2°$, and an amorphous alkaloidal principle, which, on treatment with alkali hydroxides, yielded a crystalline *base*, $C_{12}H_{16}N_2$ (m. p. 116° C.). The leaves and stems yielded the following new compounds: a monohydric alcohol, *somnirol*, $C_{32}H_{43}O_6{\cdot}OH$, decomposing at 205° C., and having $[\alpha]_D + 34{\cdot}8°$; a dihydric alcohol, *somnitol*, $C_{33}H_{44}O_5(OH)_2$, decomposing at about 250°, and having $[\alpha]_D + 21{\cdot}2°$; and an acidic, hydrolytic product, *withanic acid*, $C_{29}H_{45}O_6{\cdot}CO_2H$ (m. p. 226°), the *methyl* ester of which decomposed at 255° C. *Withania somnifera*, unlike some other solanaceous plants, contains no mydriatic alkaloid, and physiological tests, conducted on a dog, failed to confirm the sedative or hypnotic properties attributed to it.

South African boxwood (Gonioma kamassi); Pharmacological action of ——. W. E. Dixon. Roy. Soc. Proc., 1911, **83B**, 287—300.

Within recent years South African boxwood has occasionally been used for the manufacture of shuttles in Lancashire, and symptoms of poisoning have arisen among some of the men employed in sawing and working the wood. In 1906, Gibson (see Biochem. J., 1906, **1**, 39) extracted from an African boxwood (probably *G. kamassi*) 0·07 per cent. of an impure alkaloid. The present investigation has been carried out with samples of an alkaloid extracted from the wood of *Gonioma kamassi* (N.O. *Apocynaceæ*) exported from Knysna. The alkaloid belongs to the curare group of drugs, and from a study of its pharmacological action, the author concludes that the symptoms of boxwood poisoning hitherto reported, of which the most common are respiratory trouble, headaches, cerebral depression and nasal catarrh, are mainly due to the local action of the drug and occur only in persons of marked idiosyncracy.—J. H. L.

Camellia Japonica seeds; Constituents of ——. R. Ketamura. Yakugakuzasshi, Oct., 1910, 5. Pharm. J., 1911, **86**, 297.

When the seeds of *Camellia japonica*, previously freed from fat, are extracted with boiling alcohol, a crystalline glucoside, camellin, $C_{18}H_{32}O_7$, is separated; it melts at 181°—184° C., and is readily soluble in 80 per cent. alcohol. When hydrolysed it yields a syrupy substance and a sugar allied to rhamnose. It is accompanied in the alcoholic extract of the seeds by an amorphous substance, which gives a yellow precipitate with basic lead acetate. The seeds contain no caffeine.

Paeonol produced by fission of a glucoside. G. Péron. J. Pharm. Chim., 1911, 3, 238—241.

Paeonol does not exist as such in the root of *Paeonia Moutan*, but is present in the form of a glucoside which yields on hydrolysis paeonol and dextrose, the latter being identified by its osazone. The hydrolysis is effected by a specific enzyme which is contained in the root of the plant and also in that of *P. officinalis*, and may be brought about also by dilute mineral acids, but not by invertase or emulsin.—R. V. S.

Essential oils; Constituents of ——. Identity of the alcohol $C_{10}H_{16}O$ in ginger-grass oil with perilla-alcohol. Tricyclene carboxylic acid. F. W. Semmler and B. Zaar. Ber., 1911, **44**, 460—463.

Ginger-grass oil has been found to contain an alcohol, $C_{10}H_{16}O$ (this J., 1904, 1235, and 1905, 687). When oxidised with chromic acid it yields an aldehyde, $C_{10}H_{14}O$, b. pt. 235° C. at 755 mm., and 85° C. at 4 mm. The aldehyde has the sp. gr. 0·9698 at 15° C., $n_D = 1{\cdot}50702$ at 20° C., and $[\alpha]_D = -37°54'$. The semicarbazone melts at 198°—198·5° C. It appears to be identical with perilla-aldehyde (this J., 1911, 154). The alcohol, $C_{10}H_{16}O$, from ginger-grass oil boils at 107°—110° C. at 12·5 mm., has the sp. gr. 0·946 at 20° C., $n_D = 1{\cdot}4968$ and $[\alpha]_D = -7°$. It was converted into the chloride and reduced with sodium, when *l*-limonene was produced. The methyl ester of tricyclene carboxylic acid, $C_{11}H_{18}O_2$ (from camphenile nitrite) was prepared by the action of methyl iodide on the silver salt. As it boils at 98° C. at 14 mm., it is not identical with the methyl ester of teresantalic acid, b. pt. 84° C. at 10 mm.—F. Shdn.

Angelica root; A new constituent of the essential oil of ——. E. Böcker and A. Hahn. J. prakt. Chem., 1911, **83**, 243—248.

The last runnings obtained when a quantity of angelica root was distilled with steam, were allowed to stand at 0° C. After some weeks a solid separated, amounting to 5 per cent. of the runnings. This solid was removed and crystallised from a mixture of ether and light petroleum, when it was found to melt at 83° C. and to be optically inactive. The substance has the composition, $C_{15}H_{16}O_3$, and appears to be a γ-lactone. It takes up bromine from a solution of the same in acetic acid, forming a dibromide, $C_{15}H_{16}O_3Br_2$, m. pt. 143°—145° C. The hydrogen chloride addition product, $C_{15}H_{16}O_3{,}HCl$, melts at 101° C. The potassium salt of the lactone can be formed by the action of a hot alcoholic solution of potassium hydroxide, but when attempts are made to liberate the free acid, the lactone separates.—F. Shdn.

Esterification and hydrolysis; Direct —— by catalysis. P. Sabatier and A. Mailhe. Comptes rend., 1911, **152**, 494—497.

By passing the vapours of a mixture of a primary alcohol and a fatty acid (other than formic acid) over a column of titanium oxide (TiO_2) heated at 280°—300° C., the corresponding ester is formed, the yield being approximately the same as that obtained by Berthelot by direct esterification after prolonged contact of the interacting substances. With molecular proportions of the alcohol and acid, the following yields of esters were obtained:—isobutyl acetate, 69·5; methyl propionate, 72·9; isoamyl propionate, 72; ethyl butyrate, 71; isoamyl butyrate, 72·7; and ethyl isobutyrate, 71 per cent. The yield can be increased by using an excess of either constituent. Benzyl alcohol can also be readily converted into its esters by this method. Benzyl isovalerate was prepared and found to be a liquid, having a pleasant odour, and boiling at 245° C. By passing a mixture of the vapour of the ester with excess of steam, over the heated titanium oxide, the reverse reaction—hydrolysis of the ester—can also be easily effected.—A. S.

Hydroquinone [quinol]; Determination of ——. J. Pinnow. Z. anal. Chem., 1911, **50**, 154—164.

The reducing power of quinol towards Fehling's solution increases, with rising concentration, to a maximum (compare Bourquelot and Fichtenholz; this J., 1910, 295); the substance cannot, therefore, be determined by means of this reagent, unless an empirical table be employed, as in sugar estimation, and then only if certain other substances, such as sulphites, be absent. Fehling's solution is not reduced by sulphites alone, but these increase the reducing power of quinol by 50 per cent., and the reducing power of potassium quinolsulphonate is similarly increased by about 25 per cent., a common oxidation product being formed in the two cases. The oxidation, either of quinol or of potassium quinolsulphonate, by Fehling's solution involves 3 atoms of oxygen per molecule oxidised. The best method of determining quinol is by extraction with ether (for 45 minutes) in Partheil's apparatus (this J., 1901, 1244), with subsequent evaporation and drying in a steam oven. Quinol forms double molecules in ether, the dissociation coefficient of which is 0·5646; the distribution coefficient for the single molecules, between ether and water at 15° C., is 1·885.—F. Sodn.

PATENTS.

Organic compounds of calcium; Manufacture of same. H. C. Folmer, Enschede, Holland. Eng. Pat. 25,696, Nov. 4, 1910.

Stable compounds suitable for use in treating diabetes, rickets, and tuberculosis, are obtained by treating honey with lime and dextrose or lævulose, with or without the addition of a compound of iron (ferric chloride or hydroxide). —T. F. B.

Monochlorhydrin; Process for preparing ——. Deutsche Sprengstoff-A.-G. Ger. Pat. 229,872, Jan. 30, 1910. Addition to Ger. Pat. 201,230, Jan. 11, 1906.

The product obtained by the action of sulphur chloride on glycerin in the process described in the principal patent (see Fr. Pat. 370,224 of 1906; this J., 1907, 278) is heated at a temperature about 120° C., and the chlorinated substance separated from the molten sulphur, which forms the lower layer of the mixture.—T. F. B.

Iodo-compounds; Process for preparing organic —— from the corresponding chloro- or bromo-compounds. Knoll und Co. Ger. Pat. 230,172, Aug. 26, 1908.

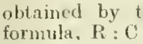
Organic chloro- or bromo-compounds are converted into the corresponding iodo-compounds (occasionally into the di-iodides) by treatment with alkali iodide in presence of acetone, methylethyl ketone, diethyl ketone, or acetoacetic ester. The temperature necessary is not high, and no secondary reactions occur. The process is applicable to the production of compounds in which not more than one iodine atom is attached to an aliphatic carbon atom, united to the neighbouring carbon atom by a single linkage.—T. F. B.

Oxygenated derivatives of unsaturated carbon compounds; Process for preparing ——. N. Prileschajew. Ger. Pat. 230,723, May 27, 1908.

Unsaturated organic compounds are treated with organic derivatives of hydrogen peroxide in presence of organic solvents, water being excluded. A large number of new compounds, and compounds difficult to obtain by other methods, can be produced thus, such as limonene monoxide, limonene dioxide, caprileue oxide, pinene oxide, and geraniol.—T. F. B.

Carbonic acid esters; Process for preparing ——. Chem. Fabr. Ladenburg, G.m.b.H. Ger. Pat. 230,827, June 17, 1909.

Carbonic acid esters of the formula, $R:C(OR^1)_2$, are obtained by the action of sulphur compounds of the formula, $R:C:S$, on salts of phenols or naphthols, preferably those the metal of which forms an insoluble sulphide. When sulphur compounds of the formula, $(R.NH)_2:C:S$, are employed, the iso-urea derivates,



$\begin{matrix} R.NH \diagdown \\ R.N \diagup\!\!\!\diagup \end{matrix} C.OR^1$, are produced by decomposition of the unstable carbonates $(R.NH)_2:C:(OR^1)_2$.—T. F. B.

Tariric acid di-iodide. A. L. Arnaud and S. Posternak, Paris, Assignors to F. Hoffmann-La Roche und Co., Grenznach, Germany. U.S. Pat. 982,656, Jan. 24, 1911.

See Fr. Pat. 404,477 of 1908; this J., 1910, 234.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Photographic films; Manufacture of ——. E. Brandenberger, Thaon-les-Vosges, France. U.S. Pat. 984,886, Feb. 21, 1911.

See Eng. Pat. 13,328 of 1909; this J., 1909, 1223.—T. F. B.

Rendering celluloid in any form non-inflammable. Fr. Pat. 420,044. *See* V.

XXII.—EXPLOSIVES; MATCHES.

Patents.

Explosives. Nobel's Explosives Co., Ltd., Glasgow, J. Sayers, W. A. Wilson, and J. Thornburn, Ardeer, Ayrshire. Eng. Pat. 26,239, Nov. 12, 1909.

The composition consists of nitroglycerin in which is dissolved a mixture of nitro bodies (mononitronaphthalene, dinitrotoluene, and trinitrotoluene) constituting a solution either gelatinised or not gelatinised. This is mixed with a suitable oxidising agent and with an absorbent combustible of the nature of woodmeal. The following are given as examples of suitable mixtures:—(*a*) Nitroglycerin (23·83 parts) nitrocotton (1·60), mononitronaphthalene (1·09), dinitrotoluene (3·27), trinitrotoluene (5·83), potassium perchlorate (52·35), and woodmeal (12·00 parts). (*b*) Nitroglycerin (17·20 parts), nitrocotton (1·34), mononitronaphthalene (1·20), dinitrotoluene (3·59), trinitrotoluene (6·37), potassium chlorate (60·30), and woodmeal (10·00 parts). (*c*) Nitroglycerin (16·00 parts), nitrocotton (1·24), mononitronaphthalene (1·10), dinitrotoluene (3·34), trinitrotoluene (5·92), ammonium nitrate (69·90) and woodmeal (2·50 parts). (*d*) Nitroglycerin (15·80 parts), mononitronaphthalene (1·10), dinitrotoluene (3·30), trinitrotoluene (5·80), potassium nitrate (41·00), woodmeal (32·50), and chalk (0·50 part).—G. W. McD.

Explosives. B. J. Flürscheim, Fleet, Hants. Eng. Pats. 3907, Feb. 17, 1910, 4700, Feb. 24, 1910, 5338, March 3, 1910, and 10,433, April 28, 1910.

Claim is made for the use of tetranitroaniline or its derivatives in explosive compositions. The following compositions are given as samples. Tetranitroaniline (13 parts), charcoal (6 parts) and ammonium nitrate (81 parts). Mercury fulminate (25 parts) and tetranitroaniline (75 parts).—G. W. McD.

Nitroglycerin compounds; Machine for packing —— *into shells.* H. A. Stillwell, Woodbury, N.J., Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 983,655, Feb. 7, 1911.

The machine has a reciprocating frame, a tamp, and wedges for connecting the two. One of the wedges is loose upon the other and can be moved by means of a projection so as to release the connection. The projection is movable in and out of alignment with the movable wedge.
—G. W. McD.

Matches; Igniting compositions for the manufacture of ——. E. W. Wheelwright, Birmingham. Eng. Pat. 3214, Feb. 9, 1910. Addition to Eng. Pat. 21,866, Oct. 3, 1906 (this J., 1907, 780).

The composition consists of phosphorus hydride (P_9H_2) (6·5 parts), sulphur (4·41), zinc oxide (13·01), chalk, (8·67), glass (11·5), potassium chlorate (38·35), glue (17·25), and dye (0·31 part).—G. W. McD.

Gunpowder; Process for the manufacture of smokeless ——. C. Claessen, Berlin. Eng. Pat. 23,145, Oct. 6, 1910.

See Addition of April 2, 1910, to Fr. Pat. 410,239 of 1909; this J., 1910, 1229.—T. F. B.

Recovery of solvents (alcohol and ether) used in the treatment of nitrocellulose. Fr. Pat. 420,086. *See* V.

XXIII.—ANALYTICAL PROCESSES.

Refractive index of liquids; Measurement of ——. O. W. Griffith. Phil. Mag., 1911, 21, 301—309.

The refractive index of a liquid may be determined by using an ordinary spherical flask filled with the liquid as a convergent lens, and observing its focal length. Two causes of error exist, (*a*) the optical effect of the glass shell of the flask; and (*b*) the spherical aberration of the beam of light employed. These errors act in contrary directions; so it is possible, by choosing a suitable aperture, to make them neutralise each other, when the process gives the refractive index with great accuracy. A second method is indicated, the apparatus consisting of two plano-convex lenses, of equal curvature, with the plane faces interiorly fitted on the ends of two tubes sliding one within the other through a stuffing-box. The apparatus is mounted on the table of a spectrometer whose telescope and collimator have been previously focussed for parallel light. The distance between the lenses is adjusted so that a clear image of the collimator slit is observed in the telescope with the tube (*a*) full of air, (*b*) full of water or other liquid. Index marks are placed on the tubes, and the distance between these may be measured and the refractive index determined by a simple calculation.—R. C. P.

Lithium; Determination of ——. E. Murmann. Z. anal. Chem., 1911, **50**, 171—174.

Lithium may be determined in a mixture containing its chloride, with those of sodium and potassium, by extraction with pyridine, in which the latter salts are insoluble. The pyridine extract is evaporated to dryness, and a slight excess of dilute sulphuric acid is added to the residue, after which the mixture is again evaporated, and the sulphate finally ignited and weighed. A trace of lithium remaining with the chloride residue may be recovered by dissolving this in water, evaporating, and again extracting with pyridine. The alkali chloride mixture must not be heated to redness, or very appreciable loss of lithium occurs.—F. Sodn.

Calcium; Determination of very small amounts of —— *by means of potassium permanganate.* L. T. Bowser. J. Ind. Eng. Chem., 1911, 3, 82—84.

The following method of determining calcium when present in the proportion of parts per million is recommended:—The solution under examination (measuring from 5 to 10 c.c.) is treated with a few drops of ammonia solution, and then with about 0·4 grm. of powdered ammonium chloride. It is then heated to the boiling point, 0·2 grm. of powdered ammonium oxalate introduced, and the boiling continued for a short time, after which the solution is diluted with about its own volume of 3 per cent. ammonia solution (to prevent crystallisation of ammonium oxalate) and allowed to stand for 2 to 3 hours. The precipitated calcium oxalate is collected on an asbestos filter (filtration being accelerated by suction) and is washed with hot 3 per cent. ammonia solution until free from ammonium oxalate, after which it is decomposed with one c.c. of $N/1$ sulphuric acid, titrated with $N/200$ potassium permanganate solution, and the excess of the latter titrated back with $N/200$ oxalic acid solution. Throughout the titrations the solution is kept as nearly as possible at the boiling point, and a blank titration is made to find the amount of permanganate consumed by the acid, water, and asbestos. For accurate work a 2 c.c.

burette graduated in fiftieths of a c.c. is used for the permanganate solution, and a 1 c.c. burette graduated in hundredths for the oxalic acid solution. Since such dilute solutions of permanganate do not oxidise the theoretical quantities of calcium (*e.g.* 0·0793 mgrm. instead of 0·1002 mgrm. per c.c.) they must be standardised upon a calcium solution of known strength, under the conditions of the actual determination. It is also essential that the amount of calcium present shall require not less than 4 c.c. of $N/200$ permanganate solution for oxidation. When smaller quantities than 0·3 mgrm. of calcium are used, there is a tendency for the results to be too high. The tabulated results obtained with solutions containing from 5 to 34 parts of calcium per million show that the method is extremely accurate.—C. A. M.

Barium; Separation and determination of ——, associated with calcium and magnesium, by the action of acetyl chloride in acetone upon the mixed chlorides. F. A. Gooch and C. N. Boynton. Amer. J. Sci., 1911, **31**, 212—218.

Acetyl chloride acts on a concentrated solution of barium chloride to remove the water and precipitate the hydrated chloride, $BaCl_2,2H_2O$. The action is less violent if the acetyl chloride is diluted with acetone, and under the best conditions the process can be conducted so that filtration of the deposited chloride on an asbestos filter forms a convenient way of estimating barium. The necessary conditions are that there should be about 0·1 grm. of hydrated barium chloride per c.c. of solution, to which should be added 30 c.c. of a mixture of acetone and acetyl chloride (4 : 1) at the rate of about five drops to the second, with constant shaking, the temperature being kept at about 15° C. The precipitate is washed with acetone and dried at low redness. In this way barium chloride may be satisfactorily separated from as much as ten times its weight of calcium or magnesuim chloride, neither of which is precipitated by the mixture of acetone and acetyl chloride. When large quantities of calcium or magnesium are present, however, it is advisable to add the precipitating mixture more slowly at first. The separation from strontium by this method is not very satisfactory.—W. H. P.

Platinum and tin; Separation of ——. L. Wöhler and A. Spengel. Z. anal. Chem., 1911, **50**, 165—171.

Attempts to effect the separation of tin and platinum by means of reducing agents, or by the solution of one constituent only from an alloy of the two metals or from a mixture of their sulphides, have led to unfavourable results. Volatilisation of the tin as stannic sulphide, in a current of hydrogen sulphide, or as stannic bromide in bromine vapour, gives accurate results but consumes much time, and hydrolysis of the tin (stannic) salt is satisfactory only when carried out under pressure, at 150°—200° C. The best method of separation is found to be the following:—The mixture is hydrolysed by heating with dilute sulphuric acid, and then the precipitate is allowed to settle, and the platinum is deposited electrolytically from the clear solution, without disturbing the precipitate until the operation is almost at an end, when the liquid is stirred. A potential of 1·1 rising to 1·5—1·7 volts is employed and a current density of 0·2 amp., at the ordinary temperature or at 50°—60° C., a freshly silvered wire gauze electrode being used. After separating the platinum, the stannic oxide precipitate is rendered flocculent by the addition of ammonium nitrate and is then collected.—F. Sodn.

Use of perhydrol [hydrogen peroxide] in the determination of total sulphur in illuminating gas. Dickert. *See* IIa.

Determining sulphuric acid and sulphates. Auger and Gabillon. *See* VII.

Determination of tartaric acid. Heczko. *See* VII.

Formation of iron bisulphide in solutions and some reactions of thionates. [Determination of sulphurous acid, thiosulphate, and polythionates.] Feld. *See* VII.

Carbonylferrocyanides. Extraction, analysis, applications. Lecocq. *See* VII.

Determination of small quantities of iodides. Bernier and Peron. *See* VII.

Report of German plaster standards committee. *See* IX.

Exact electrolytic assay of refined copper. 1. Standard method. 2. Rapid assay by rotation of the electrolyte in a solenoid. Heath. *See* X.

Determining arsenic and antimony in copper. Heath. *See* X.

Surface effects between mercury and certain solutions and an electrochemical method of determining dissolved oxygen. Smith and Higgins. *See* XI.

Interpolation method of oil analysis. Kessler and Mathiason. *See* XII.

Determination of unsaponifiable matter in wool oils. Gill and Shippee. *See* XII.

Colour reactions of resins with Halphen's reagent for colophony. Hicks. *See* XIII.

Dehydration of [beetroot and other] substances by means of ether. Stanek. *See* XVII.

Determination of dry substance [in sugar factory products]. Urban. *See* XVII.

Rapid determination of the volatile acidity of wines and fermented liquors. Malvezin. *See* XVIII.

Determining the water-absorbing power of flour. Besson. *See* XIXa.

Determination of tin in canned foods. Schreiber and Taber. *See* XIXa.

Determination of dissolved oxygen. Winkler. *See* XIXb.

Detection of atropine in presence of physostigmine and pilocarpine. Pohl. *See* XX.

Determination of hydroquinone [quinol]. Pinnow. *See* XX.

Patent.

Separatory apparatus. C. A. Jacobson and S. C. Dinsmore, Reno, Nev. U.S. Pat. 984,923, Feb. 21, 1911.

A separating funnel having in place of the usual cylindrical body, two superimposed bulbs. Through the open top a siphon is inserted which reaches down to the constriction between the bulbs. On the other (outer) limb of the siphon is a suction device for starting the siphon and a clip for regulating the flow.—B. G. McL.

XXIV.—MISCELLANEOUS ABSTRACTS.

Glycerol; Action of ultraviolet light on ——. H. Bierry, V. Henri, and A. Ranc. Comptes rend., 1911, **152**, 535—536.

Two mercury lamps in parallel served as the source of light. The liquids were placed in quartz flasks or in large open porcelain basins. Experiments were made at different temperatures, in presence of air or in vacuum, and with or without shaking. Lastly the concentration of the glycerol solution was varied from 1 to 100 per cent. After treatment the solutions were concentrated in a vacuum and their behaviour studied towards Fehling's solution and phenylhydrazine. The action on neutral glycerol at 25° C. in presence of air leads to the formation of a glycerose giving a positive phloroglucinol reaction for glyceric aldehyde. The quantity is small and other substances reacting with phenylhydrazine are also formed. In presence of alkali the product is not glycerose but β-acrose identified by means of the phenylosazone. The amount formed is small but it may be increased by the addition of salts of iron or cobalt or in particular by uranium salts. Numerous other compounds are also formed.—E. F. A.

Books Received.

Die Beziehungen zwischen Farbe und Constitution bei organischen Verbindungen. Unter Berücksichtigung der Untersuchungsmethoden dargestellt von Dr. H. Ley. a. o. Professor an der Universität Leipzig. S. Hirzels' Verlag. Leipzig. 1911. Price M. 7; bound M. 8.

8vo volume, containing 241 pages of subject matter, with 51 illustrations, and followed by an alphabetical index of subjects, and 4 photolithographs of absorption, spark- and fluorescence-spectra. The work is divided into two parts, subdivided as follows:—I. (i), Absorption. Production of colour. (ii), Definition of colour. (iii), Alteration of absorption spectra. (iv), Chromophoric theory. Different kinds of chromophor. (v and vi), Colour change through introduction of new groups. (vii), Quantitative relations. Influence of absorption, and introduction of new groups, etc. (viii), Optical effect of substituents. (ix), Special colour relations through formation of salts. (x), Colour changes resulting from polymerism. II. Relating to methods and instruments of observation. A. Spectroscopes and spectrographs, etc. B. Spectralphotometer. C. Sources of light.

Electrical Engineering Abstracts. Journal of the International Institute of Technical Bibliography. Published by the Internat. Inst. of Tech. Bibliography, 57—58, Chancery Lane, London, W.C. 1910. Subscription per section 24s. per annum. post free. Price in paper cover, £2 10s.

Published monthly in seven sections, *viz.* :—I. Mechanical engineering. II. Electrical engineering. III. Civil engineering. IV. Mining and metallurgy. V. Applied chemistry. VI. Military engineering, including aerial navigation. Orders, to the Secretary at address given.

Organic Chemistry for the Laboratory. W. A. Noyes. Ph.D., Professor of Chemistry in University of Illinois, Urbana, Ill. Second edition, revised and enlarged. The Chemical Publishing Co., Easton, Pa., U.S. America. 1911. Price $2.00.

8vo volume, containing 273 pages of subject matter with 41 illustrations, and an alphabetical index of subjects. The subject matter is classified under the following heads:—I. Analysis of compounds of carbon. II. General operations. III. Hydrocarbons. IV. Alcohols and phenols. V. Ethers. VI. Aldehydes, ketones and their derivatives. VII. Acids. VIII. Derivatives of acids. IX. Hydroxy- and ketonic acids. X. Carbohydrates. XI. Halogen compounds. XII. Nitro compounds. XIII. Amines. XIV. Diazo-, hydrazo-, nitroso- and other nitrogen compounds. XV. Sulphur compounds. XVI. Qualitative examination of carbon compounds. Reagents.

Internationale Zeitschrift für Metallographie. Zentralblatt für die gesamte Theorie und Praxis der Metallegirungen. Band I. Heft. I. Feb. 1911. Unter Mitwirkung von Arnold (Sheffield), Bauer (Berlin) Benedicks (Upsala), Brunf (Padova), Campbell (New York), Carpenter (Manchester), Charpy (Montluçon), Chikashigé (Kyoto), Cohen (Utrecht), Friedrich (Breslau), Giolitti (Torino), Goldschmidt (Essen), Heyn (Berlin), Howe (New York), Mazzotto (Modena), Rosenhain (Middlesex), Shepherd (Washington), Turner (Birmingham), und unter besonderer Unterstützung von Matthewson (New Haven) für America. Herausgegeben von Dr. W. Guertler, der Kgl. Technischen Hochschule, Berlin. Gebrüder Borntraeger's Verlag. Berlin W. 35, Schöneberger Ufer 12b. 1911. Price per volume entire, M. 20.

Large 8vo pamphlet, forming the first issue (Heft I) of the new periodical, which is an international journal of metallography. The preface is written in English, and is entitled "The aim and scope of Metallography." The present issue contains 63 pages of subject matter, with 25 fine photolithographic illustrations, etc., and terminates with a bibliography for the year 1910.

Potash Salts: their Use and Occurrence in the United States. By W. C. Phalen.

The Production of Platinum and Allied Metals in 1909. By W. Lindgren.

The Production of Fuller's Earth in 1909. By F. B. Van Horn.

The Production of Fluorspar and Cryolite in 1909. By E. F. Burchard.

The above are "advance chapters" from "Mineral Resources of the United States, 1910," prepared by the U.S. Geological Survey, and published by the Government Printing Office, Washington.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

Patent Specifications may be purchased at the Sale Branch of the Patent Office, Quality Court, Chancery Lane, London, W.C., fifteen days after the date on which acceptance of the complete specification is advertised. The price is 8d. each.

I.—GENERAL PLANT; MACHINERY.

Applications.

4908. Buck. Apparatus for vaporisation, diffusion, etc. Feb. 27.

4991. Watson. Evaporators.* Feb. 28.

5257. Smallwood. Furnaces for heating, roasting, calcining, etc. March 2.

5281. Elektrochemische Werke. Method of producing endothermic compounds from their components. [Ger. Appl., March 2, 1910.]* March 2.

5429. Bradford Dyers' Assoc., Ltd., and Metcalf. Centrifugal drying machines. March 4.

5466. Testrup and Söderlund. Separation of solids from liquids. March 4.

5660. Coplans. *See under* XIX.

5663. Shenton. Separation of gases of different densities. March 7.

5872. Neuberger. Evaporating or concentrating fluids * March 8.

5901. Hatton and Sala. Purification of liquids or separation of solids from liquids. [Appl. in Cuba, March 11, 1910.]* March 9.

5936. Smallwood. Plant for precipitating and collecting dissolved or other substances from liquids. March 9.

Complete Specifications Accepted.

2496 (1910). Schneider. Apparatus for producing very low temperatures, especially for liquefying gases and separating gas mixtures. March 15.

5797 (1910). Evans and Tipper. Appliance for abstracting fumes and gases evolved from crucibles, etc., used in metallurgical, chemical, and similar operations. March 15.

9205 (1910). Haddan (International Clarifying Co.). Centrifugal separators. March 8.

16,836 (1910). Chem. Fabr. vorm. Weiler-ter-Meer. Stirring and mixing apparatus. March 8.

17,550 (1910). Berrigan. Apparatus for expressing liquids from solids. March 8.

28,927 (1910). Reid. Settling tanks for separating liquids and solids. March 15.

II.—FUEL; GAS; MINERAL OILS AND WAXES; DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

4935. Félizat. Furnaces for burning residues, especially of oil works, to obtain wood charcoal.* Feb. 27.

5219. Cunliffe. Gas producer plants. March 2.

5286. Pratt. Gas producers. March 2.

5288. Forwood and Zimmer. Manufacture of fuel briquettes. March 2.

5504. Richter und Richter. Manufacture of coal of high activity. [Ger. Appl., March 5, 1910.]* March 4.

5651. Simon. Removal of naphthalene from coal-gas, etc. March 7.

5667. Fabry. *See under* VII.

5751. Wyld. Furnace for the combustion of sulphuretted oxide. March 7.

5837. Feld. Removal of sulphuretted hydrogen and ammonia from gases.* March 8.

5962. Coppée. Manufacture of gas for lighting, heating, or power. March 9.

6070. Sumner. Manufacture of incandescent gas mantles. March 10.

6165. Demuth. Manufacture of solidified petroleum or like oils. March 11.

Complete Specifications Accepted.

5388 (1910). Lederer, and Westinghouse Metal Filament Lamp Co. Manufacture of metal filaments for electric lamps. March 8.

6508 (1910). Burstall, and British Pure Fuel, Ltd. Extraction of tar and other products from gases. March 15.

6631 (1910). Haage. Increasing the waterproof property of substances prepared with sulphite-cellulose lye as a binding material in making fuel and ore briquettes, building blocks, etc. March 8.

9086 (1910). Feld. Extraction of tar and tar constituents from gases. March 15.

9408 (1910). Dempster and Sons, and Brooke. Gas retorts. March 15.

9610 (1910). Lake (Tait Producer Co.). Gas producers. March 15.

17,162 (1910). Leach. Manufacture of artificial fuel. March 15.

23,368 (1910). Van Tienen. Treatment of acid tar resulting from the purification of mineral oils, etc. March 8.

26,168 (1910). Simmance and Abady. *See under* XXIII.

III.—TAR AND TAR PRODUCTS.

Complete Specification Accepted.

9086 (1910). Feld. *See under* II.

IV.—COLOURING MATTERS AND DYES.

Application.

5955. Newton (Bayer und Co.). Manufacture of diazotisable dyestuffs. March 9.

Complete Specifications Accepted.

2106 (1910). Newton (Bayer und Co.). Manufacture of dyestuffs of the anthracene series. March 8.

5760 (1910). Newton (Bayer und Co.). Production of vat dyestuffs. March 15.

12,558 (1910). Read Holliday and Sons, Ltd., Turner, and Dean. Manufacture of direct dyeing cotton dyestuffs. March 8.

17,105 (1910). Newton (Bayer und Co.). Manufacture of azo dyestuffs. March 15.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Application.

5552. Rosenblum and others. Manufacture of cellulose from substances containing cellulose fibres. March 6.

Complete Specifications Accepted.

6631 (1910). Haage. *See under* II.

10,211 (1910). Weertz. Apparatus for use in making artificial threads. March 8.

14,393 (1910). McNaught. Drying machines for wool and other fibrous materials. March 15.

27,539 (1910). Verein. Glanzstoff-Fabr. Utilising washing liquids obtained in making cellulose products by the copper process. March 8.

29,582 (1910). Boult (Rebello, Faria, et Cie.). Manufacture of paper, cardboard, or other cellulose products. March 15.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

5184. Imrie (Anilinfarben u. Extract-Fabr. vorm. J. R. Geigy). Process for dyeing with a mixed chrome-copper lake.* March 1.

5430. Bradford Dyers' Assoc., Hannam, and Melville. Apparatus for circulating liquids in dyeing vessels. March 4.

5523. Brooks and Mellor. Dyeing machines. March 6.

5852. Ozonair, Ltd., and Joseph. Bleaching, sterilising, or other process wherein ozone is used. March 8.

5874. Bratkowski, de Lange, and Pusch. Apparatus for measuring and regulating the concentration of dye liquors. [Ger. Appl., March 12, 1910.]* March 8.

5999. Sutherland. Bleaching cotton and other fibrous material. March 10.

Complete Specifications Accepted.

18,297 (1910). Wickham. Bleaching straw by means of hydrosulphites. March 8.

876 (1911). Lesser. Dyeing with benzoquinone and *α*-naphthoquinone dyestuffs. March 8.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

5281. Elektrochem. Werke. *See under* I.

5282. Elektrochem. Werke. Production of ammonia and its compounds. [Ger. Appl., March 3, 1910.]* March 2.

5610. Parker. Manufacture of salt. March 6.

5615. Patterson. Substitute for table salt. March 6.

5667. Fabry. Recovery of ammonium sulphate direct from coke-oven or retort gas.* March 7.

5713. Collett and Eckardt. Production of graphite and other by-products in making ammonia. [Appl. in Norway, March 10, 1910.]* March 7.

5833, 5834, and 5836. Johnson (Badische Anilin und Soda Fabrik). Catalytic agents for use in making ammonia. March 8.

5835. Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia and catalytic agents therefor. March 8.

5837. Feld. *See under* II.

5838. Feld. Combination with sulphurous acid of ammonia and sulphuretted hydrogen contained in gases or liquids and the obtainment of ammonium sulphate.* March 8.

5967. Namekawa and others. *See under* X.

5976. Ashcroft. Manufacture of ammonium chloride. March 9.

6006. Nobel's Explosives Co., and Sayers. Concentration of sulphuric acid. March 10.

COMPLETE SPECIFICATIONS ACCEPTED.

30,323 (1909). Rollin, and Hedworth Barium Co. Manufacture of barium oxide. March 8.

228 (1910). Ashcroft. Manufacture of metallic amides, cyanamides, and cyanides. March 15.

5382 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia and aluminium compounds from mixtures containing aluminium nitride. March 15.

5471 (1910). Clemm. Treatment of barium chloride and strontium chloride to produce chlorine and hydroxides of barium and strontium. March 15.

VIII.—GLASS; CERAMICS.

APPLICATIONS.

5050. Bethell. Abrasive materials. Feb. 28.

5449. Goodwin. Frit kilns. March 4.

IX.—BUILDING MATERIALS.

APPLICATIONS.

5079. Fraser. Manufacture of artificial stone.* March 1.

5171. Cooper and Archer. Manufacture of fire-bricks. March 1.

5262. Grote and Davies. Manufacture of magnesite cement with hydraulic properties. March 2.

5402. Abraham and Haines. Manufacture of waterproof cement, mortar, and concrete. [U.S. Appl., March 9, 1910.]* March 3.

COMPLETE SPECIFICATION ACCEPTED.

6631 (1910). Haage. *See under* II.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

APPLICATIONS.

4931. Jewett. Composition for fluxing metals. [U.S. Appl., March 1, 1910.]* Feb. 27.

5015. Allison (International Metal Products Co.). Alloys and their manufacture. [Addition to No. 27,201 of 1909.] Feb. 28.

5140. Helfenstein. Smelting furnaces with electric refining hearths. [Ger. Appl., March 10, 1910.]* March 1.

5164. Clador Synd., Ltd., and Lockwood. Extraction of precious metals from their ores. March 1.

5196. Moulden, Webster, and Central Zinc Co. Zinc distillation. March 1.

5420. Bartlett. High tensile and non-magnetic steel. March 4.

5464. Davy and others. Extraction of gold from refractory ores. March 4.

5577. Wahnschaff and Savelsberg. Separation of zinc from materials containing zinc or zinc oxide. [Ger. Appl., March 7, 1910.]* March 6.

5684. Neil. Removal of oxidation and tarnish from silver, gold, etc.* March 7.

5811. Burgess. Coating with metal. [U.S. Appl., April 2, 1910.]* March 8.

5867. Perret. Extraction of metals. [Belg. Appl., Aug. 12, 1910.]* March 8.

5944. Hopkins. Distillation of zinc. March 9.

5967. Namekawa and others. Separation of zinc from zinc sulphate solution. [Japanese Appl., March 19, 1910.]* March 9.

COMPLETE SPECIFICATIONS ACCEPTED.

27,558 (1909). Lockwood. Treatment of auriferous and argentiferous ores. March 8.

5013 (1910). Ashcroft. Manufacture of sodium and potassium. March 8.

5559 (1910). Hislop. Treating oxidisable metals to preserve them. March 8.

5797 (1910). Evans and Tipper. *See under* I.

6631 (1910). Haage. *See under* II.

14,743 (1910). British Thomson-Houston Co. (General Electric Co.). Alloys suitable for use as electric resistance conductors. March 15.

17,609 (1910). Du Pont. Means for separating the constituents of certain iron ores. March 15.

20,776 (1910). Consigliere. Process and apparatus for electrodeposition. March 8.

XI.—ELECTRO-CHEMISTRY.

APPLICATIONS.

5165 and 5167. British Thomson-Houston Co. (General Electric Co.). Insulating materials.* March 1.

5734. Estelle. Anodes for use in the electrolytic treatment of alkaline salt solutions. [Appl. in Sweden, March 9, 1910.]* March 7.

6158. Billon-Daguerre. Electric furnace for two- or three-phase currents. March 11.

COMPLETE SPECIFICATION ACCEPTED.

28,813 (1909). Wassmer. Electric furnaces. March 15.

XII.—FATS; OILS; WAXES.

APPLICATIONS.

4832. Pratt. Manufacture of toilet soaps. Feb. 27.

5188. Paal. Reduction of fats and unsaturated fatty acids. [Ger. Appl., Aug. 5, 1910.]* March 1.

5306. Shearman and Wilson. *See under* XV.

5574. McLarty. *See under* XIX.

5786. Lothammer. Manufacture of soap.* March 8.

5958. Blackburn. Cleansing soap and method of manufacturing it. March 9.

6044. McLaren. Soap for cleaning cloth, paint, stone, wood, metal, etc. March 10.

6161. Reisdorff and Soulier. Detergent composition particularly for washing in sea water. [Fr. Appl., March 11, 1910.]* March 11.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

5712. Kelly. Body or base for paint or filler or body for rubber, rubber substitute, etc.* March 7.

5740. Booth. Manufacture of zinc white.* March 7.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

5349. East. Regeneration of rubber and the like. March 3.

5352. East. Apparatus for regenerating rubber. March 3.

5395. Campbell. Production of artificial rubber. March 3.

5712. Kelly. *See under* XIII.

Complete Specifications Accepted.

9616 (1910). Plinatus. Production of elastic or resilient masses. March 8.

13,201 and 13,425 (1910). Crude Rubber Washing Co., and Dessau. Apparatus for removing foreign matter from indiarubber, guttapercha, balata, etc. March 8.

16,353 (1910). Lapisse. *See under* XV.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

5006. Silberrad. Manufacture of leather substitutes. Feb. 28.

5306. Shearman and Wilson. Apparatus for separating glue and grease from bones, etc. March 3.

5396. Campbell. Production of artificial leather. March 3.

Complete Specifications Accepted.

225 (1910). Reidel. Leather substitute. March 15.

5211 (1910). Bennett and Thorp. Waterproofing leather. March 15.

6281 (1910). Simon. Treatment of hides and skins. March 8.

16,353 (1910). Lapisse. Substitute for leather, indiarubber, etc. March 8.

XVII.—SUGARS; STARCHES; GUMS.

Applications.

5431. McNeil, McNeil, and McNeil. Macerating crushed sugar-cane. March 4.

5705. Naswanoff. Manufacture of refined sugar. March 7.

XVIII.—FERMENTATION INDUSTRIES.

Application.

5170. Overbeck. Apparatus for obtaining alcohol.* March 1.

Complete Specifications Accepted.

11,545 (1910). Green. Treatment of malt for brewing purposes. March 8.

12,917 (1910). Whitaker. Manufacture of porter and stout. March 15.

25,108 (1910). Dickson. Treatment and utilisation of distillery or brewery wash or waste. March 15.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

5339. Martin, Bartholomew, and Schaaf. Treatment and purification of liquids containing albumen. [Cuban Appl., March 3, 1910.]* March 3.

5574. McLarty. Rendering lard and other fats and oils.* March 6.

5660. Coplans. Apparatus for purifying water and other liquids by separating solid matter. March 7.

5671. Pearsall. Sterilising water, sewage, etc. March 7.

5852. Ozonair, Ltd., and Joseph. *See under* VI.

5948. Dunham. Manufacture of wheaten flour. March 9.

6160. Koster and Goettler. Production of solid matter from skimmed milk.* March 11.

Complete Specifications Accepted.

5393 (1910). Urbain, Feige, and Seal. Use of metals in the electric arc for sterilising liquids. March 15.

5827 (1910). Lifebelt Coffee Co. (Kaffee Patent A.-G.). Preparation of coffee containing little or no caffeine. March 15.

13,969 (1910). Bell and Tuke. Apparatus for purifying sewage and other liquids. March 8.

27,988 (1910). Power. Triple purification water stills. March 15.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

5595. Meister, Lucius, und Brüning. Manufacture of nitro-oxyarylarsenic acids. [Ger. Appl., May 24, 1910.]* March 6.

6076. Soc. Chim. des Usines du Rhône. Manufacture of nitrophenylnitromethanes, their homologues and derivatives. [Ger. Appl., March 12, 1910.]* March 10.

Complete Specification Accepted.

24,240 (1910). Von Arlt. Manufacture of a pharmaceutical preparation. March 15.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Complete Specification Accepted.

5154 (1910). Smith. Sensitive photographic emulsions. March 8.

XXII.—EXPLOSIVES; MATCHES.

Complete Specification Accepted.

5707 (1910). Carlson. Explosives. March 8.

XXIII.—ANALYTICAL PROCESSES.

Application.

4910. Marks (Hydro Apparatus Works). Process and apparatus for the continuous examination of liquids.* Feb. 27.

Complete Specifications Accepted.

19,564 (1910). Savory. Apparatus for ascertaining the specific gravity of fluids and vapours. March 8.

26,168 (1910). Simmance and Abady. Gas analysis apparatus. March 15.

Journal of the Society of Chemical Industry.

No. 7, Vol. XXX. APRIL 15, 1911. No. 7, Vol. XXX.

Official Notice.

ANNUAL GENERAL MEETING, 1911.

In accordance with the provisions of By-law 64, notice is hereby given that the Annual General Meeting will be held in the Montgomery Hall, Sheffield, at 10.30 a.m., on Wednesday, July 12th. 1911. A programme of the proceedings will be issued later.

Under Regulation 5, all elections to the Committees and all elections of officers of Local Sections, with the exception of those to fill up unforeseen vacancies, must take place so that they can be reported to the Council in time to be considered at the meeting held under By-law 24 not less than two months prior to the Annual General Meeting. This meeting will be held on April 24th next.

Charles G. Cresswell,
Secretary.

Birmingham Section.

Meeting held at Birmingham University on Thursday, March 2nd, 1911.

MR. HARRY SILVESTER IN THE CHAIR.

ADAPTATION OF THE TAP-FUNNEL TO RAPID ELECTRO-ANALYSIS WITH STATIONARY ELECTRODES.

BY T. SLATER PRICE, D.SC., F.I.C., AND A. W. T. HYDE.

The use of the tap-funnel with rotating electrodes in rapid methods of electro-analysis was first described by Price and Judge (Trans. Faraday Soc., 1906, 2, 85.) In the present paper a method of extending the use of the tap-funnel to stationary electrodes is described and a record of the results obtained with copper, nickel, and zinc is given. At the same time results obtained by Frary and Peterson (Trans. Amer. Electrochem. Soc. 1910, **17**, 295) and by Blasdale and Cruess (J. Amer. Chem. Soc., 1910, **32**, 1264) which appeared to be at variance with those obtained by one of us in conjunction with Mr. T. C. Humphreys (this J., 1909, **28**, 117; 1910, **29**, 307) led us to repeat some of their work along with that mentioned above.

The difficulty in the use of the ordinary tap-funnel with stationary electrodes is that some of the electrolyte remains in the neck of the funnel, thus escaping electrolysis. This difficulty may be overcome by using a funnel with a two-way tap such as is used at the bottom of a Hempel gas burette, one way being for the delivery of liquid in the ordinary manner, the other being connected with a rubber hand-bellows (or Shenstone water-blower) by means of which air bubbles may be blown through the solution. Thus the electrolyte remaining in the neck may be mixed with the rest of the solution from time to time during the electrolysis. Incidentally the stream of bubbles rapidly stirs the electrolyte.

The following points have to be considered in using this apparatus :—(1) There must be no leakage of electrolyte down the airway of the tap. (2) The removal of the electrolyte remaining in the neck must be complete. (3) There must not be undue splashing. (4) The air bubbles must have no deleterious effect either on the electrolyte or on the deposit.

(1) In order to prevent any air leakage, the air reservoir of the bellows was always filled before opening or closing the tap; also, it was found that the opening which is necessary for the passage of a steady stream of bubbles is extremely small.

(2) The removal of electrolyte from the neck was found to be complete. If this had not been the case the washings run from the funnel would have always contained the metal being deposited. (See Tables I, 1, 3, 4, ; III. 6, 8.)

(3) It was found that small bubbles splash more than large ones and that by adjusting the size of the bubbles until sufficiently large, very little, if any, more splashing on to the cover glass took place than from the escape of gas (from the electrodes) alone.

(4) In no experiment was any effect on the electrolyte or deposit observed. The experiments made with cathode C. (Tables II and III) have a special bearing on this point.

The funnel used had a capacity of about 100 c.c., being approximately 10 cm. deep and 4·5 cm. in diameter. In all our experiments the volume of the solution was from 70—75 c.c. During the electrolysis the mouth of the funnel was covered by a split cover glass; towards the end of the experiment the cover glass and the sides of the funnel were washed down with distilled water, and the current passed for a short time longer to ensure complete deposition. The liquid was then allowed to run out slowly from the funnel, the cathode being at the same time washed by a rotating jet of water. Before the liquid reached the bottom of the cathode the funnel was refilled by pouring in water more rapidly; this was then allowed to run out nearly to bottom of cathode which was washed as before, the process being repeated until the current fell to zero. The cathode was then washed and dried in the usual way.

In the experiments on copper three types of cathode were used; these are referred to in the table of results under the letters A, B, C.

Cathode A (rotating) was a sand-blasted gauze electrode similar to those described in F. Mollwo Perkin's "Practical Methods of Electro-chemistry," p. 81, being 22 mm. in diameter, and 40 mm. long. The anode used with this cathode was a double ring (40 mm. in diameter) of wire with baffle plates. This electrode was used to make the standard determinations, so that the results obtained with other electrodes could be checked.

Cathode B was a stationary cylindrical electrode of sand-blasted gauze 45 mm. long and 32 mm. in diameter, with 4 meshes to the sq. mm., its weight being about 15·5 grams. The anode was a cylinder of similar gauze 44 mm. long and 22 mm. in diameter.

Cathode D was a double disc, sand-blasted gauze electrode (Hildebrand electrode), the discs being 5 cm. in diameter and 0·5 cm. apart and having about 15 meshes to the sq. cm. The weight of this cathode was about 27 grms. The anode used with it was of coiled platinum wire 0·9 mm. in diameter. Since this cathode was placed above the anode so that the gases given off from the latter passed through its meshes it could not conveniently be used with the tap funnel, which was therefore replaced by a vessel made as follows :—The bottom was cut from an ordinary wide-mouth bottle, a little wider than 5 cm., and the neck fitted with a tightly fitting rubber bung. The wire leading from the centre of the spiral anode was sealed into a glass tube which was inserted in the bung. The bung was then pushed into the neck until it came flush with the shoulder, the anode being drawn down until it all but touched the latter. The cathode was fixed about 1 cm. above the anode. At the end of an experiment the electrolyte was siphoned off in the usual manner.

The rotating cathode (A) was used as a control for the others since cathodes of this type are known to give accurate results. Unfortunately a large number of determinations was rendered almost valueless owing to using a cathode which was afterwards found to be faulty in construction. This particular cathode gave results which were almost uniformly one milligram higher than those given by the stationary electrodes for the same solutions, and this was also found to be the case when it was compared with another rotating cathode of the same type but of later date and slightly different in construction.

It was found impossible to determine the exact cause of these high results, but it was observed that the stem of the cathode fitted into two sleeves (or tubes) which had become loose, although they were not so originally, also that a quantity of unnecessary gauze was wrapped, as an attachment, over the circular flanged rim at each end of the cathode. In the later pattern these undesirable features were absent, the gauze being soldered direct on to a plain circular rim. and the sleeves done away with. It was concluded that in some way a small quantity of electrolyte got sucked into the annular space between the sleeve and the stem, was not removed in the washing and, on drying, was driven out on to the deposit. There was some evidence of this from the fact that a dark ring was frequently obtained round the cathode at the point where the alcohol dried off last and also on the stem just above the sleeve. This ring was absent from other electrodes dried in a similar manner.

This result was of some interest as showing that rotating, electrodes require to be carefully constructed so as to prevent any possibility of such an occurrence happening.

No attempt was made in any of these experiments to find the minimum time of deposition, since methods which give satisfactory results if electrolysis proceeds for a certain minimum period often become quite inaccurate if electrolysis is allowed to proceed for a longer time. (*Cf.* Table VI and Price and Humphreys, this J., 1910, **29**, 307.)

In a paper on the Comparison of Rapid Electro-analytical Methods, Part 1. (Trans. Amer. Electrochem. Soc., 1910, **17**, 295), Frary and Peterson have compared different methods for the electro-analysis of copper, using solutions of Kahlbaum's pure recrystallised copper sulphate. They find :—

1. That with stationary electrodes and depositing from the cold nitric acid electrolyte (3—10 drops of concentrated nitric acid and 4—10 drops of concentrated sulphuric acid), either with or without magnetic rotation, there is a decided tendency towards high results ; further, without rotation the deposits are frequently spongy. Larger amounts of nitric acid, as recommended by Withrow (J. Amer. Chem. Soc., 1908, **30**, 381) were also found to be unsatisfactory, from the tendency of the deposit first formed to redissolve.

2. That with magnetic rotation, using a gauze cathode and heating to a temperature of from 65°—70° before commencing the electrolysis, adherent deposits of good colour are obtained when the electrolyte contains 3—5 drops of concentrated nitric acid and 8—10 drops of concentrated sulphuric acid. From cold electrolytes containing the same quantities of acid, and using magnetic rotation, three deposits are described as being perfect in character. The results are slightly high.

It was impossible for us to compare our results accurately with those of Frary and Peterson since they give the quantity of concentrated acid added in drops, and omit to state the number of drops per cubic centimetre. In the case of nitric acid the number of drops per c.c. may vary within wide limits (12—30 drops) according to the nature of the dropping instrument. In drawing comparisons we have therefore based our remarks on a low value, namely 12—16 drops per c.c.

With the types of both stationary and rotating cathodes used by us we have never succeeded in obtaining a perfect or even good deposit with such small amounts of acid, either with warm or cold electrolytes.

Blasdale and Cruess have found ("Conditions affecting the Electrical Determination of Copper," J. Amer. Chem. Soc., 1910, **32**, 1264) :—

(1. That it is difficult to precipitate the last few milligrams of copper from a solution containing as much as 2 c.c. of concentrated nitric acid per 140 c.c., which is heated to 60° ; also that under these conditions neither the rotating anode nor gauze cathode is satisfactory, whether the solution is heated either externally, or internally by the current. In such cases the solutions usually showed the presence of copper by the ferrocyanide test and, occasionally, faint traces of the same could be detected in the wash water. They therefore recommend that where currents of five or more amperes are used, nitric acid should not be present except in small concentrations.

2. That in using a cylindrical gauze cathode under which a disc anode of coiled wire is placed, much of the liberated oxygen comes in contact with the deposited copper and may produce an appreciable amount of oxidation, dark deposits being frequently obtained when the disc form of anode was used.

1. Blasdale and Cruess washed their cathodes as follows:— " Except where Classen dishes were employed, the stand to which the electrodes were attached was raised at the end of the desired time interval, the electrodes plunged in a beaker of water, and the current allowed to run for some minutes longer. after which the cathode was removed, washed in two changes of alcohol, dried and weighed."

This method was adopted because they wished to interrupt the course of the analysis at intervals in order to obtain the amount of copper deposited in a given time, and they appear to have used it with the strongly acid solutions referred to (*i.e.*, 2 c.c. nitric acid per 140 c.c.).

The present authors have always found traces of copper left in the solution when the cathode was lifted out in the above manner (*e.g.*, No 9, Table III, among others), whereas all the copper may be deposited from solutions containing a considerably greater concentration of acid than the one mentioned above (viz., 2 c.c. of concentrated nitric acid and 1 c.c. of concentrated sulphuric acid in 60—70 c.c.) by the usual method of siphoning and running in water until the current falls to zero. (See Nos. 1, 5, 6, 13, Table III : 3, 4, Table I).

In all our copper determinations the final temperature was at least 60°.

2. In some experiments made by us with a stationary cathode which was designed so as to increase the circulation of the electrolyte it was observed that gas from the anode was forced through the meshes at the upper part of the cage and that the deposit was always harder and brighter round the part where this occurred. This led to the trial of cathode C, the construction of which has been described. In this case all the gas liberated from the anode passed through or over the meshes of the cathode. The results are given in Table III, 9—14 ; Table II, 4 and 5.

The deposits were slightly dark and powdery where the current density was greatest, when small concentrations of nitric acid were used (Nos. 10, 11, 12, Table III) but it does not seem likely that this was due to oxidation, as the upper disc was always perfectly bright and the oxygen from the anode passed through both discs. Determinations 10 and 11 are slightly high, this probably being due to the small concentration of nitric acid and consequent formation of sulphide from the sulphuric acid used, as is known to be the case with other cathodes.

This arrangement of the anode and cathode is very easy to manipulate ; the distance of the cathode from the anode may be varied ; a maximum stirring of the electrolyte round the cathode is obtained and the volume of the solution may be kept very small, if desired.

These results agree with our observations on the tap-funnel with stationary electrodes and bubbling air through the electrolyte.

Determination of copper.—The following experiments were made as a further check on Stoddard's results, which have already been criticised by Price and Humphreys (*loc. cit.*) to the effect that the deposits show a tendency to become spongy.

A solution of copper sulphate was used in each case and only nitric acid added, according to Stoddard's instructions, although he, also, does not mention the number of drops of nitric acid per c.c. Kahlbaum's copper sulphate was re-crystallised and used in these determinations. The weight of copper taken in each case was 0·527 grm., as determined by check analyses with the rotating cathode. Cathode B was used. 24 drops of concentrated nitric acid = 1 c.c.

TABLE I.

	State.	Copper found.	Drops conc. nitric acid.	Time in mins.	Current in amps.	Remarks.
1	Cold	0·5284	6 (¼ c.c.)	40	5	Deposit dark and burnt in appearance. All down.
2	Cold	0·5285	6 (¼ c.c.)	40	5	Deposit as in (1) but also somewhat spongy.
3	Cold	0·5295	6 (¼ c.c.)	40	5	Deposit dark. All down.
4	Warm	0·5288	6 (¼ c.c.)	30	5	All down. Deposit hard but burnt in appearance.
5	Warm	0·5276	8 (⅓ c.c.)	30	5	Trace left in.
6	Warm	0·5276	5	30	5	Deposit commenced to oxidise in oven.

The above results show that in no case was a satisfactory bright deposit obtained, thus confirming the results of Price and Humphreys, and also of Frary and Peterson. With the cold electrolyte the results were always high, and they are not satisfactory with the warm electrolyte. The times taken for the electrolysis are longer than those previously used, for the reason stated above.

TABLE II.

Weight of copper (as sulphate) taken in each case = 0·5264 grm. 30 drops nitric acid = 1 c.c.

	Cathode used.	Copper found.	Conc. nitric acid.	Time in mins	Current in amps.	Remarks.
1	A. Warm (60—70°)	0·5264	13 drops	25	3—4	All down. Good deposits.
2	A. Cold	0·5261	18 drops	30	3	All down. Good deposits.
3	A. Cold	0·5264	2 c.c.	30	3	All down. Good bright deposits.
4	C. Cold	0·5265	1 c.c.	35	2·5 for 10 mins. 5·0 for 25 mins.	All down. Good bright deposits.
5	C. Cold	0·5265	1 c.c.	42	2·5 for 10 mins. 5·0 for rest	All down. Good bright deposits.

TABLE III.

The solution used was prepared from Kahlbaum's pure copper sulphate (which had been carefully re-crystallised and dried. 41·62 grms. of this salt were dissolved in water and made up to 1 litre; 50 c.c. of this solution should therefore contain 0·52975 grm. of copper.

	Cathode used.	Copper found.	Error in mg.	Acid conc.	Time in mins.	Current in amps.	Remarks.
1	A. Cold.	0·5296	—0·1	2 c.c. HNO_3	30	3	All down. Deposit bright.
2	A. Cold	0·5297	nil.	½ c.c. HNO_3 ½ c.c. H_2SO_4	25	3	All down. Deposit hard and coherent but rather dark.
3	A. Hot (60°—70°)	0·5295	—0·2	½ c.c. HNO_3 ½ c.c. H_2SO_4	18	3	All down. Deposit much brighter than the last but showed one minute speck of sulphide (?).
4	A. Cold	0·5348	+5·1	½ c.c. HNO_3 ½ c.c. H_2SO_4	25	3	Dark, showed 2 or 3 sulphide spots about 1 sq. mm. which probably account for high result.
5	A. Cold	0·5296	—0·1	1 c.c. HNO_3 1 c.c. H_2SO_4	25	3	All down. Deposit bright.
6	B. Cold	0·5297	nil.	2 c.c. HNO_3 1 c.c. H_2SO_4	50	4	All down. Very bright deposit.
7	B. Cold	0·5294	—0·3	1 c.c. HNO_3 1 c.c. H_2SO_4	35	4	Minute trace left in.
*8	B. Cold	0·4935	+0·2	2 c.c. HNO_3 1 c.c. H_2SO_4	50	4	All down. Very good deposit. Wt. Cu taken = 0·4933 grm.
9	C. Cold	0·5294	—0·3	1 c.c. HNO_3	30	2·5	Minute trace left in. This cathode was lifted out and washed.
10	C. Cold	0·5303	+0·6	½ c.c. HNO_3 ½ c.c. H_2SO_4	33	2	All down. Dark directly over anode and somewhat powdery.
11	C. Cold	0·5302	+0·5	½ c.c. HNO_3 ½ c.c. H_2SO_4	42	2	All down.
12	C. Cold	0·5299	+0·2	½ c.c. HNO_3 ½ c.c. H_2SO_4	40	2	All down.
13	C. Cold	0·5298	+0·1	2 c.c. HNO_3 1 c.c. H_2SO_4	30	4	All down. Very bright, slightly powdery where current density greatest.
*14	C. Cold	0·5180	—0·1	2 c.c. HNO_3 1 c.c. H_2SO_4	30	2·5 for 10 mins. 5·0 for rest	All down. Good deposit. Wt. Cu taken = 0·5181 grm.

* In 8 and 14 electrolytic copper was used. In each case the copper was dissolved in 2 c.c. conc. HNO_3 and 1 c.c. conc. H_2SO_4 dded before electrolysis (Cf. Price and Humphreys, this J. 1909, 28, 117).

The above results show that the best deposits are obtained hen the amount of nitric acid is not too small, being not ess than 1—2 c c. per 70 c.c. of electrolyte. When less than this amount is present there is a tendency for the deposit to become dark and give high results, especially when the time of electrolysis is somewhat prolonged. This is probably due to reduction of the sulphuric acid, either added or contained in the copper sulphate used, and formation of sulphide on the deposit. Experiment No. 4 and the results given in Table I. are examples of this.

Moreover, with low concentrations of nitric acid previous heating of the electrolyte did not give much better results as the colour and nature of the deposits were unsatisfactory and in some cases high results were obtained (compare No. 4, Table I). Even with concentrations of nitric acid as high as 0·5 c.c. per 60—70 c.c. of electrolyte, this tendency to high results is observed (compare Nos. 10 and 11, Table III.)

Our experiments lead us to the conclusion that with all the types of cathode used by us 0·5 grm. of copper may be quantitatively deposited within reasonable time from a solution of copper sulphate containing as much as 2 c.c. of nitric acid per 70 c.c. of solution; it is also preferable to add 1 c.c. of concentrated sulphuric acid. The deposits are perfect in colour and texture and previous heating of the electrolyte is unnecessary. The fact that Frary and Peterson found high results with a cold electrolyte may possibly be due to insufficient stirring by means of magnetic rotation (compare Alders and Stähler, Ber., 1909, 42, 2685), but more probably to insufficient nitric acid being present.

Our results confirm those previously obtained by Price and Humphreys (*loc. cit.*), who found that as much as 4 c.c. of concentrated nitric acid could be present without deleterious effect, and are contradictory to those of Blasdale and Cruess, who write, "Where currents of five or more ampères are used, nitric acid should not be present except in small concentrations." Moreover, the experiments with cathode C show that oxygen has not the deleterious effect on the cathode deposit which was ascribed to it by Blasdale and Cruess.

Determination of Nickel.—The salt used was nickel ammonium sulphate (Kahlbaum). In each case the electrolyte contained 1·5 grms. of ammonium sulphate and 12 c.c. of concentrated ammonia (0·880). Cathode B used, the electrolysis being commenced in the cold. Current 6 Amps. Weight of nickel taken in each case = 0·2981 grm.

TABLE IV.

	Nickel found.	Error in mg.	Time.	Remarks.
1	0·2981	nil.	25 mins.	All down. Good bright deposit.
2	0·2980	—0·1	25 mins.	All down. Good bright deposit.
3	0·2975	—0·6	25 mins.	All down. Good bright deposit.

The results are thus satisfactory (compare Price and Humphreys, *loc. cit.*).

Price and Humphreys (this J. 1910, **29**, 307) found that the sodium hydroxide-potassium cyanide electrolyte is satisfactory if cold solutions are used and the times of electrolysis given by Stoddard (*loc. cit.*) are adhered to. They point out however that one never feels certain of the result, and the present experiments show that the uncertainty is well founded. If the current is run for too long a time the electrolyte becomes hot and zinc is re-dissolved; such a method cannot therefore be said to be satisfactory, and it was given up as unreliable.

TABLE V.

Determination of zinc using a cyanide electrolyte.—The cathode (B) was silvered in each instance. The salt used was the re-crystallised zinc sulphate (Kahlbaum I) which had been prepared by one of us for a previous investigation (Trans. Faraday Soc., 1907, **3**, 88). Sodium hydroxide was added to partial solution and then potassium cyanide in slight excess according to the indefinite instructions of Stoddard. (J. Amer. Chem. Soc., 1909, **31**, 385). The whole of the washings were tested in each case by acidifying and adding ferrocyanide. The electrolysis was commenced in the cold. Weight of zinc taken in each case=0·2273 grm.

	Zinc found.	Error in mg.	Time in mins.	Current in amps.	Remarks.
1	0·2307	+3·4	35	6	
2	0·2293	+2·0	35	6	Not quite all down.
3	0·2245	—2·8	35	6	Not down. NaOH added until precipitate first formed was almost redissolved, then KCN until dissolved. .
4	0·2269	—0·4	40	6 for 30 mins. 7 for 10 mins.	All down. In this case less NaOH and more KCN was added.
5	—	—	—	6	NaOH and KCN as in (4). After running 35 mins. deposit commenced to redissolve.
6	—	—	—	6	After 35 mins. solution showed trace of zinc, 5 mins. later a considerable quantity of zinc was present.

TABLE VI.

B. Using sodium sulphate, sodium acetate and acetic acid as electrolyte. (Compare Trans. Farad. Soc. 1907, **3**, 88). 2 grms. sodium sulphate and 1 grm. sodium acetate were added for each determination. The amount of glacial acetic acid (54 drops=1 c.c.) added is indicated in the table. The cathode was silvered in each case. Wt. of zinc taken in each expt.=0·2273 grm.

	Zinc found.	Error in mg.	Drops acetic.	Time in mins.	Current in amps.	Remarks.
1	0·2271	—0·2	0	40	1·5	Deposit spongy and dark.
2	0·2270	—0·3	2	35	1·5—2	All down. Deposit spongy.
3	0·2273	±0·0	4	30	0·75, 1·5, 1·75 for 5 mins. each 2 for 15 mins.	All down. Slightly spongy in one small patch.
4	0·2271	—0·2	5	35	0·75 for 15 mins. 2·0 for 15 mins. 2·5 for 5 mins.	All down. Deposit crystalline.
5	0·2266	—0.7	10	23	2 for 10 mins. 2·5 for 13 mins.	Zinc was not all down.
6	0·2269	—0·4	15	20	2 for 5 mins. 2·5 for 10 mins. 3·0 for 5 mins.	All down.
7	0·2270	—0·3	20	25	2, 2·5, 3·0, 3·5 for 5 mins. each	All down. Good hard metallic looking deposit.
8	0·2270	—0·3	30	23	2 for 8 mins. 2·5 for 5 mins. 3·0 for 10 mins.	Deposit would not rub off even inside cathode except in one small patch.
9	0·2272	—0·1	30	30	2·0 for 12 mins. 2·5 for 10 mins. 3·0 for 8 mins.	All down. Very good deposit.
10	0·2266	—0·7	40	40	2·0 for 25 mins. 2·5 for 15 mins.	Trace left in. Fine bright deposit.

With 5 drops of acetic acid per 70 c.c. the deposit was no longer spongy but coarsely crystalline; the crystals could be readily detached by rubbing with the finger. With 10 drops of acetic acid (expt. 5) the deposit became adherent on the exterior of the cathode except in one small patch of about 1 sq. cm. With increasing concentrations of acetic acid the deposits became brighter and more adherent until with 30 drops the deposit was adherent even inside the cage.

TABLE VII.

C. Using ammonium sulphate and ammonia as electrolyte.
3 grms. of ammonium sulphate were added in each case with varying amounts of ammonia.
Wt. of zinc taken in each expt. = 0·2273 grm.

	Zinc found.	Error in mgs.	c.c. of aq.NH_3 ·880	Time in mins.	Current in amps.	Remarks.
1	—	—	2	60	2—2·5	Not all down and therefore not weighed. Bad spongy deposit.
*2	0·2269	−0·4	5	40	1·5 for 30 mins. 2·0 for 10 mins.	All down. Coarsely crystalline, not adherent.
3	0·2242	−3.1	10	45	1·5 for 20 mins. 2·0 for 30 mins.	All down. Not adherent. Low result due to deposit being rubbed off while drying.
†4	—	—	10	—	1·5—2	Very spongy inside cage, hard outside.
5	0·2257	−1·6	10	44	0·75 for 30 mins. 2·0 for 14 mins.	Trace left in. Deposit crystalline but not adherent.
6	—	—	20	55	2·5—3	Nearly all down in 20 mins.. then began to redissolve.
7	—	—	15	35	1·0	After 30 mins. deposit commenced to redissolve.

Method given up as unsatisfactory.

* Deposit showed no signs of being attacked when placed in water.
† No ammonium sulphate was added in this case.

TABLE VIII.

D. Using sodium hydroxide (10 *per cent. solution*) as electrolyte. Wt. of zinc taken in each expt. = 0·2273 grm.

	Zinc found.	Error in mgs.	c.c. NaOH Solution.	Time in mins.	Current in amps.	Remarks.
1	0·2280	+0·7	Till clear	50	1—1·5	All down.
2	0·2282	+0·9	27	40	1—1·5	All down.
3	0·2283	+1·0	30	60	1—1·5	All down.
*4	0·2270	—0·3	20 drops glacial acetic acid.	40	2	All down.

* This deposit was from the acetic acid electrolyte and was made as a control to the high deposits of 1, 2 and 3.

There was a slight "bloom" on the surface of these deposits which could be rubbed off, leaving a hard adherent deposit underneath. This bloom was probably largely zinc hydroxide (cf. Spear. J. Amer. Chem. Soc. 1910, 32, 533). and accounts for the high results obtained.

Spear, Wells, and Dyer (J. Amer. Chem. Soc., 1910, 32, 530) have confirmed the result obtained by one of us (Trans. Far. Soc. 1907, 3, 88) that when zinc is completely precipitated the results are almost invariably too high,* while Spear (J, Amer. Chem. Soc., 1910, 32, 533) has investigated the causes of these high results. He finds :—

1. That zinc deposits from neutral or dilute alkaline solutions have little or no metallic appearance and are frequently coated with a white deposit of oxide or hydroxide of zinc; while from strongly alkaline solutions they are grey to black depending upon the fineness of division of the metal.

These finely divided black deposits decompose water so rapidly, if sodium salts are present, that bubbles of hydrogen gas can be seen rising from the surface of the metal. If they are wet with water and then dried in a desiccator they increase in weight and become quite white.

2. That with neutral or slightly alkaline solutions the true cause of the high results is the deposition of zinc oxide or hydroxide with the zinc and is not due to formation of hydroxide, or oxidation during washing and drying.

The following experiments were made in order to observe the action of water on the various deposits obtained by us. The numbers refer to the deposits of Table VIII.

1. No hydrogen bubbles were observed on immersing in water for a short time.

2. On allowing the deposit to stand in water overnight the gauze was found to be covered with bubbles and a steady but slow stream of gas was being given off. Electrode and deposit dried and reweighed showed an increase in weight of 9·3 mg.

3 and 4 were each left in water for 16 hours.

In the case of (3) the liquid appeared clear, but when acidified and tested with potassium ferrocyanide it gave a cloudiness showing the presence of zinc in solution. The electrode dried and reweighed showed an increase in weight of 11·7 mg.

4. Gas bubbles were observed on the gauze but there was no steady stream of gas as above. However, the solution was slightly cloudy. This cleared on acidifying and the solution gave a cloudiness with potassium ferrocyanide. The electrode dried and reweighed showed an increase in weight of 8·6 mg.

A similar deposit from the same electrolyte (acetate) as (4) after immersion in water for one hour, on washing with alcohol and drying in the usual way showed an increase in weight of 0·6 mg.

Our interpretation of these results agrees with that of Spear, viz., that the high results obtained with alkaline solutions are due to the deposition of zinc oxide or hydroxide along with the zinc. The action of water on the deposit is not sufficiently rapid to account for the high results obtained with these solutions. Some confirmation of this is obtained from the fact that in no case was a high result obtained (the zinc being all deposited) from the acetic acid electrolyte although the deposits were washed and dried under the same conditions as those from the alkaline electrolyte; yet, the action of water on deposits from the former appears to be almost as great as on the latter.

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* This statement applied only to deposits obtained from alkaline solutions or when using an unsilvered cathode. With silvered cathode and using sodium acetate and acetic acid electrolyte the results were satisfactory.

As the result of our work on rapid electro-analysis with stationary electrodes we have come to the following conclusions.

(1) The tap-funnel may be satisfactorily adapted for use with stationary electrodes in the deposition of copper, nickel, and zinc.

(2). With the type of stationary electrodes used with the tap-funnel (cathode B), a concentration of less than 1 c.c. of nitric acid per 70 c.c. of electrolyte is inadvisable, while a concentration of 2 c.c. of nitric acid may be used with advantage.

(3). With a sufficient amount of nitric acid, previous heating of the electrolyte is unnecessary, but a final temperature of 60°—70° does not prevent the deposition of the copper with 2 c.c. of nitric acid per 70 c.c. of electrolyte.

(4). Zinc may be deposited satisfactorily from the sodium sulphate,sodium acetate,acetic acid electrolyte, about 0·5 c.c. of glacial acetic acid per 70 c.c. of electrolyte giving the most favourable results.

(5). After an extended experience of both stationary and rotating electrodes, we are of the opinion that the latter are to be preferred in actual practice.

Discussion.

Mr. C. **Leigh** asked what current was used with the stationary cathodes. With regard to the use of the funnel he thought the beaker was equally good if proper means were adopted for taking the cathode out quickly. That was essential, and could easily be done. The cathode should be washed instantly in not less than 750 c.c. of water. The beaker was convenient where it was necessary to weigh out large quantities, and seemed more suitable for a commercial laboratory than the tap-funnel.

Mr. W. E. **Hughes** observed that on the deposition of zinc and copper from brass he had used the methods described by the authors in their former paper on brass analysis, but had not found the deposition of zinc quite satisfactory. He, and others, had found that not only were the results high, but that the deposit was not particularly good. Had he taken the right proportion of acetic acid—about 1 c.c. He had used 3 c.c. of 1·42 nitric acid, and 80 c.c. of electrolyte, to deposit about 0·85 grm. of copper; then he got good results which agreed well with others determined by ordinary analytical methods independently obtained. Had Dr. Price, from his experience, any objection to the use of that quantity of nitric acid? It was found in practice, in nickel-plating works, that it was almost impossible to get a good white or silvery deposit when ammonia was used. He constantly used the tap-funnel in electro-analysis, but he almost always got a certain leakage through the tap, and this, although he had obtained the apparatus from several different firms. That was a source of error which had to be guarded against, when using the tap-funnel.

Dr. H. W. **Brownsdon** inquired whether Dr. Price had examined the physical properties of copper obtained by using his stationary electrodes and high current densities. The obtaining of dense tough copper deposits at high current densities on a commercial scale by agitation of the electrolyte and the use of either rotating or moving cathodes was such an interesting application of an analytical to a commercial process, that it would be interesting to know if the use of stationary electrodes at high current densities held out any hope of successful commercial application. Since at high current densities agitation of the electrolyte was necessary in order to maintain as high a concentration as possible of the cathions round the cathode, it seemed somewhat difficult to understand how that concentration was to be satisfactorily maintained by the use of stationary electrodes. He suggested that the ingenious device used by the authors for bringing the electrolyte which collected at the base of the tap-funnel into the field of electrolytic action, might be also used for blowing a more or less continuous stream of air bubbles up through the electrolyte so as to ensure its more complete agitation, and thus make possible the use of a higher current density with a corresponding curtailment of the time required for an analysis.

Dr. **Price**, in reply, pointed out that where high current densities were used it was essential to have a vigorous stirring of the electrolyte by rotating electrodes or by magnetic rotation of the electrolyte, otherwise the copper in the immediate neighbourhood of the electrode would be used up, and it could not be replaced by diffusion, except comparatively slowly. The potential rose at the electrode and hydrogen was evolved. With copper therefore a spongy deposit resulted. The respective advantages of beaker and funnel were a matter of controversy; but personally he had given up the use of beakers wherever possible. In his judgment they were not as convenient as the funnel. He never liked weighing a beaker in the balance; neither did he agree as to the advisability of lifting the deposit out of the electrolyte and dipping it in water. The amount of copper dissolved does not depend on the volume of water into which the electrode is dipped, since the acid clinging to the electrode dissolves the copper during the transference of the electrode from the beaker to the water. As to the determination of zinc being unsatisfactory in the brass, Mr. Humphreys daily used the method with perfectly satisfactory results. Zinc was about the worst common metal with which to obtain good results. Acetic acid was necessary in order to do away with the hydroxide that might be suspended in the electrolyte. He did not think it was necessary to use as much as one c.c. The nickel deposit had been white deposits generally, with an occasional brown one. When ammonium borate was added to the electrolyte, as given in Mollwo Perkin's book on electro-analysis, the deposit was generally white, at all events with stationary electrodes. He did not find leakage with the funnels he used, but it was necessary to choose them very carefully.

Manchester Section.

Meeting held at Manchester on Friday, March 10th, 1911.

MR. R. H. CLAYTON IN THE CHAIR.

PERTITANIC ACID AND ITS INFLUENCE ON THE VOLUMETRIC ESTIMATION OF IRON IN TITANIFEROUS MINERALS.

BY EDMUND KNECHT AND EVA HIBBERT.

The direct estimation of ferric iron in presence of titanic salts presents no difficulty if any of the recognised reduction methods (stannous chloride, sodium hydrosulphite, or titanous chloride) are employed.

If, however, refractory titaniferous minerals or ores have to be dealt with, fusion has to be resorted to and under certain conditions this operation may give rise to erroneous results. The ordinary method of fusing with soda or fusion mixture in a platinum crucible having been found too slow and uncertain, recourse was made to fusing with caustic potash in a nickel crucible or dish. In this way it was found that minerals like rutile and ilmenite were completely resolved by heating over a Bunsen burner for 10 minutes. The melt is then taken up with water, transferred to a beaker and strongly acidulated with hydrochloric or sulphuric acid, when both iron and titanium pass into solution. At this stage it was noticed that the solution always showed a characteristic orange colour which was quite distinct from the yellow colour of ferric salts. Further examination showed that the colour was due to the presence of pertitanic acid (TiO_3), which if not destroyed before the titration, would necessarily bring about too high a result in the iron estimation. The highest amounts of pertitanic acid formed in this way were invariably observed when nickel vessels had been used for the fusion; in silver vessels, the amount formed was very small.

It was first attempted to get rid of the pertitanic acid, previous to titrating the iron with titanous chloride in presence of potassium sulphocyanide, by adding titanous chloride until the orange colour had disappeared (Knecht and Hibbert, Ber., 1905, 3324), but the end-point was unsatisfactory on account of the presence of ferric salt. Ultimately the difficulty was completely overcome by strongly acidulating the melt (after transferring from the nickel dish to a beaker) with sulphuric acid and then running in permanganate until a faint pink colour persisted. Under these conditions the pertitanic acid acts like hydrogen peroxide and is reduced by the permanganate to the condition of titanic oxide, with evolution of oxygen.

In order to prove that the reaction is quantitative, 10 c.c. of a solution of hydrogen peroxide of known strength were mixed with 25 c.c. of iron alum solution of known strength. The solution was then acidulated with dilute sulphuric acid, warmed slightly, and dilute permanganate run in until a permanent pink colour resulted. Potassium sulphocyanide was then added and the iron was titrated with standard titanous chloride. In this way 99·8 per cent. of the iron added was found by experiment. Another 10 c.c. of the hydrogen peroxide solution and 25 c.c. of the iron alum solution were then mixed and titrated with titanous chloride which estimates the two together. This accounted for 99·7 per cent. of the hydrogen peroxide present.

The amount of pertitanic acid formed is not inconsiderable, especially if the fusion be continued for any length of time. Thus with an ilmenite containing 39·2 per cent. of titanic oxide and 48·8 per cent. of ferric oxide, which was fused with caustic potash for 7 minutes, 2·2 per cent. of pertitanic acid (calculated on the titanic oxide present) were found. A sample of rutile containing 91·07 per cent. of titanic oxide and 2·72 per cent. of ferric oxide, which was fused for 20 minutes, gave 14·52, and in another 11.88 per cent. of pertitanic acid (also calculated on the titanic oxide present).

The formation of the pertitanic acid does not seem to depend upon the presence of iron, for pure titanic oxide prepared from potassium titanium fluoride also gave it (13·2 per cent.).

BLEACHING FAULTS: THE TENDERING OF LINEN FABRICS IN PRESENCE OF METALLIC COPPER.

BY J. F. BRIGGS.

The number of this Journal dated February 28, 1911, page 188, contains a paper by Mr. S. H. Higgins on the tendering of linen fabrics during the bleaching process, owing to the presence of oily threads. I have been familiar with this fault for some years, although, fortunately for the bleachers, it cannot be described as of frequent occurrence. The characteristics of the damage are accurately described by Higgins, who correctly diagnoses its association with the presence of copper. But neither the author nor Ulzer and Ziffer (this J., 1910, 811) whom he quotes, have offered quite a satisfactory explanation of the nature and origin of the fault.

As stated by Higgins, the damaged portions of the cloth, when examined microscopically, show the presence of minute black grains embedded among the fibres of the yarn. These grains do not, however, as a rule, consist of copper oxide, as suggested, nor are they produced by the decomposition of a fatty copper soap; they are composed essentially of metallic copper, which before bleaching existed as particles of brass.

Although it is possible that, in some cases, these particles may be superficially oxidised, in my experience the damaged cloth shows no immediate reaction when treated with a solution of potassium ferrocyanide acidified with hydrochloric acid. On the other hand, the presence of metallic copper may be very strikingly demonstrated by the following experiment:—A cutting of the bleached cloth, including the damaged zone, is damped with water and squeezed. It is then exposed in a covered beaker to the action of an atmosphere of chlorine gas for half an hour. The cloth is next slightly dried without washing and placed in a solution of ferrocyanide. It immediately becomes sprinkled with red spots all along the damaged zone where the copper has been locally attacked by the action of the chlorine.

The means by which the particles of copper (originally brass) have been introduced into the yarn is undoubtedly the lubricating oil, either of the spinning or weaving machinery. It is well known that any lubricant, if used sparingly and for a long time, *i.e.*, if lubrication be neglected, becomes charged, by the friction of the metallic surfaces, with minute particles of the metals it has been lubricating. Thus the presence of grains of brass among the fibres is very simply explained, without recourse to the assumption that vegetable oils, containing copper compounds in a diffused form, have been employed.

The degree of tenderness (formation of oxycellulose) is always proportional to the intensity of the copper reaction found after exposure to chlorine gas. The result of the presence of a metal in contact with cellulose under the action of bleaching liquor has been ably investigated in a paper published by A. D. White (this J., 1903, 132—134). The metal induces a rapid decomposition of the hypochlorite with the local production of oxycellulose. According to White's researches, metallic iron in contact with the fabric, produces a similar effect, but the oxide appears to be harmless.

I have never encountered a similar case of damage in which the tendering was associated with particles of iron, although these must be present in stale lubricating oil at least as frequently as brass. I attribute this immunity to the use of the "black sour"—treatment with hydrochloric acid after boiling with lime—which is sufficiently strong to dissolve the minute particles of iron before the cloth is subjected to the bleaching liquor. Nothing short of a sharp sour with nitric acid could perform a similar service in the case of particles of brass, and this, on account of its cost and the comparative rarity of the necessity, is practically inadmissible.

The cause, therefore, of the trouble is neglected lubrication with undue friction and accumulation of dirty oil, and the question as between mineral and vegetable lubricants hardly arises. It is a manufacturer's fault, and the bleacher is powerless either to foresee it or to remedy it.

In conclusion I should mention another form of contamination by lubricant, which takes the form of black threads absolutely resistant to the ordinary bleaching operations. These black threads are due to the use of graphite lubricants, and whereas the grease is removed in the course of bleaching, the deposit of graphite remains embedded in the yarn. Such black threads are, of course, absolutely harmless, provided they are free from metal particles, and they are easily removed from the bleached cloth by hand-washing.

ERRATUM.

This Journal, Feb. 28, 1911, page 185, column 1, line 29, *for* "1 per cent." *read* "0·1 per cent."

Newcastle Section.

Meeting held at Armstrong College on Thursday, March 16th, 1911.

MR. N. H. MARTIN IN THE CHAIR.

A RAPID METHOD FOR THE ESTIMATION OF SULPHUR IN COAL GAS, OR OF AMMONIUM SULPHATE.

BY H. BLAIR.

Ammonia can be determined with rapidity and accuracy by making use of the well-known reaction of Malfatti—the formation of hexamethylenetetramine and liberation of acid by treating a solution of an ammonium compound with formaldehyde; the reaction proceeds quantitatively according to the reaction:

$$4NH_4Cl + 6CH_2O = N_4(CH_2)_6 + 4HCl + 6H_2O$$

and the acid liberated can be titrated with standard alkali, using phenolphthalein as an indicator.

Determination of sulphur in coal gas.—The liquor obtained in the "Referee's test" is made up to 500 c.c. and 50 c.c. boiled for two or three minutes to get rid of carbon dioxide; to the hot solution 10 c.c. of a neutral formaldehyde solution (of about 30 per cent. strength) are added, and the solution is at once titrated with $N/10$ caustic potash solution. 1 c.c. of this solution corresponds to 0·0247 grain of sulphur.

It is well to standardise the potash solution by means of a standard solution of ammonium sulphate containing a little ammonium carbonate.

The following figures show that the method gives concordant results, and although the determinations by barium sulphate are a little lower, the discrepancy is too small to be of any importance.

Sulphur in grains per 100 cubic feet.

Sample.	By barium sulphate.	By rapid method.
i.	4·53	4·923 5·211 5·058 Mean 5·064
ii.	10·19	10·89 10·89 10·665 11·115 Mean 10·89
*iii.	32·81	33·97 33·97 Mean 33·97
*iv.	24·98	24·80 25·29 Mean 25·04
*v.	27·46	27·72*
*vi. Redheugh Works	21·02	22·12*
*vii.	21·12	21·63*
*viii. Elswick	4·80	5·30*

* Figures kindly furnished by Mr. G. Weyman.

As the volume of potash used is considerable the method can be utilised for the determination of sulphur in a smaller volume (1 or 2 c. ft.) of gas and the whole operation can be completed in an hour. It is only necessary to burn a measured volume of the gas under a glass adapter and by means of a water pump draw the products of combustion through a solution of ammonium carbonate, which is then treated with formaldehyde as already described.

Determination of ammonium sulphate. The ammonium sulphate is dissolved in water and, as it is always acid, neutralised with standard caustic potash. An aliquot portion is then boiled for a few minutes, 10 c.c. of neutral formaldehyde solution added, and the liquid allowed to boil for a few seconds. Phenolphthalein is now added, and the hot solution titrated with $N/10$ caustic potash (of which 1 c.c. = 0·0049 H_2SO_4, 0·017 NH_3, 0·0066 $(NH_4)_2SO_4$).

Rapid method.		Barium sulphate method.
Ammonia per cent.		Ammonia per cent.
*1.	25·65	25·64
2.	25·14	25·16
3.	24·95	24·92
4.	24·78	24·77
5.	25·18	25·16

* This series made by Mr. G. Weyman.

AN UNUSUAL CAUSE OF RUSTING IN A SHIP-YARD.

BY F. C. GARRETT.

It is generally found that during the building of a ship rusting proceeds only so far that by the time she is ready to be painted the scale can easily be removed from the plates; a case recently occurred, however, in which the ship was so rusty that the extra scraping cost a very considerable sum, and the builders were uneasy lest the trouble should recur after completion. The ship in question lay by the eastern boundary of the yard, and it was found that another ship laid down about a quarter of a mile further west, and built of plates of the same make, was only slightly more rusty than usual, showing that the plates were not at fault, and suggesting that the cause of the rust was some substance wind-borne from the east.

Samples of rust were obtained from the two ships and 100 grms. of each were repeatedly extracted, in platinum dishes, with cold distilled water which had been collected in platinum. The *western* ship gave 0·342 grm. of a brown extract which slowly absorbed water from the air, while the *eastern* ship gave 0·804 grm. of a nearly white, and extremely deliquescent solid.

On analysis the following results were obtained:—

	Calcium	Magnesium	Chlorine	Chlorine calculated for the two metals
	Per cent.	Per cent.	Per cent.	Per cent.
East Ship	10·43	7·72	41·60	41·38
West Ship	5·68	4·24	21·78	20·70

The "western" rust therefore contained 0·1047 per cent. of the mixed magnesium and calcium chlorides and the "eastern" rust 0·478 per cent.; as there was at least twice as much rust on the eastern as on the western ship there must have been about ten times as much of the two chlorides per square foot of the former. Both these salts being deliquescent, and giving acid solutions the extra rusting was accounted for.

On inquiry it was found that excavation had been carried on just over the eastern boundary of the yard, that during this excavation some alkali waste had been disturbed, and that the men working on the ship had complained of the dust. I was not able to get a sample of this waste, but as the local limestones commonly contain much magnesium, and as the air was found to contain a chloride—probably as hydrogen chloride—this seems to have caused the trouble.

The ship has now been afloat for two years, and there has been no recurrence of the rusting.

Nottingham Section.

Meeting held at Nottingham on Wednesday, January 25th, 1911.

MR. S. J. PENTECOST IN THE CHAIR.

THE ACTION OF IODINE ON PHENOLS AND ITS APPLICATION TO THEIR VOLUMETRIC DETERMINATION.

PART I.—PHENOL, SALICYLIC ACID, BETA-NAPHTHOL.

BY JOHN M. WILKIE, B.SC., F.I.C.

At first sight this appears an uninviting field in view of the amount of work already published on the subject.

Although by general consent the Koppeschaar method gives excellent results, a number of workers have reported adversely on it from time to time. The trouble appears to be due to the use of solutions containing hypobromite. On this account it seems better to make the solution from pure sodium bromide and bromate, but excellent results are obtained if Koppeschaar's directions are followed—addition of bromine to sodium hyroxide solution and boiling down to a low volume (*cf.* Lloyd, this J., 1905, 155; Mascarelli, J. Chem. Soc., 1910, Abs. II. 353; Autenrieth and Beuttel, Archiv Pharm., 1910, 112). Lloyd's results and modifications of the Koppeschaar method have been adversely criticised by Olivier (Analyst, 1910, 134). The methods suggested for the determination of salicylic acid closely resemble those for phenol. Curiously enough it has taken quite a long time for it to be generally recognised that the final product of the action of bromine on salicylic acid is likewise tribromophenol or more correctly, tribromphenol bromide (*cf.* Autenrieth and Beuttel, *loc. cit.*; also Fellenberg, An. 1910, 437, who practically redescribes Freyer's method (An. 1897, 39); also Fresenius and Grünhut (this J., 1899, 714). Seidell (this J., 1909, 1166) states that the bromine method of Freyer is uncertain, and suggests a cumbersome method of titration in hydrochloric acid solution with an acid solution of bromine the salicylic acid solution being heated after each addition of bromine. Dibromosalicylic acid is stated to be formed almost quantitatively under these conditions.

Vaubel (Ann., 1896, 237) investigated the action of nascent bromine on β-naphthol dissolved in acetic acid and found that under these conditions two atoms of bromine were absorbed, and that the end reaction was well marked. Fahrion (Z. angew. Chem., 1901, 1221) obtained good results for β-naphthol using Waller's solution; cf. also Wake and Ingle (this J., 1908, 315).

An entirely new method for the determination of phenol and phenols generally was worked out by Messinger and Vortmann (*cf.* this J., 1890, 1070) in which decinormal iodine was added in excess to a hot alkaline solution of the phenol; after acidification residual iodine was determined in an aliquot part of the filtrate. Owing to a misconception of its limitations the Messinger and Vortmann process for salicylic acid was criticised most adversely by Fresenius and Grünhut (*loc. cit.*). Messinger (Jour. Prakt. Chem., **61**, 238) replied to their criticisms and shewed that if the method is carried out correctly good results are obtained.

Gardner and Hodgson (J. Chem. Soc., 1909, 1819) undertook primarily the determination of tannic acid, but they extended it to many other phenols. Excess of iodine was added to the dilute aqueous phenol solution, and after adding a few drops of starch solution aqueous soda was run in drop by drop until the blue colour of the starch iodide disappeared. Excess of acid was then added and the residual iodine titrated with thiosulphate. The phenols were classed in two groups: (*a*) Those which require two atoms of iodine for each hydroxl group present. Of this type are phenol, catechol, gallic acid, etc. (*b*) Those in which the absorption of iodine is "strictly quantitative but not molecular." Of this latter type salicylic acid is an interesting example.

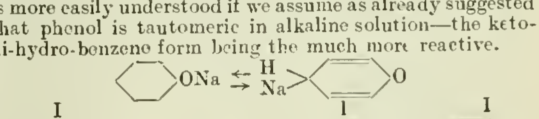
Working on Kahlbaum's pure acid Gardner and Hodgson found an absorption of 11 atoms of iodine per molecule (of gallotannic acid), and add "on the supposition that tannic acid may be regarded as digallic acid it may be assumed that the chain connecting the two benzene nuclei is reponsible for the absorption of the additional atom of iodine, the moleculer undergoing fission at the chain and forming two molecules of sodium gallate." But if the fission occurred in the manner suggested an absorption of two atoms is demanded, making 12 in all, and not 11. Working under the conditions adopted by me, the absorption corresponds to 12 atoms if allowance be made for the moisture content of the gallotannic acid.

With regard to the exact mode in which iodine attaches itself to the phenol it seems almost fair to assume from the statement on p. 1823 (*loc. cit.*) that in the opinion of Gardner and Hodgson the reaction involved is fundamentally, $ROH + 2I = ROI + HI$. But, as will be shown, the typical phenol itself does not react in this manner, for three atoms of iodine enter the nucleus and the hydroxyl group is maintained intact, the primary product being tri-iodophenol ($OH : I : I : I = 1 : 2 : 4 : 6$). It occurred to me that the best way to show definitely that the action of iodine on phenols in alkaline solution depends merely on the extra reactivity due to the presence of the hydroxyl group and not on any interaction with the hydroxyl itself would be to find a phenol in which the direct action of iodine gives a quantitative yield of a mono-iodophenol. β-Naphthol was found to be such a substance. In this connection the results previously obtained by Fahrion for *m*-cresol and β-naphthol (*loc. cit.*) and by Wake and Ingle for phenol, carvacrol and β-naphthol (*loc. cit.*) are not available because the absorption of iodine occurred in the presence of a second halogen (chlorine) and in the absence of alkali.. Attention is drawn specially to this because Messinger and Vortmann (*loc. cit.*) found that three atoms of iodine were absorbed by two molecules of β-naphthol, and considered that the product of the reaction was the somewhat extraordinary substance dinapthyl di-iodide of the formula, $IO.C_{10}H_6.C_{10}H_6.OI$, more correctly an iodoso derivative.

Although, so far, I have not come across the statement in literature, a dilute aqueous solution of β-naphthol on treatment with decinormal iodine gives an abundant crystalline precipitate of 1.2-iodo-oxy-naphthalene. In this connection it is to be mentioned that Jorrissen (Analyst, 1902, 257) uses iodine to distinguish α- and β-naphthols. β-Naphthol gives a clear solution, whilst α-naphthol gives a violet coloration. This precipitation of iodo-β-naphthol in neutral solution does not go to completion at ordinary temperatures, although 90 per cent. of the theoretical amount of iodine is absorbed in five minutes. The same reaction proceeds much more rapidly in alkaline solution provided the alkali hydroxide does not exceed one molecule per molecule of naphthol. About 90 per cent. of the theoretical amount of iodine is absorbed in five minutes, and if some hours are given for the reaction the results are quantitative. This then somewhat conclusively proves that the hydroxyl as such does not enter into the reaction, and that the essential condition governing reaction is the reactivity of the phenol. This last point is well illustrated by consideration of salicylic acid and its acetyl ester. Salicylic acid was found in all essential features to behave precisely as phenol itself—three atoms of iodine are absorbed and the product of the reaction is as with phenol, 2.4.6-tri-iodo phenol. But with the acetyl ester if care is taken to avoid hydrolysis no absorption of iodine occurs. One gram of the ester was dissolved by shaking in a litre of cold water. 30 c.c. of this solution absorbed only 0·09 c.c. of $N/10$ iodine, whereas on hydrolysis the same amount of ester absorbed under similar conditions 10·01 c.c. $N/10$ iodine (theoretically, 10·0 c.c. are required).

The non-reactivity of the acetyl ester of salicylic acid appears to receive its most satisfactory explanation if we postulate that phenol in alkaline solution is tautomeric (cf. Wake and Ingle, this J., 1908, 316).

This assumption receives considerable support from a consideration of the *final* product of the action of iodine on phenol itself. Lautemann (Annalen, 1861, 120, 309; *cf.* also Benzinger and Kämmerer, Ber. xi., 557; Bougault, J.C.S., 1908, Abs. II., 738) has shown that the final product in alkaline solution is a red, highly insoluble substance, tetra-iodo-di-phenylene quinone $(C_6H_2I_2O)_2$. The exceedingly ready conversion of 2.4.6-tri-iodophenol into this red quinonic substance does not appear to have been recognised. What led me to investigate the matter was that the reaction product of cold iodine solution on phenol and salicylic acid was at times tinted pink, the colour rapidly deepening as the reaction period was prolonged. It was ultimately found that with five minutes' reaction time the product was wholly tri-iodophenol, but with 20 minutes the conversion to the red quinone was practically complete (at least 95 per cent.). This ready conversion is more easily understood if we assume as already suggested that phenol is tautomeric in alkaline solution—the keto-di-hydro-benzene form being the much more reactive.



The behaviour of *p*-phenolsulphonic acid gives further support to the idea of tautomerism in the phenols. On treatment of the sodium salt as for salicylic acid the action is much slower, but is complete in 20 to 30 minutes against five minutes for salicylic acid or phenol. Four atoms of iodine react, two going to the nucleus presumably to form a soluble di-iodo-sulphonic acid; no further absorption of iodine occurs on standing for days, and in no case was any quinone produced, since no precipitation occurred on making acid prior to titrating the excess of iodine. The retarding action of the sulphonic group in the para position and the total inhibition of quinone formation is in agreement with theory.

The only practical iodometric method hitherto suggested for the determination of phenols is that of Messinger and Vortmann (*loc. cit.*). The phenol solution, which must contain a certain minimal amount of alkali hydroxide, is heated to about 60° C. and decinormal iodine added in portions, with shaking, until the supernatant liquor after subsidence of the precipitated iodo derivatives is of a deep yellow colour. When cold, excess of sulphuric acid is added and the residual iodine is determined in an aliquot part of the filtrate. Kossler and Penny (J. Chem. Soc., 1893, Abs. II. 100) state that for complete reaction somewhat over three molecules of sodium hydroxide per molecule of phenol and five c.c. of decinormal iodine over that necessary for the production of hypoiodite are required. It will be seen that this process of Messinger and Vortmann requires some considerable care in carrying out and that good results are only obtainable provided certain relationships exist between the amount of phenol, alkali hydroxide, and iodine present. This appears to demand that two titrations should be made—the first to give a rough idea of the amount of phenol present, the second to give a more accurate result when the correct amounts of alkali and iodine have been added. The method has been largely used for the determination of minute amounts of phenol in urine, gas liquors, etc. The requirements for a correct iodometric method for the determination of phenol and allied substances are that the reaction involved should be molecular and reach completion rapidly in the cold; within limits it should be independent of the excess of iodine and if carried out in alkaline solution the amount of alkali to be added should be independent of the quantity of phenol present. In addition, it would be advantageous if the reaction product were soluble in the alkaline iodine solution so as to eliminate irregularities due to occlusion of iodine or phenol and so render shaking unnecessary. The method ultimately worked out fulfils practically all these requirements. To 0·01175 grm. of phenol dissolved in about 100 c.c. of water, was added 15 c.c. of $N/10$ iodine, and then 15 c.c. $N/10$ soda solution; after a given time an excess of sulphuric acid (15 c.c. $N/1$) was added and the unabsorbed iodine titrated with thiosulphate. In one series of experiments 7·0, 7·2, 7·3 c.c. of $N/10$ iodine was absorbed for respective intervals of 5, 10, and 30 minutes (Theory for $C_6H_2I_3OH = 7{\cdot}5$). These and all subsequent experiments, unless the contrary is specially stated, were carried out at laboratory temperature; the standard phenol solution used contained 1/40th molecular weight per litre (2·351 grm.), so that 1 c.c. $= 1{\cdot}5$ c.c. of $N/10$ iodine. The phenol used in the preparation of the standard solution was "pure detached crystals" of commerce. The fraction distilling at 183° C. was collected under such conditions as to exclude access of moisture. The diluting water in the experiments was added uniformly at about 20° C. (19—25°) but otherwise no attention was paid to temperature.

The following table gives some further results :—

$N/10$ Phenol.	$N/10$ Iodine added.	$N/10$ caustic soda added.	Vol. iodine : vol. caustic soda.	Time of standing.	Excess of iodine.	$N/10$ Iodine absorbed.
c.c.	c.c.	c.c.			Per cen .	c.c.
15·0	30·0	15·0	2	5 mins.	100	14·7
7·5	30·0	12·5	2·4	5 ,,	300	7·4
7·5	15·0	6·25	2·4	5 ,,	100	7·4
15·0	30·0	10·0	3	5 ,,	100	14·7
15·0	15·0	7·5	2	5 ,,	0	12·4
15·0	30·0	12·5	2·4	5 ,,	100	14·6

No precipitation prior to acidification occurred except in (4).
1 c.c. $N/10$ phenol $= \frac{0{\cdot}0094 \text{ grm.}}{6}$ of phenol.

150 c.c. of water was added in all the experiments.

The high absorption of iodine in (5) is noteworthy considering the amount initially added.

The above results suggested the substitution of sodium carbonate for hydroxide and the results obtained were so satisfactory that it was used in all subsequent determinations. (In a few experiments sodium bicarbonate was tried but as no special advantages were revealed its use was not persisted with.)

$N/10$ Phenol.	$N/10$ Iodine added.	$N/10$ sod. carb. added	Vol. iodine : vol. sod. carb.	Time of standing.	Excess of iodine.	$N/10$ Iodine absorbed.
c.c.	c.c.				Per cent.	c.c.
7·50	15·0	15·0	1	15 mins.	100	7·54
7·50	15·0	15·0	1	12 ,,	100	7·47
7·50	15·0	15·0	1	9 ,,	100	7·54
7·50	15·0	15·0	1	5 ,,	100	7·56
7·50	15·0	15·0	1	5 ,,	100	7·53
7·50	15·0	15·0	1	105 ,,	100	7·43
7·50	15·0	15·0	1	5 ,,	100	7·50
7·50	12·0	12·0	1	5 ,,	60	7·49
7·50	11·0	11·0	1	5 ,,	50	7·43

These results are given in detail to illustrate what results may be expected when no special precautions are taken as to calibration of burettes, temperature of measurement, etc. The last three experiments were carried out more carefully to illustrate the effect of diminished excess of iodine.

A great number of determinations have been made with phenol and these have uniformly shown that with a reaction period of 5—10 minutes excellent results are obtained. With more prolonged reaction periods high results are obtained, the maximum divergence being about 1—2 per cent.—thus for 0·25, 0·33, 2 and 19 hours standing the highest result obtained was 102·4 per cent. (15·36 c.c. of $N/10$ instead of 15·00). This distinct indication of a slight absorption of iodine beyond that required for the formation of tri-iodo phenol or tetra-iododiphenylene quinone is of some interest.

The following experiments shew the rapid nature of the reaction :—6·26, 7·09, 7·34 c.c. of $N/10$ iodine were absorbed in ½, 1, and 3 minutes, the full absorption being 7·5 c.c.—which is reached as already shown, in five minutes (excess of iodine in these experiments was 100 per cent.). The method is available for very small amounts of phenol in the presence of large volumes of water. In two experiments 0·00235 grm. phenol was dissolved in 150 and 500 c.c. of water respectively, 5 c.c. of $N/10$ iodine and 5 c.c. of $N/10$ sodium carbonate were added to each and the excess of iodine determined after five minutes. In each case 1·48 c.c. of $N/10$ iodine was absorbed $= 98{\cdot}7$ per cent. of theory (1·5 c.c. $N/10$). At such high dilutions two opposing sources of error require consideration—the air effect, $2HI + O = H_2O + I_2$, which tends low, and the effect due to the presence of oxidisable matter leading to high results. With the distilled water at my disposal the first effect alone has to be considered. Thus 10 c.c. of $N/10$ iodine, 10 c.c. of $N/10$ sodium carbonate with 1000 c.c. of the same water treated as in the manner just described required 10·08 c.c. of $N/10$ thiosulphate. It might be mentioned here that the decinormal sodium carbonate does not require to be prepared with any high degree of accuracy and is in no sense to be regarded as a standard solution, for measuring purposes the ordinary graduated cylinders of the laboratory answer quite well.

It is of interest to note that even in the absence of any final excess of iodine the reaction goes to completion provided long enough time be given. Thus when 15 c.c. of $N/10$ phenol was treated with 15·0 c.c. of $N/10$ iodine and sodium carbonate in the usual manner, 13·0 c.c. was absorbed in 5 minutes and 14·7 c.c. in 17 hours and with 18·0 c.c. of $N/10$ iodine 14·9 c.c. was absorbed in 16 hours. With limited amounts of iodine tri-iodo-phenol separates in distinct crystals during the alkaline stage. This will be referred to again later.

Quite early it was noticed that after the excess of iodine had been removed by thiosulphate the precipitated tri-iodo-phenol was at times of a distinct pink tint—in some cases when the reaction period had been prolonged, quite a full red tint was reached, due, as already stated, to the more or less complete conversion of the tri-iodo-phenol to tetra-iodo-diphenylene quinone. From the following equations

$2C_6H_5OH+6I_2=2C_6H_2I_3OH+6HI$ (1).
$2C_6H_2I_3OH=(C_6H_2I_2O)_2+2HI$ (2)
$2C_6H_5OH+6I_2=(C_6H_2I_2O)_2+8HI$ (3).

it is seen that the consumption of iodine is the same whether tri-iodo phenol or tetra-iodo-diphenylene quinone or a mixture of both is the reaction product. This ready production of Lautemann's red substance in the cold was surprising, and the failure to obtain a good yield of tri-iodo phenol led me to investigate the matter early. 1·0 grm. of phenol had been dissolved in 500 c.c. of water—1000 c.c. of approximately $N/10$ iodine added and finally 500 c.c. of $N/5$ sodium carbonate. After about 30 minutes the mixture was acidified with sulphuric acid and excess of iodine discharged by means of sulphurous acid. The reaction product was of a deep red colour, and was practically insoluble in ether and other organic solvents. Bougault (*loc. cit.*) in his gravimetric method for the determination of salicylic acid obtains a quantitative yield of tetra-iodo-diphenylene-quinone by heating with iodine and sodium carbonate first on the water bath and finally boiling under a vertical condenser. Some work was therefore called for to determine the conversion rate at ordinary temperature. Consideration of equations (1) and (3) above shows that in the tri-iodo-phenol stage hydriodic acid is produced in amount corresponding to half the reacting iodine while in the quinone stage, the hydriodic acid corresponds to two-thirds of the iodine. In short, provided the full amount of iodine has been absorbed (6 atoms per molecule of phenol) the hydriodic acid may be used to determine the conversion rate. This can be done very conveniently by means of the iodide iodate reaction (*cf.* Ingle, this J., 1902, 587), the only doubt being whether this reaction was available in the presence of the carbon dioxide resulting from the sodium carbonate present. A preliminary experiment, however, gave very promising results. 0·0235 grm. of phenol dissolved in 100 c.c. of water was treated with 30 c.c. of $N/10$ iodine and an accurate 30 c.c. of $N/10$ sodium carbonate. After five minutes 30 c.c. of $N/10$ sulphuric acid was added, and the excess of iodine titrated with $N/10$ thiosulphate and starch; 5 c.c. of 2 per cent. potassium iodate solution was then added, and the iodine liberated titrated with thio. In the first titration 15·07 c.c. of $N/10$ thiosulphate was added, corresponding to an absorption of 14·93 c.c. of $N/10$ iodine (theory=15·00), and in the second 7·57 c.c. of $N/10$ thiosulphate was added, which in this case corresponds to the acid (hydriodic) produced since the sodium carbonate and the sulphuric acid were equivalent to each other. In a precisely similar experiment in which the reaction period was 20 minutes the iodine absorption was 15·34 c.c. of $N/10$ solution, and the acid corresponded to 10·18 c.c. of $N/10$. (Theoretical acid production for tri-iodophenol=7·5 c.c. of $N/10$; for $(C_6H_2I_2O)_2$=10·0 c.c. of $N/10$.) Assuming that the presence of carbon dioxide does not interfere, the conversion to the quinone would appear from these experiments to be complete in 20 minutes in the cold. A blank experiment was then carried out with the same quantities of reagents, save that no phenol was added, and 37·5 c.c. $N/10$ sulphuric acid was added vice 30·0 c.c. In the iodine titration 30·02 c.c. of $N/10$ thiosulphate was required, and after addition of iodate 7·65 c.c. of $N/10$ instead of 7·50; the effect due to carbon dioxide is thus quite small but appreciable. This explanation of the high values in the acid determinations receives support from experiments in which sodium hydroxide was substituted for the carbonate—13 c.c. of $N/10$ caustic soda was used instead of 30 c.c. of $N/10$ sodium carbonate. For five minutes standing the iodine absorption as 14·76 c.c. of $N/10$ and the acidity developed was 7·19 c.c. of $N/10$ for 20 minutes, and the respective figures were 15·16 and 9·44 c.c. of $N/10$. Making allowance for the fact that the liberated iodine was titrated immediately on addition of the iodate without any interval for the reaction to go to completion, these results are in good agreement with theory. This rapid conversion in cold feebly alkaline solutions is noteworthy. The effect of temperature has not been investigated with any degree of completeness, but it was incidentally observed that low temperatures distinctly retarded the absorption of iodine. At 10° C. 7·35 c.c. of $N/10$ was found, and at 40° C. 7·56 c.c. instead of 7·50 in each case. In an experiment carried out as near 100° C. as possible, 15·07 c.c. of $N/10$ were obtained instead of 15·0—in this case judging from the colour conversion to the quinone was complete in the five minutes. As already mentioned, the most convenient plan is to carry out the reaction in the neighbourhood of 20° C.

As is well known, phenol absorbs very little iodine in the absence of alkali, and in the presence of acid the absorption is negligible. In fact it is quite practicable to determine phenol iodo-metrically in the presence of sulphites if advantage be taken of this behaviour.

The diminished absorption in the presence of excessive alkali is well shown in the following experiments. Five quantities of 0·01175 grm. of phenol in 150 c.c. of water were treated in each case with 15 c.c. of $N/10$ iodine and with 15, 10, 5, 2·5, 1·5 c.c. of *normal* soda respectively. In five minutes the respective iodine absorptions were 4·2, 4·5, 5·2, 5·5, 6·6 c.c. of $N/10$. (Theory for $C_6H_2I_3OH$ =7·5 c.c. of $N/10$). These results throw some light on the method of working of Messrs. Gardner and Hodgson. In the first experiment the amount of soda is such that no blue colour is given by starch, but in the other cases too little soda is present to discharge the blue colour. In order to eliminate the time factor the soda was added in one portion and not drop by drop, in the last three experiments the equivalent amount of decinormal soda being used. It is to be noted that in every case the absorption of iodine is largely in excess of that corresponding to two atoms per molecule. To recapitulate, the method of determination recommended is as follows. To the dilute phenol solution is added equal volumes of decinormal iodine and sodium carbonate. After five minutes excess of sulphuric acid is added, and the residual iodine titrated with decinormal sodium thiosulphate and starch. Should too little iodine have been added this is indicated by pronounced fading of the brown colour due to the iodine, and in extreme cases by precipitation of tri-iodo-phenol—in such circumstances more iodine and sodium carbonate is to be added, and the determination completed in the usual manner, after five minutes standing. In the general case not more than half the added iodine should enter into reaction. The determination is most conveniently carried out in stoppered bottles.

Salicylic acid.—As already mentioned, Bougault (*loc. cit.*) has obtained excellent results by converting salicylic acid by boiling with iodine and sodium carbonate, into tetra-iododiphenylene quinone and weighing as such. It was therefore somewhat confidently hoped that no trouble would be experienced in arranging conditions so that the formation of tri-iodophenol and its conversion product, tetra-iodo-diphenylene quinone, would be realised in two separate stages just as for phenol, the first named substance being the sole or predominating product in five minutes' contact and the second in a somewhat longer period. This was found indeed to be the case provided the sodium salt was taken as the starting point and not the free acid. 2·301 grms. of the pure acid after powdering and drying, was dissolved in 16,7 c.c. normal sodium hydroxide and the volume adjusted to 1,000 c.c. Of this solution 15 c.c. was transferred to a stoppered bottle, 150 c.c. of water at 20° C. added, and then 30 c.c. each of decinormal iodine and sodium carbonate. After five minutes excess of sulphuric acid was added and the residual iodine titrated with thiosulphate and starch; 14·98 c.c. of $N/10$ iodine was found to have been absorbed corresponding to 99·9 per cent. (theory=15·00 c.c. of $N/10$).

Equally satisfactory results have been obtained with sodium salicylate, the phenyl ester (salol), the methyl ester, and many other derivatives.

Preparation of 2·4·6 *tri-iodophenol from phenol and salicylic acid*—One grm. of phenol dissolved in about 500 c.c. of water was treated with 1000 c.c. of approximately $N/10$ iodine, and 14·3 grms. of sodium carbonate crystals dissolved in about 500 c.c. of water. After five minutes sulphuric acid was added and excess of iodine removed by the cautious addition of sulphurous acid. The precipitated iodo compound was shaken out with ether, in which it immediately dissolved. After washing with water the ethereal solution was washed with water and filtered to remove an insignificant trace of Lautemann's red substance, and finally evaporated to dryness on the water-bath. During removal of the last traces of ether the whole solidified to a crystalline mass of which the melting point after drying was 155° C. This m.pt. is in good agreement with the usually accepted figure of 156°. No alteration was produced by crystallisation from dilute alcohol, the same figure 155° being obtained.

Tri-iodophenol was then prepared from sodium salicylate in the same manner, and the product had the identical melting point (155° C., uncorrected).

These results, together with the consumption of iodine and development of acidity previously given, do not leave much doubt that the primary product of the reaction is 2·4·6-tri-iodophenol. To exclude possibiity of error the iodine content of the two products obtained from phenol and salicylic acid respectively was determined by Pringsheim's method (this J., 1909, 44). 0·2359 grm. was intimately mixed with 0·1 grm. of pure sucrose and then with 6 grms. of pure sodium peroxide (Kahlbaum). After firing in the usual manner the alkaline solution was boiled to expel oxygen, and thoroughly cooled. Excess of cold dilute nitric acid was then added and the liberated iodine cautiously decolorised by means of sodium sulphite solution added drop by drop until a permanently colourless solution resulted, in which iodine was determined by Volhard's method. With both products 14·8 c.c. of *N*/10 silver nitrate were required, corresponding to 98·7 per cent. of theory (15·0 c.c. of *N*/10).

In sodium peroxide fusions by the Pringsheim method (*loc. cit.*) a nickel crucible is very much better than the iron crucible recommended. Under the specified conditions of Pringsheim (firing by means of a hot iron wire inserted through a hole in the crucible lid, the crucible being immersed in water) no corrosion of the nickel occurs. The polished metal surface is retained in a surprising fashion and though no weighings have been made I am of opinion that the crucible does not lose weight.

Since the iodine contents of tri-iodophenol and tetra-iodo-diphenylene quinone are distinctly different (80·7 per cent. and 73·8 per cent.) it appeared desirable to ascertain whether the somewhat low iodine content previously found for tri-iodophenol was due to the mode of determination used by me. Accordingly some of the red substance was prepared from salicylic acid in the manner already described, an hour's contact in the cold being given. After acidification and addition of the requisite amount of sulphurous acid the insoluble red substance was collected on a filter and washed with boiling water until free from sulphate, and finally dried in the water-oven. 0·172 grm., after oxidation with sodium peroxide, required 9·84 c.c. of *N*/10 silver nitrate instead of the theoretical 10·0 c.c. It would thus appear that my specimen contained no tri-iodophenol, and that Pringsheim's method in the form adopted by me gives somewhat low results. At this stage attention should be drawn to the fact that in none of my experiments did precipitation of the red substance occur in alkaline solution, although Benzinger and Kämmerer, and later Bougault (*loc. cit.*), find this to occur in boiling alkaline solution. In some cases the alkaline solutions stood for many weeks without precipitation occurring, and the only effect of adding sodium sulphite solution to remove excess of iodine was to allow the fine crimson colour of the solution to appear which was previously obscured by the iodine.

When highly diluted these coloured solutions are not precipitated by acids even on boiling, but repeated filtration through close-textured filter paper removes the coloured substance (the quinone). The solutions are probably colloidal in nature.

β-Naphthol has already been referred to as being noteworthy for giving an almost quantitative yield of 1.2-iodo-oxy-naphthalene when its aqueous solution is treated with decinormal iodine in the cold. In the presence of the slightest excess of alkali hydroxide over that corresponding to the production of the sodium salt, a crystalline colourless product was no longer obtained, but instead the green amorphous product of Messinger and Vortmann. A great many experiments were carried out, and these showed that alkali carbonate was not available and even if the hydroxide was substituted the determination could not be carried out on the same lines as for phenol and salicylic acid. The effect of the alkali was not covered by the iodine so that the results obtained varied with the excess of iodine. Thus 0·072 grm. dissolved in 150 c c. of water and 5 c.c. of *N*/10 soda when treated with 20 c.c. of *N*/10 iodine gave a fine crystalline precipitate and in five minutes absorbed 9·76 c.c. of the iodine; 0·036 grm. when treated with the same amounts of soda (5 c.c.) and iodine 20 c.c.) absorbed 6·2 c.c. of the iodine in five minutes instead of the theoretical 5 c.c. and the product was dark and amorphous and showed no crystals at any stage. In the case of phenol and salicylic acid it is to be remembered that the absorption of iodine was independent of the iodine and alkali provided the excess exceeded 60 per cent. and the amount present corresponded to the theoretical equation,

$$Na_2CO_3 + I_2 + H_2O \rightleftarrows NaI + NaHCO_3 + HOI.$$

As it is so important that the alkali to be added should be independent of the precise amount of naphthol present, the plan of carrying out the absorption in practically neutral solution was tried and the results so obtained were much more satisfactory—reaction going to completion in the hot. 0·072 grm. was transferred to a Jena bottle in a volume of 150 c.c., 20 c.c. of *N*/10 iodine was added and two drops of *N*/1 soda. The stopper was secured and the bottle placed in a bath at 60° C. for 15 minutes. After cooling some sulphuric acid was added and the residual iodine titrated with thiosulphate in the usual manner—the absorbed iodine was 9·98 c.c. of *N*/10, corresponding to 99·8 per cent. of theory. When 0·036 grm. was treated with 20 c.c. of *N*/10 iodine solution under identical conditions the theoretical amount of iodine 5·00 c.c. of *N*/10 was absorbed, showing that working in this manner the amount of iodine absorbed is independent of the precise amount present.

In these determinations shaking is to be avoided as the iodo-naphthol separates as a layer of large crystals which float on the surface and low results are usually obtained. Without shaking fine crystals form throughout the mass of liquid, gradually sinking to the bottom of the container.

In practice it is very convenient to dissolve the naphthol in caustic alkali of known strength. Thus 1·44 grms. may be dissolved in 10 c.c. of *N*/1 soda, and if this solution is diluted to 200 c.c. it is decinormal to iodine. 10 c.c. are then transferred to a Jena bottle, 150 c.c. of water at laboratory temperature added and then 4 c.c. of *N*/10 sulphuric acid so as to leave a feebly alkaline solution. 20 c.c. of *N*/10 iodine are added and after standing 15 minutes in a bath of water at 55°—65° the determination is completed in the manner already described.

Some of the iodo compound was prepared in the cold in the manner already described. The melting point of the dry substance was found to be 94° C. instead of 94·5°. The iodine content was determined in the manner already described and found to be in good agreement with theory.

It is my intention to extend the method if available to the determination of other phenols, and trust to bring my results before the Society in due course.

In conclusion, I wish to express my hearty thanks to Messrs. Boots, Ltd., in whose laboratory the work was carried out.

A SENSITIVE TEST FOR THE DETECTION OF PHENOL AND SALICYLIC ACID.

BY JOHN M. WILKIE, B.SC., F.I.C.

In the course of my investigation of the action of iodine on phenols (preceding) my attention was forcibly drawn to the bulky nature of the precipitates of tri-iodophenol obtained from comparatively trifling amounts of phenol. It therefore appeared not unlikely that the formation of this compound would prove of service for the qualitative detection of phenol and presumably of other allied products.

It is to be remembered that the delicacy of the bromine test which is largely used for the purpose is limited by the considerable solubility of the bromo-derivatives. Allen

(Com. Org. Analysis, vol. ii, part 2, p. 244), states the limits of the bromine test as about 1 in 60,000; such dilutions do not show any immediate indication, but do so after standing twenty-four hours. In the preliminary experiments 2·4 mgrms. of phenol dissolved in 150 c.c. was treated (1) with bromine water, (2) with 10 c.c. each of decinormal iodine and sodium carbonate. On adding acid after an interval of five minutes to the iodine test a copious precipitate of tri-iodophenol was immediately obtained, but the bromine test showed nothing. To eliminate the possibility of error two more bromine tests were put on in which the amount of bromine water added was varied considerably, but no better result was obtained, and only in one of the three was there a faint precipitate after twenty-four hours. It will be noticed that the concentration is about 1 in 60,000, in agreement with the statements of Allen. Fresh experiments were then carried out, in which the same amount of phenol, 2·35 mgrms. (1·5 c.c. $N/10$ was dissolved in volumes of 500, 1175, and 2350 c.c. corresponding to dilutions of 4, 2 and 1 part per million respectively and treated as just described, 10 c.c. each of decinormal iodine and sodium carbonate being added to each and 5 c.c. of dilute sulphuric acid ($3N$) after five minutes interval. Strong positive reactions were obtained in all cases, the four per million test showing up almost coincidently with the addition of the acid, the two per million about five minutes after addition of the acid and the one per million in about an hour—in this last test a considerable amount of fine crystals fell to the bottom of the bottle when allowed to stand undisturbed for some time. In these tests the smaller the concentration of the phenol the larger and more characteristic are the crystals which separate on acidification.

For salicylic acid the test is not quite so delicate because of the higher molecular weight (138) as compared with phenol (94). But if this difference of molecular weight be allowed for the sensitiveness is of the same order. Thus 2·3 mg. salicylic acid in the form of sodium salicylate was dissolved in 2000 c.c. of water and treated with 15 c.c. each of decinormal iodine and sodium carbonate. On adding 5 c.c. of $3N$-sulphuric acid after the usual interval of five minutes a fine crystalline precipitate separated in about an hour, forming a distinct deposit on standing undisturbed. This corresponds to a concentration of about 1 in 870,000 for salicylic acid and to about 1 in 1,250,000 for phenol. In connection with the recent work of Autenrieth and Beuttel (*loc. cit.*) on the gravimetric determination of various phenols by means of their bromine derivatives the much more insoluble tri-iodophenol when available would appear to offer substantial advantages. The experiments just given and many others whose enumeration is unnecessary show that a very large excess of iodine may be added with safety. Thus for 2·35 mgrms. of phenol 20 c.c. of iodine was used quite satisfactorily, although the theoretical absorption is only 1·5 c.c. $N/10$. On the other hand the same amount of phenol, 2·35 mgrms., when dissolved in 1175 c.c. of water gave quite normal results although only 3 c.c. each of $N/10$ iodine and sodium carbonate were added. A few experiments were also made, in which much less iodine than the theoretical amount was added to comparatively large amounts of phenol. Of course such conditions would be unlikely to occur in practice, because deficiency of iodine would be indicated by marked fading of the iodine colour during the period of standing in the alkaline condition. In such a case more iodine and sodium carbonate would be added, and acid added after a further five minutes' standing. The experiments referred to were as follows: 11·8 mgrms. of phenol dissolved in 150 c.c. of water was treated with 1·5 c.c. of $N/10$ iodine, and the corresponding amount of sodium carbonate. On adding 5 c.c. of $3N$ sulphuric acid five minutes later an almost immediate separation of crystals occurred, although only one-fifth of the theoretical amount of iodine had been added. This experiment was repeated, save that 500 c.c. was the amount of water present. In this case the indication on adding acid was feeble but distinct. To a similar experiment (11·8 mgrms. phenol in 500 c.c. of water) 1·5 c.c. of $N/10$ iodine and sodium carbonate were added—five minutes later when the colour of the iodine had almost entirely faded, a further addition of 2·5 c.c. of iodine and alkali was made, and finally on the following day 10 c.c. of iodine and alkali was added. On adding acid five minutes later copious precipitation corresponding apparently to the whole amount added (11·8 mgrms.) occurred.

In testing for minimal amounts of phenol it is of no importance whether the prescribed period of five minutes is exceeded, the conversion to the red insoluble tetra-iodo diphenylene quinone only taking place slowly at such dilutions. But longer periods than an hour are to be avoided. Thus the 1 per million experiment on phenol was repeated with a larger amount of iodine and carbonate (20 c.c.). But instead of five minutes a reaction period of 13 hours was given before acid was added. Under these conditions no separation of crystals occurred, and nothing marks the addition of acid beyond the faintest immediate turbidity. On standing some days, however, a few flocks of a reddish colour gradually fell to the bottom of the bottle.

The formation of tri-iodophenol is thus of valuable service for the detection of phenol and salicylic acid. The reaction is so delicate that by its aid it is possible to detect phenol in aqueous solution even when present to the extent of less than 1 part per million—with salicylic acid the limit is in the neighbourhood of 1 per million.

At this point some mention should be made of a colorimetric method, devised by Skirrow (*cf.* this J., 1908, 58, and Jour. Gaslight, 1908, 357), for the determination of very small amounts of phenol. After titrating by Messinger and Vortmann's method he dilutes until the pink tint is just visible, which he finds corresponds to a concentration of 2·5 per million. Since the final product in Messinger and Vortmann's process is a mixture of the iodo-phenol and tetra-iodo-diphenylene quinone (*cf.* Bougault, An., 1908, 407), and the latter body alone is coloured such a method can have only a limited value.

In view of the results obtained in the paper already referred to, it seemed of interest to see if the colorimetric method of Skirrow could be applied to minimal amounts of phenol. In the first experiment 0·0235 grm. of phenol was dissolved in 150 c.c. of water and treated with 30 c.c. of $N/10$ iodine and sodium carbonate. After two hours excess of sodium sulphite was added and the volume adjusted to 500 c.c. The colour was a fine one and could be well matched against neutral red. 5 c.c. = 0·000235 grm. of phenol was diluted to 940 c.c., and at this dilution corresponding to one part of phenol in four millions 100 c.c. when examined in a Nessler cylinder had a distinct pink tint.

But all attempts of mine to apply this colorimetric method directly to minimal concentrations of phenol were unsuccessful. This failure was due of course to inability to secure a quantitative conversion of tri-iodophenol to the red quinone.

In conclusion, I desire to express my hearty thanks to Messrs. Boots, Ltd., in whose laboratory the work was carried out.

Discussion.

Mr. D. J. Law said he had had the privilege of trying the method, and from the few experiments which he had carried out he could speak as to the great convenience and simplicity of the quantitative reaction and also the extreme delicacy of the qualitative test, which was, as Mr. Wilkie had pointed out, of a far higher order of delicacy than the bromine test. Had the minute crystals produced at great dilutions any characteristic appearance under the microscope? There might be other substances which would yield a crystalline precipitate under these conditions. The regulating and accelerating action of the weaker alkali was remarkable; would the increased activity of the iodine be due to its being held in combination with the alkali more loosely? Jean (Analyst, 1900, 127), in estimating tannic and gallic acids iodometrically, made use of a still weaker alkali in sodium bicarbonate.

The consumption of twelve atoms of iodine by gallotannic acid was very significant and a point that should help to throw light on the vexed question of the composition of that body, and if the method just described could be extended to serve for its estimation it should be extremely valuable.

The change of the tri-iodo phenol into tetra-iodo-diphenylene quinone was very interesting. as the formation of hydriodic acid during the change afforded an exceptionally convenient means of observing its progress. The colouration of the green substance into which the iodo-naphthol passed seemed to suggest the formation of a quinonoid body, and that the change was analogous to that undergone by tri-iodo-phenol.

Mr. T. H. Harvey said that it would be interesting if Mr. Wilkie would give them some idea of the mechanism of the reaction as compared with the reaction in the Messinger and Vortmann method. The halogen appeared to enter directly the benzene nucleus by substitution; it would be interesting to know whether this was the case in the Messinger and Vortmann method, which was carried out at an elevated temperature, or whether the halogen in either method passed through some such stage as that of hypoiodite.

It also appeared that a certain ratio had to be maintained between the amounts of alkali and iodine present, and it would be interesting to know within what limits that ratio might be varied.

Mr. Wilkie, in reply said that he had not examined the appearance of the crystals of tri-iodophenol under the microscope but thought that it might be useful to do so when only small amounts of highly dilute solutions were available. From analogy with the action of bromine in acid solution it seemed highly probable that tri-iodophenol would be produced from other substances than phenol and salicylic acid. He trusted to go into the matter later. Gardner and Hodgson had applied their method to the examination of tanning materials with satisfactory results, the iodine absorption being determined before and after treatment with hide powder. Mr. Law's remark with respect to the iodo-naphthol derivative of Messinger and Vortmann was suggestive.

The mechanism of the method of Messinger and Vortmann did not differ materially from that occurring in the cold, but in all probability no definite tri-iodophenol stage occurred, conversion to the red quinone proceeding progressively. With respect to the ratio that must exist between the iodine and alkali, he had found with sodium carbonate the amount present must not be much less than that corresponding to the theoretical equation, $Na_2CO_3+I_2+H_2O=NaI+NaHCO_3+HOI$. With 70 per cent. of the correct amount of carbonate the absorption was markedly low, but he had no experience of the effect of increased amounts of carbonate.

On the other hand when sodium hydroxide was used, low results were obtained with the corresponding amount of alkali, much more iodine being absorbed when the alkali was reduced to one-half or one-third of this amount. Hypoiodous acid was in all likelihood the active substance, and it was conceivable that the superior effect of the carbonate was due to a given concentration of hypoiodous acid existing in the presence of a higher concentration of alkali.

Yorkshire Section.

Meeting held at Bradford on Monday, March 20th, 1911.

PROF. W. M. GARDNER IN TNE CHAIR.

THE ESTIMATION OF SOLUBLE MERCURIC SALTS AT GREAT DILUTIONS.

BY PROF. H. R. PROCTER AND R. A. SEYMOUR-JONES.

In the course of some investigations it became necessary to estimate quantities of mercuric chloride in solutions containing as little as one part by weight in one hundred thousand of water. It was found that the methods at present in use were hardly suitable for such low concentrations and a method had therefore to be devised.

Advantage was taken of the fact that in the presence of certain organic acids, such as formic or citric, mercuric sulphide is not precipitated on treatment of the mercuric chloride solution with hydrogen sulphide, but remains in the coloured colloidal form in solution. This colour is perfectly definite for definite concentrations of the chloride and acid, if the liquid has been saturated with hydrogen sulphide, and is directly proportional to the concentration of the original mercuric chloride solution. Thus if we examine certain thicknesses of the liquids and take one solution as standard, a solution of half the concentration will require to be twice as thick to produce the same colour.

To compare the colours we use a Schmidt and Haensch dipping colorimeter, which was described by one of the present authors in this Journal for 1910, pp. 663-666, and reference can be made to that paper for details of the apparatus.

The experimental details are as follows:—A standard solution containing one part of mercuric chloride by weight in 10,000 of water, and also 1 per cent. by weight of formic acid, is saturated with hydrogen sulphide gas, and run into a standard 1 c.m. cell, which is placed on the upper platform of a Schmidt and Haensch dipping colorimeter. This then gives the standard colour, against which we may match all solutions of mercuric salts of less concentration than one part by weight in ten thousand of water.

The mercuric salt solution of unknown concentration is then made into a 1 per cent. formic acid solution, and saturated with hydrogen sulphide gas. The colloidal sulphide solution is run into the dipping cylinder of the colorimeter, and the dipping stage adjusted until the field of view in the telescope is of a uniform colour. The depth of the solution thus found is read off and its concentration calculated. As the depth of standard is 10 mm., and the concentration of the standard is 1 in 10,000, the concentration of the unknown can be rapidly found. By this method a practised observer can distinguish between 76 and 77 parts of mercuric salt per 100,000.

Where many estimations have to be carried out it is often convenient to match the standard colour described above with Lovibond standard tinted glasses, if these are available. To do this the standard solution of coloured colloidal mercuric sulphide is poured into the dipping cylinder of the colorimeter and the dipping stage adjusted until the depth of liquid under observation is exactly 10 mm. On the upper stage is placed a small stand to contain the Lovibond glasses, and the quantity and colour of these latter is adjusted until the combination accurately matches the colour of the standard solution. This combination of glasses then becomes the standard colour for matching purposes, and has the advantage of remaining unaltered on standing.

This method has also been successfully employed in the estimation of small quantities of arsenic and lead, but can only be used where the original solution is clear and colourless and contains no other bodies capable of giving a precipitate or colouration with hydrogen sulphide.

Since reading this paper we have had the work of Schidrowitz and Goldsbrough* brought to our notice, and find that they estimate small quantities of antimony by a method similar to ours. They use a coloured colloidal sulphide solution of antimony, obtained by passing hydrogen sulphide into a solution of the antimony salt, which contains a small quantity of citric acid. This colour is then compared with a standard. It is gratifying to find such substantial confirmation of our work.

Discussion.

Mr. F. W. Richardson asked how the Lovibond tintometer was used as a standard. Was it possible to get close readings with the tintometer used by the authors? Had the authors experimented with the chrometer?

Professor W. M. Gardner asked what means were adopted to ensure uniform illumination of the field of observation. That was a very important point, since the two parts of the field received light from different sources and any lack of uniformity would vitiate the results obtained.

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* The Analyst, March, 1911, 35, 101.

Mr. T. **Fairley** spoke of a method described before the Society of Public Analysts recently for estimating antimony, similar in principle to the one in the paper. Certain organic acids (*e.g.*, citric acid) prevented the precipitation of some sulphides. It was possible to use ordinary colorimetric methods to estimate minute quantities of antimony, kept in solution by that method, and very fair and accurate results could be thus obtained.

Mr. H. **Brumwell** said the chrometer did not give sufficiently accurate results. It had been tried for tan liquors, but was not very satisfactory.

Mr. R. A. **Seymour-Jones**, in reply, showed how the standard solution was matched first against standard glasses from Lovibond's tintometer and how these equivalent colours were then used in place of the standard. Five readings were usually taken, and with practice the error was usually not more than one in 100,000. The three fields were equally illuminated by having the reflector at right angles to an inverted incandescent gas mantle of high power. The instrument gave intelligible results, and Dr. Dawson of the Leeds University had found it satisfactory for colorimetric work.

SOME CONSTANTS OF MUTTON BIRD OIL.

BY L.]HEWGILL SMITH.

The petrels, fulmars, and shearwaters are remarkable for the enormous quantities of oil contained in their bodies, and for the fact that, except in the nesting season, they seem to be entirely independent of dry land. The stormy petrel, or "Mother Carey's chicken," which is perhaps the best known, is very highly valued by the inhabitants of Faro, as is also the fulmar in St. Kilda and the islands of Western Scotland. These birds supply the islanders with "oil for their lamps, down for their beds, a delicacy for their table, a balm for their wounds, and a medicine for their distempers." Some idea of the numbers that congregate may be gathered from the fact that 18-20,000 of fulmars are killed in St. Kilda during a certain week in August, which is the only time in the year when killing is allowed by law. Extermination would quickly follow were the birds not protected to this extent. So oily in texture are the petrels that the islanders draw a wick throug their bodies and utilise them as rough and ready lamps. It is not surprising that this oil should now have become of commercial importance outside the islands on which the birds breed.

The first bird oil to be put on the market is that of the mutton bird (*Aestrelata lessoni*), a petrel peculiar to the Antarctic regions. The mutton bird congregates on the shores of Tasmania and New Zealand for the breeding season, when thousands are now killed annually for the fat and "oil" they yield. The output of oil can only, of necessity, be small, and is likely to be more of scientific than commercial interest. It must be explained that, to embarrass intruders, the petrel ejects "oil" with considerable force from its nostrils, and it is this "oil," which is carried in the stomach and there found after death, that is now described as mutton bird oil.

The oil varies in colour from bright ruby red to straw, with faint, not unpleasant, fishy smell. On treatment in the usual manner, with sulphuric acid, in the refining process, the ruby colour is destroyed and straw oil results.

At 0° C. the oil solidifies to a translucent mass. A specimen was found to contain 2·23 per cent. free fatty acids (as oleic acid).

Constants. Specific gravity, 0·8819—0·8858 at 15·5° C. Saponification value, 125·9. Iodine value (Wijs), 71 per cent. Unsaponifiable (alcohols), 36·88 per cent. Melting point of alcohols, 30·5—31·5° C. It yields no glycerin.

From these particulars it appears that mutton bird oil cannot be considered a glyceride and must be classed with the liquid waxes. It will be noticed that it resembles arctic sperm oil, to a remarkable degree in its properties, and, like sperm oil, it shows no tendency to gum.

It would be interesting to know the exact part the oil takes in the internal economy of the bird. It is said that the young are fed on it when in the nest.

The body fat is of a soft consistency, brown in colour with a strong fishy smell. The samples examined contained 3·5—4·3 per cent. free fatty acids (as oleic acid). Iodine value (Wijs), 89·1 per cent. Unsaponifiable matter, 1·76—2 per cent. Specific gravity, 0·9351—0·9380 at 15·5° C. Titre test, 29·4° C.

Discussion.

Mr. F. W. **Richardson** said the oil appeared to be similar to sperm oil, but the specific gravity was much higher. It probably contained large amounts of cetyl oleate.

Mr. T. **Fairley** supposed that the unsaponifiable matter probably consisted of alcohols and waxes. The oil was not like ordinary oils, consisting of glycerides of fatty acids. No glycerin could be obtained on saponification, and the constituents of the oil seemed to be more like those in waxes.

Obituary.

LORD AIREDALE.

Formerly Chairman of the Yorkshire Section of this Society (1891—1893.)

James Kitson, afterwards Lord Airedale, was born on September 22nd, 1835, at Leeds, was the second son of the late James Kitson, who three years before that date had commenced in a small way the engineering works which subsequently developed into the extensive Airedale Foundry, now one of the most prominent in England. Kitson senior began business two years after Stephenson had built his "Rocket," and constructed his first locomotive in the very year of the birth of James Kitson, junr., the subject of the present memoir, who was thus brought up in the atmosphere of mechanical engineering. The earlier part of his education was obtained at the Wakefield Preparatory School, but later he proceeded to University College, London, where he attended up to the age of nineteen. The father, soon recognising that a supply of reliable Yorkshire iron was important for financial success in mechanical engineering of the kind he was engaged in—purchased an ironworks at Holbeck and placed it in charge of his two sons—the late F. W. Kitson, and James Kitson (Lord Airedale).

James Kitson's sympathies were with metallurgy rather than with mechanics, and he lost no opportunity of insisting on the reliability of Yorkshire iron. The death of his elder brother in 1877, left the sole control of the iron works to the younger man, who also found increased responsibility at the engineering factory at Hunslet, where his father now required more assistance.

Lord Airedale was intimately associated with many of the technical societies. He was one of the original members of the Iron and Steel Institute, and acted as its President in 1889—1891. In 1904, recognising his great services in the cause of education, the University of Leeds conferred upon him the degree of D.Sc. (*Hon. causa*). His baronetcy was conferred upon him in 1886, his election as a Privy Councillor took place in 1906, and he was raised to the peerage in 1907. As first Chairman of the Yorkshire Section of this Society, he gave an inaugural address. Lord Airedale died suddenly in Paris, March 17th, as the result of cardiac failure.

JACOBUS HENRICUS VAN'T HOFF.

J. H. van't Hoff, born on August 30th, 1852, was the son of a physician practising in Rotterdam. He was educated at the "Hoogere Burgerschool" in that city and later spent two years at the Polytechnicum in Delft; after continuing his studies at Leyden, with Kekulé in Bonn and with Wurtz in Paris, he graduated in 1874 as doctor in "Wis- en Natuurkunde" at the University of Utrecht upon a thesis dealing with cyanacetic and malonic acids.

Van't Hoff began his career as a teacher in 1876 as Docent in Physics in the Veterinary School at Utrecht; the next year he was appointed Reader in Chemistry in the University of Amsterdam and in 1878 became Professor of Chemistry in the same University. He refused an invitation to Leipzig in 1887 and was appointed Research Professor of Chemistry by the Royal Prussian Academy of Sciences in 1896. The latter position he held until his death in Steglitz from an affection of the lungs on March 1st of the year present.

Amongst the many honours showered upon van't Hoff the following may be mentioned. He became a foreign member of the Chemical Society of London in 1888, a member of the Imperial Academy of Sciences of Berlin in 1896, and a foreign member of the Royal Society of London in 1897; he received from the German Emperor the Prussian Order "pour le Merite" and in 1901 was awarded the Nobel Prize for Chemistry.

It is probably not yet possible duly to appraise van't Hoff's services either to chemistry, or to the related sciences of physics, mineralogy and geology. The power of taking a wide survey over a great mass of detail and the constructional faculty of framing a vast theoretical scheme in which every fact finds a place, possessed by van't Hoff is not easily and immediately appreciated at its true value.

Van't Hoff's greatest and most fruitful achievement was a so his first. In 1874 he published a short paper in Dutch in which he showed that the graphic formulæ developed by Kekulé from Frankland's doctrine of valency must be extended in three-dimensional space in order to accord with the facts of organic chemistry. He indicated that the four valency bonds of the carbon atom were not to be regarded as lying in one plane, but as directed towards the apices of a tetrahedron described about the carbon atom. The recognition that the graphic formulæ of organic chemistry are not merely diagrammatic but possess a real physical significance in that by their aid the true relative disposition of the atoms composing the molecule can be represented, led immediately to the elucidation of the isomerism of the tartaric and lactic acids, and to the foundation of stereochemistry. It is scarcely too much to say that the major part of the progress made in organic chemistry during the last thirty years has been inspired by the idea of stereoisomerism enunciated independently and almost simultaneously by van't Hoff and Le Bel.

Van't Hoff's power of wide generalisation next evinced itself in a work entitled "Ansichten über die organischen Chemie" in which an attempt was made to arrange the whole of organic chemistry in accordance with a carefully thought out and logical scheme. This work also insists on the need for the quantitative study of chemical changes on the lines laid down by Guldberg and Waage and by Harcourt and Esson. The pioneer work which van't Hoff himself did in this connection was described in the "Etudes de dynamique chimique" published in 1884; in this volume van't Hoff applied for the first time the methods of thermodynamics to the study of velocity of reaction and of chemical equilibrium and so established the modern method of treating such questions on a sure foundation.

The next great achievement of van't Hoff was introduced in a paper dealing with the laws of chemical equilibrium in the dilute, gaseous, and dissolved state of matter presented to the Swedish Academy in 1886. In this and several succeeding papers the now well-understood analogy between gaseous and osmotic pressure was developed; the impetus which was thus given to the study of the behaviour of dilute solutions is not yet exhausted. One of the more important practical results of this work is found in the methods of determining molecular weights by aid of observations of the depression of the freezing point and the rise in the boiling point of solutions.

The crowning work of van't Hoff's scientific career which occupied most of his time in Berlin, consisted in the exhaustive study of the heterogeneous equilibria of mixed and double salts in contact with their solutions. This part of van't Hoff's life-work is, perhaps, not characterised by that brilliancy of novel conception exhibited during his previous great epochs; it is marked, however, by the same broad grasp of detail as the older work and is carried out with a thoroughness and completeness which leaves but little for future investigators to do. The now classical work on the Stassfurt salt deposits remains not only as a model for the student of heterogeneous equilibria but also as an abiding source of revenue to the country of van't Hoff's adoption.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Patents.

Steam generation, feed water heating, and the heating of liquids generally. W. A. Bone and J. W. Wilson, Leeds, and C. D. McCourt, London. Eng. Pat. 4362, Feb. 22, 1910.

The invention relates to the method of heating liquids in boilers or vessels by means of heating tubes which pass through them and are heated by a combustible mixture of gas and air. In order to attain a very high efficiency in the utilisation of the heat generated, the tubes are closed at one end by a perforated plug of refractory material through which the gaseous mixture is supplied. The interior of the tube is packed with granular refractory materials, and the other end is closed by a perforated plate or a gauze disc. The gaseous mixture must be previously freed from dust, and must be supplied at such a speed that no flashing back can occur when the apparatus is in use. The gaseous mixture is ignited either at the outlet end of the tube or at the inlet end. In the latter case an igniting chamber is formed at the inlet end and is provided with an explosion valve or door. To equalise the utilisation of the heat, the tube may be lined throughout a portion of its length with refractory material. Nodules of burnt fire-clay are used to pack the tube, but should there be any liability to fusion this packing is partially replaced by granular nodules of

carborundum or other highly refractory material. Two or more tubes may be used as found convenient. It is stated that when heating water under atmospheric pressure so that it boils at 100° C., 90 per cent. of the total heat available from the gas is transferred to the water.
—W. H. C.

Filtering or straining apparatus for separating liquids from solids. Wm. Reid, Burnbank, Lanark. Eng. Pat. 7109, March 22, 1910.

The materials to be separated are pressed between two bands of porous material each carried by a pair of rollers. The bands are inclined both longitudinally and transversely to facilitate the escape of the liquid. The strained material is stripped from the band by a scraper after passing the last pair of rollers.—W. H. C.

Mixing of materials. B. I. Levin, Manchester. Eng. Pat. 10,006, April 25, 1910.

The claim is for a method of adding one powdered substance to another. The powder to be added is withdrawn in regulated quantities from a container by the suction produced by the passage of a blast of air through an injector, and the air carrying the powder with it is discharged into a tube provided with a worm conveyor or other suitable mixer in which the other material is placed.
—W. H. C.

Fire extinguishing; Preparations for —. V. Campbell, Leicester, and A. L. F. Carr, Birmingham. Eng. Pat. 12,136, May 17, 1910.

Claim is made for the use of carbon tetrachloride as an agent for the direct extinction of conflagrations and also as a fire-proofing material. Carbon tetrachloride being a non-conductor of electricity is claimed to have advantages over water where fire breaks out in connection with electrical installations.—B. G. McL.

Centrifugal machines; [Means for discharging —]. A. Dunsmore, Glasgow. Eng. Pat. 12,962, May 28, 1910.

In suspended centrifugal machines the discharge is arranged to take place from the bottom of the basket by means of a discharge valve disposed concentrically either inside or outside the basket. According to this invention, a tubular guard-sleeve is provided, carried at its upper end by a flexible plate enabling it to oscillate with the spindle, which it envelops, but without rotating with it. The usual bell-shaped discharge valve, forming the central portion of the bottom of the basket, is connected at its upper end, by way of a ball bearing, with a handled sleeve which has an internal thread engaging with an external thread on the upper guard-sleeve. Thus when the handle of the lower sleeve is rotated, this sleeve, and the bell valve connected with it, travel upwards on the shaft, and the valve can be opened or shut whilst the machine is unning. Other claims relate to various modifications of the same principle.—J. F. B.

Pumps for viscous liquids and the like. F. H. Shoppee, Bracknell, Berks., and M. W. Shippey, Cambridge. Eng. Pat. 13,098, May 30, 1910.

A pair of pump barrels are formed in the base of the reservoir containing the liquid to be pumped, so that the ength of the inlet passage is very short. The inlet valve opens by gravity, and is mechanically closed by the action of a pair of cams. The pump plungers are operated by another pair of cams in such a way that the power stroke of one plunger operates the suction stroke of the other. The cams themselves are operated by a rachet and wheel mechanism driven directly from the prime-mover.
—W. H. C.

Drying-drums; Apparatus for removing water from steam —. J. R. Happer and J. K. Horsburgh, Linwood, N.B. Eng. Pat. 19,584, Aug. 22, 1910.

Attached at one end to the inner periphery of the drum is a U-shaped cup and scoop in such a manner that it will fill with water when at the bottom. The rotation of the drum causes the cup containing the water to be carried up and to discharge into a stationary receiver supported on the axis of the drum; the water thence passes away by an axial discharge pipe fitted with a special valve which ensures the discharge of water and sediment and prevents the blowing-off of steam.—B. G. McL.

Desiccating liquids. J. S. Merrell, Assignor to Merrell-Soule Co., Syracuse, N.Y. U.S. Pat. 985,747, Feb. 28, 1911.

The liquid to be desiccated is sprayed into a chamber through which a current of heated air or other moisture-absorbing fluid is conducted. A rotary dust collector is placed at the outlet of the desiccating chamber and is provided with screened pockets which collect the dried product but allow the moisture-laden air to pass forward. As the collector rotates, the pockets are successively moved into position in front of the outlet of the desiccating chamber.—W. H. C.

Kiln. F. E. Goldsmith, Middletown, Ohio, Assignor to The Ceramic Machinery Co., Hamilton, Ohio. U.S. Pat. 985,797, March 7, 1911.

The apparatus consists of a long tunnel-shaped retort set on fire-clay brackets and surrounded by fire-clay chambers. A longitudinal opening extends the whole length of the bottom of the retort; the support of an internal carrier for the material to be fired, passes down through this slot, which it fits fairly closely, and is attached to a truck running on rails in a chamber placed below, which is shielded from the heat by fire-brick partitions.
—B. G. McL.

Filter-charcoal; Process of utilising spent — *and for manufacturing filter-charcoal.* Richter und Richter. Fr. Pat. 421,829, Oct. 26, 1910. Under Int. Conv., Nov. 29, 1909.

The ash obtained from spent filter-charcoal is mixed with fresh carbonaceous matter and the mixture is submitted to destructive distillation. A charcoal is thus obtained which is used for filtering purposes, and which, when spent, is incinerated. The ash thus obtained is again mixed with carbonaceous matter, and, after these operations have been repeated a number of times, a final ash is obtained which contains about 12 per cent. of phosphates. This ash may then be used as a manure.—W. P. S.

Separating the solid precipitates produced in the manufacture of certain gases; Apparatus for continuously —. R. J. Pictet. Fr. Pat. 421,839, Oct. 26, 1910.

The gas is passed through a chamber closed above but communicating at its lower part, beneath an inclined baffle-plate, with an adjacent open vessel. Both vessels are partly filled with water so that the former is effectually sealed. The solid particles are washed out of the gas in the closed chamber by a number of sprays of water, and the separated particles which float on the water are withdrawn by a flexible rake or scraper, operated mechanically, which draws them along the under surface of the inclined baffle into the open chamber, from which they can be removed in any convenient manner.—W. H. C.

Evaporating apparatus. F. Scheinemann. Fr. Pat. 421,848, Oct. 26, 1910. Under Int. Conv., Nov. 9, 1909.

The steam space surrounding the tubes of a tubular evaporator, is divided into two compartments by a suitable partition, which extends from the lower side of the upper tube-plate to within a short distance above the lower tube-plate. The partition is also continued a short distance above the upper tube-plate to facilitate the circulation of the liquid. Live steam enters the upper part of the outer compartment, and passes downwards, causing a violent ebullition of the liquid in the tubes and an upward flow which induces a corresponding downward flow in the tubes in the other compartment, with a consequent circulation of the liquid. The steam passes under the partition and upwards through the second compartment to the outlet, preheating the liquid flowing down the tubes.—W. H. C.

By-products which are contained in the state of gas or vapour in the atmosphere of works ; Apparatus for recovering ——. A. Collard, Brussels. Eng. Pat. 29,879, Dec. 21, 1909.

See Fr. Pat. 410,555 of 1909 ; this J., 1910, 810.—T. F. B.

Separators ; Centrifugal ——. H. J. Haddan, London. From International Clarifying Co., Chicago. Eng. Pat. 9205, April 15, 1910.

See Fr. Pat. 414,841 of 1910 ; this J., 1910, 1191.—T. F. B.

Separating solids and liquids ; Apparatus for ——. W. A. Hendryx, Denver, Colo., U.S.A. Eng. Pat. 12,471, May 23, 1910. Under Int. Conv., June 12, 1909.

See U.S. Pat. 960,546 of 1910 ; this J., 1910, 826.—T.F.B.

Stirring and mixing apparatus. Chem. Fabr. vorm. Weiler-ter-Meer, Uerdingen, Germany. Eng. Pat. 16,836, July 14, 1910. Under Int. Conv., July 23 1909.

See Ger. Pat. 228,544 of 1909 ; this J., 1911, 73.—T.F.B.

Mechanical and chemical operations ; Apparatus for carrying out ——. Chem. Fabr. vorm. Weiler-ter-Meer. Fr. Pat. 420,931, July 16, 1910. Under Int. Conv., July 22, 1909.

See Ger. Pat. 228,544 of 1909 ; this J., 1911, 73.—T. F. B.

Expression of liquids from solid matters ; Apparatus for ——. J. J. Berrigan, Orange, U.S.A. Eng. Pat. 17,550, July 23, 1910. Under Int. Conv., Aug. 27, 1909.

See Fr. Pat. 418,156 of 1910 ; this J., 1911, 10.—T. F. B.

Gas ; Apparatus for bringing a —— *in contact with a liquid.* The Metals Extraction Corporation, Ltd. Fr. Pat. 421,298, Oct. 10, 1910. Under Int. Conv., Nov. 6, 1909.

See Eng. Pat. 25,679 of 1909 ; this J., 1910, 1446.—T.F.B.

Evaporating apparatus with vertical tubes. J. F. P. Kestner. Fr. Pat. 421,675, Dec. 28, 1909.

See Eng. Pat. 4571 of 1910 ; this J., 1910, 1145.—T. F. B.

Filtering apparatus. G. Johnston. Fr. Pat. 421,750, Oct. 24, 1910.

See Eng. Pat. 17,088 of 1909 ; this J., 1910, 1446.—T.F.B.

IIa.—FUEL ; GAS ; MINERAL OILS AND WAXES.

Coal ; Spontaneous combustion of ——. S. W. Parr and F. W. Kressman. J. Ind. Eng. Chem., 1911, 3, 151—158.

From the results of an experimental investigation of the causes underlying the spontaneous combustion of coal, the authors conclude that oxidation processes of the freshly-mined coal begin at the ordinary temperature, these processes being of different character and varying in their speed and intensity. Speaking generally, each kind of coal has a critical temperature of oxidation below which the process, which depends upon external factors, does not prove ultimately destructive and stops when the contributing causes are removed ; whilst if this temperature be exceeded the oxidation becomes autogenous and results in ultimate destruction of the coal. The average temperature at which autoxidation begins varies from 200° to 275° C., according to the fineness of the division of the coal, whilst ignition does not take place until a much higher temperature, usually beyond 350° C., is reached. The temperature of autogenous oxidation depends upon a number of factors which include :—*A. External sources of heat*, such as contact with steam pipes, hot walls, etc. ; the heat of impact or pressure due to the method of unloading ; climatic temperature at the period of storage ; and direct absorption of heat from the sun or reflecting surfaces. *B. Fineness of division*, which has an especial influence upon the oxidation of carbonaceous matter. *C. Easily oxidisable compounds* :—Bituminous coals contain unsaturated compounds which rapidly absorb oxygen, producing, not carbon dioxide, but humic acid or other non-volatile compounds. This property depends largely upon the freshness and the state of division of the coal, and cannot therefore be regarded as an absolute index of the liability of a given sample of coal to spontaneous combustion. In the case of coal (*e.g.*, of the Illinois type) rich in iron pyrites this factor is probably of secondary importance. *D. Iron pyrites* :—The heat produced by the oxidation of the sulphur in the pyrites in coal may be regarded as the second stage of the process. In this case, too, the fineness of the state of division influences the speed of oxidation, and hence the large proportion of fine earthy constituents (rich in iron pyrites) in coals from the mid-American fields is a source of danger. Thus in most cases coal of the Illinois type contains more than 5 per cent. of pyrites, the oxidation of a fifth part in the sulphur of which would raise the temperature of the mass by about 70° C., assuming there were no loss by radiation. Under the ordinary conditions of storage there would be but little loss of heat from this cause. It is commonly accepted that coal containing less than about 1½ per cent. of sulphur will not be liable to heating, but no system of sorting at the mine can eliminate all the pieces containing iron pyrites, though the danger from this cause would probably be reduced by complete separation of the large pieces from the fine material. *E. Moisture* :—The oxidation of the pyrites in coal is promoted by the presence of water, the normal proportion of which in coals of the Illinois type is usually 12 to 15 per cent., and is seldom less than 10 per cent. *F. Oxidation of carbon and hydrogen* :—At temperatures above 120° to 140° C. oxidation of certain hydrocarbons of the coal takes place, with the formation of carbon dioxide and water, this representing the third stage of the process—a particularly dangerous one owing to the much greater quantity of heat produced by the oxidation of carbon and hydrogen. *G.* The fourth stage of oxidation is autogenous and begins at temperatures above 200° to 275° C., whilst above 300° C. an exothermic decomposition of the coal begins, and increases the temperature still further, until ignition occurs, usually above 300°—400° C. Any measures to prevent spontaneous combustion must be based upon a consideration of the foregoing facts. All external sources of heat should be eliminated, and all coal dust or finely-divided material separated. Oxidation of iron pyrites would be inhibited by complete dryness in storage. Drenching a heating mass with water may increase the danger, when there is much sulphur present, and it is uniformly distributed throughout the coal, though when it occurs in localised spots or is only present in small proportion the drenching may check the process or may prolong the oxidation so that the carbonaceous constituents are not materially affected. Yet, even then, the only ultimate safe course is to remove the heated portions. Preliminary heating might be employed to bring about the initial stages of the oxidation, so that subsequently the further destructive stages of oxidation would lack the necessary high starting temperature contributed by these sources of heat. Submerging the coal would also eliminate all the factors contributing to the initial production of heat, but whether either this or the preceding precaution would prove industrially practicable must be determined experimentally. Treatment with specific chemicals does not promise much hope of success, although certain results seem to justify further experiments in this direction. It is suggested that the oxidation might be confined to the lower stages by distributing, throughout the coal, pipes through which circulated a cooling liquid, so as to prevent any accumulation of heat. On the other hand, the making of passages for the circulation of air currents, which is sometimes recommended as a remedy, is of doubtful utility, since the oxidation promoted by the

access of fresh oxygen may result in the contribution of more heat than is carried away by the current of air.
—C. A. M.

Acid value of oils and fats; Determination of ——, with special reference to mineral lubricating oils. H. Loebell. Chem.-Zeit., 1911, 35, 276—277.

The use of a mixture of alcohol and ether as a solvent in the determination of the acidity of oils gives inaccurate results, since it only permits of a very slight dissociation. With phenolphthalein as indicator, in very dilute solution, the change of colour is not sharp, and the acid value is invariably too high, whilst when "alkali-blue" is used the disadvantages of this solvent are still more pronounced. On the other hand the use of a mixture of benzene and 96 per cent. alcohol (2 : 1) as the solvent enables the end-point of the titration to be ascertained sharply in solutions of moderate concentration with "alkali-blue" as indicator, whilst, with phenolphthalein as indicator very sharp changes of colour are obtained by titrating the liquid with $N/10$ aqueous barium hydroxide solution instead of with alcoholic sodium hydroxide solution.—C. A. M.

Patents.

Retorts and ovens for coking coal at high temperatures; Manufacture of ——. J. G. Aarts. Fr. Pat. 421,316, Oct. 10, 1910. Under Int. Conv., Oct. 12, 1909.

Gas retorts, or the coking chambers of coke-ovens, are constructed of silicon carbide. This material is not attacked by the carbon, or by the gases and acid vapours, at temperatures above 2000° C.; it does not shrink or expand and does not become porous; and it has a considerably higher conductivity than firebrick. Silicon carbide may be moulded to the desired form with any refractory material for binding agent, or the retort or separate sections of it, may be moulded in graphite and treated with silicon vapour.—A. T. L.

Fuel; Apparatus employed in the treatment of ——. B. Ely, Alfreton, Derby, and A. Rollason, Nottingham. Eng. Pat. 6759, March 17, 1910.

The fuel produced in coke ovens is cooled slowly in chambers having hollow walls of iron or firebrick, the hollow spaces being filled with coke breeze, broken firebrick, or other non-conducting material. The cooling chambers may either be stationary or mounted on rails.
—H. H.

Heating gas [from sugar cane]; Manufacture of ——. S. H. Leach, Rochdale, A. McA. Lang and Fawcett, Preston, and Co., Ltd., Liverpool. Eng. Pat. 4482, Feb. 23, 1910.

Sugar cane is disintegrated into short fibres which are fed in a compact condition and in a wet or dry state into a gas producer. A gas of between 8000 and 9000 B.T.U. per pound is thus obtained.—H. H.

Producer gas plant comprising two or more units; Method of working —— and control of air supply. E. U. G. Ernst. Fr. Pat. 421,596, Oct. 19, 1910. Under Int. Conv., Nov. 2, 1909.

The producers are mounted above a common water trough and are sealed in it to different depths. The water-level in the trough is determined by the pressure in the gas main. The air supply is admitted to the lower part of one of the producers, and when the consumption of gas increases, the pressure in the gas main falls, the water sinks in the trough beneath the producers, and the air supply can then enter one or more of the other producers.
—A. T. L.

Gas; Apparatus used in the purification of ——. H. S. Sadler and Ashmore, Benson, Pease, and Co., Ltd., Stockton-on-Tees. Eng. Pats. 4613 and 19,382, Feb. 24 and Aug. 18, 1910.

In a rotary washer-scrubber, the scrubbing material carried by the rotating drums consists of canvas screens. In one arrangement the screens are disposed perpendicularly to the axis of the scrubber, so that the gas passes between a series of parallel rotating screens in each compartment of the scrubber, entering the end compartment at the periphery and passing to the next compartment by an axial passage and so on. In another arrangement the screens are disposed parallel to the axis of the scrubber and the gas passes through the canvas. For regulating the level of the liquid in the scrubber, the overflow-pipe is provided with a screwed socket, adjustable vertically by means of a hand-wheel, in a pocket at the side of the scrubber.—A. T. L.

Gas purifying apparatus. J. R. Masters, London. Eng. Pat. 17,281, July 20, 1910.

In a purifier in which the gas is passed through lime or other purifying material, vertical grids are suspended from cross-bars at the top of the purifier in such a manner that they can be shaken or separated to facilitate the removal of the purifying material, which is withdrawn at the bottom of the purifier. The base of the purifier is fitted with rollers and can be lowered on to rails and removed. The bottom of each compartment enclosed by adjacent pairs of grids is made as a hinged door. The inlet and outlet for the gas are in opposite side walls of the purifier, and open into free gas spaces enclosed between the outermost grids and the adjacent walls.—A. T. L.

"Acid tar" resulting from the purification of mineral oils and the like; Treatment of ——. W. O. T. van Tienen, Rotterdam. Eng. Pat. 23,368, Oct. 8, 1910.

The "acid tar" obtained by treating crude oils with strong sulphuric acid, consisting chiefly of sulphonic derivatives of aromatic and unsaturated hydrocarbons, is mixed with water and heated under pressure at 140°—165° C. for a quarter of an hour to two hours according to the nature of the tar. The product separates into three layers, consisting of oil, sulphuric acid, and tarry residues, which can be readily separated. The quantity of water to be used is calculated so that the acid layer after the reaction has a density of 52° B.—A. T. L.

Petroleum or tar residues; Process for separating solid hydrocarbons from ——. J. Tanne and G. Oberländer. First Addition, dated Oct. 6, 1910, to Fr. Pat. 409,516, Nov. 23, 1909.

See Ger. Pat. 227,334 of 1910; this J., 1910, 1367. Halogen derivatives of hydrocarbons may be used in place of such homologues of acetic acid, as propionic or butyric acid, etc.—T. F. B.

Hydrocarbons [paraffins, benzene, terpenes]; Purification of —— by means of charcoal and oxygen. Richter und Richter. Fr. Pat. 421,277, Oct. 10, 1910. Under Int. Conv., May 12, 1910.

Liquid hydrocarbons, such as the paraffins, benzene, and the terpenes, are mixed with finely divided animal charcoal or wood charcoal and brought into intimate contact with air, ozone, or pure oxygen. The impurities containing sulphur and nitrogen are completely removed by oxidation.—A. T. L.

Liquid hydrocarbons and alcoholic liquids; Purification of —— by means of charcoal, and preparation of charcoal therefor. Richter und Richter. Fr. Pat. 421,760, Oct. 24, 1910. Under Int. Conv., March 4, 1910.

A very active form of charcoal is prepared by the dry distillation of coal dust in admixture with finely divided mineral substances such as clay, chalk, slaked lime, ashes, etc. This charcoal not only absorbs certain impurities from the hydrocarbons and alcohols, but also has a powerful oxidising action on the sulphur and nitrogen compounds which are present.—A. T. L.

Petroleum and lubricating oils; Process for refining —— by the action of air. Cie. des Produits de Naphte. Fr. Pat. 421,550, Oct. 17, 1910.

A current of air is passed through the oil, at a temperature between 100° and 350° C., either before or during the distillation. The various fractions are thereby rendered purer, the viscosity being greater and the proportion of unsaturated hydrocarbons less than when the oil is distilled without air.—A. T. L.

Wood charcoal; Process for manufacturing a combustible agglomerate of ——. L. Felizat, Bouches-du-Rhone, France. Eng. Pat. 5010, Feb. 28, 1910.

SEE Fr. Pat. 410,395 of 1909: this J., 1910, 806.—T. F. B.

Fuel and ore briquettes, building blocks, and the like; Process for increasing the waterproof property of substances prepared with sulphite cellulose lye as a binding material, in the manufacture of ——. W. Haage, Walsum-on-Rhine, Germany. Eng. Pat. 6631, March 16, 1910.

SEE U.S. Pat. 969,504 of 1910; this J., 1910, 1148.—T.F.B.

Coking and gas-generating oven. H. Koppers, Essen-on-Ruhr, Germany. U.S. Pat. 985,909, March 7, 1911.

SEE Eng. Pat. 12,363 of 1909; this J., 1910, 144.—T. F. B.

Gas producers; Method of working up-draught ——. J. Fielding, Gloucester. U.S. Pat. 986,374, March 7, 1911.

SEE Eng. Pat. 14,292 of 1908; this J., 1909, 512.—T. F. B.

Methane; Catalytic synthesis of ——. The Cedford Gas Process Co., Ltd. Fr. Pat. 420,933, July 18, 1910. Under Int. Conv., July 21, 1909.

SEE Eng. Pat. 17,017 of 1909; this J., 1910, 1242.—T. F. B.

Gas washer; Centrifugal ——. W. Feld. Fr. Pat. 420,943, Aug. 13, 1910. Under Int. Conv., March 30, 1910.

SEE U.S. Pat. 983,037 of 1911; this J., 1911, 272.—T. F. B.

Suspended matter from gases; Apparatus for extracting or separating ——, *particularly tar from illuminating gas.* F. W. Burstall. Fr. Pat. 421,633, Oct. 20, 1910. Under Int. Conv., Oct. 22, 1909.

SEE Eng. Pat. 24,261 of 1909; this J., 1910, 932.—T. F. B.

Distilling under high vacuum oils from the petroleum, tar, and the like industries; Apparatus for ——. E. C. R. Marks, London. From P. Porges, Königsfeld, L. Singer, Pardubitz, and L. Steinschneider, Königsfeld, Austria. Eng. Pat. 14,390, June 14, 1910.

SEE U.S. Pat. 981,953 of 1911; this J., 1911, 202.—T. F. B.

Apparatus for automatically indicating and recording the percentage of carbon dioxide in combustion gases. Eng. Pat. 21,835. *See* XXIII.

IIB.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

PATENTS.

Carbonaceous substances; Process for treating [distillation] ——. F. W. Burstall, Birmingham. Eng. Pat. 18,148, July 30, 1910.

TO obtain a maximum proportion of tar substances, ammonia liquor, and light oils in the destructive distillation of carbonaceous materials, the temperature is maintained between the limits of 850° and 1000° C. and the pressure between 10 and 18 inches of mercury below atmospheric pressure.—H. H.

Metal filaments for incandescent electric lamps; Manufacture of ——. A. Lederer, Vienna, and The Westinghouse Metal Filament Lamp Co., Ltd., London. Eng. Pat. 5388, Mar. 3, 1910. Addition to Eng. Pat. 6936, Mar. 23, 1909 (this J., 1910, 340).

COMMERICAL metallic filaments such as are imported and placed upon the market as finished filaments, are treated by the process described in the prior patent, whereby the percentage of carbon in the filaments is reduced to 0·04 per cent.—A. T. L.

Finely divided metals [tungsten]; Production of ——. F. Blau, Berlin, Assignor to General Electric Co., New York. U.S. Pat. 985,386, Feb. 28, 1911.

OXYGEN compounds of tungsten are reduced at a low temperature by means of a current of hydrogen or other reducing gas which is used in very large excess.—A. T. L.

Metallic illuminating bodies for electric incandescent lamps; Method of manufacturing ——. F. Blau, Berlin, Assignor to General Electric Co., New York. U.S. Pat. 985,387, Feb. 28, 1911.

THE filaments are brought to a white heat, by the passage of an electric current, in vessels through which a very rapid current of reducing gas is passed, in order to prevent the heated filament being attacked by steam. The metal terminals with which the filaments are connected are cooled by the current of gas sufficiently to prevent oxidation.—A. T. L.

Metallic filaments for incandescent electric lamps; Apparatus for making ——. F. Blau, Berlin, Assignor to General Electric Co., New York. U.S. Pat. 985,502, Feb. 28, 1911.

A NUMBER of counterweighted bells or hoods are arranged in ring-fashion on a plate on which the filaments are supported, and the bells can be lowered over the filaments so as to form chambers in which the filaments can be heated in a current of gas. Connections are provided for passing the gas through all the chambers in series, and through drying chambers between the successive filament chambers. By means of a single control device each chamber in turn is made the first in the path of the gas, and this device is connected with the switch which controls the electrical circuits.—A. T. L.

Electrical incandescent lamps; Illuminant for ——. O. M. Thowless, Newark, N.J. U.S. Pat. 985,474, Feb. 28, 1911.

A ROD or filament is formed from the oxides of refractory metals, and is brought to a fritting temperature. The air is exhausted from the containing vessel and sufficient of the oxide is reduced to metal to render the filament a conductor at ordinary temperatures.—A. T. L.

Boron; Manufacture of ——. [*Use of platinum boride for uniting lamp filaments with the leading-in wires.*] Cie. Franç. pour l'Exploitation des Procédés Thomson-Houston. Third Addition, dated Oct. 26, 1910, to Fr. Pat. 377,683, May 8, 1907. (See Eng. Pat. 25,978 of 1906; this J., 1907, 1015.)

CARBON, tungsten, or other electric lamp filaments are connected with the platinum leading-in wires of the lamp by means of a small quantity of platinum boride which melts at the temperature of the Bunsen flame and readily adheres to the filament.—H. H.

Metallic filaments for electric lamps; Process for manufacturing ——. J. Schilling. Fr. Pat. 420,982, September 30, 1910. Under Int. Conv., Dec. 29, 1909.

THE metal is divided as finely as possible and made into a paste by means of a small quantity of ammonia solution or by subjecting the metal to the action of ammonia vapour, the paste being thoroughly kneaded in either case. The filament is then formed in the usual manner.—H. H.

Tungsten filaments for electric incandescence lamps; Process of manufacture of ——. Cie. Franç. pour l'Exploitation des Procédés Thomson-Houston. Fr. Pat. 421,427, Aug. 13, 1910.

TUNGSTEN filaments are treated during the final stage of manufacture in an electric furnace, being first maintained at a temperature of 700° to 900° C. in an atmosphere containing nitrogen and ultimately raised to a white heat in an atmosphere of hydrogen.—H. H.

Carbon filament lamps; Process for renewing ——. Allgem. Chem. Lab. O. H. Arendt. Fr. Pat. 421,724, Oct. 22, 1910.

In the process for renewing carbon filament amps, in which the black deposit upon the inside of the globe is first removed by heat, the filament thickened by the passage of an electric current while the globe is filled with hydrocarbon vapour, and the globe finally exhausted and resealed:—(1) The apparatus is arranged so that the lamp when once mounted in connection therewith does not require to be moved until the process is finished, suitable valves and conduits serving to connect it with the low and high vacuum pumps and with the hydrocarbon supply; (2) the hydrocarbon is introduced through an injector having a fine orifice; (3) the valve controlling the hydrocarbon supply is connected with the automatic switch supplying current to the filament, so that the supply of hydrocarbon is cut off as soon as the current ceases to flow.—H. H.

Incandescence filament or body and process for manufacturing the same. E. Cervenka, Paris. Eng. Pat. 8341, April 6, 1910. Under Int. Conv., Oct. 23, 1909.

See Fr. Pat. 419,702 of 1909; this J., 1911, 123.—T. F. B.

Tungsten filaments; Processes for making ——. Comp. Franç. pour l'Exploitation des Proc. Thomson-Houston. (Fr. Pat. 421,012, Oct. 1, 1910.)

See Eng. Pat. 23,499 of 1909; this J., 1911, 291.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Carbon in tar; Determination of the free ——. I. Ceruti. L'Ind. Chimica, 1911, 11, 5—8.

10 grms. of the tar are weighed into a beaker of 200 c.c. capacity and heated for two hours to 110° C. in an oven; 150 grms. of castor oil, previously heated to 120 ° C., are then added, and after a further 2 hours the mixture is poured, a little at a time, on to a weighed filter mounted inside the oven. The residue on the filter is washed with hot castor oil, and then after removing the filter from the oven, and cooling, the washing is completed with alcohol and carbon tetrachloride, and the filter and residue are weighed. The residue thus obtained, apart from inorganic matter, contains about 95 per cent. of carbon, and consists mainly of finely divided carbon similar to lampblack, but it also contains a small proportion (not more than 2 per cent. of the weight of the tar) of coarser graphitic carbon.—A. S.

Aniline; Quantitative experiments on the nitration of ——. A. F. Holleman, J. C. Hartogs, and T. van der Linden. Ber., 1911, **44**, 704—728.

From a large number of experiments on the nitration of aniline and its derivatives, the authors draw the following conclusions: (1) The para-compound is formed chiefly, together with certain amounts of the ortho-isomeride. (2) Two circumstances can influence this rule, viz.: (*a*) the formation of sulphate and the accumulation of acid groups in the amino-group, whereby meta-nitro-derivatives are formed; (*b*) indirect substitution whereby chiefly ortho-nitro-compounds are formed. By nitration with substances having a strong affinity for water, such as acetyl nitrate, and also by nitration in the presence of acetic anhydride, the intermediate formation of phenylnitramine must be assumed, and this probably exerts its own specific influence. In the nitration of acylanilides (formanilide, acetanilide, and benzanilide), the amount of para-nitro-compound formed increases with the concentration of the nitric acid, and in sulphuric acid solution this isomeride is almost exclusively produced.—J. C. C.

Characteristics of carbolic acid [phenol] in the Fifth German Pharmacopœia. Raschig. *See* XX.

Patent.

Aminobenzoylaminonaphtholsulphamic acids or their sulphonic acids; Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 421,846, Oct. 26, 1910. Under Int. Conv., Dec. 2, 1909.

Aminobenzoylaminonaphtholsulphamic acids are obtained by treating nitrobenzoylaminonaphthols or their sulphonic acids with sulphites. Example: 308 parts of 1-*m*-nitrobenzoylamino-6-naphthol are boiled with water, 200 parts of sodium acetate and 800 parts of a solution of sodium bisulphite, with the addition of sufficient alcohol to bring the whole into solution. When a sample no longer gives a precipitate with hydrochloric acid the alcohol is distilled off, sulphuric and sulphurous acids are precipitated by adding chalk, the excess of which is removed by precipitating with sodium carbonate, and the sulphamic acid is precipitated from the filtrate by adding salt.
—J. C. C.

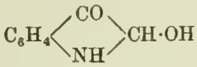
IV.—COLOURING MATTERS AND DYES.

Indigotin; Determination of —— *in the presence of starch.* W. Thomson. J. Soc. Dyers and Col., 1911, 27, 49—52.

The author describes experiments carried out on the estimation of indigo, in admixture with starch in various proportions. Rawson's permanganate process, with salt precipitation of the sodium indigotin disulphonate (this J., 1885, 489), was found to always give results corresponding to a much lower percentage of indigotin than that actually present, the discrepancy increasing as the proportion of starch to indigotin became greater. Bloxam's tetrasulphonate process (see this J., 1906, 735; 1907, 4, 1174), though also giving somewhat low results, was not so much affected by the presence of starch. In both processes the end-point in the permanganate titration was more or less ill-defined. It was therefore found advisable to remove the starch with hydrochloric acid before applying either Bloxam's or Rawson's process.—E. A. B.

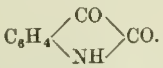
Indirubin. A. G. Perkin. J. Soc. Dyers and Col., 1911 27, 52—57.

Indirubin appears to be present in all natural indigos, though in many cases the quantity amounts to a mere trace, whilst in others it is quite considerable. With reference to the cause of the presence of indirubin in natural indigos, the author points out that since the indigo plant contains no substance, other than indican, which will account for the production of indirubin, and since this can only be formed according to Baeyer's equation, there can be no doubt that some isatin is formed during the manufacture of indigo under certain conditions. This substance has, in fact, been detected in Java indigos, rich in indirubin. Experiments carried out at Leeds (Thomas, Bloxam, and Perkin, Chem. Soc. Trans., 1909, 824; this J., 1909, 516) showed that when indigo is produced from pure indican in the laboratory, by fermentation and oxidation under factory conditions, indirubin could be detected in practically all the samples thus produced, and considerable amounts were produced if the oxidation was carried out under slightly alkaline or acid conditions. As regards the mechanism of the production of isatin from indoxyl during the manufacture, the author suggests that this may take place in two stages, the first product, having the formula—



$$C_6H_4{<}\begin{matrix}CO\\NH\end{matrix}{>}CH{\cdot}OH$$

and being converted by further oxidation into isatin—

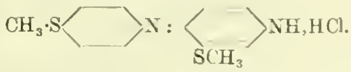


$$C_6H_4{<}\begin{matrix}CO\\NH\end{matrix}{>}CO.$$

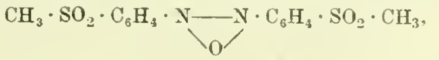
In support of this view, it is pointed out that samples of indoxylic acid, when kept for a long period with access of air, gradually suffer oxidation, the main product being indirubin, the formation of which can be accounted for by similar reactions to those given above. The author has found, by investigation of leaves of the indigo plant which have been kept for long periods, that the loss of indican, which has been previously noted, is partially accounted for by a simultaneous production of indirubin in the leaf. The dyeing properties of the dyestuff are discussed, and it is pointed out that the deterioration of an indirubin vat on standing has been shown, by recent work at Leeds, to be due not only to the production of indoxyl but also of oxindole, by reduction (see this J., 1909, 516). This reaction is in support of Baeyer's formula for indirubin. The pyridine method of estimating indirubin, devised by the author in conjunction with Bloxam (this J., 1910, 872), is discussed.—E. A. B.

1 : 4-*Aminothiophenol. III.* T. Zincke and P. Jörg. Ber., 1911, **44**, 614—626.

When 1 : 4-aminophenyl-methyl sulphide is oxidised with ferric chloride in alcoholic solution, a black violet dyestuff is obtained having the formula



This can be reduced by means of stannous chloride to a leuco-compound which crystallises in white needles, m.pt. 105° C. The dyestuff condenses with phenanthrenequinone to give a compound forming a dark carmoisine red powder, m. pt. 281° C., and it also condenses with carbon bisulphide, *o*-xylylene bromide, etc. With hydrogen peroxide it yields azoxyphenylmethylsulphone,

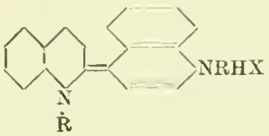


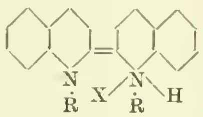
$$CH_3 \cdot SO_2 \cdot C_6H_4 \cdot \underset{\diagdown O \diagup}{N\text{——}N} \cdot C_6H_4 \cdot SO_2 \cdot CH_3,$$

which forms yellow plates, m. pt. 264° C.—J. C. C.

Quinoline dyestuffs. I. Apocyanines. A. Kaufmann and P. Strübin. Ber., 1911, **44**, 690-701.

When quinoline methiodide is treated in boiling methyl alcohol solution with a 10 per cent. solution of potassium hydroxide in methyl alcohol, condensation occurs, with the formation of two dyestuffs belonging to a class closely resembling the cyanines and isocyanines, and which the author therefore terms apocyanines. The sparingly soluble dyestuff formed as above is yellow and is therefore called xanthoapocyanine, and the more soluble one is red and called erythroapocyanine. The constitutions of the xantho- and erythro-apocyanines are respectively as follows :—





Erythroapocyanine forms dark red needles with a coppery lustre. Oxidising agents convert it into 2.2-diquinolyl derivatives. Xanthoapocyanine is formed with less yield than erythroapocyanine ; the salts, unlike those of the erythro-compound, are not oxidised by iodine or ferricyanide in alkaline solution. The orange yellow xanthoapocyanine produced from quinoline ethiodide melts and decomposes at 320° C. and the yellow xanthoapocyanine from quinoline methiodide melts above 300° C.—J. C.C.

Patents.

Dyestuffs of the anthracene series ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 2106, Jan. 27, 1910.

Dihalogen substitution products of diarylsulphones of the benzene series, or their homologues, are condensed with α-aminoanthraquinones and their substitution products (*e.g.*, by means of sodium and copper acetates). The dyestuff from *p*-*p*-dibromosulphobenzide and 1-aminoanthraquinone dyes cotton fast red shades from the hydrosulphite vat, whilst that from the same dibromosulphobenzide and 1-benzoylamino-4-aminoanthraquinone produces fast violet shades. The corresponding dyes from dichlorosulphobenzide (obtained from sulphuryl chloride and chlorobenzene) dye reddish-violet and blue shades, respectively.—T. F. B.

Oxazine dye. W. Lommel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 985,424, Feb. 28, 1911.

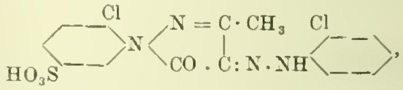
Claim is made for the dyestuff prepared by the interaction of *p*-nitrosophenol and gallaminic acid. It produces a reddish violet chrome lake on the fibre. The bisulphite compound furnishes a reddish corinth chrome lake.
—J. C. C.

Disazo dyestuffs for wool: Manufacture of ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron. Frankfurt-on-the-Maine, Germany. Eng. Pat. 28,678, Dec. 9, 1910.

Disazo dyestuffs producing brownish red to yellowish red shades on wool are obtained by combining tetrazotised *m*-tolidine or *m*-dichlorobenzidine with one mol. of a benzenoid orthohydroxycarboxylic acid and, in alkaline solution, with one mol. of 2-amino-8-naphthol-6-sulphonic acid or the corresponding alkylamino- or arylamino-acids. The dyestuff prepared from *m*-tolidine, salicylic acid and the above naphtholsulphonic acid dyes wool in brownish red tints and that from *m*-dichlorobenzidine, salicylic acid and the same naphtholsulphonic acid dyes wool in reddish brown shades.—J. C. C.

Pyrazolone dye for wool ; Yellow ——. H. Geldermann, Gross-Lichterfelde-Ost, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 982,050, Jan. 17, 1911.

A dyestuff having the formula



is obtained by combining the diazo compound of o-chloroaniline with o-chloro-1-phenyl-3-methyl-5-pyrazolone-*m*-sulphonic acid ; or the diazo compound may be combined with ethyl acetoacetate and the product condensed with o-chlorophenylhydrazine-*m*-sulphonic acid ; or the hydrazone of o-chlorophenylhydrazine-*m*-sulphonic acid with ethyl acetoacetate may be combined with the diazo compound of o-chloro-aniline, and the pyrazolone nucleus formed by means of a condensing agent. The dyestuff thus produced dyes unmordanted wool from an acid bath fast, clear, yellow shades (compare Ger. Pat. 229,641 of 1909 ; this J., 1911, 351).—T. F. B.

Anthracene ; Production of a series of new derivatives and dyestuffs from ——. Badische Anilin und Soda Fabrik. Thirteenth Addition, dated Oct. 12, 1910, to Fr. Pat. 349,531, Dec. 21, 1904.

The process of nitration, described in the 4th Addition (this J., 1905, 1298), can be applied similarly to the dyestuffs described in the 9th Addition (this J., 1907, 251). When *iso*Violanthrene is thus nitrated, the product gives a vat which dyes cotton in blue shades : this is a dinitro-derivative. On reduction it yields a dyestuff which produces similar shades to those furnished by the original compound.—J. C. C.

Alkaline salts of indoxyl in the solid form from alkaline fusions of phenylglycine, its derivatives, homologues, or combinations behaving in a similar manner ; Separation of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 420,947, Sept. 3, 1910 (under Int. Conv., Sept. 27, 1909), and First Addition thereto, dated Oct. 21, 1910 (under Int. Conv., Oct. 25, 1909).

(1) Fusions which yield indoxyl or its derivatives are treated with a small quantity of water or ice so that the alkali salt of indoxyl separates out. This is then filtered off and washed. The alkaline filtrate can be used over

again, or air may be blown through it, after dilution, in order to recover the indigo from it. (2) Instead of fusions of the type of phenylglycine, fusions of the type of phenylglycine-o-carboxylic acid or of its equivalents may be employed.—J. C. C.

Vat dyestuffs; Manufacture of reddish blue ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 421,096, Oct. 4, 1910. Under Int. Conv., Jan. 24, 1910.

By brominating the product of condensation of 7-methylindoxyl and isatin, new reddish blue vat dyestuffs are produced. The bromination is effected by any of the well known methods which are employed in the bromination of indigo, and, according to the conditions and amount of bromine used, products varying in composition from mono- to penta-bromo-derivatives are obtained.—J. C. C.

Thioindigo derivatives containing nitrogen; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 421,574, Dec. 24, 1909.

See U.S. Pat. 955,699 of 1910; this J., 1910, 621. Ammonia or another primary amine may be used in place of aniline.—T. F. B.

Indigo, its homologues and substitution products; Preparation of ——. Soc. Chem. des Usines du Rhone. Fr. Pat. 421,717, Oct. 22, 1910.

Indigo or its homologues or substitution products are obtained by oxidising o-nitrophenylnitromethane or its derivatives, in neutral or alkaline solution in the presence of acetone, and transforming the resulting ketone into indigo by means of an excess of alkali.—J. C. C.

Azo dyestuff; Manufacture of a yellow ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 12,423, May 21, 1910.

See U.S. Pat. 982,050 of 1911; preceding.—T. F. B.

Monoazo dye for wool. W. Herzberg and O. Scharfenberg, Schöneberg, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 986,287, March 7, 1911.

See Fr. Pat. 420,330 of 1910; this J., 1911, 351.—T. F. B.

Direct dyeing cotton [azo] dyestuffs; Manufacture of ——. Read Holliday and Sons, Ltd., J. Turner, and H. Dean, Huddersfield. Eng. Pat. 12,558, May 24, 1910.

See Fr. Pat. 416,898 of 1910; this J., 1910, 1370.—T. F. B.

Anthraquinone vat dye. M. Kugel, Leverkusen. Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 985,352, Feb. 28, 1911.

See Fr. Pat. 418,908 of 1910; this J., 1911, 78.—T. F. B.

Vat dyes. W. Bauer, Vohwinkel, A. Herre, and R. Meyer, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 985,767 to 985,770, March 7, 1911.

See Addition of June 1, 1910, to Fr. Pat. 407,507 of 1909; this J., 1910, 1369.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cellulose; Mercerisation of ——. O. Miller. Ber., 1911, **44**, 728—731.

Replying to certain criticisms by Cross and Schwalbe (this J., 1911, 204), the author supports his statement that cotton cellulose shows no gain in weight on mercerisation, by further determinations in which precaution was taken to recover any cellulose lost in the lye. The results, calculated on dry weights, were: mercerised product 99·6; fibres, etc., recovered from the lyes after neutralisation, 0·26; loss, 0·14 per cent. of the original cellulose taken. The matter recovered from the lye could in no sense be regarded as dissolved cellulose but consisted mainly of fibres and debris. The moisture of mercerised cellulose in equilibrium with air at the ordinary temperature is readily given off in a desiccator over calcium chloride and is not chemically fixed. It is well known that free water and water fixed in solid chemical hydrates evaporate with a constant velocity at a constant temperature under a constant tension of aqueous vapour lower than the saturation point. The author has subjected cotton, mercerised in a 30 per cent. lye, and containing at the ordinary temperature 1·8 mol. of adsorption water per $C_{12}H_{20}O_{10}$, to the conditions stated above under a bell jar with calcium chloride. Weighings were made at intervals over 48 days and the results showed that the rate of evaporation of the adsorption water was by no means constant but diminished rapidly from day to day over the whole period of observation.—J. F. B.

Celluloid; Preparation of non-inflammable ——. A. Eichengrün. Oesterr. Chem.-Zeit., 1911, **14**, 59—60.

The product of the acetylation of cellulose is not a simple triacetate but, apparently a complex mixture consisting of acetyl derivatives formed by the entry of the acetyl group into different positions in the cellulose molecule, and of intermediate compounds, produced by addition of water or by internal anhydride formation. A large series of cellulose acetates, therefore, exists, which do not differ essentially in composition from the triacetate, although in mechanical properties, stability and solubility they differ considerably among themselves. Some of the acetates are soluble in chloroform, in acetone, in ethyl acetate, in alcohol, or in acetylene tetrachloride, whilst others are completely insoluble in these solvents. "Cellit" is a definite acetate soluble in acetone. Of this it is possible to make thin sheet suitable for cinematograph films, but no sheet thicker than about 0·25 mm. The reason for this is that concentrated solutions, such as would be used for making the thicker sheet, dry from the outside and enclose solvent. The cellulose acetates have hitherto been devoid of gelatinising power, but the author has now succeeded (see Fr. Pat. 412,797, of 1910; this J., 1910, 1005) in producing cellulose acetate solutions which readily gelatinise, and render it possible to produce workable plastic masses such as "Cellon" and "Sicoid."
—E. W. L.

Mechanical wood pulp; U.S. Experimental laboratory for studying the production of —— *at Wausau, Wis.* H. S. Bristol. Papierfabr, 1911, **9**, 309—312.

The U.S. Forest Service has established a "Ground-wood Laboratory" at Wausau, Wis. for the study of the production of mechanical wood pulp from indigenous trees. At present a large portion of the mechanical pulp used in the American mills is manufactured from Canadian spruce, the supply of which is limited. The experiments up to date have been devoted to an investigation of the jack pine (*Pinus divaricata*), and attention will be given later to the hemlock; subsequently it is proposed to include all kinds of available woods from all parts of the States. "News" paper has been made on the experimental paper machine, consisting of 80 per cent. of jack pine mechanical pulp and 20 per cent. of sulphite pulp. The author appeals for support from the trade which so far has not shown much enthusiasm. Incidentally a study will be made of the whole question of efficiency in grinding mechanical pulp, the plant being erected on a very flexible system to permit of variations of conditions.—J. F. B.

Resin in sulphite wood pulp; Microscopic test for ——. P. Klemm. Wochenbl. Papierfab., 1911, **42**, 967—968.

For the quantitative determination of resin in sulphite pulp, extraction with ether is the standard method. The author, however, describes a rapid approximate test which consists in staining the particles of resin with a suitable dyestuff and estimating their relative abundance by microscopic examination. The sample to be tested is reduced to a pulp with water, the excess of water is drained off and the moist fibres are treated with a strong solution of the dyestuff Sudan III in a mixture of 3 parts of alcohol with 1 part of water. At this dilution there is no danger of the particles of resin being dissolved by the alcohol, whilst the moisture in the fibres is sufficient to prevent them from absorbing the dyestuff, only the resin being stained. After a few minutes' immersion, the excess of the dyestuff solution is removed, as completely as possible, with blotting paper, and the fibres are mounted for observation in water. The stained particles of resin are then observed as red amorphous bodies, chiefly in the cells of the medullary rays, but also attached to the outside of the wood fibres proper. Their irregular amœba-like or globular form readily distinguishes them from crystals of dyestuff which may have been deposited as the result of the dilution of the alcoholic solution. The deposits of the resin in the cells of the medullary rays are unobjectionable, but the loose particles attached to the fibres tend to clot together when the pulp is manufactured into paper, producing specks which are plainly visible in the paper. Soda wood pulp is relatively free from resin. With a little experience it is possible to estimate microscopically whether the proportion of resin in a sample of sulphite pulp is sufficient to cause trouble in the paper mill.—J. F. B.

Chlorine and caustic soda [*in paper mills*]; *Electrolytic production of* ——. W. Ebert. Papierfabr., 1911, **9**, 305—308.

THE simultaneous production of chlorine and caustic soda by electrolysis in the paper mill is an attractive alternative proposition to the electrolytic bleach-liquor process, and the author describes a Siemens and Halske installation which has been in successful operation at the alkali works at Aschersleben since 1909. The cells and their removable covers may be made of granite slabs or reinforced concrete, with iron cathodes, supported on insulated iron beams. The salt solution is distributed uniformly by pipes through the covers into the anode chambers of the cells. The chlorine gas produced in the anode chambers is collected in earthenware pipes and conducted to the chemical department, where it may be absorbed directly in milk of lime to produce bleaching liquor or may be utilised for the preparation of dry bleaching powder. The caustic soda solution produced in the cathode chamber runs into a reservoir, whilst the hydrogen escapes into the air, or is collected for use if convenient. The cells are connected in series and are constructed for a load of 2000—3000 ampères at 3·5—4·2 volts. The concentration of sodium hydroxide in the cathode liquor is about 130 grms. per litre; the chlorine gas contains 1·17 per cent. of carbon dioxide. A unit consuming about 10 HP produces in 24 hours about 57 kilos. of chlorine gas and 64·4 kilos. of sodium hydroxide. In actual practice the production of 1 kilo. of active chlorine in the form of bleaching liquor requires the expenditure of about 4 kilowatt-hours, as against 6 kilowatt-hours in the production of electrolytic bleach-liquor. The consumption of salt depends on the manner in which the caustic soda solution is utilised. If the cathode lye can be utilised in the paper mill as it comes from the electrolysers, containing a certain proportion of salt, the costs of evaporation and purification are eliminated, but the consumption of salt is about 3 kilos. per kilo. of active chlorine. If the soda lye is concentrated and purified, the salt is recovered from it and the consumption then falls to about 1·6 kilo. per 1 kilo. of active chlorine. These figures are to be set against a salt-consumption of 5 kilos. in the ordinary electrolytic bleaching-liquor system.
—J. F. B.

Rosin sizing; Use of magnesium sulphate in ——. Frohberg. Wochenbl. Papierfab. 1911, **42**, 968—969.

IN connection with the proposal to substitute magnesium sulphate for a portion of the aluminium sulphate employed for precipitating the rosin size in paper making (this J., 1911, 352), the author has made experiments with solutions of size and magnesium sulphate at dilutions equivalent to those employed in practice. When a solution of magnesium sulphate is added gradually to a solution of rosin size, in proportions equivalent to the quantity of soda present, no precipitate is formed. Only when three times the equivalent quantity of magnesium sulphate is added, does a precipitate form, but the precipitation of the rosin is by no means complete. When a mixture of equivalent quantities of magnesium sulphate and aluminium sulphate is treated with half an equivalent of sodium hydroxide, the whole of the aluminium hydroxide is precipitated with only a trace of the magnesium hydroxide. When rosin size is treated with the calculated equivalent of a mixture of magnesium and aluminium sulphates, the precipitation of the rosin is incomplete and practically no advantage is derived from the employment of the magnesium sulphate.—J. F. B.

Parchment paper; Preparation of —— *for microscopic examination.* C. Bartsch. Mitt. K. Materialprüfungsamt, 1911, **29**, 61—62.

IN the microscopic examination of parchment papers, prepared by the action of sulphuric acid on unsized paper, it is extremely difficult by ordinary methods to separate the component fibres in a form which admits of their accurate quantitative estimation. The author describes the following method for separating the fibres without destroying them:—Concentrated sulphuric acid, sp. gr. 1·84, is poured into an equal volume of water, and 50 c.c. of the diluted acid are warmed in a beaker to a temperature of 50°-60°C. Pieces of the parchment paper are then introduced and as soon as they show a tendency to become soft they are violently beaten up with glass rods. The pulp is poured on a sieve and washed. The success of the operation depends on its being carried out as rapidly as possible before the more delicate wood fibres of the paper are excessively attacked by the hot acid. In the case of parchment papers prepared exclusively from rag fibres, the danger of excessive treatment is not so great.—J. F. B.

Papers and parchments; Preservation of decayed —— *by treatment with cellulose acetate.* A. Martens. Mitt. K. Materialprüfungsamt, 1911, **29**, 57—60.

A COLLODION preparation called "zapon" varnish has previously been recommended for the preservation of decayed documents, but it is not quite unobjectionable on account of its inflammability and liability to chemical changes and discolouration. The author now advocates the use of "cellit" varnish which is claimed to be free from the objections recognised in the case of "zapon." "Cellit" varnish is a solution of a particular modification of cellulose acetate in a mixture of alcohol, ethyl acetate, ethyl acetoacetate and camphor. The suitability of this preparation for the above purpose has been called in question by Schluttig, who objects that the liquid and the film of varnish produced from it have a reddish colour and a distinctly acid reaction, that a portion of the solvent is not readily volatile and the varnish dries very slowly, lastly that it is not suitable for treating photographs. The author replies to these contentions, stating that the red colouration was due to the use of iron vessels and that the preparation is colourless if stored in glass or stoneware, that the acidity can only amount to traces left in the ethyl acetoacetate and cannot injuriously affect the documents, and that the varnish is not intended to be used for the treatment of photographs on collodion-coated papers.—J. F. B.

Papers; Spontaneous ignition of greasy waste ——. W. Herzberg. Mitt. K. Materialprüfungsamt, 1911, **29**, 115—120.

THE author records a legal action in which claim was made on account of the burning of a closed railway van containing a consignment of waste paper. No abnormal signs were apparent on loading the van, but in a few hours the contents were found to be on fire. Analysts' evidence was called to show that a sample of the unburnt paper contained 0·88 per cent. of fatty matter, which had caused spontaneous ignition. The author's examination showed no trace of fat, and he concludes that the above percentage simply represents the rosin of the sizing. According to his view no spontaneous ignition of greasy paper, packed in bags, could conceivably occur without

some warning in the form of smoke, etc., being present long before the actual outbreak. Inquiries made in the trade and among insurance companies have elicited no authenticated case of the spontaneous ignition of greasy waste paper, and the author expresses his opinion that such ignition, although well known in the case of porous fibrous materials, is highly improbable in the case of paper.
—J. F. B.

Paper mills in British India. Board of Trade J., March 16 1911. [T.R.]

There were eight paper mills at work in British India in 1909—three in Bengal, four in the Bombay Presidency, and one in the United Provinces. The estimated capital of these mills was about 50 lacs of rupees. The value of the output reported rose from 74 lacs in 1908 to 77·5 lacs in 1909, the largest production in any single year on record. The competition of cheap wood-pulp paper imported from Europe has checked the development of paper-making by older methods in India, and the most successful mills are those which have Government contracts for the supply of cheap foolscap, blotting paper, notepaper, and envelopes. The following table shows the number of paper mills, the capital and labour employed, and the production of paper in British India, and also the value of paper imported during each of the years 1905–9 :—

——	1905.	1906.	1907.	1908.	1909
Number of mills at work	6	7	7	8	8
Nominal capital employed (as far as known) ... Rs.	48.15,000	48,15,000	50,35,000	50,35,000	50,35,000
Daily average number of persons employed	4,012	4,421	4,959	4,784	4,645
Production—Quantity ... lb.	44,146,157	47,153,013	53,886,767	55,351,540	55,452,980
„ —Value ... Rs.	51,86,729	62,70,088	71,24,268	74,26,057	77,53,327
Imports ... Rs.	69,95,655	77,59,290	94,34,865	94,25,025	1,00,02,675

Rupee = 1s. 4d. Lakh = 100,000 rupees.
Note.—Figures for the paper mills at Gwalior are not included in the foregoing.

Patents.

Artificial threads; Manufacture of ——. M. Weertz, Bradford. Eng. Pat. 10,211, April 26, 1910.

In the manufacture of artificial silk the threads are wound directly on to reels of which the portions which come in contact with the silk are constructed of aluminium or nickel, or both, or are plated with nickel. The silk is dried whilst on these reels, and twisted direct from them without the intermediate step of re-winding. The reel is formed of a hub and radial arms carrying cross-bars, the cross-bars, and preferably the other portions also, being constructed of the metals mentioned above.—J. F. B.

Cellulose products by the copper process; Utilisation of the washing liquids obtained in the manufacture of ——. Ver. Glanzstoff-Fabriken A.-G., Elberfeld, Germany. Eng. Pat. 27,539, Nov. 26, 1910. Under Int. Conv., June 18, 1910.

For the recovery of the ammonia liberated in the manufacture of artificial silk by the cuprammonium process, the washing liquids produced by the washing of the precipitated cellulose may be utilised as absorbing agents. In the case of alkaline precipitating baths, these liquids containing sodium hydroxide, sugar, and copper hydroxide are caused to flow down a tower up which travels the current of air containing ammonia drawn from the place where it is generated. The ammonia is absorbed by the copper hydroxide and is recovered from the solution by distillation. In the case of acid precipitating baths, the acid and the copper sulphate contained in the wash waters serve directly as absorbents for the ammonia vapours, and their action is intensified by the addition of calcium chloride which also forms a double compound with ammonia.—J. F. B.

Artificial threads or films and artificial horse-hair; Process for preparing ——. F. Lehner, Zürich, Switzerland. U.S. Pat. 986,017, March 7, 1911.

Concentrated solutions of cellulose, adapted for spinning, are prepared by the action on cellulose of a solution of ammonia and copper salts or cupric oxide, including cuprous chloride.—J. F. B.

Artificial silk; Apparatus for spinning ——, *and lustreing natural silk and other textile fibres.* B. Loewe. First Addition, dated Dec. 11, 1909, and Second Addition, dated Aug. 31, 1910, to Fr. Pat. 403,242, Sept. 18, 1908 (this J., 1909, 1310).

The bobbins and intermediate baths described in the original patent are suppressed and the filaments are wound directly from the jets on a polygonal bobbin with the assistance of a guide-roller having a to-and-fro motion. The single jets originally described may be replaced by multiple spinnerets, each orifice of which can be closed by a plug and each group of jets being controlled by taps. Each set of jets is provided with an air chamber to equalise the pressure. The jets for lustreing textile fibres are carried on a horizontal tube with an orifice for the entrance of the thread on the upper side and a corresponding orifice for its exit immediately beneath; the jets may be prolonged by capillary tubes in glass or metal. According to the second addition, the jet through which a filament of raw natural silk is being lustred, may be surrounded at a short distance from its orifice by a cluster of jets through which artificial filaments are being spun. The torsion set up by the to-and-fro guide acting at a long distance from the spinning orifice combines all these filaments into a compound thread containing a central filament of natural silk.—J. F. B.

Cocoanut fibre; Treatment of —— *for the production of artificial horsehair.* Soc. Commerciale des Crins. Fr. Pat. 421,381, Dec. 20, 1909.

Cocoanut fibre is digested at a temperature of about 110° C. with about 15 per cent. of sodium hydroxide for 1½ hour, or to such an extent that 40—50 per cent. of the weight of the fibre is removed. When carded in water the product yields an artificial horsehair capable of being used as a substitute for genuine hair.—J. F. B.

Celluloid; Process for preparing a substance having the nature of —— *from acetylcellulose.* A. Eichengrün. First Addition, dated Sept. 29, 1910, to Fr. Pat. 419,530, Aug. 11, 1910 (this J., 1911, 205).

In carrying out the process described in the original specification, particularly favourable results are obtained by the use of acetylene tetrachloride with or without alcohol.—J. F. B.

Plastic composition [*cellulose acetate*] *for manufacture of combs and other purposes.* G. Convert. Fr. Pat. 421,843, Oct. 26, 1910.

A solution of cellulose acetate in tetrachloro-ethane separates on standing into two portions: a liquid free from cellulose acetate, and a jelly of constant composition in which 100 parts of the acetate retain 720 parts of the solvent. On drying at 50° C. the product still retains 27·2 grms. of the solvent per 100 grms. of the cellulose acetate. This product appears to be a stable compound of the two components: it is non-inflammable and possesses remarkable plastic properties. In the manufacture of these plastic masses, a mixture of 100 parts of cellulose acetate and 28—40 parts of tetrachloro-ethane is treated with sufficient acetone, alcohol, or other solvent of cellulose acetate to produce a uniform paste. Other substances, such as camphor, vaseline, oils, sulphur, caoutchouc dissolved in ethylene dichloride, etc., may be incorporated with the mixture, to modify the properties of the product. The solution may be poured on plates or evaporated in shallow vessels.—J. F. B.

Plastic materials, celluloid, non-inflammable or otherwise; Process and apparatus for manufacturing ——. P. A. D. Prost and Les Fils Pinay jeune. Fr. Pat. 421,854, Dec. 30, 1909.

Apparatus is described for effecting the nitration or acetylation of cellulose (paper) in closed vessels. The paper is first corrugated by passage between grooved rolls and the corrugated paper is reeled up loosely to form cylinders in which the corrugations afford free access of liquid to the interior. The treatment of these rolls is effected in earthenware pots, containing the acid, with aluminium hoods. The roll of paper is placed in an aluminium basket which is lowered into the acid. When the paper is saturated with liquid, the basket is raised into the hood and allowed to drain, whilst the cellulose is all the time subjected to the action of the vapours above the liquid. A plate is then slid between the hood and the pot, and the hood, basket, and plate are carried on rails to a vessel of cold water into which the basket is dropped. The acid pot, meanwhile, is covered with another plate until the hood is charged again. The product s washed, dried, and reduced to small particles. These are packed in a perforated shell and impregnated in a press with a liquid containing the following ingredients: solvent (*e.g.*, alcohol and ether), 1000 c.c.; stannous chloride, 300—400 grms.; camphor, 300—400 grms.; castor oil, 10 grms.; ammonium or barium chloride, 3—10 grms.; sodium chloride, 1—5 grms.; carbon tetrachloride, 20—40 grms.; and lactic acid, 15—50 c.c.—J. F. B.

Drying wool and other textile materials; Machine for —— J. F. White, Bradford. U.S. Pat. 986,253, March 7, 1911.

See Eng. Pat. 227 of 1910; this J., 1910, 1451.—T. F. B.

Silk; Process for increasing the durability of weighted ——. O. Meister. Fr. Pat. 421,485, Oct. 14, 1910. Under Int. Conv., Oct. 16, 1909.

See Ger. Pat. 223,883 of 1909; this J., 1910, 1154.—T.F.B.

Wood-cellulose; Process for refining ——. C. G. Schwalbe, Darmstadt, Germany. Eng. Pat. 29,991, Dec. 22, 1909.

See Fr. Pat. 410,460 of 1909; this J., 1910, 810.—T. F. B.

Viscose; Process of concentrating and maturing ——. L. Naudin, Assignor to Soc. Franç. de la Viscose, Paris. U.S. Pat. 986,306, March 7, 1911.

See Fr. Pat. 374,123 of 1906; this J., 1907, 775.—T. F. B.

Celluloid; Non-inflammable —— and process for making it. W. C. Parkin and A. Williams. Fr. Pat. 421,010, Oct. 1, 1910.

See Eng. Pat. 26,657 of 1909; this J., 1910, 1152.—T.F.B.

Solvents for pyroxlin and analogous substances; Process for making —— and also certain intermediate products. H. V. Walker. Fr. Pat. 421,058, Oct. 4, 1910.

See U.S. Pats. 972,952, 972,953, and 972,954 of 1910; this J., 1910, 1332, 1299, and 1305.—T. F. B.

Extracting alcohols from suint [wool-grease]. Fr. Pat. 421,044. *See* XII.

Production of tanning agents from waste [sulphite pulp] liquors. Eng. Pat. 7438. *See* XV.

Making a fermentable, glucose-like product from cellulosic and ligneous materials. U.S. Pats. 98[illegible],725 and 9[illegible]5,72[illegible]. *See* XVIII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Sodium perborate; Bleaching with ——. J. M. Matthews. J. Ind. Eng. Chem., 1911, **3**, 191—193.

Commercial sodium perborate (10·4 per cent. of active oxygen) is prepared from sodium peroxide and boric acid. As in the case of other per-oxygen compounds its bleaching activity depends upon the fact that it readily yields a solution of hydrogen peroxide when dissolved in hot water, the other products of the reaction being caustic soda and borax (or probably sodium metaborate). In the author's opinion hydrogen peroxide itself would be both a safer and cheaper bleaching agent for the laundry. The only advantage (and that is a questionable one) possessed by sodium perborate is that it can be incorporated with soaps and washing powders. Several preparations of the kind are now on the market, such as "persil," which is a mixture of soap, soda ash, sodium silicate, and sodium perborate; "clarax," consisting of borax, sodium phosphate, and sodium perborate; and "ozonit," which resembles "persil" in composition. In England these preparations are sold under the general name of "perborin" products, "perborin" itself being pure sodium perborate, and "perborin M" being a mixture of soap, alkali and sodium perborate, designed to meet the requirements of the laundry trade for a combined washing and bleaching agent.—C.A.M.

Formic acid: its properties and application in dyeing and finishing. T. Walther. Färber-Zeit., 1911, **22**, 61—62, 83—85.

The author gives a short account of experiments on the use of formic acid as a substitute for tartar, oxalic acid, and acids such as acetic, hydrochloric, sulphuric, etc., usually employed in mordanting. (*a*) *Dyeing on a mordant*: The use of formic acid is attended by numerous advantages. The same depth of shade is produced by using considerably less bichromate than is required when other acids are used, and, moreover, the complete exhaustion of the mordanting bath effects a further economy. The addition of sulphuric acid to the bath is not necessary, and the goods, whether loose wool, yarn or pieces, may be entered dry at the boil with perfectly even results. In mordanting heavily milled goods the author first neutralises the formic acid bath with ammonia, enters at 70° C., and after keeping the bath at this temperature for 15—20 mins., raises to the boil, and boils for the required length of time. The colours produced by the formic acid method are deeper and fuller than those produced by the aid of tartar, besides possessing greater fastness to milling and light. Also the wool is left soft and smooth, whilst the tartar method leaves it with a harsh feel. For the dyeing of Eriochrome colours topped with indigo, the following method is recommended: The wool is entered at 70° C. in a bath containing the necessary amount of dissolved dye and about 2 per cent. of formic acid, and kept at that temperature for 15—20 mins. The bath is then raised to the boil, boiled for about ½—¾ hour, 1 per cent. more formic acid or 0·5 per cent. of sulphuric acid added, and the boiling continued ½ hour longer. Then 1 per cent. of bichromate is added, and after boiling ½ hour, the wool is rinsed and dyed with indigo. The resulting dyeings possess excellent fastness to light, milling, potting and stoving. (*b*) *Single-bath method*: By using formic acid the process is rendered both simpler and more rapid. The wool is entered at 50° C. in a bath containing the dyestuff along with ¼ per cent. of bichromate (on the weight of dye), and 1 per cent. of formic acid, and dyeing continued 15 mins. at 50° C. The bath is then raised to the boil, and boiled for 1 hour. Then more formic acid is added, and boiling continued until the bath is completely exhausted. (*c*) *Dyeing and development with bichromate*: In this process acetic and sulphuric acids may be replaced by formic acid with considerable advantage The material may be entered at a higher temperature, and the bath raised more rapidly to the boil, without danger of uneven results. The bath is prepared with the necessary quantity of dissolved dyestuff and 1 per cent. of formic acid, and the goods, previously wetted out (loose wool may be entered dry, at the boil) are entered at 60°—70° C. The bath is raised to the boil in $\frac{1}{2}$ hour, and kept $\frac{1}{2}$ hour at the boil, when 1—2 per cent. of formic acid is added, and the boiling continued until exhaustion is complete. Then, without cooling, potassium bichromate ($\frac{1}{3}$—$\frac{1}{2}$ per cent. on the weight of dye taken) is added, and the bath kept at the boil for $\frac{1}{2}$—$\frac{3}{4}$ hour. The old bath is neutralised with ammonia before re-using. (*d*) *Dyeing with logwood, or its colouring matter, Haematin*: The author obtained good results by using formic acid instead of sulphuric and oxalic acids, in both the single and two-bath processes, the dyed goods being much smoother and more glossy, and having a softer feel. The employment of formic acid is especially recommended when calcareous water is used, since oxalic acid is precipated as calcium oxalate by such water. (*e*) *Milling of cloth and goods dyed in the form of loose wool*: The use of formic acid in milling has many advantages over soap. The possibility of formation of calcium soaps when hard water is used is precluded, whilst the goods are equally soft and smooth. The method of procedure is the same as in the soap method, except that the soap solution is replaced by one of dilute formic acid, and the duration of the impregnation longer. Goods dyed in the loose state, with dyes which will not stand milling with soap, may be milled with formic acid without damaging the colours.—E. A. B.

Patents.

Dyeing with benzoquinone and α-naphthoquinone dyestuffs; Process of ———. R. Lesser, Berlin, Germany. Eng. Pat. 876, Jan. 12, 1911. Under Int. Conv., March 3, 1910.

Dyestuffs derived from benzoquinone or α-naphthoquinone by substituting for one or more hydrogen atoms the residue of an aromatic amine, a homologue or substitution product of the same, or two such residues, and in which one or more of the remaining hydrogen atoms of the quinone may or may not be replaced by a halogen atom or atoms, or an alkyl group or groups, may be used as vat dyestuffs. The material is dyed in the usual manner by reduction in alkaline solution, and subsequent oxidation of the leuco-compound.—B. N.

Hair or hat bodies made therefrom; Process for dyeing ———. Farbwerke Meister, Lucius, und Brüning. Ger. Pat. 229,957, Feb. 19, 1910.

Deep black fast shades on hair or on hat-bodies made therefrom can be obtained by dyeing in Aniline Black baths in the cold, if *p*-phenylenediamine, *p*-aminophenol, or their derivatives be added to the bath.—A. S.

Bleaching straw by means of hydrosulphites. P. E. Wickham, London. Eng. Pat. 18,297, Aug. 2, 1910.

See Fr. Pat. 420,725 of 1910; this J, 1911, 354.—T. F. B.

Electrolyser [*for preparing bleaching liquors*]. E. Weichert. Fr. Pat. 421,038, Oct. 3, 1910.

See Eng. Pat. 23,629 of 1909; this J., 1910, 1102.—T. F. B.

Dyeing skeins; Apparatus for ———. J. and L. Regordosa, Barcelona, Spain. U.S. Pat. 985,936, March 7, 1911.

See Fr. Pat. 401,988 of 1909; this J., 1909, 1247.—T. F. B.

Dyeing; Process for ——— *and new compounds for use therein.* Act.-Ges. f. Anilinfabr. Fr. Pat. 421,564, Oct. 18, 1910. Under Int. Conv., Jan. 12, 1910.

See Eng. Pat. 25,007 of 1910; this J., 1911, 280.—T. F. B.

Textile materials; Process of treating ———. R. Weiss, Kingersheim, Germany. U.S. Pat. 986,332, March 7, 1911.

See Eng. Pat. 15,284 of 1908; this J., 1908, 1201.—T.F.B.

Method of and appliances for indicating or testing colour values. Eng. Pat. 3551. *See* XXIII.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphuric acid manufacture; Critical remarks on "intensive" working in ———. A. Nemes. Z. angew. Chem., 1911, 24, 387—392.

The rapid development of the contact process a few years ago caused alarm for the future of the chamber process; but new developments and improvements in the old process have renewed its vitality, and in 1909 only 6 per cent. of the total German make of acid was stronger than 100 per cent. H_2SO_4. Many of these improvements were in the direction of "intensive" working, and there is no doubt that the increase of yield per cubic metre of chamber space is in many respects economical; but it may be questioned whether on the whole the balance of advantage is in favour of "intensive" working, and some of the "intensive" installations have now been at work long enough to allow of comparisons being instituted. The author summarises the literature on the subject, and the various contrivances designed to increase the yield; he then quotes a number of instances from his own experience, and summarises in the following table the yield per cubic metre (1 kilo. per cubic metre = 1/16 lb. per cubic foot), the nitre consumption, and the life of the installation where that has terminated:—

	Kilos. of H_2SO_4 per cb. m. per day	Nitre consumed. kilos.	Life—years.
A	2·20—2·40	0·58—0·64	18—20
B	2·34	0·51	20
C	3·74	1·01	15—17
D	3·75	1·76	
E	5·00	1·28	
F	5·94	2·88	
G	6·25	2·64	

These may be looked on as typical of various "densities of yield"; and though results vary greatly with mode of working, raw materials, construction, etc., yet invariably the nitre-consumption rises with, and much more rapidly than, the yield per cubic metre. Over a wide field of observation, the following figures for nitre-consumption hold for very various systems:—for a production of 3 kilos. of chamber acid per cb. m., 0·35—0·55 kilo. of nitre; 4, 0·50—0·70; 5, 0·60—0·90; 6, 0·70—1·10; 7—8, 0·80—1·30; 8—9, 1·00—1·60; 9—10, 1·20—1·80; and for a production of 10—12 kilos. of chamber acid, 1·50—2·00 kilos. of nitre. The variations are greater in the case of forced working than with smaller production. In respect of the proportion of the sulphur introduced which is recovered in the acid, there is perhaps not much difference between "natural" and forced working; but to maintain the "intensive" process in continuous and regular work is far more difficult, and makes enormously greater demands on the staff, than is the case with the old process. The following costs of production are worked out, for four imaginary systems each producing 30 tons of chamber acid daily, from those of related actual systems in the author's knowledge. It is supposed that in each there are Glover and two Gay Lussac towers, fan, water-spray, etc. The respective daily yields per cubic metre are 3, 5, 8, and 10 kilos. of chamber acid, and hence the capacities of the systems 10,000, 6000, 3750, and 3000 cubic metres. This means an area in each case of 1100, 720, 480, and 400 sq. metres for the chambers, and hence say 5 times these respective areas for the total of each work. Mechanical arrangements, buildings, burners, etc., will be the same in all cases, but there will be differences in the actual construction of the chambers and the amounts of lead used in them. The costs of installation will be :—

	1	2	3	4
	£	£	£	£
Ground	2,600	2,200	1,950	1,900
Buildings	2,500	2,500	2,500	2,500
Machines	900	900	900	900
Burners	2,500	2,500	2,500	2,500
Lead	6,000	4,200	2,500	2,000
Towers, chamber framework	9,000	5,000	3,750	3,000
Total ..... £	23,500	17,300	14,100	12,800

The working expenses are calculated as follows : Sulphur, at 15·4 pence per 100 kilos. of H_2SO_4 (the same in all) ; nitre-consumption, 0·60, 0·88, 1·76, and 2·40 per cent., and coal 14 per cent., on the monohydrate ; wages, 10 men at 4s. daily ; repairs £196, £245, £441, £588 per annum ; depreciation 5, 6·5, 8, 10 per cent. (20, 16, 12½, 10 years' life) ; interest on capital 5 per cent. In calculating depreciation the cost of the ground is not included, and 15 per cent. of the cost of the lead is deducted as recoverable. The figures, per 100 kilos. of H_2SO_4, are as follows :—

Yield of H_2SO_4 per cub. m.	1·87 kilos.	3·28 kilos.	5·00 kilos.	6·26 kilos.
	d.	d.	d.	d.
Sulphur	15·4	15·4	15·4	15·4
Nitric acid	1·44	2·11	4·22	5·76
Power and light	2·40	2·40	2·64	2·64
Wages	2·52	2·52	2·52	2·52
Repairs	0·72	0·88	1·57	2·27
Depreciation	2·94	2·70	2·32	2·32
Interest	4·14	3·02	2·47	2·24
Total pence per 100 kilos.	29·56	29·03	31·14	33·15
shillings per ton ..	25·02	24·58	26·37	28·06

The figures show that, contrary to the general belief, "intensive" working of the chambers raises the cost of production of the acid above that in a system with a normal production of say 6 kilos. of chamber acid per cubic metre. This arises chiefly from the greater cost of nitre, and of repairs and depreciation. "Intensive" working will be advantageous only in special circumstances, as the impossibility of extending a work, the laying off for repairs of another system, etc. It would appear possible, however, that the newest development in "intensive" working, the tower process, may have a future before it. Information given to the author of the working of a system of six towers in Hruschau shows that 25 kilos. of monohydrate per cubic metre were made, with a nitre-consumption of only 1·1 per cent. Time will be required, however, before the costs of working and repairs can be established.—J. T. D.

Chamber process; Theory of the ——. O. Wentzki. Z. angew. Chem., 1911, **24**, 392—400.

A reply to Raschig and to Berl (this J., 1911, 21 and 22). The blue acid is not produced by addition of hydrogen to nitrosylsulphuric acid (for mercury with sulphuric acid does not yield hydrogen), but by removal of oxygen from it, two molecules then coalescing to produce the blue acid as formulated by the author (this J., 1910, 1247). He admits that sulphur dioxide does not reduce the blue solution, the vanishing of the blue colour in his former experiments being due to oxidation by the air in the apparatus. By this oxidation, however, nitrosylsulphuric acid is formed, and must be formed in the chambers, so that the blue acid would never be observed in the chambers in normal working. The author disputes the existence of nitrososulphonic acid ; and still more its reaction on nitrous acid even in presence of sulphur dioxide, to form nitrosisulphonic acid. He contends that hydroxylaminedisulphonic acid and nitrilosulphonic acid would be formed under chamber conditions rather than nitrososulphonic acid. The difference between the reaction of mercury and that of sulphur dioxide on nitrosylsulphuric acid is that mercury reduces it even in strong sulphuric acid solution, sulphur dioxide only in acid weaker than 88 per cent. of monohydrate. The non-appearance of the blue acid in solutions weaker than 75 per cent. of monohydrate is not due to the non-existence of nitrosylsulphuric acid in those solutions, but to the fact that the blue acid is decomposed more rapidly than it is formed. It is true that water is necessary for the reaction of nitrogen peroxide on sulphur dioxide, but that is not because it forms any intermediate products but because the reaction $NO_2+SO_2 \rightleftarrows NO+SO_3$ is reversible, and proceeds with greatest rapidity from right to left, so that, in equilibrium, the proportion of sulphur trioxide present is very small ; water removes this, and allows the reaction to proceed further in the direction from left to right. That reaction does represent what occurs in the chambers.
—J. T. D.

Ammonia ; Solubility of —— at different temperatures and pressures. A. Brichaux. Bull. Soc. Chim. Belg., 1911, **25**, 145—153.

The author has found that for solutions of ammonia of concentrations up to 12 per cent., the difference between the temperature of the solution in equilibrium with its vapour under a definite pressure and the temperature at which water boils under the same pressure, varies only with the ammonia-content of the solution. For stronger solutions of ammonia, also, the rule is approximately true for pressures between 1 and 2 atmospheres. This difference is termed the differential temperature, and a curve showing the relation between the differential temperature and ammonia content will prove useful in many ways in connection with the distillation and absorption of ammonia. Several examples of the manner of utilising such a curve are given. For example the concentration of ammonia solutions saturated at 95° C. under pressures of 1, 2, 3, and 4 atmospheres respectively may be readily ascertained by the aid of the curve, as indicated in the following table :—

Pressure, in atmospheres	1	2	3	4
Boiling temp. of water, °C.	100	120·6	133·9	144
Differential temperature.	5	25·6	38·9	49
Ammonia content, from curve	1·1	7·85	13·3	17·9

(See also following abstract.)—A. S.

Ammonia solutions ; Chart of vapour pressures of ——. E. Herzen. Bull. Soc. Chim. Belg., 1911, **25**, 154—157.

The author has constructed a chart for ammonia solutions of concentrations up to 12 per cent. ; by means of which if any two of the three quantities : temperature, vapour pressure, ammonia-content, be known, the third can be read off directly. The chart is based on the data of Regnault for the vapour pressures of water between 25° and 150° C., and the relation described by Brichaux (see preceding abstract) between the "differential temperature" and ammonia concentration. This latter relation can be expressed by the formula :

$$\theta = 40{\cdot}191 - 18{\cdot}634\sqrt{4{\cdot}652+n},$$

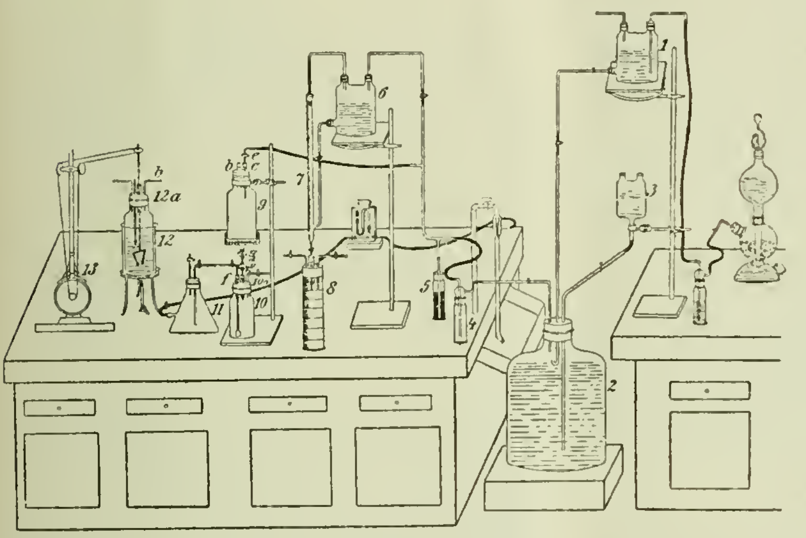
where θ is the differential temperature and n is the percentage of ammonia in the solution.—A. S.

Potassium bicarbonate ; Action of —— on magnesium chloride and on the soluble salts of magnesium generally. Nanty. Comptes rend., 1911, **152**, 605—607.

When aqueous solutions of potassium bicarbonate and magnesium chloride are mixed, under ordinary conditions of temperature and pressure, a precipitate is formed after some time, the composition of which depends on the strengths of the solutions employed. If the potassium bicarbonate constitutes less than about 3·8 per cent. of the ternary mixture ($KHCO_3$; $MgCl_2$; H_2O) the precipitate formed consists only of hydrated magnesium carbonate, $MgCO_3,3H_2O$. If a larger proportion of potassium bicarbonate is present, the double salt, $MgCO_3,KHCO_3,4H_2O$, separates out at first, but in many cases the composition of the deposit changes as precipitation proceeds owing to alteration of the composition of the solution, the portions of the precipitate last deposited consisting of hydrated magnesium carbonate, $MgCO_3,3H_2O$.—J. H. L.

Hydrosulphite; Preparation of pure ——, and the system hydrosulphite-water. K. Jellinek. Z. anorg. Chem., 1911, 70, 93—134.

The author's experiments on the preparation of pure sodium hydrosulphite from the commercial product show that purity is dependent on the "salting out" process being almost instantaneous, and on the dehydration of the hydrated salt, under saturated sodium chloride solution, being effected in the presence of alkali, the mixture being well stirred; air also must be rigidly excluded during the whole process. The figure represents an apparatus which may conveniently be used for the preparation of the pure salt. Pure carbon dioxide, for replacing air in the various parts of the apparatus, is generated in the vessel, 2, which contains bicarbonate solution (1 kilo. of bicarbonate in 10 litres of boiled water), 20 per cent. sulphuric acid, saturated with carbon dioxide, being introduced from the vessel, 1. In carrying out the process, the vessel, 9, the bottom of which fits gastight into a porcelain funnel, is, several times, alternately connected with the filter-pump and with the carbon dioxide generator; 400 c.c. of water and 100 grms. of commercial (82 per cent.) sodium hydrosulphite are then introduced through the tube, 9*b*, the salt is dissolved by shaking, and connection is made with vessel, 10, into which the solution, free from solid impurities, is drawn by means of the pump. The vessel, 10, is then disconnected and filled with carbon dioxide, 112 grms. of sodium chloride are quickly introduced, and the vessel is shaken, when a deposit of about 70 grms. of pure hydrated hydrosulphite is obtained. The tube, *f*, the lower end of which is covered with filtering material, is then fixed in place, a current of carbon dioxide being maintained meanwhile, and the mother liquor is drawn over from 10 to 11, the material being broken up, as necessary, and repeatedly treated with a saturated solution of sodium chloride, which is likewise drawn over into 11. A mixture (about 180 c.c.) of brine and hydrated hydrosulphite is finally left in the vessel 10, and to this 10 c.c. of 20 per cent. sodium hydroxide are added; the stopper, 10*a*, is then replaced by the stopper, 12*a*, and, whilst carbon dioxide is led in by the tube, 12*b*, the stirrer is set into rapid motion. The temperature is next raised rapidly to 60° C. and maintained at this point for about half-an-hour, until transformation to the anhydrous salt (a heavy sandy powder) occurs, when, after 5 minutes' further heating, the stopper, 10 *a*, is again inserted, and the hot mother liquor is removed through the tube, *f*. The material is then washed successively with hot 50 per cent., hot 100 per cent., and cold 100 per cent. alcohol (50—100 c.c.) and, after replacing the tube, *f*, by a thermometer, is dried at 50°—60° C. for $\frac{1}{2}$—1 hour, the vessel being connected with the pump. About 50 grms. of anhydrous salt (99—100 per cent.) are obtained, and, even in presence of air, may be preserved for months. The purity of hydrosulphite is best determined by titration with ammoniacal copper sulphate (in excess), the titration being carried out in absence of air, as indicated in the Fig. (6, 7), and a drop of indigo solution, as recommended by Bernthsen, being added to increase the sharpness of the colour change (blue to yellow). For the determination of sulphate in the presence of hydrosulphite, the method of Binz and Sondag (this J., 1905, 1302), is recommended; for thio-sulphate, the solution is added to iodine solution, until the blue colour is no longer formed with starch, and the tetrathionate, thus produced, is determined by Feld's method (this J., 1898, 1186) by reduction with pure aluminium and hydrochloric acid and absorption of the liberated hydrogen sulphide in excess of standard iodine; sulphite is determined by difference, after converting all the sulphur compounds into sulphate by means of ammoniacal hydrogen peroxide solution, or the method of Binz and Sondag (*loc. cit.*) may be employed. Equilibrium in the system hydrosulphite-water has been studied by means of freezing-point and solubility determinations, and an equilibrium diagram is given. A cryohydrate is formed at –4·58° C. and at a concentration of 19·00 grms. of sodium hydrosulphite to 100 grms. of water. Both freezing-point and conductivity determinations confirm the molecular formula, $Na_2S_2O_4$.—F. Sodn.



Barium orthosulpharsenate; Normal ——. E. Glatzel. Z. anorg. Chem., 1911, 70, 86—92.

Normal barium orthosulpharsenate ($Ba_3As_2S_8,6H_2O$) is prepared by dissolving arsenic pentasulphide (precipitated by passing a rapid current of hydrogen sulphide, in excess, through a solution of arsenic acid containing hydrochloric acid) in a solution of barium hydrosulphide and concentrating the solution. It crystallises in pale yellow transparent needles which dissolve sparingly in water, with partial decomposition, and decompose with the production of white fumes when strongly heated in the air.—F. Sodn.

Nitric and nitrous acids, and nitric oxide; The equilibrium between ——. G. N. Lewis and A. Edgar. J. Amer. Chem. Soc., 1911, 33, 292—299.

The reaction of nitric acid in aqueous solution with nitric oxide to produce nitrous acid, has been shown by Saposhnikov to yield an equilibrium condition independent of the direction of approach. The authors have determined the equilibrium constant by passing a stream of nitric oxide through a $N/10$ solution of nitric acid, and determining the change in specific conductivity of the solution. Equilibrium was established at the end of about 50 hours. Five experiments gave mean specific conductivities, at the beginning and end, of 0·038670 and 0·032392 respectively. The degree of ionisation of the nitric acid was assumed to be equal to that of potassium nitrate of the same concentration. Allowing for the slight ionisation of the nitrous acid, and for the partial pressure of water vapour, the value of the equilibrium constant, $\frac{(HNO_2)^3}{(H+)(NO_3)}$, at 25° C., with nitric oxide at one atmosphere, was calculated and found to be 0·0267. Experiments made with $N/5$ nitric acid appeared to indicate a change in the equilibrium constant with the concentration.—T. ST.

Hydrogen peroxide, nitric acid and ammonia; Formation of — by the electric discharge with water as one electrode. A. Makowetzky. Z. Elektrochem., 1911, 17, 217—235.

THE author has studied the passage of the current through an electrolyte consisting of about $N/60$ sulphuric acid in which only one of the electrodes was immersed, the other being brought sufficiently near to allow of the circuit being completed by a discharge through the short column (generally 5 mm.) of air or nitrogen. If the external electrode is made cathode and the discharge passes through nitrogen, hydrogen and a little ammonia are found in the product. In this case the fall of potential at the cathode is small, but when the external electrode is made anode, the fall at the cathode (the surface of the liquid) is very rapid, and not only oxygen but a good deal of hydrogen is found in the residual gas, owing to the action of the arc on the water vapour. At the same time ammonia, nitric acid, and hydrogen peroxide are formed and dissolve in the acid water. The formation of peroxide appears to take place in the neighbourhood of the surface and its quantity is not affected on replacing by oxygen the nitrogen in which the discharge takes place. It is therefore assumed that it is the result of the change $2H_2O = H_2O_2 + H_2$ taking place just above the surface, where the potential gradient is steepest. The quantities of hydrogen peroxide obtained, with small currents (about 0·04 amp.) are greatly in excess of those which would be expected from Faraday's law if the process were electrolytic (1000 coulombs gives as much as 0·009 grm-mol.). In addition to the quantity found some of it is probably used in the oxidation of nitric oxide to nitric acid, some is probably decomposed thermally in the heated atmosphere above the liquid, and some of it migrates to the cathode and is there destroyed. Suitable cooling and other precautions will raise the yield of peroxide but it is not possible to get very concentrated solutions or really profitable yields. The formation of ammonia and that of nitric acid both show a maximum current yield at 0·04 amp., which is also the current at which the discharge voltage has its minimum value. The author has shown the validity of Faraday's law for the whole process by calculating the oxidised products together with the free oxygen, and the reduced products together with the free hydrogen at the external electrode. These are not equivalent as would be the case in a non-polar process, but their difference is accounted for by the current which has passed and the gas which has been liberated at the immersed electrode. In this way it is possible to make sure that no product is overlooked. No evidence was thus obtained of the formation of another oxide of nitrogen suggested by previous observers (Scheuer, Z. Elektrochem., 1905, 11, 565, and Rasch, Z. Elektrochem., 1907, 13, 669.)
—W. H. P.

Silicon; The chlorobromides and chloroiodides of ——. A. Besson and L. Fournier. Comptes rend., 1911, 152, 603—605.

THE authors have prepared the chlorobromides of silicon of the type SiX_4 by a new method which gives products uncontaminated with oxychlorides. A mixture of silicon tetrachloride and dry bromine in the proportions indicated by $SiCl_4 : 2Br$ is repeatedly drawn in a current of hydrogen through a tube in which it is submitted to electrical discharges until the product after condensation is almost colourless. The liquid so obtained consists mainly of the three chlorobromides, $SiCl_3Br$, $SiCl_2Br_2$ and $SiClBr_3$, the second one preponderating. Small quantities of other chlorides, *e.g.*, Si_2Cl_6, Si_3Cl_8, etc., are also present, but the removal of these and the separation of the main constituents are fairly easily effected by fractionation. If iodine is substituted for bromine the reaction takes a similar course, chloroiodides being formed, but it is better to employ hydriodic acid instead of the free element. When chlorobromides of the type SiX_4, together with hydrogen, are submitted to the electric discharge, compounds of the type Si_2X_6 are formed, chlorine (but not bromine) being eliminated. When the chlorobromide $SiCl_2Br_2$ is submitted to this process there occurs also a partial rearrangement in the sense of the equation:—

$$2SiCl_2Br_2 = SiClBr_3 + SiCl_3Br.$$ —J. H. L.

Mercurous chloride; Reactions of ——. W. Herz. Z. anorg. Chem., 1911, 70, 170-172.

THE reaction, $Hg_2Cl_2 + 2KOH \rightleftarrows Hg_2O + H_2O + 2KCl$, has been studied by shaking an excess of mercurous chloride with potassium hydroxide solution of various concentrations until equilibrium was established, the temperature being kept at 25°C. The results show that the reaction proceeds in accordance with the law of mass action, and a like conclusion was reached by studying the reaction, $Hg_2Cl_2 + Na_2CO_3 = Hg_2CO_3 + 2NaCl$, in a similar manner.—F. SODN.

Ionium and actinium; Separation of —— from certain residues, and the production of helium by ionium. B. B. Boltwood. Proc. Royal Soc., 1911, A85, 77—81.

THE author describes the treatment of "actinium residues." obtained from pitchblende residues by Rutherford and Greenwood, and the extraction therefrom of highly radioactive substances containing ionium and actinium. The actinium, as has been previously noticed by several observers, was not precipitated by ammonia, but remained in the filtrate, from which a substance containing a large amount of actinium was subsequently obtained by separation from non-active ammonium salts and some calcium, which were present. A final precipitation with ammonia gave a slight precipitate, containing much actinium. Its radioactivity was only slight when first obtained, but increased rapidly: after four months its activity was over 20,000 times that of an equal weight of uranium oxide. The ionium was obtained from the precipitate of oxalate, by redissolving it in hydrochloric acid, nearly neutralising with ammonia, and precipitating with hydrogen peroxide. The substance thus obtained contained calcium and the rare earths, which were separated, the final product being thorium oxide, with a radioactivity 3000 times as great as that of an equal weight of uranium oxide, owing to the ionium it contained. 1·5 grm. of the ionium-bearing thorium oxide, sealed up in a glass tube with oxygen, yielded 0·031 cb. mm. of helium after 125 days. Calculated from the comparative rate of emission of α-particles, by radium and by the ionium preparation, the amount of helium formed should have been 0·0595 cb. mm. The difference is probably due to the occlusion of some of the helium by the thorium oxide, as no other means than heating were employed to expel it.—R. W. N.

Boron hydrides; Two new methods of preparation of ——. J. Hoffmann. Chem.-Zeit., 1911, 35, 265.

1. *Gaseous boron hydride.*—This is generally prepared by dissolving magnesium boride in hydrochloric acid. It is easily obtained by dissolving commercial ferroboron in dilute sulphuric acid. Boron hydride admixed with hydrogen is evolved and an insoluble residue formed. The gas has a smell like certain hydrocarbons or burning rubber; it ignites below the ignition temperature of hydrogen, though boron hydride is not self-inflammable. It decomposes a moderately concentrated silver nitrate solution, forming a blackish brown precipitate with metallic lustre. A boron mirror is formed when it is passed through red hot glass tubes. It burns with a green flame at the beginning of the preparation, subsequently with a green edged flame, and deposits blackish brown flakes of boron on a cool surface. Manganese boride gives rise to a similar mixture of gases.

2. *Solid boron hydride.*—The residue obtained as above described melts in a Bunsen flame, giving gases which colour the flame green. When heated in glass tubes gas is evolved without the residue melting; this gas consists of hydrogen and boron hydride. The residue corresponds

to the boron hydride obtained by Ramsay and Hatfield (Proc. Chem. Soc., 17, 152) by cooling a mixture of hydrogen and boron hydride with liquid air.—E. F. A.

Potash in Germany; Authorised sale of —— for 1911. Board of Trade J., March 16, 1911. [T.R.]

The "Reichsanzeiger" of 7th March contains a notice to the effect that the Potash Distributing Bureau has fixed the amounts of potash to be sold in Germany during the calendar year 1911 as follows:—

Varieties.	For home consumption.	For export.
	Metric tons of pure Potash (K_2O)	Metric tons of pure Potash (K_2O)
Carnallite with 9 to 12% K_2O	7,710	320
Crude potash salts with 12 to 15% K_2O	260,210	156,950
Manure salts with 20 to 22% K_2O	1,570	28,080
„ „ „ 30 to 32% K_2O	2,350	15,050
„ „ „ 40 to 42% K_2O, including potash manure with 38% K_2O	107,610	32,040
Chloride of potassium	60,870	170,200
Potassium sulphate with more than 42% K_2O	1,460	46,180
Potassium magnesium sulphate ...	100	11,240
	441,880	460,060
	901,940	

Compare this J., 1911, 207.

Patents.

Sulphuric acid and electrolytic iron; Process of making ——. A. S. Ramage, Detroit, Mich., Assignor to National Tube Co., Pittsburg, Pa. U.S. Pat. 984,703, Feb. 21, 1911.

A ferric ore is dissolved in sulphuric acid, and the ferric sulphate, thus produced, is reduced by means of sulphur dioxide. The solution is then electrolysed in a cell which is divided into anode and cathode compartments and is provided with an insoluble anode, depolarised by sulphur dioxide. The cell may contain a series of electrodes separated by diaphragms, the electrolyte being made to flow on either side of each diaphragm, in the same direction, and passing in proximity to each cathode (or anode) successively. After separating sulphuric acid from the electrolyte, the residual acid liquor may be employed for decomposing a fresh quantity of ore.—F. Sodn.

Nitric anhydride in monohydrate nitric acid; Process for preparing solutions of ——. Elektrochem. Werke, Ges. m. b. H. Ger. Pat. 231,546, July 17, 1910.

It is known that nitrogen peroxide or nitrous acid in presence of water or very dilute nitric acid can be oxidised electrolytically so as to yield monohydrate nitric acid. It has now been found that if fresh quantities of nitrogen peroxide or nitrous acid be introduced into the monohydrate nitric acid, then on further electrolytic oxidation a solution of nitric anhydride in nitric acid is obtained. —A. S.

Nitrogen peroxide free from nitric acid. Badische Anilin und Soda Fabrik. Ger. Pat. 231,805, May 18, 1909.

Nitric oxide admixed with nitrogen peroxide but free from oxygen, or a gas mixture containing nitric oxide and nitrogen peroxide but no oxygen, is freed from the nitrogen peroxide, and the remaining nitric oxide is dried and allowed to interact with dry oxygen (or air) to form nitrogen peroxide. Nitrogen peroxide which is to be preserved or transported must be free from nitric acid and moisture.—A. S.

Persulphuric acid; Manufacture of ——. Consortium für Elektrochem. Ind. Ges. m. b. H., Nürnberg, Germany. Eng. Pat. 23,548, Oct. 11, 1910. Under Int. Conv., Nov. 4, 1909.

The process consists in electrolysing sulphuric acid with the use of cooled anodes. Very low temperatures are unnecessary, and the electrolysis of acid (sp. gr., 1·3) with an anode through which passes water at 13° C. (corresponding to an electrolyte at about 17°—18° C.) may give, without any addition to the electrolyte, persulphuric acid of more than 40 per cent. strength, with a current output of over 50 per cent.—F. Sodn.

Barium oxide; Manufacture of ——. C. Rollin and Hedworth Barium Co., Newcastle-on-Tyne. Eng. Pat. 30,323, Dec. 28, 1909.

In preparing barium oxide in a form suitable for the manufacture of barium peroxide by heating barium hydroxide in admixture with barium peroxide or nitrate in a furnace having a floor of barium oxide, as described in Eng. Pat. 26,140 of 1909 (this J, 1910, 276), in order to prevent the product from adhering to the floor, a bed of loose barium oxide, nitrate or peroxide, which does not melt, is placed between the charge and the floor of the furnace. The charge may consist of small quantities of the hydroxide and the oxide or other compound, fed alternately into the furnace. The hydroxide may be prepared by one of the processes described in Eng. Pats. 27,587 of 1908, 26,696 of 1909 and 14,268 of 1910 (this J., 1910, 151; 1911, 129).—A. T. L.

Barium oxide; Process for the manufacture of porous ——. H. Schulze. Ger. Pat. 231,645, Aug. 21, 1909.

The claim is for the preparation of porous barium oxide by subjecting a mixture of barium carbonate and charcoal simultaneously to electro-thermal and electrolytic action. The mixture is packed in a furnace provided with resistance-rods through which the current is passed. When the charge becomes hot, it conducts the current, which then passes through the whole mass.—A. S.

Aluminium nitride and other metallic nitrides; Process for the manufacture of ——. O. Serpek, Paris. Eng. Pat. 13,086, May 30, 1910.

A powdered mixture of carbon and alumina (bauxite), or other metallic oxide, is treated with nitrogen at a high temperature, the material and the gases travelling in opposite directions within two revolving inclined tubes, arranged in series; the reaction proper takes place in an electric resistance furnace (preferably detachable) inserted in the lower tube, and the calcination of the bauxite takes place in the upper tube, by the combustion of the gases (carbon monoxide) coming from the electric furnace and from the generator supplying the nitrogen required for the reaction. The carbon may be added after the calcination, during the passage of the material from the first tube to the second, and air may be injected into an intermediate chamber between the two tubes, for the purpose of burning the silicon derived from the bauxite and volatilised in the electric furnace; the silica formed is separated from the gas by means of baffle-plates, before the carbon monoxide is utilised for calcining the bauxite. A pressure slightly above atmospheric is maintained throughout the apparatus.—F. Sodn.

Ammonium carbonate; Process of manufacture of ——. J. Bueb and Deutsche Continental-Gas-Ges., Dessau, Germany. Eng. Pat. 22,586, Sept. 29, 1910.

Carbon dioxide and ammonia, either or both of which have been passed through hot water, preferably at 60°—90° C., are mixed, and then conducted to a sublimation chamber. The proportion of water vapour in the mixture is adjusted by regulating the temperature of the water, so as to give a product containing the desired percentage of ammonia.—F. Sodn.

Ammonium sulphate; Apparatus for the production of —— with impure acids. H. Drehschmidt, Berlin, Germany, Eng. Pat. 24,138, Oct. 18, 1910.

A saturator for the absorption of ammonia gas is connected by means of a pipe, ending below the surface of the acid, with another vessel communicating with the outer air. In consequence of the slight pressure in the saturator, this pipe serves to conduct the scum containing the impurities of the acid (arsenic, iron, etc.) into the outer vessel, from which it is removed, any liquid carried over with the scum flowing back into the saturator through a separate pipe.—F. Sodn.

Ammonia-absorber. S. S. Wyly, St. Joseph, Mo. U.S. Pat. 984,729, Feb. 21, 1911.

The apparatus, which may comprise a number of sections, consists of a pipe, or series of such, through which "aqua ammonia" may be passed under pressure, a central water pipe, acting as cooler and extending longitudinally through each ammonia pipe, and a gas pipe, containing ammoniacal gas under pressure and surrounding a large portion of each ammonia pipe with which it communicates by a number of apertures. A supply of gas may be separately admitted to each gas pipe, and all the pipes are under separate control.—F. Sodn.

Ammonium perchlorate; Method of producing ——. O. B. Carlson, Mansbo, Sweden, Assignor to O. F. Carlson, Stockholm. U.S. Pat. 985,724, Feb. 28, 1911.

Sodium perchlorate is allowed to react with ammonium sulphate, and the product is crystallised at a temperature not lower than 22° C.—F. Sodn.

Hydrosulphites; Manufacture of anhydrous ——. Kinzlberger und Co., Prague, Bohemia. Eng. Pat. 25,872, Nov. 7, 1910. Under Int. Conv., Nov. 25, 1909.

Formic acid or formates are made to react with sulphurous acid or its salts, in the absence of water. For example: sulphurous acid is introduced into a boiling alcoholic solution of acid sodium formate, and the sodium hydrosulphite which separates is filtered off and dried *in vacuo*; or, potassium formate (68 parts by weight) is added to a mixture of ammonia (17 parts) and sulphur dioxide (64 parts), both dissolved in alcohol, and the mixture is well stirred and boiled for several hours; or, 104 parts of dry finely powdered sodium bisulphite are added to 63 parts of fused ammonium formate, and, after a short time, the product is cooled and freed from ammonium salts by heating *in vacuo*.—F. Sodn.

Lead chloride; Method of making ——. E. O. Barstow, Assignor to The Dow Chem. Co., Midland, Mich. U.S. Pat. 984,525, Feb. 21, 1911.

Metallic lead, which may be in a finely divided or granulated form and may be mixed with carbon, is treated with chlorine water.—F. Sodn.

Potassium compounds [from sugar juices, molasses, etc.]; Separation of —— by insoluble double fluorine-salts. L. Rivière. First Addition, dated Dec. 11, 1909, to Fr. Pat. 413,677, Dec. 8, 1909 (this J., 1910, 1123).

The reagent employed for precipitating potassium in accordance with the principal patent, is regenerated from the precipitated fluosilicate by bringing about the reversal of the reaction referred to in the original specification (*loc. cit.*). For instance, if sodium or barium fluosilicate be the precipitating reagent, it may be regenerated by macerating the precipitate, at a temperature below 50° C., with a solution of sodium carbonate or with barium chloride or with a liquid containing barium carbonate in suspension; potassium carbonate or chloride are thereby also produced.—F. Sodn.

Peroxides and oxides or hydrated oxides; Process for obtaining with the help of the carbonates of barium, strontium, potassium, and sodium, the respective ——. V. Bollo and E. Cadenaccio. First Addition, dated Oct. 13, 1910, to Fr. Pat. 420,470, Aug. 11, 1910 (this J. 1911, 361). Under Int. Conv., April 25, 1910.

Iron and its compounds, claimed in the principal patent, may be wholly or partially replaced by other catalysts, such as manganese, nickel, cobalt, copper, chromium, or their compounds (together or singly), or by steam. The process may also be carried out without the addition of carbon or carbonaceous matter, although in that case the effect of the catalyst is less marked, and an electric resistance furnace may be employed for the heating.—F. Sodn.

Hydrogen peroxide; Process for the preparation of ——. A. Pietzsch and G. Adolph. Fr. Pat. 421,164, Oct. 7, 1910. Under Int. Conv., Oct. 9, 1909.

A persulphate is heated or distilled with concentrated sulphuric acid, when hydrogen peroxide is obtained in accordance with the equations: (1) $K_2S_2O_8 + H_2SO_4 = K_2S_2O_7 + H_2SO_5$, (2) $H_2SO_5 + H_2O = H_2SO_4 + H_2O_2$, and (3) $K_2S_2O_7 + H_2O = 2KHSO_4$. The process, which consists therefore in the conversion of water into hydrogen peroxide by means of the persulphate, may be made continuous by separating the bisulphate produced and regenerating the persulphate electrolytically. For example, 2400 grms. of potassium persulphate, recrystallised once from the commercial salt, are added in portions, to 1000 c.c. of ordinary pure sulphuric acid (sp. gr. 1·40), the mixture being agitated for half-an-hour at 50°—55° C. during the addition of the salt and then for a further half hour; after cooling, the hydrogen peroxide (34 per cent.) is separated by suction from the precipitated potassium bisulphate. Or, 1500 grms. of potassium persulphate are added to 1 litre of sulphuric acid (sp. gr. 1·6), and the mixture is distilled *in vacuo* at 80° C. with the gradual addition of 730 grms. of water; 182 grms. of 20 per cent. hydrogen peroxide solution are obtained. The process offers the following advantages over that in which persulphuric acid is employed (this J., 1906, 321):—there is no appreciable loss of oxygen even in the presence of catalysts and at a high temperature; stronger sulphuric acid may be used and stronger peroxide solutions obtained; and apparatus of comparatively small size is required, 600 litres of 25 per cent. hydrogen peroxide being obtainable in 10 hours with a 200 litre retort.—F. Sodn.

"Spinellides" contained in bauxites; Process of extraction and treatment of ——. N. Lecesne. Fr. Pat. 421,230, Oct. 8, 1910.

The bauxite is thoroughly crushed, and the product is mechanically sorted according to its specific gravity and degree of fineness, so as to extract the crystallised alumina (present in certain bauxites in the form of spinellides), which is utilised as emery, etc. The finest spinellides and dust are converted into a substitute for gutta-percha by digestion with an appropriate ferrocyanide and a little solution of the liquid extract of tannin, and then mixing the dried product with a drying oil, preferably linseed or poppy oil.—F. Sodn.

Oxyhalogen compounds [chlorates, etc.]; Process for the electrolytic production of ——. Centralstelle für Wissenschaftlich-Techn. Untersuchungen Ges. m. b. H. Fr. Pat. 421,618, Oct. 19, 1910.

In the electrolytic production of oxyhalogen salts, compounds of the rare earths (especially cerium chloride) are added to the acidified electrolyte, in order to improve the current yield.—F. Sodn.

Amides, cyanamides, and cyanides; Manufacture of metallic [sodium and potassium] ——. E. A. Ashcroft. Fr. Pat. 421,851, Oct. 26, 1910. Under Int. Conv., Jan. 4, 1910.

An alloy of one or more of the alkali metals (especially sodium and potassium) with one or several other metals (such as lead) is employed as anode in an electrolytic cell, in which the electrolyte consists of or contains the fused product to be manufactured (*e.g.*, sodium amide), with the addition of ammonia and carbon or other material to react with the nascent alkali metal. The process may be carried out in a bi-cellular apparatus (as described in Eng. Pat. 12,377 of 1903; this J., 1904, 25), so that the alloy produced in the first cell by the electrolysis of the alkali chloride or hydroxide above a molten electrode, is passed, as anode, into a second cell containing the fused amide, cyanamide, or cyanide as the electrolyte, ammonia gas or other suitable nitrogenous compounds and (in the case of the cyanamide or cyanide) the proper quantity of carbon being also introduced. Apparatus similar to that described in Eng. Pat. 26,813 of 1905 (this J., 1907, 55) is preferably employed. For the preparation of sodium amide, the temperature in the second cell is conveniently maintained at 250°—350° C., but for the cyanamide and cyanide higher temperatures (500° and 800° C. respectively) are required, especially toward the end of the reaction.—F. Sodn.

Stannic oxide and chlorine ; Process for the preparation of —— from stannic chloride. L. Loewenstein. Ger. Pat. 230,358, Jan. 22, 1909.

Stannic oxide and chlorine are produced by heating a mixture of stannic chloride vapour and oxygen :

$$SnCl_4 + O_2 = SnO_2 + 2Cl_2.$$

—A. S.

Salts of heavy metals [pigments] ; Process for obtaining slightly soluble —— by electrolysis. B. Huick. Ger. Pat. 230,826, Jan. 24, 1909.

The heavy metal which is to form the base of the slightly soluble salt is used as anode, either pure or in the form of an alloy, and the electrolyte consists of a dilute solution of a mixture of salts, one of which acts on the metal of the anode to form a soluble salt, whilst another, preferably an alkali or ammonium salt, interacts with this soluble salt to precipitate the desired slightly soluble salt. The "precipitating salt" is added continuously during the electrolysis. In order to prevent alkali hydroxide accumulating in the electrolyte, it is separated by "electrolytic filtration" and collected in the special "filter-cathodes" used, and withdrawn from the latter from time to time. The "filter-cathodes" are similar to the electrodes of secondary batteries, being composed of a metal frame filled with a mass of a metallic oxide which is readily reduced to spongy metal. At intervals, the electrolyte is run off, and the cathodes exposed to the air, in order to re-convert the reduced metal to oxide. Examples are given of the application of the process to the manufacture of "chrome yellow" (lead chromate), Prussian blue, and white lead. For the manufacture of "chrome yellow," anodes of soft lead and cathodes consisting of lead frames with an active mass of lead oxide are used. The electrolyte is a 1·5 per cent. aqueous solution of 95 parts of sodium chlorate and 5 parts of sodium bichromate. During the electrolysis, sodium bichromate and water are added to the electrolyte as required, and caustic soda solution is withdrawn from the "filter-cathodes."—A. S.

Boron [electrically] ; Manufacture of —— [and use of boron in a thermo-electric couple]. Comp. Française pour L'Exploitation des Procédés Thomson-Houston. (1) Fourth Addition, (2) Fifth Addition, dated Oct. 26, 1910, to Fr. Pat. 377,683, May 8, 1907.

(1) The addition relates to a modification of the electric furnace, for the treatment of refractory elements, *e.g.*, for the purification of boron. A chamber of glass, copper, or other suitable material, is closed at each end by a stopper, through which pass copper tubes cooled by a flow of cold water through them. The tubes are connected externally with a source of current of high voltage, which is produced in the secondary of a transformer, and the ends of the tubes inside the chamber are connected with rods of the material to be treated, which thus form the electrodes for the production of the electric arc. By means of tubes connected with the chamber, a suitable atmosphere may be maintained inside the chamber at a pressure below that of the outer atmosphere. (2) This addition is concerned with the employment of boron as an element of a thermo-electric couple.—B. N.

Boron ; Process of manufacture of hard substances for bearings, pivots, draw-plates, etc., starting with ——. Cie. Franç. pour l'Exploitation des Proc. Thomson-Houston. Fr. Pat. 421,391, Oct. 13, 1910.

Non-crystalline boron in a form which is harder than sapphire is prepared by one of the following methods :— (1) Boric anhydride (in excess) is reduced by means of magnesium, and the product is compressed into rods, which are heated *in vacuo* to at least 1200° C. and are then employed as electrodes for a high tension arc produced in an atmosphere of hydrogen at about 12 cm. pressure ; the substance is thus purified and, by proper regulation of the current is obtained in black, heavy, vitreous globules, free from flaws. A little carbon, silicon, magnesium, or aluminium may be added in making the rods, if desired. (2) A high tension alternating arc is maintained between cooled copper electrodes in an atmosphere of boron chloride and hydrogen ; globules or threads are thus obtained, and powdered boron which may be treated as above or melted in an electric resistance furnace. (3) Boron, pure or mixed with carbon, is melted as described in the Second Addition to Fr. Pat. 377,683 (see Eng. Pat. 1197 of 1907 : this J., 1908, 226). (4) Boron is deposited on a filament of carbon or other conducting material by heating in an atmosphere of boron chloride and hydrogen, and the rod thus produced is heated in a vacuum electric furnace by the passage of an electric current.—F. Sodn.

Hydrogen and oxygen ; Electrolytic production of ——. Elektrizitäts-A.-G. vorm. Schuckert und Co. Ger. Pat. 231,545, Aug. 13, 1910.

The claim is for the addition of soaps or soap-forming substances, preferably emulsified soaps, and of ferric oxide to the alkaline electrolyte employed.—A. S.

Ammonium nitrate ; Process of making pure ——. O. Nydegger, Assignor to R. Wedekind und Co., Uerdingen, Germany. U.S. Pat. 986,204, March 7, 1911.

See Eng. Pat. 20,907 of 1909 ; this J., 1910, 1156.—T. F. B.

Persulphuric acid and its salts ; Process for preparing ——. A. Pietszch and G. Adolph. Fr. Pat. 421,165, Oct. 7, 1910. Under Int. Conv., Oct. 11, 1909.

See Eng. Pat. 23,252 of 1910 ; this J., 1911, 85.—T. F. B.

Potassium or sodium persulphate ; Process for preparing ——. A. Pietzsch and G. Adolph. Fr. Pat. 421,168, Oct. 7, 1910. Under Int. Conv., Oct. 9, 1909, and Feb. 16, 1910.

See Eng. Pats. 23,157 and 23,551 of 1910 ; this J., 1910, 1454 and 1911, 85.—T. F. B.

Persulphuric acid and its salts ; Process for making ——. Consortium f. Elektrochem. Industrie. Fr. Pat. 421,328, Oct. 11, 1910. Under Int. Conv., Nov. 4, 1909.

See U.S. Pat. 981,900 of 1911 and Eng. Pat. 23,548 of 1910 ; this J., 1911, 284, and preceding.—T. F. B.

Sulphuryl chloride and acetic anhydride ; Process for producing ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 421,249, Oct. 8, 1910. Under Int. Conv., Oct. 19, 1909.

See Eng. Pat. 23,924 of 1910 ; this J., 1911, 48.—T. F. B.

Barium hydroxide ; Process and apparatus for making anhydrous, amorphous ——. C. Rollin, and Hedworth Barium Co., Ltd. Fr. Pat. 421,355, Oct. 12, 1910. Under Int. Conv., Nov. 17, 1909, and June 13, 1910.

See Eng. Pats. 26,696 of 1909 and 14,268 of 1910 ; this J., 1911, 129.—T. F. B.

Sulphur ; Process of obtaining ——. W. Feld, Hönningen on Rhine, Germany. U.S. Pat. 985,667, Feb. 28, 1911.

See Eng. Pat. 3061 of 1909 ; this J., 1910, 352.—T. F. B.

Hydrogen; Process for producing —— by decomposing steam by means of a metal. W. Gerhartz. Fr. Pat. 421,353, Oct. 12, 1910.

See Ger. Pat. 226,453 of 1909; this J., 1910, 1250.—T. F. B.

Utilising the products of the distillation of vinasses. Fr. Pat. 421,241. *See* XVIII.

Extracting tartar from marcs and wine lees. Fr. Pat. 421,370. *See* XVIII.

VIII.—GLASS; CERAMICS.

Glass; A rapidly devitrifying ——. E. Donath and A. Indra. Sprechsaal, 1911, 44, 160.

Some glass tubes used for laboratory purposes were observed to become iridescent, then more opaque, and ultimately quite devitrified like porcelain. A fresh consignment showed the same phenomenon, which, by repeatedly bending the glass or heating in a muffle, can be accelerated so as to be demonstrated in the course of a lecture. The glass was found to be high in baryta and alumina and low in alkalis, the composition being: silica, 67·7; barium oxide, 8·0; alumina, 6·6; lime, 11·6; magnesia, 0·6; potassium oxide, 0·9; and sodium oxide, 4·5 per cent. By choosing suitable bases, the tendency to devitrification can be increased. Gröger (Dingler's Polyt. J., 1889, 297) obtained radial crystals imbedded in a dark green bottle glass, and confirmed Pelouze's statement that the ultimate composition of the devitrified portion was the same as that of the original glass, a molecular change having taken place. On heating with hydrochloric acid on the water-bath, he found that the devitrified part dissolved more easily in acid, and gave up more baryta (19·8 per cent.) and lime (23·4 per cent.) and less alumina (1 per cent.) than the original (16·4, 20·6, and 40 per cent. respectively). He concluded that the change was not merely physical, but that dissociation had taken place. The authors confirm Gröger's experiments and state that the lime-soda glass yields calcium silicate and sodium silicate, of which the former separates out. Zulkowski's theory of the constitution of glass (this J., 1900, 442; 1903, 365) was that it corresponded to the formula—

$$\mathrm{Si_n\,O_{2n-1}} < \begin{matrix}\mathrm{OM'M'O}\\ \mathrm{OM''O}\end{matrix} > \mathrm{Si_n\,O_{2n-1}}.$$

In making glass, the single silicates are first formed and then the divalent metals act to form the double silicates as above. In devitrification the reverse process takes place. Devitrification can be overcome by re-heating, but the authors suggest that it should be used for decorative purposes in forming coloured rims and in depicting figures.—H. H. S.

Microchemical examination of silicates. Ganaval. *See* XXIII.

Patents.

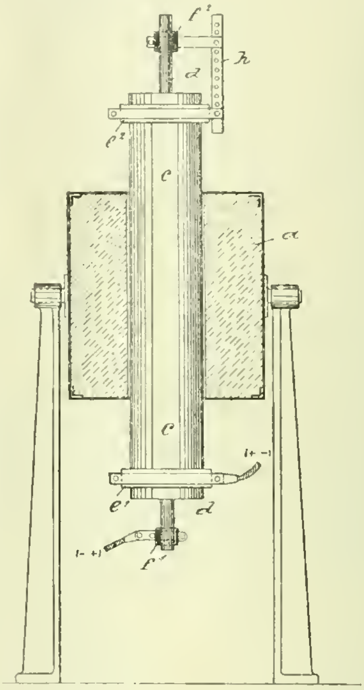
Glass furnaces. G. E. and H. A. Bateson, Liverpool. Eng. Pat. 18,508, Aug. 5, 1910.

Tank furnaces, which are usually confined to the coarser kinds of glass-making, are provided with two series of crucibles for better grade glass, one at the end of the tank nearer the fire and one at the end remote therefrom. The furnace gases are adapted to heat the nearer set of crucibles on their way to the remote part of the tank, and the remoter set just previously to leaving the tank. —H. H. S.

Quartz; Manufacture of transparent objects in ——. Deutsche Quarzges. m. b. H. Fr. Pat. 421,526, Oct. 17, 1910.

The difficulty in making transparent quartz vessels lies in obtaining a transparent fused body, approximately cylindrical or tubular, which can then be worked to a definite shape. A non-transparent cylindrical or tubular body is therefore used as a core to give form to the melted quartz which after rolling and conversion into a coagulated mass or granular powder is heated till transparent and worked into shape.—H. H. S.

Furnace; Electric resistance fusion —— for the preparation of melted bodies in the form of quartz collars or tubes. Deutsche Quarzges. m. b. H. Fr. Pat. 421,631, Oct. 20, 1910.



The furnace body, *a*, is provided with a carbon tube, *c*, in which is arranged concentrically a carbon or graphite rod, *d*, the material to be melted being placed between *c* and *d*. Sliding carbon collars, f^1, f^2, e^1, and e^2, make contact with the rod and tube, the current passing between these by means of a rod, *h*, provided with openings at different heights. By sliding the collars on the rod or tube, the resistance may be varied and the temperature regulated. —B. N.

Quartz glass; Production of transparent ——. Deutsche Quarzges. m. b. H. Fr. Pat. 421,718, Oct. 22, 1910.

The quartz is subjected to triple fusion, first round a core to a non-transparent tube, then in another furnace whilst being drawn, and, lastly, in a blast or in the arc it is shaped to the desired form.—H. H. S.

Ceramic ware and artificial stone; Manufacture of —— by employment of slate waste as flux. C. Henroz. Fr. Pat. 421,599, Oct., 1910.

The waste from slate schists, both cleavable and noncleavable, is used as a flux either in addition to or instead of felspar, slag, etc., in all the ordinary processes of manufacture. It can also be utilised as a colouring agent in ceramic ware and cement.—H. H. S.

Kilns; Continuous moving —— for firing porcelain and similar products. Soc. Anon. des Faienceries de Creil et Montereau and E. G. Faugeron. Fr. Pat. 421,765, Oct. 24, 1910.

Continuous kilns work satisfactorily when no change in the atmosphere is required. But for porcelain and many other products a reducing atmosphere is necessary in parts of the firing. To achieve this, conduits leading directly from the fire-boxes debouch into the kiln at the required places without receiving additional air.—H. H. S.

Enamelling and other industrial operations; Means for confining and expelling poisonous, noxious or objectionable gases, vapours, dust, and the like generated in ——. H. F. Wilson, Leeds, and C. D. McCourt, London. Eng. Pat. 4244, Feb. 21, 1910.

The process described refers to spraying enamel, but is also applicable to dusting, sand-blasting and to the discharge of objectionable gases or particles as in wool-sorting, for example. The casting to be enamelled is carried on a turntable which is itself carried on a carriage running in guides. The turntable is enclosed in a stationary casing connected with a suitable source of draught and provided with sleeves to receive the arms of the operator.—H. H. S.

Quartz; Process for facilitating the moulding of a mass of molten ——. Deutsche Quarzgesellschaft. Fr. Pat. 421,666, Oct. 21, 1910.

See Eng. Pat. 28,391 of 1909; this J., 1910, 630.—T. F. B.

IX.—BUILDING MATERIALS.

Portland cement; The correction of raw materials chemically unsuitable for the production of ——. H. Kühle. Chem.-Zeit., 1911, **35**, 255.

At a certain cement works the raw material was a very silicious marl containing 20 parts of silica, 4 parts of sesquioxides and a normal amount of lime. The clinker produced therewith crumbled to powder, and the raw materials were therefore corrected by the addition of an iron ore, poor in silica, but containing 68 per cent. of ferric oxide. The increase of the ferric oxide, together with the small alumina content produced a cement with great constancy of volume, which after a year had a compression strength of 468 kilos. per sq. cm. Such cements, rich in iron and poor in alumina are particularly suitable for sea water constructions. At another works a limestone with 85—90 per cent. of calcium carbonate, and a clay, exceptionally low in silica gave a very aluminous cement which set too quickly and showed little subsequent hardening. Addition of sand to the raw materials raised the compression strength of the cement from 246 to 344 kilos., and after hardening for a year, from 324 to 538 kilos. In a third case, a normal cement was produced from a limestone, poor in silica, and a blast-furnace slag with less than 1 per cent. of iron by a proper addition of sandstone and iron ore. The addition of water-granulated slag to the cement caused a considerable increase in the strength.—W. C. H.

Portland cement; The manufacture of standard and alkali-resisting —— *in Colorado.* Met. and Chem. Eng., 1911, **9**, 133—137.

There are three manufactories of Portland cement in Colorado. Two make standard cement and the third a special alkali-resisting cement for use in "alkali soils and waters." The raw materials obtained locally for the manufacture of standard cement are a lime rock containing 90 per cent. of calcium carbonate, and an argillaceous rock containing 67 to 78 per cent. of calcium carbonate. Details of the working at both manufactories of standard cement are given. Alkali-proof cement is a mixture of iron blast-furnace slag, standard Portland cement, and a mixture containing gypsum and other materials. The mixture is more finely ground than standard cement, and has the following composition:—silica 32·9, ferric oxide and alumina 13·2, lime 48·0, magnesia 2·5, sulphuric anhydride 1·8, and loss on ignition 0·3 per cent. There is thus an excess of silica over the quantity required to hold all the lime in combination, and to this fact, the cement owes its resisting powers to the attacks of alkaline solutions. In standard cement there is an excess of lime, which is attacked by the acid radicals of the "alkali," forming compounds which, in their subsequent crystallisation, expand and disintegrate the mass. The alkali-resisting cement has a specific gravity of 2·96. It has a slower setting time, and developes tensile strength more slowly, but more steadily and for a longer time than standard cement. Results are given of comparative tests made on briquettes exposed to the action of air, and to fresh and "alkali" water (magnesium sulphate 650, calcium sulphate 900, sodium carbonate 200, sodium chloride 200, and sodium sulphate 1300 grains per gallon), and also on briquettes made up with varying quantities of gypsum. Briquettes composed of 1 part of standard cement to 5 parts of sand disintegrated in the "alkali" water in between 28 days and 6 months, but the one made from alkali-resisting cement increased continuously in tensile strength during the 6 months.—T. St.

Portland cement after burning with coals of different contents of ash; Quality of ——. Wecke. Chem.-Zeit., 1911, **35**, 256.

The best results were given with German and English coals which passed a sieve of 500 meshes to the sq. cm. and left 19 per cent. on a 10,000-mesh sieve. Two hundred grms. of the powdered coal were mixed with 1000 grms. of cement and burnt in an experimental oven. The burnt and ground cement was added to an equal quantity of gravel and ½ per cent. of water and after thorough mixing, sifted from the gravel; in this way the quick-setting was changed into a slow-setting cement. The highest strength values were obtained with cement burnt without the addition of coal, and the strengths of those burnt with coal diminished as the ash content of the coal increased. —W. C. H.

Portland cement; Report on the work carried out in the Royal Testing Station at Gross-Lichterfelde on the constitution of ——. Wetzel. Chem.-Zeit., 1911, **35**, 256.

The problem has been attacked by microscopic and thermal analysis. The cooling curve for silica-lime fusions shows that tridymite separates first, then monocalcium silicate, crystals of dicalcium silicate, and finally, at over 2000° C., free lime. In order to observe the change occurring in cement raw materials as the heat was increased, the burnings were interrupted at intervals and cooling curves taken of each burning test. An electric resistance furnace with a low alternating current was used, and the temperatures measured with a thermo-couple. A distinct arrest point occurs in the cooling curve at 1300° C., at which chemical reactions leading to fusion begin to take place with the raw materials. At 1350° C. the amount of fused material has increased and at 1400° C. is in equilibrium with the raw material and can absorb no further constituents.—W. C. H.

Sea water Commission; German ——. [*Action of sea water on cements and mortars*]. C. Goslich and R. Dyckerhoff. Chem.-Zeit., 1911, **35**, 255.

Test-pieces immersed in sea water last August at Sylt were examined, and it was found that trass in sea water cement had stood the test very well, and had been of service when added to cements deficient in silica. The experiments showed that in sea water, cements containing combined sulphuric acid did not stand the tests worse than those free from sulphates. Dyckerhoff reported that sulphuric acid up to 2½ per cent. in a cement is quite harmless as regards hardening in sea water, and induces the formation of calcium aluminium sulphate, which is accompanied by a slight expansion, which is advantageous in sea water. He also made fresh proposals as to the form, pressing and mixing proportions of the cubes to be tested in sea water. (See also this J., 1910, 567.)—W. C. H.

Portland cement concrete containing different amounts of calcium sulphate in sea water; The alteration of the chemical composition of ——. F. Framm. Chem.-Zeit., 1911, **35**, 256.

Concrete slabs made from mixtures of 1 part of cement and 4 parts of gravel were laid in sea water for several years, and afterwards the outsides and centres of the slabs were analysed. Experiments were made with a German cement with 1·19 and 2·47 per cent of sulphuric acid (SO_3), and a Boulogne cement with 0·57 and 2·43 per cent. The following table shows the ratios of cement to gravel after the immersion:—

	Without addition of calcium sulphate.		With addition of calcium sulphate.	
	Outside.	Centre.	Outside.	Centre.
German cement	1 : 3·44	1 : 3·75	1 : 3·69	1 : 3·74
Boulogne ,,	1 : 3·23	1 : 3·76	1 : 3·84	1 : 3·49

Not only is there less deviation from the original ratio of 1 part of cement to 4 parts of gravel in the case of concretes with an addition of calcium sulphate, but these also were more resistant to sea water. The Boulogne cement showed most disintegration, and some fine cracks, but these was less apparent in the test pieces enriched with calcium sulphate.—W. C. H.

Portland cement concrete tests in sea water ; American ——. O. Schott. Chem.-Zeit., 1911, 35, 256.

CONCRETE bodies showed a much greater durability in sea water when they had been previously hardened in the air. Concrete columns so treated were not disintegrated at all after 2 years' immersion in sea water, whereas disintegration soon took place to a considerable extent in concrete which had not been previously hardened in the air.—W. C. H.

Slag-concrete. A. Knaff. Stahl u. Eisen, 1911, 31, 373—379. (Compare this J., 1910, 758.)

FURTHER tests are described showing that a satisfactory concrete can be made with blast-furnace slag. Boiler slag, which is lighter and more porous, is unsuitable, and the author considers that this fact explains the bad results obtained by Klahre (Zement u. Beton, 1910, 177), who states that iron embedded in slag concrete is liable to rust. A number of cases are cited in which iron, embedded in concrete made with blast-furnace slag, has remained free from rust for a prolonged period. In one case, the piece examined had been embedded for 19 years, and in another case for 13 years ; the concretes contained 1·29 and 1·67 per cent. respectively of sulphur. Rusting, which occurs with concrete made from boiler slag, is due to the porosity of the material, permitting access of air and moisture to the embedded iron. The presence of sulphur in a dense non-porous concrete made from blast-furnace slag is in no way deleterious. Good concrete was also made with a blast-furnace slag and slag sand containing 13·3 and 19·3 per cent. respectively of manganese.—A. T. L

PATENTS.

Portland cement ; Burning ——. F. L. Woods and M. Boyd, Assignors to Hunt Engineering Co., Iola, Kans. U.S. Pat. 985,313, Feb. 28, 1911.

FUEL and sufficient air under pressure to afford complete combustion are fed into the kiln and "superatmospheric" pressure is maintained throughout the clinkering and firing zones. The position of the firing zone is controlled by a zone of kiln gases at "superatmospheric" pressure between the firing zone and the stack. The escape of the kiln gases is retarded in order to obtain increased time of contact of the raw materials and to be independent of atmospheric conditions.—H. H. S.

Cement plaster. J. D. Cady, Quanah, Tex. U.S. Pat. 985,656, Feb. 28, 1911.

GYPSUM rock is calcined in an oxidising atmosphere to produce anhydrous calcium sulphate. A solution of one part of caustic potash to 3·5 parts of aluminium sulphate is heated and stirred until dry, and 40 parts of this mixture are then added to each part of the anhydrous calcium sulphate.—H. H. S.

Rotary plaster calciner, dryer and roaster ; Continuous ——. W. A. Bishop, Newark, N.J., Assignor to Calvin Tomkins, New York. U.S. Pat. 986,350, Mar. 7, 1911.

THE apparatus comprises a main heating flue, above which is a horizontal calcining chamber, surmounted by a drying chamber. The heating gases pass from the main flue to a return flue which runs through the calcining chamber. This return flue consists of a rotating cylinder which carries a screw thread on its exterior surface, forming a conveyor for the plaster under treatment. One end of the calcining chamber is connected with a dust-collecting box, and the dust is transferred by a small screw conveyor back to the other end of the calcining chamber.—A. T. L.

Stucco plaster ; Process for obtaining —— *by treatment with water or steam.* Berliner Gipswerke L. Mundt vorm. H. Kühne. Ger. Pat. 229,698, May 28, 1910.

THE plaster, after being heated in water or steam, and whilst still hot, is sprinkled with glue solution, borax solution, and alum solution, and after evaporation of the water, is ground. The heating in water or steam may be omitted, and the treated plaster may be mixed with lime in order to regulate its setting.—A. S.

Artificial stone ; Process for preparing from magnesium hydroxide a mass which can be cast, for the production of ——. E. R. Tappert. Ger. Pat. 229,766, April 30, 1908.

MAGNESIUM sulphate solution is treated with sodium monosulphide, the precipitate is warmed and repeatedly washed, and the gelatinous mixture of magnesium hydroxide with traces of sodium-magnesium sulphate is incorporated with magnesium carbonate and sintered magnesia. The product can be cast, and rapidly sets and hardens to a water-resistant material.—A. S.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron-ores of Central and North-eastern Cuba ; Origin of the ——. C. K. Leith and W. J. Mead. Trans. Amer. Inst. Min. Eng., 1911, 217—229.

LARGE deposits of low-grade iron ore have recently been discovered and opened in Eastern and North-eastern Cuba. In the report on the iron ore reserves of the world published in 1910 by the International Geological Congress in Sweden, these Cuban deposits are estimated at about 2,000,000,000 tons. The two principal fields are the Mayari and the Moa, on Nipe Bay in the province of Oriente ; whilst less well-known deposits occur at Baracoa in the eastern part of the island and in Camaguey province in Central Cuba. Ore has already been shipped to Sparrow's Point, Md., U.S.A., and can be delivered there at a cost per unit of iron considerably lower than Lake Superior ores. The Mayari and Moa ores appear to have resulted from surface alterations, in place, of serpentine rock ; they consist mainly of limonite but contain more or less hæmatite, magnetite, and intermediate hydrated oxides of iron near the surface, whilst the principal impurities are bauxite and kaolin. Nickel and cobalt are present in quantities ranging up to 1·5 per cent., and chromium up to 2·5 per cent. ; the last-named can be eliminated economically in smelting. Phosphorus is mostly below the Bessemer limit. The ore contains on the average 46 per cent. of iron, which is increased to 50—55 per cent. after treatment in a nodulising plant such as is established at the port of Felton. The Camaguey ores may have been derived like the Mayari ores from serpentine, or from a once overlying limestone ; if from the latter, it is possible that along certain main drainage channels, the deposits extend to a greater depth than has yet been observed. These ores consist of about equal proportions of limonite and hæmatite (with magnetite) at the surface, the proportion of limonite increasing from the surface downwards. The principal impurities are bauxite, kaolin, and chert. Nickel is present to about 0·5 per cent., and chromium to 1—2 per cent. Phosphorus is mostly above the Bessemer limit.—A. S.

Iron-ores of Camaguey and Oriente provinces, Cuba ; Occurrence, origin, and character of the surficial ——. A. C. Spencer. Trans. Amer. Inst. Min. Eng., 1911, 231—237.

IN the author's opinion the ferruginous deposits of the Cubitas, Mayari, and Moa districts of Cuba consist of "brown iron ore" of residual origin formed *in situ* by disintegration of the underlying serpentine rock. Although limonitic in character, they are not true limonite, but contain a certain amount of iron oxide uncombined with water. They differ from bog iron ore in their mode of origin and low phosphorus-content. In places where clay-like ore exists, it is found beneath the brown ore and preferably would be mined together with the latter.—A. S.

Iron-carbon alloys; Chemical physics involved in the precipitation of free carbon from ——. W. H. Hatfield. Proc. Royal Soc., 1911, A85, 1—13.

The author describes experiments demonstrating that free carbon will not separate from the iron-iron carbide solid solution (austenite): the carbide must separate out from the solution before free carbon can appear, and only structurally free carbide can dissociate. If silicon be the only foreign element present, it is not uniformly distributed. The carbide contains less than the matrix, but its silicon content increases with the silicon content of the alloy. When manganese is present it is largely found in the carbide to the exclusion of the silicon. Sulphur appears not to enter appreciably into the carbide, although it appears to cause the exclusion of the silicon therefrom. A series of heat-treatment experiments indicate that the dissociation of the carbide at a given temperature is facilitated or otherwise by the presence of silicon, manganese, and sulphur, which also, by altering the composition of the alloy, modify the solubility of the carbide, thus leading to separation of more or less free carbide, subject to dissociation. For example, in white iron, silicon renders the carbide less stable, whilst manganese and sulphur render it more stable. The author deals with the cementation of iron bars, and observes that the carbon can only diffuse in the bar, when the carbide is in solution in the iron, and also points out the agreement between the solubility of the carbide and the degree of carburisation, *viz.*, about 1·8 per cent. of carbon, obtainable on fair-sized bars. In dealing with the difficulty of "black" steels, the author says that this difficulty can be overcome by adding to the steel those elements which will produce a stable carbide; he states that if steel be worked or rolled at a temperature at which the carbide does not dissolve so as to form austenite, a "black" steel may result. The method employed throughout the experiments was the heat-treatment, under well-defined conditions, of alloys of known composition, followed by micrographical examination.

—R. W. N.

Precious metals; Determination of —— in ores rich in copper. J. Loevy. Chem.-Zeit., 1911, 35, 278.

In order to obtain a lead button sufficiently free from copper for cupellation, in the determination of gold or silver in ores rich in copper, the proportion of copper should be reduced to 6 per cent. by the addition of silica. Copper ores (whether oxidised or containing sulphur) which do not contain more than 6 per cent. of copper may be readily reduced by fusion, and yield a lead button which is poor in copper and can be at once subjected to cupellation. A copper ore containing, *e.g.*, 12 per cent. of copper is intimately mixed with its own weight of sea sand, and 100 grms. of the mixture then fused in two crucibles (size G), with a suitable flux (sodium carbonate, litharge, borax, tartaric acid and sodium chloride), so as to obtain two lead buttons, each weighing 30 to 40 grms. These are united and concentrated down to a button of 30 to 35 grms., which may then be cupelled without further treatment. If the ore contains, *e.g.*, 24 per cent. of copper, 50 grms. of the sample are mixed with 150 grms. of sand, the mixture fused in four crucibles, and the buttons concentrated as before into one of 30 to 35 grms.—C. A. M.

Brasses, bronzes, and other non-ferrous metals; Recent U.S.A. Government specifications for ——. The Brass World and Platers' Guide, **1910**, 397—400.

Specifications issued by the U.S. Bureau of Steam Engineering on July 1st, 1910, give the following chemical compositions for various classes of metals and alloys, the figures being percentages in each case.

(1) *Casting materials.*

Commercial brass. Cu 64—68, Zn 32—34, Fe 2 (maximum), Pb 3 (maximum).

Muntz-metal. Cu 59—62, Zn 39—41, Pb 0·6 (maximum). (No mention made of iron content.)

Brazing metal. Cu 84—86, Zn 14—16, Fe 0·06 (maximum), Pb 0·3 (maximum.)

Gun-bronze. Cu 87—89, Sn 9—11, Zn 1—3, Fe 0·06 (maximum), Pb 0·2 (maximum).

Journal-bronze. Cu 82—84, Sn 12·5—14·5, Zn 2·5—4·5, Fe 0·06 (maximum), Pb 1·0 (maximum).

Valve-bronze. Cu 87, Sn 7, Zn 6, Fe 0·06 (maximum), Pb 1·0 (maximum).

Ingot-copper. Cu 99·8 (minimum) and free from sulphur and other impurities.

Manganese-bronze. Cu 57—60, Zn 37—40, Sn 0·75, Fe 1·0 (maximum), Al 0·5 (maximum), Mn 0·3 (maximum). (No mention is made of lead content.)

Monel-metal castings. Ni 60 (minimum), Cu 33, Fe 6·5, Al 0·5, Pb none.

Cast naval-brass. Cu 59—63, Zn 35·5—40·5, Sn 0·5—1·5, Fe 0·06 (maximum), Pb 0·6 (maximum).

Phosphor-bronze. Cu 80—90, Sn 6—8, Zn 2—14, P 0·3, Fe 0·06 (maximum), Pb 0·2 (maximum).

Screw pipe fittings of brass. Cu 77—80, Zn 13—19, Sn 4, Fe 0·1 (maximum), Pb 3·0 (maximum).

Nickel. Ni 97 (minimum).

Tin. Sn 99·6 (minimum).

Lead. No. 1 lead 99·5 (minimum). No. 2 lead 97·5 (minimum).

Thrust rings. Cu 82—84, Sn 12·5—14·5, Pb 2·5—4.5. (No mention is made of zinc or iron content.)

Monel-metal ingots. Ni 60 (minimum), Cu 38, Mn 2, with small amounts of other ingredients not injurious to casting qualities, or detrimental to strength or non-corrosive properties.

(2) *Rolled materials.*

Admiralty metal. Cu 70 (minimum), Zn 29, Sn 1·0 (minimum), Pb 0·075 (maximum), Fe 0·06 (maximum).

Benedict nickel. Cu 84—86, Ni 14—16.

Sheet brass and tubing. Cu 60—70, Zn 30—40, Pb 0·5, (maximum).

Brass rods. Cu 60—63, Zn 37—40, Pb 3 (maximum).

Copper. Cu 99·5 (minimum).

Muntz-metal. Cu 59—62, Zn 38—41, Pb 0·6 (maximum) (No mention is made of iron content.)

Phosphor-bronze. Cu 85—95, Sn 5—10, Zn 4 (maximum), Pb 0·2 (maximum), Fe 0·06 (maximum), P 0·15.

Manganese-bronze. Cu 57—60, Zn 37—40, Sn 0·5 (maximum), Fe 1·0 (maximum), Mn 0·3 (maximum).

Monel-metal. Ni 60, Cu 36, Fe 3·5, Al 0·5, Pb none.

Rolled naval brass. Cu 59—63, Zn 35·5—40·5, Sn 0·5—1·5, Pb 0·2 (maximum), Fe 0·06 (maximum).

The following are the physical requirements of the preceding alloys and metals:—

	Minimum tensile strength	Yield point	Elongation on 2 in.
	lb. per sq. in.	lb.	per cent.
Copper (rolled)	30,000	—	25
Muntz-metal (rolled)	40,000	20,000	25
Phosphor-bronze (rolled)	50,000	25,000	25
Phosphor-bronze (cast)	40,000	20,000	20
Naval-brass (rolled) (1 in. and below)	62,000	31,000	25
Naval-brass (rolled) (over 1 in.)	60,000	30,000	28
Manganese-bronze (rolled) (1 in. and below)	72,000	36,000	28
Manganese-bronze (rolled) (over 1 in.)	70,000	35,000	30
Manganese-bronze (cast)	60,000	30,000	20
Monel-metal (rolled) (1 in. and below)	84,000	47,000	25
Monel-metal (rolled) (over 1 in.)	80,000	45,000	28
Monel-metal (cast)	65,000	32,500	25
Gun-bronze (cast)	30,000	15,000	15

In the case of large castings, such as screw propellers, test pieces are to be cast on the hub and each blade for manganese-bronze, or all on the hub for Monel-metal, while for smaller castings, separate test pieces may be poured, one before and one after the casting. The colour of the fracture of the test pieces, and the grain of the metal, must be uniform throughout. Spring brass is not to be ordered in widths exceeding 12 in. All brass tubing, unless ordered "hard," is to be annealed sufficiently to prevent "fire-cracking" and to stand other physical tests. A 3 in. length when split, must stand opening out flat without showing cracks or flaws. Brass tubing for radiators for heating systems, are to be semi-annealed and to stand bending 180° round a diameter of 1½ times the outside diameter of the pipe. Benedict-nickel, Monel-metal, and similar materials, must stand the test of having pieces, 2 ft. long, plunged at 300° F. into ice-cold water without showing cracks. Brass condenser tubes must be tinned inside, must stand hammering flat, must be capable of expansion by a tapered plug so that the internal diameter is increased 16 per cent. without splitting; also not more than 10 per cent. of the tubes may show "slivers" inside. All tubes must stand a hydrostatic pressure of 1000 lb. per sq. in. and a pneumatic pressure of 80 lb. per sq. in. All tinned tubes must be acid cleaned, dipped in molten tin, and then immediately wiped with hempen tow inside and outside to insure their being smooth. All Admiralty-metal tubes are to be annealed and acid cleaned before tinning. Benedict-nickel tubes are not to be annealed.

(3) *Babbit-metals.* The composition of babbit-metal shall consist of Banca tin 88·8 per cent., antimony 7·5 per cent., and copper 3·7 per cent. The metals are to be well fluxed with rosin and borax in mixing. In case Banca tin cannot be obtained, other brands may be substituted upon application to the Bureau of Steam Engineering. —H. H.

Bearing metals; Investigations on ——. (*Part II.*) E. Heyn and O. Bauer. Mitt. Kgl. Materialprüfungsamt, 1911, **29**, 63—110. (See also this J., 1904, 1219).

THE cooling curves of an alloy containing 83·5 per cent. of copper, 15·9 of tin, and 0·2 of zinc showed a melting point of 939° C., with eutectic points at 782° C. and 525° C. Castings were made of the alloy and after five re-meltings both in sand and in chill and a large number of tables are given of the results of the mechanical tests applied to them. It is shown: (1) That the rate of cooling so influences the mechanical properties (hardness, resistance to blows, and compression) that by correct cooling a relatively cheap bronze poor in tin can be obtained which will have quite as good properties as more expensive alloys rich in tin. (2) That the hardness is raised by rapidly cooling from temperatures above 782° C. (3) The greater the diameter the lower is the hardness in sand castings, which influence is not so evident in those made in chill. (4) That sand castings are more porous than those cast in chill. The influence of the presence of arsenic on the mechanical properties was determined. Alloys containing from 0·18 to 1·52 per cent. of arsenic were prepared, and the tabulated records of the tests applied to them are given. The influence of the content of arsenic on the temperatures of crystalline separations and changes, was only evident in the case of the richer arsenic alloys. Up to 1·32 per cent. of arsenic there was no deleterious effect on the casting capabilities, and the texture was scarcely affected. Increasing arsenic content raised the Brinel ball-test, reduced the breaking strain, and increased the elongation. The resistance to compression was increased with an increasing arsenic content, the influence being first evident at 0·65 per cent. of arsenic. The paper is illustrated by forty-four microphotographs.—A. H. C.

Armour plating and the Simpson weld. Times Eng. Suppl., March 29, 1911, 23.

IN the "Navy League Annual" of October, 1910, it is stated that whilst Krupp armour is estimated to have 50 per cent. more resisting power than Harveyed armour, Simpson armour is estimated to have a resisting power 75 per cent. greater than that of Harveyed armour. Some three years ago W. S. Simpson found that when two plates of steel with a section of copper between them, were placed in a mixture of carbon, brown sugar, and water, of the consistency of compressed snow, and the whole mass submitted to a temperature of 2000° F., the copper melted away into the steel and formed a perfect weld. So complete was the union between the two plates that, however treated, they would not part or split at the juncture. Moreover, the copper, when it entered the steel, increased the tenacity of the latter metal. (See Fr. Pat. 376,868; and Eng. Pat. 86 of 1907; this J., 1907, 1053; 1908, 338.) Samples of such welds were submitted to Professor J. O. Arnold, who examined them by alternating stress tests and micrographic analysis. Referring to one micrograph he said that it showed: "A portion of the thin weld line, in which a considerable part of the copper seam has disappeared owing to the metal dissolving in the steel to form a solid solution micrographically almost indistinguishable from the steel itself. Had the welding been continued for some time longer, there would be no visible weld line left, but merely a solution of copper in the steel molecularly continuous with the steel itself, and considerably stronger than the main body of metal, because the copper will have disappeared (visually) after having brought into perfect continuity the molecules of both faces of the steel."

Application to armour plating. As is well known, by the face-hardening processes which have been in use for some time past, carburisation of the armour plate does not extend to a greater depth than seven-eighths of an inch. A hard face and a tough back are obtained, but the hard face is neither as hard nor as thick as could be wished. If, then, it were possible to take high speed steel, say of double this thickness, and weld it to a soft steel backing, an immense advantage would be gained, and this is what can be done with the Simpson weld. Not only is the high speed steel many times harder than ordinary steels, but the hardened face of the plate can be made of any thickness desired. It is understood that trials have been made already with plates of the usual regulation size in which two inches of hard steel were welded to four inches of soft, and which, when attacked by a 6 in. gun, gave entirely satisfactory results. Larger plates are now being made and will soon be tried.

Ores [*tin and tungsten*]; *Valuation of* ——. A. Rzehulka. Z. angew. Chem., 1911, **24**, 444—447. (See also this J., 1910, 494).

Tin ore. The current London price of Straits tin is usually the basis of valuation in Germany (M. 20 per 1000 kilos. being considered equal to £1 per ton). M. 200 per 1000 kilos. (dry weight) of ore are deducted for smelting, from the value of the tin contained, in the case of the purest and richest ores such as stream tin; for medium grade ores containing about 65 per cent. of tin, M. 400 are deducted, and for inferior ores M. 800 (or even more in exceptional circumstances). 9000 tons of tin were produced in Germany in 1909, almost entirely from Bolivian ore, the annual British production being about 5000 tons from native ore and 11,500 tons from imported ore. *Tungsten ore.*—Wolfram containing 68—70 per cent. of tungsten trioxide and free from objectionable impurities, is now valued at M. 43—52 (according to the price of tungsten) per ton per unit (1 per cent.) of tungsten trioxide. Clean lump ore is preferred to small ore or washed concentrates. Scheelite is valued at M. 43—47 per ton per unit. In America less pure ores are treated; concentrates containing at least 60 per cent. of tungsten trioxide (and not more than 0·25 per cent. of phosphorus and 0·01 per cent. of sulphur) are worth $5·50—5·85 per ton per unit. The world's annual production of ore is estimated at fully 3300 tons and valued at about £300,000. —A. SELD.

Alloys of silver with cadmium. G. J. Petrenko and A. S. Federow. Z. anorg. Chem., 1911, **70**, 157—169.

A THERMAL and micrographic study of the alloys of silver and cadmium shows that these metals, which, in the molten state, are miscible in all proportions, form a series of solid solutions, α, β, γ, δ, η, with gaps from 7—19, 31—34, 39—43, and 57—64 per cent. of silver (compare Bruni and Quercigh; this J., 1910, 1253). The compound, AgCd, is formed in the solid state at 200° C. by reaction between the α and γ crystals. The existence of a compound, Ag_2Cd_3, (very brittle) is also probable, and that of compounds, $AgCd_4$ and $AgCd_3$, is possible. The melting point

of cadmium, contrary to the assertion of Kirke-Rose (this J., 1904, 1149), is raised by the addition of silver.
—F. Sodn.

Metals; Transport of particles of certain —— under the influence of heat. G. Reboul and E. Grégoire de Bollemont. Comptes rend., 1911, **152**, 758—760.

Blondlot in 1886 (Comptes rend., **102**, 210) found that when two electrodes, one of platinum and one of copper, disposed opposite to one another, were heated for several hours, an abundant black deposit was produced on the platinum. In the authors' experiments pieces of sheet platinum, about 2 cm. square, and strips of copper, 0·5 mm. wide, were heated in a Guntz electric resistance furnace, being separated from one another by small pieces of mica or quartz. The deposit produced on the platinum consisted largely of copper oxide; it was partly soluble in boiling nitric acid and completely soluble in *aqua regia*. The amount of deposit increased to a maximum and then diminished and finally disappeared, owing to volatilisation of the deposit. In a confined atmosphere the amount of the deposit increased. No deposit was obtained at temperatures below 400° C. At 400° C. there was a vague maximum deposit after 30 mins.; at 500° C., a sharp maximum after 10—15 mins., at 600° C. after 5—10 mins., at 800° C. after one minute, and at 900° C. after 30 seconds. The amount of deposit diminished rapidly when the distance between the two metals was increased; at 850° C. the deposit was very plain for a distance of 0·5 mm., but only just visible for a distance of 2 mm., whilst at 3 mm. no deposit was obtained. The deposit reproduced exactly on the platinum the contour of the piece of copper, indicating that it is probably due to the direct projection of particles. The condition of the surfaces of the two metals plays an important part in the phenomenon.
—A. S.

Metals; Replacement of —— in non-aqueous liquids and the solubility of metals in oleic acid. C. B. Gates. J. of Phys. Chem., 1911, **15**, 97—146.

Detailed results of numerous experiments on the replacement of copper by other metals in non-aqueous media are described. The results, some of which have been mentioned previously (see Kahlenberg, this J., 1911, 290), show that it is possible to precipitate copper from non-aqueous, non-conducting solutions by means of lead, zinc, cadmium, tin, bismuth, antimony, mercury, silver, iron, nickel, cobalt, aluminium, magnesium, sodium, potassium, and calcium, but not by platinum and gold. Copper can also be separated from its fused salts (organic and inorganic) by many of the common metals, without the intervention of moisture. In the course of the investigation it was observed that many of the metals are dissolved appreciably by oleic acid, and also by palmitic and stearic acids, with evolution of hydrogen.—A. S.

Mineral production of the United Kingdom in 1910. Board of Trade J., March 16, 1911. [T.R.]

The following tables, showing the output of coal and certain other minerals in the United Kingdom at mines worked under the Coal and Metalliferous Mines Regulation Acts (the returns from quarries under the Quarries Act are not yet available) during the year 1910, with comparative figures for the preceding year, are extracted from an advance proof (subject to correction) of the Mines and Quarries General Report and Statistics for 1910:—

Output of minerals under the Coal Mines Regulation Acts.

	1909.	1910.
	Tons.	Tons.
Barium (compounds)	4,897	5,970
Coal	263,758,562	264,292,588
Clay and shale, other than fire-clay and oil shale	297,604	410,797
Fire-clay	2,695,861	2,484,069
Igneous rocks	551	374
Iron pyrites	7,173	8,551
Ironstone	8,039,441	7,979,750
Limestone	16,392	16,428
Oil shale	2,966,937	3,130,280
Sandstone (including "Ganister"*)	118,641	125,153

* The quantity of ganister obtained was 112,317 tons in 1909, and 124,883 tons in 1910.

Output of certain minerals under the Metalliferous Mines Regulation Acts.

	1909.	1910.
	Tons.	Tons.
Barium (compounds)	35,212	36,979
Clay and shale	120,282	113,022
Copper ore and copper precipitate	3,699	3,771
Fluorspar	27,577	43,488
Gold ore	5,538	6,154
Gypsum	200,962	218,247
Igneous rocks	70,318	65,154
Iron ore	1,674,643	1,851,101
Lead ore	29,688	28,511
Limestone †	407,830	381,154
Manganese ore	2,768	5,467
Rock salt	209,552	205,423
Sandstone ‡	148,925	131,817
Slate	92,223	99,619
Tin ore, dressed §	7,403	6,558
Zinc ore	9,902	11,273

† Including 2,540 tons of calc spar in 1909 and 6,797 tons in 1910.
‡ Including 8,413 tons of ganister in 1909 and 13,615 tons in 1910.
§ In addition, 2,893 tons of undressed tin ore were obtained in 1909, and 2,720 tons in 1910.

The above figures do not in all cases represent the total production of the minerals for the year. Large quantities of several important minerals, such as iron ore, limestone, sandstone, slate, clay, etc., are obtained from quarries under the Quarries Act and from other open workings, the returns from which are not yet available. The totals for coal and for the ores of copper, lead, and zinc are, however, substantially complete.

Arsenic and silver from Canada. Oil, Paint, and Drug Rep., March 6, 1911. [T.R.]

A smelter has been erected, covering nearly ten acres, in Orillia, Canada, for treating ores from the Cobalt mines. The chief products will be silver bullion and arsenic. Electric power will be used from the municipal plant. Twenty tons of ore (one car) will be used every day, including Sunday. The larger quantity of the silver bullion will probably go to New York, with occasional shipments to London. At present a car of arsenic will be shipped to New York every week, with an increase later.

Osmium-iridium production in Russia. Board of Trade J., March 23, 1911. [T.R.]

The production of osmium-iridium in Russia, the output of which diminishes year by year, was in 1910 52¼ oz. troy, as compared with 55¾ oz. in 1909, and about 145 oz. in 1902. The metal is obtained from crude platinum, or from native admixtures with osmium and platinum, in which iridium predominates. It is produced in the Miassk mineral district, the Kyshtym mining works district, and the north Ekaterinburg mineral district, all in the Ural region.

Wolframite discovery in Peru. Board of Trade J., March 16, 1911. [T.R.]

The discovery of large deposits of wolframite, assaying up to 72 per cent. of tungstic acid, is reported in the northwest of the Department of Ancachs.

Gauze electrode for the rapid electrolytic determination of lead and copper. Benner. *See* XXIII.

Volumetric method for the determination of tungsten. Knecht and Hibbert. *See* XXIII.

Microchemical examination of silicates. Canaval. *See* XXIII.

Patents.

Metals; Recovery of —— in complex or low grade ores. F. H. Wintle, London. From S. Laszczynski, Miedzianka, Poland, and W. Stoeger, Vienna. Eng. Pat. 1341, Jan. 18, 1910.

The crushed ore, which may consist of a complex lead-zinc material containing copper, is roasted, if necessary, and lixiviated with hot dilute sulphuric acid. After adding a small amount of permanganate to the solution in order to oxidise the last traces of ferrous iron, the whole of that metal is precipitated as ferric hydroxide by addition of zinc oxide. The bulk of the copper is subsequently deposited electrolytically, preferably whilst sulphur dioxide is passed through the solution, its last traces together with any other metals of the same group being removed by means of sodium sulphide, and finally the liquid is electrolysed for the recovery of the zinc. In this operation, the electrolyte is kept thoroughly agitated, whilst the anode is covered with some porous non-conducting material, such as cocoanut fibre, which will retain the liquid in its pores in a quiescent state and so prevent the oxidation of the manganous salts at the anode surface. The sulphide precipitate and the undissolved residue from the lixiviation may then be smelted for the values they contain. If the lixiviation has been effected at a raised temperature, that temperature must be maintained through the remaining operations of filtration and electrolysis. The introduction of the sulphur dioxide, which is converted into sulphuric acid during the precipitation of the copper, has the effect of maintaining the temperature of the bath and increasing the proportion of free acid, thus reducing the resistance of the bath.—C. A. W.

Complex ores or products; Selective separation of metals from ——. H. L. Sulman and H. F. K. Picard, London. Eng. Pat. 8650, April 9, 1910.

THE process is particularly applicable to the separation of lead from zinc, or to the treatment of any mixture where one of the metals is more easily reducible than the other. A mixture containing the oxides of zinc and lead is crushed and heated with carbon, or in an atmosphere of reducing gas, to a temperature of about 600° C., when the lead alone is reduced to metal distributed in small particles through the mass. The product is allowed to cool under conditions preventing the re-oxidation of the lead, and may then be subjected to some process of concentration, such as vanning or flotation, so that only the lead particles are separated, the unreduced zinc being left with the silica in the watery pulp. Sulphide ores must receive a preliminary calcination; in this operation, should any sulphide of the more easily reducible metal be converted into sulphate, it will be reduced to sulphide in the final reduction and subsequently will easily be separated.
—C. A. W.

Ores or the like; Separation of ——. Murex Magnetic Co. and A. A. Lockwood, London. Eng. Pat. 13,009, May 28, 1910.

THE process can be applied to the magnetic separation of metallic oxides or carbonates from their gangue. The ore is mixed with a magnetic substance, such as magnetite, the whole being agitated with an oily liquid to which a soluble metallic sulphide, generally a solution of potassium sulphide, is subsequently added. No preliminary treatment of the oily liquid is necessary. As an example, 100 parts of a lead ore, containing lead carbonate, phosphate and chloride, are crushed, agitated with 80 parts of water and mixed with 4 parts of finely ground magnetite and 2 parts of Texas residuum oil. The whole is agitated for about ten minutes, a solution of $\frac{1}{16}$ part of potassium sulphide is added, when, finally, the carbonate particles will be found coated with magnetite, and the pulp is ready for classification in a wet magnetic separator.—C. A. W.

Ammoniacal solutions used for dissolving cupro-metallic fouling from the bores of guns and rifles; Treatment of ——. King's Norton Metal Co., London, T. A. Bayliss, Warwick, H. M. Smith, Abbey Wood, Kent, and H. W. Brownsdon, Birmingham. Eng. Pat. 7472, March 24, 1910.

THE liquid, consisting of an ammoniacal solution of an oxidising agent, such as ammonium persulphate, is coloured blue if copper be present and is therefore rendered useless for further tests. It may then be treated with zinc dust (containing at least 75 per cent. of metal), 10 parts being employed for each 8 of copper present. The copper is precipitated, and the colourless solution, after addition of fresh oxidising agent, may be employed again.—C. A. W.

Wire; Apparatus and process for making —— *electrolytically.* W. E. Gibbs. Eng. Pat. 19,593, Aug. 22, 1910. Under Int. Conv., Sept. 4, 1909.

THE process consists essentially in starting with an endless wire of the desired diameter, passing this continuously and repeatedly through the depositing bath and through a draw-plate, whereby it gradually becomes longer, and at intervals cutting off the increment. The wire is guided through the depositing bath in a series of coils by means of a pair of drums, the upper one being grooved. On leaving the bath, it is drawn through the draw-plate by means of an ordinary wire-drawing drum or "block." The lengthwise increment of the wire accumulates in coils on the upper smaller part of the "block," and when desired, this increment is cut off, the ends of the remaining wire are welded together, and the process is continued. The wire always passes through the draw-plate in the same direction.—A. S.

Copper wire by electrotyping; Process and apparatus for producing ——. W. E. Gibbs. Fr. Pat. 420,249, Sept. 2, 1910. Under Int. Conv., Sept. 4, 1909.

THE process is an improvement on that described in a previous patent (see preceding abstract). After leaving the draw-plate, the wire is wound on a stationary conical drum, mounted on a stationary hollow upright, by means of a rotating winder. The speed of the winder is regulated, according to the speed of the wire through the depositing bath. Before re-entering the depositing tank, the wire is passed through a bath of washing acid. Any abnormal speed of the coils of wire in the depositing tank is rectified locally by an arrangement, such as a rotating screw, which engages by friction successively with the coils, thus retarding those which are advancing at an excessive speed.
—B. N.

Hearth for cooling ores or other materials proceeding from calcining or roasting furnaces. T. Edwards, Ballarat, Australia. Eng. Pat. 21,197, Sept. 12, 1910.

THE cooling hearth consists of a flat surface over which the material is moved by one or more series of rabbles revolved by means of vertical spindles geared to horizontal shafts. The paths of the rabbles intersect, and the hearth, being supported at one end on adjustable bearings, may be given any inclination to the horizontal. The cooling of the ore is accelerated by means of water spray, delivered from arms which rotate on the vertical spindles slightly in advance of the rabble teeth. If any additional cooling be required, the teeth themselves may be made hollow and cooled with water, or the underside of the hearth may be provided with a water-jacket.—C. A. W.

Ores; Apparatus for the production of matte and smelting of ——. R. R. Moore, Garfield, and J. H. Kees, Salt Lake City, Utah. U.S. Pat. 985,195, Feb. 28, 1911.

THE furnace is provided with a converting chamber which opens directly into it, the two being separated by a shoulder, so that the upper part of a bath of molten matte and slag in the converter-chamber is allowed to come into intimate contact with the base of a column of silica and other constituents supported wholly on the floor of the furnace. Means are provided for passing a blast of air through the molten matte and slag in the converter-chamber, the resulting nitrogenous and sulphurous gases being subsequently carried into and through the furnace charge.
—C. A. W.

Cast iron; Manufacture of ——. Soc. Anon. des Forges et Fonderies de Montataire. Fr. Pat. 420,925, Dec. 7, 1909.

IN order to obtain a cast-iron which will contain the minimum proportion of sulphur and very little silicon, and which will therefore be suitable for the manufacture of steel by a basic process, it is proposed to add fluorspar to the charge in order to obtain a more basic, but still fusible slag.—C. A. W.

Metals and alloys ; Production of —— by fusion of alkaline earth metallo-acids or metalloïdo-acids with metallic sulphides and carbon, in the electric furnace. Ampère Ges. m. b. H. and E. Müller. Fr. Pat. 420,954, Sept. 17, 1910.

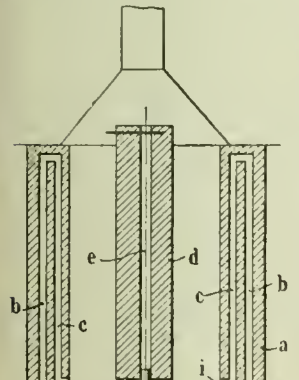
In order to obtain the rarer metal from compounds of an alkaline earth with a metallo-acid, such as calcium tungstate, it is proposed to smelt the substance with carbon and a metallic sulphide in the electric furnace. In the above case, if pure tungsten be required, the sulphide employed will be that of the alkaline earth metal, calcium sulphide ; whereas, by employing any other, such as iron sulphide, an alloy may be obtained. In order to obtain products entirely free from sulphur, it is necessary to make a special addition of lime to the mixture. By taking more than one metallic sulphide, it is possible to obtain ternary alloys such as ferromolybdotungsten ; whilst, finally, in place of the alkaline earth salt, a mixture of base and acidic oxide may be substituted. Thus, in order to obtain an alloy of iron and uranium, it is only necessary to smelt together a mixture of lime, uranium oxide, iron sulphide and carbon.—C. A. W.

Cementation of metals susceptible of being tempered and of alloys capable of being cemented. M. Gräf and O. Peschel. Fr. Pat. 421,000, Oct. 1, 1910.

The material in which the metallic pieces are embedded for the purpose of cementation is composed almost wholly of ordinary sawdust and any other sufficiently filamentous waste obtained in the course of wood-working. To this, a small proportion, about 5 to 10 per cent., of sodium carbonate and colophony may be added ; whilst, finally, in order to retard the course of the carbonisation, the material may be saturated either wholly or partially with any of the usual impregnating liquids.—C. A. W.

Furnace ; Shaft cementation ——. H. Trachsler and F. Ernst. Fr. Pat. 416,781, May 10, 1910. Under Int. Conv., May 26, 1909.

The furnace, which may be cylindrical in form, is intended for the combustion of coal or coke, the combustible being mixed with the raw material. It is provided, around the base of the exterior wall, with apertures, *b*, by means of which air may be passed either directly into the lower part or into an upper circular channel, *c*, which itself communicates through the air-inlets, *i*, with the middle part of the furnace. Up the centre of the furnace passes a shaft, *d*, with air channel, *e*, which can be closed by means of a valve at the top. In this way air can be forced or drawn through the conduit, *k*, and the channel, *e*, and passed through the transverse inlets, *g*, and, *f*, into the cold and hot zones respectively, the admission being stopped when desired by means of the movable valve, *h*, regulated from outside the furnace. The fresh current of hot air provided towards the upper part of the furnace then serves for the combustion of the carbonic oxide produced below. Alternatively, the furnace may have a semi-annular section, in which case the central air-shaft is arranged in the centre of the diameter ; in essential details, however, the construction remains the same.—C. A. W.



Antimonious slags or dross ; Treatment of —— accruing from reduction furnaces, as well as oxides proceeding from distilling furnaces, and other products of antimony. A. Vietti. Fr. Pat. 421,076, Dec. 11, 1909.

Antimonious slags and drosses are composed generally of sodium sulphoantimonites and sulphoantimoniates, antimony oxides, sodium silicate and free soda, silica and alumina. It is proposed to smelt these products in a fusion furnace in a manner analogous to that employed in the case of lead ores, the only addition being the combustible necessary for the reduction and for the heating of the furnace, although in some cases it may be advantageous to employ a flux. In order to avoid the formation of oxides, only a feeble blast and the smallest quantity of air necessary for the combustion should be employed, the removal of the fumes being effected by means of an aspirating fan. In consequence of the corrosive action of the soda, the partitions of the furnace should be constructed of cast-iron or steel plates which must be cooled externally by means of water. As an alternative, the dross may be crushed, mixed intimately with wood charcoal or coal and heated in a reverberatory furnace provided with a gas generator. In either case the metal obtained should be afterwards refined by the usual methods.—C. A. W.

Electric furnace for metallurgy with large and spacious working-chamber and heating by flame or electric arc acting on the surface of the bath. Ges. für Elektrostahlanlagen m. b. H. Fr. Pat. 421,292, Oct. 10, 1910.

In the electric furnace, a large quantity of heat is lost at the commencement by reason of the difficulty of obtaining a circulatory movement in the bath ; so that, during the fusion, only those portions near the arc are sufficiently heated ; whilst, even when the mass is completely liquefied, certain parts are only heated indirectly. In addition to the ordinary electrodes, it is therefore proposed to arrange, in the walls of the furnace, below the surface of the bath, electrodes which are in direct contact with the mass. These electrodes or conducting plates, of which two are provided in the furnace, one occupying the entire width on each side of the bath, are composed on the external face of some refractory material which only conducts electricity at a high temperature ; this material can be mixed with an agglomerant containing carbon. The inner surface, in contact with the wall of the furnace, is constituted of a metal plate, of similar shape, to which the outer sheet is dove-tailed. The current for these secondary electrodes may be taken from the same source as that feeding the arc. If a transformer be employed, its secondary winding may be divided into two portions composed of thick rods and thinner wires respectively. From the first of these, the supplementary current is taken, whilst the high tension current feeding the arc is obtained from the whole winding of thick and thin wires. The device may be applied to the Martin furnace, where a bath of metal is heated by a flame playing over the surface ; in this case also the underlying portions may be heated electrically in a similar manner.—C. A. W.

Ores ; Method and apparatus for the treatment of ——. G. Mitchell. Fr. Pat. 421,524, Oct. 15, 1910.

The apparatus, which is intended more particularly for the treatment of ores of copper, iron, lead, zinc, gold and silver, comprises a chamber which resembles a large reverberatory furnace except that the hearth of the latter is replaced by a series of hearths separated by a series of converting chambers, one such converter being placed between any two hearths. The furnace may be provided at one end with a fire-box, the flames passing over a partition into the working chamber, as in the ordinary reverberatory furnace ; whilst at the other end, nearest the chimney, the waste heat may be employed to generate the steam for the production of the blast. The converters of which the furnace may contain three or more, take the shape of deep rectangular crucibles arranged in the hearth and occupying the whole width of the furnace. The whole plane of the latter slopes downwards towards the fire-box, so that each converter is raised above the one in front of it; whilst each hearth shows a similar inclination towards its converter. In this way the ore having previously been melted on one of the hearths, the matte is caused to discharge by its own weight into the converter, where it is submitted to an air-blast, the heat produced being utilised in melting a fresh quantity of ore, so that after a time the fire in the fire-box can be suppressed. The supply of molten matte to the converter is controlled by means of a partition provided with fire-clay plugs and arranged at the bottom of each hearth. A door in the side of the furnace at this point permits the removal of the slag. Each converter is fitted with tuyères and with a tapping-hole through which the liquid mass can be run either into another furnace or into the adjacent converter. In the latter case, the method of operation is altered, the ore being placed only on the hearth feeding the first crucible. In the case of copper ore, the matte is then melted in the first crucible, transformed into "white metal" in the second, and finally converted into metallic copper in the third and smallest crucible. The furnace may be provided with petrol burners arranged along the sides and in the fire-box; whilst the lower sections of the converters may be made removable, each section being mounted upon a carriage on which it can be raised or lowered by means of hydraulic jacks.—C. A. W.

Alloys; Process for the production of metallic ——. W. Rübel. Fr. Pat. 421,723, Oct. 22, 1910. Under Int. Conv., Sept. 19, 1910.

The alloy, intended primarily for the manufacture of propeller blades, is obtained by melting 45 to 57 parts of copper in a crucible, pouring in 3 to 15 parts of a new vanadium alloy, which has previously been melted, and finally adding 40 parts of zinc. The proportion of copper employed depends on the proportion of vanadium alloy to be added. This new vanadium alloy, intended generally for the amelioration of copper-zinc compositions, is composed of vanadium, copper, aluminium and iron; the iron may be replaced by nickel or manganese, whilst the proportion of vanadium is such that there is always one part for every two parts of iron, nickel and manganese taken together. In order to prepare the alloy, the iron and vanadium are melted in a crucible, the necessary quantities of aluminium and copper being added to the molten ferro-vanadium. As an example, 10 parts of an alloy possessing the formula $Cu_2AlFe_2Ni_3V_2$ may be combined with 50 parts of copper and 40 parts of zinc.—C. A. W.

Cutting, soldering, and autogenous welding of metals by means of blow-pipe jets. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany, Eng. Pat. 29,796, Dec. 20, 1909.

See U.S. Pat. 972,079 of 1910; this J., 1910, 1256.—T.F.B.

Metallic ores or oxides; Reduction of ——. C. M. Johnson, Avalon, Pa., U.S.A. Eng. Pat. 8531, April 8, 1910.

See U.S. Pats. 964,868 and 964,871 of 1910; this J., 1910, 1015.—T. F. B.

Minerals and the like; Means applicable for use in separating —— from earthy and other matters. F. A. M. Schiechel, Frankfort on Maine, Germany. Eng. Pat. 19,408, Aug. 18, 1910. Under Int. Conv., Sept. 21, 1909.

See Fr. Pat. 419,775 of 1910; this J., 1911, 137.—T.F.B.

Iron and steel; Process of making ——. B. Talbot, Darlington. U.S. Pat. 985,225, Feb. 28, 1911.

See Eng. Pat. 22,201 of 1909; this J., 1910, 1112.—T.F.B.

Ores and the like; Process of refining and agglomerating ——. H. Dicke, Assignor to J. E. Goldschmid, Frankfort on Maine, Germany. U.S. Pat. 986,271, March 7, 1911.

See Fr. Pat. 343,313 of 1904; this J., 1904, 1032.—T.F.B.

Furnace for roasting ores. Nichols Copper Co. Fr. Pat. 420,975, Sept. 30, 1910.

See U.S. Pat. 976,175 of 1910; this J., 1910, 1459.—T.F.B.

Process of making sulphuric acid and electrolytic iron. U.S. Pat. 984,703. *See* VII.

XI.—ELECTRO-CHEMISTRY.

Electric furnace notes. J. Härdén. Met. and Chem. Eng., 1911, 9, 130—132.

A furnace is described which was used for graphitising carbon rods. A direct current of about 3000 amps. at 40 to 45 volts was available. The bottom of the furnace was built up on a hollow cast-iron plate. Electrode stumps, about 8 inches high, were placed in carbon cement on the iron plate. This formed the positive electrode, while the negative one consisted of a carbon, 6½ inches square in section, suspended from above, by means of a water-cooled holder, through an opening in the furnace roof. On starting the arc, with the furnace cool, violent rushes of current took place, but this was remedied, and the arc prevented from extinguishing, by means of a spark coil, made to discharge between the electrodes. Several forms of interrupter having been tried unsuccessfully, the electrolytic interrupter shown in Fig. 1 was found to give the best results. A porcelain insulator was suspended in a double-walled vessel of lead, cooled by running water. A lead spiral formed the positive electrode, and the active liquid was sulphuric acid of about 1·14 sp. gr. The boring in the insulator was found to be critical for good working, the correct shape being that shown in Fig. 2. The hole should be well polished and preferably glazed. The insulator had to be replaced about every three months owing to the gradual widening of the hole by the action of the current. The period of interruption was adjusted to give the best effect by means of a variable inductance in the primary circuit, and large glass condensers were used in the secondary circuit to produce the oscillations necessary. With this device, it was found quite possible to keep the coil going day and night for many months, only stopping to change acid.—T. St.

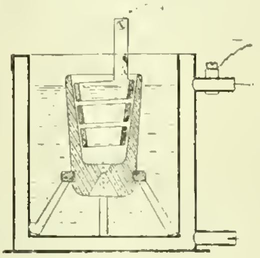


Fig. 1.

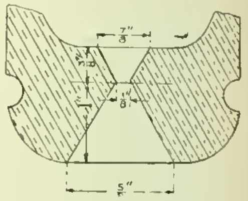


Fig. 2.

Formation of hydrogen peroxide, nitric acid, and ammonia by the electric discharge with water as one electrode. Makowetzky. *See* VII.

Exact electrolytic method for determining metals. Perdue and Hulett. *See* XXIII.

Patents.

Furnaces; Electric ——. J. Thomson, New York. Eng. Pat. 15,167, June 23, 1910. Under Int. Conv., Sept. 1, 1909.

A number of elements, supported at the ends, form a resister, which is partially or wholly immersed in the bath, and is provided with a tubular casing to prevent the material of the bath from coming into contact with the resister elements. The casing is provided with open ends, through which the terminals of the resister extend, and the ends are sealed in the walls of the furnace by suitable packing.

The terminals are also mounted in the walls, and both terminals and resister pass through the casing without making contact with it, thus leaving the resister surrounded by an inert gas.—B. N.

Carbon electrode for electric furnaces. Planiawerke A.-Ges. für Kohlenfabrikation. Fr. Pat. 421,357, Oct. 12, 1910.

To increase the conductivity of the carbon electrode, it is provided with metallic garnishings, in the form of strips, which are consumed uniformly with the electrode itself. Metals are employed which volatilise at a temperature lower than that of the furnace, or which oxidise or combine with the furnace gases, thus escaping in the form of gas or remaining in the furnace as a powder. Suitable metals or alloys may be employed, so that determined quantities of these may be introduced during the operation into the material in the furnace. Various forms of garnishings are described, such as a bar of metal, a split tube, or a rod with a cross-section in the form of a star, lodged in a longitudinal cavity in the carbon electrode, or the metal may be in the form of wires in internal grooves, or metallic pieces lodged in external grooves, or in the form of a metallic screw passing through a similar cavity in the electrode.—B. N.

Resistance; New electric —— with base of boron and carbon. Comp. Française pour L'Exploitation des Procédés Thomson-Houston. (1) Fr. Pat. 421,392, Oct. 13, 1910. (2) First Addition, and (3) Second Addition, dated Oct. 26, 1910 thereto.

(1) The principal patent relates to the manufacture of electric resistance elements composed of boron mixed with a little carbon, so as to form resistances which are variable with change of temperature. (2) Electric conductors are manufactured from carbon containing a small quantity of boron, and have a positive coefficient of temperature. (3) This addition is concerned with the use of boron for electric pyrometers.—B. N.

Refractory electric resistance for the heating of electric furnaces. M. Sauvageon. Fr. Pat. 421,495, Dec. 22, 1909.

The furnace is heated by a resistance composed of a mixture of artificial or natural purified graphite and refractory clay or kaolin. The material is purified, prepared and baked in the same manner as other refractory products, and moulded into suitable forms. The material may be heated to any temperature, resists the action of air and heat, and is not acted upon by the material in the bath. It may be employed for the roofs, bottoms and walls of electric furnaces of various types, and for use as a resistance material for heating the furnace.—B. N.

Furnace; Electric resistance ——. L. Friderich, J. and H. Terrisse. Fr. Pat. 421,706, Oct. 21, 1910. Under Int. Conv., Oct. 26, 1909.

The electric resistance of the furnace body, which is independent of the mass to be treated, is very feeble, and the tension of the current is maintained as low as possible, preferably under 10 volts.—B. N.

Accumulator containing chromium and mercury; Alkaline ——. W. Morrison. Fr. Pat. 421,870, Oct. 27, 1910. Under Int. Conv., Nov. 22, 1909.

See U.S. Pat. 976,277 of 1910; this J., 1910, 1461. The positive electrode contains mercuric oxide.—T. F. B.

Electrolytes; Circulation of —— and vacuum apparatus to effect it. C. Gabrielli. Fr. Pat. 421,559, Oct. 18, 1910. Under Int. Conv., Oct. 21, 1909.

See Ger. Pat. 224,907 of 1909; this J., 1911, 94.—T. F. B.

Manufacture of boron and use of boron in a thermo-electric couple. Additions to Fr. Pat. 377,683. *See* VII.

Obtaining slightly soluble salts of heavy metals by electrolysis. Ger. Pat. 230,826. *See* VII.

Electric resistance fusion furnace for the preparation of melted bodies in the the form of quartz collars or tubes. Fr. Pat. 421,631. *See* VIII.

XII.—FATS; OILS; WAXES.

[Hydrolysis and synthesis of fats.] Enzyme action; Reversibility of ——. A. Welter. Z. angew. Chem., 1911, **24**, 385—387.

Since Croft Hill in 1898 showed that the same enzyme which hydrolysed maltose by production of dextrose, could also reproduce maltose from a strong solution of dextrose, many instances have been recorded of enzymes effecting a reversible reaction. The author has observed this in the case of the enzyme contained in many seeds, particularly in castor-oil seeds. When this ferment is added in the proportion of 6 or 7 parts to 100 parts of oil or fat and 35 to 40 parts of water, it effects in one or two days hydrolysis of about 90 per cent. of the fat, and during the following few days the hydrolysis proceeds much more slowly, finally reaching a state of equilibrium. If in place of 35 to 40, only 20—25 parts of water be present, the hydrolysis proceeds much more slowly, and equilibrium is reached when about 80 per cent. of the fat has been hydrolysed. This dependence of the reaction upon the proportion of water present gave rise to the thought that the enzyme might react upon anhydrous glycerol and fatty acid in the reverse direction, and effect a synthesis of fat or oil. This was found to be the case: when 100 parts of fatty acid were mixed with 20 parts of pure glycerol and 10 parts of castor-oil enzyme added, in 2 days the acid value was reduced so as to indicate the conversion into fat of a considerable percentage of the fatty acids—palm kernel 35, cocoanut 21, maize 22, arachis 19, castor 14, pure olein 26, cottonseed 7 per cent. No reaction occurred if the glycerol was omitted, so that the diminution of the acid value was not due to formation of anhydride by the enzyme; and no reaction occurred if the mixture of fatty acid and glycerol were heated to 60—80° C. before stirring in the enzyme, so as to destroy the activity of the enzyme. The experiments with arachis and palm kernel acids were repeated on a larger scale and the resulting fats isolated: in one case a sample of arachis oil, in the other a colourless fat was obtained, both practically neutral, and each yielding on saponification the calculated quantity of a substance identified as glycerol. The dependence of the position of equilibrium upon the amount of water present is technically important, for when the castor oil enzyme is used industrially for the hydrolysis of fats, it will be clearly advantageous to increase the yield of glycerol by the addition of water till the point is reached at which the advantage of the increased yield is balanced by the greater dilution.—J. T. D.

Insoluble fatty acids; Purification of ——. E. B. Holland. J. Ind. Eng. Chem., 1911, 3, 171—173.

Distillation of the insoluble fatty acids themselves under reduced pressure in an atmosphere of an inert gas cannot be advocated as a generally applicable method of separation, since overlapping of the fractions is inevitable and any unsaturated fatty acid originally present will probably appear in every fraction. Crystallisation from anhydrous neutral alcohol, though useful for the removal of unsaturated acids and small amounts of impurities, must be regarded as a supplementary process. In dissolving the fatty acids it is essential that the heating should not be continued too long, since otherwise esters will be produced. Thus when alcoholic solutions of various fatty acids were boiled for a few minutes the following decreases in their neutralisation values were observed:—Stearic acid, 1·70; palmitic acid, 0·56; myristic acid, 2·24; lauric acid, 0·89; and oleic acid, 0·28. This change is cumulative and may readily exceed these figures. It is suggested that a more stable solvent such as acetone might prove suitable for this purpose. Distillation of the ethyl esters *in vacuo* is more generally applicable than distillation of the acids. The esters are most readily prepared by heating together in an open flask 100 grms. each of the fatty acids and alcohol with 10 c.c. of concentrated hydrochloric acid for about 30 minutes, after which the excess of acid is separated in a separating funnel. At least one redistillation of similar fractions is required. For the quantitative separation of the fatty acids from the esters, the best means were found to be saponification by heating the esters over a naked flame with twice their volume of glycerin and an excess of potassium hydroxide, and treatment of the solution of the resulting soap with a slight excess of sulphuric acid.—C. A. M.

Soap solutions; Electrical conductivity of ——. J. W. McBain and M. Taylor. Z. physik. Chem., 1911, **76**, 179—209.

THE authors consider that attempts to determine the nature of soaps by the boiling point or vapour-pressure methods are rendered ineffective by the presence in the soap of enclosed or absorbed air. They have confirmed their preliminary experiments on the electrical conductivity of solutions of sodium palmitate and of solutions of palmitic acid in caustic soda of various strengths (this J., 1910, 288), and as a result of these conclude that the normal soap, even in solutions up to 56 per cent. strength, does not exist as a simple colloid, but that in such solutions there is a mixture of colloidal acid sodium palmitate and caustic soda. They have further noted that the addition of caustic soda to a solution of sodium palmitate causes the separation of all but traces of the soap and that the alkalinity of the mother liquor is raised. The separated soap consists of acid sodium palmitate, the normal palmitate and absorbed sodium hydroxide in proportions which vary with the strength of the caustic soda solution used. —J. A.

Soap solutions; Density of ——. E. C. V. Cornish. Z. physik. Chem., 1911, **76**, 210—211.

THE author has determined the densities, at 90°/4° C., of solutions of sodium palmitate and stearate, together with those of sodium hydroxide and sodium acetate solutions. The soap solutions are lighter than water. The results obtained were as follows, the numbers being, in most cases, accurate to three decimal places:—Water, 0·9653; 2N sodium hydroxide, 1·0437; N/1 sodium acetate, 1·0020; sodium palmitate: N/1, 0·9625; 0·5N, 0·9638; 0·35N, 0·9624; 0·2N, 0·9658; 0·1N, 0·9654; 0·05N, 0·9655; 0·01N, 0·9655; sodium stearate: 0·5N, 0·9599; 0·2N, 0·9631; 0·1N, 0·9629; 0·05N, 0·9621; 0·01N, 0·9639; sodium palmitate with an equivalent excess of sodium hydroxide: N/1 Na, 0·9796; 0·1N Na, 0·9654; 0·02N Na. 0·9646; sodium palmitate with three equivalents excess of sodium hydroxide: 0·8N Na, 0·9883; 0·4N Na, 0·97935; 0·2N Na, 0·9698.—A. S.

Cottonseed products in the United States. Oil, Paint, and Drug Rep., March 6, 1911. [T.R.]

THE following table gives the general results of the 1909 census of cottonseed crushing establishments, the figures for 1904 and 1899 being added for comparison:—

Item.	Census.		
	1909.	1904.	1899.
Number of active establishments	809	717	357
Seed crushed:—			
Quantity, tons	3,827,300	3,345,400	2,479,400
Cost	$78,112,000	$51,879,000	$28,633,000
Average cost per ton	$20.41	$15.51	$11.55
Average crush per establishment, tons	4,731	4,666	6,945
Crude products:—			
Total value	$107,538,000	$69,311,000	$42,412,000
Average value per establishment	$133,000	$97,000	$119,000
Oil—			
Quantity, gallons	158,328,500	133,817,800	93,325,700
Value	$55,328,000	$31,342,000	$21,391,000
Average value per gallon	$0.35	$0.23	$0.23
Meal and cake—			
Quantity, tons	1,674,500	1,360,000	884,400
Value	$40,493,000	$27,767,000	$16,031,000
Average value per ton	$24.18	$20.42	$18.13
Hulls—			
Quantity, tons	1,269,200	1,213,000	1,169,200
Value	$7,711,000	$5,589,000	$3,189,000
Average value per ton	$6.08	$4.61	$2.73
Linters—			
Quantity, pounds	175,512,100	117,793,000	57,272,000
Value	$4,006,000	$4,613,000	$1,801,000
Average value per pound	$0.023	$0.039	$0.031

While the increase in the quantity of seed crushed was 54 per cent., the production of oil increased 70 per cent., indicating the employment of better methods and greater economy in the use of machinery. The increase in the quantity of cake and meal is shown to have been 89 per cent., which is probably accounted for in part by the establishment during the decade of a number of mills operated under the "cold process" system, by which the hulls and meats are pressed together and disposed of as cake and meal. Another factor in this percentage is the recent practice by many establishments of mixing varying quantities of hulls with the cake in grinding, especially when the product is designed for sale as a feedstuff. These conditions also account for the very slight percentage of increase in the production of hulls. An interesting feature brought out by the statistics is the increase in the quantity of linters saved from re-ginning the seed for oil extraction. The linter fibre is in commercial demand among certain manufacturers who used the better grades of cotton before the present era of high prices in that staple. A double economy is thus effected by the greater production of linters and by the larger percentage of oil saved when the seed has been closely re-ginned.

During the decade the real advance of the cottonseed products industry has possibly been attributable more to the development in the refining processes than to any other cause. With the improvements in refining methods in recent years new uses for cottonseed oil have been developed, among the most important of which is the manufacture of lard compound, which is a most palatable and economical food. So large a percentage of the home consumption of cottonseed oil is used in the lard compound that the value of the oil varies with the supply of lard; hence cottonseed oil has greatly profited by the increase in the value of the hog products during the last few years.

The exports of cottonseed oil, cake, and meal during 1899 and 1909 were as follows :—

	1899.		1909.	
	Quantity.	Value.	Quantity.	Value.
Oil ....gallons	49,969,420	$12,467,135	45,514,435	$19,567,067
Cake and meal ....tons	571,852	$11,229,188	407,212	$10,660,760

In the order of their importance, the largest importing countries of American oil are :—The Netherlands, Italy, Mexico, United Kingdom, France and Germany. The principal countries which take cake and meal are Germany and Denmark, where it is used chiefly as a stock food by dairymen. While a large percentage of the meal retained in the United States is used either directly as a fertiliser or as an ammonia base in the manufacture of commercial fertilisers, its use as a foodstuff is rapidly increasing, and its employment for this and other superior purposes with the resultant increase in value must tend to reduce its immediate use for fertilising.

Determining acid value of oils and fats, especially mineral lubricating oils. Loebell. *See* IIa.

Replacement of metals in non-aqueous liquids and solubility of metals in oleic acid. Gates. *See* X.

Patents.

Suint [wool-grease] ; Process for extracting alcohols from——. S. Morgenstern. Fr. Pat. 421,044, Oct. 3, 1910.

The crude alcohols obtained by any suitable process from wool-grease (saponification with lime or an alkali, etc.) and containing not more than 15 per cent. of neutral fatty matter (usually something between " 10 and 15 per cent."), are submitted to distillation under reduced pressure, a small volume of superheated steam being admitted to the still to aid in the distillation of the alcohols. The distilled alcohols are stated to be practically pure.—W. P. S.

Fatty acids of marine animal oils [" Tranfettsäuren "] ; Process for deodourising the ——. E. Böhm. Ger. Pat. 230,123, May 18, 1909.

The fatty acids, after purification in the usual manner, and before the distillation process, are heated at a temperature a few degrees below that at which they distil and are subjected to the simultaneous action of a powerful vacuum and a strong current of an inert gas, until the vapours evolved are free from lower fatty acids and ill-smelling substances. The loss amounts only to about 1·5 per cent.
—A. S.

Ozone ; Composition yielding——. A. H. Twombly, Summit N.J., Assignor to Gerard Ozone Process Co., New York. U.S. Pat. 984,722, Feb. 21, 1911.

The composition consists of a solid excipient, viz., cocoanut oil, impregnated with ozone, which is given up when the oil is melted by the heat of the body.—E. W. L.

Crude oil [petroleum] soap, or soap lye ; Process of manufacturing —— for application as a detergent and for street sprinkling. O. Cassel, Vienna. Eng. Pat. 14,844, June 20, 1910. Under Int. Conv., Aug. 21, 1909.

The addition of montan wax to the materials employed in the manufacture of soap renders the soap capable of taking up large quantities of crude oil [petroleum]. For example 15 to 25 parts of colophony are dissolved in a solution of 10 parts of caustic soda in 100 parts of water, and 10 parts of montan wax are added. After boiling again for from ¾ to 1½ hours, and so dissolving the montan wax, 100 parts of crude oil are added, the mixture is boiled again and 10 parts of stearine are added. The montan wax causes an exceedingly fine division of the crude oil to take place, one result of which is that the product can be largely diluted with water for sprinkling purposes.
—E. W. L.

Soap ; Process of manufacturing —— by utilising alkali solutions which have been used for washing vegetable substances. Soc. Commerciale des Crins. Fr. Pat. 421,382, Dec. 20, 1909.

Alkali solutions which have been employed in washing vegetable substances such as cocoanut fibre, are filtered and then used for saponifying fats and oils in the manufacture of soaps.—W. P. S.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Turpentine and rosin in the United States. Oil, Paint, and Drug Rep., March 13, 1911. [T.R.]

The subjoined table shows the statistics of the production of turpentine and rosin in the United States, as collected by the Census Bureau in 1904 and 1909 :—

	Census.		Per cent. increase, 1904 to 1909.
	1909.	1904.	
Number of establishments	1,585	1,287	23
Capital	$12,375,000	$6,961,000	78
Cost of materials used ..	$4,911,000	$3,775,000	30
Salaries and wages	$11,019,000	$9,535,000	16
Miscellaneous expenses ..	$3,103,000	$1,639,000	89
Value of products	$25,295,000	$23,937,000	6
Value added by manufacture (products less cost of materials)	$20,384,000	$20,162,000	
Products :—			
Spirits of turpentine—			
Gallons	28,941,000	30,687,000	*6
Value	$12,654,000	$15,170,000	*17
Rosin—			
Barrels (280 pounds)	3,258,000	3,508,000	*7
Value	$12,577,000	$8,726,000	44
All other, value	$64.000	$41,000	56

* Decrease.

While the quantities of spirits of turpentine and rosin decreased between 1904 and 1909, as did the value of turpentine, yet the combined value of these products has increased from $23,896,000 to $25,231,000, or 6 per cent. This decrease in quantity is probably due to the depletion of the forests in older localities, and to unsatisfactory prices for the product in 1908. Two disastrous storms, one in 1906 and another in 1909, visited a large area of the turpentine section, working especial havoc in Mississippi and Louisiana, where a vast amount of the timber being worked was blown down and many turpentine establishments were compelled to cease operations. The only redeeming feature for the industry shown by this five-year comparison is the increase of 44 per cent. in the value of rosin.

The exports of turpentine and rosin (mainly to Europe) during the years ending June 30. 1910 and 1905. were as follows :—

	Turpentine.		Rosin.	
	gallons.	value.	gallons.	value.
1910....	15,618,581	$8,797,531	2,145,225	$9,758,121
1905....	15,927,948	8,922,354	2,311,346	7,073,588

Patents.

Volatile products [turpentine] from wood ; Process of extracting ——. F. A. Kummer. New York. U.S. Pat. 984.818. Feb. 21, 1911.

Turpentine and other products are obtained from resinous woods by immersing the wood in a bath of rosin oil. and heating to a temperature higher than that at which turpentine boils but lower than that at which rosin oil boils. The volatile products are condensed and collected in the usual manner.—H. H.

Pigment composed of barium sulphate in a very fine state of subdivision, and process for making it. A. Moffatt. Fr. Pat. 421,015, Oct. 1, 1910.

See U.S. Pats. 973,373 and 973,374, and Eng. Pat. 22,033 of 1910 ; this J., 1910, 1321, and 1911, 294.—T. F. B.

Obtaining slightly soluble salts of heavy metals [pigments] by electrolysis. Ger. Pat. 230,826. *See* VII.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Kickxia rubber. I. Researches on Kickxia latex and serum. Frank and Gnaedinger. Gummi-Zeit., 1911, 25, 840—841.

The authors found the sp. gr. of the latex to be 0·979—0·988 at 25° C. The content in rubber, including resin, was from 40—45 per cent. Calculated on the dry rubber the protein was 2·5 per cent. (mean of 32 determinations) ; the ash was from 0·2 to 1·8 per cent. except in one case (37 estimations) ; the resin was 9 per cent.(never less than 7 and rarely above 10). In the W. African sorts the resins were chiefly balsamic, while harder resins preponderated in the E. African sorts. The serum contained dextrorotatory proteins, probably glycoproteins. When fractionally precipitated by alcohol the protein contained very little nitrogen. The presence of cinnamic acid was proved, and that of rhamnose and phlobaphene indicated.—H. E. P.

Kickxia rubber. II. Comparative chemical-technical experiments. F. Frank and E. Marckwald. Gummi-Zeit., 1911, 25, 877—881.

It is suggested that the protective bodies hindering coagulation, which can be removed by dialysis, may be glucosidic glyco-proteins or glycopeptones (see preceding abstract). 37 samples of rubber of different origins, coagulated in various ways, were examined for loss on washing, resin content, protein and ash ; viscosity measurements were also made. The washed rubber was then mixed with 10 per cent. of sulphur, calendered to 5 mm. (0·2 inch) and cured in the press for 1 hour at 4 atmos. Total sulphur, free sulphur and resin content were estimated in the vulcanised samples, which were also tested on a Schopper dynamometer. Full details are given of all these results. The apparent change in resin-content after vulcanisation varied from −6·1 to +5·15 per cent. The rubbers were classified according to the mechanical tests, and the following conclusions were drawn :—Rubber can be obtained from Kickxia latex on German plantations which is comparable completely with first-class Para and Congo sorts. The method of coagulation, rather than the place of origin, appears to decide the quality. The latex, best not too fresh, is coagulated rapidly. The rubber should be heated as little as possible later. A high protein content does not appear essential for good quality : the four best samples were variable in this respect. These were coagulated in Berlin, and yielded figures on the dynamometer very similar to those of 1a Para and Upper Congo similarly cured [(1) latex mixed with Purub or sulphuric acid and poured slowly into boiling water, then washed with cold water and pressed (Marckwald-Frank method) ; (2) coagulation by tannin and acetic acid, followed by drying in smoke ; and (3) a purely physical method]. The two next best samples were coagulated by pouring on a wood plate (Strauss' method) which is probably a process of dialysis.—H. E. P.

Rubber resins. P. Zilchert. Gummi-Zeit., 1911, 25, 716—717.

Various raw rubbers were extracted with acetone in a Rademacher extractor, with frequent change of the flask, till 2 hours further extraction only removed 0·01 per cent. The maximum time required was 32 hours. Of the 17 samples examined, 10 were completely extracted after 22 hours. The author suggests that 10 hours is sufficient for most technical purposes, with vigorous action of the extractor. The minimum amount removed in this time was 92·3 per cent. of the total resin present.—H. E. P.

Raw rubber ; Examination of ——. G. Fendler. Gummi-Zeit., 1910, 25, 311—316, 351—357.

Replying to the criticisms of Korneck (this J., 1910, 1321—1322) the author deals in turn with the nitrosite method, the tetrabromide methods, and the direct precipitation methods. (1) In the case of the nitrosite method, he shows that the nitrosites of the rubber resins are certainly not in all cases removed from the rubber nitrosite by washing the crude nitrosite either with benzene followed by anhydrous ether, or with petroleum ether. On the other hand the author advocated previous extraction of the resins from the crude rubber by means of acetone ; it is shown that the errors arising from imperfect extraction can only have been small, and cannot account for the very high values for rubber obtained in some cases. The error due to the possible weighing in of nitrosite compounds of protein can also only have been of the order 0·09 per cent. to 0·60 per cent. Whether these compounds are really soluble in benzene and anhydrous ether is a point still unconfirmed. (2) In the case of the tetrabromide methods, he concludes that there are no sufficient grounds for replacing Fendler and Kuhn's gravimetric method by Budde's volumetric method, more particularly as Korneck claims to have discovered sources of error in the latter. The necessity for removing resins from the rubber before bromination is demonstrated by Korneck's discovery that certain rubber resins yield bromides which are insoluble in the alcohol-carbon tetrachloride mixture. It is possible, in all the cases examined, to obtain sufficiently clear solutions of rubber in toluene, by filtration, after three hours' heating, through filter-paper. (3) With reference to the precipitation methods the author points out that he has already given up his own method on account, first, of the difficulty of getting complete solution of the rubber at ordinary temperatures, and secondly, of the fact that complete precipitation by means of alcohol is in some cases very difficult to achieve, whilst moreover, a certain amount of resin is carried down with the rubber and weighed with it. Spence's method of extraction with acetone, followed by solution in benzene, filtration through glass-wool, and evaporation of the filtrate to dryness, while not open to the latter objection, is still rendered uncertain by the difficulty, in certain cases, of complete solution.—E. W. L.

Caoutchouc ; Determination of —— *as tetrabromide.* D. Spence, J. C. Galletly, and J. H. Scott. Gummi-Zeit., 1911, 25, 801—803.

The authors find that there is a considerable loss of bromine in the tetrabromide method, during the decompositions of the bromide by nitric acid in presence of silver nitrate. For instance, with a sample of bromide of vulcanised rubber, prepared by Huebener's method, the bromine content, as determined by Carius' method, was

74·76 per cent., when care was taken to avoid contact of the bromide with the nitric acid before the tube was sealed. When the bromide and the acid were allowed to come into contact before sealing, the result obtained was 73·84 per cent. and when, in addition, the tube was heated in a steam bath for a short time before sealing, the amount of bromine found was reduced to 52·73 per cent.; when acid diluted with its own volume of water was employed, and bromide and acid were allowed to come in contact, without heating, before sealing the tube, higher results were obtained, viz., 74·41 and 74·51 per cent. in two experiments. A determination carried out according to Budde's method gave 63·30 and 62·30 per cent. of bromine, whilst in another pair of experiments—(*a*) being gently (*b*) strongly heated—the results were 61·7 and 59·6 per cent. respectively. With a higher concentration of nitric acid the percentage shown was still further reduced to 57·45 and 57·00 per cent.

In a second series of experiments the bromide prepared by Budde's method from highly purified, protein-free rubber of *Landolphia owariensis* was used. This contained, by Carius' method, 68·76 per cent. of bromine. When decomposed with 50 c.c. of nitric acid in presence of 25 c.c. of $N/10$ silver nitrate solution, the bromine content was found to be 48·80 per cent., and when 15 c.c. of nitric acid (sp. gr. 1·5) and 40 c.c. of $N/10$ silver nitrate were employed, the percentage of bromine found rose to 67·25. It appears that the loss of bromine is greater the higher the concentration of nitric acid used. But even with relatively dilute acid there is still some loss. By conducting the decomposition in a distilling flask, hermetically sealed at the top and arranged with the side-tube dipping into sodium hydroxide solution, the presence of bromine in the latter could be shown. Thus, in three experiments, with varying strengths of acid, the amounts of bromine found in the sodium hydroxide solution were 2·59, 1·24 and 1·43 per cent.

The authors' observations indicate that the high loss of bromine is due to the presence of the filter paper, and of some alcohol during the decomposition with nitric acid. —E. W. L.

Patents.

India-rubber; Production of —— [from latex]. T. Cockerill, Colombo, Ceylon. Eng. Pat. 5854, Mar. 9, 1910.

In the apparatus described in Eng. Pat. 21,441 of 1908 (this J., 1909, 210), latex was coagulated by the passage of an electric current between a stationary cathode and a moving, belt-like anode. In the present instance a moving cathode is provided. Both anode and cathode take the form of endless belts, built up of metallic (aluminium) sections hinged together. The anode, which forms the trough in which the latex is carried, is built up of aluminium plates hinged together and provided with packing material at the joints so as to form a water-tight surface. Along the edges of these plates, between them and the sections of the cathode, run deckle straps which prevent the overflow of latex. Transverse distance-strips (of vulcanised rubber), which also act as dams to prevent the flow of the latex continuously through between the moving electrodes, are provided on the lower surface of the cathode sections. By means of these the cathode is kept at a uniform short distance from the anode. Means are provided for the removal of the serum, the washing and branding of the sheet of rubber, and the cleansing of the anode and cathode by scrubbing. It is found advantageous to allow a certain short interval of time to elapse between the emergence of the sheet of rubber from between the electrodes, and its compression between rollers, in order to permit of the disappearance of surface tackiness. The cathode may be provided with projections to ensure the passage of the current should the level of the liquid fall too low for proper contact with the surface of the cathode plates.—E. W. L.

Caoutchouc-like substance or mass; Manufacture of a ——. W. Plinatus, Berlin. Eng. Pat. 4080, Feb. 18, 1910.

The mass consists of a gelatin-glycerin mixture hardened by means of both formaldehyde and tannin. A warm or hot solution of gelatin, to which glycerin has been added, is treated, first with small quantities of a tannin solution, and then with a small quantity of an aldehyde—*e.g.*, formaldehyde, and allowed to set in either an open or an air-tight vessel. When greater hardness or plasticity with less tensile elasticity is required, it is desirable to have an excess of tannin present, and it is then necessary to add formaldehyde to the glycerin-gelatin mass before the addition of tannin, otherwise the mass sets too rapidly to permit of the desired further treatment. By allowing the mass to set in a chamber from which air is entirely excluded, the evaporation of water is prevented, and the degree of insolubility is increased. The effect is greater if the mass be introduced into the chamber under pressure; the solidity and elasticity of the mass are also increased by this treatment. In addition to animal gelatin, vegetable gelatin such as agar-agar may be used; in addition to glycerin various other substances may be added to modify the properties of the mass, such as molasses, syrups, albuminoids, casein, albumin, colouring matters, weak organic acids, metallic salts, oxides or hydroxides, resins, starch, gum arabic, oils, fats, etc. An addition of castor oil and dextrin is specially suitable.—E. W. L.

India-rubber; Artificial ——. [*Rubber substitute.*] J. B. Scammell, London. Eng. Pat. 9636, Apr. 20, 1910.

Cotton, or other suitable form of cellulose is soaked in butyric acid, then removed and dried. It is then introduced into cottonseed oil (or other animal or vegetable oil) in which from 1 to 5 per cent. of gum elemi has been dissolved by gentle heating, the proportion of cotton being, say, 1 to 5 per cent. A quantity of sulphur chloride equal to about 20 per cent. of the weight of oil is dissolved in a suitable solvent such as paraffin oil, and a portion (say one-third) of it is added to the cotton and oil mixture. In the course of from, say, 8 to 12 hours the cotton dissolves. Some oxide or carbonate of calcium or magnesium is added to neutralise any acid formed, and the remainder of the sulphur chloride solution is then added. In about an hour's time the mixture becomes a homogeneous solid, taking the form of the mould (core for golf balls, motor or cycle tyres) into which it has meanwhile been filled. In allowing the material to set it is advisable to spread it out in layers one or two inches thick to prevent overheating. In mixing the product with rubber the mass is first granulated or shredded, left exposed to the air for some days and then mixed in the ordinary way.—E. W. L.

Rubber-producing plants; Process for coagulating the latex of ——. W. Pahl. Fr. Pat. 421,650. Oct. 20, 1910. Under Int. Conv., Feb. 4, 1910.

See Eng. Pat. 26,173 of 1910; this J., 1911, 225.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Mangrove swamps of the Philippines; The economic possibilities of the ——. R. F. Bacon and V. Q. Gana. J. Amer. Leather Chem. Assoc., 1911, 6, 124—128.

The results of analyses of samples of mangrove barks collected from the Island of Mindoro and from the east coast of the Zamboanga Peninsula are given and it is suggested that a profitable industry could be developed in the production of extract at the sources of supply. The percentages of tannin in the barks from Zamboanga range from 9 to 27, with an average of about 23, whilst those from Mindoro, range from 10 to 28, with an average of about 20 per cent. of tannin. Samples of bark from Sarawak, Borneo, gave on analysis, percentages of tannin from 20 to 32.—J. R. B.

Chestnut oak bark extracts; Tests for the purity of ——. F. H. Small. J. Amer. Leather Chem. Assoc., 1911, 6, 107—112.

To determine if chestnut oak-bark extract contains as impurities, chestnut wood extract or extract from other barks than chestnut, the author uses several of the tests given by Procter. Because of the variation shown by different specimens of genuine chestnut oak bark it seems improbable that an exact determination of the amount of admixture can be made. The most satisfactory qualitative reagents were sulphuric acid, iron ammonium alum, ammonium acetate, and lime water. To estimate the probable extent of the impurities the formaldehyde-hydrochloric acid method of Stiasny (see this J., 1906, 275) was found most useful, when carried out in the following manner. A dilute solution of formaldehyde and hydrochloric acid is added to a dilute solution of the extract and heated on the steam bath, the precipitate is filtered off and its amount determined by evaporating the filtrate. From the precipitate-weights obtained with pure extracts and with the impurities, conclusions may be drawn as to the purity of a doubtful extract.—J. R. B.

Patents.

Tanning agents; Process for the production of —— from waste [*sulphite-pulp*] *liquors.* W. H. Dickerson, Muskegon, Mich., U.S.A. Eng. Pat. 7438, Mar. 24, 1910.

Weakly acid or neutral reagents are used to liberate sulphurous acid from waste sulphite liquors (from the wood-pulp process), and tannin from the tannin complexes contained therein, without producing secondary decomposition of the resulting or remaining organic constituents. For example, oxalic acid, in the proportion of about ½ to 1 per cent. by weight, is added to undecomposed waste liquor, preferably soon after its discharge from the digestor, and either in its untreated state, or after free sulphur dioxide and calcium sulphite have been removed by evacuation, or by a stream of an indifferent gas, and preferably without any considerable concentration of the liquor. If complete removal of calcium is desired, sufficient oxalic acid must be added for this purpose. After settlement the supernatant liquid is decanted off and immediately subjected to reduced pressure or to a stream of an indifferent gas to remove free sulphur dioxide, and this process may or may not be accompanied by concentration in a vacuum evaporator or otherwise. The liquors thus obtained may be used for leaching tannin-containing materials.—E. W. L.

Plastic substances [*from glue*]; *Manufacture of* ——. H. Linnekogel, Feuerbach-Stuttgart, Germany. Eng. Pat. 9190, Apr. 15, 1910.

Fibrous material such as refuse from paper and cellulose factories, wood pulp, waste fleece from cloth factories, etc., is boiled with a solution of glue until it becomes a consistent mass. A hygroscopic substance, for example glycerin, and a tanning or hardening substance—*e.g.*, tannin, are then added. An alkaline solution (in diluted ammonia or gas liquor) of resinous soap, resin, colophony, etc., is added, followed by the necessary oil. The whole mass is then worked up and heated.—E. W. L.

XVI.—SOILS; FERTILISERS.

Soils; Cholesterol bodies in ——: Phytosterol. O. Schreiner and E. C. Shorey. J. Biol. Chem., 1911, **9**, 9—11 (see this J., 1911, 227).

A sample of peaty soil containing 27 per cent. of organic carbon was treated with boiling 95 per cent. alcohol, the extract being filtered whilst hot. On cooling, a precipitate, containing lignoceric acid (this J., 1911, 40), separated; this was filtered off, the filtrate being evaporated and kept at constant volume by addition of water, until all the alcohol was removed. The reddish brown precipitate thus formed was filtered off, washed with water, dried, and extracted with boiling petroleum ether. On removing the solvent from the extract, a light-coloured oily mass, which became semi-solid on standing, was left. This residue was saponified with alcoholic potash, the alcohol was removed, and the soap dried and extracted with boiling petroleum ether. The residue left on removing the solvent from this extract was dissolved in a relatively large volume of hot alcohol. On cooling, hentriacontane (J. Amer. Chem. Soc., 1911, **33**, 81) separated; this was filtered off, and the alcohol allowed to evaporate. On dissolving the residue thus obtained, in a small quantity of chloroform, and leaving the solution to stand, crystals of phytosterol (m. pt. 135° C.) were formed after a few hours. The authors have not found it possible to obtain phytosterol from the soil under investigation by any method that does not involve hydrolysis, and conclude that phytosterol is present in the soil, not in the free state like agrosterol, but in combination, probably as an ester of a higher fatty acid. The wide distribution of phytosterol in plants, and the fact that when found in soil it is in combination, as in plants, make it probable that the phytosterol is a plant residue which remained unchanged in the soil examined.—L. E.

Superphosphate industry; General regulations for the trade in chemical manures of the ——. Rettich. Chem.-Zeit., 1911, **35**, 267.

The following are the essential regulations adopted by a Committee of the German Board of Agriculture and the Association of German Manure Manufacturers. Fertilisers may not contain substances injurious to plant life. The percentage of plant nutrient present must be stated on the invoice and each package properly labelled. The percentage of nitrogen present must agree with that stated within 0·25 per cent., that of phosphoric acid or potassium oxide within 0·5 per cent. The difference between the stated minimum and maximum content of superphosphate must not exceed 2 per cent. Mixed fertilisers are only to be sold according to the agreed percentage of nutrient materials. The buyer can refuse to accept delivery when the amount of water-soluble phosphate is more than 1 per cent. below the contracted proportion. Samples are taken from well inside every tenth sack, moist or damaged sacks being rejected. The samples are well mixed, lumps broken up and three portions of 250 grms. preserved in dry air-tight glass or earthenware vessels.—E. F. A.

Patents.

Potassium- or ammonium phosphate; Process for preparing primary —— for use as a fertiliser. C. Klingbiel. Ger. Pat. 229,913, Jan. 30, 1910.

Primary sodium phosphate is caused to interact with potassium chloride or ammonium chloride.—A. S.

Nitrate fertilisers; Process of manufacturing ——. E. Collett and M. Eckardt, Christiania. U.S. Pat. 987,781, March 7, 1911.

See Eng. Pat. 10,815 of 1910; this J., 1910, 1010.—T. F. B.

Fertiliser; Process for preparing a chemical ——. L. R. Coates. Fr. Pat. 421,049, Oct. 4, 1910.

See U.S. Pat. 971,830 of 1910; this J., 1910, 1262.—T.F.B.

Utilising spent filter-charcoal, and manufacturing filter-charcoal. Fr. Pat. 421,829. *See* I.

XVII.—SUGARS; STARCHES; GUMS.

Bagasse drying; Experiments on ——. E. W. Kerr. Modern Sugar Planter, 1911, **41**, 13.

The problem of utilising the heat passing up the factory chimney for drying the bagasse used for the furnaces, and of thus obtaining a greater fuel value, has recently been studied by the author with special reference to the conditions of sugar manufacture in Louisiana. The dryer was designed for use with a 100 H.P. boiler. In the main, it consisted of a rectangular sheet-iron box, about 4 ft. × 6 ft. × 20 ft. high, with six shelves, each about 4 ft. square, placed at equal distances from top to bottom on the inside. These shelves were inclined so as to cause the bagasse, which was delivered first to the top shelf, to slide and then fall to the next below it, and so on from each shelf to the one below it until the bottom was reached; the shelves were also given a slight shaking motion. The bagasse was delivered to the dryer at the top, and removed at the bottom through mechanically-operated, double counterpoised doors, in order to prevent entrance of air. The necessary draught was induced by a 50 in. fan placed near the top of the dryer, and this fan not only drew the gases through the dryer itself, but also produced the draught for operating the boiler furnaces. The average time required for the material to pass through the apparatus was slightly less than one minute. According to the average figures given, the decrease in the moisture content of the bagasse was about 10 per cent. (54 to 44 per cent.), *i.e.*, an evaporation of about 18 per cent. of the original moisture of the wet bagasse. The average temperature of the flue gases entering the dryer was about 253° C., and of those leaving about 112° C. In the case of the undried bagasse, the evaporation tests showed an average of about 1·74 lb. of water from and at 100° C. per lb. of the wet material with 54 per cent. of moisture. With the fuel dried in the manner described above, an evaporation of 2·54 lb. of water from and at 100° C. per lb. of the dried material, with a moisture content of 44 per cent. was found. With the average initial and final moisture values stated above, the relative weights of dried and undried bagasse is approximately in the ratio of 82 : 100, so that the percentage increase of fuel value due to drying is:

$$\frac{100\ (82\times 2{\cdot}54 - 100\times 1{\cdot}74)}{100\times 1{\cdot}74} = 19{\cdot}1 \text{ per cent.}$$

Reducing sugars; Method for the determination of ——. S. R. Benedict. J. Biol. Chem., 1911, **9**, 57—59.

For the determination of reducing sugars, the reagent, previously proposed for their detection (this J., 1909, 385) is modified in the following way:—Two hundred grms. of sodium citrate, 100 grms. of anhydrous sodium carbonate, and 125 grms. of potassium thiocyanate are heated with enough water to produce about 800 c.c. of solution, the latter then being filtered. To this solution is added, slowly and with constant stirring, a solution of 18·0 grms. of crystallised copper sulphate in about 100 c.c. of water; the whole is treated with 5 c.c. of a 5 per cent. solution of potassium ferrocyanide, cooled, and made up to 1000 c.c.—Twenty-five c.c. of this reagent (equivalent to 0·050 grm. of dextrose or 0·053 grm. of lævulose) are measured into a porcelain dish (25—30 cm. diam.), treated with 5—10 grms. of anhydrous sodium carbonate (in order to insure a sharp end-point) and a very small quantity of powdered pumice. The mixture is heated to vigorous boiling over a direct flame, the sugar solution being then run in quite rapidly until a heavy white precipitate is produced and the blue colour of the solution begins to diminish perceptibly. The sugar solution is then run in more and more slowly (in portions of 1—2 drops towards the end, with an interval of about 30 seconds after each addition), until the disappearance of the last trace of blue colour. The solution must be kept vigorously boiling throughout the titration, and, if it becomes too concentrated, distilled water may be added.—The reagent appears to keep indefinitely, without any special precautions such as exclusion of light, etc. The object of adding the trace of ferrocyanide is to prevent precipitation of red cuprous oxide which may be caused by certain impurities; chloroform has such a marked tendency in this respect that it must not be present during the titration. The method gives very satisfactory results and is probably preferable to any other method of titration at present available for sugars.—L. E.

Honey; Biological study of —— [*presence of enzymes*]. E. Moreau. Ann. Falsif., 1911, **4**, 65—66.

The author has examined various samples of French honey with the object of detecting the presence or absence of different enzymes. The results obtained agree with those found by Auzinger (this J., 1910, 291). The specimens of honey contained catalase, amylase, and invertase, but not anaeroxydases or aeroxydases.—W. P. S.

Starch paste; Formation of crystallised polysaccharides (dextrins) from —— *by microbes.* F. Schardinger. Zentr. Bakt. u. Parasitenk. 1911, II. Abt., **29**, 188—197. Chem. Zentr., 1911, **1**, 874—875. (See this J., 1909, 153).

Specific microbes act on starch paste with the production of soluble substances similar to dextrins. The action of the same organism (*Bac. macerans*), under the same conditions, differs according to the kind of starch used; potato starch is completely dissolved, and arrowroot starch to a large extent, but rice and wheat starches only to a relatively small extent. The dextrins formed are partly crystalline, partly amorphous and gummy; the amount of crystallised product (crude) is 25—30 per cent. in the case of potato and maranta (arrowroot) starches. Two crystallised dextrins (α and β) have been obtained from potato, maranta, rice, and wheat starches, the α-dextrin being produced in larger quantity. These products can be precipitated from aqueous solution by alcohol, ether, chloroform or iodine solution. They do not reduce Fehling's solution and are not fermented by yeast. The chief point of difference between them is their reaction with iodine: the iodine compound of the α-dextrin, in a thin layer, is blue when moist and greyish-green when dry, whilst the iodine compound of the β-dextrin has a brownish colour both when moist and after drying.—A. S.

Patents.

Mucilage. C. V. Greenwood, Liverpool. Eng. Pat. 5018, Feb. 28, 1910.

When solutions of gummy vegetable products, *e.g.*, gum tragasol, are treated with tannin solutions, a mucilaginous precipitate is formed, which is insoluble in cold water but soluble in hot.—J. H. L.

Manufacture of heating gas [*from sugar cane*]. Eng. Pat. 4482. *See* IIa.

XVIII.—FERMENTATION INDUSTRIES.

Invertase; Composition of ——. A. P. Mathews and T. H. Glenn. J. Biol. Chem., 1911, **9**, 29—56.

The authors have investigated the invertase obtained from yeast by O'Sullivan and Tompson's method of autolysis and precipitation with alcohol. It was found that on repeated precipitation with alcohol, the nitrogen-content of the precipitate decreases, and that the activity of the precipitate increases at first and subsequently decreases. The most active preparation thus obtained contained about 2 per cent. of ash, and 2·2 per cent. of nitrogen, and, in optimum acidity, had an activity of K = 0·057 at 24° C., the invertase-concentration being expressed in grms. per 100 c.c. Preparations containing less than 1 per cent. of nitrogen were almost inactive. The invertase was found to consist of a gum (a mannosan) and a nitrogenous portion, and on hydrolysis it yielded 70—76 per cent. of its weight of reducing sugar (chiefly mannose). All the active preparations of invertase gave the xanthoprotein and Millon's reactions faintly, and the biuret reaction very faintly, the last only being perceptible when carried out at the ordinary temperature and allowed to continue for 24—72 hours. A preparation containing 1·55 per cent. of nitrogen was found to contain about 0·38 per cent. of tyrosine or phenylalanine; if the nitrogen is present in the form of a protein, the latter would contain about 3·5 per cent. of tyrosine. It would appear that ordinary preparations of invertase consist of a union of an inactive colloidal gum (a mannosan), which the authors call the "carrier," with an active protein ferment; the active principle may be an albumose or a coagulable albumin. This union is inert, but by the action of acid the ferment is freed from its carrier and becomes capable of uniting with, and decomposing, an appropriate substratum. Diastase would appear to be a union of an albumose enzyme with a pentose gum (*cf.* Wroblewski, Ber., 1897, **30**, 2289, also this J., 1897, 1031.) The carriers appear to be usually of the same chemical nature as the substratum of each ferment, and to be colloids. In examining their preparations of invertase, the authors have not been able to account for 10—15 per cent. of the weight; until this is done, and a closer parallelism between nitrogen-content and activity is found, the conclusion that the enzyme is a protein must be tentative. (Compare O'Sullivan and Tompson, this J., 1890, 1049; Salkowski, this J., 1901, 489).—L. E.

Invertase; Temperature-coefficient of the destruction of ——. H. Euler and S. Kullberg. Svenska Vet. Akad. Arkiv f. Kemi, 1911, **4**, No. 9. Z. physiol. Chem., 1911, **71**, 134—152.

EXPERIMENTS have been carried out to determine the influence of heat on the activity of solutions of invertase in $0{\cdot}001N$ hydrochloric acid. The invertase employed was prepared from autolysed yeast and was very active. 0·15 grm. was dissolved in 25 c.c. of $0{\cdot}001\ N$ hydrochloric acid and the solution was maintained at some particular experimental temperature (between 50° and 65° C.) for exactly half-an-hour. It was then at once cooled to 20° C. and 50 c.c. of a 20 per cent. solution of sucrose was added, the velocity of inversion being determined. From the constant of inversion (k_1) and that corresponding to the unheated invertase (k_0), the "stability constant" (k_E) was calculated from formula (1). Values of k_E calculated

$$(1)\ k_E = \frac{1}{t} \log \frac{k_0}{k_1} \quad (2)\ k_1 = k_0 e^{\frac{A(T_1 - T_0)}{2T_1T_0}}$$

from the formula of Arrhenius (2), in which A is a constant (about 70,000), gave corresponding values of k_E agreeing with those obtained by formula (1). In a previous investigation (Euler and Ugglas, Z. physiol. Chem., 1910, **65**, 124) similar experiments were carried out with invertase extracted from dried brewery yeast and containing much more protein and carbohydrate matter than the specimen now used. In both series, however, the results were substantially the same, the constant A being 72,000 in the earlier experiments and 68,000 in the present ones. The temperature at which, in 30 minutes, half the activity of the invertase was destroyed—and which the author terms the "killing temperature" (Tötungstemperatur)—was in both series 63±0·2° C. The proteins and carbohydrates present in the earlier preparation could therefore have exerted very little or no protective influence on the enzyme, against heat. Further experiments showed that neither lactose (in 4 per cent. solution) nor monosodium phosphate (in 0·5 molecular normal solution) exercises any appreciable protective action on invertase under the conditions of these experiments. The authors conclude that in the presence of a given concentration of hydrogen ions (10^{-6} to 10^{-4}), the constant A of equation (2), the "stability constant" (k_E) for particular temperatures, and especially the "killing temperature" of invertase preparations are quantities which can be determined exactly and which are scarcely affected by the presence of other substances extracted with the invertase from yeast. The statement found in many books, that the optimum temperature of the invertase of top-fermentation yeast is 25° C. higher than that of the invertase from bottom-fermentation yeast was not confirmed by the authors, who found no marked difference.—J. H. L.

Wines; Composition of Madeira ——. F. da Silva. Ann. Falsif., 1911, **4**, 57—65.

RESULTS of analyses of 105 samples of Madeira wine are given; the samples comprised various qualities of the wine, and the vintages examined range from the year 1820 to 1897. The average quantity of alcohol found in the wines was 20 per cent. by volume, the maximum being 23·30 and the minimum 16·69 per cent. The total solids varied from 31·6 to 185 grms., the average amount being 78 grms. per litre; on subtracting from the amount of total solids the quantity of reducing sugars, the residual solids ranged from 12·7 to 82 grms. per litre, the average being 30 grms. Small quantities of tannin are present in the wines; as determined by the zinc acetate method the maximum quantity found was 1·05 and the minimum 0·07 grm. per litre, with an average quantity of 0·15 grm. The total acidity of the wines is usually high, the average acidity being 5 grms. per litre expressed as sulphuric acid (H_2SO_4). Contrary to a generally accepted opinion, these wines are not "dry"; they contain a more or less considerable quantity of non-inverted sugars.—W. P. S.

Wine; Influence of exposure to air on the composition of ——, *with regard to the detection of adulteration.* E. Rousseaux and Sirot. Ann. Falsif., 1911, **4**, 88—90.

A SAMPLE of wine having been alleged to contain 15 per cent. of added water, the defence raised the point that the composition of the wine, as shown by the analytical results, was not due to the addition of water but to the fact that the sample had been exposed inadvertently to the atmosphere before being analysed. In order to ascertain whether this could really be the case, the authors made a number of experiments with wine drawn from the same cask as the incriminated wine; they found that the alcoholic strength of the wine diminished rapidly by exposure to the atmosphere, but that the quantity of total solids increased in proportion to the concentration due to the evaporation of the alcohol. The total acidity of the wine also increased, as did the amounts of the other non-volatile constituents. A wine which had been exposed to the air, or which had been mixed with such exposed wine, could not be mistaken, judging from the results of an analysis of the same, for a wine which had been watered.—W. P. S.

PATENTS.

Malt; Method of, and apparatus for, treating [grinding] —— *for brewing purposes.* S. K. Green, Leeds. Eng. Pat. 11,545, May 10, 1910.

THE malt is fed to a pair of shredding rolls set only sufficiently close together to shell out the grits, and the resulting grist is passed through an air current which separates all the light clean shell, medium grits and flour, from the heavy shell and hard grits, the latter then passing alone between a second pair of rolls. A device for effecting this is also claimed. The grist from the first pair of rolls is led by a shoot into a vertical tube up which a current of air passes, the lighter portions of the grist being thereby carried over into a settling chamber whilst the heavier grits fall into a shoot leading to the second pair of rolls. By means of a fan air is continuously withdrawn from the settling chamber and forced again up the vertical tube, a continuous current being thus maintained within the apparatus. The light grist deposited in the settling chamber is automatically discharged into a shoot by which it joins the product from the second pair of rolls.—J. H. L.

Beer and other fermented beverages; Brewing of—— A. E. Berry, Snaresbrook. Eng. Pat. 10,818, May 2, 1910.

THE nitrogenous matters, phosphates, etc., extracted from the malt wort by the yeast during fermentation, are returned to the beer by adding to the fermented beverage an extract of yeast rich in such matters. The extraction of the nutritive principles from yeast may be effected in any known manner, *e.g.* by digestion with 0·5 per cent. of phosphoric acid, and if desired, an extract of malt culms may be prepared simultaneously with that of the yeast. —J. F. B.

Beer; Production of clear or "non-deposit"——. F. M. Hotblack and Kidd and Hotblack Ltd., Brighton. Eng. Pat. 12,993, May 28, 1910.

THE beer is "fined" as it comes from the fermenting tuns and is decanted off into bottles or other closed vessels in which it is allowed to attain by natural means a high "condition" at the ordinary temperature, corresponding to an internal pressure of 15-30 lb. per sq. in. The beer is then chilled at a temperature of about 30° F., to a sufficient extent to precipitate and deposit the protein and other matters, whilst the gas present at the ordinary temperature becomes dissolved in the chilled liquid. The clarified beer is decanted and bottled at a temperature not exceeding 32°F., so that when the normal temperature is again restored the natural "condition" of the beer re-appears. —J. F. B.

Cellulosic and ligneous materials; Method of making a fermentable, glucose-like product from ——. W. P. Cohoe, Toronto, Canada. U.S. Pats. 985,725 and 985,726, Feb. 28, 1911.

Sawdust or similar material is treated in a digester in the dry condition with live steam containing a volatile hydrolysing acid, *e.g.* hydrochloric acid, until a mass of sugary material accumulates, portions of which are removed from time to time from the further action of the acid. The treatment may be carried out in two stages: in the first stage steam alone is used to bring the material into a suitable condition for hydrolysis, and the acetic acid which is produced at this stage may be collected separately; in the second stage hydrochloric acid vapours are admitted with the steam, and conversion is effected under suitable conditions of temperature and pressure. —J. F. B.

Distilling apparatus. H. Daniel. Fr. Pat. 421.350, Oct. 7, 1910.

The claim is for improvements in portable distilling apparatus, consisting in fixing a hinged flap-valve to the lower conical end of each distilling chamber. Further a conical steam coil is provided in the conical part of the chambers and a grating or grid to support the solid residue or marc. The object of the flap-valves which are fastened in position by bolts and wing-nuts is to allow the residue to be discharged and the vessels to be cleaned without inverting the vessel. A preliminary condenser is fixed between the still and the condenser proper to serve as a rectifier and preheater, the liquid to be distilled being used as a cooling agent.—W. H. C.

Vinasses; Process for utilising the products of the distillation of ——. Chem. Fabr. Schlempe, Ges. m. b. H. Fr. Pat. 421,241, Oct. 8, 1910.

The vinasses are subjected to a preliminary destructive distillation and the distillate is condensed and collected, the gaseous products which do not condense being conducted to the furnace where they are used as fuel. The condensed substances are then submitted to a second destructive distillation in order to produce cyanogen and cyanogen products. The preliminary distillation is made with the object of removing inert substances which do not yield cyanogen.—W. P. S.

Tartar; Process for extracting —— *from marcs and wine lees.* J. Salat. Fr. Pat. 421,370, Oct. 12, 1910. Under Int. Conv., Oct. 22, 1909.

The marc is extracted in a diffuser with cold water, or, preferably, with liquid which has been previously used for the same purpose, a quantity of sulphuric acid sufficient to decompose all the calcium tartrate and an amount of oxalic acid sufficient to dissolve the potassium bitartrate being also added. After about 6 hours, the liquid portion is drawn off and distilled in order to recover the alcohol present. The residual liquid is then treated, while hot, with a quantity of potassium sulphate sufficient to convert all the tartaric acid into potassium bitartrate, and, immediately afterwards, calcium oxide or carbonate is added to neutralise the sulphuric and oxalic acids. The potassium bitartrate remains in solution and, after about 30 minutes, the solution is separated from the precipitated calcium salts and cooled. The potassium bitartrate then crystallises out and is collected.—W. P. S.

Purification of liquid hydrocarbons and alcoholic liquids by means of charcoal. Fr. Pat. 421,760. *See* IIA.

XIXa.—FOODS.

Watering of milk; Detection of ——. Ledent. Bull. Soc. Chim. Belg., 1911, 25, 133—134.

Cornalba (this J., 1909, 738) found that the content of total soluble matter of milk (total solids minus fat and casein) may be regarded as a constant (6·15) for normal milk, any considerable lowering of which will indicate added water. This method has been tested by the author and others, including M. Vandam, the director of the Belgian Central Laboratory for the Analysis of Alimentary Materials, and has yielded excellent results.—A. S.

Phosphorus compounds in vegetable seeds, with special reference to phytin. W. Vorbrodt. Anz. Akad. Wiss. Krakau, 1910, A, 414—511. Chem. Zentr., 1911, 1, 895—897.

The author's work is divided into four sections dealing with: (1), methods for determining the different forms of phosphoric acid in vegetable substances; (2), the content of the different forms of phosphoric acid in seeds; (3), enzymatic decomposition of organic phosphorus compounds; (4), constitution of phytin. The best method for the determination of the mineral phosphoric acid was found to be the so-called triple precipitation process, the phosphoric acid being first precipitated with magnesia mixture, the precipitate dissolved in 1 per cent. nitric acid, the ammonium molybdate compound precipitated according to Riegler's method (this J., 1903, 46), and this decomposed with ammonia and precipitated with barium chloride. The soluble organic phosphoric acid is taken as the difference between the mineral phosphoric acid and the total phosphoric acid (Neumann) in the extract prepared by digesting the material for 3 hours with 0·2 per cent. hydrochloric acid or acetic acid The lecithin-phosphoric acid is determined in the solution obtained by extracting the material for 24 hours, first with absolute alcohol and then with ether. The protein-phosphoric acid is taken as the difference between the total phosphoric acid and the phosphoric acid soluble in 1 per cent. acetic acid plus the lecithin-phosphoric acid. The proportions of the different forms of phosphoric acid in a number of vegetable seeds are tabulated. It is pointed out, however, that the numbers for the mineral, soluble organic, and protein phosphoric acid possess only a relative value, the quantities varying considerably according to the time during which the solvents remain in contact with the material in the digestion process. Enzymatic processes may come into play and modify considerably the proportions of the different forms of combination of the phosphoric acid. The organic phosphorus compounds in barley and maize, for instance both those soluble and those insoluble in 1 per cent. acetic acid, suffer decomposition under the influence of enzymes, with formation of inorganic phosphoric acid. Phytinic acid was prepared from maize flour by the method of Patten and Hart (this J., 1904, 618) and was purified by means of its barium salt, which has a composition corresponding to the formula, $C_{12}H_{26}O_{46}Ba_7P_{11}$. When heated with water at 155° C. (under a pressure of 6 atmospheres), it is decomposed into inositol and phosphoric acid. An attempt to liberate and isolate inositol from the phytin (phytinic acid) of germinated maize corns by the action of the enzyme, phytase (compare Suzuki, Yoshimura and Takaishi, this J., 1907, 1061), gave a negative result. —A. S.

Pepper; New constant in the analysis of ——. C. Arragon. Ann. Falsif., 1911, 4, 103—104.

A determination of the iodine value of a sample of ground pepper is recommended as affording evidence of the genuineness of the sample. Two grms. of the finely-powdered pepper are treated in a stoppered flask with 15 c.c. of chloroform and 25 c.c. of Hübl's reagent. After the lapse of 4 hours, the excess of iodine is titrated with thiosulphate solution in the usual way, but during the titration the contents of the flask must be shaken thoroughly as the powder persistently retains free iodine.

Thirty samples of pepper examined yielded iodine values varying from 16·1 to 18·0, whilst 4 other samples, each containing 60 per cent. of rice starch, showed an iodine value of 7·5. No advantage is to be derived by first extracting the pepper with chloroform and determining the iodine value of the extracted matter.—W. P. S.

XIXb.—WATER PURIFICATION: SANITATION.

Nitrates in water; The phenolsulphonic acid method for the determination of ——. E. M. Chamot, D. S. Pratt and H. W. Redfield. J. Amer. Chem. Soc., 1911, 33, 366—384 (see this J., 1910, 714).

The chief source of error in the method as usually practised is the phenolsulphonic reagent. So long as any monosulphonic acid is present, errors will arise due to the tendency of the mono-acid to pass into the di-acid. The volume of the reagent used, usually 2 c.c., should be carefully measured. The reagent must be left in contact with the residue for at least two minutes, to ensure completion of the reaction. Potassium hydroxide is the best alkali to use, excess having no influence on the colour. Organic colouring matter should be removed from the water. "Aluminium cream" has been found to do this satisfactorily without affecting the nitrates present. When carbonates are absent, the usual method of working produces no measurable loss from mechanical causes. When carbonates are present small mechanical losses ensue, but these compounds produce errors chemically only when the reagent contains mono-acid. Chlorides should be removed by means of a measured equivalent amount of silver sulphate. With waters high in iron or magnesium compounds, care must be taken to ensure complete penetration of the residue by the reagent, by heating or rubbing with a glass rod. Nitrites present in small amount do not appreciably affect the final results, but when exceptionally high must be destroyed or corrected for. The following modified method is recommended:—The alkalinity, the chlorine and nitrite content of the water having been determined, 100 c.c. (if the water contains about 10 parts per million of nitric nitrogen) are treated with sufficient $N/50$ sulphuric acid almost to neutralise the alkalinity, and with sufficient silver sulphate solution to precipitate all but about 0·5 mgrm. of the chlorine. The liquid is heated to boiling, treated with a little "aluminium cream," filtered, and evaporated to dryness. The residue is treated with 2 c.c. of the disulphonic acid reagent, stirred with a glass rod, and the mixture diluted. A strong solution of potassium hydroxide (10—12-N) is then slowly added until the maximum colour is developed. The solution is filtered if necessary, transferred to a colourimeter cylinder, and compared with a potassium nitrate or tripotassium nitrophenoldisulphonate standard. To prepare the reagent, 25 grms. of pure white phenol are dissolved in 150 c.c. of pure sulphuric acid, and 75 c.c. of fuming sulphuric acid added. The solution is stirred well and heated for two hours at about 100° C. Permanent standards made with this reagent do not change with time.—T. St.

Disinfectants in Japan. Oil, Paint, and Drug Rep., March 13, 1911. [T.R.]

The U.S. Consul-General at Yokohama has supplied the Bureau of Manufactures with the following information concerning disinfectants in Japan:—

Crescine is a liquid extract and is a by-product of gas. It is manufactured by the Tokyo and Osaka gas companies, and is wholesaled at 37s. per 100 pounds. *Disinfectol*, a by-product of camphor, is manufactured by the Formosa Camphor Monopoly Bureau, and is wholesaled at 44s. per 100 pounds. The exports of *camphor oil* in 1909 amounted to 1,697,020 pounds, valued at £22,858, of which 1,161,819 pounds, valued at £15,534 were exported to the United States. The wholesale price varies from 25s. to 33s. per 100 pounds. It is all manufactured in Kobe. Almost all the *carbolic acid* used in Japan comes from Germany, none being made at home. The imports in 1909 amounted to 802,451 pounds, valued at £16,642. The wholesale price is about 33s. per 100 pounds. Several gas companies in Japan make *naphthalene* during the winter, most of which is used by the military department as a disinfectant. Naphthalene is largely imported from the United States. The wholesale price varies from 12s. 6d. to 15s. per cwt. *Formalin* is imported largely from Germany, none being manufactured in Japan. The imports in 1909 amounted to 732,408 pounds, valued at £13,978. The wholesale price is 67s. 6d. per 100 pounds, 40 per cent. grade. A Japanese company was formed in 1896 for the purpose of manufacturing a disinfectant called *albose*. It is in the form of a liquid and also in a soap form. It sells wholesale at 37s. 6d. per 100 pounds. No statistics are available as to quicklime.

PATENTS.

Sterilisation of liquids; Employment of metals in the electric arc for the ——. E. Urbain, A. Feige, and C. Scal, Paris. Eng. Pat. 4795, Feb. 25, 1910. Under Int. Conv., Jan. 17, 1910.

The employment of metals, in particular aluminium and silver, in the electric arc is claimed, for the purpose of extending the spectrum farther into the ultra-violet than that of mercury, and thus effecting the sterilisation of liquids economically. In carrying out the invention a surface or wall transparent to the ultra-violet rays is arranged to form a passage or chimney or part of such, so that the metallic dust produced by the arc cannot be deposited on the effective surfaces. (Reference is directed to Eng. Pats. 15,021 and 17,951 of 1900; 8308 of 1902; 9242 of 1903; 22,927 of 1904; and 6515 of 1906; this J., 1901, 816; 1903, 878; 1905, 207.)—E. W. L.

Water; Apparatus for the sterilisation of —— by means of ultra-violet rays. M. P. Otto. Fr. Pat. 421,296, Oct. 10, 1910.

The apparatus consists of a cylindrical vessel in the interior of which are placed clusters of lamps capable of emitting ultra-violet rays. The water to be treated enters the cylinder at one end and leaves at the other The lamps may be fitted in a movable chamber in the cylindrical vessel, so that faulty units may be repaired as required, and the diameter of the cylinder may be reduced by means of suitable plates at the points where the lamps are situated. Serpentine Geissler tubes may be used in place of the lamps.—W. P. S.

Water; Apparatus for purifying —— by ozonised air. Siemens Bros. and Co., Ltd., London. From Siemens und Halske Akt.-Ges., Berlin. Eng. Pat. 17,787, July 26, 1910.

The water is admitted into a tank and ozonised air is drawn into the bottom of the tank, and through the water contained therein, by means of a pump connected with the upper part of the tank. A portion of the water to be treated may be admitted through a pipe at the top of the tank; this pipe is fitted with an injector so that the water carries with it a quantity of ozonised air, the main volumes of water and ozonised air being introduced at the bottom of the tank. The ozonised air thus passes through the water before it comes in contact with the working parts of the pump, the object of the invention being to minimise or prevent the action of the ozone on the pump.—W. P. S.

Water; Process for softening —— and for relieving it of iron and manganese. Permutit-Filter Co., Ges. m. b. H., Berlin. Eng. Pat. 26,094, Nov. 9, 1910. Under Int. Conv., May 10, 1910.

Natural porous stones, such as trass, phonolite, porphyry, leucite, trachyte, sodalite, and mica are employed in making filters through which the water to be treated is passed. The minerals are used either directly, if they have been hydrated naturally, or after they have been treated with steam under pressure. The treatment with steam may take place in the presence of alkaline substances, and the minerals may be subjected subsequently to the action of neutral alkali salts in order to give to the minerals the character of a zeolite such as is used in the processes described in Eng. Pats. 21,184 and 26,842 of 1909 (this J., 1910, 590, 1033). If the mineral used contains sodium it may be employed for softening the water; if it contains lime it may be employed, in conjunction with one of the higher oxides of manganese, for removing iron or manganese from the water.—W. P. S.

Sewage and other liquids; Apparatus for the purification of ——. C. W. Bell, Wembley, Middlesex, and J. E. Tuke, Sanderstead, Surrey. Eng. Pat. 13,969, June 9, 1910.

The apparatus includes a septic liquefaction tank wider at the top than at the bottom to allow of free scum-formation, the unliquefiable fibrous matter being carried to the surface instead of falling to the bottom. The inlet and outlet of the tank are governed by vertical slides across the corners or ends, the sewage entering and leaving well below the surface. The distance of travel inside the tank is increased by a baffle-plate. The liquid flows from this tank into a long tipping bucket which delivers it alternately into two rows of shoots so constructed as to take the whole contents of the tipper without obstruction and splashing. From the shoots the liquid flows into horizontal perforated channels (with suitable covers) which distribute it over the filter. The filtering bed is preferably made in two units with an air space between or around for aeration and ventilation. The bottom and internal walls or divisions of the filter may be of expanded metal or other suitable grids. The whole apparatus is designed to be easy of access for inspection and cleaning, and capable of efficient ventilation.—J. H. L.

Sterilising water or other liquids by means of ozone; Apparatus for ——. C. S. Piestrak. First Addition, dated Dec. 21, 1909, to Fr. Pat. 408,317, Jan. 20, 1909.

See Eng. Pat. 1117 of 1910; this J., 1910, 1406.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Assay processes of the Fifth German Pharmacopœia. Pharm. J., 1911, 86, 295—296.

Pomegranate bark.—The air-dry powder is now taken for assay, instead of the powder dried at 100° C.; this is mixed with ether, instead of ether and chloroform, and diluted caustic soda, and extracted for three hours. Then two-thirds of the ethereal liquid is filtered off, whereas formerly water was added, with shaking, until the drug balled together, and after an hour's standing five-sixths of the ethereal liquid was filtered off. Part of the ether is distilled off and the remainder shaken with dilute acid to extract the alkaloid; after three extractions the united acid liquid is alkalised with sodium carbonate and the alkaloid extracted by four shakings with chloroform. This purification by shaking into acid and back again is new. The chloroformic solution is then shaken with a given quantity of $N/100$ acid, enough ether being added to make the chloroform float, and the acid liquid is titrated with $N/100$ potash, iodeosin being the indicator; formerly the original ether-chloroform extract was shaken directly with standard acid and the excess titrated. Formerly the alkaloid of 10 grms. was required to neutralise at least 28 c.c. of $N/100$ acid; now the (purified) alkaloid of 8 grms. is required to neutralise at least 22 c.c. (=27·5 c.c. per 10 grms.), which represents 0.4 per cent. of alkaloids, of average molecular weight 148, in the drug.

Fluid extract of pomegranate (not formerly official).—This is assayed by a process very similar to that for the bark; it is required to contain 0·2 per cent. of alkaloids.

Hydrastis rhizome (not formerly standardised).—This is extracted with ether and ammonia for three hours, and an aliquot part of the ethereal solution filtered off. The ether is distilled from this, and the solid residue taken up with dilute acid, filtering the solution and washing with water. The acid liquid is then alkalised with ammonia and the alkaloid shaken out with ether—once only; an aliquot part of the ethereal solution being evaporated and the residue weighed. This is the only case (besides the fluid extract of the same drug) where alkaloid is weighed and not titrated, and nearly every stage of the process shows a departure from the usual procedure. The requirement is that the alkaloid so obtained shall correspond to 2·5 per cent. in the drug; but the amount actually present is probably greater than this, having regard to the final shaking out of the alkaloid with only one portion of ether.

Fluid extract of hydrastis.—This is diluted with water and then evaporated to remove all alcohol, acidified with hydrochloric acid, and the liquid well shaken with talc and filtered. An aliquot part of the filtrate is alkalised with ammonia and shaken with ether for some minutes, petroleum benzine then added, and the shaking repeated; a considerable amount of powdered tragacanth is then added, with more shaking until the ethereal layer is clear, when an aliquot part of this is filtered off and evaporated and the alkaloid weighed: the amount is required to correspond to 2·2 per cent. in the fluid extract, which, therefore, does not quite correspond to the rhizome in strength. In this case an intermediate stage of purifying the alkaloid by shaking into acid and back again has been omitted, being presumably rendered superfluous by the use of acid in the first place, which, with the addition of talc and filtering, is new. The use of tragacanth in separating the ether-benzine layer is also new, and the latter contains a much larger proportion of petroleum benzine. The strength was formerly 2·0 per cent., and is thus somewhat increased.

Ipecacuanha root.—In this, as in pomegranate bark, the assay is now made on the air-dry powder, instead of the powder dried at 100° C. as formerly; the drug is shaken with a mixture of ether and chloroform and sodium carbonate solution: an aliquot part of the ether-chloroform solution is filtered off and distilled, and the residue extracted three times with diluted acid; the united acid liquid is alkalised with sodium carbonate, the alkaloid extracted with chloroform, then shaken back from this into a certain quantity of standard acid, and the excess of the latter determined by titration. The alkaloid, calculated as emetine from the amount of acid neutralised, is required to be not less than 1·99 per cent. of the drug. Formerly the powdered drug dried at 100° C. was taken for the assay; caustic soda was used to make alkaline instead of the carbonate, and as caustic alkali retains cephaeline, this makes an important difference. After the extraction more water was added, with shaking, until the drug balled, when an aliquot part of the ether-chloroform liquid was filtered off and distilled down to about one-half its volume; this was then shaken with standard acid, without purification, and the excess of acid found by titration. The requirement as to acid neutralised corresponded to 1·99 per cent. of emetine, but in view of the change in the alkali used, and the variable proportions in which emetine and cephaeline occur in the root, there is more difference than at first appears between the requirements of the two editions, but it is not possible to state an exact ratio between the two standards.

Tincture of ipecacuanha (not formerly official).—The tincture is concentrated by evaporation, then absolute alcohol, chloroform, ether, and sodium carbonate solution added; after extraction, an aliquot part of the ethereal liquid (which is assumed to contain all the alcohol) is taken and reduced in volume by distillation, the alkaloid shaken into acid, and then back to chloroform, sodium carbonate again being the alkali used. The alkaloid is then shaken into a known quantity of standard acid, and the excess of this found by titration. The alkaloid, calculated as emetine, is required to be 0·194 per cent. of the tincture, which is thus rather less than one-tenth of the strength of the root.

Opium.—Several important changes have been made in the assay process; also there are now two articles—"Opium" required to yield by the given process (after drying at 60° C.) not less than 12 per cent. of morphine, and "Opium Pulveratum" required to contain just 10 per cent. The process is the same for both; the opium is mixed with water only, and an aliquot part filtered off (allowance being made for the opium being partly soluble and partly insoluble), then a small quantity of ammonia is added, avoiding strong shaking, and the liquid filtered at once. To an aliquot part of the filtrate more ammonia is added, and ethyl acetate, and the whole shaken for ten minutes. More ethyl acetate is then added and the mixture allowed to stand for a quarter of an hour, with occasional shaking. The morphine is then collected in the usual way, washed with water saturated with ether, dried, dissolved in excess of standard acid, and the excess titrated; no allowance is made for the morphine remaining dissolved in the liquids. In the former edition, the aqueous extract was precipitated by sodium salicylate, and the filtrate from this by ammonia with the addition of ether, twenty-four hours being allowed for the morphine to separate. The morphine was titrated in the same way as now, the amount of acid which it was required to neutralise corresponding to 10·2 to 11·98 per cent. of morphine in the opium.

Extract of opium.—The assay process is similar to that for opium. It is required to yield just 20 per cent. of morphine.

Tincture of opium (simple). Tincture of opium with saffron.—These are also assayed by a similar process, and are required to yield 1 per cent. of morphine.

Nux Vomica seeds.—The air-dry powder is extracted by treatment with a mixture of ether and chloroform and diluted caustic soda solution. An aliquot part of the ether-chloroform liquid is filtered off, the bulk reduced by distillation, and the alkaloid shaken into dilute acid and back to chloroform. From this it is removed by a known quantity of standard acid, and the excess of the latter found by titration. The drug is required to yield 2·5 per cent. of total alkaloid in this way. The powder dried at 100° C. was formerly taken. The extraction was made with a different ether-chloroform mixture and diluted caustic soda, and water was added to make the drug ball together before filtering off a part. The alkaloid went through no purification, but was at once transferred to standard acid and the excess of this titrated; the amount of acid which the alkaloid was required to neutralise corresponded to 2·5 per cent., as now.

Extract of Nux Vomica.—The extract is dissolved in water, absolute alcohol, and dilute sulphuric acid, then caustic soda, sodium carbonate, and chloroform added, and the mixture well shaken; after an hour's extraction, ether is added, and an aliquot part of the ether-chloroform mixture (assumed to contain the alcohol, which in this one case is measured, not weighed) is filtered; the alkaloid is shaken into acid and back to chloroform, and from this into a known quantity of standard acid, the excess of which is then titrated. The amount of total alkaloids so found is required to be just 16 per cent. The use of caustic soda as well as the carbonate is new, and the extraction was formerly made with ether and chloroform instead of the ether being added afterwards; there was no purification of the alkaloid, and the titration result which was required corresponded to not less than 17·5 per cent. of alkaloid.

Tincture of Nux Vomica.—The process is similar to that for the extract; 0·25 per cent. of alkaloid is required, which is again a slight reduction in strength.

Cantharides.—The powder is extracted with chloroform and dilute hydrochloric acid for twenty-four hours, and an aliquot part filtered and evaporated; the residue is extracted with petroleum benzine for twelve hours, the liquid filtered off, and the extraction repeated several times. The undissolved portion is then treated with water containing a trace of ammonium carbonate as long as this removes any colour, then dried and weighed; if it is then resinous or dark in colour, the cantharidin is extracted from it with hot acetone. Not less than 0·8 per cent. of crystalline cantharidin is required. The process only differs in minor points from what was formerly official, the purification of the cantharidin being more thorough. The required proportion is unaltered, but as it is now purer, the strength is actually somewhat increased.

Jalap.—The drug in fine powder is macerated with alcohol for twenty-four hours at 30° C., an aliquot part of the liquid filtered and evaporated. The resin is washed with warm water as long as the washings are coloured, then dried and weighed. Not less than 10 per cent. is to be obtained. Coarse powder was formerly used and extracted with two portions of alcohol in succession, pressing after each; not less than 9 per cent. of resin was required. The resin is now required to yield not more than 10 per cent. to ether, whereas it was formerly required to yield not more than 10 per cent. to chloroform.

Rhubarb (not previously assayed).—The drug in fine powder is macerated with a mixture of alcohol and water, equal parts, for twenty-four hours, an aliquot part then filtered off and evaporated, and the residue dried at 105° C. and weighed. Not less than 35 per cent. of extract is required.

Mustard seed.—The powdered seed is digested with water for two hours, alcohol and a little olive oil then added, and the mixture distilled, the distillate being received in a flask containing ammonia. A known quantity of standard silver nitrate solution is then added, and the mixture digested for an hour in a water-bath. An aliquot part is filtered and the excess of silver found by titrating with thiocyanate the result being required to show at least 0·7 per cent. of allyl isothiocyanate in the seed. The silver mixture was formerly allowed to stand twenty-four hours in the cold; and the titration requirement corresponded to not less than 0·56 per cent. of allyl isothiocyanate.

Quinine and euquinine. A. Astruc and L. Courtin. J. Pharm. Chim., 1911, 3, 292—294.

Euquinine which is prepared by the action of ethyl chlorocarbonate on quinine, resembles the latter in many of its properties, but differs from it in not giving the herapathite reaction and in forming only normal salts with acids. 1 mol. of euquinine requires 1·05 mol. of hydrochloric acid to render it neutral to methyl orange, whereas 1 mol. of quinine requires 1·97 mols.—A. S.

Pseudomorphine; Preparation of ——. G. Denigès. Bull. Soc. Pharm., Feb. 1911, 49. Pharm. J., 1911, 86, 399.

Pseudomorphine (oxymorphine, oxydimorphine, or dehydrodimorphine) is very difficult to obtain in commerce, and the methods of making it which have been tried by the author are laborious, and give small yields. The author finds that the double cyanide of copper and potassium, acting in presence of hydrogen peroxide, acts catalytically. 5 grms. of morphine hydrochloride are dissolved, with the aid of heat, in 200 c.c. of water, and the solution allowed to cool; 20 c.c. of solution of hydrogen peroxide (10 to 12 vols.), or an equivalent quantity of another strength, which must be quite neutral, or at least whose acidity does not exceed that of a $N/100$ solution, are then added, and the liquid is run into a mixture, prepared in advance, of 10 c.c. of a solution of copper sulphate (40 grms. of the crystalline salt in 1 litre), and a quantity of a solution of potassium cyanide equivalent to $N/10$ silver nitrate, sufficient to decolourise exactly the copper solution (about 30 c.c. will be required). The mixture is shaken. A turbidity first appears; in less than a minute this begins to increase until a precipitate forms, at first colloidal, and then agglomerating in three or four minutes. Still later, oxygen is vigorously disengaged, and at this moment the mixture, first yellowish, becomes redder, and a crystalline precipitate forms. After standing for an hour, the precipitate is collected on a filter and washed, first with cold water, then with alcohol, and finally with ether, and dried on the filter below 100° C. The weight of pseudomorphine thus obtained represents 20 to 25 per cent. of the morphine hydrochloride used. It may be purified by dissolving 1 grm. in 100 to 120 c.c. of solution of ammonia (22° Bé.), adding 5 or 6 grms. of purified animal charcoal, boiling, filtering, and washing out the charcoal with a little water. The filtrate is evaporated on a water-bath to a small volume, preferably in a flask under reduced pressure. The alkaloid is thus obtained in extremely well-formed, small tabular crystals.

Coca leaves; Production and use of ——. Bull Imp. Inst., 1910, **8**, 388—392.

The commercial supply of coca leaves is derived almost entirely from Peru, Java, and Ceylon. Only small quantities are exported from other countries. Both the leaves and crude cocaine are exported from Peru; the latter chiefly to Germany, where it is purified. The leaves only are exported at present, from Java. Javan leaves are stated to contain but little cocaine, as such, but are rich in other alkaloids which can be readily converted into that base. Holland and Germany consume all the Javan product. In 1904 the amount exported was 57,032 lb.; in 1908, 1,026,022 lb. The Ceylon leaves, derived from Bolivian stock, differ from Javan in containing more cocaine; they are in consequence better suited for medicinal use and for the manufacture of galenical preparations, than the Javan leaves. They therefore command higher prices. In 1906 the total export from Ceylon was 41,724 lb.; in 1909, 68,306 lb. Precise data as to the export of coca leaves from Peru are not available. The amount of crude cocaine exported in 1903 was 7800 kilos.; 5900 kilos. in 1906, and 6057 kilos. in 1907. De Jong (Teysmannia 1910, 201) estimates the world's consumption of cocaine at 12,000 kilos. per annum, and since the yield of coca leaves in Java is equivalent to about 6 kilos. of cocaine per acre, the area under coca cultivation in that island can be extended to 3500 acres, assuming that the Peruvian supply can be suppressed by the competition of the Javan product.—J. O. B.

Alkaloids of the Pukatea. B. C. Aston. Chem. Soc. Trans., 1910, **97**, 1381—1387.

The author has previously drawn attention to the presence of alkaloids in the bark of the Pukatea (*Laurelia Novae Zealandiae*) tree, decoctions of which are used medicinally in New Zealand by the Maoris. By extracting the bark with alcohol containing 0·5 per cent. of acetic acid, expelling the alcohol from the extract, diluting the residue with boiling water, filtering, and shaking with chloroform, two feebly-basic alkaloids, *pukateine* and *laureline*, were separated, whilst from the residual acid aqueous solution, a third, *laurepukine*, was precipitated by sodium hydroxide. Pukateine, $C_{17}H_{17}O_3N$, is a white crystalline alkaloid melting at 200° C. (uncorr.), and has $[\alpha]_D = -220°$ in alcohol. It is insoluble in water, sparingly soluble in light petroleum, more readily in ether, chloroform, and alcohol, and very soluble in pyridine. The hydrochloride and platinichloride, and sodium and potassium salts of the alkaloid were prepared. Pukateine has a physiological action similar to, but weaker than, that of strychnine. Laureline, $C_{19}H_{21}O_3N$, and laurepukine, $C_{18}H_{19}O_3N$, are both amorphous, but the former yields crystallised salts, of which the sulphate, hydrochloride, and nitrate were prepared.—A. S.

Liquorice powder and extract; Dermination of glycyrrhizin and sugars in ——. E. Eriksson. Arch. Pharm., 1911, **249**, 144—160.

The method proposed by the author is based on the fact observed by Tschirch that glycyrrhizin on hydrolysis yields two molecules of glucuronic acid, $CHO(CH.OH)_4COOH$, an aldehyde-acid which reduces Fehling's solution. 10 grms. of the liquorice extract are coarsely powdered and treated with 100 c.c. of cold water. 100 c.c. of 90 per cent. alcohol are mixed well with the resulting solution, and after heating for ½ hour on the water-bath, the solution is filtered and the filter washed with 50 c.c. of hot alcohol. The filtrate is heated on the water-bath until free from alcohol, filtered, and made up to 200 c.c. To 40 c.c. of the solution, 25 per cent. sulphuric acid is added so long as a precipitate is produced, and after allowing to stand for 2—3 hours, the glycyrrhizin is filtered off and washed with 5 per cent. sulphuric acid. The filter with the glycyrrhizin is heated with 50 c.c. of 90 per cent. alcohol, filtered, and 30 c.c. of water added to the filtrate. After expelling the alcohol, the glycyrrhizin is re-precipitated with sulphuric acid, then dissolved in a 5 per cent. solution of alkali and after diluting with water, boiled for 15 hours with 120 c.c. of Fehling's solution, and from the cupric-reducing power the percentage of glycyrrhizin is calculated (360 parts of dextrose are equivalent to 896 parts of glycyrrhizin). In the filtrate from the first precipitation of glycyrrhizin, the reducing sugars (dextrose) and hexoses (sucrose) are determined with Fehling's solution after neutralising with 5 per cent. alkali, the former by allowing to stand overnight with Fehling's solution at the ordinary temperature, and the latter by boiling the filtrate from the cuprous oxide with a further quantity of Fehling's solution for 3 minutes. For liquorice root, essentially the same method is used, except that the order of the separate determinations is different. The powdered root is extracted with alkaline water, and after precipitating gummy substances with alcohol, the reducing sugars are determined with cold Fehling's solution; in the filtrate from the cuprous oxide, the hexoses are determined by boiling for 3 minutes with Fehling's solution; and finally after again filtering off the cuprous oxide, the glycyrrhizin is determined by boiling for 15 hours with Fehling's solution. Some results obtained by the method are given.—A. S.

Anise oil; A new plant from Madagascar yielding ——. E. Heckel. Comptes rend., 1911, **152**, 565—567.

There has recently been imported into France from the island of St. Marie, Madagascar, a large quantity of the leaves, fruits and fruit-stalks of a plant, probably identical with the *Pelea Madagascarica* of Baillon, and now placed for the first time on the European market. The parts named above smell strongly of anise and contain 4—5 per cent. of a yellowish essential oil. The oil is most abundant in the fruit, which somewhat resembles that of *Ruta* but is much larger and uniformly tetramerous. The density of the oil is 0·953 at 15° C., its optical rotatory power is $+32° 22'$ and its refractive index at 20° C. is 1·51469. It is soluble in four times its volume of 80 per cent. alcohol. No anethol separates on cooling the oil to —18° C., but the behaviour towards sodium bisulphite indicates a large content of aldehydes, probably anisic aldehydes. If the author has rightly identified the plant from the portions to hand, it should be found abundantly in the northern part of Madagascar besides in the neighbouring islands of St. Marie and Mayotta (Comoros).—J. H. L.

Carbolic acid [phenol]; Characters for ——. *in the fifth German Pharmacopœia*, 1910. F. Raschig. Pharm. Zeit., 1910, **55**, 1055—1056.

The statement that "a solution of one part of carbolic acid in 50,000 parts of water should give a white flocculent precipitate with bromine reagent" is incorrect. At the ordinary temperature, such a solution will not even give a turbidity; and, at 25° C., a solution of 1 : 40,000 will give no reaction. Even with stronger solutions, what is produced is not a "white flocculent precipitate," but a more or less distinctly yellowish white turbidity, which, after a time, aggregates to a yellowish white, crystalline precipitate. The statement that "a 1 : 15 aqueous solution should not redden litmus paper" is also incorrect. The author has previously shown that solutions of chemically pure synthetic phenol have an acid reaction towards litmus. It is noted that the solidifying point is now adopted instead of the melting point, formerly given as a test for purity, on account of the hygroscopic nature of the acid. The official range for the boiling point of the acid, 178°—182° C. is wide, for an acid of the prescribed purity would boil within one degree Centigrade.—J. O. B.

Patents.

Isoprene; Manufacture of ——. O. Silberrad, Buckhurst Hill. Eng. Pat. 4001, Feb. 18, 1910.

The depolymerisation of turpentine for the production of isoprene is effected by the action of heat on its vapour in a rarefied condition. For example, the turpentine vapour may be passed through a tube, preferably over a considerable surface of metal, heated to 450°—750° C., under a much diminished pressure, or the turpentine may be dropped into an evacuated retort heated to redness, and the vapours removed by a suction apparatus. Yields of from 25 to 50 per cent. of isoprene have been obtained by this method.—T. F. B.

Acetylene tetrachloride ; Producing ——. E. Hoefer and M. Mugdan, Nuremberg, Germany. U.S. Pat. 985,528, Feb. 28, 1911.

Acetylene tetrachloride is produced by passing the calculated proportions of acetylene and chlorine into a relatively large volume of acetylene tetrachloride (or other inactive liquid diluent) containing anhydrous ferric chloride, the mixture being agitated during the process (compare Fr. Pat. 420,489 of 1910 ; this J., 1911, 307). —T. F. B.

Bismuth betanaphtholate ; Process of preparing ——. J. L. Turner, Philadelphia, and C. E. Vanderkleed, Collingswood, N.J., Assignors to H. K. Mulford Co., Philadelphia. U.S. Pat. 985,559, Feb. 28, 1911.

β-Naphthol (25 lb.) is dissolved in a solution of 28 lb. of sodium hydroxide in 20 galls. of water, a solution of 84 lb. of bismuth nitrate and 100 lb. of glacial acetic acid in 11 galls. of water is added, and then a solution of 62 lb. of sodium hydroxide in 10 galls. of water ; the solution is boiled and the precipitated bismuth β-naphtholate separated.—T. F. B.

Ethylsulphuric acid ; Process for making ——. C. Leproux. Fr. Pat. 421,628, Oct. 17, 1910.

Acetylene and hydrogen are separately generated and then mixed together in another compartment of the generator ; the mixture is then passed into a gas-holder until a suitable pressure is produced, and convenient portions of it are heated in a water-jacketed vessel. The ethylene thus formed is passed into a second gas-holder and thence into a mixing apparatus containing sulphuric acid, where the ethyl hydrogen sulphate is formed, the excess of ethylene being returned to the first gas-holder. Suitable apparatus is illustrated and described in the specification.—T. F. B.

Vanillin ; Process for making ——. Soc. Franç. de Parfums D. Esclafit et Cie. Fr. Pat. 421,784, Dec. 29, 1909.

Vanillin is obtained from iso-eugenol by dissolving it in a hydrocarbon and oxidising it by means of ozone. The hydrocarbon should have as high a boiling-point as possible ; thus, toluene or ethylbenzene may be used. The yields are stated to be about 35 per cent., compared with about 20 per cent. when the oxidation is carried out in aqueous emulsion ; the amount of resinous matter formed is also much less than in the older processes.—T. F. B.

Borneol and borneol esters from pinene ; Process of making ——. G. Austerweil, Paris, France. U.S. Pat. 986,038, March 7, 1911.

See Fr. Pat. 392,159 of 1908 ; this J., 1909, 41.—T. F. B.

Oxyarylarsinic acids ; Derivative of —— *and process of making some.* P. Ehrlich and A. Bertheim, Frankfort, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 986,148, March 7, 1911.

See Ger. Pat. 224,953 of 1909 ; this J., 1910, 1178.—T. F. B.

Lævo-o-dioxyphenylethanolmethylamine ; Salt of the optically active ——. F. Flächer, Höchst on Maine, Germany, Assignor to H. A. Metz and Co., New York. U.S. Pat. 986,156, March 7, 1911.

See Eng. Pat. 3021 of 1909 ; this J., 1909, 442.—T. F. B.

Purifying hydrocarbons [*paraffins, benzene, terpenes*]. Fr. Pat. 421,277. *See* IIa.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Silver ; The polychromy of ——. Lüppo-Cramer. Gedenkboek van Bemmelen, 1910. Z. angew. Chem., 1911, 24, 315.

Increasing quantities of colloidal silver were added to silver nitrate solutions containing gelatin, which were then reduced by quinol : the reduced silver from the solution containing no colloidal silver was bluish-grey, whilst with increasing additions of colloidal silver, successively blue, blue-violet, ruby red, and yellowish-brown sols were obtained. Further, the size of the silver particles decreased as the colour passed from the blue to the yellow. Similar results were obtained when the solutions were reduced by means of light alone.—T. F. B.

Photohalides ; Studies on ——. W. Reinders. Chem. Weekblad, 1910, 7, 961-973, 993-1005. Chem. Zentr., 1911, 1, 454—455.

As a result of his experiments the author concludes that silver and silver chloride form no stable intermediate compounds at temperatures from 20° to 100° C., and that subchlorides formed under other conditions are unstable. Photohalides may be obtained by crystallising solutions of silver chloride either in light, or from a solution of collodial silver. The crystals obtained by the first method are indigo-blue octahedra and cubes ; if the crystals are allowed to remain in the solution, their colour gradually changes to reddish-brown and finally to grey, indicating reduction to metallic silver. The crystals dissolve in ammonia and sodium thiosulphate to colourless solutions, leaving a residue of about 1·1 per cent. of silver. The photohalides obtained from colloidal silver solutions are homogeneous in structure, but vary considerably in colour : they contain from 1 to 2 per cent. excess of silver, and when exposed to diffused light change in colour from yellow, red, and violet to indigo-blue. The solutions from which the crystals were removed contained formaldehyde, besides formic acid and carbon dioxide. The solutions of colloidal silver, obtained by passing carbon monoxide into ammoniacal solutions of silver chloride, are more stable when obtained from dilute solutions. Very stable solutions are obtained by adding a small quantity of an alkali silicate. Crystals of the photochloride from these solutions vary in colour according to the amount of carbon monoxide used. It is considered that the photohalides are absorption compounds of colloidal silver with the normal halides.—T. F. B.

Photographic developers for use in tropical countries ; Composition of ——. A. and L. Lumière and A. Seyewetz. Bull. Soc. Franç. Phot., 1911, 2, 70—73.

The following formulæ are given for developers which can be used at temperatures of 38°—40°C. without affecting the gelatin film :—(1) Diaminophenol, 5 grms. ; anhydrous sodium sulphite, 30 grms. ; crystallised ammonium sulphate, 250 grms. : potassium bromide, 3 grms. : water, 1000 c.c. (2) Metoquinone, 5 grms. ; anhydrous sodium sulphite, 200 grms. ; potassium bromide, 2·5 grms. ; water, 1000 c.c. (3) Metol, 1·5 grms. ; quinol, 1·5 grms. ; anhydrous sodium sulphite, 200 grms. ; anhydrous sodium carbonate, 10 grms. ; potassium bromide, 2·5 grms. ; water, 1000 c.c. (4) Pyrogallol, 10 grms. ; anhydrous sodium sulphite, 25 grms. ; anhydrous sodium carbonate, 50 grms. ; potassium bromide (10 per cent. solution), 30 c.c. ; water, 1000 c.c. The diaminophenol developer is the only one which will produce negatives absolutely free from fog at 40°C., but when it is required to keep the developers in solution for considerable times, either of the others may be used, only very slight fog being produced by them (See also Bunel ; this J., 1910, 783).—T. F. B.

[*Photographic*] *reduction processes.* Lüppo-Cramer. Phot. Korr., 1910, 489, and Phot. Wochenbl., 1910, 441. Z. angew. Chem., 1911, 24, 316.

When a photographic negative is treated with a solution of chromic or nitric acid containing a chloride or bromide, the parts of the negative containing more silver are oxidised and dissolved more rapidly than they are converted into silver halide, whilst the parts containing less silver are more readily halogenated than oxidised. This is probably due to the fact that the colloid structure of the image is finer and the adsorptive power of the silver greater, the shorter the exposure of the silver bromide in the first place : hence, the more nearly the silver approaches the colloidal condition, the more readily will it combine with halogens. The denser silver of the highlights is much more resistant to halogens, because it has a smaller "specific surface." Similar results were obtained by replacing the chloride or bromide with potassium cyanide or thiocyanate, and the oxidising agents by quinone or permanganate. Farmer's ferricyanide reducer may be made to exhibit the properties associated with persulphate, if the negative is first treated with a solution of mercuric chloride, potassium thiocyanate, and gold chloride.—T.F.B.

[*Photographic*] *Reduction with persulphate.* E. Stenger and H. Heller. Z. wiss. Phot., **9**, 73. Z. angew. Chem., 1911, **24**, 316.

Solutions of ammonium persulphate in distilled water reduce the lights and the shadows of photographic images in the same ratio: it is only when the solutions contain a small quantity of a chloride that they act more strongly on the darker parts of the image. On the other hand, when the solutions contain more than 0·03 per cent. of sodium chloride, the relative reduction is only very slight. To obtain a strong relative reduction, a 2 per cent. solution of ammonium persulphate in distilled water, with the addition of 1·5—2·5 c.c. of a 1 p.c. sodium chloride solution to each 100 c.c., is recommended.—T. F. B.

Patents.

Photography in colours; Process of ——. A. J.-B. Tauleigne, Pontigny, and E. Mazo, Paris. Eng. Pat. 27,818, Nov. 29, 1909.

See Fr. Pat. 420,584 of 1909; this J., 1911, 308.—T.F.B.

Photographic emulsions; Sensitive ——. J. H. Smith, St. Thibault, France. Eng. Pat. 5154, March 1, 1910. Under Int. Conv., March 3, 1909.

See Fr. Pat. 413,222 of 1910; this J., 1910, 1135.—T.F.B.

Screens [*for photography*]; *Process for making coloured* —— *by means of celluloid sheets.* C. Späth. Fr. Pat. 421,119, Oct. 5, 1910. Under Int. Conv., Oct. 29, 1909.

See Eng. Pat. 23,138 of 1910; this J., 1911, 109.—T.F.B.

XXII.—EXPLOSIVES; MATCHES.

Gases caused by blasting in mines; Report on investigations into the composition of ——. E. A. Mann, Chief Inspector of Explosives for Western Australia.

The work of Cullen and Weiskopf is referred to (this J., 1909, 162, 1170). No carbon monoxide could be detected in nearly 50 per cent. of the samples of gas taken before blasting was carried out. The highest amount found was 0·1 per cent., and the average of the results, where gas was present, was 0·0046 per cent. Samples of gas were taken at the face immediately after blasting. Four different brands of blasting gelatin, gelatin dynamite and gelignite used in the West Australian mines were investigated, and, in addition, three different brands of explosives used in the South African mines. When using the first group of explosives, under ordinary conditions for "cut" and "easer" shots, the greatest depth from the surface at which blasting was carried out was 2500 ft., the least 200 ft. The greatest distance from the nearest air was 600 ft., and the least 90 ft. The largest weight of explosive used was 20 lb., the smallest 5¾ lb. The longest length of fuse employed was 60 ft., the shortest 12 ft. Detonators Nos. 7 and 8 were used: the smallest number being 2, the largest 10. The largest amount of carbon monoxide found in the gas was 0·652 per cent., the least 0·042 per cent. The largest amount of carbon dioxide was 7·83 per cent., the least 0·56 per cent. Nitrogen peroxide was found to be present in all cases; the smallest amount being 0·00002 per cent., the largest 0·025 per cent. These results differ considerably from those obtained in the South African mines by Cullen and Weiskopf, where the smallest percentage of carbon monoxide found was 0·195 per cent., and the largest 1·28 per cent. The average of the whole of the results for the three different types of the four brands of explosives was as follows with respect to the important point of the ratio of carbon monoxide to carbon dioxide in the gas. For the gelignites, the least satisfactory ratio was 1 to 9·5, and the most satisfactory 1 to 14·35. For the gelatin dynamites the ratios were 1 to 9·25 and 1 to 15, and for blasting gelatins 1 to 7 and 1 to 13·25 respectively. In some special cases, where electric firing was used and the paper wrapper enclosing the gelignite was taken off, the ratio of carbon monoxide to carbon dioxide attained the satisfactory figure of 1 to 52. In the case of the three South African gelignites, the least satisfactory ratio of carbon monoxide to carbon dioxide was 1 to 12·75, and the most satisfactory 1 to 39·7. For the South African blasting gelatins the corresponding figures were 1 to 6·5 and 1 to 15·5. In the samples of gas taken during shovelling out of the ground broken by the blast, only 0·007 per cent. at most, of carbon monoxide was found to be present. Analyses of all the explosives used showed that, excepting in the case of the blasting gelatins, the explosives were theoretically over-oxidised as regards conversion of the carbon to carbon dioxide and the hydrogen to water. If, however, the paper wrapper was taken into account a considerable number of the explosives were under-oxidised. The South African explosives contained sodium nitrate in the place of potassium nitrate present in the explosives in use in Western Australia. Objection is raised to the use of sodium nitrate on account of its hygroscopic character, and it is considered that, although theoretically the presence of moisture would not affect the total energy of the reaction, it would affect the amount of heat available for expansion, and hence diminish the initial explosive impulse. A further objection to the use of sodium nitrate is to be found in the greater difficulty experienced in procuring it free from impurities, and, in consequence, there would appear to be a greater tendency for degradation of the heat test in explosives containing this ingredient than in those containing potassium nitrate. Physical rather than chemical conditions are given as the reason why gelignites containing a large theoretical excess of oxygen should still produce incompletely oxidised gases on explosion. All the explosives investigated were found to differ very materially from each other in their physical appearance and structure. Reproductions are given of photographs of the various explosives by transmitted, reflected and polarised light, which bring out very well the differences referred to. The conclusions drawn from the investigation are as follows:—Carbon monoxide and nitric oxide are formed, in all instances, on the explosion of nitroglycerin compounds under working conditions: the former in considerable quantities, the latter in slight traces only. The chief reasons for the presence of these gases are, probably, the nature of the rock and the relation of "burden" to charge; the physical structure of the explosives, which does not permit of the attainment of their theoretical effects; the method of firing; and the influence of wrappers upon the products of explosion. To entirely prevent harmful effects, arising from the gases formed, the main reliance must be placed upon ventilation. The explosives in use in Western Australia compare very well with those used in South Africa and it is difficult to suggest, with certainty, any direction in which their character could be improved. Other gases, such as hydrogen sulphide and oxides of sulphur were sometimes present, after blasting in rock containing much sulphur. The special "anti-fume" compositions which have been suggested to reduce the fumes do not present sufficient advantages to justify their use in the Western Australian mines. The use of sodium nitrate instead of potassium nitrate as an ingredient of the explosives used did not present any advantage justifying alterations to the existing regulations implicitly excluding its use. The following recommendations are made:—A limit should be set as to the amount of carbon monoxide, and, if necessary, the nitrogen peroxide, which may be present in the air of a mine when a certain period has elapsed after blasting. The study of the use of electric firing involving the use of delayed action fuses for "timed" holes should be encouraged throughout the mines as providing greater safety to the miners and as a means of reducing the noxious gases.

The consideration of manufacturers should be invited to the results of the investigations with a view to testing the value of the suggestions put forward relating to the composition and physical structure of their explosives and to minimising the effect of the wrappers. Provision should be made for the further study of the problems involved by the establishment of Testing Stations of a similar nature to those in use in other countries.
—G. W. McD.

Patents.

Explosives. O. B. Carlson, Mansbo, Sweden. Eng. Pat. 5707, March 7, 1910.

The following examples are given :—Equal parts of dinitrotoluene and nitro-derivatives of resin. Dinitrotoluene (5 parts), azobenzene (5), nitro-derivatives of resin (5), and nitro-derivatives of flour (1 part). Ammonium perchlorate (4 parts) and nitro-derivatives (1 part). Potassium chlorate (7 parts) and combustible (2 parts). Potassium perchlorate (3 parts) and combustible (1 part).
—G. W. McD.

Smokeless powders ; Method for the manufacture of ——. C. Claessen. Second Addition, dated Sept. 29, 1910, to Fr. Pat. 410,239, Dec. 11, 1909 (this J., 1910, 842, 1229).

A gelatinised propellant explosive can be obtained, without the addition of solvents, by heating nitrocellulose containing, mixed with it, not more than 30 per cent. of nitroglycerin at a temperature of 90° C., under a pressure of 200 atmospheres.—G. W. McD.

Safety explosive ; Method of manufacture of a ——. M. A. G. Himalaya. Fr. Pat. 421,202, Sept. 15, 1910. Under Int. Conv., Sept. 29, 1909.

The following composition is given as an example :—The chlorates of the alkalis or alkaline earths (60—80 parts), starch, charcoal, etc. (10—25), oil (4—10), finely divided metals, such as magnesium, aluminium, etc., (2—10), and metallic oxides, such as oxides of iron, chromium, manganese, etc. (2—5 parts).—G. W. McD.

Safety explosive for fiery and dusty mines. Soc. Anon. d'Explosifs et de Prod. Chim. Fr. Pat. 421,497, Dec. 23, 1909.

Ammonium nitrate (93 or 95 parts) and tetranitromethylaniline (7 or 5 parts). It is stated that the *charge limite* of such mixtures can be raised to 175 grms. without igniting the explosive mixture used in a testing gallery, and that the temperatures developed on detonation are respectively 1350° C., and 1475° C.—G. W. McD.

Blasting explosive. Deutsche Präpositwerke Karlsruhe, Ges. m. b. H. Ger. Pat. 231,598, May 5, 1907.

Potassium nitrate, about 12 parts ; sulphur, 3 ; wood charcoal, 1 ; and powdered horse-dung, about 1 part.
—A. S.

Nitro-explosives ; Process and apparatus for increasing the density of fusible ——. C. E. Bichel. First Addition, dated Sept. 30, 1910, to Fr. Pat. 369,371, Aug. 30, 1906. Under Int. Conv., Jan. 24, 1910.

See Eng. Pat. 17,194 of 1910 ; this J., 1910, 1412.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Drying agents ; The efficiency of calcium bromide, zinc bromide and zinc chloride as ——. G. P. Baxter and R. D. Warren. J. Amer. Chem. Soc., 1911, 33, 340—344.

As sulphuric acid and phosphorus pentoxide react with hydrobromic acid, experiments were made to test the efficiency of the fused bromides of calcium and zinc as drying agents for this gas. About 8 litres of air were aspirated through a U-tube containing the bromide, and then through a weighed U-tube containing phosphorus pentoxide. The U-tube containing the bromide was kept at a constant temperature. The weight of water passed by the bromide was thus found, and the volume of air as measured by the aspirator having been corrected to standard conditions, the maximum pressure of water vapour over the bromide was calculated. The experiment was varied by passing air dried over phosphorus pentoxide, over bromide which had taken up moisture in a previous experiment. The aqueous vapour pressures found were as follows :—With calcium bromide at 0° C. 0·09 mm., at 25° C. 0·18 mm., at 50° C. 0·19 mm. ; with zinc bromide at 0° C. 0·28 mm., at 25° C. 1·16 mm., at 50° C. 6·34 mm. ; with zinc chloride at 25° C. 0·85 mm., at 50° C. 2·19 mm. The weights in grms. of residual water in 1 litre of a gas dried at 25° C. by the following drying agents are :—Calcium bromide, 0·0002 ; zinc bromide, 0·0011 ; zinc chloride, 0·0008 ; calcium chloride, 0·0021 ; sulphuric acid, 0·000003.—T. St.

Capillary analysis. I. Traube. Ber., 1911, **44**, 556—560.

Whilst many physical properties have been used for analytical purposes, capillarity has been almost completely neglected in this respect, although its determination is extremely simple, especially by the author's drop method. Salts and other substances possessing large attraction pressure ("*Haftdruck*") have little influence on the surface tension of water, but substances, such as alcohols, ethers, esters, ketones, etc., with small attraction pressure, reduce considerably the surface tension of water, and hence very small quantities of these latter substances can be determined in presence of salts, etc., in aqueous solution. This principle has been applied, for example, to the determination of fusel oil by means of the author's stalagmometer (see this J., 1888, 42). A further application of the drop method, with the aid of the stalagmometer, depends upon the fact that in many colloidal media (dyestuff solutions, lecithin or soap emulsions), the surface tension (size of drops) is frequently considerably altered by addition of "colloid poisons." Substances which act as colloid poisons are also blood poisons. With a solution of Night Blue, preferably containing dextrin, 1 part of the anions, I', $(CNS)'$ or $(ClO_4)'$ in about 400,000 parts of solution, and 1 part of mercuric chloride in 3,000,000 parts, can be detected by the drop method, and similarly, using a solution of Wool Violet, 1 part of cocaine, atropine, aconitine, etc., in 3,000,000 parts can be detected. Acid and basic dyestuffs can be distinguished by observing their effects on solutions of Night Blue and Wool Violet respectively. Very small quantities of iodions in presence of large quantities of chloride, bromide, and other ions can be determined, and iodine in ionic combination can be distinguished from that not in ionic combination in organic compounds. Quantitative determinations of "colloid-poisons" can be made by a method based on the action of substances which neutralise the effects of the poisons. For example on adding a solution containing an alkaloid to a solution of Wool Violet, the "drop-number" determined with the stalagmometer is increased, and then on adding tannin solution, drop by drop, it falls gradually to the original value, the quantity of tannin solution required being proportional to the amount of alkaloid added.—A. S.

Temperature measurements ; Optical ——. M. v. Pirani. Verh. Deutsch. Phys.-Ges., 1911, **13**, 19—25. Chem. Zentr., 1911, **1**, 865.

The author describes a simple process and apparatus by means of which the true temperature of a solid body can be determined. An electrically heated carbon tube has bored in its wall a small hole through which the interior can be viewed. A piece of the substance under examination is placed in a depression near the hole. The true temperature is then ascertained optically from the radiation of the interior of the carbon tube. (Compare this J., 1910, 339). By this method the absorptive power of the substance can be easily ascertained. For substances which may not be placed in contact with incandescent carbon, a modification of the method is described. The melting point of gold by this method was found to be 1060° C.—A. S.

Metals; Exact electrolytic method for determining ——. W. L. Perdue and G. A. Hulett. J. of Phys. Chem., 1911, **15**, 147—154.

It is pointed out that solid electro-deposited metals always contain inclusions and for accurate work it is advisable to use a mercury cathode in order to avoid this source of error. The chief difficulty in connection with a mercury cathode is the washing and drying, after completion of the electrolysis, this difficulty being due mainly to the fact that mercury does not "wet" the containing vessel, and so a film of electrolyte is allowed to get beneath the mercury. The authors have got over this difficulty by amalgamating the inside of the platinum containing vessel. The platinum is plated electrolytically from a mercury cyanide solution, or the vessel is filled with mercury and then heated nearly to the boiling point of the latter. The apparatus used for the actual determination is shown in Fig. 1. The mercury cathode is contained in a platinum cup, the inside of which has been amalgamated, so that the mercury "wets" it. In the upper part of this cup fits the end of the funnel, *f*, through the stem of which passes a glass tube carrying the platinum anode, which is a flat spiral. The funnel can be raised clear of the cup without disturbing the anode. Towards the end of the electrolysis the current is increased: this insures the complete separation of the metal and the agitation of the electrolyte causes spray to wash down the funnel and sides of the cup. When deposition is complete, the funnel is raised, and the electrolyte is pipetted off, whilst at the same time distilled water is run in, the current being continued. The water is afterwards pipetted off, the anode is removed, and the cup with the cathode and deposit is dried in a vacuum desiccator over calcium chloride. With this method very accurate results can be obtained. In the case of metals which readily yield solid amalgams, it is necessay to agitate the mercury cathode during the deposition, and this is effected by means of the apparatus shown in Fig. 2. The platinum crucible containing the cathode fits exactly into a brass cup on the upper end of a brass shaft, which works in a bronze socket fitted into a lead base as shown. The spiral anode is sealed in a small funnel and is so disposed that it is only a few mm. from the cathode when the crucible is at rest. With this apparatus the average error appears to be about 1 in 4000 as compared with 1 in 20,000 with the apparatus shown in Fig. 1, but it offers some advantages where great accuracy is not essential.—A. S.

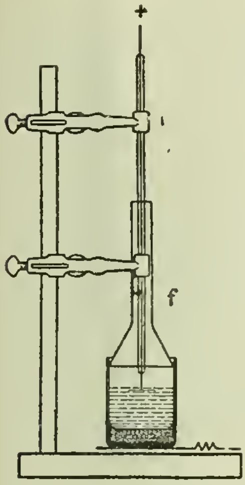


Fig. 1

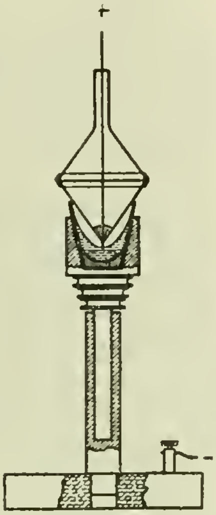


Fig. 2

Lead and copper; A new form of gauze electrode for the rapid electrolytic determination of ——. R. C. Benner. Met. and Chem. Eng., 1911, **9**, 141—144. (See this J., 1910, 698, 1110, 1274.)

Using light electrodes, 1·2 grms. in weight, and depositing small quantities of metal, Guess and Haultain have succeeded in obtaining complete deposition in from 1·5 to 3 hours, with stationary electrodes and a current of 1·5 amps. In order to combine the advantages of the cylindrical gauze electrode with this method, the author uses sand-blasted gauze electrodes. The cathode is in the form of a corrugated sheet, and the anode is a narrow rectangular sheet. Suitable wiring arrangements, and details of chemical manipulation for lead and copper ores are given.—T. St.

Bromine; Determination of ——, in the presence of chlorides and iodides. P. Clausmann. Bull. Soc. Chim., 1911, **9**, 188—192.

The method is founded on Carnot's modification of Dechan's method, and is applicable to the determination of very small quantities of bromides, such as are found in mineral waters, etc. The substance containing bromine, or the concentrated mineral water, is placed in a 200 c.c. flask with a long neck terminated by a narrow tube 15 cm. long; 0·5 grm. of chromic acid and 2—4 c.c. of sulphuric acid are added, and the volume of liquid is made up to about 100 c.c. The narrow tube is now bent at a right angle, drawn out at the end and sealed, and the flask heated for an hour in boiling salt water. It is now cooled, finally in ice, then the tube is passed into the inner tube of a condenser and a tight joint made by means of stout rubber tube, the lower end of the condenser-tube dipping (without any cork or rubber connexions) into slightly acidulated solution of potassium iodide. The drawn out end of the narrow tube is now broken against the condenser-tube, and the bromine is distilled off into the potassium iodide. After 50 c.c. have been distilled, the iodide is changed, to see that all the bromine has come over. The liberated iodine is then titrated with thiosulphate, or shaken out into successive 2 c.c. quantities of carbon bisulphide and estimated by colour-comparison. If iodides are present in the sample they must be separately determined, and the iodine corresponding to them deducted from the total iodine found, to give that corresponding to the bromides. Even in presence of large quantities of chlorides, three-quarters of the liquid may be distilled without any chromyl chloride coming over.—J. T. D.

Antimony; Detection and determination of small quantities of ——. P. Schidrowitz and H. A. Goldsbrough. Analyst, 1911, **36**, 101—103.

The method is adapted to the determination of minute quantities of antimony: one part of antimony in two million parts of solution gives a distinct colouration. In a colloidal solution small quantities of antimony sulphide are compared colourimetrically with solutions of known strength. 0·01 grm. of gum acacia in 10 c.c. of total liquid is sufficient to maintain 0·002 grm. of antimony sulphide in colloidal solution. The colour obtained by passing hydrogen sulphide through the hot solution is darker than that obtained with a similar cold solution. The cold process, however, is sufficiently delicate for quantities of about 0·02 mgrm. of antimony. The control solutions are made up with known quantities of tartar emetic in distilled water to a total bulk of 10 c.c., after adding 0·5 c.c. of strong hydrochloric acid and 0·1 c.c. of a 10 per cent. solution of gum acacia, and are then saturated with hydrogen sulphide. The intensity of colouration is directly proportional to the amount of antimony present. The above presupposes the absence of heavy metals of the second group. Organic matter also interferes. Arsenic and mercury form colloidal solutions under the conditions described for antimony. In other than clear aqueous media, the antimony is precipitated on copper (Reinsch's method) and the copper with the precipitated antimony warmed to about 70° C. for a few minutes with 5 c.c. of a 5 per cent. solution of potassium hydroxide, 10 c.c. of distilled water, and an excess of potassium permanganate. The solution is poured off from the copper, the latter washed with distilled water, and the solution boiled and filtered. In the filtrate the excess of permanganate is destroyed by means of tartaric acid. The solution is made up to a known volume, an aliquot part taken and made up to 10 c.c. with gum and hydrochloric acid as above, and saturated with hydrogen sulphide.

The amount of antimony thus detected varies between 70 per cent. and 80 per cent. of the actual total amount present. This, on such small quantities of antimony, is probably more accurate than any other known method.
—R. W. N.

Tungsten ; Volumetric method for the determination of ——. E. Knecht and E. Hibbert. Analyst, 1911, **36**, 96—98.

The tungstic acid or its salts are reduced with granulated zinc in a strong hydrochloric acid solution until a brown solution of the tetrachloride is obtained. This is reoxidised by means of a standard solution of iron alum, after adding potassium thiocyanate as an indicator. During the titration, which is carried out in an atmosphere of carbon dioxide, the brown colour changes to blue, which latter persists until the end-point is reached. This blue colour may serve as an indicator, in place of the thiocyanate. The titration can be carried out in presence of ferrous iron, which is not the case with Otto van der Pfordten's permanganate method (Ber. 1883, **17**, 508.) The decomposition of ferro-tungsten by means of potassium persulphate is recommended ; 4 grms. of persulphate to 0·1 grm. of the alloy are fused in a porcelain crucible, the melt taken up with water, rendered alkaline with sodium hydroxide and filtered. The tungsten is estimated in the filtrate, while the iron, remaining on the filter, can be redissolved and titrated in the usual manner.
—R. W. N.

Molybdenum ; Volumetric determination of ——. E. Knecht and F. W. Atack. Analyst, 1911, **36**, 98—100.

The molybdenum is reduced in a hydrochloric acid solution, a current of carbon dioxide being maintained. The progress of the reduction can be followed by colour changes: the solution becoming successively green, blue, orange, yellow, and pink. This latter tint shows the end of the reduction, and is best seen in presence of much hydrochloric acid. It is not seen if air is present. The reduced solution is titrated with a methylene blue solution, containing 4 grms. to the litre. and standardised as described by Knecht (this J., 1905, 154). The oxidation takes place in two stages : from $MoCl_3$ to $MoCl_4$ and from $MoCl_4$ to $MoCl_5$. The completion of the first stage is shown by the appearance of a pale-green tint, half-way through the titration, the final end-point being shown by the colour produced by one drop of methylene blue solution in excess. The reduction and titration are effected in an 8-oz. flask provided with a rubber stopper which is fitted with a tube for the passsage of carbon dioxide, the adapter for the burette, and a Bunsen valve through which passes a platinum wire to which is attached a zinc rod. The reduction is effected by means of granulated zinc, and the zinc rod is then plunged into the liquid for a short time to ensure perfect reduction. It is then raised from the solution and washed down with water through the Bunsen valve. The titration is then immediately proceeded with. The reduction and titration should not require more than fifteen minutes unless ferric iron is present. Provided that all the iron is in, or is reduced to, the ferrous state, it does not interfere with the method. It should be noted that the lower oxides of titanium, tungsten, chromium, and vanadium exert a reducing action on methylene blue, and might therefore interfere.—R. W. N.

Phosphorus ; Volumetric determination of —— in small amounts. L. T. Bowser. Amer. Chem. J., 1911, **45**, 230–237. (See also this J., 1894, 176, 667 ; 1895, 511 ; 1896, 381 ; 1909, 1067, 1105.)

Very satisfactory results were obtained with the molybdate method as follows :—The solution obtained in the usual manner is diluted to at least 20 c.c., 0·5 grm. of ammonium nitrate added and then about 1·5 c.c. of the molybdate reagent for each mgrm. of phosphorus pentoxide (or 1 c.c. for quantities less than 0·8 mgrm. Precipitation should be effected at 55° C., the mixture kept for an hour at that temperature and then for 2 hours at the ordinary temperature. The precipitate is filtered off, washed with the usual potassium nitrate solution and titrated with $N/50$ alkali hydroxide. Silicic acid did not appreciably influence the results (see also this J., 1901, 751).—A. Sbld.

Silicates ; Microchemical examination of ——. R. Canaval. Z. prakt. Geol., 1910, **18**, 460–461. Chem. Zentr., 1911, **1**, 756.

In the examination of a decomposed green schist it was deemed necessary to supplement the microscopical examination by chemical tests for alkalis and titanium oxide, and for the preliminary treatment, fusion with pure lead oxide was adopted. 0·3 grm. of the finely-powdered mineral was rubbed in an agate mortar with about an equal volume of lead oxide, and the mixture fused to a bead by placing it, a portion at a time, in an aluminium spoon heated in a blue blowpipe flame. The bead was powdered and evaporated with nitric acid, and the residue was treated with very dilute nitric acid and exposed overnight to ammonium sulphide vapours. After filtering, the solution was evaporated and the residue ignited and dissolved in water acidified with hydrochloric acid. The solution, almost free from lead, gave a distinct reaction for potassium with platinum chloride and for sodium with uranium acetate ; calcium and magnesium could also be detected. For the detection of titanium oxide, the precipitate produced with ammonium sulphide was fused with potassium bisulphate, the fusion was extracted with cold water, and the filtered solution boiled for a long time, the water lost by evaporation being replaced. The precipitated titanium oxide was filtered off and tested by means of a bead of microcosmic salt containing ferric oxide. Litharge, red lead, and white lead cannot be used in place of pure lead oxide because of their impurities, but lead carbonate prepared by the action of carbon dioxide on finely-granulated assay lead may be employed. In the case of silicates which do not fuse readily with lead oxide alone, quartz powder may be added ; whilst if alumina be present, a layer of graphite is first placed in the aluminium spoon.—A. S.

Organic compounds ; Action of potassium permanganate on ——. J. Hetper. Anz. Akad. Wiss. Krakau, 1910, A, 601–605. Chem. Zentr., 1911, **1**, 927.

The author has studied the action of potassium permanganate in acid solution on different classes of organic compounds, a solution of the substance in 27 c.c. of water being heated for 1½ hours at 92°–93° C. with 25 c.c. of $N/5$ permanganate solution containing 20 grms. of crystallised phosphoric acid per litre : the hot solution is then treated with 25 c.c. of $N/5$ oxalic acid solution containing 50 grms. of concentrated sulphuric acid per litre, and the excess of oxalic acid titrated with $N/5$ permanganate. The nature of the reaction depends upon the constitution of the organic compound and the method may be used for the detection of definite groups in the molecule. The following conclusions have been drawn from the results of experiments. (1) All hydroxyl compounds and all those which are soluble in water, alkali solutions, and phosphoric acid, and do not contain the groups mentioned under (2), (3), and (4), are completely oxidised. (2) Compounds containing a group of the type, $CH_3{\cdot}C\vdots$, are not completely oxidised, since this group is converted into the corresponding acid, *e.g.*, $CH_3{\cdot}C\vdots$ into acetic acid, which suffers no further change. (3) Compounds containing the methyl group are oxidised with difficulty, the more so the nearer the methyl group is to a carboxyl group or to a group yielding carboxyl on oxidation. The greater the distance between the methyl and carboxyl groups, the more readily the latter is split off and oxidised to carbon dioxide, the adjacent carbon atom being oxidised to a carboxyl group, and a lower homologous acid thus formed. Acetic acid is the most resistant compound of this type ; butyric acid is oxidised to propionic acid more readily than propionic to acetic acid. Compounds containing other radicals, such as phenyl, instead of methyl, together with a carboxyl group, appear to behave in a similar manner. (4) Dicarboxylic acids are not oxidised except when the two carboxyl groups are directly united (oxalic acid) or united to the same carbon atom (malonic acid). (5) Acid and basic groups of an inorganic character are converted into the corresponding acids or bases, for example the sulphonic group into sulphuric acid, the nitro group into nitric acid, the amino group into ammonia, etc.—A. S.

Kjeldahl's process; Note on ——. V. Edwards and D. Chads. Chem. News, 1911, **103**, 138.

By using granulated tin instead of the granulated zinc commonly employed to prevent "bumping," it is stated that "frothing" also is considerably reduced.—A. S.

Highly coloured holo- and meri-quinonoid imonium salts of benzidine and their use for the analytical estimation of the value of oxidising agents. W. Madelung. Ber., 1911, **44**, 626—631.

When oxidising agents act on benzidine the first product is, according to the author, the *meri*-quinonoid imonium salt; with further addition of the oxidising agent the *holo*-quinonoid salt is obtained and with still more the quinonoid di-imide is formed. These compounds are decomposed by hydrochloric acid with the formation of benzidine and the dichloroimide. The value or oxidising power of an oxidising agent may thus be determined by allowing it to act on benzidine in neutral aqueous solution, filtering off the resulting blue substance and decomposing it with hydrochloric acid, adding potassium iodide and finally titrating the separated iodine with thiosulphate and starch. The end result is the same as if the oxidising agent had acted directly on the hydriodic acid.—J. C. C.

Determining acid value of oils and fats, especially mineral lubricating oils. Loebell. *See* IIa.

Determination of free carbon in tar. Ceruti. *See* III.

Determination of indigotin in presence of starch. Thomson. *See* IV.

Microscopic test for resin in sulphite wood pulp. Klemm. *See* V.

Determining precious metals in ores rich in copper. Loevy. *See* X.

Examination of raw rubber. Fendler. *See* XIV.

Determination of caoutchouc as tetrabromide. Spence and others. *See* XIV.

Tests for the purity of chestnut oak bark extracts. Small. *See* XV.

Determination of reducing sugars. Benedict. *See* XVII.

Detection of watering of milk. Ledent. *See* XIXa.

New constant in the analysis of pepper. Arragon. *See* XIXa.

Phenolsulphonic acid method for the determination of nitrates in water. Chamot and others. *See* XIXb.

Assay processes of the Fifth German Pharmacopœia. *See* XX.

Determination of glycyrrhizin and sugars in liquorice powder and extract. Eriksson. *See* XX.

Patents.

Colour values; Method of and appliances for indicating or testing ——. C. E. Towell and J. Heywood, Ltd., Manchester. Eng. Pat. 3551, Feb. 14, 1910.

The apparatus consists of a disc or drum which may be rotated at a high rate of speed. This disc or drum is covered with the fabric which is to be printed or dyed, and the fabric is coated or painted with the colours which are to be used; definite areas of the fabric on the disc or drum may be coated with the different colours. When the disc or drum is rotated, the colours blend and indicate the shade which will be obtained on the fabric when this is dyed with the mixed colours in the proportions used in the test. A travelling band, or other moving surface, may be employed in place of the disc or drum.—W. P. S.

Specific gravity of fluids and liquids; Apparatus for ascertaining the ——. C. B. Savory, Fleet, Hants. Eng. Pat. 19,564, Aug. 20, 1910.

The apparatus, which is portable and easily packed up, consists of a standard on a base plate provided with levelling screws, and having at the top a plate on which a balance beam is supported. One end of the beam has upper and lower graduated arms supported on the flat plate by a knife edge attached to the upper arm. A counterpoise slides on the upper arm and a rider on the lower arm. A spirit level attached to the lower arm serves instead of a pointer. The other end of the beam carries a knife edge upon which a hook is supported by a grooved plate which forms a bearing for the knife edge. A cylindrical pyknometer is attached to this end of the beam.—G. W. McD.

Carbon dioxide in combustion gases of furnace flues and the like; Apparatus for automatically indicating and recording the percentage of ——. E. P. Ward, Bradford. Eng. Pat. 21,835, Sept. 20, 1910. Addition to Eng. Pat. 23,846, Oct. 18, 1909 (this J., 1910, 1241).

The vessel comprising the gas measuring chamber and motor described in Eng. Pat. 23,846 of 1909 (*loc. cit.*) is divided by two transverse partitions into three separate superposed compartments, the central one of which forms the gas measuring chamber; the inlet and outlet pipes of the chamber are replaced by a single pipe connected with a multiple-way cock and this pipe serves for the inlet of the gas to the measuring chamber and for the outlet of the gas therefrom through suitable passages in the multiple-way cock. The measuring chamber is provided with a pipe reaching nearly to the bottom of the lower compartment and the bottom of the upper compartment is connected by a pipe with the top of the lower compartment. The bucket depending from the lever arm connected with the multiple-way cock, and into which the siphon emptying the tall cylindrical vessel discharges, is arranged in a water tank and acts alternately as a float and a weight, so that a slow movement of the cock is obtained.—W. P. S.

Trade Report.

The Patents Act, 1907. Times, March 23, 1911.

Section 27 of the Patents and Designs Act, 1907—the "compulsory working clause"—continues its steadily favourable effect upon the number, variety, and prosperity of industrial undertakings in this country. In the first two years of the working of this section, according to the report of the Comptroller-General, there were 73 applications to revoke the patents of foreign patentees who, it was alleged, were manufacturing the patented article or carrying on the patented process exclusively or mainly outside the United Kingdom. The Comptroller-General was satisfied in 56 instances that the patent had been adequately worked in this country within the meaning of the Act. In 17 instances, however, the patent was revoked. Down to date the number of applications for revocation under the section has been increased to 76, and the actual number of patents revoked to 21. Some 50 firms have commenced or are about to commence work under the Act, and the new factories involved a total outlay of some £800,000. It is hoped that employment will, in this connection, be found for 7000 additional men and that the wages paid to them will total something like £8000 per week. Among the new industries are metallic filament electric lamps, cinematograph films, aniline dyes, mercerised cotton, foods and medicines, oxygen, clay glaze; the foreign firms principally represented are German and American. In far larger proportion, licences and royalties permitting British firms to manufacture the patented articles and carry on the patented processes of foreign firms have been granted. There is good reason for believing that this will increasingly represent the material results of Section 27.

Protection of inventions and designs in British India. Board of Trade J., March 16, 1911.

The "Gazette of India" of 28th January publishes the report of the Select Committee on the Bill to amend the law relating to the protection of Inventions and Designs, and the text of the Bill as amended by the Committee. Among other amendments the Committee have inserted a clause (23) providing under certain conditions for the revocation of patents worked exclusively or mainly outside British India, on the application of a person who is prepared, and is in a position, to manufacture or carry on the patented article or process in British India, if the patentee refuses to grant a licence on reasonable terms. It is provided that the Act shall come into force on January 1st, 1912.

Ceylon; Exports from —— in 1909 *and* 1910. Board of Trade J., March 23, 1911.

The report of the Ceylon Chamber of Commerce for the half year ended 31st December, 1910, contains the following statistics of the exports of certain Ceylon produce from Colombo and Galle during the years 1909 and 1910:—

Articles.		1909.	1910.
Rubber	lb.	1,492,580	3,586,854
Cardamoms	„	824,008	639,007
Cinnamon quills	„	3,509,506	3,283,202
Cinnamon chips	„	2,941,578	3,022,858
Cocoanut oil	cwt.	581,478	616,377
Copra	„	772,032	766,906
Plumbago	„	627,737	630,569
Citronella oil	lb.	1,573,932	1,762,919

The estimated quantity of rubber to be shipped in 1911 amounts to 5,000,000 lb.

Chemical industries of Norway in 1910. Chem.-Zeit., 1911, 35, 284—285.

The factory at Notodden for the production of Norwegian saltpetre (calcium nitrate) had an output during 1910 of about 20,000 tons, of which all but about 2000 was exported, the demand being greater than the supply. Nitrites and nitric acid were also produced. The harnessing of the Rjuban waterfall (with a h.p. of 125,000) approaches completion, and this source of power will be utilised during the coming summer in the saltpetre industry. Of the five existing carbide works, one in Trondheim intends to discontinue the manufacture of carbide, and to devote itself to the electric refining of metals, whilst the calcium carbide works in Hardanger also produce calcium cyanamide. For several years past metallic sodium has been produced in the electrolytic works at Vadheim in Sogn. With regard to the electro-iron industry, a commission appointed by the Norwegian Government has reported that although iron ore cannot be obtained more cheaply in Norway than in many foreign countries, this drawback is more than outweighed by the abundant supply of cheap water power. The total amount of capital invested in electric iron and steel works (see this J., 1911, 31, 290) is about 4½ million kr. (£248,000) and is, for the most part, in Norwegian hands. About 100,000 tons of pig-iron, mainly derived from outside, were consumed in Norway during the past year. The largest iron ore deposits in Norway are situated in the North and are estimated to amount to 124 million tons. The total production of iron ore rose from about 31,000 tons in 1909 to about 75,000 tons in 1910. An experiment upon a large scale has been made in the works of the Dunderland Iron Co. in Ranen with Ullrich's method of magnetic separation, and the results have proved very favourable. Two large works in Sydvaranger and Salangen for the magnetic separation of iron ore have been completed. Metallic copper was produced at Röraas (650 tons of refined copper) and at Sulitjelma (1100 tons of Bessemer copper), whilst at the Elmore works there was an output of 8000 tons of concentrate containing an average of 7·3 per cent. of copper. These works are to be enlarged and will, it is anticipated, be able to produce about 2500 tons per annum. The remaining Norwegian copper mines produced about 1800 tons of metallic copper and about 346,000 tons of ore, together worth about 8¾ million kr. (£482,000). Of the ore about 305,000 tons were exported, and the remainder used in the Norwegian sulphuric acid and sulphite cellulose works. The State silver works at Königsberg produced during the year 1909—1910 about 7200 kr. (£400) of pure silver, whilst in May, 1910, a private company began to work the silver deposit at Vinoren. The output of the nickel mine at Evje in Sötersdal increased from 6600 tons of ore in 1909 to 15,389 tons in 1910, and a production of 25,000 to 30,000 tons is anticipated during the current year. The newly erected furnaces of the Christiansand Nickelraffinierungswerk are able to deal daily with 100 to 125 tons of ore. Since Nov. 1st, 1910, they have produced daily ½ ton of nickel (99·5 per cent. of Ni), and during the current year this output will be doubled. Zinc blende is produced by several companies at Grua in Hadeland and in Hakedal, whilst metallic zinc is produced by an electric method at Hafslund. Large deposits of bismuth ore have been discovered at Kjonnerüd and will shortly be exploited, whilst 136 tons of arsenic ore containing 32 per cent. of arsenic were produced at Kviteseid. About 400 tons of superphosphate were made at the two older works at Lysaker and Stavanger, whilst considerable quantities of fish guano, prepared from the refuse of the fisheries and the canning industry, were exported and fetched a good price. The amount of cellulose products made was in excess of the demand. The price of sulphite cellulose was unprecedentedly low, and inferior kinds were sometimes unsaleable. At the close of the year the conditions for the sale of sulphate cellulose were somewhat more favourable. The selling price of mechanical wood pulp, which at the close of 1909 had fallen to about 36 kr. (£1 19s. 6d.) (f.o.b.), declined still further in 1910, and in August reached 25 kr. (£1 17s. 6d.). Subsequently it rose again to 30·5 to 31 kr. (£1 13s. 6d. to £1 14s.), but in most of the works this was not sufficient to cover the cost of production. Recently attempts have been made, and apparently with good results, to obtain cheaper wood from Finland and Russia. The output of Norwegian matches was about 63,000 cases containing about 50 gross (about 100 kilos. net.), which was an increase of about 1000 cases on the previous year. About a sixth of this quantity was consumed at home, and the remainder exported. The consumption of Norwegian matches in Germany has been greatly restricted by the tax on matches.
—C. A. M.

Books Received.

The Manufacture of Sulphuric Acid and Alkali, with the Collateral Branches. A Theoretical and Practical Treatise. By George Lunge, Ph.D., Professor Emeritus of Technical Chemistry in the Federal Polytechnicum, Zürich, etc. Third Edition. Vol. III. Ammonia-Soda, Various Processes of Alkali-making and the Chlorine Industry. Gurney and Jackson, Paternoster Row, London, E.C. 1911. Price 30s. net.

8vo volume, containing 744 pages of subject matter, and combined alphabetical index of subjects and authors. The text is illustrated with 184 engravings, and there is a statistical appendix of eight pages. The extent of the work may be gathered from the following scheme of arrangement of the text: I. The Ammonia-Soda Process. (i), Historical and general. (ii), The ammonia solution of salt. (iii), Production of carbonic acid for the ammonia-soda process. (iv), Precipitation of sodium bicarbonate by the bicarbonating process. (v), Filtering, drying, and calcining the bicarbonate. (vi), Recovery of the ammonia. (vii), Combination of the apparatus. Final products. Costs. Statistics. (viii), Other forms of the ammonia-soda process. (ix), Manufacture of commercial bicarbonate by the ammonia-soda process. II. VARIOUS PROCESSSES OF THE ALKALI MANUFACTURE. Introductory. (x), Manufacture of soda from cryolite. (xi), Soda directly from sodium chloride. (xii), Soda from sodium sulphate without previous reduction to sulphide. (xiii), Soda from sodium sulphate after reduction to sulphide. (xiv), Soda from nitrate of soda and felspar. III. THE CHLORINE INDUSTRY. (xv), General notes on chlorine. (xvi), Manufacture of chlorine by manganese ore. (xvii), Utilisation of still-liquor. Original Weldon process. (xviii), Deacon process. (xix), Other processes for the manufacture of chlorine. (xx), Properties and behaviour of the hypochlorites and of bleaching-powder. (xxi), Manufacture of bleaching-powder. (xxii), Bleaching liquids and other bleaching compounds. (xxiii), The chlorates.

LITERATUR DER SULFITABLAUGE. Von Dr. MAX MÜLLER. [Bd. 4 der Schriften des Vereins der Zellstoff- und Papier-Chemiker.] Verlag der Papier-Zeitung, Carl Hofmann. Berlin, S.W. 11. 1911. Price M. 6.

THIS is practically a bibliography of the subject, inclusive of patents, together with a classified history of its development, and of processes hitherto proposed for the utilisation or disposal of sulphite-cellulose spent liquors. The work contains 114 pages of subject-matter.

*New Books.

Baskerville, C. : *ed.* Municipal chemistry ; a series of thirty lectures by experts on the application of the principles of chemistry to the city, delivered at the College of the City of New York, 1910. N.Y., McGraw-Hill. 1911. 9+526 p. il. 8°. $5.

Beadle, Clayton, and *Stevens*, H. P. : Rubber, Production and Utilization of the Raw Product. (Pitman's Common Commodities of Commerce.) Illustrated. Cr. 8vo, pp. x.—132. I. Pitman. London. 1911. net 1s. 6d.

Blücher, H. : Auskunftsbuch f. die chemische Industrie. 7. Aufl. 1910—11. (XV, 1362 u. 37 S.) gr. 8°. Berlin, F. Siemenroth. 1911. Cloth M. 15.

Bowles, O. : Tables for the Determination of Common Rocks. 18mo, limp. Spon. London. 1911. Net 2s.

Brehier, E. : Traité pratique de la chaudronnerie industrielle en cuivre et en fer. Outillage, tracés et coupes, construction des appareils industriels, fig. et pl. in-8°. Geisler, Paris. 1911. 10 fr.

Calmette, Dr. A., E. *Rolants*, E. *Boullanger* et F. *Constant* : Recherches sur l'épuration biologique et chimique des eaux d'égout effectuées à l'Institut Pasteur de Lille et à la station expérimentale de la Madeleine. T. VI. 32 fig. 34 graph., 2 pl., in-8°. Paris, Masson et Cie. 6 fr.

Carnot, A. : Traité d'analyse des substances minérales. T. III. Métaux (1re partie) fig., in-8°. Paris, Dunod et Pinat. Br., 27 fr. 50 ; cart. 29 fr.

Chaplet, A. et A. *Rousset :* Blanchissage et nettoyage, 30 fig., in-8°. Paris, Gauthier-Villars. 1911. Br., 2 fr. 50 ; cart. 3 fr.

Chaplet, A. : Le blanchiment. Chimie et technologie des procédés industriels de blanchiment, 10 fig., in-8°. Paris, Gauthier-Villars. 1911. Br., 2 fr. 50 ; cart. 3 fr.

Clerc, L. P. : Guide complet de manipulations chimiques (2e et 3e parties) fig., in-8°, L. Goisler, Paris. 1911. 50. fr.

Don, J. and J. *Chisholm* : Modern Methods of Water Purification. 8vo. pp. 384. E. Arnold. London. 1911. Net 15s.

Donkin, Bryan : A Text-Book on Gas, Oil, and Air Engines. 5th Edition, Revised and Enlarged. 8vo, pp. 664. C. Griffin, London. 1911. Net 25s.

Eder, Dr. J. M. : Ausführliches Handbuch der Photographie. Mit üb. 2000 Abbildgn. u. zahlreichen Taf. I. Bd., 4. Tl. Die Photograph. Objektive. 3. gänzlich umgearb. u. verm. Aufl. (VII, 329 S. m. 272 Abbildgn.) gr. 8°. Halle, W. Knapp. 1911. M. 12 ; cloth M. 13.50.

Farrington, E. H., and *Woll*, F. W. : Testing milk and its products. 20th rev. and enl. ed. Madison, Wis., Mendota Bk. 1911. 6+297 p. il. tabs. $1.25.

Fremont, Ch. : La fatigue des métaux et les nouvelles méthodes d'essais pour tuyaux en acier, acier pour rivets, soudure, fils d'acier, 52 fig., in-8°. Paris, H. Dunod et E. Pinat. 1911. 1 fr.

Fritsch, J. : Fabrication du ciment. Chaux hydraulique, ciment de grappiers, ciment de Portland, ciment laitier, ciment de Portland de fer, ciments pouzzolaniques, manutention et transbordement économiques, analyse et contrôle chimique, 202 fig., 5 pl., in-8°. Paris, H. Desforges. 1911. 25 fr.

Gardner, H., and *Schaeffer*, J. : The analysis of paints and painting materials. N.Y., McGraw-Hill. 1911. c. 1910. 9+100 p. il. tabs., 8°. $1.50.

Gianformaggio, F. : Manuale pratico di vinificazione, con appendice riguardante la fabbricazione die vini Marsala, Moscato, Malvasia, Vermouth. Catania, 16° fig., p. xvi, 386. Milano. 1911. L.4.

Greco, A. : Elementi di metallurgia. I : Siderurgia. 32° fig., pagine 202. Livorno. 1911. L.1.50.

Grünwald, Dr. J. : Abhandlungen aus der Eisenemaille- u. Verzinnungstechnik. Gesammelte technologisch-histor. Arbeiten. (226 S.) gr. 8°. Leipzig, F. Stoll, jr. 1910. Cloth M. 4.

Haddan, R. : The Inventors' Adviser and Manufacturers' Handbook to Patents, Designs and Trade Marks. 8th Edition. Cr. 8vo, pp. 484. Harrison, London. 1911. 5s.

Hohorst, Dr. C. v. : Laboratoriumsbuch f. die anorganische Grossindustrie. Nebst e. Kapitel : Kunstdüngerindustrie v. M. Rosenberg. (VIII, 119 S. m. Abbildgn.) 1910. gr. 8°. Halle, W. Knapp. M. 5.60.

Holleman, A.-F. : Traité de chimie organique. trad. par Marcel Bernheim, préf. de A. Haller, fig., in-8°. Paris, L. Geisler. 1911. 16 fr.

Hornby, J. : A Text-Book of Gas Manufacture for Students. 6th Edition, Revised and Enlarged. 8vo, pp. 436. Bell, London. 1911. Net 7s. 6d.

Jochum, Dr. P. : Der Drehrohrofen als modernster Brennapparat. (70 S. m. 19 [4 farb.] Taf.) Lex. 8°. Braunschweig, F. Vieweg und Sohn. 1911. Cloth M. 6.

Jouaust, R. : Le ferro-magnétisme. Applications industrielles. 55 fig. in-18, cart. Paris, P. Doin. 1911. 5 fr.

Kipping, F. S., and *Perkin*, W. H. : Inorganic Chemistry. Part 2. Cr. 8vo, pp. 448. London, Chambers. 1911. 4s.

Kirchner, Prof. E.,: Das Papier. III. Tl. Die Halbstofflehre der Papierindustrie. Abschn. D. Die Lumpen- od. Hadern-Hablstoff-Fabrikation m. 104 Illustr. od. etwa 180 Einzeldarstellgn. Abschn. E. Altpapier, Papier-Abschnitte u. Ausschuss m. 32 Illustr. od. 55 Einzeldarstellgn. Hrsg. vom Verleger des Güntter-Staib'schen Wochenblattes f. Papier-fabrikation in Biberach a. d. Riss. Vollendet 1910. (VIII, VIII, 210 u. 55 S.) Lex. 8°. Biberach, (Dorn). 1910. Cloth M. 8.50.

Kohn Abrest, E. : Recherches sur l'aluminium, fig. in-8°. Paris, Ch. Béranger. 1911. 6 fr.

Kraus, E. H. : Descriptive mineralogy ; with especial reference to the occurrences and uses of minerals. Ann Arbor, Mich. G. Wahr, 1911. 8+334 p. diagrs. 8°. $2.75.

Lambling, E. : Précis de biochimie in-8° cart. Paris, Masson et Cie. 1911. 8 fr.

Lenard, P., u. C. *Ramsauer :* Ueber die Wirkungen sehr kurzwelligen ultra-violetten Lichtes auf Gas u. üb. e. sehr. reiche Quelle dieses Lichtes. III. Tl.

Uber Bild. grosser Elektrizitätsträger. (Aus dem radiolog. Institut der Universität Heidelberg.) (31 S. m. 8 Abbildgn.) gr. 8°. Heidelberg, Carl Winter. 1910. M. 1.50.

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Macfarlane, W.: A Practical Guide to Iron and Steel Works Analyses. Cr. 8vo, pp. 196. London, Longmans. 1911. 4s.

Marshall, W. J., and *Sankey*, H. R.: Gas Engines. 8vo, pp. 294. London, Constable. 1911. Net 6s.

Mast, S. O.: Light, and the Behaviour of Organisms. 8vo. Chapman and Hall, London. 1911. Net 10s. 6d.

Mathews, E. B., and *Grasty*, J. S.: The limestones of Maryland; with special reference to their use in the manufacture of lime and cement. Balt., Johns Hopkins Press. 1910. [1911.] 12+227-484 p. il. pl. (fold. map in pocket) diagrs., 4°, pap. $2.

Ostwald, Wilh.: Ueber Katalyse. Rede, geh. bei Empfang des Nobelpreises f. Chemie. 2. Aufl. (39 S.) 8°. Leipzig, Akadem. Verlagsgesellschaft. 1911. M. 1.50.

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Paracelsus, Philippus Aureolus, [Theophrastus Bombastus von Hohenheim.]: The Hermetic and alchemical writings of Aureolus Philippus Theophrastus Bombast, of Hohenheim, called Paracelsus the Great, now for the first time faithfully and accurately translated into English; the present American, Oriental, Egyptian and Asiatic ed. prepared for publication under the editorship of L. W. de Laurence; faithfully reproduced from the London ed. of 1894, which was ed., with a biographical preface, elucidatory notes, and a copious Hermetic vocabulary and accurate index, by Arth. E. Waite. Limited ed. In 2 v. Chic., De Laurence, Scott and Co. 1910, [1911]. c. pors. 4°. $12.

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75. Bd. *Schmidt*, Hans: Das Photographieren m. Blitzlicht. (VII, 132 S. m. 55 Abbildgn. u. 9 Taf.) 1910. M. 3.60.

Schifferer, Dr. Ant.: Praktische Mälzerei- u. Brauerei-Betriebskontrolle. I. Mälzerei- u. brautechnischer Teil. 2. verm. u. verb. Aufl., bearb. v. Alfons Forster. (XIII, 405 S. m. 109 Abbildgn. u. 1 Taf.) 1911. 8°. München. R. Oldenbourg. Cloth M. 12.

Schlötter, M.: Galvanostegie. 2. Tl. Uber besondere Einrichtgn. zum Plattieren. (X, 191 S. m. 157 Fig.) 1911. gr. 8°. Halle, W. Knapp. M. 9.60.

Schröder, J. von: Metodo semplice per un apprezzamento dei materiali concianti. Avviamento pratico all'analisi ed al dosamento tannico dei materiali da concia con l'aiuto de un areometro. Con appendice di W. Appelius. Traduzione di Camillo Coda. Torino, 16° fig., p. 72. 1911. L. 2.50.

Scott, W. W.: Qualitative chemical analysis; a laboratory guide. N. Y., Van Nostrand. 1910, [1911]. c. 11+165 p. il. pls. 8°. $1.50.

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Vocabolario tecnico illustrato nelle sei lingue: italiana, francese, tedesca, inglese, spagnuola, russa, sistema Deinhardt-Schlomann, diviso in volumi per ogni singolo ramo della tecnica industriale, compilato da ingegneri specialisti. Vol. IX: Macchine utensili; lavorazione dei metalli e del legno. Milano, 16° fig., p. x, 706. (Man. Hoepli.) 1911. L. 12.50.

Wiley, H. W., M.D.: Foods and their adulteration; the origin, manufacture, and composition of food products; infants' and invalids' foods; detection of common adulterations, and food standards; with 11 coloured plates and 87 other illustrations. 2nd ed., rev. Phil., Blakiston, 1911. 12+641 p. 8°. $4.

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*Dissertations.

[Prices vary, ranging from two to three shillings.]

Achenbach, F.: Studium der Einwirkung von Anilin, Ammoniak und Hydroxylamin auf einige Derivate des Anthrachinons. Giessen. 1910. 63 S. 8°.

Apitz, R.: Untersuchungen über Abkömmlinge des Cumaranons u. des Oxythionaphtens. Greifswald. 1910. 60 S. 8°.

Behrens, O.: Ueber die Einwirkung von Natriumhypochlorit auf imidenthaltende Stoffe. Kiel. 1910. 42 S. 8°.

Benthaus, W.: Ueber braunes amorphes Silicium. Göttingen. 1910. 74 S. 8°.

Berg, D.: Versuche mit drei neuen Morphinderivaten. Rostock. 1910. 44 S. 8°.

Boessler, W.: Zur Kenntnis der Harmala-Alkaloïde. Erlangen. 1910. 39 S. 8°.

Böttger, F.: Zur Kenntnis der Cyanine der Naphthalinreihe und zur Konstitution des Aethylrots. Jena. 1910. 27 S. 8°.

Bube, H.: Ueber Magnesiumammoniumphosphat. Leipzig. 1910. 72 S. u. 6 Taf. 8°.

Bucher, W.: Untersuchung über die Verbrennung methanhaltiger Gasgemische. Dresden. 1910. 50 S. m. 20 Fig. Gr. 8°.

Degórski, J.: Beiträge zur Kenntnis des Cumarons und einiger seiner Derivate. Rostock. 1910. 33 S. 8°.

Dippel, E.: Abhängigkeit der spezifischen Wärme gewisser Legierungen von der thermischen Vorgeschichte und ihr Zusammenhang mit den magnetischen Eigenschaften bei Heuslerschen Legierungen. Marburg. 1910. 44 S. u. 4 Fig. 8°.

Dranzburg, W.: Ueber die Produkte der Einwirkung von Salpetersäure auf Dihydroanethol. Berlin. 1910. 44 S. 8°.

Egger, F.: Ueber die Vergärung der Ameisensäure in künstlichen Nährböden bei Gegenwart verschiedener Zuckerarten und Aminosäuren. Heidelberg. 1910. 179. S. 8°.

Engelhardt, P.: Eine neue massanalytische Bestimmungsmethode des Arsens. Giessen. 1910. 32 S. 8°.

Eschmann, M.: Ueber Bildung und Zersetzung von Calciumcyanamid. Karlsruhe. 1910. 83 S. m. 16 Fig. 8°.

Falcke, F.: Die Widerstandsänderungen sehr dünner, stromdurchflossener Drähte im Vakuum und ihre Beziehung zur Empfindlichkeit einiger Thermoindikatoren. (Mitteilungen der physikal. Versuchs-Station Halle-Cröllwitz No. 23). Halle. 1910. 20 S. u. 15 Fig. 4°.

Fellmann, M.: Die Kondensation von Benzilsäure mit Salicylaldehyd. Abspaltung von Kohlenoxyd aus Aldehyden. Freiburg. 1910. 69 S. 8°.

Felser, H. L.: Der Einfluss der Seigerung auf die Festigkeit des Flusseisens. Aachen. 1910. 25 S. u. 15 Taf. Gr.-8°.

Fiedler, A.: Synthese von Polypeptiden. Derivate der Asparaginsäure. Berlin. 1910. 31 S. 8°.

Frank, G.: Eine Methode der Phosphorsäurebestimmung. Giessen. 1910. 22 S. 8°.

Gaupp, O.: Derivate der Sulfoxylsäure. Freiburg. 1909. 55 S. 8°.

Geiger, O.: Beiträge zur Kenntnis der Oxyphenanthrene und Oxyphenanthrenchinone. Stuttgart. 1910. 61 S. 8°.

Gillhausen, W. G.: Untersuchungen über die Wärme und Stoffbilanz beim Hochofen. Aachen. 1910. 49 S. u. 4 Taf. Gr.-8°.

Harwood, H. F.: Ueber die quantitative Analyse von Vanadinverbindungen mittels Tetrachlorkohlenstoffs. Heidelberg. 1910. 55 S. 1 Taf. 8°.

Heinle, E.: Ueber Nitro- und Aminophenanthrene und deren Abkömmlinge. Stuttgart. 1910. 70 S. 8°.

Henrich, R.: Zur Kenntnis des Methylnonylketons. Giessen. 1910. 70 S. 8°.

Hermsdorf, A.: Studien über Jodlösungen. Leipzig. 1910. 72 S. m. 9 Fig. 8°.

Hirschkind, W.: Die umkehrbare Einwirkung von Sauerstoff auf Chlormagnesium. Karlsruhe. 1910. 49 S. 8°.

Kasarnowski, H. H.: Ueber die Diffusion der Kolloide. Basel. 1910. 48 S., 1 Fig. 8°.

Kornek, O.: Kritische Untersuchungen über die analytischen Bestimmungsmethoden des Rohkautschuks. Kiel. 1910. 65 S. 8°.

Krausz, M.: Beiträge zur fermentativen Fettspaltung. Hannover. 1910. 50 S. m. 1 Taf. 8°.

Krumbhaar, W.: Ueber die Löslichkeit von Gasen in Metallen und Legierungen. Leipzig. 1910. 69 S. m. 9 Fig. 8°.

Kuessner, H.: Ueber das anodische Verhalten des Molybdäns, Mangans, Chroms und Tantals. Leipzig. 1910. 19 S. m. 2 Fig. 4°.

Landauer, P.: Studien über das Methylenblau. Würzburg. 1909. 42 S. 8°.

Liesching, Th.: Ueber den Einfluss des Schwefels auf das System Eisen-Kohlenstoff. Aachen. 1910. 16 S. m. 21 Fig. u. 3 Tab. Gr.-8°.

Loose, R.: Ueber indikationsfähige Azokombinationen. Marburg. 1909. 58 S. 8°.

May, R.: Beziehungen des Kamphens zur Apokamphersäure. Ein Beitrag zur Erklärung der Umwandlung des Kamphens in Kampher. Aachen. 1910. 80 S. 8°.

McBain, J. W.: Zur Kenntnis der Katalyse in heterogenen Systemen. Die Zersetzung des Chromochlorürs mit kolloidem Platin. Heidelberg. 1909. 83 S. 8°.

Meyer, E.: Beiträge zur Auxochromtheorie. Stuttgart. 1910. 87 S. 8°.

Meyer, Fr.: Die Technik der Verbrennung u. Energiegewinnung aus städtischen Abfallstoffen. Berlin-Charlottenburg. 1910. 24 S. m. Abb. 4°.

Meyering, H.: Die Bedeutung des osmotischen Druckes und der elektrolytischen Leitfähigkeit für die Beurteilung des Bodens. Münster. 1910. 56 S. m. 5 Fig. u. 1 Taf. 8°.

Müller, R.: Untersuchungen in der Menthenon (3)-Reihe. Göttingen. 1910. 59 S. 8°.

Nowak, A.: Ueber die chemische Wirkung dunkler elektrischer Entladungen auf Kohlenoxyd und kohlenoxydhaltige Gasgemenge. München (Techn. Hochsch.). 1910. 68 S. m. 6 Fig. 8°.

Platon, E.: Calorimetrische Untersuchungen über Stickoxydbildung aus Luft mittels Hochspannungswechselstromentladungen verschiedener Frequenz. Karlsruhe. 1910. 72 S. 8°.

Reichel, H.: Farbreaktionen bei der Hydrolyse von Säureanhydriden. Leipzig. 1910. 65 S. 8°.

Rümschin, P.: Zur Kenntnis katalytischer Wirkungen bei der Acetylierung organischer Verbindungen. Heidelberg. 1910. 43 S. 8°.

Sachs, St.: Ueber die Wirkung des ultravioletten Lichtes auf Gase und über die dabei erzeugten Nebelkerne. Heidelberg. 1910. 47 S. m. 3 Fig. 8°.

Sakom, D.: Zur Kenntnis der katalytischen Wirkung des Jods. Heidelberg. 1910. 30 S. u. 1 Tab. 8°.

Sanè, Sh. M. v.: Untersuchungen über Nitrophenole. Berlin. 1910. 45 S. 8°.

Schaidhauf, A.: Untersuchungen über Natriumamid nebst einem Anhang über quantitative Bestimmung der Salpetersäure. München (Techn. Hochsch.). 1910. 68 S. 8°.

Scheller, E.: Ueber die Bestimmung des Eigehaltes in Nahrungsmitteln mit Hülfe des Cholesterins. und Beiträge zur Aufklärung der Konstitution des Cholesterins. München. 1909. 48 S. 8°.

Schering, H. G.: Chemische Untersuchungen über Löss und Lehm. Freiburg. 1909. 50 S. 8°.

Schertel, L.: Studien über einige Verlustquellen des Blei- und Kupfer-Hochofenprozesses. Dresden. 1910. 49 S. m. 3 Fig. u. 1 Taf. 8°.

Schimpff, H.: Ueber die Wärmekapazität von Metallen und Metallverbindungen. Göttingen. 1909. 18 S. m. 13 Tab. u. 3 Fig. 8°.

Schneider, J. J.: Die Kugelfallprobe. Berlin-Charlottenburg. 1910. 50 S. m. 21 Fig. Gr.-8°.

Schröder, J.: Das Verhalten des Aethyläthers beim Durchgang elektrischer Ströme. Greifswald. 1910. 59 S. 8°.

Schubert, C.: Beiträge zur Kenntnis der Dissoziation einiger Oxyde, Karbonate und Sulfide. Dresden. 1910. 72 S. m. 4 Fig. 8°.

Schwarzenauer, E.: Quantitative Trennungen durch Persulfat und die Zersetzung komplexer Cyanide mit Persulfaten. Heidelberg. 1910. 88 S. 8°.

Seidel, T.: Ueber die quantitative Verflüchtigung des Arsens aus Lösungen unter Reduktion der Arsensäure durch Hydrazinsalze. Heidelberg. 1910. 54 S. m. 2 Fig. 8°.

Singer, F.: Ueber künstliche Zeolithe und ihren konstitutionellen Zusammenhang mit anderen Silicaten. Berlin-Charlottenburg. 1910. 72 S. 8°.

Spillner, F. G.: Die Trocknung des Klärschlammes. Hannover. 1910. 63 S. m. 8 Abb. 8°.

Splawa-Neyman, H. v.: Ueber die Ozonide einiger cyclischen Kohlenwasserstoffe und ihre Spaltungsgeschwindigkeit. Kiel. 1910. 42 S. 8°.

Stadel, A.: Versuche über addierende und oxydierende Wirkung von Hypochlorit auf aromatische Verbindungen. Giessen. 1909. 28 S. 8°.

Steppuhn, O.: Ueber die Vergärung der Ameisensäure durch Hefen. Heidelberg. 1910. 96 S. 8°.

Subow, W. G.: Düngewirkung des Kochsalzes im Vergleich zu Chlorkalium bei Futterrüben, mit besonderer Berücksichtigung der Kali-, Natron.und Chlor-Aufnahme. Halle. 1910. 61 S. m. 1 Taf. 8°.

Taubert, G.: Einige Derivate des Orcins. Beiträge zur Kenntnis von Oxydationsprodukten der Phenole. Erlangen. 1910. 36 S. 8°.

Thomas, F.: Ueber den Einfluss von Wasserdampf, bezw. Kohlenwasserstoffen, auf die Röstung der Zinkblende. Aachen. 1910. 16 S. m. 5 Fig. u. 9 Tab. Gr. 8°.

Vetter, F. A.: Beiträge zur Kenntnis der Abscheidungen des kohlensauren Kalkes aus Bicarbonatlösungen. Jena. 1910. 65 S. u. 1 Taf. 8°.

Vogel, E.: Ueber die Temperaturveränderung von Luft und Sauerstoff beim Strömen durch eine Drosselstelle bei 10° C. und Drücken bis zu 150 Atmosphären. München (Techn. Hochsch.). 1910. 54 S. m. 15 Fig. Gr. 8°.

Volmer, M.: Photographische Umkehrungserscheinungen. Leipzig. 1910. 46 S. m. 9 Fig. u. 3 Taf. 8°.

Wagner, H.: Beiträge zur Kenntnis des Hydroxylamins. Bern. 1910. 51 S. 8°.

Weckbach, Fr.: Ueber die elektrolytische Oxydation von Manganosalzen in stark saurer Lösung. München (Techn. Hochsch.). 1910. 90 S. 8°.

Wehrheim, O.: Ueber d. Oxydation von Ammoniak, Blausäure und Cyan. Darmstadt. 1910. 47 S. m. 1 Taf. 8°.

Werkmeister, O.: Ueber Bildung und Zerfall von Eisenkarbid, und die gasförmigen Produkte der Einwirkung von Mineralsäuren. Karlsruhe. 1910. 78 S. m. 2 Fig. 8°.

Weyl, F.: Ueber Zementation im luftleeren Raum mittels reinen Kohlenstoffs. Aachen. 1910. 21 S. m. 14 Tab. u. 39 Fig. Gr. 8°.

Wille, L.: Die elektrochemische Reduktion von Nitroformylanilinen und Nitro-Guajakolen. Giessen. 1909. 40 8°.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding lists can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

Patent Specifications may be purchased at the Sale Branch of the Patent Office, Quality Court, Chancery Lane, London, W.C., fifteen days after the date on which acceptance of the complete specification is advertised. The price is 8d. each.

I.—GENERAL PLANT; MACHINERY.

Applications.

6865. Pye-Smith. Apparatus for making solutions or their filtrates.* March 18.

6866. Macgregor, and Scott and Co., Ltd. Concentration of syrupy or viscous liquids and apparatus therefor. March 18.

7050. Uhl. Centrifugal machines for separating solids from liquids and sorting the solids.* March 21.

7263. Calder. Centrifugal hydro-extractors. March 23.

7391. Crolbois. Apparatus for the continuous evaporating, concentration, and distillation *in vacuo* of liquids. [Fr. Appl., March 26, 1910.]* March 24.

7516. Pulsometer Engineering Co., and Björnstad. Mixing liquids. March 25.

7518. Bell Bros., Ltd., and Johnson. Method of purifying steam generated by pouring molten slag into water.* March 25.

7536. Smith and others. Absorbers or separators for gases or vapours of the bubble scrubber type.* March 25.

7601 and 7602. Merrill. *See under* X.

7754. Zschocke. Purifying and cooling hot gases. March 28.

8045. Beeton. Vacuum drying process. March 31.

8233. Passow. Manufacture of filters. [Ger. Appl., April 21, 1910.]* April 1.

Complete Specifications Accepted.

5855 (1910). Cockerill. Drying and like machines. March 22.

7152 (1910). Humphrey. Methods and apparatus for raising or forcing liquids. March 29.

7824 (1910). Humphrey. Methods and apparatus for raising or forcing liquids. April 5.

11,063 (1910). Greenhalgh. Distilling apparatus. March 29.

11,078 (1910). Newton (Bayer und Co.). Apparatus for crushing or pulverising materials. March 22.

15,263 (1910). McClelland. Method and apparatus for evaporating, volatilising, or distilling liquids and solids. March 22.

17,594, 17,601, and 17,625 (1910). Du Pont. Separation of solids by means of a liquid. April 5.

18,743 (1910). Mitchell. Centrifugal drying machines. March 29.

23,430 (1910). Lockyer (Edwards). Tilting, calcining, or roasting furnaces. March 29.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

6491. Allsebrook and Robertson. Manufacture of fuel. March 15.

6617. Ofenbau-Ges. Horizontal coke ovens or retorts. [Ger. Appl., April 27, 1910.]* March 16.

6625. Holzapfel. Gas producers. March 16.

6773. Belger and Whitehead. Composition for coating the walls of coal mines to lessen the possibility of coal dust explosions. March 17.

6798. Thomas. Manufacture of artificial fuels. March 18.

6849. Stephenson. Generation of water-gas. March 18.

6924. Stettiner Chamotte-Fabrik. Coke ovens, retort furnaces, etc. [Ger. Appl., Sept. 12, 1910.]* March 20.

7182. Smith. Manufacture of fuel. March 22.

7272 and 7273. Smith. Apparatus employed in making fuel. March 23.

7274. Smith. Manufacture of fuel. March 23.

7330. Koller. Apparatus for producing gas from brown coal, lignite, etc. [Appl. in Hungary, March 25, 1910.]* March 23.

7547. Aldridge. Charges for gas retorts. March 25.

7640. Zschocke. Filters for separating suspended impurities from gas.* March 27.

7664. Boult (Putsch). Coke or like ovens.* March 27.

8004. Schwab. Incandescing bodies for electric lamps and their manufacture. [Ger. Appl., April 9, 1910.]* March 30.

8005. Holzapfel. Gas producers. March 30.

Complete Specifications Accepted.

19,932 (1908). Bloxam (Siemens und Halske A.-G.). Manufacture of filaments for electric lamps from tungsten or its alloys. March 22.

3352 (1910). Lowe. Producer gas plants. March 22.

6755 (1910). Weil. Gas producers of the suction type. March 29.

7420 (1910). K. and A. Water Gas Co., and Smith. Utilisation in water gas plants of fine breeze or other small fuel. March 29.

8174 (1910). Benninghoff and Klönne. Gas-fired coke ovens, etc. April 5.

8178 (1910). Slick. Method and apparatus for producing gas. April 5.

8664 (1910). Heckel. Process for binding coal-dust, etc. April 5.

10,357 (1910). White and White. Gas generating plant. March 22.

18,084 (1910). Bagrachow. Impregnating the filaments and mantles used in incandescent gas lighting. March 29.

19,555 (1910). Laliberte. Mixtures for treating fuel. March 29.

19,573 (1910). Dempster and Sons, and Broadhead. Gas purifiers. April 5.

28,388 (1910). Duckham. Vertical retorts for the carbonisation of coal and the like. March 22.

III.—TAR AND TAR PRODUCTS.

Applications.

7633. Liebrecht. Manufacture of *p*-chloro-*m*-cresol. March 27.

8007. Weil. Apparatus for distilling tar.* March 30.

Complete Specifications Accepted.

16,151 (1910). Bloxam (Ullmann). Manufacture of carboxylic acids of the anthraquinone series. March 18.

16,272 (1910). Ullmann. Manufacture of derivatives of the anthraquinone series. April 5.

IV.—COLOURING MATTERS AND DYES.

Applications.

6267. Johnson (Badische Anilin und Soda Fabrik) *See under* VI.

7297. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of vat dyestuffs of the anthraquinone series. March 23.

7422. Bayer und Co. Manufacture of disazo dyestuffs. [Ger. Appl., June 15, 1910.]* March 24.

8013. Newton (Bayer und Co.). Manufacture of azo dyestuffs. [Addition to No. 12,433 of 1910.] March 30.

8068 and 8069. Read Holliday and Sons, Ltd., Turner, and Dean. Manufacture of black colouring matters. March 31.

8143. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. March 31.

8203. Newton (Bayer und Co.). Manufacture of indigoid vat dyestuffs containing chlorine. April 1.

Complete Specifications Accepted.

8967 (1908). Act.-Ges. f. Anilinfabr. Manufacture of polyazo dyestuffs. April 5.

10,053 (1910). Newton (Bayer und Co.). Manufacture of dyestuffs of the anthracene series and process of dyeing. March 22.

12,142 (1910). Newton (Bayer und Co.). Manufacture of vat dyestuffs. March 29.

12,921 and 22,306 (1910). Ransford (Cassella und Co.). Manufacture of dyestuffs. March 29.

28,679 (1910). Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of vat dyestuffs of the anthracene series. March 22.

1729 (1911). Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of brown sulphurised vat dyestuffs. April 5.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

6241. Verein. Glanzstoff-Fabr. A.-G. Production of formyl celluloses. [Addition to No. 15,700 of 1910. Ger. Appl., Nov. 23, 1910.]* March 13.

7073. Chapman. Pulp for paper-making, etc.* March 21.

7099. Boult (Dobler). Manufacture of blotting paper, cardboard, etc.* March 21.

7442. Soc. Anon. des Celluloses Planchon. Cellulose fabric and its manufacture. [Fr. Appl., May 23, 1910.]* March 24.

8214. Bonar. Manufacture of pulp for paper-making and other purposes. April 1.

Complete Specifications Accepted.

6741 (1910). Ekstrom. *See under* XVIII.

6785 (1910). Inouye and Mochida. Treatment of the raw material of spun silk. March 29.

7748 (1910). Pellerin. Production of hydrated cellulose. March 29.

8646 (1910). Merckens and Manissadjian. Non-inflammable celluloid-like material. March 29.

13,100 (1910). Newton (Bayer und Co.). Manufacture of lustrous threads, wires, and bands. March 29.

14,271 (1910). Newton (Bayer und Co.). Manufacture of acetyl derivatives of cellulose. March 22.

15,752 (1910). Pellerin. Preparation of xanthic solutions of cellulose. March 22.

22,309 (1910). Walker. Process of making solvents for pyroxylin, etc. April 5.

309 (1911). Verein. Glanzstoff-Fabr. A.-G. Manufacture of stable viscous cellulose solution. March 22.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

6258. Meister, Lucius, und Brüning. Dyeing with certain vat dyestuffs. [Addition to No. 3241 of 1911. Ger. Appl., March 15, 1910.]* March 13.

6267. Johnson (Badische Anilin und Soda Fabrik). Production of colouring matters on the fibre. March 13.

6874. Lord. Machines for dyeing, bleaching, mordanting, etc., cotton, wool, silk, and other materials in the hank. March 20.

7000. Roy. Waterproofing fabrics and the like. March 21.

7057. Dörr. Dyeing vegetable fibre. [Ger. Appl., April 1, 1910.]* March 21.

8097. Schmidlin and Speirs. Kiers or vessels for use in subjecting textile materials to boiling, bleaching, and like processes.* March 31.

Complete Specifications Accepted.

867 (1910). Shimizu. Treatment of cotton yarns or fabrics. March 22.

8043 (1910). Riley and Co., and Riley. Apparatus for treating yarn with dye or other liquors. March 22.

8122 (1910). Iwanoff. Manufacture of printing rollers for textile fabrics, etc. April 5.

10,053 (1910). Newton (Bayer und Co.). *See under* IV.

21,802 (1910). Imrie (Anilinfarben u. Extract Fabr. vorm. J. R. Geigy). Process for shading indigo dyeings. March 22.

412 (1911). Bayer und Co. Production of brown to olive shades on the fibre. April 5.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Applications.

6463. Spence, Llewellyn, and Spence and Sons, Ltd. Production of aluminous compounds. March 15.

6464. Spence, Llewellyn, and Spence and Sons, Ltd. Production of compounds of alumina. March 15.

6546. Vantin. Treatment of solutions containing copper. March 15.

6684. Friedrich. Preparation of ammonium chloride and sulphites of calcium, strontium, barium, magnesium, zinc, or iron.* March 17.

6721. Spence, Llewellyn, and Spence and Sons, Ltd. Treatment of aluminous compounds. March 17.

7088. Pigments, Ltd., and Thompson. Manufacture of lead compounds and by-products. March 21.

7103. British Thomson-Houston Co. (General Electric Co.). Boron compounds and method of producing them.* March 21.

7205. Ges. f. Linde's Eismaschinen. Separation of hydrogen from mixtures of gases. [Ger. Appl., May 6, 1910.]* March 22.

7206. Phillips and Bulteel. Obtaining oxides of nitrogen. March 22.

7222. Rees, and Metals Extraction Corporation. Deposition of metallic salts from solutions containing them. March 22.

7394. Watrigant. Recovery of nitrogen from certain residual liquors. [Fr. Appl., March 26, 1910.]* March 24.

7404. Carey, and United Alkali Co., Ltd. Manufacture of soda from black ash and recovery of sulphur from black-ash waste. March 24.

7447. Dodd. Salt-making pan. March 25.

7969. Woolf. Process of salt-making. March 30.

7994. Parent. *See under* XVI.

8058. Bottomley. Manufacture of hydrochloric acid. March 31.

8142. Vialleix and Perrin. Apparatus for concentrating sulphuric acid. [Fr. Appl., Sept. 20, 1910.]* March 31.

Complete Specifications Accepted.

4376 (1910). Szirmay. Preparation of chemically pure lithium sodium citrate. March 29.

7718 and 7720 (1910). Dieffenbach and Moldenhauer. Production of hydrogen. April 5.

10,378 (1910). Hall. Apparatus for the manufacture and manipulation of solid carbon dioxide. March 29.

12,137 (1910). Newton (Channing). Manufacture of sulphuric acid from smelter gases. March 29.

15,285 (1910). Woltereck, and Sulphate of Ammonia Co. Production of ammonia from peat. March 22.

20,131 (1910). Salessky. Denitrating nitrous sulphuric acid in the lead chamber process. March 22.

23,660 (1910). Pietzsch and Adolph. Manufacture of hydrogen peroxide. March 22.

26,568 (1910). Wildermann. *See under* XI.

VIII.—GLASS ; CERAMICS.

Applications.

6441. Royer. Glass melting furnaces or ovens. [Addition to No. 20,393 of 1908.]* March 14.

6465. Moore and Warrington. Production of earthenware. March 15.

6718. Broadhurst. Potters' ovens. March 17.

7115. Brooke. Silica firebricks and the like. March 22.

IX.—BUILDING MATERIALS.

Applications.

8085, 8086, and 8087. Owen. Manufacture of products of concrete, cement, and the like. [U.S. Appls., April 1, 1910.]* March 31.

8161. Herdt and Fraass. Artificial stone and process of making same. [Ger. Appl., April 6, 1910.]* March 31.

Complete Specifications Accepted.

4358 (1910). Holden. Manufacture of Portland and like cements. March 29.

8208 (1910). Mendham (Simcock). Process for clay drying. April 5.

11,242 and 28,264 (1910). Barrett and Renwick. Production of artificial stone. April 5.

12,886 (1910). Funge. Bricks for building purposes. March 29.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

6301. Bonnafoux *dit* Reyer. Purification of metals, particularly cast iron and steel.* March 13.

6438. Skinner, and Patent Corporation, Ltd. Treatment of iron pipes or other articles to prevent rust. March 14.

6590. Lawson. Preparing iron and other ores for smelting. March 16.

6808. Paul. Manufacture of steel. March 18.

6837. Holloway and Wagner. Smelting ores of tungsten. March 18.

6885. Martin. Separation of complex sulphide and other ores. March 20.

7098. Bourcoud. Treatment of metallic ore. March 21.

7235. Tainton and Pring. Electrodeposition and refining of zinc. March 23.

7370. Mackie and Forwood. Manufacture of steel. March 24.

7518. Bell Bros., Ltd., and Johnson. *See under* I.

7601 and 7602. Merrill. Process and apparatus for precipitating and recovering materials, especially metals, from solutions. March 27.

7663. Titan-Ges., and Meissner. Production of alloys.* March 27.

7863. Duke. Metallic alloys. March 29.

7890. Williams and Williams. Manufacture of iron or steel. March 29.

8035. Hardingham (Huntington). Separation of zinc from its ore or other metalliferous substances. March 30.

8046. Wainwright. Alloy. March 31.

8154 and 8155. Comp. d'Enterprises de Lavage de Minerais. Process and apparatus for the separation of ores. [Fr. Appls., April 8, 1910.]* March 31.

8175. Stone. Treatment of steel and apparatus therefor. April 1.

Complete Specifications Accepted.

29,482 (1909). Reynolds. Manufacture of steel. March 29.

6036 (1910). Radford (Ahlers). Furnaces for metallurgical purposes. March 22.

6670 (1910). Ashcroft. Metallurgy of lead-bearing zinc sulphides. March 22.

7329 (1910). Ashcroft. Metallurgy of zinc bearing lead sulphides. March 29.

7444 and 7536 (1910). Ashcroft. Metallurgy of metal sulphides. April 5.

7657 (1910). Elektrochem. Werke. Treatment of copper. April 5.

13,755 (1910). Plimmer. *See under* XX.

18,695 (1910). Canning. Electroplating apparatus. March 29.

20,386 (1910). Heys (Nitrogen Co.). Production of metals of the alkalis or alkaline earths. March 29.

20,601 (1910). Jacquier. Alloy. March 22.

23,430 (1910). Lockyer (Edwards). *See under* I.

25,969 (1910). Langbein-Pfanhauser Werke. Manufacture of ductile electrolytic iron. April 5.

26,415 (1910). Von der Linde. Cleaning tin plate waste before recovering the tin by chlorine. March 29.

29,473 (1910). Pucklitzsch. Electroplating apparatus. March 29.

XI.—ELECTRO-CHEMISTRY.

Complete Specifications Accepted.

6768 (1910). Stora Kopparbergs Bergslags Aktiebolag. Electric furnaces and method of charging them. March 22.

15,164 (1910). Thomson. Electric furnaces. April 5.

15,165 (1910). Thomson. Revoluble or oscillatory electric furnaces. April 5.

26,568 (1910). Wildermann. Electrolytic cells for the electrolysis of alkaline salts. March 22.

XII.—FATS; OILS; WAXES.

Applications.

7216. Breidenbach. Manufacture of soap tablets. March 22.

7334. Speakman. Recovery of glycerin from sulphonated oils. March 24.

7854. Bamberg. Hydrolysis. March 29.

8016. Testrup. Treatment of unsaturated fatty acids or their glycerides or bodies containing them. March 30.

8147. Schlinck und Co. A.-G. Manufacture of solid fatty substances from oils. [Ger. Appl., Jan. 30, 1911.]* March 31.

Complete Specifications Accepted.

10,429 (1910). Stadley. *See under* XIX.

12,234 (1910). Livingston. Apparatus for extracting fat from garbage and similar materials by volatile solvents. April 5.

14,942 (1910). Cassel and Steininger. Crude oil soap and soap lye and process for making it. April 5.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

6429. Bakelite-Ges. Manufacture of condensation products of phenols and formaldehyde. [Ger. Appl., March 14, 1910.]* March 14.

6430. Bakelite-Ges. Condensation products of phenols and aldehydes. [Ger. Appl., March 14, 1910.]* March 14.

6662. Barton. Manufacture of white lead. March 16.

6959. Leroy. Manufacture of ultramarine blue. [Belg. Appl., Sept. 20, 1910.]* March 20.

7088. Pigments, Ltd., and Thompson. *See under* VII.

7271. Luciani. Manufacture of ultramarine blue. [Fr. Appl., April 7, 1910.]* March 23.

Complete Specification Accepted.

9625 (1910). Wright. *See under* XIX.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

6444 and 6445. Schleiffer. Extraction of resins from raw india-rubber. [Austrian Appls., March 24 and 25, 1910.]* March 14.

6540. Bayer und Co. Production of artificial caoutchouc. [Addition to No. 17,734 of 1910. Ger. Appl., March 31, 1910.]* March 15.

6642. Bayer und Co. Production of products similar to vulcanised caoutchouc. [Ger. Appl., April 6, 1910.]* March 16.

6858. Derry. Curing india-rubber.* March 18.

7735. Caldwell, and Pileumatic (1910), Ltd. Manufacture of elastic, cellular, foamy, or spongy material. March 28.

Complete Specifications Accepted.

29,277 (1909). Lilley. Production of synthetic india-rubber or of a rubber-like material. March 22.

29,566 (1909). Matthews and Strange. Manufacture of caoutchouc and an intermediate product. March 29.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

6795. Forster. Preparation of tanning liquors. March 18.

6796. Forster. Tanning. March 18.

7091. Chem.-Technologische Studienges. Tanning process. [Ger. Appl., March 21, 1910.]* March 21.

7639. Reidel. Artificial leather. [Addition to No. 225 of 1910.]* March 27.

8070. Wilson. Means for facilitating the tanning of hides and skins. March 31.

XVI.—SOILS; FERTILISERS.

Application.

7994. Parent. Apparatus for use in the treatment of products such as superphosphates. [Belg. Appl., March 31, 1910.]* March 30.

XVII.—SUGARS; STARCHES; GUMS.

Complete Specification Accepted.

7032 (1910). Wulkan. Manufacture of dextrine. March 29.

XVIII.—FERMENTATION INDUSTRIES.

Complete Specifications Accepted.

6175 (1910). Elmassian. Malting process and apparatus. March 22.

6376 (1910). Loew. Process and apparatus for pasteurising beer. March 22.

6741 (1910). Ekstrom. Production of alcohol from sulphite cellulose lyes. March 22.

18,938 (1910). Brangier. Manufacture of purified potable spirits. March 29.

20,058 (1910). Fleming. Treatment of fermented liquids. April 5.

29,071 (1910). Winde. Manufacture of malt. March 29.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

6494. Barton and Thorpe. Sterilising compound and apparatus for use therewith. March 15.

7029. Wilson. Apparatus for purifying water and other liquids. March 21.

7232. Lecomte. Manufacture of food products or beverage from the soja bean. March 23.

7233. Lecomte. Treatment of milk. March 23.

7234. Lecomte. Treatment or manufacture of butter. March 23.

7394. Watrigant. *See under* VII.

8157 and 8158. Henri, Helbronner, and von Recklinghausen. Apparatus for treating liquids with ultraviolet rays. [Divided Appls. on No. 12,948 of 1910.]* March 31.

Complete Specifications Accepted.

6721 (1910). Loring. Manufacture of flour. March 22.

7951 (1910). Hewitt. Manufacture of mineral waters or artificial saline waters, cordials, etc. March 22.

9625 (1910). Wright. Treatment of sewage sludge and manufacture of lampblack, etc. March 29.

10,394 (1910). Jones. Apparatus for purifying water and other liquids. March 29.

10,429 (1910). Stadley. Edible fat. April 5.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

7204. Meister, Lucius, und Brüning. Manufacture of a dimethylphenylbenzylammoniumdisulphonic acid. [Ger. Appl., March 22, 1910.]* March 22.

7591. Newton (Bayer und Co.). Manufacture of pharmaceutical products. March 27.

7619. Easterfield and Taylor. Preparation of ketones. [Appl. in New Zealand, April 21, 1910.]* March 27.

8011. Newton (Bayer und Co.). Manufacture of the ethers of diethylbromo-acetyliso-urea. March 30.

8012. Newton (Bayer und Co.). Manufacture of esters of aromatic acids. March 30.

8016. Testrup. *See under* XII.

Complete Specifications Accepted.

4376 (1910). Szirmay. *See under* VII.

7669 (1910). Henri and others. Preparation of tuberculin and serums for tuberculous bacilli. March 29.

13,755 (1910). Plimmer. Manufacture of finely-divided antimony for use as a therapeutic substance. March 29.

15,560 (1910). Johnson (Verein. Chininfabr. Zimmer und Co.). Manufacture of esters of the hydrohalogenic addition products of quinine. April 5.

16,048 (1910). Wolff und Co. Manufacture of compounds containing iron, albumin, and phosphorus. March 22.

16,632 (1910). Meister, Lucius, and Brüning. Manufacture of a remedy for tuberculosis. March 29.

26,645 (1910). Act.-Ges. f. Anilinfabr. Manufacture of ω-*p*-alkyloxyphenylethylamines and their N-alkyl derivatives. March 22.

28,049 (1910). Bayer und Co. Manufacture of mercury compounds substituted in the nucleus of alkylated or halogenated benzoic acids. March 29.

30,129 (1910). Busch and von Wülfing. Preparation of albuminous compounds of guaiacolsulphonates. April 5.

411 (1911). Bayer und Co. Process for producing pinacone. March 22.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

6279. Palmer. Manufacture of colour screen plates and films for colour photography. March 13.

7201. Enjolras. Collodion silver bromide instantaneous photographic plate. [Fr. Appl., March 24, 1910.]* March 22.

8015. Hamburger. Colour photography.* March 30.

8153. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Manufacture of polychrome photographic screens. [Fr. Appl., April 7, 1910.]* March 31.

XXII.—EXPLOSIVES; MATCHES.

Applications.

6952. Kowatsch. Production of blasting charges. March 20.

6956. Bichel. Explosive charges for projectiles, mines, and torpedoes. [Ger. Appl., June 20, 1910.]* March 20.

7719. Dymond (Satanite Powder Co.). Process for making material for explosives.* March 28.

Complete Specification Accepted.

24,978 (1910). Polster. Detonating pellets. March 22.

XXIII.—ANALYTICAL PROCESSES.

Applications.

7280 and 7281. Levy. Apparatus for estimating and recording the percentage of carbon monoxide in gaseous mixtures. March 23.

Complete Specification Accepted.

20,692 (1910). Hellige. Colour-measuring device. March 29.

Journal of the Society of Chemical Industry.

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The Society of Chemical Industry.

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Official Notice.

ANNUAL GENERAL MEETING, 1911.

In accordance with the provisions of By-law 64, notice is hereby given that the Annual General Meeting will be held in the Montgomery Hall, Sheffield, at 10.30 a.m., on Wednesday, July 12th, 1911. A programme of the proceedings will be issued later.

In accordance with the provisions of By-law 24, notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting. The only Ordinary Member of Council eligible for re-election to that office is Mr. W. J. Leonard, under By-law 32.

Dr. Rudolph Messel has been nominated to the office of President under By-law 20; Sir William Crookes, O.M., F.R.S., Mr. H. Hemingway, and Dr. G. G. Henderson have been nominated Vice-Presidents under By-law 21; and Mr. Walter F. Reid has been nominated a Vice-President under By-law 20. Mr. Thomas Tyrer has been appointed Hon. Treasurer, and Dr. J. Lewkowitsch, Hon. Foreign Secretary under By-law 35.

Members are hereby invited to nominate, on or before May 23rd next, fit and proper persons to fill four vacancies among the Ordinary Members of Council under By-law 24. Forms for this purpose can be obtained, on application, from the Secretary of the Society.

By-law 23 :—An ordinary member of Council shall be nominated by ten or more members upon Form B in the Schedule, a copy of which form shall be furnished by the Secretary upon the written or verbal request of any member, but a member shall not be eligible to sign more than one such nomination form, and the member nominated shall sign the declaration set forth on the form. A nomination shall be declared invalid by the Council if :

a. The member thereon nominated is disqualified for election, or ineligible to be elected, as provided by the By-laws.

b. The nomination is not made on the authorised printed form or substantially not in the manner directed thereon.

c. The nomination form is signed by less than ten members not disqualified or not ineligible to nominate as provided by the By-laws.

d. The nomination form is not received before or upon the day appointed therefor.

e. The member nominated has not signed the declaration printed upon the form.

A member whose nomination aforesaid is declared to be invalid shall receive notice thereof from the Secretary, and shall not be submitted for election.

Charles G. Cresswell,
Secretary.

London Section.

Meeting held at Burlington House on Monday, March 6th, 1911.

MR. E. GRANT HOOPER IN THE CHAIR.

THE INDUSTRY OF BREWING.

BY A. CHASTON CHAPMAN.

To deal at all adequately with so vast a subject within the limits assigned to this paper is clearly an impossibility, and I have decided to limit myself to a consideration of certain of the more striking developments which have taken place in this industry during comparatively recent years, and to a brief account of some of the more important improvements which have been introduced in respect of plant and procedure. The brewer is conservative and the evolution of plant and procedure was, up to a certain point, much slower in connection with brewing than in other important industries. But if the process took a long time to get under way, it has in recent years progressed rapidly, and the plant in many breweries (particularly on the Continent and in America) now leaves little to be desired. The heavy fiscal burdens which the industry has been called upon to bear, in conjunction with certain other causes, have combined to produce a state of depression which at first sight might not appear to be favourable to rapid developments in the matter of plant and practice. In very many cases, however, it has virtually compelled the brewer to instal perfected machinery and to adopt scientific methods which under more prosperous circumstances he would not have done.

One of the first operations of importance in the brewing process is the grinding of the malt. The simplest form of mill consists of a pair of steel or cast-iron rolls, set at such a distance that when working each corn is thoroughly crushed. This statement might seem to imply that the process of grinding is simple. Such, however, is not the case, and many brewers do not realise the importance of proper grinding. If there were no objection to the very fine grinding, or powdering, of the malt, the matter would be considerably simplified, but unfortunately with the infusion system and an ordinary mash-tun, the resulting drainage would be so bad that a great deal of extract would probably be lost, even if a "set" mash were avoided. It is in fact necessary so to crush the malt that the greater part of the husk is left intact to keep the mash "porous." If the rolls are set sufficiently close to grind a very thin foreign malt, the corns of a plump English material will be too completely broken up. On the other hand, if the rolls are set at the proper distance to deal with the large corns, the smaller escape and loss of extract results. To meet this difficulty a type of mill has been widely adopted, consisting of two pairs of rolls placed side by side, the rolls of the one pair being set closer than those of the other. The malt is then separated by grading machinery into large and small corns, the former passing through the rolls of wider gauge and the latter through the more closely set pair. In this way something like uniformity of grind is obtained, if all the malt to be dealt with is well-modified, thoroughly mealy and friable. Unfortunately much malt has to be used which is in part tough and gritty and which contains a percentage of hard-ended corns. This is frequently the case with English, but with certain foreign material, such as Ouchac, the difficulty is greatly increased and unless some form of really fine grinding can be adopted, which will not have the accompanying disadvantage of impeding mash-tun drainage, the extract yield will suffer, often to a serious extent. The problem to be solved is that of obtaining the whole of the starchy portion of the malt in a finely divided condition (but not in the form of flour) with as little breaking up of the husk as possible. This problem has been attacked during the past few years by milling engineers and has been satisfactorily solved by several firms. One of the best known Continental mills, the Seck mill, consists essentially of two pairs of steel rolls, the one pair placed above the other. Between them there is an oscillating sieve which has the effect of separating the crushed grain from the first pair of rolls into husk on the one hand and grits (together with some flour) on the other. The husk with any imperfectly modified hard-ends are then passed through the lower rolls, after which the products from both pairs are mixed together, a grist being thus obtained in which the hard starchy portions of the grain are reduced to a state of fine division without any undue breaking up of the husk. In the case of a very steely malt the position of the sieve can be moved by means of a switch, so that the coarse grits from the first pair of rolls can be passed through the second pair in order to secure finer grinding, which in the case of such malts is necessary if anything like the full available extract is to be obtained. In the case of the British mill known as the Boby two-high mill, there are also two pairs of rolls, the one placed immediately above the other. The malt having been coarsely crushed by the top pair, passes on to the beater in rapid motion, which has the effect of detaching the starchy portion of the grain entirely from the husk. The husks and the separated grits are then passed through the second pair of rolls which are set more closely, by means of which the larger grits and the starchy portions are reduced to such a size that conversion is capable of taking place readily in the mash-tun whilst at the same time there is very little breaking up of the husk and very little flour is formed. Both these mills fulfil the conditions specified above—that is to say, they resolve the malt into a grist consisting of uniformly ground grits with the minimum of flour and large flaky unbroken husk. In this way it is possible to obtain the full benefit of the husks as aids to mash-tun drainage, whilst insuring that the whole of the starchy matter shall be in such a state of division as to render it readily amenable to the action of diastase during the mashing process. With a perfectly modified and thoroughly mealy and friable malt these perfected forms of mill possess very little if any advantage over the ordinary double roller mills. Unfortunately, however, such malts constitute only a small proportion of the total grain with which the brewer has to deal, the bulk consisting of malt made from medium-grade barleys, harvested very often under very unfavourable climatic conditions and containing often a high percentage of hard-ended and gritty corns. A certain proportion—sometimes seriously large—of the starch in such corns is incapable of undergoing saccharification under the ordinary mash-tun conditions, and so is left in the spent grains and is lost. It is this starch which the perfected mill enables the brewer to get into solution. The question of extract yield is obviously one of almost supreme importance, and it is extraordinary, therefore, that so many brewers should take so little trouble to assure themselves that they are getting all that their material is capable of yielding. As a very general rule, the brewer is content to assume that all is right so long as his extracts do not fall low enough to compel attention, and in many breweries there is a serious loss of extract. The number of breweries in which a regular analysis of the mash-tun grains is made is comparatively small, and yet such an examination, if properly conducted, furnishes results of the highest importance, showing not only how much starch is being lost, but also how far such loss is due to incomplete conversion and how far to defective sparging or to a faulty method of running off. With the infusion system, an ordinary mash-tun, and a well-made malt, the residual starchy and other extractive matters (expressed on the dry grains) will rarely if ever fall below 4 per cent., but I have often found numbers as high as 8 per cent., and in bad cases as much as 12 or even 15 per cent. The want of interest which the brewer often displays in the question of yield is partly to be accounted for by the old prejudice against "getting too much out of the malt," which dates from the time when malts were usually badly made and when the rationale of sparging was not properly understood, with the consequence that unconverted starch and other incompletely modified matters occasionally passed into the worts. This, however, is practically impossible at the present day, and the brewer ought, therefore, to aim at getting all that is possible from his material. There are very few breweries in this country at the present time where at least an additional pound of extract could not be obtained, and this in a 50 quarter brewery, brewing five times a week, would mean a saving of more than £250 per annum. In most breweries of that size the saving would be considerably greater.

This brings me to a brief consideration of the mashing process. Just as an ordinary double roller mill will give good results when working with first-class malts, so with the same high grade of material the ordinary mash-tun and the infusion method of mashing leave little to be desired. With the ordinary run of material, however, the mashing system as ordinarily practised in this country is very far from being efficient. Steam-driven rakes, outside mashing machines, and improved sparging appliances have simplified and perfected the process, but in principle the mash-tun of to-day is what it was a century ago. In Continental and American breweries, where the decoction system of mashing is practised, the mash-tuns are, as a rule, more perfectly fitted than is the case in this country, and even with infusion mashing a good deal might be done to make the English mash-tun one which would enable a more perfect control over the mash to be maintained than is at present possible. A good many years ago I advocated the more extensive adoption in this country of a semi-decoction system of mashing, and in certain cases, as for example in the brewing of full drinking low gravity bottled beers, the system possesses advantages. Greater palate fulness can be secured, and, other things being equal, the extracts are higher than by the ordinary infusion method; but some brewers have objected to the process on the ground that a coarseness of flavour is occasionally observed in the resulting beers. In my own experience this has been very rarely the case, but in the decoction system, a strong flavour, owing to the treatment of the husk with boiling water, is sometimes noticeable, and the same kind of flavour, though fainter, might occasionally be observable in the case of English beers. In at least one well-known brewing system, which is practised on the Continent, this difficulty is overcome by separating the grist, after it has passed through a four-roller mill, into grits, husk, and flour. The grits alone are submitted to the high decoction temperatures, the separated husk with any adherent starch being mashed in subsequently, together with the flour. In this way all the increased extract yield, etc., of the decoction system are obtained, without the boiled husk flavour. A much more important advance than those already mentioned, and one involving a new principle, is the employment of a convertor and filter press in place of the ordinary mash-tun. This process, named after its originator, Mr. Meura, a Belgian engineer, has been successfully adopted since its introduction about the year 1900 in a number of Continental (chiefly French and Belgian) breweries, and has met with warm approval. The plant consists of a convertor, a filter press, and a mill capable of producing a very fine grist, which last can be dealt with in the convertor more easily and quickly than the coarsely ground material in an ordinary mash-tun, The malt, finely ground, passes to the convertor, a cylindrical vessel, jacketed and provided with a stirrer worked through stuffing boxes. The convertor also serves, by the aid of an air-compressor, as a pneumatic reservoir for charging the mash-filter and ensuring some top air pressure during the filtration. Any form of closed "cooker" or convertor may be used, or even the mash-tun itself might be adapted for the purpose, but this is a matter of some difficulty, and is not to be recommended. The mash-filter resembles the well-known yeast press, but its precise construction is a matter of importance, and the original press as designed by Meura was found to be capable of considerable improvement. The press which appears to be best suited to the requirements of the English brewer is that designed by J. G. Crossman. This has a greater working capacity than the Meura press, and is so constructed that each cloth only requires one slot in the middle, instead of the six holes of the Meura cloths. In addition, all the filling and drainage passages are outside the filter proper, so that the full draining capacity of the chambers can be utilised. The use of such a convertor gives the brewer complete control over the conversion of his grist, and the mash-filter subsequently enables him to get the whole of the extract with ease and relative rapidity. In a well-equipped convertor the amount of unmalted grain which may be used is conditioned only by the necessity of having sufficient diastase for starch conversion and by considerations of flavour, and the brewer is able to deal with steely and imperfectly modified malt as easily as with tender malt of the highest quality. In the mash filter arrangements are made for the perfect washing of the residual grains, and as a rule the specific gravity of the last runnings is little if at all greater than that of water. The employment of a highly efficient piece of plant such as I have described might possibly lead some brewers to suppose that with it almost any starch-containing materials might be converted into beer. As a technological possibility this is to a great extent true, but with the Meura system, as with any other, quality of product will tell, and the majority of brewers would probably find it impossible to employ with advantage materials differing greatly from those they are already using. The point is that those materials would be used with greater ease and with increased economy.

Now a word with regard to the increased extract yield. With the infusion system and ordinary mash-tun working the residual grains will rarely contain less than 5 per cent. of unconverted starch (on the dry grains), whilst in some cases this number will be very considerably higher. Assuming, however, the lower number, which represents really good working, it will be seen that 4 lb. of extract are left for every quarter of malt mashed. Taking the value of this at 5d. per pound, a preventable loss of over £4 is incurred on every 50 quarter brewing. This, of course, assumes that complete conversion is obtained with the process under discussion, and that such is substantially the case is my own experience and that of others who have studied the working of this system. The following analyses, which are selected from many, show the relative composition of mash-tun and mash-filter grains :—

	Mash-tun grains. Per cent.	Mash-filter grains. Per cent.
Starch	4·15	1·10
Digestible fibre and gum	30·00	31·14
Fat and oil	6·50	7·10
Albuminoids	16·40	20·29
Ash	4·12	4·50
Moisture	8·96	6·14
Crude fibre	29·87	29·73
	100·00	100·00

In several cases I have found much less than 1 per cent. of starch in the filter-press grains, but I have given the above numbers so as not to over-estimate the economic advantages to be derived from the adoption of the system. A further advantage of the system is that the working day is shortened by several hours. Although this is not sufficient to permit of two brewings being made in an ordinary working day in place of one, the amount of fuel necessary to maintain the sparge water at the proper temperature will be very considerably reduced, and under ordinary circumstances there will be no necessity for overtime work and pay. I will summarise briefly the various advantages attaching to this system of brewing, merely adding that each of the following statements is made as the result of personal observation, or direct experiment :—

(*a*) Increased extract yield (at least 1 lb. per barrel per quarter and often much more).

(*b*) Shortened working day.

(*c*) The reduction of the bills for fuel and labour.

(*d*) The possibility of using larger proportions of grain adjuncts with ease and certainty of result ; and

(*e*) Full extracts when brewing strong beers without the necessity of resorting to parti-gyle brewings.

The last point is one of some importance, since with the ordinary system the brewing of strong ales necessitates either the brewing of a parti-gyle or else carrying over some of the raw wort to the following day, both objectionable practices. This system has been in regular operation in at least one English brewery, and the resulting beers have been in every way satisfactory. In regard to the cattle feeding value of the grains, it may be pointed out that those from the mash-filter are at least as good as those from the tun. The former contain, of course, less starch but more albuminoids, and taking the two analyses given above it will be seen that the combined food and manurial values are 91 units for the mash-tun and 96 units for the filter-press for equal moisture percentages.

Of course I am well aware that the present condition of the brewing industry is not such as to induce the majority of brewers to incur any great outlay for new and expensive plant, but on the other hand the keenness of the competition which exists to-day will compel many to avoid the waste which has too often characterised their working in the past, and in brewing, as in all other industries, efficiency is the most important factor of success.

The next stage in the brewing process is the boiling of the wort, the objects of which are the sterilisation of the wort, the arresting of diastatic action, the extraction of the preservative and flavouring constituents of the hops, the precipitation of undesirable protein matters, and finally the necessary concentration of the wort. No very important improvements have been introduced into this process during recent years. The original system of boiling by fire has been largely superseded by the more convenient and economical method of steam-boiling, and in one or two breweries boiling by water-gas has I believe been adopted. Provided the wort really does boil thoroughly, no one system has any advantages over the other, save those connected with convenience and fuel economy.

Despite the many investigations which have been undertaken in connection with the constituents of the hop, much yet remains to be learned as to the precise functions of certain of those constituents in regard to brewing practice. It is very generally held that the preservative properties of hops reside in the so-called soft-resins, that is, in those resinous matters which are soluble in light petroleum. A good deal of this resin is left behind with the spent hops in the hop-back and this in cases in which experience has shown that the brewer is already using the lowest hop-rate compatible with adequate stability. The ordinary method of using hops is wasteful and unscientific. A boiling period sufficiently long to extract the preservative resins will result in the dissipation of practically the whole of the volatile oil, on which the flavour of the beer (especially bitters and pale ales) so much depends. A good many devices have been suggested during recent years to avoid these difficulties, such as machinery for separating the hop strobiles into certain constituent parts intended to be used at different periods of boiling, or of methods involving the use of a portion of the hops in the fermenting tun. Such methods have not, however, found much favour among practical brewers (although in several cases at least they have something to recommend them), and in perhaps the great majority of breweries the hops are still added to the copper in the manner sanctioned by long usage. A good many brewers however, are beginning to recognise the fact that the prolonged boiling of the hops is neither necessary nor desirable, and it is to-day a very common and commendable practice to add a proportion of the best hops, say half an hour before turning out. In addition the old bad practice of using returned hops is disappearing, but there is still room for a good deal of improvement in the direction of the more rational and economical use of a material which is subject to such great variations in price. From the copper the wort passes to the hop back and thence to the cooler, wort-receiver, or occasionally direct to the refrigerator.

Of the processes involved in brewing, that of cooling is one of the most important, since on the way in which it is carried out depends to a very great extent the soundness and the flavour of the finished beer. More beer is spoiled on the cooler and refrigerator than at any other stage of the brewing process. In the old days, before the introduction of refrigerators, the wort was allowed to cool to the pitching temperature entirely on the cooler, and notwithstanding the greater alcoholic strength of the beers then brewed and the larger hop-rate, beers of reasonable stability could only be brewed during the winter months. With the advent of refrigerators it became possible to brew the whole year round, but even at the present day there are many breweries in which the stability of the beers during the summer months is largely a matter of chance. The function of the cooler is not only to cool the wort, but also to facilitate the absorption of oxygen and to permit of the deposition and elimination of the insoluble albuminoid matters constituting the "sludge." Unfortunately it is not possible to secure these results without submitting the wort to bacterial and other infection. In the majority of breweries large open coolers are still to be found, and whilst such vessels favour the absorption of oxygen and the deposition of the albuminoids, it has to be considered whether those advantages do not entail inferiority of flavour and reduced soundness. It happens fortunately that the absorption of oxygen by the wort—the so-called hot aeration—takes place readily at quite elevated temperatures, say 180° F. or even higher, and consequently a prolonged stay on the cooler is not necessary for the purpose of securing the full benefit. It is still held by some brewers that large coolers are necessary for the production of brilliant and easily-clarifying beers, but that is disproved by the fact that in a good many breweries the cooler has been done away with altogether, and the worts pass directly from the hop-back to the refrigerator, with quite satisfactory results. That, however, involves the possession of a plentiful supply of water at a low temperature, and on the whole I think the combination of a fairly deep wort reservoir or receiving-vessel and a refrigerator represents the best system. In order to secure full aeration the wort may be delivered into the receiver in a fine spray, or purified air may be pumped through the hot wort by means of a small compressor. During the past ten years or so I have been instrumental in securing the replacement of shallow coolers of large area by such deep vessels in a considerable number of breweries, and whilst the beers have in all cases benefited immensely in respect of increased stability, in no instance has there been any trouble in regard to clarification and brilliancy. There are two objections that might be urged against this curtailment of the cooler. The first is that the cooler-sludge cannot be so completely eliminated, but apart from the fact that there is not any real evidence that a little more of such matter in the fermenting tun is seriously objectionable, I feel that the advantages accruing from diminished infection far more than outweigh any such objection. The second objection is a more weighty one, namely that in many breweries the water supply is such that the existing refrigerators will not stand the strain of the additional cooling without unduly prolonging the working day. My reply to this is that the possession of adequate refrigerating power is one of the first essentials for success in modern brewing, and that without it the brewer is so heavily handicapped as to be practically out of the race. In most breweries the refrigerating power is sufficient, but in those in which it is not, much can be done by installing an additional refrigerator, or by adopting refrigerators constructed for a double feed supply in cases where the supply of cold deep-well water is not enough. Artificial cooling machinery suitable for breweries has been brought to a high degree of perfection during recent years, and there is now but little excuse in the case of the larger breweries, at least, for that lack of control over the wort between the hop-back and the fermenting tun, which has been, and still is, responsible for so much failure. The question of expense will be put forward by many brewers who are content to work on the old unsatisfactory lines, but the loss, direct and indirect, represented by a few bad brewings would often more than pay for an improved cooling plant. The main secret of success is regularity of output, and this I contend can only be obtained with a refrigerating system which enables the brewer to maintain complete control, in the fullest sense, over his worts at this most critical stage of the brewing process. Wort leaving the cooler at or above 150° F. is always practically sterile, and given adequate refrigerating power, there is no reason why the temperature should ever be allowed to fall materially below that point. It is during the actual passage of the wort over the refrigerators that infection is most to be feared and that its results are most serious. The sources of infection at this stage are twofold, viz., from the air and from the refrigerator itself. The necessity for thoroughly cleaning the refrigerator surfaces is now fully recognised, but the importance of the construction of the refrigerator itself is not always realised. In many breweries there are in operation vertical refrigerators, in which the tubes are separate, but so close to one another that the spaces between adjacent tubes are barely sufficient to permit the insertion of a knife blade. In a very short time these spaces become filled with yeasty and bacterial matters which cannot be removed by brushing or by any of the cleansing methods which are usually adopted. Even treatment with caustic soda and boiling water is of but little use, and, in a word, it may be said that such refrigerators *cannot* be cleaned. As the wort runs over these infecting areas it contracts an amount of bacterial and other contamination which is in many cases sufficient very seriously to diminish the stability of the resulting beer. A few years ago I dealt at some length with this subject in a paper communicated to the Institute of Brewing (J. Inst. Brewing, 1906, 12, 549) giving examples of the amount of infection occurring in certain breweries, and both before and since that time I have had numerous opportunities of witnessing the very serious consequences resulting from the use of such faulty appliances. Several well-known brewers' engineers are now fully alive to the importance of manufacturing refrigerators having continuous metal surfaces, and there is now no difficulty in obtaining machines of a thoroughly satisfactory pattern. This is, in my experience, one of the most frequent sources of instability in modern breweries. Even if the amount of infection derived from such a faulty refrigerator is not sufficient to cause the beer to be thoroughly unsound, it may yet be, and often is, enough to cause a marked deterioration of flavour, and to make all the difference between beer that is really good and beer that is only passable.

I now pass to a brief consideration of the question of air-borne infection. The wort passes over the refrigerator in a very thin layer and the surface exposed to the air by a whole brewing is enormous. Under these circumstances the purity of the air to which it is exposed becomes a matter of the greatest importance. It is fortunate for the brewer that the great majority of aerial organisms are incapable of living either in hopped wort or in beer. Some experiments of Zikes, which are confirmed by results of my own, showed that of 107 varieties of bacteria experimented with (including bacilli, micrococci, sarcinae, and spore-forming bacteria) only 15 per cent. could develop in hopped wort, provided that the wort was simultaneously seeded with yeast, and that less than 4 per cent. were capable of growing in beer even at summer temperatures. This is, of course, a comforting reflection, but it must not be forgotten that bacteria reproduce with enormous rapidity, and of the 4 per cent. referred to some may consist of organisms of a particularly virulent type, from the brewer's point of view. There is still a superstition that the cooling wort requires immense volumes of air; this is, of course, not the case, and in perhaps the majority of modern breweries some attempt (often imperfect) is made to protect the wort from impure air at this critical stage. The refrigerator room should be preferably small, and should admit of being supplied with purified (that is, filtered) air, or, when this is not considered possible, should admit of being closed up as regards windows, doors, etc., during the actual process of refrigeration. At the present time, several simple and effective air-filtering appliances are on the market, or an adequate apparatus may be quite easily constructed at comparatively little cost, by any firm of engineers working in conjunction with a good carpenter. An *extraction* system is not advisable, since it is as a rule impossible to make a room quite air-tight, and so considerable volumes of air are often drawn in through cracks and other open spaces instead of passing through the filter. In all cases an injection system should be adopted so that the air-pressure in the room is just a little in excess of that outside. With any form of filter, bacteriological examinations of the air direct from the filter and of the air of the room itself, should be made at fairly frequent intervals.

In regard to the question of fermentation, there are but few striking developments to note. The use of single-cell yeast has made little or no headway in Great Britain, and whilst its introduction into many Continental breweries has been productive of the greatest benefit, the system is not generally applicable to the production of top-fermentation beers as brewed in this country. Some experts have expressed themselves in a sense favourable to its use, and it is possible that in the case of certain running beers it may be successfully employed, but the bulk of expert opinion is against it, and the subject has hardly advanced beyond the point at which it was left by the experience of Brown and Morris at Burton. The main difficulty is in connection with the so-called secondary fermentation.

So far as the construction of the fermenting vessels is concerned, there can be little doubt that wood, apart from the difficulty of keeping it thoroughly clean, is on the whole the best. That difficulty, however, is so great, particularly in the case of old vessels, that many attempts have been made to replace it by metals, glazed-bricks, glass and other materials capable of being kept biologically clean. In the North, stone is largely used in connection with a special system of fermentation, and slate vessels are not by any means uncommon. Of the metals, copper is the one most frequently used in breweries, it being a very common practice to copper-line wooden vessels which have become old and worn. I recently found that in certain breweries the fermentations were of a most unsatisfactory character, the yeast reproduction abnormally small, and the resulting beers yeast-bitten and unpleasant. This I found to be due to the corrosion of the copper vessels and to the toxic effect on the yeast of the small quantities of copper salts passing into solution. I am convinced (and subsequent experience has amply confirmed me) that in not a few cases fermentation irregularities must be ascribed to the poisonous effect on yeast of traces of copper. But in the great majority of cases in which copper fermenting vessels are used, those injurious effects are either non-existent or at any rate are not sufficiently marked to have any real bearing on brewing practice. Aluminium, which is now much cheaper and which can be worked much more easily than formerly, has recently been proposed as a material for the construction of brewing vessels (including those intended for fermentation), and such vessels are now in actual use in a number of breweries both in this country and on the Continent with, I believe, quite good results. It is, however, rather too soon to speak with any certainty as to the future of this metal in relation to brewery plant construction.

By far the most striking change which has taken place in the brewing industry during recent years is the enormous development of the bottle trade, and the gradual disappearance of the small cask. Originally all bottled beer was beer specially brewed for the purpose and naturally conditioned and matured in bottle, and such is still the practice with regard to all bottled beer of the highest quality—such as export beers and the finest Burton pale ales. About thirty years ago, however, the practice of artificial carbonation made its appearance and was speedily found to meet a widely spread demand. From the brewers' point of view it had the advantage of enabling him to do a much quicker trade and to increase his turnover, whilst the consumer was glad to get a bottle of beer which was always in condition and which, being practically free from sediment, involved no waste. This process, which is still widely adopted and which has at least the merits of cheapness and simplicity of production, is not technologically a very perfect one, for not only is it impossible to prevent effectually the occurrence of fermentation and consequently of sediment if the beer is not quickly consumed, but there is from time to time difficulty due to albumenoid haze even when the beer is quite new. Even the most perfect filtration could not entirely eliminate this defect, and so brewers were quite prepared to welcome the introduction of the "chilling" system which had been brought to such a high state of perfection in American breweries. As to the respective merits and demerits of "quick chilling" and "slow chilling," the latter, in my opinion, gives by far the best results. It is, however, in all cases a question of the character of the trade to be done, and where the beer is intended for quick consumption and has to be sold at low competitive prices, it is very doubtful whether the "slow chilled" beer has sufficient advantages over the quick chilled product, to justify the increased cost of production. The great objection which is urged against these chilled and filtered beers is that they are usually wanting in character and especially in hop flavour. This is, undoubtedly, a just indictment and it is a fact that even a well brewed bitter tends, after it has passed the filter, to acquire something of the character of a mild ale. Of course this difficulty can be met to some extent by using strong foreign hops in the brewing process and by allowing the beer to mature as long as possible in cask or in tank before filtering and bottling. I have recently been experimenting on a large scale with specially distilled hop oil, and the results have been of a character to lead me to suppose that in the production of this class of beer the hop oil in question may be found to meet a real want. The cost of the special oil does not amount to more than about twopence per barrel, and as the rate of dry hopping may be reduced, the actual increased cost of production is small. The introduction of the chilled and filtered bottled beers met a widespread demand, and many brewers who at first resisted it have had to fall into line and are now doing a very large business in these beers. On the other hand such advantages as these beers possess are almost invariably secured at the expense of other desirable qualities, especially character and carbonic acid "grip." I think that whilst the chilled and filtered beer has "come to stay," there will always be a demand for the naturally conditioned article, which undoubtedly represents the highest type of quality and excellence. This class of beer at its best is magnificent, but unfortunately its all important secondary fermentation is to some extent a matter of chance, and no brewer can always undertake to turn out an article of a certain flavour and standard. For a very long time the bottle fermentation was held to be due entirely to secondary yeasts, but during recent years it has been shown (first by Claussen) that certain organisms belonging to the group of torulæ are in reality the active agents. Not all of these organisms are suitable since many are quite incapable of breaking up the residual carbohydrate matter of the beer, but others have this property and successful experiments with these organisms have been made on a large scale. I think, however, that there is abundant evidence that the so-called secondary yeasts are also operative in this respect. I must here refer briefly to a development of the chilling and filtering system in which the beer is transferred from the fermenting vessel to a tank in a cold room in which the beer is charged with gas and in which clarification and some maturation take place. After a few days in the case of mild ales, the beer passes direct to the filter and is then racked into gas-tight casks, when it is ready for consumption. This system originated in America, but has been modified and adapted to English conditions by H. J. Hill, and is known as the Schneible-Hill system. Its main features are (*a*) the collection of the carbon dioxide from an ordinary fermentation and its compression, (*b*) the chilling of the beer immediately after its fermentation and its carbonation with the collected gas, (*c*) the storage of the chilled and gassed beer for several days in a clarifying vessel in a cold room, and (*d*) the filtration through pulp and the racking of the bright beer. The essential features of this system, apart from the special plant employed, are the charging of the chilled beer with the natural fermentation gas, its period of storage for deposition of sediment and some maturation, and its racking in a brilliant condition into cask. The system, which is specially adapted to the treatment of runnng mild ales, is in successful operation in a number of breweries in this country; it possesses several important advantages, chief among which are reduced cost of production, uniformity of quality, and the possibility of drawing the beer bright to the last drop. Hops may be added to the beer in the clarifier if desired, or the hop oil to which I have referred might be used at that stage.

The following table shows the number of bulk barrels (that is, barrels of beer containing 36 gallons) of beer produced in the United Kingdom during the years 1902—1910 inclusive, and the average specific gravities for those years :—

Year ended 31st March,	Bulk barrels.	Average specific gravity.
1902	36,887,260	1053·47°
1903	37,153,978	1053·42°
1904	36,329,813	1053·43°
1905	35,415.523	1053·24°
1906	35,066,094	1053·33°
1907	35,406,797	1053·31°
1908	35,359,024	1053·44°
1909	34,376,352	1053·26°
1910	34,299,914	1053·20°

The above numbers show that the average strength of the beer brewed in this country has not been appreciably reduced during the past decade, and that there has been a fall in production equal to about 7 per cent. over that period. This latter is an unpleasant fact, but it may be hoped that the period of depression is passing, and that better days are in store for the industry. The times are, however, admittedly critical, and never was there a period when there was so great a necessity for maintaining or improving quality and for taking every possible step to secure the highest manufacturing efficiency. The race will be to the best equipped, and it is only by taking advantage of every improvement in working that science can suggest that the brewer will be able to emerge successfully from the period of stress and strain through which the industry is passing.

Discussion.

The Chairman said the matter might be considered under the three heads of science, plant, and practice. With regard to the first, he should have liked the author to put the question very distinctly, Had the progress of science been adequately represented in the brewing industry of the United Kingdom during the last 30 or 40 years? Apart from actual starch conversion, the science of brewing was very largely connected with the discoveries and labours of Pasteur. Was it a fact that the industry had taken to itself the lessons of Pasteur's life in the way they had been assimilated by medicine and surgery? If not, the further question might be asked, Was there not room for considerable improvement in the design of breweries, and plant, and in the substitution of non-absorbent material for a good deal of that which was now used? Another point he should like to hear discussed more fully was connected with yeast. Mr. Chapman had referred to the question of the use of yeast produced from a single cell; but he, the speaker, was not quite sure that the brewing industry had done full justice to that particular subject. The use of yeast produced from a single cell was generally admitted to have been a failure. Why? He imagined it was because the flavour of the beer was a compound flavour not obtainable from a single variety of yeast. To those acquainted with the work done on certain races of yeast as regards the development of certain characteristic flavours the question suggested itself whether sufficient study had been given to the possibility of using a combination of pure yeasts. Another question he should like to hear discussed was, Had there been an adequate increase of what he might call scientific control; had brewing become really a chemical industry; watched and controlled from beginning to end of the process by chemists? That was to his mind the secret of future progress. There were two directions in which the benefit of close scientific control might be looked for, first, profit connected with the more economical use of material, and, second, advantage in increased certainty as to the character of the product. Mr. Chapman had referred to the grinding of malt and to the necessity for examining brewers' grains; but the matter was not confined to these questions, and he was not sure that in a sufficiently large number of cases there was that amount of scientific control which a brewing operation ought to have, and which brought with it the other great advantage, which was connected with what he called the scientific spirit, the careful isolation of facts before conclusions were drawn as to the cause of particular defects or evils; he still thought there was too much readiness to assign causes without adequate investigation. He fully agreed with all Mr. Chapman had said as to coolers; but in connection with the designs of breweries and brewing plant he would specially ask, Were the general cooling arrangements quite up-to-date? for he gathered that the special air purifying plant to which Mr. Chapman had referred was quite exceptional. With the condemnation of certain refrigerators all would fully agree. One piece of plant, he thought, the paper had not done full justice to, viz., the outside masher to which Mr. Chapman incidentally referred. There used to be a very large number of breweries of quite respectable size which were arranged without outside mashers. If a systematic mixture was to be made it was undoubtedly best to do it in detail; and in such a case an outside masher was, he thought, essential. He was disappointed that Mr. Chapman did not deal with the subject which might be described as the free mash-tun question. To his mind the grant of the free mash-tun was the greatest opportunity the English brewer had ever enjoyed; and he should like to ask whether he had fully availed himself of it. In that connection he would have been glad to hear Mr. Chapman say a little more about converters and discuss the question of the degree of preparation needed where unmalted grain was used as an adjunct to the malt and the modification of the ordinary brewing process which was necessary properly and fully to utilise unmalted grain. He would conclude by suggesting that as regarded the future there was still room for improvement in the design and fitting of breweries, in the material used for certain portions of the plant, in the conditions under which wort was cooled, and generally in securing greater scientific control and the recognition of the great part played by flavour, which, to his mind, was made up of three elements—wort-composition, yeast, and hops.

Mr. Babington said he was not prepared to give a plain answer Yes or No to the question the Chairman had put to them collectively—viz., whether scientific methods were as yet sufficiently appreciated and employed by the brewery trade, but perhaps he could answer in part. When he first came to London the art of brewing, to which he was then apprenticed, was certainly "mysterious." Almost the one point on which brewers then took special precautions was in never allowing anybody to know the temperature at which they mashed their grist. The thermometers were not marked with any figures, and each thermometer was different from the other. The heat to which the liquor was brought was measured by a separate ivory scale. He was apprenticed to a brewer who was one of the first to see that science had to be brought in to the assistance of the brewer. He remembered well the difficulties thrown in his way. It was realised with some alarm that the man of science who came to help would make the discovery of the temperature at which they mashed the grist; yet when he made an entry into the brewery his work was extremely practical, and had the happiest result. From about that time science had come increasingly into breweries, and had done very valuable economic work. There were two points particularly in which the commercial brewer had found the scientist's help of the greatest use; the first was, naturally, in the extract obtained, and the second was in the keeping qualities of the beers. Then, along with a great deal of other brewing plant, the coolers had been greatly changed within his memory: he remembered when they must have covered acres, old wooden coolers, black with dirt. He remembered the horror of the brewery directors of those days when they were told the number of living organisms that were to be found on one square inch of their wood. Speaking broadly, he thought the trade had realised the value and necessity of scientific methods; and, if not for progress, at any rate for protection, almost every brewer now turned to the laboratory. He thought the operative brewers were all now willing to listen to the dictates of science, and that, as time went on, the feeling would grow stronger and stronger. Another aspect of brewing, which the brew master could not afford to neglect, was the utilisation of waste products. Possibly their long neglect of yeast might have something to do with the inherent weaknesses that Mr. Chapman found in it. Yeast had, he believed, improved in vitality and power within the memory of living brewers; but it was possible that they still did not take sufficient care of it. The Chairman probably had that thought in his mind. The Americans took much greater care of it, and had stronger types than we had. Several ale breweries in the Eastern States had never had, during thirty or forty years, a change of yeast or a yeast trouble which was not directly connected with avoidable carelessness in the manipulation They took the greatest care of their yeast, and perhaps partly because there was no such friendly arrangement as there is in this country, where if a brewer's yeast went wrong he could rely on getting another brewer to supply him. Their greater freedom from yeast trouble was probably due to these precautions, and perhaps also to climatic influences, which might possibly be more favourable to the yeast plant than in this country.

Mr. Arthur R. Ling said that the author had wisely thrown aside altogether the vexed question of starch conversion, which was more or less controversial, and, as it stood at the present time, perhaps of academic more than of practical interest. He had referred to some of the modern developments of milling systems, and he had done ample justice to those which aimed at grinding up the contents of the endosperm to grits whilst keeping the husk as far as possible intact. This idea had been developed by Messrs. Seck, and he believed also by Messrs. Boby, in such a way that it was possible to get a wort which, whilst giving the highest possible yield of useful extract, did not introduce into the wort objectionable substances (pentosans and certain nitrogenous matters), derived from the husk and from the peripheral layers of the corn. Messrs. Seck had now put on the market a mill which contained three pairs of rolls instead of two; and by its use he understood that the extract amounted to almost as much as when the filter mash was used. Contrary to the opinion he held formerly, he did not quite agree with the lecturer's observations as to the advantages of the filter mash. This process necessitated the grinding of the malt to the finest flour, and thus objectionable substances, above referred to, might be introduced into the wort from the husk of the grain. A further difficulty encountered with the filter mash was that the filter pipes sometimes clogged, and the press had to be taken to pieces and the whole filtering process started afresh. This happened usually when the malt was not ground sufficiently fine. He was not sure that the wort got much hot aeration on the coolers, on which vessel the cooling took place by evaporation in a current of air and not by contact of the wort with cold air, which like all gases possessed a low conductivity and therefore had very little cooling power. There was thus always a space of water vapour between the wort and the air passing over it. He could not agree entirely with Mr. Chapman in his remarks on the economy of hops. He thought that the system of introducing all the hops at the start and boiling for the whole time had been found preferable for the best beers. For hop aroma they had to depend chiefly on dry hopping; but in the copper the hops should be thoroughly cooked. In most of the Burton pale ale breweries the hops were put into the copper at the start and boiled the whole time. He did not know exactly what the samples of hop oils were, but an observation had been made some time ago by C. J. Lintner that any excess of hop oils added to the finished beer tended to produce thinness of palate, and that was an additional reason for a prolonged boil in the copper, as the bulk of the oil was thereby dissipated.

Mr. **Julian Baker** said that for some years he had worked with pure yeast on an industrial scale with results each year more encouraging; and he considered that for running beers only there was a wide field for further investigation.

Mr. E. L. **Joseph** supposed that when the author referred to the use of aluminium he meant an aluminium alloy. He was disappointed that Mr. Chapman had not mentioned the use of ozone in brewing; it was not new, for he found that 40 or 50 years ago it was suggested. But, as a matter of fact, ozone on practically a commercial scale had been for some five years in use in three or four leading breweries in this country.

Dr. L. T. **Thorne** agreed with the Chairman, that although there was room for further scientific control there was no doubt that the advance in the brewing industry had been pretty nearly equal to the advance in any other application of chemistry to technology, and that some of the most far-reaching experimental work had come from brewers. Like Mr. Babington, he remembered the time of the masked or falsified thermometer.

Dr. J. **Lewkowitsch** asked whether it might not be possible so to treat or to deal with the yeast in the brewery that it should fulfil the same purpose that the distiller's yeast did. If anything could be done in that way, undoubtedly a good income would result to the brewer, and that was a matter which seemed, judging from a scientific point of view, not too difficult to attain.

Mr. **Chapman**, in reply, said that the Chairman had referred to quite a number of matters which he would have liked to have dealt with, but some of his observations had been already answered by subsequent speakers. Whether the industry had taken all the advantage it might of scientific assistance and control he did not know; probably it had not, but it had done a great deal. Specific combinations of yeast had been tried and had not been found to work satisfactorily. The obvious reason was, that if one started with a mixture of two species it was found impossible in practice to maintain the original proportions after a certain number of fermentations. The same point had been raised by Mr. Baker, but the pure yeast question was one about which there was not absolute unanimity of opinion, and some brewing technologists had found that in the case of certain beers pure yeast acted perfectly well, but such beers were invariably running mild ales, where there was no real question of true secondary fermentation. To have dealt in detail with the question of the free mash-tun to which the Chairman had referred would have taken him too far. He had purposely excluded any reference to the exact manner in which the starch molecule was broken down at the instance of diastase; as it hardly came within the scope of his paper. One of the disadvantages of the mash-filter was the liability of the mill to break down, but there was no reason why that should not be easily overcome. Another objection was that one might get from the husk certain substances which were not desirable. He did not, however, attach much importance to that point, because the beers produced by this method were not shown to have been in any way inferior in flavour. He considered the combination of converter and mash-filter an excellent substitute for the mash-tun and thought that it had a great future before it. With regard to the question of boiling hops, he did not altogether agree with Mr. Ling. With regard to the three pair of rollers he had mentioned in the paper that such a mill had been constructed. Mr. Ling said that Lintner had pointed out that when hop oil was added to beer it produced a certain thinness of flavour, and it destroyed the head-retaining capacity of the beer. It was to avoid those defects that the "separated" hop oils had been produced; they did not destroy the head-retaining capacity, they had a larger amount of flavouring power, and did not produce any thinness.

The aluminium used was over 99 per cent. and was not an alloy. As far as he knew, its solubility in any liquids which were likely to come into contact with it in brewing was negligible. Ozone was another small matter to which time did not allow him to refer. Dr. Lewkowitsch had raised an important point with regard to brewers' yeast and distillers' yeast. It was well known that certain brewers commanded a ready sale for their yeast among bakers; but no brewers' yeast, as far as he knew, could fully take the place of distillers' yeast. Certain brewers made a good quality, but even that was not as vigorous as distillers' yeast. If the brewer could transform his yeast into first-class bakers' yeast it would be a highly important thing, because instead of being in the nature of a waste product which sold for only a few shillings a ton, they might sell it at several pence per pound. Apparently at present it was impossible to do that. Messrs. Baker and Hulton had shown that the main difference between distillers' and brewers' yeast was that the distillers' yeast had got acclimatised to certain toxins from the grain which were present in the distillers' worts and consequently it was not poisoned by the similar products present in the bread. With brewers' yeast that was not so; the toxins present in the wheat did exert a markedly poisonous effect on brewers' yeast, and if some means could be found of immunising brewers' yeast or rendering it non-sensitive to wheat toxins, one would have a means of converting brewers' yeast into bakers' which would undoubtedly become very profitable.

Meeting held at Burlington House on Monday, April 3rd, 1911.

MR. E. GRANT HOOPER IN THE CHAIR.

GUM FROM THE BOMBAX MALABARICUM.

BY P. P. PHILLIPS, PH.D.

The *Bombax malabaricum* (vernacular name, *semul*), the red, silk-cotton tree, is a large tree belonging to the natural order *Malvaceæ*. It is found in the plains of India, and the sub-Himalayan tract where it ascends to a height of 3,500 feet. It is also indigenous in Ceylon, Burmah, the Malay peninsula, and in Northern Australia (Brandis, Indian Trees, 1906).

The *Bombax malabaricum* yields a gum which exudes only from those portions of the bark which have been injured by decay or by insects, since incisions in the healthy bark do not cause the gum to flow. The gum first exudes in the form of a white, opaque, viscous mass, which readily turns red, and finally dries into hard, brittle, mahogany-coloured tears, the larger of which are hollow in the centre, the cavity being produced during the gradual drying of the jelly-like mass which first exudes from the tree. The fresh exudation contains about 84 per cent. of moisture which it loses on drying in air. The gum is best collected during the early part of the hot season—from March till June—since it has then lost most of its moisture, and consequently is less liable to ferment and deteriorate when it is stored.

The gum is known in the vernacular under the name of *mocherus*, and is sold in all the large Indian bazaars. The best quality, freed from bark and excessive mineral impurities, fetches 12 rupees per maund of 80 lb. It is a very astringent substance and is largely used by all classes of Indians as a medicine.

Regarding the formation of this gum, in the Pharmographia Indica, 1890, vol. I., p. 216, it is stated that—"*Mocherus* is not a normal juice, but the product of a diseased action, which consists of the proliferation of the parenchyme cells of the bark; upon making a section of the diseased parts, a number of small cavities are seen, which contain a semi-transparent, jelly-like substance, consisting of oblong cells containing a little granular matter, and a small group of starch cells. At the margin of the cavity the columns of healthy cells are seen breaking up, and the cells separating to join the jelly-like mass; this gradually increases in size, and finds its way to the surface to be extruded as *mocherus*."

Chemical properties of the gum.

In the brief note contained in the Pharmacopœia of India, 1868, p. 36, and in certain later works*, it is stated that the gum contains a large proportion of tannic acid, but, apart from this bare statement, there is little evidence to show that any systematic chemical examination of the product has ever been undertaken (vide Watt's Dictionary of the Economic Products of India, 1889—1896, vol. I., p. 488; also The Commercial Products of India, 1909, by Sir G. Watt, p. 168).

For the purpose of examination, the gum was reduced to a very fine powder in a steel mortar. The product then possesses a reddish-brown colour, and has an odour resembling tea. When macerated with water, it swells up, and resumes very much the appearance of the freshly exuded material. It yields a reddish-brown solution from which a little gum is precipitated by the addition of alcohol; the bulk of the original powder is, however, insoluble in water.

On incineration over a Bunsen flame, the dried gum yields a mineral residue, generally amounting to 8 or more per cent., which chiefly consists of sand, together with alumina, calcium carbonate, magnesium carbonate, and small quantities of clay and ferric oxide. From personal observations made on the spot, the writer is of opinion that the gum results chiefly, if not exclusively, from the damage caused by termites to the bark of the tree, and that most of the earthy impurities undoubtedly become associated with the gum through the action of those insects. The mineral residue left after incineration of the better qualities of *mocherus* should not, however, exceed 8 or 9 per cent.

The filtered liquid, obtained by boiling 20 grammes of the powdered gum for 4 hours in 1·25 litres of water, gave the following reactions:—

Ferric chloride: green coloration changed to purple on the addition of very dilute ammonia. Dark green, almost black, precipitate with stronger solutions. The green coloration is destroyed by the addition of dilute hydrochloric acid, and is also changed to a dirty brown coloured liquid with a greenish fluorescence by the addition of an excess of the reagent. A few drops of sodium carbonate changes the green colouration into a blue-black precipitate.

Ferric acetate: bluish-black precipitate acquiring a purplish fluorescence when treated with a few drops of dilute ammonia.

Gelatin solution (½ per cent.): copious precipitate. Slight cloudiness with dilute solutions of the extract, but a precipitate is at once obtained by adding a few drops of a solution of ammonium chloride.

Tartar-emetic: buff coloured precipitate, readily soluble in an excess of the reagent, but re-precipitated by adding a few drops of ammonium chloride. With dilute solutions of the extract, only a slight clouding is noticeable, but this is increased by the ammonium chloride treatment.

Stannous chloride: buff coloured, mucilaginous precipitate. If the original solution be dilute, then the liquid will become turbid.

Lead nitrate: light brown precipitate.

Lead acetate: brownish red precipitate. The precipitate will have a purplish tint if the solution be dilute.

Bromine water: copious yellow precipitate which darkens on standing.

Nitrous acid: light brown mucilaginous precipitate which subsequently darkens. With dilute solutions only a slight darkening results.

Copper sulphate: brown precipitate. If ammoniacal copper sulphate be employed, then the precipitate will be of a darker colour, and, on boiling the liquid, some cuprous oxide will be precipitated.

Pine shaving moistened with hydrochloric acid: no result, but if the shaving be allowed to remain overnight in contact with the extract, then it will become slightly red.

Sodium sulphite: no result.

Lime water: light brown precipitate.

Ammonium picrate: no precipitate is produced but the liquid darkens slightly.

Ammonium molybdate: A nitric acid solution of ammonium molybdate yields, with a few drops of the extract, a light—rapidly becoming dark—brown precipitate. With dilute solutions the liquid becomes turbid, and darkens.

Manganese acetate: dark brown mucilaginous precipitate: clouding in dilute solutions.

Cobalt acetate: purplish precipitate.

Potassium dichromate: dark brown precipitate: clouding and darkening of the liquid with dilute solutions of the extract.

Aluminium sulphate: brown precipitate.

Aluminium acetate: light brown precipitate.

Sodium acetate: light brown precipitate with strong solutions, soluble in an excess of the reagent.

Alkalis: caustic soda or potash produces a light brown precipitate with the extract; on warming, the precipitate dissolves, and forms a deep wine-red solution. The original extract, and alkaline solutions of the same, readily ferment if left exposed to the air. Apart from a small amount of mineral residue, the powdered gum dissolves completely in a solution of caustic soda or potash.

Acids: A buff coloured precipitate is obtained by the addition of a few drops of dilute hydrochloric or sulphuric acid; the precipitate dissolves on boiling the liquid. Concentrated sulphuric acid, with one drop of the extract, gives an intense crimson solution, which dilutes pink, and this solution yields a dark brown flocculent precipitate on standing; the liquid is then colourless.

From the foregoing reactions, it is therefore evident that the gum contains a considerable quantity of tannin and belongs, in fact, to that class of tannin materials which Procter* has classified as being of "mixed and doubtful constitution." The reaction with bromine water, and also with ferric chloride, which contained a very small quantity of free acid, indicates the presence of a catechol tannin. A portion of the original powdered substance was therefore submitted to dry distillation, and the distillate examined for catechol. Catechol was isolated from the distillate, and a dilute solution of the crystalline product gave, with ferric chloride, a fine green coloration which turned purple on the addition of a little dilute ammonia. During the distillation an interesting result was obtained by moistening a pine shaving with hydrochloric acid and placing it at the mouth of the receiver; it was instantly coloured violet.

Hydrolysis of the gum.—Boiling the original substance with dilute acid, preferably hydrochloric acid, yields a red coloured solution, together with an insoluble residue which possesses the colour of crimson lake. For brevity sake this amorphous product will be referred to as "*semul red.*" It is only very moderately soluble in alcohol, and, therefore, this colouring matter does not possess the solubility ordinarily attributed to the phlobaphenes.[*] The filtrate from the hydrolysis deposits a small quantity of a dark red, amorphous powder, and if the tannin substances be removed by means of precipitation with lead acetate, and the excess of lead in solution be removed from the filtrate by means of sulphuretted hydrogen, then the residual liquid, freed from sulphuretted hydrogen, will reduce Fehling's solution.

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* Pharmographia Indica 1890. Vol. I. p. 216. The Vegetable Materia Medica of Western India, 1885, by W. Dymock; p. 106. The Supplement to the Pharmacopœia of India, 1869, by Moodeen Sheriff; p. 7.

* This J., 1894, 487.

This investigation is being continued.

Nottingham Section.

Meeting held at Nottingham on Monday, February 27th, 1911.

MR. S. J. PENTECOST IN THE CHAIR.

SEWAGE SICKNESS IN SOIL, AND ITS AMELIORATION BY PARTIAL STERILISATION.

BY E. J. RUSSELL, D.SC., AND J. GOLDING, F.I.C.

The method known as the land purification of sewage consists in allowing the sewage to run over a field, of light soil if possible, carrying or about to carry some crops which shall take up part of the ammonia and nitrates formed during the decomposition, and thus give a certain financial return for the fertilising constituents present. Whatever the theoretical advantages of the system, it suffers in practice from the very grave defect that the soil cannot indefinitely carry on the decomposition processes, but gets into a "sewage-sick" state, when it must be rested for a longer or shorter time, during which no sewage can be run on to it. Thus a part of the sewage farm is invariably idle, and in consequence a disproportionately large amount of land is needed. Our purpose in the present paper is to discuss some of the causes of sewage sickness.

The essential feature of the method, as distinct from the various others in vogue, is that the decomposition is effected in the soil, and presumably follows the ordinary course of soil reactions, the organic matter being first broken down to simpler compounds, and then to ammonia which is oxidised to nitrites and nitrates. This normal decomposition has been studied at some length by soil chemists and bacteriologists because of its great agricultural importance. It is mainly, if not entirely, effected by bacteria, and the rate at which it takes place depends on the extent to which the conditions are favourable or not to the development and activity of these organisms. The favourable conditions are sufficient air, moisture, warmth, and food, and the absence of harmful factors. The air and water relationships are very closely connected; as the space in between the soil particles is not very great there is always the risk of insufficient air supply whenever much water happens to be present. Bacteria apparently flourish best when the soil is moist without being actually wet; they can then get the air they want, while at the same time the film of water sticking to the soil affords sufficient moisture for their needs. The wet, sodden state in which the soil of a sewage farm lies while it is receiving sewage is not the most favourable for bacteria; on the other hand, the drier, more crumbly state it assumes when it is ploughed up into ridges is much better suited to their activity. This, indeed, is a fundamental defect of the method: it requires that decomposition shall go on in presence of so much water that the organisms do not get sufficient air, and are, therefore, not working at their maximum efficiency.

The causes of sewage sickness.—It is, however, the injurious factors that play the most important part in determining sewage sickness. These may fall into three groups—chemical, physical, and biological. Little is known about possible chemical factors: when calcium carbonate is absent from ordinary soils acid substances are formed harmful to bacteria, but there is no satisfactory evidence of any toxic substance in soils that are not acid. The sewage-farm soil we have studied is alkaline, hence the acid substances do not come into play, but it is always possible that other toxins are present, derived from the sewage. We do not in the present paper propose to discuss possible chemical toxins.

Adverse physical conditions arise from a change in the condition of the clay, of which there is always a certain amount even in comparatively light soils. Clay, as is well known, can exist in two states—in a flocculated state, in which it is somewhat friable and pervious to water: and in a deflocculated state, in which it is extremely sticky and impervious and tends to cake. Acids and salts in certain concentrations flocculate clay, alkalis deflocculate it; in presence of water clay will remain deflocculated, but on drying it tends to flocculate again. Thus, while sewage is being run on to the land, the clay is rendered sticky and impervious by the free alkalis of the sewage and the long contact with water, and instead of the soil being in its best condition for percolation it gradually assumes its worst. The trouble is even more pronounced in very wet weather. Deflocculation is well known to the agriculturist, and is remedied by dressings of lime, chalk, or limestone, whichever happens to be most convenient. None of these agents itself flocculates clay—indeed, pure lime has a deflocculating action on pure clay, but in the soil they all change to calcium bicarbonate, which is a powerful flocculator. No method of avoiding deflocculation is known, but the trouble can be remedied by periodical dressings of lime, chalk, or limestone just before the land is ploughed up for its rest.

The adverse biological factors are probably the most complex. The delay in the rate of percolation just referred to leads to an accumulation of water in the soil which, as we have seen, is unfavourable to the decomposition bacteria. It is, however, eminently favourable to the development of a number of organisms much larger than bacteria, and these grow so rapidly that they form a dark green slime on and near the surface, which still further increases the difficulty of percolation. On the other hand, when the soil is laid up in ridges to dry and to become aerated, the conditions again become favourable to bacteria and unfavourable to the larger organisms. The latter therefore die, and, after sufficient time, the flora once more approximates to the type obtaining in normal arable soils. Thus the device of resting soil, which long experience has shown to be an essential feature of the management of a sewage farm, results in improvement in two directions: in the physical condition of the clay, and in the type of the micro-organic flora of the soil.

The change in the micro-organisms is not merely a change from a complex to a simple type. Although bacteria are the best-known inhabitants of a normal arable soil, they are by no means the only ones. Both the flora and the fauna are highly complex; moulds and algæ are known to occur, and recent experiments indicate the presence of protozoa: ciliates, flagellates, and amœbae.

It appears that there is some factor in ordinary soils which keeps down the numbers of the useful decomposition bacteria and prevents them from doing as much work as might have been expected. The experiments of Russell and Hutchinson[*] indicate that the factor is biological and consists of large organisms harmful to bacteria. Aerating the soil is favourable to the bacteria, but does not destroy the harmful organisms: no matter how long the soil is "rested," the bacteria never attain their maximum development. It has, however, been shown that the harmful organisms are more readily killed than bacteria; thus they are completely destroyed by a moderate heat (60° C.) or by treatment with toluol, carbon disulphide, etc., while the bacterial spores and some of the active forms survive. When the antiseptic is removed the surviving bacteria are now free to multiply to an extent previously impossible, and they attain extraordinary numbers. There is also a marked increase in the amount of decomposition effected, and, in arable soils, an increase in fertility. Our experiments show that a similar factor injurious to the decomposition organisms is at work in sewage-sick soils also.

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[*] Commercial Organic Analysis; Allen. Vol. III., part 1, page 27.

[*] Russell and Hutchinson, Journal of Agricultural Science, 1909, 3, 3.

The effect of partial sterilisation on the rate of recovery of sewage-sick soils.—In the first series of experiments, designed to investigate the rate of recovery when the "sick" soil is aerated, we left the soil under very favourable conditions of aeration and temperature, and made periodical bacterial and chemical analysis. The soil of the Kegworth sewage farm, on which we have worked, is light, of excellent texture for the purpose, and the sewage is largely domestic, there being no trade effluent except from one large brewery; neither sewage nor soil presents any abnormal or unusual feature, and we think that our conclusions will be found to hold generally. The soil was taken from the field to which sewage had been recently applied for some months, and which was about to lie up for a time. There was an abundant development of the dark green slime; further, the soil was strongly alkaline, and contained a large amount of ammonia—some 60 or 70 parts per million, in place of the 1 or 2 parts found in ordinary arable soils—but only small quantities of nitrates. After partial drying it was kept for seven weeks (from June 23rd to August 10th) under very favourable conditions of aeration, moisture content, and temperature, the conditions being made to resemble those obtaining when a soil is rested in a very favourable season. It was then divided into several equal lots: one was heated to 98° C. for 3 hours; another was heated to a higher temperature, not determined, but sufficient to cause a certain amount of charring; a third was put into a closed vessel and received 0·2 per cent. of carbon disulphide, which after two days was allowed to evaporate at ordinary temperature; and a fourth received the same amount of toluol, which likewise was allowed to evaporate after two days. The soils were then brought to a uniform moisture content of 16 per cent., and put into wide-mouthed sterilised bottles plugged with cotton wool.

TABLE I.

Number of bacteria in partially sterilised sewage-sick soils.

In millions per gram of dry soil.

	No lime applied.				Lime applied.			
	At start. Aug. 11.	Aug. 24.	Oct. 19.	Nov. 21.	At start. Aug. 11.	Aug. 24.	Oct. 19.	Nov. 21.
Untreated soil	21·9	12·4	35	91	14·4	29·5	30·3	38
Soil heated to 98° C.	0·04	18	36·6	37	0·8	51·8	53	55
Burnt soil	very few	—	29	42	very few	50	54·5	49
Soil treated with carbon disulphide	2·8	11	136	253	1·5	348·4	355	168*
Soil treated with toluol	4·2	24	60	441	1·8	180·6	199	229

* This sample had become very dry during the last four weeks of the experiment.

Table I. shows the rate of multiplication of bacteria in the untreated and heated soils, and in the soils treated with carbon disulphide and toluol. The first effect of the treatment is to kill many of the bacteria as might be expected, but afterwards they increase to a marked extent and maintain their high numbers without any sign of falling off.

After the injurious factor has been killed by toluol one gram of the soil can accommodate 400 million bacteria, but while the injurious factor remains the bacteria are kept down below one-tenth of this number, and no matter how favourable the conditions of aeration they only exceptionally reach 40 millions. These remarkably high numbers are never attained in our experience on arable soils, nor is the injurious factor anything like so potent; indeed the conditions of a sewage farm seem particularly favourable to it.

It will be noticed that lime has, at first, a strong depressing action on the bacteria, reducing the numbers in the otherwise untreated soil from 22 to 14 millions, and in the toluol and carbon disulphide-treated soils from 4·2 and 2·8 to 1·8 and 1·5 millions respectively. Lime itself is harmful to the organisms but the calcium bicarbonate to which it quickly gives rise in soil is beneficial, so that the numbers quickly rise again. Neither toluol nor carbon disulphide appears to have any very profound modifying effect on the type of the bacterial flora. The brown varieties, which constitute about 4 per cent. of the colonies on the unsterilised soils are killed by carbon disulphide and reduced to 1 per cent. by toluol, otherwise the organisms growing on gelatine are not obviously affected. Heat has a greater effect: it kills a number of varieties and it further gives rise to a number of compounds, presumably of acid nature, especially favourable to moulds; for whereas moulds form less than 2 per cent. of the colonies from the untreated, the chemically treated, and the steamed and limed soils they form 7 per cent. of the colonies from the steamed soil without lime. That a slightly acid medium is favourable to moulds is well known: on the other hand bacteria prefer a slightly alkaline medium, hence the nutrient gelatine for the plate cultures is made just alkaline. Probably some other compounds harmful to bacteria are formed by heat, for even in the heated and limed soil the numbers never become anything like so high as on those chemically treated.

There are, however, two significant changes produced by partial sterilisation. The nitrifying organisms are completely destroyed, and the other organisms that survive the treatment are all weakened and rendered less virulent. The decomposition process stops at the ammonia stage, and we have the remarkable phenomenon of well aerated soils in which ammonia accumulates instead of being, as usual, converted into nitrates. The weakening of the bacteria by partial sterilisation has been demonstrated in the paper by Russell and Hutchinson already referred to. It is easy to introduce some of the unweakened stocks into the partially sterilised soils by adding a little of the untreated soil: the result is an enormous increase in bacteria numbers, as shown in Table II.

TABLE II.

Effect of introducing unweakened bacteria into partially sterilised soils.

Number of bacteria in millions per gram of dry soil.

	At start. Jan. 5.	Jan. 14.	Jan. 27.
Untreated soil	37	31	31
Soil treated with carbon disulphide	—	130	110
Soil treated with carbon disulphide 0·5 per cent. of untreated soil	—	110	475

The numbers of Jan. 5th are calculated on the wet soil as 41 per cent. of water was present.

The increased bacterial population in the partially sterilised soils brings about an amount of decomposition considerably greater than that taking place in the untreated soil, with, of course, the difference that ammonia only is produced and not nitrates. In Table III. are given the amounts of ammonia and of nitrate[*] formed in the soils used for the bacterial counts already set out in Table I.

In the untreated soil decomposition proceeds but slowly; the initial samples contain rather large quantities of ammonia which, however, by the end of the experiment had been almost completely converted into nitrates. In the partially sterilised soils decomposition was much more vigorous but as nitrification was not taking place there was an extraordinary accumulation of ammonia and in consequence losses set in, as shown by a comparison of the results of November 21st and October 19th. Two sets of causes seem to operate; there is some loss by evaporation[†] and also, apparently, some assimilation by micro-organisms when large quantities of ammonia remain long in the soil. As we do not know the precise amount of the loss it is not possible to say exactly what the rate of decomposition has been, but it is clearly much greater than in the untreated soil.

TABLE III.

Amounts of ammonia + nitrate formed in partially sterilised sewage sick soils.

Expressed as parts per million of dry soil.

	No lime added.				Lime added.			
	Already present at start. Aug. 12.	Additional amount formed after			Already present at start. Aug. 12.	Additional amount formed after		
		13 days. Aug. 24.	69 days. Oct. 19.	102 days. Nov. 21.		13 days. Aug. 24.	69 days. Oct. 19.	102 days. Nov. 21.
Untreated soil	397	0	37	55	397	34	66	53
Soil heated to 98° C.	412	81	268	314	418	126	243	130
Burat soil	236	0	0	35	210	0	100	80
Soil treated with carbon disulphide	370	103	163	153	391	72	158	60
Soil treated with toluol	356	87	194	165	384	106	164	174

TABLE IV.

Amounts of ammonia and nitrate in partially sterilised soils re-infected with unweakened organisms from untreated soil.

Parts of nitrogen per million of dry soil.

	Ammonia.		Nitrate.		Ammonia and Nitrate.	
	Jan. 14	Jan. 27	Jan. 14	Jan. 27	Jan. 14	Jan. 27
Untreated soil	73·8	90·8	12·3	9·1	86	100
Soil treated with carbon disulphide	93·2	139	16·3	7·9	109·5	147
Soil treated with carbon disulphide and re-infected with 1 per cent. untreated soil	105	263	11·5	9·2	116·5	272

Although the loss of ammonia precludes any strict comparison between the numbers of bacteria as shown in Table I. and the amount of decomposition products as shown in Table III. there are nevertheless two general facts brought out. The chemically treated soils show, when compared with the untreated soil, a connection between the rate of increase of the bacteria and the amount of decomposition. There is no exact relationship, but the periods of rapid bacterial growth are, in general, periods of rapid ammonia production also. But there is no such connection between bacterial growth and ammonia production in the heated soils. Heating to 98° C. has, however, been shown to have a very complex action on the soil, some of the organic matter is decomposed, thus lightening the work of the bacteria, and also a substance toxic to bacteria is formed.

It has been shown in Table II. that the addition to the chemically sterilised soils of unweakened bacteria from the untreated soil leads to a great increase in the bacterial population. As might be expected there is a corresponding increase in the amount of decomposition effected; this is set out in Table IV.

The soil was brought down from the farm on January 5th and was then very wet (30 per cent. of water being present) strongly alkaline, and contained 150 parts of nitrogen as ammonia and 16 as nitrate per million of dry matter. It was allowed to dry till half the water was gone, a considerable amount of ammonia disappearing at the same time. The decomposition was proceeding normally for some days prior to the 14th and is seen to be much more rapid in the re-infected soil than in the others.

The effect of partial sterilisation of the soil of a land filter on the amount of purification effected.—In the second series of experiments a number of small land filters were made 24 inches in diameter and 8 inches in depth when the soil had shrunk to its minimum volume.

These were filled with partially "rested" soil and set up in the field, and they received sewage daily at the same time as it was run on to the land. The effluents were sampled periodically and analysed, with results set out in Table V.

In the early days of the experiment the effluents from the treated soils were not as good as those from the untreated soil because the bacteria had not yet multiplied sufficiently. But after about a fortnight the effluents from the partially sterilised soils are seen to be distinctly better than from the untreated soil. The samples collected on October 20th may be taken as typical of the effluent during the autumn, and show satisfactory purification, especially when the shallowness of the filter is considered. The November sample was taken not long after the filters had frozen. It ran through the soil very quickly in consequence of cracks produced by the frost, and hence was not well purified, but still the treated soils give the best effluents. The February samples were taken so long after frosts that all danger of cracks was past, but the purification effected by the untreated soil is not so good as in the earlier samples, indicating that sewage sickness is setting in. The treated soils on the other hand, show little sign of falling efficiency; they are as effective as in November, although not quite as good as in the warmer autumn weather.

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[*] The nitrates were determined by a modification of Warington's method (Trans. Chem. Soc., 1882, 351; 1889, 537) and the ammonia by distillation of the soil *in vacuo* with water and magnesia. (Russell; Journal of Agricultural Science, 1910, 231.)

[†] This source of loss is reduced to a minimum by the conditions of the experiment; the soil is kept in bottles plugged with cotton wool to allow entrance of air, but as fifteen or sixteen per cent. of water is present, and only 0·02 per cent. of ammonia the partial pressure of the ammonia must be very small.

TABLE V.

Composition of effluents from small filters which contained partially sterilised soils.

Parts per 100,000.

	Aug. 12	Aug. 26	Oct. 20	Nov. 19	Feb. 18
	Free and saline ammonia.				
Crude sewage ...	9·50	9·00	5·48	15·00	13·50
Effluent from untreated soil ...	1·61	1·38	1·84	1·50	3·88
Soil treated with carbon disulphide	3·56	3·03	1·26	1·03	1·90
Soil treated with toluol	2·92	0·85	0·40	0·30	0·65
Burnt soil	—	4·86	0·41	0·50	0·50
	Albuminoid ammonia.				
	Aug. 12	Aug. 26	Oct. 20	Nov. 19	Feb. 18
Crude sewage ...	1·40	0·72	1·28	1·85	1·25
Effluents from untreated soil ...	0·59	0·28	0·22	0·31	0·35
Soil treated with carbon disulphide	0·92	0·31	0·16	0·27	0·20
Soil treated with toluol	0·62	0·31	0·16	0·22	0·21
Burnt soil	—	0·57	0·17	0·20	0·06
	Oxygen absorbed.				
	Aug. 12	Aug. 26	Oct. 20	Nov. 19	Feb. 18
Crude sewage ...	5·6	2·32	—	10·14	7·84
Effluents from untreated soil....	3·3	1·78	1·08	2·44	3·70
Soil treated with carbon disulphide	3·9	1·28	0·8	2·42	2·25
Soil treated with toluol	3·0	1·38	0·78	2·30	1·23
Burnt soil	—	2·75	1·6	1·36	0·75

A set of filters was made up corresponding exactly with those just dealt with, but receiving in addition lime at the rate of two tons per acre. The result was a rather strongly alkaline effluent much less pure than from the unlimed soils whenever, as not infrequently happened, the alkalinity rose to 9 or 10 c.c. of decinormal alkali per 100 c.c. of effluents. As the alkalinity of the effluent seemed to be the determining factor in the purification, the results need not be discussed here: in these experiments the lime was added just before the addition of sewage.

DISCUSSION OF THE RESULTS.

The experiments set out in Tables I. and II. show that sewage-sick soils, even after prolonged aeration under very favourable conditions, contain some factor detrimental to bacteria but put out of action by heat or by treatment with carbon disulphide or toluol. This factor in our experiments kept the bacterial population down to one-tenth of what it might have been, for whilst in the partially sterilised soils the numbers rose above 400 millions per gram, in the untreated soil they only occasionally reached 40 millions. The factor is not bacterial, for as shown in Tables II. and IV., addition of the bacteria from the untreated soil to the partially sterilised soil leads to a still further increase in bacterial numbers and in the amount of decomposition effected. All the indications show that it is identical with the factor which, in ordinary soils, keeps down bacterial numbers, the nature of which has been studied by Russell and Hutchinson.

Their results led them to conclude that large organisms destructive to bacteria are among the normal inhabitants of soils. Our present experiments indicate that similar organisms are present in sewage-sick soils and are, indeed, more active than in ordinary soils; to their presence much of the "sickness" is due, certain physical causes, however, also operating. Examination of the soil for possible destructive organisms has shown the presence of *amoebae*, and a *vorticella* (*V. putrina*) and other protozoa which, so far as they are active in the soil, would destroy bacteria; monads also were found, *Euglena* and others. The destructive organisms, whatever they are, are not killed by aeration or by liming; "resting" the soil, however useful in other directions, is ineffective here. Heating the soil kills them, as also does treatment with carbon disulphide or toluol. In soils thus treated the bacteria can rise to numbers previously impossible and can effect a correspondingly greater amount of decomposition; recovery from sewage-sickness is very rapid. Treated soils are also more effective as filters than untreated soils and do not so quickly lose their efficiency.

The practical problem therefore arises: Can this method of dealing with sewage-sickness be adopted on the large scale? We do not consider that there is any insuperable difficulty. The old agricultural practice of paring and burning is a practicable method of heating the soil. Both toluol and carbon disulphide can be obtained cheaply on the large scale, and a tool is already on the market for injecting into the soil: in some of the continental vineyards such injections form a regular part of the routine of cultivation. Small plots laid out on the sewage farm and treated in this way were cropped with turnips, and the results showed marked crop gains in consequence of the increased decomposition. There is, however, no reason for confining attention to these two antiseptics; the two desiderata are cheapness, and ease of removal after the killing of the destructive agent is done. A suitable mechanical appliance is also needed for distributing the antiseptic into the soil; preliminary trials have indicated that 4 or 5 inches is a suitable depth for the injections and the holes or the drills may be about 9 or 10 inches apart; some 2 or 3 cwt. per acre seems a suitable rate for experiments, applied after the soil has been ploughed up and has had time partially to dry. It would, however, be premature to discuss the practical details at the present stage; our object in this paper has been to elucidate the nature of sewage-sickness and to indicate the lines on which those who have to deal with the problem may most usefully proceed. The physical factor can be overcome by liming and drying, but the biological factor has to be killed by some suitable method.

In conclusion we wish to tender our best thanks to the Managing Committee of the Kegworth Sewage Farm for their courtesy in allowing us access at all times to the farm, and their kindness in placing facilities at our disposal for conducting these experiments.

Meeting held at Nottingham on Wednesday, March 29th, 1911.

MR. S. J. PENTECOST IN THE CHAIR.

THE TREATMENT OF LOCAL BOILER WATER.

BY F. J. R. CARULLA.

(Abstract.)

The mild steel boiler described in this Journal in 1895 (Vol. 14, pp. 116—122) having recently been taken down owing to the closing of the Sharon Chemical Works, Derby, in consequence of the impossibility of obtaining supplies of residual liquors from neighbouring gas works, it happens that information can be given after nearly 16 years of service regarding the condition of the boiler.

The boiler when taken down was found to be in a perfect state, never having required the slightest repair to the shell and has just stood a hydraulic test of 100 lbs. to the square inch. Steam users will, therefore, be interested to know how this result has been brought about, especially as there are those who still look askance at mild steel as a material for boiler construction.

The "Suggestions on Boiler Management," by V. C. Driffield (this Journal, 1887, pp. 178—189) were closely followed and more especially in regard to the prevention of incrustation by means of sodium carbonate. This was put in daily with the feed water in the form of soda ash and in sufficient quantity to just show alkalinity in the water within the boiler, taking the further precaution to blow off daily about one or two inches of water, which by its muddiness showed the cleansing effect of the process. About 1 lb. of soda ash per day sufficed to bring about the required alkalinity.

Yorkshire Section.

Meeting held at Bradford on Monday, March 20th, 1911.

PROFESSOR W. M. GARDNER IN THE CHAIR.

THE MICROSCOPICAL EXAMINATION OF GAMBIER.

BY H. BRUMWELL.

The manufacture of gambier, until quite recently, has been of such a primitive nature that the resulting product leaves much to be desired from the point of view of purity. The cultivation of the gambier plant and the manufacture of the extract from it are carried on mainly by Chinamen, and the product is frequently adulterated with such materials as clay, leaves, stalk, dung, etc. According to Professor Procter,* *Nauclea* or *Uncaria Gambir*, a climbing shrub widely cultivated in Singapore, is the source of this extract. The plant grows rapidly, the cropping commences three years after planting and is continued two to four times annually with little regard to fitness of shrubs, the plant being cropped until it has hardly leaves left to support existence. This drastic treatment is sufficient to wear out a plantation in from ten to fifteen years.

Cropping is done with a knife called a *perang*, while a larger knife is used for cutting up the leaves and twigs, which are then placed in a boiler sunk in the ground, and boiled with water until the liquid, which is constantly stirred during the operation with a five-pronged stirrer, becomes syrupy. The leaves are then removed from the liquid and allowed to drain on a tray over the boiler. The coarser matter still remaining in the boiler is removed with an instrument similar to a racquet, and the finer by straining through a perforated cocoanut shell into small tubs, where it is allowed to cool with constant stirring with a wooden bar until the catechin crystallises. When cold the pasty mass is turned out of the tub, cut into cubes with sides about 1 in. long with a hoop-iron knife and dried; this product is known as "cube-gambier." A common quality called "block gambier," instead of being cut into cubes, is run into large oblong blocks, which are wrapped in matting and exported in a pasty condition.

It will be seen that this article cannot be expected to be very pure, considering the crude method employed. Those who have seen the manufacture of gambier state that sand and dirt are actually shovelled into the material during the process. Whether the manufacturer in ignorance thinks this is a necessary constituent of gambier, or whether he adds it as an adulterant, I am unable to say definitely, but rather lean to the latter opinion. In some cases the mineral ash of block gambier has been found to be more than 20 per cent.; the writer in one particular case found 37·4 per cent. A solution of this extract containing 0·5 per cent. of tanning matter in 1 cm. cell gave a colour-measurement by the Lovibond tintometer of red 5·3, yellow 22·5, whereas a normal gambier would give about 2·9 per cent. ash, and a tintometer measurement of about 2·8 red and 7·6 yellow.

The concentration of the liquid in open pans must lead to the loss of tannin and darkening of colour by oxidation, and the presence of mineral matter in such large quantities must have a deleterious effect in the tannery, as the mineral matter invariably contains iron.

At a meeting of the International Association of Leather Trades Chemists, in London, in November, 1909, when the question of adulteration of gambier was discussed, it was pointed out that the present method of selling gambier was iniquitous, and that under the terms of sale it was impossible to get any satisfaction from the sellers if the delivery was bad.

Reference to the following tables will give an idea of the analyses of a few normal gambiers, as analysed in the Leather Department, Leeds University, and which we had no reason to think were in any way adulterated.

	Cube Gambier.				Block Gambier.	
	"D"	"BCL"	"S"	"P"	"A"	"B"
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per ceat.
Tanning matter =	42·3	44·8	42·6	30·2	36·3	34·6
Soluble non-tans =	31·8	32·3	32·9	31·9	26·2	24·7
Insoluble........ =	11·2	9·3	9·8	15·1	10·1	11·0
Water.......... =	14·7	13·6	14·7	13·8	27·4	29·7
	100 0	100·0	100·0	100 0	100·0	100·0
Ash............ =	5·4%	4·2%	3·7%	4·3%	4·4%	4·5%
Tintometer readings:						
Red.......... =	—	1·6	1·9	2·5	—	2·4
Yellow........ =	—	4·8	4·7	5·1	—	5·9

Generally speaking the insoluble matter of gambier consists of material which is in no way available for the manufacture of leather, and not of "difficultly soluble" matter; if more scientific means were adopted in the production, the insoluble matter might easily be reduced to 3 or 4 per cent. at most, and even this might be available for tanners' purposes, as it would very likely consist of catechin, which is only slightly soluble in cold water, and would probably ultimately become converted into tannins by changes in the tan-yard.

Dr. J. Paessler (Deutsche Gerberzeitung, 1908; this J., 1909, 211) draws attention to a factory which has been started to manufacture gambier extract in Indragiri (Dutch East Indies) on similar lines to those used for other extracts. The leaves are extracted with water, the solid matter is removed by suitable means, and the liquor concentrated in vacuum pans. The resulting extract, which is in block form, is of excellent colour, free from impurities, and contains about 40 per cent. of tannin. The analysis of three different consignments gave the following figures:—

	Per cent.	Per cent.	Per ceat.
Tanning matters..........	37·6	37·1	38·9
Soluble non-tans..........	30·4	29·3	24·2
Insoluble..................	0·8	3·3	4·2
Water....................	31·2	30·3	32·7
	100·0	100·0	100·0

Particularly noticeable are the higher non-tanning matters, which may be due either to the raw material or to the more complete extraction.

The insoluble matter of ordinary gambier, when examined under the microscope, was found to consist of small particles of leafy matter along with a large quantity of hairs. Fig. 1 is a photomicrograph taken of a leaf

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* Principles of Leather Manufacture, page 277.

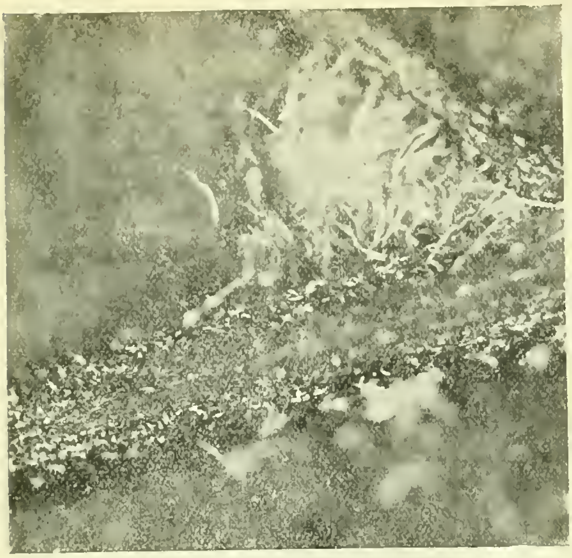

FIG. 1. Hairs on the under side of untreated leaf (×51).

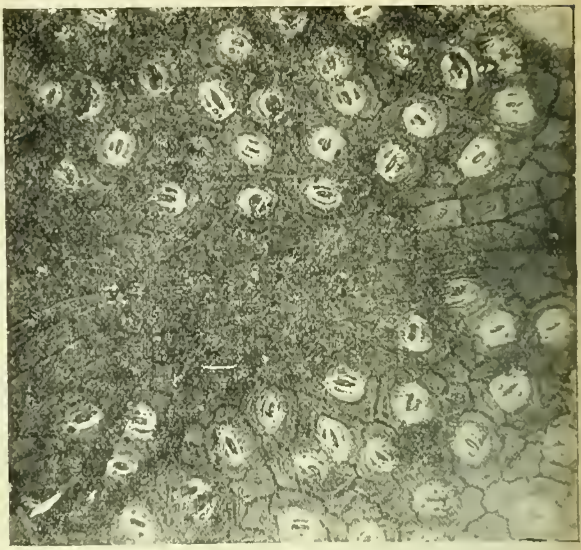

FIG. 4. Lower cuticle of leaf (× 306).

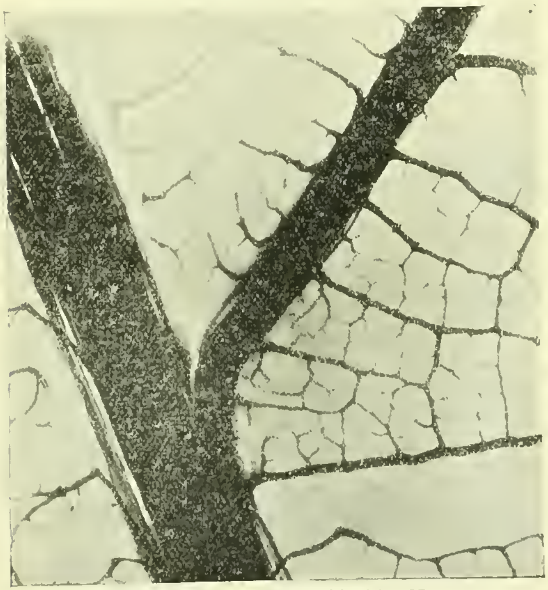

FIG. 2. Vein structure of leaf (× 17).

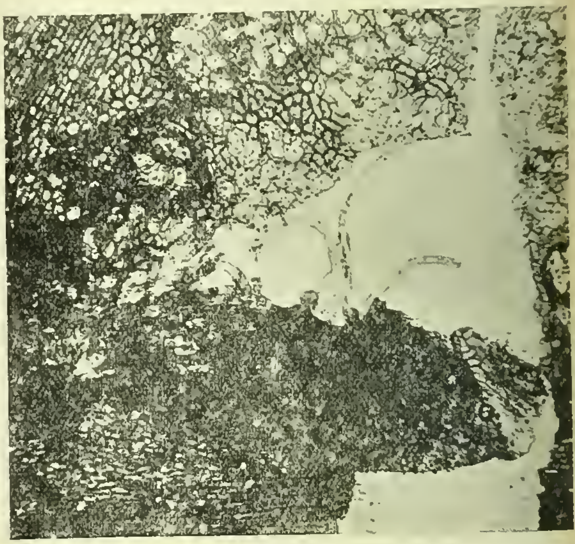

FIG. 5. Hairs between ribs on lower cuticle of leaf (× 306).

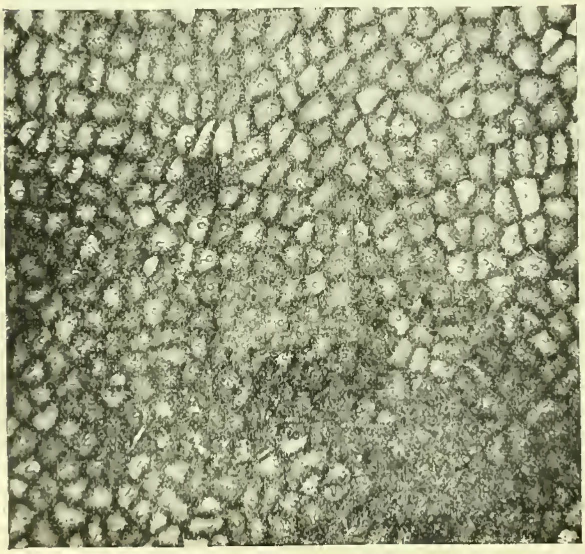

FIG. 3. Upper cuticle of leaf (× 306).

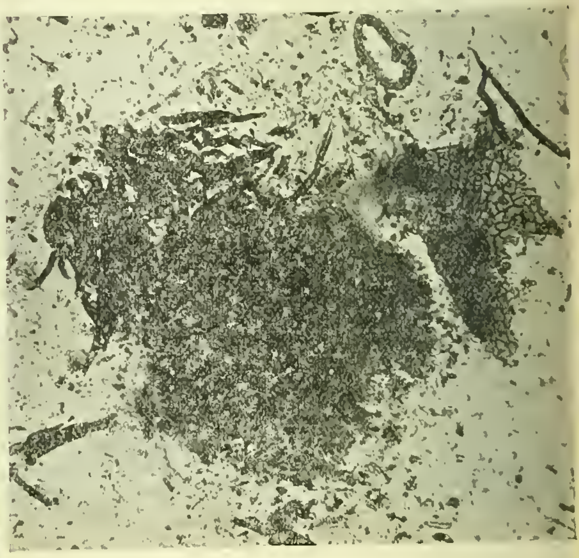

FIG. 6. Hairs and cuticle of leaf in insoluble portion of gambier extract (× 66).

without any previous treatment, showing at the junction of the side-ribs with the mid-rib (on the under side of the leaf) an abundance of hairs similar in appearance to the hairs on the veins of the *Rhus coraria* (sumach). The hairs exist in the extract in larger proportion than on the leaves themselves, since being so fine they are not so easily removed by the crude method of filtering with the perforated cocoanut shell, as are the coarser pieces of leaf.

The cuticles of the leaf were separated by the method suggested by Dr. Hellon, of Whitehaven, which proved very satisfactory both for the leaves and the insoluble part of the gambier. The method is as follows:—A portion of leaf (about 0·1 grm.) is boiled for ½ minute with about 7 c.c. of 5 per cent. sulphuric acid and the clear liquor poured away; the residue is then boiled for ½ minute with 7 c.c. of 5 per cent. caustic soda solution and the liquid poured away; the residue is boiled for ½ minute with 7 c.c. of nitric acid of sp. gr. 1·2, and the clear liquid poured away; the residue is boiled as before with another portion of nitric acid and during the boiling 0·01 grm. of potassium chlorate is added from time to time until the substance is absolutely white. The clear liquid is poured away, and the residue washed free from acid with warm water, transferred to the microscope slide, covered, and examined.

After the above treatment the cuticles were dyed in a dilute solution of Safranine. Figs. 2, 3, 4, 5, and 6 were all treated in this way. This method proves very satisfactory for almost all leaf cuticles and is far better in most cases than the nitric acid method, which is sometimes too severe.

The upper cuticle of the leaf (Fig. 3) is very similar in appearance to the upper cuticle of *Pistacia lentiscus* (frequently used as an adulterant of sumach) having very distinct cells fairly regularly disposed, and no hairs or stomata. The lower cuticle (Fig. 4) strongly resembles that of *Colpoon compressa* ("Cape Sumach"); the stomata are large, very distinct, in great profusion, and are devoid of hairs. In the samples of insoluble portions of gambier examined, I have not found any leaves which appear to be other than those of genuine gambier.

Sago-flour is, I understand, frequently added to gambier as an adulterant, and can be detected by adding a drop or two of iodine solution to a small quantity of the gambier on a microscopic slide covering with a cover glass and examining under the microscope. In mixtures of gambier and sago-flour, mixed specially for testing this method, it has proved quite satisfactory, the starchy matter of the flour being coloured deep blue and the cellulose deep brown. On the addition of a drop of sulphuric acid the starch granules swell up and finally burst, the cellulose becoming then quite blue.

Where samples of gambier of a very uneven composition have to be analysed, it is advisable to weigh about 400—500 grms. of the material in a large beaker, add sufficient hot water to make an even syrup, if necessary boil, cool, and reweigh; the analysis is then carried out on this diluted portion, the results being calculated to original moisture.

My thanks are due to Mr. C. D. Wilkinson for his assistance in producing the micro photographs.

Discussion.

Mr. R. A. **Seymour-Jones** said the upper cuticle had little spaces which looked like vacuoles. It was not known what they were.

Mr. F. W. **Richardson** said that a white material, which would take any colour, could be obtained by bleaching with potassium chlorate.

Prof. W. M. **Gardner** asked if iron was present in the gambier in sufficient quantity to interfere with its use. Was it used in a dry or pasty form?

Mr. T. **Fairley** asked if the gambier was used at all in dyeing. Was it grown on the mainland at Singapore and was it cultivated by Chinamen? He suggested that evaporation in a partial vacuum might give better results than boiling down at ordinary pressure.

Mr. J. **Evans** asked if the authors had tried chloral hydrate as a clearing reagent. It dissolved most of the cell contents, but induced a slight expansion of the cells. Had the authors made any transverse sections of the material; such a section would show the elements of which the leaf was composed. In his opinion, treatment with alkalis and acids was apt to obliterate the fine markings of the cell walls. He thought sketches were much more satisfactory than photographs, as it was impossible to get an accurate idea of the structure with a fixed focus. Accurate sketches could be made by the use of the camera lucida.

Mr. F. W. **Richardson** said that chloral hydrate gave results quite unreliable in the case of powders since it produced very high refraction. The starch granules could be made to disappear from view when it was used. It was therefore best to mount in a liquid not too refractive.

Mr. T. **Fairley** said the microscopic structure of cellulose could be easily examined even after the treatment adopted in determining woody fibre in agricultural analysis.

Mr. H. **Brumwell**, in reply, said that the method used in the paper separated the two cuticles without dissolving any. The presence of iron in the gambier gave a darker colour in the final tanned product and doubtless did interfere with the result. The gambier was used in both the dry and pasty forms. Gambier was used like cutch in dyeing. Chinamen grew and sold it, and there was need of some control over its production.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

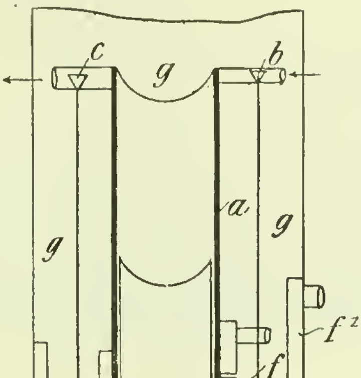
Metal drums; Importation of —— into the United States. Oil, Paint, and Drug Rep., March 20, 1911. [T.R.]

The U.S. Court of Customs Appeals has affirmed the decision of the Board of General Appraisers in holding that metal drums, containing creosote oil, were dutiable as unusual containers for the oil, and that they were designed for use other than in the *bonâ fide* transportation of the oil. A number of shipments of creosote oil in metal drums has been made to Seattle, Wash., since 1904, and it appears that these drums have been sold by the importers, and then used for shipment of American oil in the usual way.

Patents.

Liquefaction of gases; Apparatus for producing very low temperatures, more especially for the —— and the separation of gas mixtures at very low temperatures. W. Schneider, Hamburg. Eng. Pat. 2496, Feb. 1, 1910, Under Int. Conv., Feb. 1, 1909.

In existing apparatus of the kind where the piston moves directly in the expanding cylinder, jamming difficulties are encountered due to the very low temperatures and further there is a loss of efficiency due to the heat produced by the friction of the piston and to the insulating action of the lubricant. The apparatus is designed to obviate these difficulties and also, by its vertical disposition, to prevent the gas from coming in contact with the lubricant. In the Fig., *a* is a thin-walled steel cylinder provided with an admission valve, *b*, for gas at high pressure, and an eduction valve, *c*. The piston, *d*, with the packing ring, d^1, operates in the cylinder, a^1, in which it fits closely. To the upper side of the piston is attached the cylindrical part, d^2 exhausted, or made of non-conducting material, which is of sufficient diameter just to prevent contact with the cylinder wall. The cold which is unavoidably conducted through the wall is recovered, by means of a flow of gas at ordinary temperature through a conduit surrounding the cylinder, a, in the form of a spiral. The gas enters the conduit at the part, f^1, and passing in the direction of the arrows, flows along the cylinder in the part, *f*, of the conduit, in the direction of the colder end of the cylinder. The space, *g*, contains insulating material. The piston, *d*, is so operated that it reverses its stroke at such a speed that the inflowing gas will not cool before its expansion in the cylinder and that the gas, after expansion, has not sufficient time to diffuse its temperature to the cylinder and piston walls. This condition is found in practice to be given by a speed of five strokes of the piston per second.—B. G. McL.



Gases evolved from crucibles, etc.; Appliances for carrying off —— in metallurgical, chemical, and analogous operations. W. Evans and W. T. Tipper, Birmingham. Eng. Pat. 5797, Mar. 8, 1910.

The tongs used for lifting the crucible from the furnace are provided with internal projections which determine the position of the jaws round the crucible. The hood, which is approximately semi-circular in form and open at the front, and provided with a sight hole with a pivoted closure on the top, has attached to it a flexible tube, connected with a convenient induced draught, for carrying off the fumes. This hood is attached to the rear side of the crucible, after it has been removed from the furnace, by perforated projections which pass beyond the legs of the tongs and are held in position by a horizontal bar. Previous to pouring, a skimming pan may be attached in front by means of projections which hook on to the horizontal bar, the skimming being performed through an opening at one of the top corners. The skimming pan is of substantially rectangular construction, with a canopy hood, and hangs below the edge of the crucible. The apparatus obviates the dangers attending the usual process of changing the tongs.—B. G. McL.

Saturated steam; Method for drying —— during its progress through conducting pipes. H. Parry, Glazebrook, Lancs. Eng. Pat. 14,632, June 17, 1910.

A vessel is inserted in the steam main for collecting and re-evaporating the water which has condensed. This vessel takes the form of a cylinder, the axis of which is vertical and through which pass vertical tubes open at both ends. Internal baffle-plates hanging from the top plate are provided to project the condensed water downwards, whence it is conveyed by vertical pipes to sloping pipes placed in a fire immediately below the cylinder, the re-formed steam being conducted back to the cylinder. The whole apparatus is encased so as to cause the hot gases from the fire to pass through the internal tubes of the cylinder. Suitable valves and a by-pass for the steam are provided.—B. G. McL.

Separating liquids and solids; Settling tanks for ——. W. Reid, Burnbank, Lanark. Eng. Pat. 28,927, Mar. 22, 1910.

The apparatus consists of a cylindrical tank, divided into at least three equal compartments of sector section. The bottom of each compartment is slightly conical to admit of removal of sludge. The process is automatic and intermittent—one tank is filling and the second is emptying, while the contents of the third are settling—and is controlled by floats, one in each compartment. The liquid enters the compartments in turn by a swivelling spout which runs on a rail concentric with the tank periphery; this rail is capable of being raised in sections. As the first compartment fills, the float in it rises and a cam on the vertical shaft attached to this float engages with the lever controlling the emptying valves in the second compartment, firstly allowing the cleared liquor to escape through a lateral opening and secondly opening the sludge valve in the bottom; these valves subsequently close by the lever dropping off the cam. The cam then raises one end of the section of the rail over the first compartment, thereby causing the spout to run by gravitation over the second, now empty compartment, where it is arrested by a pin which does not prevent its starting when this part of the rail is raised. In the same way the filling of the second compartment controls the emptying and refilling of the third compartment. Mechanism is provided for allowing the descending cams to pass the levers.—B. G. McL.

Drying-machine. F. Wertenbruch, Meissen, Germany. U.S. Pat. 986,107, March 7, 1911.

The apparatus consists essentially of a trough in which a heating-tube system rotates on a horizontal axis. This system comprises three portions. In the first portion the heating tubes are arranged in a circle and carry ribs and shovels extending outwards; rotating beaters pass through the spaces between the shovels. In the second and third portions also, the heating tubes are arranged in a circle, but there is in addition a nest of tubes inside the circle. In the second portion the spaces between adjacent tubes in the circle are partly covered by plates; and in the third portion, in the spaces between two adjacent tubes in the circle and the rows of shovels connected with the tubes, there are additional shovels for lifting the partly dried material. The steam used for heating, after passing through the revolving tubes is led to radiators in an air-heating chamber. Above the heated trough is a smaller one for the preliminary drying of the material. This is provided with a conveyor screw, and its bottom is formed by double-walled sections, the cavities in which are connected by pipes with each other and with a receptacle for condensed water.—A. S.

Hygroscopic powder materials; Moisture-proofing —— [*water-proofing*]. H. E. Miller, Oakland, Cal. U.S. Pat. 987,079, Mar. 14, 1911.

A solution of the material to be used, is crystallised by the aid of heat and stirring, and, whilst stirring is continued, the mixture is allowed to cool to a proper temperature (still high) and a solution of cellulose nitrate added; the solvent is evaporated by the heat of the mixture, so that granules are formed, coated with a dry non-hygroscopic covering.—F. Sodn.

Separating and collecting particles of one liquid suspended in another liquid; Process and apparatus for ——. U.S. Pats. 987,114 (F. G. Cottrell), 987,115 and 987,116 (F. G. Cottrell and J. B. Speed), and 987,117 (F. G. Cottrell and A. C. Wright), all of Berkeley, Cal., Assignors to Petroleum Rectifying Co., San Francisco, Cal., Mar. 21, 1911.

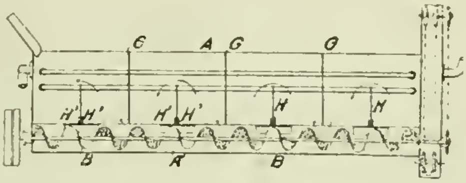
(1) The mixture is passed over a pervious septum initially wetted with a liquid readily miscible with the liquid forming the suspended drops of the mixture, this septum forming part of a system of electrodes maintained at sufficient voltage to produce coalescence of the suspended drops and cause a separation of the two liquids. The coalesced liquid drains through the septum and is collected practically free from the other liquid. The liquid which holds the other in suspension should be a non-conductor, and an alternating current should be employed. (2) In the above process, when the suspended liquid is of greater density than that containing it, the septum is dispensed with and the mixture caused to flow downwards between electrodes sufficiently charged to cause a rapid separation of the liquid but not charged so highly as to cause chains of coalescing globules of the suspended liquid to short-circuit the electrodes. The incoming stream of the liquid mixture is caused to impinge on the surface of the liquid in the separating vessel so as to produce a thorough mixing thereof. (3) An apparatus for carrying out the last mentioned process comprises two coaxial cylindrical vessels forming the two electrodes, the outer vessel having a funnel-shaped top to receive the liquid and being connected with the inner vessel by insulated supports arranged above the level of the liquid. The electrodes are so arranged that the strength of the electric field between them is weaker near the surface of the liquid than below so that the suspended particles do not coalesce at the surface. The separated heavier liquid is drawn off from the lower part of the vessel, while the lighter liquid is drawn off from the top. (4) In the above process, short-circuiting is prevented by agitating the liquid during its passage through the vessel either by means of a stirrer or by rotating one of the electrodes.—H. H.

Colloidal substances; Separation of —— *from pseudo-solutions.* Richter und Richter. Fr. Pat. 421,276, Oct. 10, 1910. Under Int. Conv., Dec. 31, 1909.

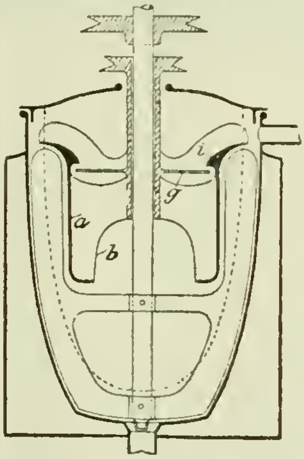
The pseudo-solution, from which the colloidal substance is to be separated, is subjected to the combined action of some "active" solid substance, such as finely divided wood-charcoal, mixed with mineral matter, and of a finely divided stream of gas, such as ordinary air.—E. W. L.

Dissolving apparatus. A. Wiese. Ger. Pat. 231,582, Jan. 21, 1909.

The apparatus is shown in the accompanying figure. The substance to be dissolved is carried through the vessel, *A*, by means of the screw, *B*, in the opposite direction to the solvent. By means of the partitions, *G*, *H*, the solvent is caused to travel along the path indicated by the arrows (*i.e.*, outside the direct influence of the screw). In order to prevent, as far as possible, the solution being carried along by the screw, the bottoms of the partitions, *H*, are provided with curved plates, *H'*, which, with the bottom of the channel, *A'*, in which the screw rotates, form pipe-like sections. In these sections, by another claim, those portions of the blades of the screw there revolving, may, if desired, be cut away and dispensed with.—A. S.



Froth; Centrifugal device for dissipating ——. Aktieselskabet Konstantin Hansen and Schroeder. Ger. Pat. 232,039, March 25, 1909.



In the accompanying figure the device claimed is shown as applied to a pasteurising apparatus mounted on a vertical axis. The rotating vessel, *a*, is provided with blades, *b*, and a liquid seal is formed by the fixed partition, *g*, extending nearly to the wall of the revolving vessel, *a*, with overlapping projection, *i*.—A. S.

Liquids of different specific gravities; Process for the treatment of —— *with one another for the purpose of extraction,, washing, etc.* A. Baur. Ger. Pat. 232,458, April 22, 1909.

The vessel containing the two liquids is connected with a pump, by which one of the liquids is withdrawn and forced through one or more injectors, before being returned to another part of the vessel. The injector communicates with the second liquid in the vessel and withdraws some of this, and then forces it back into the vessel along with the first liquid, either directly or after first passing it through a purifying chamber.—A. S.

Filtering apparatus. G. Johnston, Chihuahua, Mexico. U.S. Pat. 988,107, March 28, 1911.

See Eng. Pat. 17,088 of 1909; this J., 1910, 1446.—T.F.B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Inflammable powders; Comparative study of —— *from the point of view of inflammability.* Taffanel and Durr. Comptes rend., 1911, **152**, 718—721.

The authors use the following method for determining the relative inflammability of combustible powders. A porcelain tube, 25 mm. internal diameter and 10 cm. long, is placed with the axis vertical and heated to a determined and uniform temperature, measured with a thermo-electric couple; a definite weight of the powder, of a standard fineness, is then projected into the tube from above by a blast of air, and the dimensions of the flame produced are registered photographically. No flame is, as a rule, produced with coal dust below 775° C., and the temperature limits for lycopodium, starch, and powdered sugar are 590°, 500°, and 460° C. respectively. Coal dust is classified by the authors in eight types, designated by the letters A—H, according to the dimensions of the flame given, and this classification is found to correspond approximately with that based on the proportion of volatile matter in the coal. But the class to which a given powder must be assigned depends very largely on its state of division, and the apparatus shows clearly the increase in inflammability accompanying increased fineness. The inflammability of dust is diminished by the addition of non-inflammable dust, but dust which is not sufficiently inflammable to be a source of danger in itself may nevertheless contribute to the effects of a flame produced by more inflammable dust. Coke dust does not give rise to a flame, incandescent particles alone issuing from the tube, an effect which is also observed with some non-combustible powders, and it is suggested that the presence of volatile matter evolved by the dust is a necessary factor in the propagation of flame through a dust-laden atmosphere.—F. Sodn.

Asphaltum; Examination of ——. J. Marcusson. Chem. Rev. Fett- u. Harz-Ind., 1911, 18, 47—51.

The presence of a small proportion of petroleum pitch in natural asphaltum may be detected by the following modification of the test devised by the author and Eickmann (Chem-Zeit., 1908, 32, 965):—A solution of 10 grms. of the sample in 15 c.c. of benzene is poured into 200 c.c. of petroleum spirit (b. pt. 80° C.), and the filtrate from the precipitated asphaltenes treated three times with 15 c.c. of sulphuric acid, to remove dark coloured substances washed free from acid by means of alkali solution and water, and evaporated, and the residue dried for 10 minutes, at 105° C. and weighed. The oily residue from natural asphaltum (2 to 34 per cent. calculated upon the ash-free substance) will be fluid at 20° C. and be free from particles of paraffin wax or vaseline-like matter, whereas in the case of petroleum pitches it will contain such substance and may amount to 26 to 58 per cent. of the original (ash-free) substance. The paraffin wax in the oily residue from petroleum pitch may range from 3·3 to 16·6 per cent., whereas that from natural asphaltum will not exceed 1 per cent. Another difference is that the distillates from natural asphaltum will contain a considerable quantity of organic acids, whilst very little acid passes over in the case of petroleum pitch. The test is applied by distilling 30 grms. of the asphaltum (or a quantity of material containing about 30 grms. of bitumen) and collecting two fractions of 4 to 5 c.c. These are dissolved in ether, the solutions washed, and the acid values determined in the usual way. The first distillate from natural asphaltum should have a value in excess of 1, and the second distillate should also show a considerable value, whereas the first distillate from petroleum pitch should give an acid value of less than 1, and the second distillate be free from acid. Thus the following results were obtained with commercial products:—

	Natural asphaltum			Petroleum pitch			
	Trinidad.	Syrian	San Valentine (soft)	From heavy Wietzer oil.	Soft pitch.	Galician I.	Galician II.
Distillate I. ...	14·0	4·7	1·9	0·53	0·73	0·57	0·87
Distillate II. ..	5·6	2·7	1·4	nil	nil	nil	nil

In case of mixtures the presence of less than 1·7 per cent. of sulphur (upper limit for petroleum residues and lower limit for natural asphaltum) and also of an appreciable quantity of paraffin wax, would indicate petroleum pitch, whilst the presence of a considerable amount of sulphur, accompanying a high acid value in the first distillate and a considerable value in the second distillate would show that natural asphaltum was also present. Pitches derived from fat, however (the presence of which would be indicated by the liberation of acrolein on heating), would also give distillates with high acid values. There are also upon the market thickened products obtained from soft natural asphaltum by distilling off a considerable proportion of oil. The characteristics of the best known of these products, which are intermediate between petroleum pitches and natural asphaltum, are shown in the following table:—

Commercial name.	Ash.	Sulphur.	Oily residue.			Acid value of	
			Nature.	Amount.	Paraffin wax.	Distillate I.	Distillate II.
				per cent.	per cent.		
Mexico asphaltum	0·2	5·8	Not fluid. Contained vaseline particles.	35	2·8	1·6	0·9
Derna asphaltum bitumen	5·6	0·9	do.	25	1·6	0·7	0·7

The presence of Mexican asphaltum in admixture with petroleum pitch would be indicated by the high proportion of sulphur and the acid values of the distillates. In the case of Derna asphaltum, however, the detection would only be possible from these results when the petroleum residues formed the smaller proportion of the mixture. Lignite tar pitch in natural asphaltum may be detected by Graefe's diazobenzene chloride reaction (this J., 1906, 422). This is also given by ordinary tar pitch, which, however, may be distinguished from lignite tar pitch by other reactions (presence of free carbon, anthraquinone test); and by wood tar, which is characterised by its great solubility in alcohol and the readiness with which it absorbs sulphur. The following test may be applied to determine whether the sample consisted of lignite tar pitch or of a natural asphaltum thinned by the addition of lignite tar oil (paraffin oil):—A solution of 10 grms. of the sample in 15 c.c. of benzene is poured into 200 c.c. of petroleum spirit, and the resulting precipitate washed with petroleum spirit, dried, and powdered. It is next boiled with *N*/2 potassium hydroxide solution for 15 minutes beneath a reflux condenser, to extract the phenols which give Graefe's reaction, and the liquid then cooled and filtered, the alcohol evaporated, and the residue taken up with water. The aqueous solution is shaken with sodium chloride to separate colouring matters, and the filtrate tested with diazobenzene chloride in the usual manner. The presence of 10 per cent. of lignite tar pitch or of 20 per cent. of acid resin in natural asphaltum could in this way be detected with certainty. A pronounced diazo reaction was also obtained with the original mixture of 10 and 20 per cent. of lignite tar oil with natural asphaltum, but no colouration was given in the test applied to the substances insoluble in petroleum spirit separated as described above.—C. A. M.

Natural gas and oil in New Brunswick. Times, April 5, 1911. [T.R.]

Large supplies of natural gas of high quality, together with a more limited but promising flow of oil, have now been tapped at a point in Albert County, New Brunswick, about 12 miles from the town of Moncton, after boring to a depth of between 1,200 ft. and 2,000 ft. Some thousands of gallons of oil, pronounced to be equal to the best lubricating oil, have already been stored in the tanks erected near the borings. For the present, attention is being chiefly paid to the gas supply. Arrangements are being made for piping it during the coming year to Moncton, which is becoming an important railway centre. Here it will be employed to light the whole town, for domestic use, and for manufacturing purposes.

Roumanian petroleum exports. Ch. of Comm. J., April, 1911. [T.R.]

The exports of petroleum and its derivatives from Roumania during 1910 were 581,417 tons, compared with 424,004 tons in 1909. The total for 1910 was made up of 116,310 tons of crude petroleum residues, 339,281 tons of refined petroleum, and 125,826 tons of benzine. France imported 141,222 tons in 1910, the United Kingdom 125,683 tons (compared with 70,977 tons in 1909), Egypt 73,285 tons, Germany 50,322 tons, and Belgium 40,293 tons. The imports to the United Kingdom in 1910 consisted of 45,501 tons of crude petroleum residues, 67,047 tons of refined petroleum, and 13,135 tons of benzine.

Use of naphthenic acids in soap making. Bontoux. *See* XII.

Patents.

Gas retorts. R. Dempster and Sons, Ltd., and R. M. Brooke, Elland, Yorks. Eng. Pat. 9408, Apr. 19, 1910.

In vertical gas retorts of the type in which the setting is divided into separate and independent vertical chambers, and the retorts are built into the vertical walls forming such chambers, each of the chambers is provided with separate regenerators, flues, and dampers.—H. H.

Vertical retorts for the carbonisation of coal or the like. A. M. Duckham, Little Bookham, Surrey. Eng. Pat. 28,388, Dec. 6, 1910.

The patent relates to the type of retort in which a vertical plate, depending from the cover, divides the upper part of the retort into two chambers, one of which is left free of fuel in order to facilitate the exit of the gases. The invention consists in making the vertical plate adjustable, so that the effect of radiated heat in breaking down the liquid hydrocarbons as the gases pass through the free space, may be used to the best advantage for different kinds of coal.—A. T. L.

Producer gas plants. A. Lowe, Darwen. Eng. Pat. 3352, Aug. 11, 1910.

A combined gas producer and steam generator comprises a vertical steam-boiler of which the fire-box is adapted to be filled with fuel and to serve as a producer furnace. A central vertical uptake is provided with a feeding hopper and a gas-outlet connection. Part of the steam is used in an injector to supply air below the grate. The ash-pit is fitted with pipes for the escape of condensed water and of excess steam, and an adjustable opening is provided for the admission of air direct to the lower part of the fuel column when the injector is not in use.—A. T. L.

Gas generating plant. M. and H. J. White, Luton. Eng. Pat. 10,357, April 27, 1910.

The upper part of a producer, which is intended for burning wood and other refuse, is provided with an annular chamber in which the gas is subjected to the washing and cooling action of water sprays. The gas enters this chamber through lateral orifices near the top, and passes by an outlet connection near the bottom to a scrubbing apparatus. This comprises a number of perforated discs with oppositely curved fins, mounted on a rotating spindle.—A. T. L.

Extracting tar and other by-products from gases; Method of ——. F. W. Burstall, Birmingham, and The British Pure Fuel, Ltd., Burton-on-Trent, Staffs. Eng. Pat. 6508, Mar. 15, 1910.

The gases are led at a pressure materially below that of the atmosphere into a main which is kept as warm as possible, and are then washed by a stream of hot tar in a tar extractor which is kept at a constant temperature above the dew point of the gas. The gases are finally allowed to cool and the liquors and other condensable matters passed on to the exhausting pump. A series of tar extractors, each working at a definite temperature, may be employed for the purpose of obtaining tars of different qualities.—H. H.

Gas; Apparatus for washing or purifying ——. C. and W. Walker, Ltd., Donnington, and J. P. Bachelor, Trench, Salop. Eng. Pat. 29,925, Dec. 23, 1910.

In washing apparatus for gases of the type wherein two series of plates or scrubbing devices are mounted in tiers upon vertical rods which are dipped alternately into tanks containing the washing liquid, (1) the rods are connected by chains passing over pulleys in such a manner that when one rod is raised the other is lowered, and (2) means are provided for oscillating such pulleys from a constantly rotated shaft.—H. H.

Artificial fuel; Manufacture of ——. J. Leach, Sheppton, Pa., U.S.A. Eng. Pat. 17,162, July 19, 1910.

See Fr. Pat. 418,525 of 1910; this J., 1911, 75.—T. F. B.

Coke-oven. L. Bansart, Johmont, Belgium. U.S. Pa 987,941, March 28, 1911.

See Fr. Pat. 398,843 of 1909; this J., 1909, 1026.—T. F. B.

Gas producers. H. W. Lake, London. From Tait Producer Co., New York. Eng. Pat. 9610, April 20, 1910.

See Fr. Pat. 415,193 of 1910; this J., 1910, 1293.—T. F. B.

Gas producer. B. Versen, Dortmund, Germany. U.S. Pat. 987,195, March 21, 1911.

See Eng. Pat. 16,610 of 1908; this J., 1909, 972.—T. F. B.

Gases; Extraction of tar and tar constituents from ——. W. Feld, Zehlendorf, Germany. Eng. Pat. 9086, April 14, 1910. Under Int. Conv., April 14, 1909.

See U.S. Pat. 965,147 of 1910; this J., 1910, 999.—T. F. B.

Gas analysis apparatus. Eng. Pat. 26,168. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Wood distillation in the United States in 1909. U.S. Census Bureau Report.

During the year 1909 there were consumed in the United States in the processes of wood distillation, 1,265,157 cords of wood, by 147 plants, as against 977,844 cords by 131 plants in 1908, and 1,282,120 cords in 1907, by the same number of plants. The industry, though of relatively small importance compared with lumber production, has shown a similar recovery from the poor conditions prevailing in 1908. This is noteworthy in hardwood distillation, where it is due about half to the increase in the quantity and the average value per gallon of wood alcohol, and about half to an increased production of charcoal and gray acetate.

The following table shows for 1907, 1908 and 1909 a comparative summary of the principal statistics of the hardwood distillation branch of the industry.

	1909.	1908.	1907.
Number of establishments	116	101	100
Material (wood, chiefly beech, birch and maple) :—			
Quantity, cords....	1,149.847	878,632	1,219,771
Cost	$3,818,282	$2,710,745	$3,824,669
Products :—			
Total value	$7,641,690	$5,408,265	$7,661,379
Charcoal—			
Quantity, bushels	53,075,102	37,286,520	50,772,234
Value...........	$3,299,002	$2,644,923	$3,838.392
Crude alcohol—			
Quantity, gallons .	8,468,083	6,285,678	7,741,645
Value...........	$2,082,253	$1,084,223	$1,153,307
Gray acetate—			
Quantity, pounds	148.769,479	106,098,846	133,374,941
Value...........	$2,202,847	$1,636,825	$2,565,938
Brown acetate—			
Quantity, pounds	2,156,907	1,586,441	8,152,848
Value...........	$22,203	$13,457	$94,446
Iron acetate.......			
Quantity, gallons	302,624	262,989	—
Value...........	$27,779	$25,024	—
Oils—			
Quantity, gallons	37,995	57,829	382,959
Value...........	$3,082	$3,813	$9,296
All other—			
Value...........	$4,524	—	—

Softwood distillation as an industry is still to some extent in an experimental stage. A number of the processes which have been tried have not proved uniformly satisfactory, and consequently establishments have been abandoned or removed to more suitable localities.

The next table shows the number of establishments, the quantity and cost of the raw material used, and the quantity and value of the products of softwood distillation in 1907, 1908, and 1909.

	1909.	1908.	1907.
Number of establishments	31	30	31
Material, total :—			
Quantity, cords....	115,310	99,212	62,349
Cost	$241,726	$207,202	$210,844
Longleaf pine—			
Quantity, cords	99,686	90,991	61,149
Cost	$233,742	$201,696	$210,604
All other, including mill waste—			
Quantity, cords	15,624	8,221	1,200
Cost	$7,984	$5.506	$240
Products :—			
Total value ...	$686,794	$491,161	$534,802
Turpentine—			
Quantity, gallons	682,702	505,800	654,711
Value...........	$243,491	$166,343	$304,860
Charcoal—			
Quantity, bushels	2,403,401	1,995,728	1,158,364
Value...........	$210,017	$186,616	$102,411
Oil—			
Quantity, gallons	323,226	304,979	391,916
Value...........	$70,080	$56,043	$69,399
Tar—			
Quantity, gallons	1,364,984	966,675	760,836
Value...........	$104,671	$81,349	$58,132
Pyroligneous acid—			
Quantity, gallons	4,850	8,100	—
Value...........	$218	$810	—
All other—			
Value...........	$58,317	—	—

The quantity and value of wood alcohol exported during the fiscal years ending June 30, 1904 to 1910, were as follows :—

Year.	Quantity, galls.	Value.
1910.............	1,328,601	$581,820
1909.............	1,100,495	383,788
1908.............	1,958,630	819,753
1907.............	2,150,311	862,819
1906.............	780,222	466,467
1905.............	1,097,451	603,385
1904.............	1,194,466	585,359

By far the largest part of the exports of wood alcohol for the past six years went to Germany, the United Kingdom, and Belgium. Apparently little crude wood alcohol is exported, since the export values given in the table correspond fairly well with the trade values of refined wood alcohol for the years given.

Patents.

Filament for incandescent electric lamps; Metallic ——. K. Farkas. Assignor to G. V. Williams, New York. U.S. Pat. 986.558, Mar. 14, 1911.

A fine silver wire or other fine metallic conductor is heated electrically in a rarefied atmosphere ("of about 20 inches"), composed of vapours of a salt of a highly refractory element (such as tungsten), of a salt of a ductile metal (such as silver), and of pyrogallol, so as to produce a coating on the wire and reduce this coating to the metallic state. A suitable composition for the reacting atmosphere is 85 per cent. of tungsten compound, 8 per cent. of silver chloride, and 7 per cent. of pyrogallol vapours. —F. Sodn.

Arc lamp electrode of titanium carbide. Allgem. Elektrizitäts-Ges. Ger. Pat. 231,231, July 5, 1910.

A small quantity, preferably 4·5 per cent., of chromium carbide is added to the titanium carbide. The life of the electrodes is stated to be increased considerably by this addition.—A. S.

Filaments for electric incandescence lamps from tungsten or alloys thereof; Manufacture of ——. A. G. Bloxam, London. From Siemens und Halske Akt.-Ges., Berlin. Eng. Pat. 19,932, Sept. 22, 1908.

See Fr. Pat. 393,595 of 1908; this J., 1909, 149.—T. F. B.

Filaments for incandescent lamps; Manufacture of ——. C. P. Steinmetz, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 988,148, March 28, 1911.

See Eng. Pat. 13,161 of 1904; this J., 1905, 539.—T. F. B.

Incandescent mantles; Manufacture of ——. T. Terrell, London. U.S. Pat. 987,333, March 21, 1911.

See Eng. Pat. 11,042 of 1902; this J., 1903, 619.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Patents.

1.2-Diaminoanthraquinone; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 231,091, Sept. 28, 1909.

The first product of the sulphonation of β-aminoanthraquinone is treated with a halogenating agent; the 1-halogen-2-aminoanthraquinone-3-sulphonic acid is treated with ammonia, preferably in presence of copper or other catalytic agent, and the sulpho group is eliminated from the resulting 1·2-diaminoanthraquinone-3-sulphonic acid by heating with a dilute mineral acid.—T. F. B.

Esters of anthranilic acid substituted in the p-position to the nitrogen and also in the amino-group; Preparation of ——. Badische Anilin und Soda Fabrik. Ger. Pat. 231,687, July 29, 1909.

The substituted anthranilic acid or one of its N-substitution products is treated with an esterifying agent in presence of an aldehyde: the same products are produced by esterifying the lactonic condensation products of anthranilic acid and aldehydes. When anthranilic acid derivatives, in which the *p*-position to the amino-group is free, are treated in this way, diphenylmethane derivatives are formed.—T. F. B.

p-Chloro-m-cresol ($CH_3 : OH : Cl = 1 : 3 : 6$) from mixtures of m- and p-cresol; Process for obtaining ——. F. Raschig. Ger. Pat. 232,071, Sept. 29, 1909.

Mixtures of *m*- and *p*-cresol are treated with an amount of chlorine or sulphuryl chloride corresponding to the amount of *m*-cresol in the mixture, and the liquid thus produced is fractionated to separate the *p*-chloro-*m*-cresol. —T. F. B.

Carboxylic acids of the anthraquinone series; Manufacture of ——. A. G. Bloxam, London. From F. Ullmann, Charlottenburg, Germany. Eng. Pat. 16,151, July 6, 1910.

See Fr. Pat. 418,088 of 1910; this J., 1911, 15.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Patents.

Vat dyestuffs; Production of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 5670, March 7, 1910.

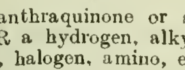
Vat dyestuffs are obtained by condensing 1 mol. of 2-arylido-3-ketodihydro-1-thionaphthene or its derivatives, substituted in the benzene nucleus, with 1 mol. of 1-anthrol or a substituted derivative having a free ortho-position to the hydroxy-group, such as 1 : 5- or 1 : 8-dihydroxyanthracene. Example: A hot solution in glacial acetic acid of 282 parts of 2-*p*-aminodimethylanilido-3-ketodihydro-1-thionaphthene and of 194 parts of 1-anthrol is heated on the water-bath for about half an hour. The dye which separates on cooling is collected and washed. It gives a brownish yellow vat from which cotton is dyed in pure fast violet shades.—J. C. C.

Azo dyestuffs; Production of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 17,105, July 18, 1910. Addition to Eng. Pat. 933, Jan. 13, 1910.

Dyestuffs similar to those described in the chief patent are obtained by using acylaminonaphtholsulphonic acids instead of naphtholsulphonic acids. On wool, the new dyestuffs give orange to blue red shades, fast to fulling and washing. Example: The diazo compound prepared from 2-toluidine-4-sulphon-*o*-anisidide is combined in alkaline solution with 2-acetylamino-5-naphthol-7-sulphonic acid. It dyes wool in orange shades.—J. C. C.

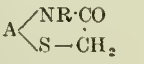
Anthracene dyestuffs; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 232,076, May 26, 1909.

When anthraquinone-*o*-aminothioglycollic acids or their derivatives of the general formula,



$$A\begin{cases}NHR\ (1)\\ S.CH_2.COX\ (2)\end{cases}$$

(where A is an anthraquinone or substituted anthraquinone residue, R a hydrogen, alkyl, or aryl, and X, hydroxyl, ethoxyl, halogen, amino, etc.), are treated so as to effect intramolecular condensation, new dyestuffs of the general formula,



$$A\begin{cases}NR\cdot CO\\ S-CH_2\end{cases}$$

are obtained.—T. F. B.

Vat dyestuffs of the anthracene series; Manufacture of ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 28,679, Dec. 9, 1910.

When the reduction products of anthraquinone, obtained by the condensation of two mols. of anthraquinone at the *meso*-carbon atom (*e.g.*, dianthrone, dianthranol), are treated with condensing agents, new vat dyestuffs dyeing unmordanted cotton in various fast shades of brown, are produced. *Example:* 20 parts of dianthrone (obtained by oxidising anthranol in glacial acetic acid solution, with ferric chloride) are suspended in 200 parts of nitrobenzene, and 20 parts of powdered, sublimed aluminium chloride are added. The solution is heated to 140°—160° C. for ten hours, the nitrobenzene is distilled in a current of steam, and the residue boiled successively with hydrochloric acid, water, and alcohol. The dyestuff dyes cotton garnet-brown shades from the vat, which become chocolate-brown after rinsing and soaping; somewhat greener or redder tints may be obtained by modifying the proportion of aluminium chloride used.—T. F. B.

Monoazo dyes for wool. W. Herzberg, Schöneberg, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 987,362, March 21, 1911.

Picramic acid is diazotised and combined with an *o*-substituted *m*-aminophenol, $NH_2 : OX : Y = 1 : 3 : 4$ (where X represents an alkyl and Y a substituent), such as *o*-ethoxy-*p*-toluidine; the dyes thus obtained are especially adapted for dyeing wool in presence of an oxidising chromium compound, in which case olive shades are produced, very fast to milling, potting, and light.—T. F. B.

Anthraquinonylglycines; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 232,127, Dec. 16, 1909.

Aminoanthraquinones are reduced (vatted) in alkaline solutions, and treated with glyoxylic or thioglyoxylic acid. The resulting anthraquinonylglycines serve as intermediate products for the preparation of vat dyestuffs. β-Anthraquinonylglycine dissolves in boiling water and in hot organic solvents, giving an orange yellow solution; it crystallises from aqueous solutions in orange yellow crystals, of m. pt. 236° C. (with effervescence), which dissolve in solutions of alkali hydroxides or carbonates or ammonia to orange-yellow solutions. α-Anthraquinonylglycine consists of garnet-red crystals, of m. pt. 262° C., with decomposition; it dissolves in alkalis to violet solutions, in alcohol to reddish-yellow, and in hot water to eosin-red solutions.—T. F. B.

Dyestuffs of the anthracene series; Manufacture of —— and process of dyeing. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 10,053, April 25, 1910.

See Fr. Pat. 418,908 of 1910; this J., 1911, 78.—T. F. B.

Vat [anthracene] dye; Yellowish-red ——. P. Thomaschewski and H. Raeder, Vohwinkel, and W. Mieg and P. Fischer, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 986,521, March 14, 1911.

See Fr. Pat. 409,407 of 1909; this J., 1910, 686.—T. F. B.

Direct-dyeing cotton-dyestuff. J. Turner and H. Dean, Huddersfield. U.S. Pat. 987,417, March 21, 1911.

See Fr. Pat. 416,898 of 1910; this J., 1910, 1370.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Bagasse [sugar cane refuse] as a papermaking material. Von Possanner. Wochenbl. Papierfabr., 1911, 42, 1157—1158.

The author agrees with the views expressed by Wrede (this J., 1911, 278) as to the possible future of bagasse as a raw material for white papers. It is desirable, however, to separate the small parenchyma cells of the pith from the useful fibres, before attempting to bleach the pulp. Such separation is readily performed by mechanical means; the author found that the pulp yielded 30 per cent. of long fibres and 60 per cent. of small cells, 5—10 per cent. being lost. When bagasse cellulose is prepared by the alkaline process, it consists of a brown-coloured product which is practically incapable of being bleached. On the other hand, an alkaline process is absolutely necessary to break down the highly silicious tissues of the outer portion of the stem. The author has found, however, that a double treatment, on the one hand with caustic soda, and on the other with bisulphites, yields a well digested pulp which can be bleached perfectly white with 6—10 per cent. of bleaching powder; it is necessary to bleach in acid solution. In the laboratory, the yield of cellulose ranges from 35 to 50 per cent.; on the large scale a maximum of 40 per cent. may be expected, since a portion of the small cells must be lost. Only by this combined acid and alkaline process of digestion can bagasse be used as a raw material for the manufacture of fine white papers.—J. F. B.

Paper; Detection of animal sizing in ——. Differentiation between gelatin and casein. C. Levi. Papierfabr., 1911, **9**, 365—367.

For the detection of animal size in paper, whether gelatin or casein, the author recommends the biuret reaction. A fragment of the paper is steeped for a few minutes in a 2 per cent. solution of copper sulphate, and is then treated with a 5 per cent. solution of sodium hydroxide, the latter being preferably dropped on the paper. If gelatin or casein be present, a violet colouration is immediately produced. For distinguishing between gelatin and casein in a paper the author recommends the xanthoprotein reaction, which is shown by casein but not by gelatin. A fragment of the paper is moistened with a drop of concentrated nitric acid, and if casein be present, an intense yellow stain is produced. This stain turns brown with caustic soda and orange with ammonia. The presence of mechanical wood fibre vitiates this test, since lignin is also stained by nitric acid. In the case of papers coated with casein, the coating may be scraped off, or in cases where the paper cannot be tested direct, the casein may be extracted with borax or alkali, precipitated with acetic acid and the dried precipitate tested with nitric acid or Millon's reagent.—J. F. B.

PATENTS.

Wool and other like fibrous materials; Drying machines for ——. W. McNaught, Rochdale. Eng. Pat. 14,393, June 14, 1910.

In drying machines of the type described in Eng. Pat. 7523 of 1909 (this J., 1910, 559), the provision in the drying chambers of two or more perforated plates is claimed. The first perforated plate is attached to the walls of the chamber and preferably has a curved form. The moist wool is dried by means of powerful blasts of air which carry a considerable proportion of the "waste," foreign matters, broken fibres, etc. through this perforated plate into a separate chamber. The second perforated plate is situated at the top of the chamber and has the object of retaining the waste carried through the first plate in the special compartment reserved for it, whilst the air escapes. Separate inspection doors are provided for the waste chamber and the drying chamber proper. If desired one waste chamber may be arranged to serve several drying machines.—J. F. B.

Textile and fibrous materials for spinning; Preparation of ——. J. Bendel. Fr. Pat. 420,992, Oct. 1, 1910.

The woody and straw-like parts of the stems of ramie, flax, hemp or the like are removed as far as is possible without injuring the fibres. The stripped stems are then tied in bundles and immersed for 24 hours at 25°—30° C. in a vat containing water to which has been added a preparation of retting ferment. This preparation is obtained by pulverising some of the woody parts separated from the fibre by the stripping machine and then stirring the powder to a paste with dilute ammonia solution, the paste being further diluted with water before adding it to the retting vat. After withdrawing them from the vat, the bundles are placed on trays which are arranged in a tank containing lukewarm water to which has been added a little sodium carbonate and Marseilles soap. The bath is slowly heated to about 75° C. and after keeping it at that temperature for 15—30 minutes it is heated to the boil for a moment. The bundles are then divided and arranged on an inclined wire screen, and hot water is discharged on to them. By suitably directing the stream of hot water the fibres can be straightened out and washed at the same time. After drying the fibres are ready for spinning.—P. F. C.

Raw fibre and yarn resembling cotton; Process for obtaining —— by chemically treating raw ramie fibre. P. Birkenstock. Fr. Pat. 421,166, Oct. 7, 1910.

Five litres of a 50 per cent. solution of sodium sulphoricinate, 20 litres of caustic soda solution (36° B.), and a solution of 5 kilos. of Solvay soda in 20 litres of boiling water are successively added, whilst stirring, to 1000 litres of cold water. 30 kilos. of stripped ramie in bundles are introduced into this bath, which is raised to and kept at the boil for 8 hours. Precautions are taken to prevent the fibres from becoming entangled during this process. The material thus obtained is washed, soured for one hour with a 1 per cent. solution of hydrochloric acid, again washed and then dried. The fibre is next passed through a breaking machine until sufficiently supple, is afterwards cut into suitable lengths and then thoroughly opened out. 50 kilos. of the opened material are immersed for one hour with constant movement in a cold bath containing 2 litres of a 50 per cent. solution of sodium sulphoricinate, 500 litres of caustic soda (36° B.) and 500 litres of water. After this treatment the material is hydroextracted, soured, washed, and dried.—P. F. C.

Vegetable fibres, such as kapok, calotropis, akone, or vegetable silks in general; Process for treating brittle —— to make them suitable for spinning or dyeing. E. G. Stark. Ger. Pat. 231,941, April 12, 1910. Addition to Ger. Pat. 230,142, Nov. 2, 1909.

See U.S. Pat. 962,173 of 1910; this J., 1910, 940. The solvents are applied in the form of vapour under normal, increased, or diminished pressure, *e.g.*, as superheated vapours. The fibres may be treated with liquid solvents before or after such vapour treatment. The pressure of the vapours may be continuously or intermittently increased during the process.—T. F. B.

Cellulose solutions; Manufacture of stable viscous ——. Ver. Glanzstoff Fabriken, Elberfeld, Germany. Eng. Pat. 309, Jan. 5, 1911. Under Int. Conv., Sept. 13, 1910.

One kilo. of approximately 99 per cent. formic acid is mixed with 1 kilo. of syrupy commercial phosphoric acid (about 84 per cent.), and 200 grms. of degreased, slightly bleached cotton are stirred in. After remaining for a few hours the cellulose is converted into a slightly coloured viscous solution, which can be worked into fibres, threads, etc. Modified cellulose, such as the refuse from the manufacture of artificial silk, is more readily soluble than ordinary cellulose.—J. F. B.

Artificial fibres and films and artificial horsehair; Process for preparing ——. Verein. Kunstseidefabrik A.-G. Ger. Pat. 230,941, Jan. 18, 1908.

Concentrated, stable solutions of cellulose may be obtained by dissolving it in ammoniacal cuprous chloride solution, which may or may not also contain other copper compounds, such as the hydroxide or carbonate; the solutions are used for spinning in the ordinary way. Cuprous chloride may also be used to produce cellulose cuprammonium solutions richer in cellulose, or to render those solutions more stable.—T. F. B.

Cellulose-cuprammonium solution suitable for use in making artificial silk, etc.: Process for preparing a ——. Hanauer Kunstseidefabrik. Ger. Pat. 231,693, May 3, 1906.

Cellulose is impregnated with ammonia, and its solution is effected by addition of cupric hydroxide: the solubility of cellulose in cuprammonium hydroxide is considerably increased if free cupric hydroxide is present.—T. F. B.

Soda-cellulose manufacture; Process for the precipitation of humus-substances from the waste lyes of —— by means of carbonic acid. E. L. Rinman. Ger. Pat. 231,254, July 13, 1910. Addition to Ger. Pat. 222,302, April 14, 1909.

It has been found that there are technical difficulties in the use of carbon dioxide gas for the precipitation of humus substances from the black lyes of soda cellulose manufacture, as described in the chief patent (see Fr. Pat. 401,856 of 1909; this J., 1909, 1163). It is therefore proposed in the present patent to use an acid carbonate, preferably sodium bicarbonate, to effect the precipitation.—A. S.

Paper, cardboard or other cellulose products [from Hedychium coronarium]; Manufacture of——. A. J. Boult, London. From Rebello, Faria and Co., Morretis, Brazil. Eng. Pat. 29,582, Dec. 20, 1910.

The application of the plant called *Hedychium coronarium*, belonging to the family of *Zingiberaceæ*, for the production of paper, cardboard or other cellulose products is claimed, the fibres being separated and prepared by any known means.—J. F. B.

Acetyl derivatives of cellulose; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,271, June 13, 1910.

See Fr. Pat. 417,274 of 1910; this J., 1911, 19.—T. F. B.

Acetyl cellulose compounds; Process of making ——. O. Bonhoeffer, Elberfeld, and H. Guntrum, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 987,692, March 28, 1911.

See Fr. Pat. 417,274 of 1910; this J., 1911, 19.—T. F. B.

Cellulose; Process for the preparation of xanthic solutions of ——. A. Pellerin, Neuilly-sur-Seine, France. Eng. Pat. 15,752, June 30, 1910.

See Fr. Pat. 417,568 of 1910; this J., 1911, 19.—T. F. B.

Production of alcohol from sulphite cellulose lyes. Eng. Pat. 6741. *See* XVIII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

The action of carbon dioxide in the bleaching process. S. H. Higgins. Chem. Soc. Proc. 1911, 27, 67—68.

On adding calcium chloride to lime-water, the rate of attraction of carbon dioxide from the air by the lime-water is increased, and this fact probably accounts for the observation that the addition of calcium chloride to bleaching powder solution increases the bleaching efficiency of that solution. On exposing bleaching powder solution to air, the free lime contained in the solution is deposited as calcium carbonate, and then the carbon dioxide of the air acts on the other calcium salts present in solution. It is the latter action that causes the exposed bleaching powder solution to have a high bleaching efficiency. Common salt added to sodium hypochlorite solution increases its bleaching activity, and this is also true of other neutral salts of sodium; solutions containing equivalent proportions of these salts have approximately the same effect in increasing the bleaching activity. Moreover, equivalent proportions of common salt and of calcium chloride have approximately the same effect in increasing the activity of bleaching powder solutions. These effects are probably due to the so-called "neutral salt action" and to the increased attraction of the carbon dioxide of the air by the neutral salt solutions. The results of the experiments and other facts (Higgins, this J., 1911, 185) do not agree with the conclusions of Taylor (this J., 1910, 693; 1302). The author represents the action of carbon dioxide on bleaching powder by the following equations:

$$(1)\ Ca(OCl)_2 + CO_2 + H_2O = CaCO_3 + 2HOCl$$

$$(2)\ 2HOCl + CaCl_2 + CO_2 = CaCO_3 + 2Cl_2 + H_2O.$$

The action represented by equation (2) is found to be reversible, and thus accounts for Taylor's (*loc. cit.*) and the author's results. In bleaching with bleaching-powder solution, hypochlorous acid enters into the bleaching action, and as much nascent chlorine as is supplied by the reaction represented in equation (2), the carbon dioxide being supplied by the air.

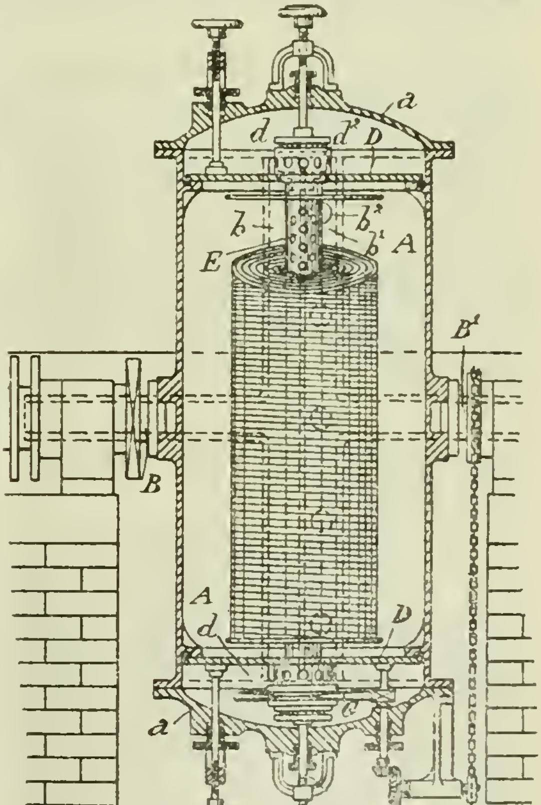
Patents.

Cotton yarns or fabrics; Process of treating —— and the products obtained thereby. S. Shimizu, Tokio, Japan. Eng. Pat. 867, Jan. 12, 1910. Under Int. Conv., Feb. 25, 1909.

The previously scoured yarn is treated with a solution of "konnyaku" in water or a mixture of alcohol and water, to which glycerin has been added. The material is then stroked until the nap is laid and afterwards mercerised, washed, soured, washed again and dried. The principal constituent of "konnyaku" is mannan (see supplementary edition Century Dictionary and Cyclopedia, Vol. XII.), a carbohydrate which is made insoluble by the action of a strong alkaline solution.—P. F. C.

Yarn; Apparatus for treating —— with dye or other liquors. J. H. Riley and Co., Ltd., and F. Riley, Bury. Eng. Pat. 8043, April 4, 1910.

In the figure, A is a dye-vat mounted upon hollow trunnions, BB¹, and provided with removable covers, *a*, just inside which are partitions, D, which form compartments, *d*, at the ends of the vat. The dye liquor flows through the trunnions into and out of the vat, and passages, *bb*¹



are formed in the sides of the vat, *b*, connecting the trunnion. B, with the end compartments, *d*, whilst b^1 connects the central part of the vat with the trunnion, B^1, through the perforations, b^2. Each of the partitions, D, is formed with a central opening through which the end of the yarn carrier, E, projects into the compartment, *d*. A packing collar, d^2, is fitted over the end of the carrier and against the partition to make a tight joint. In one end of the vat a wheel, G, is fitted to the collar, d^2, and by it the yarn carrier, E, is rotated about its longitudinal axis whilst the vat itself rotates on its transverse axis. The machine is also provided with a reversible pump by which the dye-liquor is circulated through the yarn, and with tanks from which the liquor can be withdrawn and to which it can be returned.—P. F. C.

Shading indigo dyeings; Process for ——. H. Imrie, London. From Anilinfarben und Extrakt-Fabriken vorm. J. R. Geigy, Basel, Switzerland. Eng. Pat. 21,802, Sept. 20, 1910.

IF dyeings of ortho-hydroxy-azo dyestuffs, especially the redder shades, be after-treated with copper salts, then in combination with an indigo bottom or a topping with indigo, exceedingly deep navy and indigo-blue shades, practically equal in all their properties to pure indigo dyeings, can be produced upon woollen materials. Example: The pieces are bottomed with indigo, then rinsed and topped with 2 per cent. of the ortho-hydroxy-azo colouring matter made by combining one molecule of *p*-nitroortho-aminophenol with one molecule of 1·8-aminonaphthol-3·6 disulphonic acid. 3—5 per cent. of acetic acid is added to the dye liquor at 50°—60° C., and the bath is slowly raised to and then kept at the boil for one hour. Steam is then turned off, a solution of 0·5—1·0 per cent. of copper sulphate is added and the dye-bath is boiled for half an hour longer.—P. F. C.

Rinsing, washing and dyeing wool, cotton and other yarns in hanks; Machine for ——. P. G. Fincato. Fr. Pat. 420,946, Aug. 30, 1910.

THIS machine comprises a number of longitudinally fluted rollers arranged in pairs, the lower rollers being provided with end pieces to prevent the yarn from slipping off. The hanks are hung over the lower rollers and when the machine is in motion they are nipped and kept in circulation. Perforated spraying pipes are arranged to discharge the necessary liquor on to the moving yarn and this liquor falls into troughs into which the lower ends of the moving hanks also dip. These troughs can be raised or lowered. The motion of the rollers and hence the movement of the hanks can be reversed at will and the upper roller of each pair can be raised to introduce the hanks or to remove them from the machine.—P. F. C.

Dyeing, washing, cleansing and otherwise treating yarn in hanks; Process and apparatus for ——. J. Schlumpf. Fr. Pat. 421,183, Oct. 7, 1910.

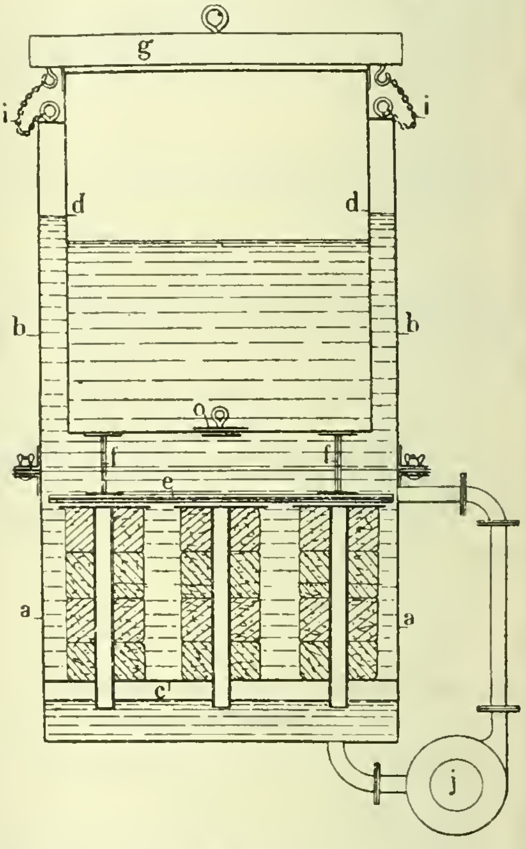
THE hanks are arranged on a support which consists of two yarn-sticks joined near their ends by cross pieces. The longer of these sticks is a little longer than the width of the dye-vat and when its ends rest freely on opposite walls, the other stick (which is shorter than the width of the vat) is immersed in the dye-liquor. To change the position of the yarn on the support, two workmen first take hold of opposite ends of the longer stick, then lift the whole support out of the vat, next seize the ends of the shorter stick and allow the longer stick to swing down, this operation being equivalent to the rotation of the yarn support round the shorter stick as axis. The hold is then changed to the longer stick and the rotation is again effected, but this time with the longer stick as axis, and the support is finally placed in position again across the dye-vat. In this way the position of the yarn is changed without any rubbing or friction against the support. Machines are also described for mechanically effecting these operations (see Eng. Pat. 23,410 of 1909; this J., 1910, 1300).—P. F. C.

Dyeing bobbins; Apparatus for ——. Textil-Maschinenfabrik B. Cohnen. Fr. Pat. 421,492, Oct. 15, 1910.

THE wooden spindle around which the bobbin is wound is displaced by a tapering perforated tube, and a number of the wound bobbins are then superposed, the narrow end of one tube being inserted in the wide end of the next. The combination can be arranged in the dyeing machine as though the bobbins had all been transferred to and mounted on one long perforated spindle.—P. F. C.

Dyeing, washing, bleaching, etc., textile fibres in any form; Apparatus for ——. F. Goetz and Soc. Anon. de Teinture et d'Impression. Fr. Pat. 421,566, Oct. 18, 1910.

A DYE-VAT consisting of two separable parts, *a* and *b*, is provided with a perforated false bottom, *c*, on which the material to be dyed is placed and pressed down by means of a perforated metal sheet, *e*. This sheet is connected by bars, *f*, with a hollow displacer, *d*, which can be raised or lowered and is connected by chains, *i*, with the upper part, *b*, of the vat, these chains being sufficiently long to allow the displacer to be freely raised or lowered through some inches. A pump, *j*, withdraws the dye-liquor from the lower part of the vat and re-delivers it into the upper part. The displacer, *d*, is ballasted by partly filling it with cold water which becomes heated during the dyeing operation by the circulation of the hot dye-liquor round the displacer. The hot water thus produced, is run into the dye-vat through an opening, *o*, after the dyeing process is completed and used to wash the dyed material. Before charging the machine, the displacer, *d*, and the upper part, *b*, of the dye-vat are raised together by means of a cross bar, *g*.—P. F. C.



Discharging dyed textiles with nitrilomethylenesulphoxylates; Process for ——. Chem. Fabr. von Heyden. Ger. Pat. 231,487, Aug. 1, 1909.

NITRILOMETHYLENESULPHOXYLATES act as powerful discharging agents for dyed textiles in presence of salts of non-volatile organic acids. Addition of ammonium salts does not assist, but rather lessens the discharging power (compare Fr. Pat. 382,884; this J., 1908, 222).—T. F. B.

Cop-tube. F. H. Daniell, Franklin. N.H., Assignor to Franklin Process Co. Reissue No. 13,223, March 28, 1911, of U.S. Pat. 974,126, Nov. 1, 1910.

See Fr. Pat. 408,400 of 1909; this J., 1910, 623.—T. F. B.

Size [for yarns]; Process of manufacturing ——. L. Paechtner, London. U.S. Pat. 987,595, March 21, 1911.

See Eng. Pat. 15,300 of 1906; this J., 1906, 1144.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Phosphoric acids; The ——. A. Holt and J. E. Myers. Chem. Soc. Trans., 1911, **99**, 384—391.

The authors' experiments relate principally to the hydration of metaphosphoric acid in solution, and the molecular complexity of the three phosphoric acids. Metaphosphoric acid was detected and determined in presence of the other two acids by precipitation with barium chloride. It was not found possible to determine pyro- or ortho-phosphoric acid in a mixture of the three acids, but the presence of the pyro-acid was detected by neutralising the solution with sodium hydroxide and phenolphthalein, and then either fractionally precipitating with silver nitrate, when after separating the yellow silver orthophosphate first formed, a white precipitate of silver pyrophosphate is obtained, or acidifying with nitric acid and precipitating with silver nitrate, when a white silver precipitate is obtained at once. Experiments with solutions of metaphosphoric acid of *N*/1 and 2*N* concentration showed that the pyro-acid is formed as an intermediate product in the conversion of the meta- into the ortho- acid. Measurements of freezing point depression, in conjunction with determinations of electrical conductivity, showed that in solutions of meta- and pyrophosphoric acids obtained by decomposing the lead salts, the acids exist as simple molecules, but when prepared by dehydrating orthophosphoric acid, the meta- and pyro-acids give complex molecules in solution. (See also Balareff, this J., 1910, 812, 1248.)—A. S.

Hydrosulphites; Electrolytic production of —— *from bisulphite solutions.* K. Jellinek. Z. Elektrochem., 1911, **17**, 245—261. (See also Frank, this J., 1902, 51, and 1904, 792.)

Sodium hydrosulphite in a concentrated bisulphite solution, that is to say under the conditions of its preparation by the electrolytic method, undergoes decomposition according to the following equation: $2Na_2S_2O_4 = Na_2S_2O_3 + Na_2S_2O_5$. The velocity of this change has been measured and it is shown to be a monomolecular reaction. Investigation of the electrolysis shows that there is no evidence of electrolytic reduction of the hydrosulphite to thiosulphate: $Na_2S_2O_4 + 2H = Na_2S_2O_3 + H_2O$, as was suggested by Elbs and Becker (this J., 1904, 611). The stationary position of the electrolysis, in which the passage of the current does not produce any more hydrosulphite is due to spontaneous decomposition according to the first equation above, which is taking place as fast as the electrolytic formation. If the current strength is made sufficiently large for a given volume of cathode electrolyte, the rate of production can be made to exceed the rate of decomposition so considerably that the stationary state is not reached till a considerable concentration of hydrosulphite has been obtained. Thus theoretically, with 100 c.c. of cathode electrolyte and a current of 1 amp., the stationary condition corresponds to a solution of about 9·4 per cent. of hydrosulphite. To obtain good yields efficient cooling and stirring are of course necessary. —W. H. P.

Manganates; Formation of —— *at high temperatures.* O. Sackur. Ber., 1911, **44**, 777—787.

The author has made a further examination of the alkali salts which are formed when oxides of manganese are fused with excess of alkali in the presence of oxygen (see this J., 1910, 347). By fusing manganic oxide (Mn_2O_3) with potassium or sodium carbonate, and noting the relation between the oxidation and the amount of carbon dioxide evolved, he concludes that the potassium salt has the formula, $Mn_5O_{13},8K_2O$, and is formed as a result of two reactions: $5Mn_2O_3 + 10K_2CO_3 + 11O = 2[Mn_5O_{13},5K_2O] + 10CO_2$, and $Mn_5O_{13},5K_2O + 3K_2CO_3 = Mn_5O_{13},8K_2O + 3CO_2$. This differs from the author's previous conclusion (*loc. cit.*) that the compound $Mn_5O_{13},5K_2O$, is the final product. When sodium carbonate is used the final product has the composition, $Mn_2O_5,4Na_2O$, and probably results from the oxidation of the intermediate manganite, $MnO_2,2Na_2O$. The difference between the two alkalis is striking, as is also the much greater rapidity of oxidation which is shown with potassium carbonate. It is further noteworthy that the complexity of salts of manganese acids appears to be greater at high temperatures than at low ones, which is the reverse of the usual tendency. —W. H. P.

Stannous chloride and ammonia; Two new compounds of ——. A. J. Sofianopoulos. Comptes rend., 1911, **152**, 865—869.

Persoz found (Ann. Chim. Phys., 1830, **44**, 315) that stannous chloride, heated with dry ammonia gas, gave a compound having the formula, $SnCl_2,NH_3$. The author finds that this compound is produced in the cold, even below 0°C. Another compound, having the formula, $SnCl_2,2NH_3$, can be obtained by passing dry, cooled ammonia gas over a shallow layer of well dried stannous chloride in a large glass tube, cooled by a mixture of ice and salt. The action of the ammonia is continued until the contents of the tube become of a uniform light yellow colour. The product thus prepared should be kept in a coloured bottle, shaded from light. A third compound, $3SnCl_2,2NH_3$, is formed by the action of gaseous ammonia on stannous chloride at a temperature between 120° and 300° C. It is a crystalline mass of reddish brown colour, powerfully double-refractive, and appears to be the most stable of the compounds of ammonia and stannous chloride. —R. C. P.

Iodine: Oxidation of —— *[to iodic acid] by hydrogen peroxide.* V. Auger. Comptes rend., 1911, **152**, 712—713.

In the presence of traces even of chlorine or bromine or their hydracids, hydrogen peroxide effects the complete oxidation of iodine (in solution) to iodic acid. This is probably due to the intermediate formation of iodine chloride or bromide which acts catalytically. The separation of solid iodine must be avoided, since it leads to the catalytic decomposition of the hydrogen peroxide. —F. Sodn.

Ozone by a chemical reaction; Producing ——. P. Malaquin. J. Pharm. Chim., 1911, **3**, 329—335.

It has been found that when a mixture of ammonium persulphate and nitric acid is heated to about 70° C., ozone is produced. The apparatus consists of a thin glass vessel fitted with a stoppered tubulure, a side tube reaching nearly to the bottom and provided with a stopcock, and a vertical gas-washing arrangement capable of holding about 30 c.c. of liquid. A delivery tube is fitted to the washing tower by a ground-in connection. No joints of rubber or cork are used. 20 grms. of ammonium persulphate and 15 grms. of pure nitric acid of 36 Bé. are placed in the vessel and the air swept out by a current of carbon dioxide. The vessel is heated in a water-bath to 70°—75° C., when an active evolution of gas takes place, which is washed by a 20 per cent. solution of potassium hydroxide. The gas consists of 94—95 per cent. of oxygen with 3—4 per cent. of ozone and 4 to 4·5 per cent. of nitrogen.—F. Sodn.

Hydrogen peroxide; Preservation of solutions of ——. M. Schlaugk. Apoth.-Zeit., 1911, 26, 106.

HYDROGEN peroxide solutions may be preserved by the addition of *p*-acetylaminophenol. This addition increases the antiseptic properties of the peroxide.—J. O. B.

Carbon and lime; Action of steam on ——. L. Vignon. Comptes rend., 1911, 152, 871—874.

STEAM is decomposed at a lower temperature, and more rapidly, by a mixture of carbon and lime than by carbon alone. On leading steam over an intimate mixture of lime and sundry substances rich in carbon, placed in a porcelain tube and heated to 600°—800° C., the gas collected was found to contain hydrogen, methane, carbonic oxide, oxygen and nitrogen. The quantity of steam employed plays an important part; as also does the period of contact between the methane formed and the excess of steam, at the temperature of the reaction, since the steam decomposes methane according to the equation: $CH_4+H_2O=CO+3H_2$. With a passage of 15 grms. of steam in two hours the methane formed (per 100) was 7·92; while a passage of 5 grms. of steam in 35 minutes gave 28·05. By employing suitable proportions of carbon and lime, increasing, though apparently limited quantities of ethylene can be formed. If the lime be regenerated by decomposing the calcium carbonate produced, it is possible to convert the carbon of organic compounds into hydrocarbons by the action of steam in presence of lime, thus:—$2(C)+CaO+2H_2O=CaCO_3+CH_4$; $CaCO_3=CO_2+CaO$; or by combining these two equations: $2(C)+2H_2O=CO_2+CH_4$. The methane being formed at a lower temperature than that of the decomposition of the calcium carbonate, the carbon dioxide and methane can be collected separately. This may explain the formation of marsh and natural gases, in which methane predominates; thus the reaction studied, appears to have taken part in the formation of petroleum. It is known that animal and vegetable remains (compounds rich in carbon), in contact with calcareous deposits have given rise, in presence of water, to hydrogen and hydrocarbons, which by successive reactions and condensations under the influence of time, temperature and pressure, have at last become converted into petroleum.—R. C. P.

Graphite; A new mode of formation of ——. W. Heinsch. Monatsh. Chem., 1911, 32, 225—239.

THE author succeeded in preparing graphitic acid from the so-called "field chalk" ("Ackerkreide") which is found on the borders of South Bohemia and Lower Austria. This "field chalk" on close examination is seen to consist of remains of bricks and pottery ware, in the pores of which in the course of, at the most, a few centuries, graphite has been formed. The possible modes of formation of graphite are discussed and the author concludes that high external pressures and temperatures are not always necessary for such formation, but that, as in the present case, the same effect may be attained by the cumulative action, during long periods, of chemico-physical molecular forces, if the carbon-rich compounds produced from vegetable matter in finely porous material or stones either by bacteria or by "active oxygen," come in contact with suitable catalysers.—A. S.

Gypsum production in the United States. U.S. Geological Survey. [T.R.]

THE quantity of gypsum mined in the United States in 1909 was 2,252,785 short tons, an increase of nearly 31 per cent. over the production of 1908, which was 1,721,829 short tons, and an increase of more than 28 per cent. over that of 1907, which was 1,751,748 short tons. The gypsum sold without calcining and used principally as land plaster and as an ingredient in Portland cement and in paint showed a large increase in quantity, but a loss of about 11 cents per ton in value; but the material calcined for plaster showed both a large increase in quantity and an increase of 30 cents per ton in selling price at the mills. The total value of gypsum and gypsum products in 1909 was $5,906,738, as compared with $4,075,824 in 1908, an increase of 44·9 per cent.

Acetic acid; Importation of —— *into Servia.* Board of Trade J., March 30, 1911. [T.R.]

A CIRCULAR issued by the Servian Minister of Finance (No. 3268 of the 7th/20th February), notifies that the importation of pure acetic acid and essence of vinegar at the "Conventional" rate of 120 dinars per 100 kilos. (about £50 per ton) will now be permitted from those countries (including the United Kingdom) with which Servia has Commercial Treaties. These articles will, however, be analysed by the Customs in order to ascertain whether they are noxious to health.

PATENTS.

Acid-condenser. F. Moore and J. A. Hall, Victoria, B.C., Canada. U.S. Pat. 986,846, March 14, 1911.

A TALL chamber, composed, for instance, of a series of pipe sections secured end to end, encloses a number of vertical condensing tubes which are closed at their lower ends and through which a cooling medium may be circulated, each tube being under separate control. Below these tubes, and above the inlet for the vapour of the acid to be condensed, is a perforated distributing plate (or there may be two of these plates superposed, so as to form a space which is filled with broken pumice or some other acid proof substance) and there are means for withdrawing condensed acid from the bottom of the chamber and for conducting away uncondensed vapour from the top.
—F. SODN.

Rocks containing potassium; Method of treating ——. A. S. Cushman, Washington, D.C. U.S. Pat. 987,436, March 21, 1911.

To bring the potassium in feldspathic or similar rock to a water-soluble condition, the rock is powdered, mixed with a salt of a mineral acid capable of decomposing the rock, such as a chloride, and heated in a furnace. Calcium chloride in the presence of lime is a suitable treating agent.—H. H.

[*Graphite*]; *Method of deflocculation* [*of*] —— *and product thereof.* E. G. Acheson, Niagara Falls, N.Y. U.S. Pat. 986,793, March 14, 1911.

AN insoluble body, such as graphite, is treated with a deflocculating agent in the presence of glycerin, or other non-aqueous liquid miscible with water, or of a mixture of such with water. The mixture of non-aqueous liquid and deflocculated insoluble body is claimed as a new article of manufacture.—F. SODN.

Reduction [*in the electric furnace*] *of refractory chemical compounds* [*chlorides or bromides of boron, zirconium, and titanium*]. Comp. Franç. pour L'Exploit. des Procédés Thomson-Houston. Fr. Pat. 421,831, Oct. 26, 1910.

VOLATILE chlorides or bromides, which do not form subsalts, such as those of boron, zirconium, titanium, are reduced by hydrogen, and withdrawn from the active zone in order to prevent the reverse reaction. The volatile chloride, such as boron chloride, is introduced at intervals from a cooled vessel into a vaporiser, which is heated electrically, and the vapour is conveyed, by means of a current of hydrogen, through refractory tubes of silica into the active zone of the arc, which is produced between cooled copper electrodes. Boron is deposited on the electrodes and on the sides of the chamber. The hydrogen, hydrochloric acid and unchanged boron chloride are passed through suitable condensers and recovered for further use. In an alternative form the gaseous mixture is introduced through a tube passing through the hollow cooled electrodes, or the hydrogen may be passed over boron chloride and the mixed gases passed into the base of a reaction chamber containing two pairs of electrodes, then through a condenser to arrest the hydrochloric acid, and afterwards through a second reaction chamber containing electrodes. With a less volatile chloride, the substance is heated in a suitable tube in a current of hydrogen.—B. N.

Hydrogen; Preparation of —— by decomposition of steam with metallic iron. O. Dieffenbach and W. Moldenhauer. Ger. Pat. 232,347, Feb. 6, 1910.

Steam is decomposed by means of metallic iron, and the iron oxide produced is again reduced to metal by treatment with reducing gases. The claim is for the use of the residue left on roasting spathic iron ore in the air, for the preparation of the iron to be employed in the process. This material is very porous, and is in most cases free from substances which would have injurious effects in the manufacture of hydrogen.—A. S.

Nitrous sulphuric acid; Process for denitrating —— in the lead chamber process. W. P. Salessky, Moscow. Eng. Pat. 20,131, Aug. 29, 1910.

See Fr. Pat. 419,609 of 1910; this J., 1911, 209.—T. F. B.

Metallic amides, cyanamides, and cyanides; Manufacture of ——. E. A. Ashcroft, London and Balestrand, Norway. Eng. Pat. 228, Jan. 4, 1910.

See Fr. Pat. 421,851 of 1910; this J., 1911, 422.—T. F. B.

Ammonia and aluminium compounds; Manufacture of —— from mixtures containing aluminium nitride. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 5382, March 3, 1910.

See Fr. Pat. 418,059 of 1910; this J., 1911, 26.—T. F. B.

Aluminium nitride; Process of producing ——. O. Serpek, Assignor to Soc. Générale de Nitrures, Paris. U.S. Pat. 987,408, March 21, 1911.

See Eng. Pat. 7507 of 1909; this J., 1910, 277.—T. F. B.

Nitrogen compounds; Process of producing ——. A. R. Frank, Halensee, Germany, Assignor to Soc. Generale per la Cianamide, Rome. U.S. Pat. 987,674, March 21, 1911.

See Eng. Pat. 21,786 of 1907; this J., 1908, 898.—T. F. B.

Barium chloride and strontium chloride; Treatment of —— for the production of chlorine and hydroxides of barium and of strontium. A. Clemm, Mannheim, Germany. Eng. Pat. 5471, March 4, 1910.

See Fr. Pat. 413,553 of 1910; this J., 1910, 1204.—T. F. B.

Hydrosulphites; Dehydrating hydrated ——. H. Rey, Assignor to Soc. of Chem. Industry in Basle, Basle. U.S. Pat. 987,170, March 21, 1911.

See Eng. Pat. 9848 of 1910; this J., 1910, 878.—T. F. B.

Carbonic oxide; Manufacture of ——. O. Loiseau, Sclaigneaux, Belgium. U.S. Pat. 987,147, March 21, 1911.

See Fr. Pat. 390,673 of 1908; this J., 1908, 1112.—T. F. B.

VIII.—GLASS; CERAMICS.

Glazes and colours; Self-luminous ——. K. Endell. Sprechsaal, 1911, 44, 185—186.

Starting wth the zinc crystalline glaze (this J., 1911, 130) which responded to radium rays, the author added small quantities of tungstic acid, vanadic acid, molybdic acid and uranium oxide. The tungstate glaze was covered with a lustrous film, and under radium rays stood out clearly and phosphoresced in the dark. The vanadates and uranates showed no luminosity, and molybdate only a slight one. A mixture of tungstate, vanadate and molybdate, however, was as effective as tungstate alone, and the author therefore failed to isolate the most luminous parts. He then introduced the tungstates, vanadates and molybdates of potassium, barium, calcium and zinc into lead glazes fired at 800°—1300° C., and tested the results under Röntgen and radium rays. The vanadates and molybdates gave no response, and only the calcium and zinc tungstates showed any effect. Both these were weaker under the action of Röntgen rays than barium platinocyanide, and than zinc sulphide with radium rays, but were about the same as willemite with radium rays. When fired at 1800° C., the luminosity is not so good because zinc is volatilised. The α-radium rays caused the strongest luminosity, there being no difference in intensity between the calcium and zinc tungstates. Under the β-rays calcium was stronger than zinc, but under the γ-rays and also under the Röntgen rays the zinc was stronger than the calcium. Thorium A+B+C is not as effective as radium. Colouring oxides, except iron oxide, do not interfere with the luminosity. The ordinary phosphorescent substances, such as calcium sulphide, can not be utilised for making luminous glazes as they are decomposed in the firing. At present the ware is a luxury. —H. H. S.

Patents.

Mica; Adaptation of —— for industrial purposes. W. McLoughlin and J. Houghton, Birmingham. Eng. Pat. 8780, Apr. 12, 1910.

The mica is disintegrated by agitating the thin material with a solution of magnesium sulphate or, less advantageously, in a solution of weak acid or alkali, no grinding being necessary. A plastic mass is obtained, which may be washed, dried and mixed with a suitable binding agent such as shellac, gum-arabic, wax or resin, or with a mixture of sodium silicate and lead acetate when a hard rather than a non-hygroscopic material is required. The mass is finally compressed in a mould, and heated to a temperature between 250°—400° F., the operation being conducted in two stages, so that any gases accumulating in the mould can be liberated before the final baking. The finished article should contain at least 80 per cent. of mica. —C. A. W.

Castable masses from non-plastic substances; Method of producing ——. E. Weber, Schwepnitz, Saxony. Eng. Pat. 12,535. May 23, 1910. Under Int. Conv., June 23, 1909.

See Ger. Pat. 224,098 of 1909; this J., 1910, 1012.—T. F. B.

IX.—BUILDING MATERIALS.

Portland cement; Manufacture of ——. A. C. Davis. J. Roy. Soc. Arts, 1911, 59, 480—491. (See also this J., 1910, 1158.)

In Britain, Germany, France and America, the standard specifications insist that Portland cement shall be an intimate mixture of calcareous and argillaceous materials burnt to a clinker and subsequently ground. In America it is also specified that no addition greater than 3 per cent. shall be made subsequent to calcination. In England there are now some 80 cement companies with a total output of 3 million tons of cement per annum, equal to 15 million tons of concrete. The suitability of a locality depends not only on the proximity of chalk or limestone and clay or shale, but also on the fuel supplies, since half a ton of coal is used for every ton of cement manufactured. A variation of 0·5 per cent. in the composition of the mixing is sufficient to alter the tensile strength of the cement and to destroy its reliable quality. The proper composition is 75 of calcium carbonate to 25 of clay. An excess of chalk, above, say, 76 per cent., allows the mixture to stand a high temperature without fusion, but the ground cement will have expansive tendencies. In tensile strength high lime produces high strains, low lime low strains. The mixed raw materials should yield on analysis the following figures :—

Silica	16·5	Clay.
Alumina and oxide of iron	6·5	
Undetermined	0·5	
Calcium carbonate	75·5	Chalk.
Magnesium carbonate	1·0	

From this, a good cement, testing at least 600 lb. per square inch in 7 days should be produced. The proper degree of burning is indicated by the formation of dense greenish-black clinker in the kilns. Light-burned clinker is brownish and soft; over-burned, fused and slag-like. A normal temperature is 1400° C., but the higher the lime content, the higher the necessary temperature. The rotary kiln, which consists of a steel or wrought-iron cylinder 100—150 ft. long and 6—8 ft. in diameter, lined with radial firebricks 9 inches thick, and inclined to the horizontal at about 1 in 30, is used to make 90 per cent. of the cement in the United States and is extending its use in England and on the Continent. The raw materials are fed into the kiln either as a dry powder or as liquid mud. Finely-ground fuel is injected into the lower end of the kiln. By this kiln the amount of fuel used is reduced to 25—35 per cent. of the cement made. The finished cement is ground to pass a 76 by 76 mesh sieve with about 1 per cent. residue. The cementitious property of the material is believed to reside principally in the extremely fine particles, the residue being inert. Modern products should require neither storage nor aeration to ensure quality; such processes were added for the purpose of slaking any free lime present.

In the subsequent discussion J. M. Thomson said that cement was a mixture of tri-calcium silicate and tri-calcium aluminate, but that little was known of the chemical processes during setting. J. F. Waycott stated that at Tournai in Belgium there was a natural rock combining accurately all the constituents of a perfect cement. Walter F. Reid instanced a similar deposit at Cambridge and said the English cements were better than the Belgian. At Rugby, on the other hand, it was necessary to mix the different layers of limestone and to eliminate fossilised pyrites, but Rugby cement is now second to none. He claimed the rotary kiln as an English invention, due to Ransome. The cement used in the Thames tunnel construction in 1828 was not Portland, but Roman cement, *i.e.*, burnt nodules of London clay. Considerable leakage now occurs in that tunnel. He questioned the author's statement that clay is dredged from the bottom of the river, as it would be too sandy. The clay really used is brought up in dredgers, for economic reasons, from the mud flats of the Thames valley. The finer cement can be ground, the more sale it will command.
—H. H. S.

Cement; Report of Special Committee of American Society of Civil Engineers on uniform tests for ——. Proc. Amer. Soc. Civil Eng., 1911, 37, 105—118.

Sampling must be left to the discretion of the engineer, but, in general, one barrel in ten should be sampled, by a sampling iron going from the middle of the side or end to the centre, and samples should be passed through a 20 mesh sieve to break up lumps and remove foreign matters.

Chemical analysis is useful in detecting adulteration, or excess of constituents believed to be harmful in excess, as magnesia or sulphuric anhydride. It is not, however, conclusive as an index of quality. The method of analysis proposed by the Committee of the New York Section of the Society of Chemical Industry on uniformity in the analysis of materials for the Portland cement industry (this J., 1902, 12 and 1223) is recommended.

Specific gravity should be determined with Le Chatelier's apparatus, using light petroleum or paraffin oil. Results should agree within 0·01.

Fineness.—The "No. 100" (96 to 100 meshes to the inch, wire 0·0045 inch in diameter) and the "No. 200" (188 to 200 meshes, wire 0·0024 inch) sieves are to be used, the fine sieve being used first, and the sifting continued till not more than 0·1 per cent. passes after a minute of continuous tapping.

Consistency.—The Vicat needle with a cylinder of 1 cm. cross section is used. Not less than 500 grms. of cement are kneaded into paste with a definite amount of water, formed into a ball with the hands, tossed six times from one hand to the other six inches away, pressed into the ring, smoothed off with the trowel, and the cylinder brought down on it. The consistency is correct when the cylinder penetrates 10 mm. in a minute. The percentage of water for "mortars" of 3 parts of sand to 1 part of cement is obtained from the percentage determined for "pastes" of cement alone, by means of the following table:—

Paste.	Mortar.	Paste.	Mortar.	Paste.	Mortar.
15	8·0	23	9·3	31	10·7
16	8·2	24	9·5	32	10·8
17	8·3	25	9·7	33	11·0
18	8·5	26	9·8	34	11·2
19	8·7	27	10·0	35	11·5
20	8·8	28	10·2	36	11·5
21	9·0	29	10·3	37	11·7
22	9·2	30	10·5	38	11·8

Time of setting.—This is measured by the Vicat needle of 1 mm. diameter, using a paste of normal consistency. Initial set occurs when the needle ceases to penetrate within 5 mm. of the glass plate; final set when it ceases to penetrate visibly.

Standard sand.—A natural sand from Ottawa, Illinois, is recommended, screened to pass a 20 mesh and be retained by a 30 mesh to the inch sieve, the diameter of wire in each sieve being half the width of the opening.

Test pieces for compression, 2 inch cubes. For tension, details of the dimensions are given, which are almost identical with those of the British standard specification. Figures of suitable moulds are also given.

Mixing.—All proportions to be stated by weight; quantity of water to be expressed as percentage of dry material. Temperature of room and of water to be as near 21° C. as possible. Sand and cement to be thoroughly mixed dry. Weighed dry material to be placed on the mixing-table, a crater formed in the centre, the proper quantity of water poured in, and the material on the outer edge turned into the crater with a trowel. As soon as the water is absorbed (1 minute), the whole is kneaded with gloved (preferably rubber-gloved) hands for one minute.

Moulding.—Moulds to be filled as soon as mixing is completed, material pressed in firmly with the fingers and smoothed off with a trowel without mechanical ramming. Material should be heaped up on the upper surface of the mould, and a moderate pressure on the excess material exerted by the trowel in smoothing off. Briquettes varying more than 3 per cent. from the average weight should not be tested.

Briquettes should be stored for 24 hours in a moist chamber, then in water as nearly at 21° C. as possible. They should be tested, whether in tension or compression, immediately they leave the water. Tensile stress should be applied at the rate of 600 lb. per minute.

Constancy of volume.—Pats of paste of normal consistency are used, 7½ cm. in diameter, 1¼ cm. thick at the centre, tapering to a thin edge. For the "normal" test, one pat is immersed in water at 21° C., and another, after 24 hours in a moist chamber, is maintained in ordinary air; during 28 days these should show no cracking, distortion, or disintegration. For the "accelerated" test, a pat is placed in an atmosphere of steam on a wire screen one inch above boiling water for 5 hours. It is recognised that the "accelerated" test alone is not enough either to condemn a cement or to prove it entirely satisfactory.—J. T. D.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Steel production of the United States. Eng. and Min. J., April 1, 1911. [T.R.]

The total make of steel in the United States in 1910, as collected and reported by the American Iron and Steel Association, was 26,094,919 long tons; an increase of 2,139,898 tons, or 9 per cent., over 1909, and the greatest production ever reported. This total in 1910 included 25,154,087 tons of ingots and 940,832 tons of castings made directly from the converter or open-hearth furnace. The proportion of direct castings was unusually large. The proportion of steel to pig iron made in 1910 was 95·6; which compares with 92·9 in the previous year.

The division of the steel made in 1910, according to the processes used, is given in the accompanying table, in comparison with the previous year; the figures being in long tons:—

	1909.	1910.
Bessemer	9,330,783	9,412,772
Open hearth	14,493,936	16,504,509
Crucible	107,355	122,303
Electric, etc.	22,947	55,335
Total	23,955,021	26,094,919

Of the total steel output in 1910, the Steel Corporation made 14,179,369 tons, or 54·3 per cent.

The division of the production into acid and basic steels is shown in the next table.

	Acid. Tons.	Basic. Tons.
Bessemer	9,412,772	—
Open hearth	1,212,180	15,292,329
Crucible, etc.	177,638	—
Total	10,802,590	15,292,329
Total, 1909	10,537,549	13,417,472

In 1906, five years ago, only 41·4 per cent. of the total make was basic. All the basic steel is made in the open-hearth furnace; the basic converter is not in use in this country. It is assumed that all the crucible and electric steel is acid. The production of electric steel was by far the largest ever reported. The total of 52,141 tons was made in seven plants, in Massachusetts, New York, Pennsylvania, Indiana, and Illinois. None is reported from California, where the Héroult plant is so far making only pig iron. 3194 tons was made by two or three special and experimental processes.

Steels; Coloured etching of ——. *An investigation on austenite and martensite.* F. Robin and P. Gartner. Rev. Mét., 1911, **8**, 224—240.

The polished specimens are etched in a saturated solution of picric acid for thirty seconds, and it is claimed that by rinsing them in water and then allowing them to dry without wiping, a variety of colours are produced by means of which the various constituents such as austenite and martensite may be distinguished. Eleven microphotographs illustrate the paper.—A. H. C.

Lead in zinc ores; Determination of ——. L. T. Merrill. Eng. and Min. J., 1911, **91**, 569.

By the usual method complete precipitation of the lead as sulphate is seldom or never attained. To remedy this, the following modifications are proposed. The ore is treated with nitric acid, and evaporated with sulphuric acid till dense white fumes are evolved. After cooling, 200 c.c. of water are added, and the whole is boiled, cooled, and filtered. The filtrate is heated with 2—5 grms. of 30-mesh granulated zinc, and let stand till the zinc is dissolved. The lead sponge is filtered off, washed with cold water, dissolved in nitric acid, and the solution evaporated with sulphuric acid till dense white fumes are evolved. The residue is diluted with 50 c.c. of water, boiled, cooled, and filtered through the original filter containing the bulk of the lead sulphate. After washing with water containing alcohol, the lead sulphate, silica, etc., are washed on to about 2 grms. of ammonium acetate, slightly acidified with acetic acid in a beaker. The whole is boiled and filtered through the same filter, the latter being washed with hot water. The lead in the solution is titrated with a solution of ammonium molybdate, using tannin as an indicator. There should be at least 0·025 grm. of lead present, unless this would require more than 10 grms. of the sample. To ensure accuracy, each c.c. of lead acetate solution should contain at least 0·001 grm. of lead. The tannic acid must be freshly made up, and the use of a 1 per cent. solution is recommended. Should lime be present in considerable quantity, the lead is precipitated on zinc from the solution of the acetate, to which a small amount of hydrochloric acid has been added. The lead sponge is then washed with water and alcohol, dried, and weighed.—R. W. N.

Aluminium; Alterability of ——. H. Le Chatelier. Comptes rend., 1911, **152**, 650—652.

An examination of some articles made of aluminium, in which the metal had undergone spontaneous disintegration, showed that in all cases a cellular structure had developed and that disintegration was evidently due to the opening of the joints between the cells. Laboratory experiments pointed to the presence of small quantities of calcium as likely to provoke the development of this cellular structure.—F. Sodn.

Arsenic amalgam; Preparation of ——. E. Dumesnil. Comptes rend., 1911, **152**, 868—869.

Ten grms. of arsenious anhydride are dissolved in 100 grms. of concentrated hydrochloric acid; and 40·65 grms. of mercuric chloride in 700 to 800 grms. of dilute hydrochloric acid (1 : 5); the two solutions are mixed and filtered; 60 grms. of sodium hypophosphite are then added. The mixture is shaken from time to time, let stand a few hours, and then heated to boiling. A granular black precipitate is formed, which under the microscope is seen to consist of crystals of a blackish brown colour, yellowish brown in thin plates. After refrigeration, it is separated by filtration, washed with hot boiled water, and dried *in vacuo*. The amalgam has the formula, As_2Hg_3. If an excess of mercuric chloride be taken, a mixture of amalgam and mercury is obtained, which can be easily separated. Arsenic amalgam, on heating, volatilises without melting, yielding a little trioxide, some metallic arsenic, and mercury.—R. C. P.

Bismuthides [of sodium and potassium]; Some definite ——. A. G. Vournasos. Comptes rend., 1911, **152**, 714—715.

The compounds, Na_3Bi and K_3Bi, have been prepared by heating together the respective metals under paraffin, thus confirming the indications of the existence of definite compounds of bismuth and the alkali metals furnished by the melting point curves of these alloys. The paraffin, which should have a boiling point of about 400° C., is rendered neutral before use by heating with 5 per cent. of sodium for at least 3 hours on the water-bath. An excess of sodium is preferably employed in preparing the compounds, and the excess is removed, after washing the product with benzene and ether, by means of liquefied ammonia. The alkali bismuthides are readily oxidised by the air, turning black, and burn easily, giving a red residue of alkali bismuthate. They absorb hydrogen at 350° C., to give a product which is decomposed by water with the evolution of hydrogen. They decompose water slowly at the ordinary temperature and more rapidly on boiling, and they reduce copper salts, in solution, to metallic copper.—F. Sodn.

Minerals; Viscosity of liquids used for the mechanical separation of ——. E. Clerici. Atti R. Accad. dei Lincei, Roma, 1911, [5], 20, I., 45—50. Chem. Zentr., 1911, **1**, 1082.

The lesser the difference between the specific gravities of the mineral and of the liquid, and the more finely divided the mineral is, the less easily do they separate; difficulties due to these factors may however be compensated by a low viscosity of the liquid. The author determined, by the capillary tube method, at 18·5° C., the viscosities of a number of liquids which have been used or recommended for the separation of minerals, namely Thoulet's solution (potassium mercury iodide), Duboin's solution (sodium mercury iodide), the same in alcohol, Rohrbach's solution (barium mercury iodide), Klein's solution (cadmium-borotungstate), Braun's liquid (methylene iodide), Muthmann's liquid (acetylene tetrabromide), Retger's liquid (solution of stannic iodide in arsenic tribromide), bromoform, liquids proposed by the author (barium mercury bromide, thallium formate, mixture of thallium formate and malonate), thallium malonate, solution of sodium mercury bromide, and solution of ammonium mercury bromide. Of these, Klein's solution had the highest viscosity. Of liquids having the sp. gr. 2·88, the viscosity increased in the following order: bromoform, thallium formate, mixture of thallium formate and malonate, Thoulet's solution, barium mercury bromide. Thallium formate should therefore prove useful for the separation of minerals. The mixture of thallium formate and malonate, which is also recommended, had, at a specific gravity of 3·70, a lower viscosity than Thoulet's solution of sp. gr. 3·19.—A. S.

Copper supplies of 1910. H. R. Merton and Co. Times, April 5, 1911. [T.R.]

The total supply of copper for 1910 increased by 13.525 tons as compared with the returns for the year 1909: the figures being 1909, 839,425 tons; and 1910, 852,950 tons. The United States mines reduced their net output by 5,390 tons, the Calumet and Hecla and Montana mines together being responsible for a diminution of 16,000 tons. The average price of copper per ton in 1910 has been £1 14s. 1d. lower than in 1909. The management of the older companies of Europe have seconded the efforts of the American financiers by slightly curtailing the output of copper, and the copper mines of Spain and Portugal in 1910, only producing 50,255 tons, as compared with 52,185 tons in 1909. Japan produced 46,000 tons in 1910, as compared with 47.000 tons in 1909. Australasia shows a gain of 5,915 tons over 1909, the total for the respective years being 40,315 and 34.400 tons. In 1907 Australasia produced 41,250 tons of copper. Russia had an increase of 4,560 tons, the output in 1910 being 22,310 tons, as compared with 17,750 tons in 1909. The Mexican mines produced 58,825 tons, a gain of 2,500 tons over the output of 1909. This total is, however, still below that of 1905, when over 64,000 tons was produced, 54.255 tons of this being from the outside mines. Germany has increased its production of copper from 22.453 tons in 1909 to 24.710 tons in 1910, the increase being due partly to the increasing activity of the outside mines. In Peru the output for 1910 was 18,305 tons as compared with 16,000 tons in 1909. Canada and Norway show gains of 1,610 tons and 1,145 tons respectively in 1910, the Canadian production in the latter year amounting to 25,715 tons, and that of Norway to 10,425 tons. The total net gain is 13.525 tons, as compared with a net gain of 85,245 tons in 1909.

Mineral production of Ontario in 1910. Board of Trade J., March 30, 1911. [T.R.]

The following statistics relate to the output of certain minerals in the Province of Ontario in 1909 and 1910:—

		1909.		1910.	
		Quantity.	Value.	Quantity.	Value.
			Dollars.		Dollars.
Gold	ozs.	2,042	32,445	3,246	60,918
Silver.......	,,	25,903,985	12,464,722	30,558,825	15,436,994
Nickel	tons of 2,000 lb.	13.907	2,790,798	18,636	4,005,961
Copper		7,933	1,127,015	9,630	1,374,103
Iron ore		263,777	645,622	231,453	513,538
Pig iron*		407,013	6,301,528	447,351	6,975,418
Petroleum	Imp. gal	14,723,105	559,478	11,004,357	368,153
Natural gas		—	1,188,179	—	1,490,334

*Produced from 220,307 tons of Ontario iron ore, and 543,544 tons of ore not produced in Ontario, in 1909; and from 143,284 and 678,890 tons respectively in 1910.

Patents.

Iron manufacture. R. B. Carnahan, jun., Middletown, Ohio, Assignor to International Metal Products Co., Newark, N.J. U.S. Pat. 986,359, March 7, 1911.

Machine-cast pig-iron, containing not more than 1 per cent. of phosphorus, 0·05 of sulphur, and 2 of silicon, is melted in admixture with lime and iron ore. The mixture is raised to a temperature of not less than 2850° F., tapped into a ladle with a de-gasifying agent, and poured into an ingot mould. During tapping and pouring, the temperature of the charge is maintained above 2775° F.—W. E. F. P.

Iron manufacture. R. B. Carnahan, jun., Middletown, Ohio, Assignor to The International Metal Products Co., Newark, N.J. U.S. Pat. 987,549, March 21, 1911.

The following process is claimed for producing iron rolling-mill and bloomery ingots of specially high purity. A high-powered open-hearth furnace is charged with iron, and, with the addition of agents for eliminating carbon, manganese, sulphur, and phosphorus, the charge is refined until the carbon is reduced to about 0·1 per cent. Then, with increasing heat, the refining is continued until the sulphur, phosphorus, manganese, carbon, and silicon together do not exceed 0·14 per cent., the temperature of the charge rising at the last to at least 2850° F. The metal is then poured into ingot moulds, being treated with a de-gasifying agent after it is tapped from the furnace.
—A. S.

Iron plates of large area; Manufacture of thin electrolytic ——. W. Pfanhauser, Leipzig, Germany. U.S. Pat. 987,318, March 21, 1911.

The essential features of the process are the use of high current densities and keeping the electrolyte at a temperature of 75°—85° C., preferably about 80° C., during the electrolysis. It is stated that detachable deposits of any desired thinness and of as large a surface as required can thus be obtained.—A. S.

Steel; Compound for treating ——. H. M. Lee and F. G. Booth, New London, Conn., Assignors to Steel Tempering Process Co. U.S. Pat. 987,468, March 21, 1911.

The solution for treating steel contains oxidising agents such as potassium chlorate and manganese dioxide and an "oil" having a flashing point as high as 600° F.—A. S.

Steel; Manufacture of ——. J. H. Gray, New York, Assignor to Illinois Steel Co., Chicago, Ill. U.S. Pat. 987,715, March 28, 1911.

Silicon and carbon are removed from the iron in a Bessemer converter, and the metal is then transferred in a ladle to an electric furnace. A charge of a basic slag, formed separately, is previously placed in the ladle, for the purpose of removing phosphorus from the metal during its passage from the converter to the electric furnace.—A. S.

Semi-steel; Process of making ——, *and the product thereof.* F. W. King, London, Ontario, Canada. U.S. Pat. 988,270, March 28, 1911.

Successive charges of sheet steel clippings (30 lb.), re-melts from previous castings of semi-steel (30 lb.), cast scrap iron (35 lb.) and a high-grade 10 per cent. silicon pig iron (5 lb.) are melted in a cupola, together with an appropriate flux, and the resulting metal is cast.
—A. S.

Steel manufacture; Reverberatory furnace, with several hearths, for ——. R. Dietrich. Ger. Pat. 231,500, April 20, 1910.

Between each two adjacent hearths a melting trough, provided with a tap-hole, is disposed; the trough may be divided into sections, each of which has a separate tap-hole. The troughs are used for preheating materials which are to be added to the charge, and for running off slag from the adjacent hearths. They may also be used for the production of small quantities of steel in the furnace.—A. S.

Pig-iron ; Process for the production of —— from iron ores, and its further working up into steel in an electric furnace. Ver. chem.-metallurgische und metallographische Laboratorien Ges. m. b. H. Ger. Pat. 231,807, Nov. 29, 1907.

Pig-iron is produced by introducing a charge of iron oxide ore, fluxes, and solid carbonaceous reducing agents into a bath of molten iron, high in carbon, heated to a high temperature in an electric furnace. The pig-iron is subsequently refined in the same furnace, in the usual manner, so as to yield steel of any desired quality.—A. S.

Metallic bodies ; Process of treating [impregnating with titanium] ——. A. J. Rossi, Assignor to Titanium Alloy Manufacturing Co., New York. U.S. Pats. 986,504 and 986,645, Mar. 14, 1911.

The patents relate to the impregnation of steel or other metallic bodies with titanium. According to the first specification, a powdered alloy of iron (or other suitable metal) and titanium is packed against the surface of the steel or other metallic body which is then heated to a temperature somewhat below its melting point. In the second specification, claim is made for such impregnated metallic bodies.—W. E. F. P.

Titanium ; Producing alloys of —— with other metals or the like. A. J. Rossi, Niagara Falls, N.Y., Assignor to Titanium Alloy Manufacturing Co., New York. U.S. Pat. 986,505, Mar. 14, 1911.

The molten metal, with which titanium is to be alloyed, is covered with a layer of molten calcium oxide upon which a mixture of titanium oxide and carbon is placed ; the charge is then heated to a temperature sufficient to ensure the reduction of the oxides employed. Alternatively, the molten metal may be covered with a mixture of titanium oxide, carbon and a compound of calcium and subjected to a temperature sufficient to ensure the reduction of the titanium oxide.—W. E. F. P.

Auriferous and argentiferous ores ; Treatment of ——. A. A. Lockwood, London. Eng. Pat. 27,558, Nov. 26, 1909.

Loss of cyanide due to base metals (especially copper) is prevented or considerably reduced by the employment of a solution of an alkaline silicate preliminary to, or simultaneously with, the cyanide solution. It is claimed that, by this means, the compounds of the base metals are practically unaffected by the cyanide.—W. E. F. P.

Ores containing telluride of gold ; Method of treating ——. T. B. Crowe, Colorado Springs, Colo. U.S. Pat. 987,964, March 28, 1911.

The ore is concentrated to remove reducing agents and is then treated with an alkali hypochlorite solution, which is left in contact with the ore until the hypochlorite is converted into chloride, after which it is displaced by an alkali cyanide solution. An alkaline earth is added with the hypochlorite solution in quantity just sufficient to neutralise the acidity of the ore.—A. S.

Sodium and potassium ; Manufacture of metallic ——. E. A. Ashcroft, London. Eng. Pat. 5013, Feb. 28, 1910.

In an electrolytic process of the kind described in Eng. Pat. 12,377 of 1903 (this J., 1904, 25)—in which a fused intermediate electrode is employed—claim is made for the use of a fused amide (or mixture of amide and hydroxide) of the alkali metal as electrolyte in the second cell ; and also for the use, in conjunction with the amide, of a fused raw material and an intermediate electrode, both of low fusion-point. In the manufacture of the alkali metals by direct electrolysis, the employment of the fused amide electrolyte and an anode consisting of an alloy of the alkali metal with fused lead (or other suitable metal) is also claimed.—W. E. F. P.

Metals ; Treating oxidisable ——, for preserving the same. G. R. Hislop, Paisley. Eng. Pat. 5559, Mar. 5, 1910.

The metal, *e.g.*, structural iron and steel, previously heated to a temperature of from 300° to 350° F., is coated with a paint consisting of lead oxide, zinc oxide or other suitable pigment in boiled linseed oil and turpentine ; and it is claimed that, at the temperature employed, the pigment penetrates the pores of the metal so effectively as to prevent oxidation under all ordinary conditions. The coating of pigment may be surface-hardened by a subsequent heating for ten minutes at a temperature of 250° F., after which a further coating (of anti-corrosive composition, etc.) may be applied as an additional protection.—W. E. F. P.

Furnaces for metallurgical purposes. R. H. Radford, Sheffield. From R. O. Ahlers, Lisbon. Eng. Pat. 6063, March 10, 1910.

The lower part of the furnace containing the hearth or bath can be lowered vertically by a hydraulic ram supporting a frame upon which the hearth is mounted in such a manner that it can be tilted by a second ram carried on the frame.—H. H.

Metallurgical furnaces ; Method of and means for refreshing and keeping cool the operatives employed in connection with ——. E. Dor-Delattre, Dorplein-Budel, Holland. Eng. Pat. 20,488, Sept. 2, 1910.

A current of more or less humidified air is supplied through the gratings upon which the men work, the air passages leading to the gratings being large, so that a large volume of air can be supplied at low velocity.—H. H.

Furnace for roasting ores. N. L. Heinz, La Salle, Ill., and W. H. Freeland, Isabella, Tenn. U.S. Pat. 986,709, Mar. 14, 1911.

Comprises a series of superposed roasting ovens, separated by chambered arches and contained in an outer casing provided with down flues. The latter are in communication with the arches as well as with the outer air, and the heated air issuing from the upper and middle portions of the furnace is conveyed to the lower part thereof. The passage of the ore through the apparatus is facilitated by a system of rotatory rakes by which the ore is directed towards the various openings provided for that purpose.
—W. E. F. P.

Blast-furnace. F. J. Zippler, Avalon, Pa. U.S. Pat. 986,792, Mar. 14, 1911.

The lining of the lower part of the furnace is formed with a portion projecting inwards, below which a water-jacket is situated. The inner face of the latter is flared downwards and outwards, while the outer part is provided with a flange portion which, in conjunction with a similar attachment to the tuyères immediately below, forms around the water-jacket an annular air-chamber from which the tuyères open into the furnace.—W. E. F. P.

Lead-bearing zinc sulphides with or without small admixtures of other metals ; Metallurgy of ——. E. A. Ashcroft, London. Eng. Pat. 6670, March 16, 1910.

Sulphide ores, more particularly zinc concentrates containing upwards of 40 per cent. of zinc and under 12 per cent. of lead and some silver, are subjected to the action of fused zinc chloride contained in a series of stirring pans having a small quantity of molten lead at the bottom. The lead sulphide is converted into lead chloride which remains in the melt; most of the precipitated zinc sulphide, together with the zinc sulphide originally present, remains in the residue, and the silver is absorbed by the molten lead. The residue is washed rapidly with hot water to remove soluble chlorides, while the melt is treated by one of two methods. (1) The melt is introduced into water, with or without the addition of a small quantity of acid, and the washing water from the treatment of the zinc sulphide residue, which contains much of the finely divided precipitated zinc sulphide in suspension, is run in.

The lead is thus precipitated as sulphide, the zinc sulphide being reconverted into chloride. (2) The melt is electrolysed for the production of either sulphur and metal, sulphur chloride and metal, or chlorine and metal, the chlorine or sulphur chloride being caused to react with zinc sulphide for the regeneration of zinc chloride to be used over again in the process. If antimony or arsenic are present they distil off from the pans and may be condensed.—H. H.

Ore-concentration; Apparatus for ——. T. J. Hoover, London. Eng. Pats. 6896, March 18, 1910, and 9255, April 16, 1910. Additions to Eng. Pat. 4911, Feb. 27, 1909 (this J., 1910, 432).

In apparatus for concentrating ores by "gaseous flotation" wherein air is beaten into the liquid containing the ore in suspension and settling allowed to take place in a spitzkasten, the tailings outlet from the spitzkasten is connected by a conduit, preferably fitted with an air inlet, with the bottom of a secondary mixing vessel provided with an agitator of screw propeller form by means of which the liquid is drawn in and further treated. In this manner a series of mixing vessels and spitzkasten may be arranged at the same level, and the liquid passed through all.—H. H.

Metallic particles; Separating —— *from pulverulent masses or mixtures.* G. Clément, Milan. Eng. Pat. 16,287, July 7, 1910. Under Int. Conv., July 9, 1909.

For the separation of metallic particles disseminated in a large mass of pulverulent material such as auriferous sand, the material is subjected to an electric discharge between two adjacent metallic surfaces, one of which is covered with a dielectric substance, such as glass, on which the material is supported. The non-metallic powder is repelled and separated, whilst the metallic particles adhere to the glass. The apparatus may consist of an annular glass disc fixed upon the upper face of a smaller disc of pewter, of similar shape, which is rotated on a vertical shaft. A high-tension electric current is supplied to the pewter-ring, and at some point above the periphery of the glass disc, a fixed metal plate is arranged in connection with the second terminal of the induction coil or transformer. The powdered material, fed through a hopper on to the top of the rotating disc, is distributed uniformly over the surface by means of a comb and carried into the electric field beneath the fixed plate. The non-metallic portion is repelled and falls over the sides of the glass disc, whilst the metallic particles adhere to the glass and can subsequently be removed by means of a scraper. A number of rotating discs may be arranged in series, or instead of the disc, a horizontally rotating cylinder or an oscillating inclined plane may be employed.—C. A. W.

Alloy. G. Jacquier, Johannesburg. Eng. Pat. 20,601, Sept. 3, 1910.

An anti-corrosive alloy is composed of aluminium 92 per cent., bismuth 2, copper 5, and silicon 1 per cent., or of aluminium 91 per cent., bismuth 2, copper 5, and magnesium 2 per cent. The metals other than aluminium are first melted together and molten aluminium then run in.—H. H.

Electro-deposition; Process and apparatus for ——. S. Consigliere, Genoa, Italy. Eng. Pat. 20,776, Sept. 6, 1910. Under Int. Conv., Sept. 7, 1909.

The apparatus, designed for electroplating objects of irregular shape, consists of a closed rotatory vessel so mounted that its axis of rotation is normal to its longer geometrical axis. Suitable means for the passage of an electric current, and hollow journals for facilitating the changing of the electrolyte, are provided. The soluble anodes (of the metal to be deposited) are attached to the inside walls of the vessel in which the object forming the cathode, is centrally disposed. The vessel also contains a quantity of small, hard, non-conducting bodies (such as glass beads), the impacts of which upon the object, during the rotation, harden and burnish the electro-deposited metal.—W. E. F. P.

Metallic sands or concentrates; Reduction plant for treatment of ——. G. F. Rendall, New York. U.S. Pat. 986,086, March 7, 1911.

An inclined, cylindrical, rotatory, pre-heating furnace is provided with suitable charging means at its upper end and communicates at the discharge end with a chamber to which a current of air is supplied by means of a fan. The charge passes through the air chamber to the upper end of the reducing furnace; the latter is similar in form and disposition to the pre-heating furnace and is provided with a cooling chamber, at the discharge end, through which communication is effected with the generator supplying the reducing gas.—W. E. F. P.

Vanadium; Extracting —— *from its ores.* G. A. Koenig, Houghton, Mich. U.S. Pat. 986,180, Mar. 7, 1911.

The ore (roscoelite) is subjected, under pressure and at a temperature of about 200° C., to the action of dilute sulphuric acid of approximately 20 per cent. strength. After evaporation to dryness, the product is mixed with sodium carbonate and roasted at a red heat in an oxidising flame. The resulting mass is disintegrated by boiling with water, the boiling mixture being finally treated with carbon dioxide for the separation of the alumina.
—W. E. F. P.

Copper; Recovery of —— *from porphyry ores and the like.* G. Schneider, Lauenstein, Germany, Assignor to O. Krauth, Charlottenburg, Germany. U.S. Pat. 986,508, Mar. 14, 1911.

The raw ore (containing copper sulphide and silica, but little or no pyrites) is mixed with about 10 per cent. of alkali chlorides and heated to dark redness, the mixture being stirred during the operation. The resulting mass is treated, at a temperature of about 50° C., with dilute hydrochloric acid of approximately 5 per cent. strength, the copper being finally precipitated from the solution by means of iron.—W. E. F. P.

Metals; Rendering porous —— *dense.* C. E. Swett, Providence, R.I. U.S. Pat. 986,519, Mar. 14, 1911.

The porous or spongy metal is impregnated with a reducible compound of the same metal (the compound being in a fluid condition) and then subjected to a reducing process by which the impregnating material is converted to metal within the pores of the mass. The treatment is repeated until the mass attains the required density.—W. E. F. P.

[Nickel] Sulphide ores; Treatment of ——. J. A. McLarty, Toronto, Canada. U.S. Pat. 987,156, March 21, 1911.

The powdered ore is passed through a magnetic separator, and the magnetic iron and nickel sulphides thus separated are then treated with steam under pressure, whereby they are converted into oxides. On now passing the oxidised ore through a magnetic separator, the iron oxide is separated from the nickel oxide.—A. S.

Tungsten; Process for the electrolytic separation of ——. Wolframlampen Akt.-Ges. Ger. Pat. 231,657, June 15, 1910.

Metallic tungsten can be deposited electrolytically by using as electrolyte a solution of pertungstic acid or one of its salts in an aqueous or organic solvent. Pertungstic acid, H_4WO_6, is obtained by the action of hydrogen peroxide on tungsten trioxide or hydrated tungstic acid.
—A. S.

Zinc; Process for obtaining —— *by reduction.* Akt.-Ges. für Bergbau, Blei- und Zinkfabrikation zu Stolberg und in Westfalen. Ger. Pat. 231,694, Jan. 28, 1908.

In order to protect the walls of the muffle from attack by the slag, in the reduction of zinc ores, a protective mass preferably prepared from old muffles is added to the charge, in such proportion that it interacts with the gangue of the ore to form a difficultly fusible silicate, which remains suspended in the residue.—A. S.

Roasting apparatus for ores. Grünewald und Welsch, Ges. m. b. H. Ger. Pat. 232,044, Dec. 21, 1909.

The patent relates to roasting furnaces provided with means for collecting the roaster-gases for the purpose of utilising the sulphur dioxide contained therein. Two pipes are provided for leading away the roaster-gases and these communicate by means of two passages in a special valve-casing with a collecting chamber into which the gases from the roasting furnace pass. One or other of the two passages in the valve-casing may be opened or closed as desired by an annular damper. In the first stage of the roasting, the gases, rich in sulphur dioxide, pass through one of the passages and pipes to the apparatus where they are utilised, whilst in the later stages, when the gases contain little sulphur dioxide, they are passed through the other passage and pipe to the chimney.—A. S.

Iron ores; Means for separating the constituents of certain ——. F. I. du Pont, Wilmington, Del., U.S.A. Eng. Pat. 17,609, July 25, 1910.

SEE Fr. Pat. 419,076 of 1910; this J., 1911, 120.—T. F. B.

Ores; Apparatus for the treatment of —— and for the electrolytic deposition of gold and silver and other metals from solutions containing said metals. F. C. Brown, Komata, New Zealand. U.S. Pat. 987,428, March 21, 1911.

SEE Eng. Pat. 17,779 of 1907; this J., 1908, 692.—T. F. B.

Alloys suitable for use as electric resistance conductors. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 14,743, June 18, 1910.

SEE U.S. Pat. 963,123 of 1910; this J., 1910, 959.—T. F. B.

Furnace for melting metals, glass, and the like. L. Le B. Mount, London. U.S. Pat. 988,131, March 28, 1911.

SEE Eng. Pat. 18,417 of 1907; this J., 1908, 739.—T. F. B.

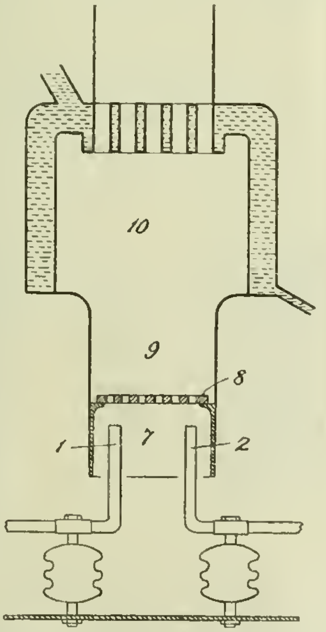
XI.—ELECTRO-CHEMISTRY.

Electrolytic production of hydrosulphites from bisulphite solutions. Jellinek. *See* VII.

PATENTS.

Furnaces; Electric ——. E. Wassmer, Geneva, Switzerland. Eng. Pat. 28,813, Dec. 9, 1909.

THE gases are led or forced into the bottom of the arc chamber, 7, an electric arc being produced between the electrodes, 1 and 2, and deflected against the "incandescer," 8, consisting of magnesium oxide. The arc is forced through the perforations in "jets or flames," and the incandescer, 8, is raised to a high temperature, thus bringing about the reaction between the gases in the reaction chamber, 9. The gases are cooled in the chamber, 10, by the circulation of brine through the cooling jacket. In an alternative form, the electrodes are placed opposite to each other, two incandescers being placed between them. Two opposing streams of gas are forced past the electrodes, and through the perforations in the incandescers into the reaction chamber between the latter, the gases being finally led off into a suitable cooling chamber.—B. N.



Electric furnace. C. A. Keller, Paris. U.S. Pat. 986,179, Mar. 17, 1911.

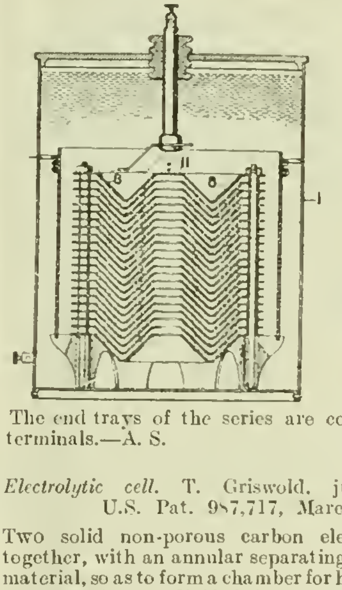
THE apparatus comprises a number of hearths disposed around a central crucible, the hearths communicating with each other and with the crucible by means of channels. Vertical electrodes are provided for each hearth and for the crucible, the arrangement being such that the current enters by the electrodes of one set of hearths and the crucible, and passes through the charge to those of the opposite set.—W. E. F. P.

Ozone apparatus. Akt.-Ges. für Ozonverwertung (System Elworthy-Kölle), Stuttgart, Germany. Eng. Pat. 3119, Feb. 7, 1911. Under Int. Conv., Feb. 7, 1910.

THE gas to be ozonised is conducted through a glass cylinder, upon which is mounted the outer metallic electrode. The inner electrode is a metal tube, open at both ends, mounted concentrically within the glass cylinder. A cooling gas, or air, which is independent of the current of gas to be ozonised, is conducted through the inner electrode, and around the outer electrode.—B. N.

Electrolytic cell. V. E. Goodwin, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 987,622, March 21, 1911.

THE general form of the cell is shown in the accompanying figure. The containing vessel, 1, is filled with an insulating fluid, such as oil, and the electrodes consist of a number of superposed trays, 8, shaped so as to form annular troughs for the electrolyte, and provided with central openings, 11, above the level of the electrolyte in the troughs. The trays are supported parallel to one another, and spaced apart, by means of insulating material, the central openings being in alignment, so as to allow circulation of the insulating liquid. The end trays of the series are connected with external terminals.—A. S.



Electrolytic cell. T. Griswold, jun., Midland, Mich. U.S. Pat. 987,717, March 28, 1911.

Two solid non-porous carbon electrodes are clamped together, with an annular separating member of insulating material, so as to form a chamber for holding the electrolyte. The chamber is divided into two compartments by a porous diaphragm, and is provided with inlet and outlet openings for the electrolyte and with a gas-outlet opening. The inner faces of the carbon electrodes act as anode and cathode respectively. A number of such cells may be connected in series.—A. S.

Electric furnaces and the method of charging the same. Stora Kopparbergs Bergslags Aktiebolag, Falun, Sweden. Eng. Pat. 6768, March 17, 1910. Under Int. Conv., March 19, 1909.

SEE Fr. Pat. 415,548 of 1910; this J., 1910, 1317.—T. F. B.

Induction-furnace; Electric ——. W. Rodenhauser, Völklingen-on-Saar, Germany, Assignor to the Gröndal Kjellin Co., Ltd., London. U.S. Pat. 987,404, March 21, 1911.

SEE Fr. Pat. 389,827 of 1908; this J., 1908, 1027.—T. F. B.

Reduction [in the electric furnace] of refractory chemical compounds [chlorides or bromides of boron, zirconium, and titanium]. Fr. Pat. 421,831. *See* VII.

XII.—FATS ; OILS ; WAXES.

Shea butter. A. Hébert. Les Matières Grasses, 1911, **4**, 2170—2171.

THE seeds of the karité tree (*Butyrospermum*), which grows extensively in the French Soudan, yield a fat which is solid at tropical temperatures. Locally it is a very common article of commerce, and it is being exported to Europe in increasingly large quantities. The native method of separating the fat is to remove the bulk of the fruit pulp and to bury the residue in the earth, where a partial fermentation liberates the kernels from their envelopes. The kernels are dried, first in the sun and then at a gentle heat over little stoves, after which they are ground between stones to a paste, and the fat extracted by treatment with boiling water. The author's experiments have shown that the yield of fat (23 to 25·4 per cent.) and its chemical and physical constants are practically the same, whether obtained from sun-dried or from roasted kernels.—C. A. M.

Oils from plants belonging to the order Papilionaceæ. C. Grimme. Chem. Rev. Fett- u. Harz-Ind., 1911, **18**, 53—55, 77—82.

ALL the oils in the following table were extracted from the seeds and fruits of plants of commercial importance as fodder, etc. :—

Oils.

Oil from	Yield.	Drying property.	Sp. gr.	Solidification point.	Refractive index.	Acid value.	Saponification value.	Iodine value (Wijs).	Hehner value.	Glycerol.	Unsaponifiable matter.
	per cent.			°C.						per cent.	per cent.
Ornithopus sativus Brotero (bird's foot)	8·96	non drying	0·918 (20° C.)	—17	1·4751 (20° C.)	19·4	185·3	69·0	93·5	9·07	1·84
Onobrychis sativa Lam. (Turkish clover)	7·18	non drying	0·915 (25° C.)	—11	1·4770 (30° C.)	13·2	175·2	67·7	90·2	8·85	5·51
Lupinus albus (white lupin)	6·27	non drying	0·920 (20° C.)	— 9	1·4742 (20° C.)	20·5	192·8	61·6	94·3	9·42	0·98
Lupinus angustifolius (blue lupin)	5·56	non drying	0·920 (20° C.)	—10	1·4725 (20° C.)	21·6	186·2	83·2	94·4	8·97	1·12
Lupinus luteus (yellow lupin)	5·41	non drying	0·920 (20° C.)	— 5	1·4776 (20° C.)	16·5	185·0	68·3	94·7	9·21	1·14
Anthyllis vulneraria (wound wort)	10·38	non drying	0·916 (25° C.)	—18	1·4756 (30° C.)	13·1	189·0	71·6	92·9	9·61	2·36
Melilotus albus (white melilot)	6·63	drying	1·931 (25° C.)	—10	1·4862 (30° C.)	15·5	187·9	71·4	93·25	9·42	2·05
Melilotus officinalis (melilot)	7·83	drying	0·928 (25° C.)	—10	1·4760 (30° C.)	86·1	193·2	69·2	96·7	5·85	0·74
Medicago sativa (lucerne)	7·63	non drying	0·922 (25° C.)	—12	1·4766 (30° C.)	14·7	193·4	78·9	93·8	9·76	1·38
Trifolium incarnatum (pink clover)	6·18	semi drying	0·910 (25° C.)	— 9	1·4723 (30° C.)	21·4	181·3	61·6	94·1	8·73	1·57
Trifolium pratense (red clover)	14·78	semi drying	0·914 (25° C.)	—14	1·4732 (30° C.)	8·3	191·8	64·1	93·1	10·02	1·93
Trifolium hybridum (bastard clover)	6·42	semi drying	0·918 (25° C.)	—14	1·4757 (30° C.)	13·4	187·2	65·9	94·3	9·49	1·03
Trifolium repens (white clover)	6·81	semi drying	0·910 (25° C.)	—16	1·4745 (30° C.)	10·5	189·4	68·5	93·3	9·77	1·77
Trifolium ograrium (yellow clover)	6·85	non drying	0·922 (25° C.)	—15	1·4757 (30° C.)	9·5	188·4	75·9	93·9	9·77	1·14
Trigonella foenum græcum (fenugreek)	5·98	semi drying	0·928 (25° C.)	—12	1·4738 (30° C.)	20·6	183·4	81·9	94·7	9·21	2·64
Lotus corniculatus (horn trefoil)	6·45	semi drying	0·930 (25° C.)	—14	1·4729 (30° C.)	12·0	190·7	70·0	93·2	9·76	1·87
Galega officinalis (lag wort)	3·89	semi drying	0·921 (25° C.)	— 9	1·4728 (30° C.)	33·5	175·1	61·8	93·1	7·73	3·11

Fatty acids.

Oils from	M. pt.	Solid. pt.	Refractive index.	Neutralisation value.	Iodine value.	Mean molec. weight.
	°C.	°C.				
Ornithopus sativus Brotero	28	25	1·4593 (50° C.)	183·0	61·7	305·[illegible]
Onobrychis sativa Lam.	19	16·5	1·4574 (50° C.)	194·0	75·9	289·5
Lupinus albus	27	24	1·4559 (50° C.)	188·3	56·3	298·2
Lupinus angustifolius	24·5	23	1·4556 (50° C.)	187·2	67·6	300·2
Lupinus luteus	35·5	32	1·4600 (50° C.)	177·3	64·0	316·7
Anthyllis vulneroria	25	22·5	1·4640 (50° C.)	179·9	79·7	312·2
Melilotus albus Desr.	27	23	1·4812 (50° C.)	178·5	74·8	314·6
Melilotus officinalis	38	35	1·4659 (50° C.)	169·3	64·7	331·9
Medicago sativa L.	32	30	1·4659 (40° C.)	183·4	77·8	306·2
Trifolium incarnatum	30	27·5	1·4620 (40° C.)	189·0	66·1	297·1
Trifolium pratense	33	29·5	1·4626 (40° C.)	185·0	66·0	303·6
Trifolium hybridum	28	24	1·4626 (40° C.)	189·0	69·5	297·1
Trifolium agrarium L.	32	28	1·4666 (40° C.)	185·3	78·3	303·2
Trigonella fænum græcum	29	25·5	1·4626 (40° C.)	178·5	79·8	314·8
Lotus corniculatus L.	30	27·5	1·4620 (45° C.)	171·6	73·4	327·4
Golega officinalis	39	36	1·4672 (45° C.)	184·5	62·0	305·1

—C. A. M.

Palm oils from different varieties of the palm tree ; Chemical study of ——. A. Hébert. Les Matières Grasses, 1911, **4**, 2171—2172.

EIGHT samples of fruit from different varieties of the oil palm, *Elæis guineensis* from French Western Africa were examined by the author, the oil in each case being extracted from the pulp by means of petroleum spirit (benzine). Six of these belonged to the sub-species *Elæis nigrescens*, the fruit of which turns black before ripening, while the others were varieties of *E. virescens*, the fruit of which is first green and then red. The following table shows the composition of the fruit and the characteristics of the different oils :—

	E. nigrescens.			*E. virescens.*		
	Var. *communis.*	Var. *vulgaris.*	Var. *sempernigra.*	Var. *pisifera.*	Var. *repanda.*	Var. *gracilinux.*
Composition of the fruit :—						
Pulp, ... per cent.	35·0	28·0	30·0	80·0	34·2	77·7
Nuts and kernels	65·0	72·0	70·0	20·0	65·8	22·3
Kernels	18·0	—	16·4	3·0	31·0	11·1
Yield of oil from pulp, per cent.	41·0	43·0	52·0	59·0	63·0	52·0
Yield of oil from entire fruit, per cent.	22·0	21·0	16·0	42·0	32·0	30·0
M. pt. of fat	42° C.	42° C.	44° C.	45° C.	43° C.	42° C.
Sp. gr. at m.pt.	0·882	0·881	0·892	0·891	0·884	0·889
Saponification value.............	201	201	196	197	196	198
Reichert value	0·8	0·8	0·9	1·3	0·8	1·1
Iodine value	43·8	48·0	52·2	50·2	52 1	55·6
Hehner value	98·0	96·2	98·1	97·7	95·0	97·7
M. pt. of fatty acids.............	46° C.	48° C.	48° C.	47° C.	44° C.	44° C.

The greatest yield of oil was thus obtained from the variety *pisifera*, which contained the smallest nuts, but the kernels of these nuts are too small and their separation from the fibres is too laborious for them to possess any marketable value. The same objection, though to a somewhat smaller extent, applies to the variety *gracilinux*. On the other hand, the smallest yields of oil were obtained from the varieties:—*sempernigra*, *communis*, and *vulgaris*, which contained the largest proportion of nuts. The chemical values of the fats corresponded closely with those given by commercial palm oil. Most of these fats might be used for food. The varieties *communis*, and especially *sempernigra*, yield oils which are greatly appreciated by the natives, whilst the fruit of the variety *pisifera* is eaten in the fresh or cooked state. On the other hand, the variety *repanda* has the reputation of yielding a fat which causes headache and sickness, and probably contains some toxic principle.—C. A. M.

Oil-seeds from French West Africa ; Composition of ——. A. Hébert. Les Matières Grasses, 1911, 4, 2158—2160.

The following table summarises the results obtained in the examination of a large number of seeds from plants growing in French West Africa, and especially in the forest of the Ivory Coast.

Plant.	Yield of fat.		Values of the fat.								Fatty acids.	
	from the kernels.	from the entire seed.	Sp. gr. at 15° C.	M. pt.	Acid value.	Saponification value.	Reichert value.	Hehner value.	Iodine value.	M.pt. of fatty acids.	Solid.	Liquid.
	per cent.	per cent.		°C.						°C.	per cent.	per cent.
Dumoria Heckeli (Beurre de Doumori)	40	14	0·956	34	5·6	188·0	0·8	96·8	56·4	60	33	67
Chrysophyllum d'Azope	10	2·5	0·907	4	—	184·4	—	92·0	88·0	35	—	—
Carapa microcarpa (Beurre de kobi)	50	35	0·895	16	8·4	188·0	3·3	92·0	58·0	28	55	45
Balanites tieghemi	10	2	0·908	liquid at —3	9·4	—	6·0	92·5	121·0	35	63	37
Ricinodendron africanum	35	8·7	0·937	20	16·8	185·0	1·5	93·0	87·6	43	70	30
Saccoglottis gabonensis	54	—	0·900	solid at —2	—	188·0	5·5	—	85·8	—	—	—
Pentadesma butyracea (Beurre de Lamy)	—	—	0·899	32	16·0	199·0	0·3	95·2	68·5	60	10	90

The fat from the seeds of *Dumoria Heckeli*, which is known as *beurre de Doumori*, is used in large quantities for food or in the manufacture of soap. It is a hard, solid yellow fat with a somewhat sweet odour and taste. The "liquid" fatty acids were found to consist chiefly of oleic acid, whilst the "solid" fatty acids (m.pt. 67° to 68° C.) contained fatty acids of high m. pt. (77° C.) such as carnaubic acid, together with some stearic and palmitic acids. The fat would thus be well suited for the manufacture of candles. The seed cake contains relatively little nitrogenous substances or carbohydrates, but might find a limited use as a feeding stuff or as a fertiliser.—C. A. M.

Oil of casso seed (*Manniophytum fulvum*). E. Heckel. Les Matières Grasses, 1911, 4, 2155—2158.

The seeds known as *casso* in the French Congo are produced by a climbing plant, *Manniophytum fulvum*, which grows there in abundance. The seeds, which may contain one, two, three or four kernels, weigh from 10 to 30 grms. The kernels, constituting about 66 per cent. of the seeds yielded 51·30 per cent. of a yellow limpid oil without pronounced odour or taste. It dried rapidly when exposed to the air in thin layers, and would be useful as a paint oil and for soap-making. The oil examined gave the following results :—Sp. gr. at 15° C., 0·907 ; saponification value, 187·6 ; Hehner value, 95·60 ; iodine value, 101 ; and m. pt. of fatty acids, 14° C. The seed cake could only be used as a fertiliser and even for that purpose is very poor in nitrogenous substances.—C. A. M.

Glycerides ; Direct synthesis of ——. I. Bellucci and R. Manzetti. Atti R. Accad. dei Lincei, Roma, 1911, [5], 20, I., 125—128. Chem. Zentr., 1911, 1, 1047.

By heating together molecular proportions of oleic acid and glycerol at a temperature rising gradually from 160° to 260° C., in a vacuum which was kept constant during the operation, a yield of 95—98 per cent. of the theoretical quantity of triolein was obtained. Other glycerides, simple and mixed, can be prepared in a similar manner. Secondary reactions (formation of acroleïn, etc.), apparently do not occur, and the resulting glycerides can be isolated in a pure condition by washing with water, drying, treating them in warm ethereal solution with a small quantity of dry slaked lime, filtering, and evaporating the solution.—A. S.

Naphthenic acids; Utilisation of —— in soap making. E. Bontoux. Les Matières Grasses, 1911, 4, 2156—2157.

NAPHTHENIC acids occur in Russian petroleum, and are extracted by the treatment with alkali solution (usually caustic soda) in the refining process. They accumulate as naphthenates in these lyes, and are subsequently separated as acids by the addition of sulphuric acid, or are precipitated as naphthenates by the addition of salt. As met with in commerce naphthenic acids and naphthenates are in the form of a soft brown mass with a strong odour, whilst products made from them are sold under the name of "myloin" or "saponaphtha" in Russia; "Mineralseife" in Germany, etc. This soap is readily soluble in water, caustic alkali lyes, and in concentrated saline solutions, which allow it to separate very slowly. When incorporated in the proportion of one-third in a soap made from tallow and cocoanut oil, naphthenates form a soap which is soft in the fresh condition, but hardens sufficiently in a few days to be usable. When mixed in the same proportion with cocoanut or palm oil, naphthenic acids may be directly saponified and yield a firm transparent soft soap. Unfortunately the persistent empyreumatic odour of these products, in addition to their bad colour, considerably restricts their use, so that naphthenic acids are only employed in very small proportions, and almost exclusively in Russia, in the manufacture of inferior soaps. Their presence in soap may be detected by the odour, by the formation of green copper salts, and by the low molecular weight of the mixed fatty acids (that of naphthenic acids being about 215).—C. A. M.

Denaturation of cottonseed, etc., oils intended for the manufacture of soap in France. Board of Trade J., March 30, 1911. [T.R.]

IN accordance with No. 110 of the French Tariff, olive, cottonseed, sesamé, ground-nut, soya, and maize oils intended for the manufacture of soap are admitted into France at reduced rates of duty (3 frs. per 100 kilos. in the case of olive oil and 6 frs. per 100 kilos. in the case of the other oils), on condition that they are rendered unsuitable for alimentary purposes and denatured at the expense of the importers, under the supervision of the Customs Service. The competent French departments have now decided that the process of denaturation adopted under the former tariff in respect of olive oil may properly be extended to the other oils concerned, *i.e.*, denaturation is to be effected by the addition to 100 kilos. of oil of 100 grms. of nitrobenzene or 200 grms. of oil of rosemary.

Glycerin; Imports of —— into the United States. Oil, Paint, and Drug Rep., March 27, 1911. [T.R.]

THE exports of crude glycerin from Marseilles to the United States for 1909 and 1910 were valued at $1,140,812 and $939,160, respectively. The decreased shipments in 1910 are attributed partly to a greater demand than usual from the home refineries and explosive factories. The total imports of glycerin into the United States during the year ended June 30, 1910, amounted to $3,665,763, viz.:—From France, $1,341,844; United Kingdom, $1,143,873; Belgium, $353,578; Netherlands, $203,143; Italy, $210,856; Germany, £98,657; Spain, $71,749; all other countries, $242,063. For the twelve months ended December 31st, 1910, the American imports of glycerin were valued at $3,799,553.

Guatemala; Unexploited agricultural products in ——. Board of Trade J., March 30, 1911. [T.R.]

MANY products of the soil of Guatemala, in which at present there is no foreign trade, might be exported. As an instance may be mentioned the "Cohune" or *Manacca nut*, locally known as the "Coroza," which grows in abundance in the valleys of the Polochic and Motagua, and is valuable for its oil. Small portable cracking machines, which could be carried about from tree to tree, would be the most useful. *Myristina wax* also is produced in the department of Suchitipequez from a nut, and is used in the manufacture of soap. Among other products of the forests as yet unexploited, such as gums, resins, fibres, etc., may be mentioned a certain wood found in the province of Petén, which is prized for its buoyancy and is said to possess advantages over cork.

Rubber also might be cultivated on a far larger scale were the numerous properties, on many of which wild rubber grows in great quantities, in the hands of persons with capital and knowledge. The native owners seem more disposed to sell these properties than to work them. With the completion of the railway system in the west of Guatemala, and the consequent outlet to the Atlantic by way of Mexico, some of these properties might prove a good investment.

Analysis of dégras. Fahrion. *See* XV.

Influence of the acidity of the aqueous solution on the surface-tension between water and oil. Reinders. *See* XXIV.

PATENTS.

Oils; Extracting —— from solids, and oil-extracting apparatus. C. Turner and R. F. Schroeder, Chicago. U.S. Pats. 985,862 and 985,863, March 7, 1911.

THE solid material is continuously conveyed through a chamber, or series of chambers, having perforated walls and surrounded by a closed casing. The material is compressed at the inlet and outlet of each chamber, the openings into which may be constricted for this purpose, whilst the screw conveyor, or other conveying mechanism, is interrupted at the extremity of each section. Means are provided for the introduction of a solvent, for the application of heat, and for the recovery of the solvent left within the chamber after extraction of the oil. Thus the material may be heated in one chamber to expel moisture, extracted with the solvent in a second chamber, and heated to drive off the solvent in a third chamber. In the special type of apparatus claimed, the interior is in the form of a tubular cylinder.—C. A. M.

Fatty acids; Manufacture of ——. G. Bottaro, Genoa, Italy. U.S. Pat. 987,426, March 21, 1911.

SEE Eng. Pat. 23,534 of 1906; this J., 1907, 1206.—T.F.B.

Soap. A. Welter, Crefeld, Germany. U.S. Pat. 986,527, March 14, 1911.

SEE Fr. Pat. 402,172 of 1909; this J., 1909, 1211.—T.F.B.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

PATENTS.

Paint. M. J. Waugh, Lincoln, Nebr. U.S. Pats., 987,605, 987,606, 987,607, and 987,608, March 21, 1911.

THE paint consists of a suitable vehicle incorporated with sublimed white lead, zinc oxide, fibrous magnesium silicate and a fourth pigment, such as calcium carbonate, "of crystalline character and rather obtuse angular formation to facilitate the application of the paint." Special proportions of these ingredients claimed are approximately as follows:—Sublimed white lead, 71, 72, 60 and 75 per cent.; zinc oxide, 18·25, 15, 30, and 10 per cent.; magnesium silicate, 7·75, 9, 7, and 10 per cent.; and crystalline calcium carbonate, 3, 4, 3, and 5 per cent.
—C. A. M.

Pigment; Inhibitive ——, and method of making same. A. S. Cushman, Washington, D.C. U.S. Pat. 987,965, March 28, 1911.

A pigment substantially free from sulphates or chlorides is subjected to the action of "the chromic acid radical," and the reaction is arrested before the conversion into chromate is complete, in order to obtain a pigment, the particles of which are superficially chromated.—A. S.

Linoxyn and like products; Process of manufacturing —— especially intended for utilisation in the linoleum manufacture. A. Genthe, Goslar, Germany. U.S. Pat. 986,562, March 14, 1911.

See Fr. Pat. 398,804 of 1909; this J., 1909, 1050.—T.F.B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Caoutchouc; Direct determination of —— as tetrabromide. F. W. Hinrichsen and E. Kindscher. Chem.-Zeit., 1911, 35, 329—330.

The authors confirm the conclusions arrived at by Spence, Galletly and Scott (this J., 1911, 436) with reference to the loss of bromine incurred on oxidising the bromide with nitric acid in open vessels in presence of silver nitrate. As an alternative method of oxidation they suggest combustion of the bromide in oxygen by Marcusson and Doescher's method (see p. 510). A sample of the tetrabromide, purified by precipitation from chloroform solution by means of benzine, gave 70·11 per cent. of bromine instead of the theoretical 70·14 per cent., starting with 0·2781 grm. of bromide and using 50 c.c. of silver nitrate solution. Since, however, the method may not always be a convenient one to adopt, experiments were made with a view to carrying out the oxidation by fusion with 2 parts of a sodium-potassium carbonate mixture and 1 part of potassium nitrate. The melt was dissolved in water acidified with nitric acid and the bromine precipitated and weighed as silver bromide. The results obtained varied considerably amongst themselves, and were, in general, too high. By the addition of a little sodium peroxide to the melt, in order to effect complete combustion of the carbon, and subsequently heating the precipitate of silver bromide with nitric acid, better values were obtained, viz., 69·88 and 70·05 per cent. of bromine. The authors put forward the outlines of a method which they suggest (*cf.* Becker; this J., 1911, 142) for the determination of rubber in vulcanised samples. The sample is extracted with acetone, and the extracted sample brominated by Hübener's method. The bromide and insoluble mineral matter are collected on a filter and washed thoroughly with alcohol and ether. The bromide is then taken up with chloroform, precipitated from the solution by means of petroleum benzine, and weighed direct (0·2012 grm. of the purified bromide, dissolved in 10 c.c. of chloroform and precipitated with 40 c.c. of petroleum benzine, gave 0·2019) grm. of precipitate). The authors further remark that the solution of the bromide in chloroform exhibits distinct colloidal properties, and that there is no appreciable rise in boiling point, facts which lend support to the views of Pickles on the constitution of the caoutchouc molecule (this J., 1910, 707).—E. W. L.

Guatemala: Unexploited agricultural products in ——. See XII.

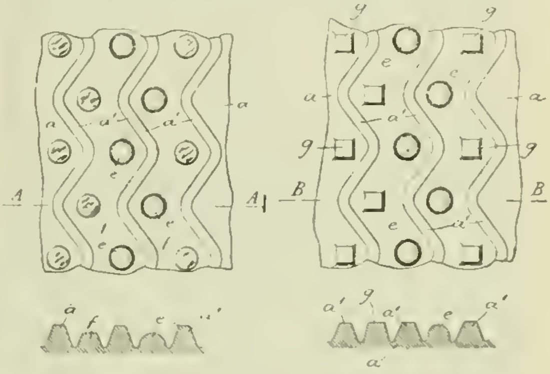
Patents.

India-rubber, gutta-percha, balata and the like; Apparatus for removing foreign matter from ——. The Crude Rubber Washing Co., Ltd., and M. M. Dessau, London. Eng. Pat. 13,425, June 2, 1910.

In rubber-washing apparatus in which the process is carried out by means of rolls working in a tank, it is desirable to prevent the impurities, after removal, from settling again on the washed rubber, etc. For this purpose, a platen is jointed to a vertically adjustable screw, so that it rocks as the rubber moves in the process of washing, and communicates to the inflowing water a surging motion in addition, stirring devices, such as spindles with radial fins, are provided in positions in which impurities are likely to settle.—E. W. L.

India-rubber, gutta-percha, balata and the like; Apparatus for removing foreign matter from ——. The Crude Rubber Washing Co., Ltd., and M. M. Dessau, London. Eng. Pat. 13,201, May 31, 1910.

The rolls employed in rubber-washing machines are provided on their surface with longitudinally arranged sinuous crests, and with a series of studs or projections,



arranged in the intervening spaces between the several crests. The studs may be of various shapes in plan, and may be of the same height as the crests or not so high. The diagram shows developments of two forms of roll surface of this type.—E. W. L.

XV.—LEATHER; BONE; HORN; GLUE.

Mimosa bark; its importance for the leather industry. J. Paessler. Collegium, 1910, 57—60, 61—65, 70—76, 82—92, 93—95.

Although the quantity of mimosa bark imported into Germany is increasing each year, it is not used to the extent that its valuable properties as a tanning material would justify. The mimosa or wattle bark is obtained from a great number of species of *Acaciae*, indigenous to Australia but now cultivated also in California, South America and South Africa. The bark of the Black and Golden Wattles is richest in tannin, containing 25—45 per cent., while that of the Silver Wattles contains less (20—30 per cent.). The earlier supply of bark from Australia was very variable in strength but bark-farming and the high duty levied (about 3s. per cwt.) have resulted in the exportation of a uniformly stronger bark. The varieties selected for cultivation are *A. decurrens*, *A. mollissima*, *A. pyncantha* and *A. penninervis*; and a bark containing less than 30 per cent. of tannin is rarely met with in commerce. The tanning *Acaciae* were introduced into South Africa 40 years ago and *A. decurrens, var. mollissima* was found most suited to the climatic conditions of that country. The soil must not be too sandy or stony, a sandy loam being the most suitable, and in Natal the Acacia flourishes at a height of 300—1100 metres (980—3600 ft.) above sea-level. A mean yearly temperature of 10°—15° C. with a rainfall of at least 400 mm. (15¾ in.) is required for the most favourable development of the trees. Under these conditions growth is rapid and bark of 6—10 mm. (0·25—0·4 in.) thickness is obtained in 6—10 years; in Natal the trees are peeled after 8—10 years. Since the seeds are very hard and consequently slow to germinate, they are, before planting, lightly roasted or boiled in water for several minutes and the glutinous matter thus produced removed with cold water. They are sown 1—2 m. (3·3—6·6 ft.) apart, as the tree grows more quickly, and produces a stronger bark, the less it is shaded by surrounding trees. It is necessary also that the leaves should receive the maximum quantity of light for the production in them of tannin. In one year the trees will reach a height of 2—3 m. (6·6—9·9 ft.), in 4—5 years 8—9 m. (26·4—29·7 ft.), and in 8 years, 15—20 m. (49·5—66 ft.), with a trunk of 20—25 cm. (8—10 in.) diameter. The bark is most easily peeled from the trees from the beginning of March to the end of April, but there is liability to damage by rain at this period; the "winter-bark" obtained in July or August is the best quality. In earlier times it was customary to dry the bark in the sun, but it has been found that, when dried in the shade, the bark is stronger and therefore more valuable. Of 260 samples of mimosa-bark examined at the German Leather Industries Research Institute since the year 1901, the mean percentage of tannin was 31·5 by the "shake-method," the actual percentages of tannin ranging from 20·5—46·5. Sugars are present to the extent of only about 1 per cent. and on that account little acid is produced in liquors made from the bark. A bright-coloured leather is produced, with a reddish tinge, and considerable darkening occurs on exposure to light as is the case also with oak- and fir-bark. By careful leaching the bark may be extracted to leave only 3—4 per cent. of tannin and very strong liquors of 8°—10° Bé. may be obtained by leaching the bark alone. Best results are obtained by previous admixture of the bark with other materials before extraction. Blended with other materials the bark may be used with good results for light as well as for heavy leather. Caution must be observed in using the bark in the layers or stains may result from its contact with the hide. The establishment of extract factories in connection with the bark-farms, as carried on in German East Africa with the mangrove, offers commercial possibilities. A mimosa extract of 27—36 per cent. of tannin and containing 53—63 per cent. of water appears in commerce. The so-called "Mimosa D" Extract is a sulphited quebracho extract and has no connection with mimosa bark extract.—D. J. L.

Tanning extracts ; Testing of ——. A. Gansser. Collegium, 1911, 101—106, 109—113.

The author has previously (this J., 1909, 319) described a method for the estimation of the colour-producing qualities of tanning extracts, using "animalised cotton fabric." In the present paper the possibilities of using the same material for estimating the weight-giving and other properties of tanning extracts, are discussed. On account of the difference between the absorptive powers of hide fibre and animalised cotton, it had been formerly urged against this method that it could not give a true indication of the leather-forming qualities of an extract. The author maintains that animalised cotton possesses some properties very similar to hide fibre and, in addition, that it gives much more constant results because of its more uniform character, being much less liable to variation than hide is. The method of manipulation is as follows: six pieces of the animalised cotton, weighing 2·5 grms. each, are tanned out in cylinders 30 cm. high by 9 cm. in diameter. The amount of infusion taken is 4 times the weight of material and of a strength of 6° Bé., the tannage taking 12 hours. For very resinous extracts, twice the volume of infusion is taken, of 3° Bé. strength. After tannage the pieces are dried between filter paper without previous washing, further dried for two hours at 40° C., and in a vacuum oven at 80°—90° C. for 1½ hours, allowed to cool in a desiccator and weighed. The greatest source of error is the difference between the amounts of moisture in the cotton before and after tanning. The results of the estimation of the weight-giving properties of extracts, by four different methods, are given: (*a*) the silk fibre method, (*b*) the hide powder method, (*c*) the method using oxhide grain, and (*d*) the animalised cotton method. The results obtained by the last method are more in accordance with practical results than by any of the other methods, although not any of the methods are very satisfactory. The animalised cotton method is the simplest and the least liable to error, and gives the closest duplicates, the highest difference obtained being 1·8 per cent., compared with 10 per cent. by the other methods. *Estimation of tensile strength or resistance to tearing.*—Tables showing the resistance to tearing of the cotton fabric before and after tanning with the various extracts, are given, and from them the author draws conclusions as to the power of the different extracts of producing tensile strength in leather. The following figures show the increase or decrease in resistance to tearing (kilos. per cm. width of test-piece) of the cotton fabric after tanning with the different extracts:—Cleared chestnut extract, +1·28; blood-decolourised chestnut, +3·28; American hemlock extract, +1·66; European pine extract, +2·09; sumach extract, —0·65; myrobalams extract, +0·88; quebracho extract, +1·28; Kaki-cutch, +2·17; gambier, +2·0; sulphited quebracho extract, +2·8. Sumach gives no increase of tensile strength whilst the sulphited quebracho gives a greater increase than the non-sulphited.—J. R. B.

Sulphur tanning in the manufacture of technical leather ; Employment of ——. W. Eitner. Gerber, 1911, 37, 1—3, 15—17, 43—45, 59—61.

The author in his writings on two-bath chrome tanning has described a kind of secondary tanning due to sulphur and has stated that the characteristic feel and texture of two-bath leather as compared with one-bath is due to this sulphur-tanning. In two-bath chrome tanning, in which sodium thiosulphate is almost universally used as a reducing agent, sulphur is precipitated both in the bath and in the leather, especially in the grain, and produces an effect similar to that due to the meal used in glacé tanning. Leather may be made by use of sulphur alone by dehydrating the hide with alcohol and treating with a solution of sulphur in alcohol and carbon bisulphide. The amount of sulphur introduced into the leather in the two-bath process may be controlled so that it may confer the desired properties on the leather. Leather for picker-bands, in which great softness and toughness are required, is made of better quality by the two-bath than by the one-bath process. In two-bath leather the average percentages of chromium oxide and sulphur are 3·8 and 0·2; where excess of the reducing agent has been used, the percentages may be 3·1 and 0·8 respectively. French leather tanned by the usual process and over-sulphurised contains 3·0 per cent. of chromium oxide and 3·8 per cent. of sulphur or 3·0 per cent. of chromium oxide, 1·6 per cent. of alumina and 3·8 per cent. of sulphur, which appears to be the highest limit to which the sulphur content can reach. Leather containing sulphur to this amount is soft and requires very little fat-liquoring. In the manufacture of picker-band leather by the two-bath process, the theoretical quantity only of the acid must be used in the first bath and more in the second bath, but too much acid must be avoided in the reducing bath or sulphur will be precipitated unequally in the outer parts of the hide. The excess of acid in the second bath may be avoided by using a combination of the one- and two-bath process. The first bath may contain, for 100 kilos. of pelt, 3 kilos. of chrome alum, 1 kilo. of bichromate and 3 kilos. of hydrochloric acid. For the reduction and sulphur-tanning in the second bath, 150 litres of water and 8 kilos. of thiosulphate are used per 100 kilos. of pelt. No acid is needed in the second bath and very little alkali is necessary for the subsequent neutralisation of the leather. The leather will contain only about 0·7 per cent. of sulphur, but will be very soft, as all the sulphur will have been precipitated in the interior of the leather. If the normal two-bath process does not introduce enough sulphur into the leather, this may be done by a separate process of treating the goods first with acid and then with thiosulphate or *vice-versa.* Suitable proportions are, for 100 kilos. of pelt, 100 litres of water containing 20 kilos. of salt and 8 kilos. of hydrochloric acid. The second bath is composed of 20 per cent. of thiosulphate on the pelt weight dissolved in 100 parts of warm water. By using a separate process as described, sulphur may be introduced to the extent of 4 per cent. and over. The sulphur-tanning process may be followed by a chrome, a chrome and alum, or a vegetable tanning process. Leather produced in this manner is especially suitable for the manufacture of automobile tyres, the high percentage of sulphur in the leather and its freedom from fat facilitating the vulcanising process. Details and quantities are given for the manufacture of leather by combinations of the sulphur-tanning process with chrome and vegetable tannages.—D. J. L.

Dégras; Analysis of——. W. Fahrion. Collegium, 1911, 53—57.

Water.—Results accurate to 0·2 per cent. are obtained by boiling off the water from 3 grms. of the oil until foaming ceases. *Ash.*—Owing to the low percentage of ash in the oil, at least 50 grms. should be used in this determination. *Free fatty acids* are estimated in the usual manner by titration with $N/1$ alkali in alcoholic solution using phenolphthalein as indicator. *Unsaponifiable matter.*—3 c.c. of 50 per cent. aqueous caustic potash solution are added to 3 grms. of the oil and the mixture is evaporated to dryness on the water-bath. The soap is dissolved in 50 c.c. of 50 per cent. alcohol and shaken in a separating-funnel with successive quantities of petroleum ether (b. p. below 70° C.). The petroleum ether solution is washed once with 20 c.c. of 50 per cent. alcohol which is added to the soap solution and the unsaponifiable matter weighed after evaporation of the petroleum ether. *Total fatty acids.*—The soap solution is freed from alcohol by evaporation on the water-bath, the residue dissolved in hot water and treated in a separating funnel with 25 c.c. of petroleum ether and 10 c.c. of 20 per cent. hydrochloric acid, shaken well, and allowed to stand overnight. The aqueous acid solution is then drawn off and the residue after evaporation of the petroleum-ether constitutes the total fatty acids. *Hydroxy-acids.*—The funnel still contains the hydroxy-acids or "dégras-former," which is dissolved in hot alcohol, evaporated to dryness in a platinum dish, weighed, incinerated, and again weighed. The difference in the weighings is the weight of hydroxy-acids. A part of the latter still remains in the acid aqueous solution and may be estimated by evaporating to dryness after making alkaline, dissolving in 10 c.c. of water and shaking in a funnel with petroleum ether after adding a little hydrochloric acid. *Volatile fatty acids* are estimated by difference. Normal dégras should cont in 15—20 per cent. of water; English sod-oil may contain 30—40 per cent., while the so-called "white-tanning dégras" from German chamois works has 40—50 per cent. of water. Pure dégras should not contain more than 0·2—0·3 per cent. of ash, but the "tawing dégras" has 1—2 per cent. of ash, consisting mainly of the sulphates of sodium and calcium. Iron, in small quantities is found in all samples of dégras and is harmless if present in small enough quantities; as little as 0·03 per cent. however may be objectionable under certain conditions. The iron soap being soluble in fluid oils at higher temperatures will pass into the leather under these conditions, but if left on the surface of the leather will cause stains. The unsaponifiable matter of the original cod-oil is scarcely changed during the autoxidation process and the dégras will therefore contain the same percentage of these bodies unless mineral oil or wool-fat has been added. The latter should not necessarily be considered as adulterants. as many samples of genuine highly oxidised dégras are too viscous to pass into the leather and require some thinning material. The determination of the iodine value of the total fatty acids is of importance as an indication of the tendency of the oil to "spue," this being, in the author's opinion, an oxidation effect. An oil having an iodine value (fatty acids) below 100 is unlikely to "spue." The percentage of free fatty acids should not exceed 20, as an excess may lead to another form of "spueing" consisting of a white incrustation on the grain of the leather. Dégras may be prepared containing 15 per cent. of "dégras-former" but 6—10 per cent. is the best for practical purposes. The hydroxy-acids are present in the latter as glycerides, which are valuable in producing a kind of after-tannage when used on vegetable-tanned leather. Two varieties of the product are recognised by the German Union of Dégras Manufacturers: "Moëllon," containing 17 per cent. of water and 6 per cent. of unsaponifiable matter, and "moëllon-dégras" with 20 per cent. of water and 12 per cent. of unsaponifiable matter.—D. J. L.

Water-soluble matter in sole and upper leathers; Determination of——. L. Gödel. Collegium, 1911, 113—114.

The results of commercial analytical work on leather, lead the author to conclude that the amount of soluble matter which can be washed out of leather by water, is increased if the leather be rasped instead of cut up into shreds. The extraction is facilitated and shortened, and more concordant results are obtained, if an ordinary joiner's rasp is employed. 12—15 grms. of the leather powder are extracted and the solution made up to one litre, the operation taking 4—5 hours. With this method the "Durchgerbungszahl" (degree of tannage) never exceeded 100, as was the case when ordinary cut up leather was used.—J. R. B.

PATENTS.

Hides and skins; Treatment of——. E. Simon, Dresden-A., Germany. Eng. Pat. 6281, Mar. 12, 1910.

The use of oxygen is claimed in removing lime from hides and skins, after unhairing, with or without the use of ammonium and alkaline salts and of organic substances producing mucus and preventing the so-called formation of shades. The use of oxygen is effected by making a paste of flour or other mucus-producing substance and supplying oxygen from some source such as hydrogen peroxide, ammonium peroxide, peroxides of the alkalis or alkaline-earths, liquid or gaseous oxygen, or by ozonising the tanning bath. The amount of oxygen thus added to the tanning bath should not exceed on the average 0·2 grm. per litre of acid bath liquid. Castor-oil meal may be employed in the process as follows. The hides and skins are "slackened" by means of lime, alone, or with the addition of orpiment, gas-lime, or alkaline sulphides, and are then macerated in a bath consisting of castor-oil meal, alkali or ammonium carbonates, and chlorides and phosphates of ammonium and of the alkaline earths, for some hours at not more than 80° C., after which the bath is diluted with warm water so as to contain castor-oil meal, 0·5 per cent.; ammonium chloride, 0·2 per cent.; sodium carbonate, 0·1 per cent., and sodium phosphate, 0·05 per cent. The skins remain in the bath for 8—12 hours. The castor-oil meal acts by virtue of its enzymatic and fat-splitting properties on the calcium compounds in the various tissues, and also has an oxidising action upon the sulphur compounds in the skins and hides.—E. W. L.

Tanning; Employment of oxidation products of phenols, in particular quinones, for——. A. Seyewetz and L. Meunier. Second Addition, dated Dec. 24, 1909, to Fr. Pat. 385,057, Feb. 25, 1907 (this J., 1908, 580 and 911).

Quinone-sulphonic acids or their salts may, with advantage, be used in place of quinones. They are more easily soluble in water than the latter, and the solutions are relatively stable and free from smell and from irritant properties.—E. W. L.

Elastic or resilient masses; Production of—— [*from gelatin*]. W. Plinatus, Paris. Eng. Pat. 9616, Apr. 20, 1910. Under Int. Conv., Sept. 6, 1909.

In masses consisting essentially of gelatin-glycerin mixtures the hardening process is accomplished by the use of glycerin, partially or wholly decomposed by heat. The hardening effect may be improved by the co-operative action of other hardening agents such as aldehyde, chromic acid and other chromium compounds.—E. W. L.

Plastic mass; Preparation of a —— from gelatin. Soc. des Colles et Gélatines Françaises. Fr. Pat. 421,383, Dec. 20, 1909.

The transformation of gelatin into a plastic mass is carried out in two stages. In the first stage the gelatin, after swelling in water and addition of sugar, molasses, glycerin, etc., is melted and mixed with a quantity of hardening reagents insufficient to appreciably modify its physical properties at the temperature of fusion. For example commercial gelatin, of such a character that a 6 per cent. gel sustains, under a pressure of 50 to 70 grms. per sq. cm., the same degree of deformation as fish glue under a pressure of 90 to 110 grms. per sq. cm., is soaked in from twice to two and a half times its weight of water, and mixed with 2 per cent. of white sugar. The hardening reagent, consisting of 100 grms. of 40 per cent. formol and 10 litres of ordinary commercial denatured alcohol per 100 kilos. of gelatin, is then added. The second stage consists in immersing the partially hardened gel in a bath or baths of one or several hardening reagents, for example in a bath consisting of equal parts of 40 per cent. formol and ordinary commercial aluminium acetate. The time of immersion is about 2 hours in the case of a sheet which, when finished and dried, is from 3 to 5 mm. thick. The product thus obtained is, after drying, hard and elastic at ordinary temperatures. At about 60° C. it becomes plastic: at about 100° C. brittle. On cooling, its original properties are restored.—E. W. L.

Elastic material [from gelatin]. G. Chandon de Briailles. Fr. Pat. 421,423, Dec. 21, 1909.

The basis of the elastic material is a gelatin-glycerin or similar mixture, in which the gelatin is rendered insoluble by one of the ordinary known methods, or by means of a special process described in the patent. Increased elasticity is conferred upon the mass by the inclusion in it of some soluble substance—such as sugar, common salt, magnesium sulphate, etc.—and the subsequent removal of this substance, after the mass has been moulded to the desired shape, by a process of solution. When the moulded mass is afterwards dried, the particles of soluble substance become replaced by innumerable air vesicles. The gelatin may be rendered insoluble by immersing it successively in acetone and acetaldehyde, or by including acetaldehyde in the mass before moulding.—E. W. L.

Leather substitute. E. Reidel, Mannheim, Germany. Eng. Pat. 225, Jan. 4, 1910. Under Int. Conv., Jan. 8, 1909.

See Fr. Pat. 410,369 of 1909 ; this J., 1910, 832.—T. F. B.

Lubricant for waterproofing leather and the like ; Process for the preparation of a ——. F. Fölsch, Wernigerode a. Harz, Germany. Eng. Pat. 15,797, July 1, 1910.

See Fr. Pat. 417,810 of 1910 ; this J., 1911, 39.—T. F. B.

Tanning. A. Seyewetz and L. Meunier, Lyon, France. U.S. Pat. 987,750, March 28, 1911.

See Fr. Pat. 385,057 of 1907 ; this J., 1908, 580.—T. F. B.

XVI.—SOILS ; FERTILISERS.

Copper sulphate and manganese sulphate ; Influence of —— upon the growth of barley. W. E. Brenchley. Annals of Botany, 1910, 24, 571. Rothamsted Exp. Stat. Ann. Rep. for 1910, 7.

It has been maintained that all substances toxic to plants act as stimuli at some stage of high dilution. The author submitted this statement to a very careful test in the case of barley seedlings growing in water cultures without finding any evidence of stimulus, even down to dilutions of one of copper sulphate in ten million parts of water. A toxic effect is always manifest, though it is greatly masked when the copper solution is added to a solution of nutrient salts, and is not used in pure water. In this latter case seedlings are very susceptible, growth being perceptibly checked or even stopped by the use of water which has been distilled from the ordinary copper vessels of the laboratory. The apparent stimulus at higher dilutions may have been due to accidental variations, since the individuality of plants grown in water cultures is very marked, and large numbers must be taken in order to obtain trustworthy results. Manganese sulphate can hardly be regarded as toxic for barley, though in moderate concentrations (more than 1 per 10,000) there is retardation of growth. At lower concentrations (1 per 100,000 and downwards) there is distinct evidence of stimulus. Incidentally it was noted that at such concentrations as 1 in 10,000, manganese was taken up by the plant and excreted as peroxide on the surface of the leaves. As manganese is universally found in plant ashes, and has been considered by Bertrand and his co-workers to aid in the actions on the oxydases of the leaf, it obviously stands in a different position to toxic substances like copper which have no normal physiological function.

Zinc and manganese ; Combined influence of —— on the development of Aspergillus niger. G. Bertrand and M. Javillier. Comptes rend., 1911, 152, 900—902.

It has already been observed that addition of small quantities of zinc or manganese salt (this J., 1911, 228) to the nutritive solution, increases the yield of *Aspergillus niger.* It is now found that the combined influence of these metals (added in the form of sulphate, and in quantities corresponding to 1 part of zinc to 100,000—25,000,000 parts of solution and 1 part of manganese to 500—25,000 parts of solution) is greater than the influence of either metal added separately. Thus, in one case, whilst 100 parts by weight of dried plant were obtained from a control solution, and 242 and 170 parts were obtained from the solutions treated with zinc and manganese respectively, 284 parts were obtained from the solution treated with both metals.—L. E.

Chemical investigation of the best conditions for making lime-sulphur wash. Van Slyke and others. *See* XIXb.

Experiments with home-made concentrated lime-sulphur mixtures. Parrott and Schoene. *See* XIXb.

Method of action of sulphur when used against oïdium. Marcille. *See* XIXb.

Patent.

Potash works ; Process for the utilisation of the liquors from ——. E. von Alten. Ger. Pat. 231,100, Dec. 2, 1909. Addition to Ger. Pat. 224,076, Feb. 21, 1909 (this J., 1910, 967).

For the preparation of the potash-lime fertiliser, the first mother-liquors obtained in the manufacture of potassium salts may be used instead of the final mother liquors mentioned in the chief patent.—A. S.

XVII.—SUGARS ; STARCHES ; GUMS.

Sugar beet ; Influence of insolation on the composition of the ——. F. Strohmer, H. Briem, and O. Fallada. Oesterr.-ung. Z. Zuckerind., 1911, 40, 11—28. Chem. Zentr., 1911, 1. 1065—1067.

Experiments were carried out in 1905 and 1909 in which seeds of similar origin were grown under as far as possible identical conditions, except that in one case the plants were exposed freely to the light, whilst in the other they were protected by a screen of trees. The shading was found to favour the growth of the leaves at the expense of the roots. The amount of root (dry substance) was less in the shaded than in the unshaded plants, the deficiency being in large measure due to a smaller production of sugar. The shaded plants were richer in nitrogenous substances than the unshaded plants. The composition of the roots and leaves of the shaded and unshaded plants respectively is shown in the following table, the figures expressing percentages of the dry substance, free from sand :—

	Unshaded plants.		Shaded plants.	
	Leaves.	Root.	Leaves.	Root.
Albumin	12·36	4·14	14·16	3·89
Nitrogen compounds, other than albumin	6·22	0·63	11·45	4·81
Fat	1·74	0·27	1·12	0·27
Sucrose	12·26	75·02	4·23	69·16
Reducing sugars (as invert sugar)	21·88	0·00	16·90	0·00
Pentosans	8·51	5·69	8·40	7·79
Other non-nitrogenous extractive matter	3·45	4·27	5·89	2·45
" Crude fibre "	14·95	7·45	17·66	7·53
Ash	18·63	2·53	20·19	4·10
Oxalic acid	2·74	0·53	4·99	1·16

—A. S.

Beet sugar ; Rapid decomposition of a raw ——. A. Schöne. Deutsch. Zuckerind., 1911, **36**, 247—248.

Before shipping at Hamburg the analysis of a sample of raw beet sugar indicated a total sucrose content of 95·2 per cent., an invert sugar content of 0·18 per cent., and a rendement of 90·05 ; but the same sugar, when examined about a month later after its arrival in England, showed a sucrose content of 92·18 per cent., an invert sugar content of 2·22 per cent., and a rendement of 76·86. On bacteriologically investigating this unusual example of deterioration, the author found that the Hamburg sample contained, in addition to the micro-organisms generally present in raw sugar, putrefying bacteria and moulds, in all about 3000 per grm. of the sugar. With the English sample, on the contrary, quite different results were obtained. On sugar-gelatin plates a white mould with erect, branched hyphae, such as hitherto has apparently not been found in raw sugar, was observed. A number of budding fungi, and a few fission fungi, also developed, and these on isolation proved to be a true yeast and a rhizopus mould respectively. In explanation of the rapid decomposition it is suggested that before shipping the sugar was unsound, as the high invert sugar content of 0·18 per cent. shows, but that during transport it had taken up moisture, and with this, new organisms, which had then found in the already altered product a suitable medium for their development.—J. P. O.

Cane sugar ; Bacterial deterioration of ——. W. L. Owen. Louisiana Planter, 1911, **46**, 153—155.

Recent investigations carried out by the author have shown that the deterioration of finished sugars on storage is due to the action of certain bacteria, which are characterised by possessing highly resistant spores. It was found that contamination with these bacteria persists throughout the entire milling process ; and that, although sulphuring and defecation considerably reduces their number, the finished sugar as it drops from the centrifugals may contain the spores. Regarding the action of the deteriorative bacteria on the sugar, inversion is apparently not brought about by the action of the acids formed, but by the direct action of the bacteria. It has further been observed that certain of these deteriorative bacteria are associated with the formation of an optically-active gum, resembling gum levan, which appreciably vitiates the Clerget determination, thus introducing an error into the analysis of finished sugars. As remedial measures, the great importance of cleanliness in the sugar mill is emphasised. Ammonium fluoride, in a 1 per cent. solution, is recommended as an antiseptic wash for tanks, cars, pans and pipes ; while for keeping the floors, walls, and general woodwork free from micro-organisms, a 1 : 1000 solution of mercuric chloride has been found to give beneficial results. Carbolic acid and formaldehyde are stated to be also useful. An infallible and practical remedy for deterioration is to keep the sugar dry during storage, and it has been claimed that sugars containing less that 1 per cent. of moisture cannot support bacterial life. Another means of checking deterioration, and one that applies more particularly to refineries, is to keep the juices, etc., acid, since it has been observed that the bacteria in question are much more active in an alkaline than in an acid medium.—J. P. O.

Starch ; Action of ultra-violet rays on ——. L. Massol. Comptes rend., 1911, **152**, 902—904.

If solutions of soluble starch (prepared by heating for 3 hours at 150° C.) of 0·2 to 1 per cent. concentration, are exposed, at a distance of 10 cm., to the action of a mercury vapour quartz lamp consuming 300 watts, the starch gradually loses the property of giving a blue colour with iodine, the colour undergoing an alteration similar to that observed when the iodine test is applied at various stages of starch-conversion. The rate of transformation increases on decreasing the concentration and on acidifying the medium. As a result of the exposure also, the solution acquires reducing power and becomes less precipitable by alcohol ; the portion soluble in alcohol possesses reducing power and is dextrorotatory. Examination of the product obtained on exposing a solution containing 1·7 grms. of soluble starch and 1·715 grms. of sulphuric acid per 1000 c.c., to ultra-violet rays, showed that the reducing substance formed is probably maltose. A control experiment in which the solution, instead of being exposed to ultra-violet rays, was heated to 72° C., showed that the transformation was not due to the acidity nor to the temperature (the temperature of the exposed solution never exceeded 30° C.). The hydrogen peroxide formed (not exceeding a trace) is incapable under the conditions of the author's experiment, of effecting the transformation, and the latter is therefore due to photochemical action.—L. E.

Bagasse [sugar cane refuse] as a papermaking material. Von Possanner. *See* V.

Digestive ferments of hexotrioses and stachyose. Bierry. *See* XVIII.

Patents.

Starch ; Manufacture of ——. L. P. Bauer and T. Speck, Chicago, Ill. U.S. Pats. 986,540 and 986,541, March 14, 1911.

For the recovery of pure starch from aqueous mixtures containing impurities (*e.g.*, gluten) of lower specific gravity, the mixture is made to flow in a shallow stream moving slowly enough to enable the starch to settle. Two layers are thus formed, the upper one consisting of water and impurities, and the lower one of an aqueous suspension of starch. The separation of these layers may be effected in various ways. For example, the aqueous mixture is run continuously on to a table over which it flows in a shallow stream. The upper stratum containing the impurities flows off by an outlet near the level of the upper surface of the stream, whilst the deposited starch is, by a suitable device, moved along in the direction of the stream but independently of it and without agitating it. This lower stratum of watery starch flows away by a second outlet extending downwards from the level of the table.
—J. H. L.

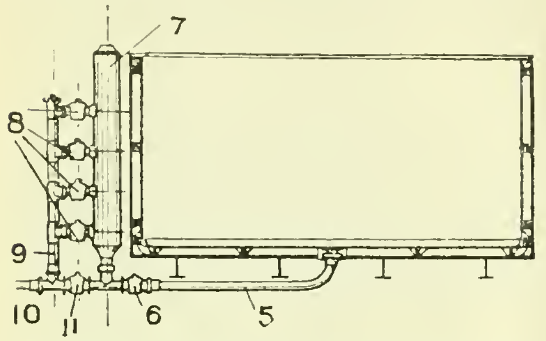
Sugar syrups ; Process for directly converting —— *into crystallised sugar of agreeable taste.* C. Grière, Grevenbroich, Germany. U.S. Pat. 988,261, March 28, 1911.

See Fr. Pat. 402,305 of 1909 ; this J., 1909, 1217.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Mash-tun ; New method of running off worts from the ——. H. M. Chubb and J. Harrison. J. Inst. Brewing, 1911, **17**, 210—217.

The authors have devised apparatus (shown in the figure) for minimising the suction on the goods in the mash-tun during the running off of the wort. The danger of set and dead mashes, flooding, etc., is thereby much reduced, and it is possible to use finer ground malt and so secure higher extracts. The wort main (5) leads from the middle of the bottom of the mash-tun to the vertical wort cylinder (7) which is made of copper, about 9 ins. in diameter and loosely covered. All the mains (5, 9, and 10) and cocks (6, 8 and 11) are sufficiently wide to carry away the wort as fast as the sparge liquor can be put on. Before mashing, all the cocks are shut. When the mash has stood the proper time and running off commences, the cock, 6, is opened and the wort allowed to rise in the cylinder, 7, to the level at which it stands in the tun. The cock, 8, next below this level is then opened and the wort run off until it stops, when the sparge is started slowly. After half the sparge length has been run on, the next lower cock, 8, is opened, and so on. To drain the goods thoroughly, the cock, 11, is opened. —J. H. L.



Beer; Influence of brewing water on the character of ——. O. Miskovsky. "Kvas," Prague, 1910, No. 40; Z. ges. Brauw., 1911, 34, 49—54, 65—69, 73—77, 85—88, 97—101.

The author has carried out a large number of comparative experimental mashes using as mashing waters solutions of one of the following salts in distilled water:—calcium sulphate, nitrate, chloride, and carbonate, magnesium chloride and carbonate, and sodium chloride. The worts obtained, both before and after hop-boiling, were subjected to a thorough examination as to their physical and chemical character. The author concludes that the influence of the salts is mainly due to the reaction they impart to the wort. He therefore groups them into two classes, one of which includes the carbonates, whilst the other comprises calcium sulphate, chloride and nitrate, and magnesium chloride and in some cases sulphate, all of which have a somewhat acid character. Sodium chloride and, as a rule, magnesium sulphate stand intermediate, being neither acid nor alkaline, and exercising little influence on the character of the wort. The alkaline group retard amylolytic and proteolytic action of the enzymes during mashing, to an extent depending upon the concentration of the hydroxyl ions. The breakdown of starch and complex proteins is consequently less rapid and complete; a smaller quantity of nitrogenous matter passes into the wort, and that which does dissolve contains a larger quantity of dextrins and partially hydrolysed proteins, than when acid waters are employed. The worts are also darker in colour, form good heads, and break well on boiling. If, however, the alkalinity exceeds a certain limit, soluble compounds are formed by the alkali with complex proteins, and then coagulation is incomplete and the wort runs "blind" and without break. Salts of the acid group, on the other hand, within certain limits of concentration, accelerate diastatic and proteolytic action. Saccharification is more rapid; the breakdown of starch and complex proteins is more complete; more nitrogen passes into the wort, but less incompletely hydrolysed proteins and dextrins, the quantity of amino-acids and reducing sugars being greater, than when alkaline waters are used. The wort has a lighter colour, clarifies well, but does not form so good a head. During hop-boiling the quantity of proteins coagulated is less, but the wort breaks well unless the acidity is too great, in which case "acid-albumins" are produced, which are not completely coagulated, and the break is not so good. —J. H. L.

Hexotrioses and stachyose; Digestive ferments of ——. H. Bierry. Comptes rend., 1911, 152, 904—906.

Enzymes capable of decomposing hexotrioses (raffinose, gentianose) and stachyose occur very abundantly in the gastro-intestinal juice of the *Invertebrata* (*e.g.*, *Helix pomatia*). The hexotrioses are hydrolysed in two stages involving the successive action of two enzymes; in the first stage, lævulose and a biose (melibiose, gentiobiose) are formed, and in the second stage the biose is hydrolysed. Stachyose is hydrolysed in three stages involving the successive action of three enzymes; in the first stage, lævulose and manninotriose (this J., 1911, 379) are formed. It is concluded that the digestive juice of *Helix* contains, besides the enzymes previously detected, a melibiase, a gentiobiase, and a manninotriase. It would appear that in raffinose, gentianose, and stachyose, the lævulose residue is attached in the same manner to the glucose residue. The invertase of the *Invertebrata* hydrolyses both sucrose and the polyoses, whilst the sucrase of the higher animals hydrolyses sucrose only; the author does not consider that this indicates a difference in structure between sucrose and the polyoses, but concludes that the liberation of lævulose from the polyoses is effected by an enzyme—lævulo-polyase—which is one of a number of invertases. The digestive juice of *Helix* also contains an enzyme—rhamnino-rhamnase—which decomposes rhamninose.—L. E.

Chicory as a source of alcohol. W. Donselt. Z. Spiritusind., 1911, 34, 93.

The root of chicory contains considerable quantities of inulin and sugar. From 1 cwt. of the finely divided root 26 litres of juice of 25·2° Balling can be obtained by pressure. This juice contains, after treatment with acid to saccharify the inulin, 20·7 per cent. of sugar. Fermentation tests showed that from 100 litres of juice not more than about 8 litres of pure alcohol can be produced, corresponding to 2·2 litres per cwt. of the fresh root. As 15—16 litres of alcohol can be obtained from 1 cwt. of rye the author considers that chicory is not likely to find use in distilleries. —J. H. L.

Patents.

Sulphite cellulose lyes; Production of alcohol from ——. P. G. Ekström, Skutskär, Sweden. Eng. Pat. 6741, March 17, 1910.

Alcohol is produced from the waste lyes obtained from the digestion of wood, etc., by the bisulphite process, by first precipitating the excess of sulphites and sulphurous acid by means of lime, chalk or other suitable neutralising agent, concentrating the liquor, cooling to a temperature of 25° C. and fermenting the saccharine constituents by the addition of yeast and a yeast nutrient. The yeast nutrient is prepared from brewers' yeast or from yeast collected from an earlier fermentation, by heating the yeast for a comparatively long time at a temperature of about 45° C., at which temperature the yeast is digested by the action of an enzyme contained in it.—J. F. B.

Porter and stout; Manufacture of ——. G. B. Whitaker, Halifax, Yorks. Eng. Pat. 12,917, May 27, 1910.

For improving the flavour and nutritive value of porter and stout, cocoa or cocoa-products are added during manufacture. Thus cocoa, to the extent of 2·5 per cent. of the total ingredients used, may be added at any stage of the brew, and a further 5 per cent. during priming. —J. H. L.

Distillery or brewery wash or waste; Treatment and utilisation of ——. A. Dixon, Dublin. Eng. Pat. 25,108, Oct. 28, 1910.

The wash or waste when first run off is cooled by passing it through peat or turf, and then agitated with 0·5 per cent.

of brewers' yeast, preferably at 65° F. After standing for some time a nitrogenous sediment is deposited. The upper liquid is run off through calcium phosphate in order to neutralise its acidity and the sediment is used directly as a fertiliser.—J. H. L.

Yeast; Process of manufacturing dry diastatic ——. P. A. Brangier, Agnew, Cal. U.S. Pat. 986,898, March 14, 1911.

The yeast in the form of cakes is dried by contact with loose particles of a hygroscopic substance.—J. H. L.

Malting process and apparatus therefor. P. H. Elmassian, Smyrna, Asia Minor. Eng. Pat. 6175, March 11, 1910.

See Fr. Pat. 416,076 of 1910; this J., 1910, 1403.—T. F. B.

Beer; Process and apparatus for pasteurising ——. C. H. Loew, Lakewood, Ohio, U.S.A. Eng. Pat. 6376, March 14, 1910.

See Fr. Pat. 413,848 of 1910; this J., 1910, 1128.—T. F. B.

XIXa.—FOODS.

Milk; The peroxydase of cows' —— and the reaction with paraphenylenediamine. E. Nicolas. Bull. Soc. Chim., 1911, **9**, 266—269.

Bordas and Touplain found that the decomposition of hydrogen peroxide by unboiled milk is due to the colloidal casein and not to a peroxydase (see this J., 1909, 538, 1160; 1910, 38, 293). The authors' experiments show that the colour reaction obtained with paraphenylenediamine in the presence of hydrogen peroxide is caused by the combination of the casein with the product of the oxidation of the diamine by the peroxide. 5 drops of a freshly prepared solution of phenylenediamine (2 per cent.) and 10 drops of hydrogen peroxide (10—12 vols.) give a blue colouration with 5 c.c. of boiled milk, practically immediately; with 5 drops of diluted peroxide (1 : 10) a reaction is only obtained after several hours. The same reactions are given by the casein precipitated from such milk, by alcohol, magnesium sulphate, or acetic or lactic acid. Fresh milk is distinguished by giving a colouration (yellow, changing rapidly to emerald green and Prussian blue) at once with phenylenediamine in presence of a drop or two of dilute peroxide (1 : 10). Boiled milk does not give a reaction with guaiacol solution (or guaiacum tincture) and peroxide until after addition of a peroxydase (macerate of bran).—A. Seld.

Milk; Determination of phosphorus in the ash of ——. F. Bordas and F. Touplain. Comptes rend., 1911, **152**, 899—900.

The amount of phosphorus in the ash obtained by incinerating milk at low redness, is practically identical with the sum of the amounts of phosphorus (1) in the ash from the lactoserum separated after coagulation of the milk by trichloracetic acid, and (2) in the coagulum separated from the lactoserum, the organic matter in this last case being first oxidised with nitric acid and potassium permanganate according to Marie's method. Hence, in the incineration of milk there is no loss of phosphorus, and the residue may be employed for determining the total phosphorus-content of the milk; if this determination is supplemented by a determination of the phosphorus in the lactoserum (inorganic phosphorus) or in the coagulum after treatment of the milk with trichloracetic acid (organic phosphorus) the amounts of phosphorus in inorganic and in organic combination may be found.—L. E.

Saccharin [in mineral waters, etc.] in Egypt. C. Muller. Bull. Assoc. Chim. Sucr., 1911, **28**, 630—640.

The use of saccharin as a sweetening agent, especially in artificial mineral waters, etc., has extended widely in Egypt, owing to the complete freedom of importation and sale of saccharin and the lack of official control with respect to food adulteration and similar matters. The author reviews the work which has been done on the physiological effects of saccharin and the methods which have been proposed for the determination and identification of this substance. He considers that there is, at present, no single reaction by means of which saccharin can be characterised with certainty, and that the simplest mode of recognising it is by its characteristic taste, especially after it has been extracted from solution by ether and purified by means of permanganate (compare this J., 1909, 732).
—A. S.

Coffee glazes containing arsenic. F. E. Notthohm and E. Koch. Z. Unters. Nahr. Genussm., 1911, **21**, 288—290.

Shellac is one of the substances which are used for glazing coffee beans, and the author draws attention to the fact that shellac is sometimes coloured by the addition of arsenic trisulphide. Samples of such coloured shellac were found to contain from 0·0785 to 0·12 per cent. of arsenic, whilst specimens of colophony examined were free from arsenic. Coffee beans, which had been glazed with arsenical shellac, were found to be strongly contaminated with arsenic. The author is making inquiries as to whether shellac containing large quantities of arsenic is actually sold for the purpose of glazing coffee beans.—W. P. S.

Alimentary products from soya beans; Factory for the manufacture of —— in Marseilles.

The *London and China Telegraph* states that a factory has been established at Marseilles, with a capital of £80,000, for the manufacture of various alimentary substances from the soya bean. The capital has been entirely subscribed by Chinese, and the factory was established by a Chinaman, and will employ Chinamen only.

Patents.

Maize; Process of making flour of ——. A. Erosa and A. Erosa, Merida, Mexico. U.S. Pat. 987,560, Mar. 21, 1911.

The maize is partially boiled in "calcium hydrate" at about 60° C., and then separated from the hulls, whilst the fecula is made into a paste with water, the liquid expressed, and the residual mass dried at 90° to 95° C., and ground to a flour.—C. A. M.

Food product; Preserved ——. C. Ellis, Larchmont, N.Y., Assignor to Ellis-Foster Co., New Jersey. U.S. Pat. 987,868, March 28, 1911.

A mixture of a foodstuff with "a modicum" of a water-soluble basic formate of an alkaline earth metal, *e.g.*, calcium.—A. S.

Infants' milk from cows' milk; Preparation of ——. A. Bernstein. Ger. Pat. 231,923, March 29, 1908.

The cows' milk is first freed from cream, and a portion of the separated milk is treated, under alkaline conditions, in the known manner with an albumin-dissolving enzyme, after which it is added to the remainder of the separated milk and the mixture subjected to the action of rennet under amphoteric or acid conditions, the separated whey being subsequently incorporated with the cream and sterilised in bottles in the usual way.—A. S.

Coffee beans; Treatment of —— for the purpose of preparing coffee containing little or no caffeine. The Lifebelt Coffee Co., Ltd., London. From Kaffee-Patent Akt.-Ges., Holzhafen, Germany. Eng. Pat. 5827, March 8, 1910.

See Fr. Pat. 412,925 of 1910; this J., 1910, 1130.—T. F. B.

XIXB.—WATER PURIFICATION; SANITATION.

Nitrogen; Loss of —— in the purification of sewage in bacteria beds. A. Müntz and E. Lainé. Comptes rend., 1911, 152, 822—826.

This paper is an investigation into the cause of the loss of nitrogen which occurs in the course of the transit of sewage through a bacteria bed, and into the form of the nitrogen to which the loss is due. It has been shown that the loss of nitrogen varies directly with the amount of organic nitrogen present in the sewage, and if the organic nitrogen be reduced to nil, then there is no loss of nitrogen. As the carbon in the organic matter is converted into carbon dioxide, the process appears to be one of oxidation. The organisms which are capable of bringing about this change are very numerous in sewage, and their action accounts for about 60 per cent. of the nitrogen present, whereas only about 30 per cent. of the nitrogen is nitrified by the nitrifying bacteria. The former process is the more important in the removal of the polluting organic matter. But as it was possible that there was also a loss of nitrogen from the nitrate produced in the bed, a special filter of peat was erected to test this point. The filter was treated with sewage for 15 days until the quantity of nitrate ordinarily produced from the sewage was known. Along with the sewage there was then admitted a definite proportion of potassium nitrate. On analysing the effluent, it was found that there was now an additional loss of nitrogen, amounting to 14·9 per cent. of the nitric nitrogen added. There is thus a loss of nitrogen from reduction of nitrates formed in the bacteria bed, but this cause of loss is much inferior to the other, namely, the direct oxidation of the organic matter.
—J. H. J.

Industrial poisoning in 1910. Labour Gazette, March, 1911. [T.R.]

The following figures of cases of industrial poisoning occurring in premises under the Factory and Workshops Acts to persons employed therein, and notified to the Department in pursuance of those Acts and of the Notice of Accidents Act, 1906, have been published (subject to correction) in advance of the annual report of the Chief Inspector of Factories. The numbers are those of attacks (fatal or otherwise) reported during the year, and not reported, so far as is known, in the 12 months preceding such attacks. The figures in brackets at the right are those of deaths ascertained during the year, whether included (as attacks) in previous tables or not. The figures for 1909 are given in black for comparison:—Lead poisoning, 505 (^{38}), **553** (^{80}); smelting of metals, 34 (^{5}), **66** (^{5}); brass works, 7, **5**; sheet lead and lead piping, 4, **9** (^{2}); tinning, 17, **21**; vitreous enamelling, 17, **3**; white lead, 34 (^{1}), **32** (^{2}); red and yellow lead, 10, **10**; china and earthenware, 77 (^{11}), **58** (^{5}); glass cutting and polishing, nil, **4** (^{2}); electric accumulators, 31, **27** (^{2}); paints and colours, 17 (^{1}), **39** (^{2}); shipbuilding, 21 (^{2}), **27** (^{1}); use of paint in other industries, 51 (^{3}), **42**. (In addition to those included in the above, 232 (^{35}) cases of lead poisoning were reported among house painters and plumbers not employed under the Acts of 1910.) Other processes, 47 (^{3}), **57** (^{2}). Mercury poisoning, 10 (^{1}), **9**; barometer and thermometer making, 2, **1**; Phosphorus poisoning, nil, **3**; lucifer matches, nil, **3**; other industries, nil, *nil*. Arsenic poisoning, 7, **4**; paints, colours, and extraction of arsenic, 5, **4**; other industries, 2, *nil*. Anthrax, 51 (^{9}), **56** (^{12}); wool, 28 (^{3}), **28** (^{3}); horsehair, 6 (^{1}), **8** (^{2}); hides and skins, 14 (^{3}), **18** (^{6}); other industries, 3 (^{2}), **2** (^{1}). Total, 573 (^{48}), **625** (^{42}).

Lime-sulphur wash; Chemical investigation of the best conditions for making the ——. L. L. Van Slyke, A. W. Bosworth, and C. C. Hedges. New York Agric. Exper. Stat., Bull. No. 329, 1910.

The authors have continued the investigations on the preparation of lime-sulphur washes described in Bull. No. 319 (this J., 1910, 589) with the object of ascertaining the conditions under which the lime and sulphur are utilised most completely and with the formation of the maximum quantity of calcium pentasulphide. As the outcome of the present experiments the following proportions are recommended for making the wash:—36 lb. of lime (CaO), 80 lb. of high-grade, finely divided sulphur, and 50 galls. of water. When lime containing less than 100 per cent. of calcium oxide is used, a proportionally larger quantity must be taken, but in no case should lime be used which contains less than 90 per cent. of calcium oxide, or more than 5 per cent. of magnesium oxide. During the boiling process, water must be added from time to time in order to prevent the mixture concentrating below the 50 galls. level. The amount of impurities in a sample of lime may be determined approximately by boiling a mixture of 1 part of the lime and 2 parts by weight of sulphur with plenty of water for 1 hour. With a pure lime, only a slight amount of sediment is obtained, but impure limes yield sediments the volumes of which are approximate measures of the amounts of impurities in the samples.
—W. P. S.

Lime-sulphur mixtures; Experiments with home-made concentrated ——. P. J. Parrott and W. J. Schoene. New York Agric. Exper. Stat., Bull. No. 330, 1910.

The results are recorded of the effects obtained by the use of home-made concentrated lime-sulphur mixtures in various station experiments during the past three years; the results of experiments by seventeen fruit growers during the year 1910 are also given. The mixture, when used at suitable concentrations (see this J., 1910, 589), was found to be very effective in the case of San José scale and blister-mite. As regards the fruit growers' experiments, ten reported satisfactory results against blister-mite and one reported failure; in the case of San José scale, there were five reports of efficient control and two reports of partial success, due probably to difficulties in spraying large trees or to the use of mixtures of too low densities. Very dilute solutions of the mixture (about 1 to 40) were found to be fairly safe for use on apple foliage; in a number of orchards slight injuries were noticed on the more tender leaves, especially following the spraying after blossoming, but these injuries were generally obscured by the new growth in from seven to ten days. Damages of a more serious nature occurred in a few orchards, and dropping of fruit and leaves was noticed in one experiment. All the fruit growers expressed their intention to use the lime-sulphur mixture for the summer spraying of apple trees.—W. P. S.

Sulphur; Method of action of —— when used against oïdium. Marcille. Comptes rend., 1911, 152, 780—783.

The method of action of sulphur in destroying *oïdium* on vines has been ascribed to a variety of causes. It is shown that it is not due to any appreciable extent to its volatilisation or oxidation in sunlight to sulphur acids, but it is considered that action is due to the sulphur acids contained in the sulphur as an impurity. Ordinarily the dry mixture is inactive, but under damp conditions favourable to the development of spores, the acid is dissolved, impregnates the spores and mycelium, and destroys them when the acid is concentrated by evaporation. Vine growers require therefore sulphur rich in acid.—E. F. A.

Nicotine in tobacco juice and tobacco; Polarimetric determination of ——. J. von Degrazia. Fachliche Mitt. oesterr. Tabakregie, 1910, 87—90, 149—152. Chem. Zentr., 1911, 1, 1085—1086.

Thirty grms. of tobacco juice are mixed with 3·5 grms. of calcium oxide and 10 c.c. of water, and distilled rapidly with a current of steam, until about 180 grms. of distillate have been collected. The rotatory power of the distillate is then determined in a 200 mm. tube, and the percentage of nicotine calculated by means of the formula: $P=\frac{\alpha.G.f.}{g}$, where G is the weight of the distillate, g that of the tobacco juice, and f is a factor ("rotation-constant") taken from the table given below. For tobacco, 20 grms. of the finely powdered material are treated with 7 c.c. of potassium hydroxide solution (1 : 1), a few grms. of sodium chloride, and 130 c.c. of a boiling concentrated solution of sodium chloride, and distilled first rapidly without steam until about 45 c.c. have come over and then with steam until the distillate amounts to 100 c.c. The distillate is polarised as in the case of tobacco juice. The factor, f (see above), is needed on account of the alteration of the rotatory power of nicotine with the temperature. Solutions of nicotine of different concentrations were examined, at different temperatures, in the 200 mm. tube of a Lippich's half-shadow polarimeter, and the "rotation-constants" were determined (see following table) for rotation angles (α) between 0° and 5°.

	0·5°	1°	2°	3°	4°	5°
10° C. .	0·6365	0·6394	0·6045	0·6414	0·6419	0·6414
15° C. .	0·6315	0·6340	0·6349	0·6355	0·6354	0·6352
20° C. .	0·6264	0·6286	0·6293	0·6295	0·6288	0·6289

—A. S.

Ozonisation of air. A. Erlandsen and L. Schwarz. Z. Hyg. u. Infekt.-Krankh., 1910, **67**, 391—428. Chem. Zentr., 1911, **1**, 1071—1072.

The authors find that ammonia and hydrogen sulphide in air are not appreciably oxidised by quantities of ozone, theoretically sufficient for the purpose; the odour of small quantities of these gases is, however, masked by that of ozone. Similar results were obtained in experiments with a number of substances present in human exhalations, *viz.*, trimethylamine, butyric and valeric acids, indole, and skatole. The authors state that ozone, in concentrations such as are used in practice, does not effect any true purification of air.—A. S.

Patents.

Liquids; Employment of metals in the electric arc for sterilising ——. E. Urbain, A. Feige, and C. Scal, Paris. Eng. Pat. 5393, Mar. 3, 1910. Addition to Eng. Pat. 4795 of 1910 (this J., 1911, 442.)

In the sterilisation of liquids by means of ultra-violet rays emitted by an arc produced between "metallic carbons," the "carbons" employed may be manufactured from a paste consisting of a mixture of powdered metals, oxides, or salts, and the usual constituents employed in making the "carbons." (Reference is directed to Eng. Pats. 17,951 of 1900, 22,090 of 1903, and 6515 of 1906.)—W. P. S.

Water stills; Triple purification ——. J. A. Power, Jamaica, N.Y. Eng. Pat. 27,988, Dec. 1, 1910.

The still consists of a vertical cylinder divided into three superposed chambers. The lower chamber serves as the boiler, the middle portion as the condensed water reservoir, and the upper chamber contains condenser tubes. The steam leaving the boiler passes through tubes in the middle chamber and enters the condenser; a small air chamber is situated between the top of the boiler and the reservoir chamber and the current of steam carries with it a supply of hot air so that the condensed water is obtained in a thoroughly aerated state. The boiler is supplied with hot water from the upper portion of the condensing chamber by means of a constant-level device, and the necessary pipes for drawing off the condensed water, for flushing out the boiler, and for the supply of air to the hot-air chamber, etc., are provided.—W. P. S.

Oil and fat mixtures containing formaldehyde; Preparation of —— *for disinfecting, deodorising, or preservative purposes.* Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Ger. Pat. 230,980, Jan. 22, 1909.

Animal or vegetable oils or fats containing acids, or resin oils, or free fatty or resin acids of fatty or oily nature, are treated first with phenols or with tar oils rich in phenols, and then with gaseous or aqueous formaldehyde. The fats, oils, or acids may first be mixed with aliphatic or aromatic hydrocarbons of an oily character; they may also be replaced by mixtures of fatty oils, fats, or resin oils with free fatty or resin acids.—T. F. B.

Disinfectants: Process for preparing ——. A. Loewenthal. Ger. Pat. 231,057, May 7, 1909.

Disinfectants whose activity extends over a considerable period are obtained by dissolving in oils or fats, ethers or their substitution products which evolve formaldehyde when in contact with water; for example, methylalkyl ethers in which the methyl group contains a halogen or acidic group as substituent, may be employed.—T. F. B.

Detecting unsaturated hydrocarbons in air. Ger. Pat. 230,749. *See* XXIII.

Apparatus for testing air and gases. Ger. Pats. 231,117 and 231,118. *See* XXIII.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Cinchona bark; A crystalline deposit from a fluid extract of ——. *Determination of cinchona alkaloids, and quinine silicotungstate.* M. Javillier and B. Guérithault. Bull. Sci. Pharmacol., 1911, **18**, 93—96. Chem. Zentr., 1911, **1**, 1065.

A crystalline deposit which separated from a fluid extract of cinchona bark prepared by the American method of percolation with a mixture of glycerin, alcohol, and water was found to consist almost entirely of calcium quinate; it was free from alkaloids.

Yvon's method for the determination of cinchona alkaloids by means of silicotungstic acid was found to give excellent results. Quinine silicotungstate has the formula, $SiO_2,12WO_3,2H_2O,2C_{20}H_{24}O_2N_2+7H_2O$. It is a pale yellow powder, of constant composition when precipitated under varied conditions; it loses 6 mols. of water at 120° C.—A. S.

Quinic acid; Some reactions of ——. R. Guyot. Bull. Soc. Pharm. Bord., February, 1911, 52. Pharm. J., 1911, **86**, 461.

Quinic acid, $C_7H_{12}O_6$, occurs in sugar-like crystals, and has an acid taste like that of citric acid. The crystals are anhydrous, and are very soluble in water and in alcohol. The aqueous solution when exposed to the air is rapidly attacked by moulds, which set up protocatechuic fermentation. The acid is eliminated from the organism in the form of hippuric acid. The following tests may be used to identify the substance:—Into a test tube are placed 2 c.c. of sulphuric acid, one drop of resorcinol reagent, then 2 c.c. of a $N/10$ quinic acid solution. In the cold there is no apparent reaction, but on heating a very fine green fluorescence develops, and remains for a long time. It is necessary to have the liquid sufficiently dilute in order to see the fluorescence to the best advantage. The reaction is characteristic, and may be used inversely for the detection of resorcinol. Sulphuric acid gives, in the heat, with the solution of quinic acid a green colouration, but no fluorescence. On dropping a particle of betanaphthol into such a solution there is developed on the surface a rose tint passing to vivid red, very distinct from the green solution. This when heated fluoresces green. On dry-distilling quinic acid, hydroquinone is obtained; this is also formed on heating the aqueous solution of the acid with puce-coloured oxide of lead, according to the following reaction: $C_7H_{12}O_6+O=C_6H_6O_2+CO_2+3H_2O$. More energetic oxidation by means of chromyl chloride, or manganese dioxide and sulphuric acid, serves to produce quinone, which may be identified by the green quinhydrone formed by means of ferric chloride. In titrating quinic acid, which is monobasic, the methods employed for the stronger acids may be used, with indicators such as litmus or phenolphthalein. The latter indicator is to be preferred. The author finds that commercial samples of quinic acid are not satisfactory as regards their purity.

Caffeine and theobromine; Separate determination of ——. C. Monthulé. Rép. Pharm., 1911, 23, 50—51.

To determine theobromine in presence of caffeine, 0·20 grm. of the mixed alkaloids is dissolved in a small quantity of ammonia, introduced into a graduated 100 c.c. flask, and treated with 20 c.c. of $N/10$ silver nitrate solution. If a precipitate be formed, it is redissolved by adding more ammonia. Distilled water is then added to half fill the flask; the ammonia is neutralised by acetic acid, with phenolphthalein as indicator. The liquid is made up to 100 c.c. with water, filtered, and the amount of uncombined silver determined in 50 c.c. of the filtrate by titration by the Charpentier-Volhard method (with thiocyanate solution). Representing the number of c.c. of $N/10$ thiocyanate used as n, the percentage of theobromine in the mixture will be $(10-n)\times16{\cdot}6$. Correction will be necessary for any chlorides, iodides or bromides present in the original mixture. The caffeine present may be determined by evaporating another portion of the above filtrate to dryness, and extracting the dry residue with chloroform, in presence of sodium chloride.—J. O. B.

Digitalis powder; Action of hydrogen peroxide upon old ——. E. Choay. J. Pharm. Chim., 1911, 3, 343—345.

Some digitalis leaves were dried in three different ways, in a vacuum in the cold, in the open air, and in a stove at 40° C. After several months the leaves were powdered. It was found that the preparation dried in a vacuum was about twenty times more active in decomposing hydrogen peroxide than the preparation dried in the stove. The air-dried preparation had an intermediate activity.
—F. Shdn.

Pepsin; Assay of ——. L. Portes. J. Pharm. Chim., 1911, 3, 341—343.

According to the French Codex, the products formed after the digestive action of pepsin are cooled, filtered, and tested with nitric acid at the ordinary temperature. The author has found that the temperature requires a more exact specification, as a test of a preparation when cooled to 10° C. gave a precipitate, whilst a test of the same preparation cooled to 20° C. gave no precipitate on adding the acid. The peptic digestion should be conducted in a water bath at 50° C., and the temperature to which the product is to be cooled before filtering and acidifying should be fixed at either 20° or 15° C.—F. Shdn.

Thea Sasanqua; Essential oil of ——. H. Kimura. Ber. deuts. Pharm. Ges., 1911, 21, 209—212.

The fresh young leaves of *Thea Sasanqua*, grown in Japan, yielded from 0·4 to 1·0 per cent. of an essential oil when distilled with steam after previously macerating with water. The oil contains about 97 per cent. of eugenol, with traces of a ketonic or aldehydic substance, and a small amount of a fragrant ester. The latter, on hydrolysing, gives an acid with an unpleasant smell and an alcohol with an odour resembling that of rose oil.—F. Shdn.

Arsenic in atoxyl [sodium p-aminophenylarsonate]; and arsacetin [sodium acetyl-p-aminophenylarsonate]; Determination of ——. E. Rupp and F. Lehmann. Apoth.-Zeit., 1911, 26, 203—204. Chem. Zentr., 1911, 1, 1082—1083.

0·2 grm. of the substance is heated with 10 c.c. of concentrated sulphuric acid to 70° C., and then 1 grm. of potassium permanganate crystals added, in small portions, with agitation, followed by 5—10 c.c. of officinal (Ger. Pharmacopœia) hydrogen peroxide until the solution is clear. The solution is diluted with 20 c.c. of water, boiled for 10—15 minutes, and then diluted with 50 c.c. more of water. After cooling, 2 grms. of potassium iodide are added, and after standing for 1 hour, the liberated iodine is titrated with $N/10$ thiosulphate, without any indicator. The method is a simplified modification of the German Pharmacopœia process.—A. S.

Ethyl alcohol; Influence of water on the boiling point of —— *at pressures above and below the atmospheric pressure.* J. Wade and R. W. Merriman. Chem. Soc. Proc. 1911, 27, 65.

The ratio of water to alcohol in the binary mixture of minimum boiling point, isolated by Young and Fortey (this J., 1902, 720) by systematic fractional distillation, is increased by raising, and diminished by lowering, the pressure under which the fractionation is effected. At pressures below about 80 mm., corresponding with temperatures below about 25° C., ethyl alcohol and water cease to form a binary mixture. Under these conditions, anhydrous alcohol is the most volatile phase present in ordinary spirit, and may be separated from the water to any desired extent by systematic fractional distillation. For the same reason, although alcohol, contrary to general belief, is not appreciably hygroscopic, the percentage of water in moist alcohol is slowly increased by exposing it to air, or even by passing dry air through it.

Patents.

Iron, albumin, and phosphorus; Manufacture of compounds containing ——. W. Wolff und Co., G. m. b. H., Elberfeld, Germany. Eng. Pat. 16,048, July 5, 1910. Under Int. Conv., July 23, 1909.

Compounds containing iron, albumin, and phosphorus are obtained by the interaction of animal or vegetable albumin, or products containing albumin, a soluble iron salt, and metaphosphoric acid or its salts. These compounds can be obtained with as much as 15 per cent. of iron and 20 per cent. of phosphoric anhydride. They form soluble alkali salts, and sparingly soluble or insoluble salts with alkaline-earths or heavy metals. A compound containing about 11 per cent. of iron, 19 per cent. of phosphoric anhydride, and 9·5 per cent. of nitrogen, is obtained by adding 10 litres of 50 per cent. ferric chloride solution and 3 kilos. of metaphosphoric acid to a solution of 10 kilos. of dry egg-albumin in 300 litres of water; the mixture is made feebly alkaline, and the new compound precipitated by addition of acid, filtered, washed, and dried.—T. F. B.

Pharmaceutical preparation; Manufacture of a ——. F. R. von Arlt, Vienna. Eng. Pat. 24,240, Oct. 19, 1910. Under Int. Conv., Nov. 10, 1909.

The solubility of copper citrate in water is materially increased by the addition of sodium borocitrate; preparations suitable for use in treating diseases of the skin and eyes, are obtained by mixing these constituents together in a dry state, or by preparing solutions or ointments of them. A solution suitable for treating trachoma is made by dissolving 0·25 part of copper citrate, 0·4 part of sodium borocitrate, and 0·8 part of sodium chloride in 100 parts of water.—T. F. B.

ω-Para-alkyloxyphenylethylamines and their N-alkyl derivatives; Manufacture of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 26,645, Nov. 16, 1910. Under Int. Conv., March 1, 1910.

By the action of ethylene-chlorhydrin on *p*-alkyloxybromobenzenes, primary *p*-alkyloxyphenylethyl alcohols are obtained; when these are treated with phosphorus halides, ω-*p*-alkyloxyphenylethyl halides are formed, which are converted into the corresponding ω-*p*-alkyloxyphenylethylamines or their N-alkyl derivatives by means of ammonia or alkylamines.—T. F. B.

Pinacone; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 411, Jan. 6, 1911. Under Int. Conv., June 2, 1910.

Two mols. of acetone are treated with one mol. of magnesium in presence of mercuric chloride and benzene or toluene, and the organo-magnesium compound thus formed is decomposed (*e.g.*, by addition of water), and the pinacone isolated. The use of benzene or toluene in place of the excess of acetone necessary in Holleman's process, is stated to be advantageous.—T. F. B.

Anhydrides of acidylsalicylic acids; Process for preparing ——. A. Einhorn. Ger. Pat. 231,093, March 6, 1910. Addition to Ger. Pat. 224,844, July 7, 1908 (see this J., 1910, 1134).

Acidylsalicylic anhydrides are obtained by prolonged heating of the mixed anhydrides of acidylsalicylic acids and other carboxylic acids, of the formula, $R.CO.O.C_6H_4.COO.CO.R'$. The resulting mixture of acidylsalicylic anhydride and the anhydride of the other carboxylic acid may be separated by means of ether, benzene, etc.—T. F. B.

Local immunisation and cure of diseased tissues ; Preparation of substances for the ——. A. Wassermann. Ger. Pat. 231,110, March 4, 1909. Addition to Ger. Pat. 229,131, Nov. 8, 1908.

In carrying out the process described in the principal patent (see Eng. Pat. 25,675 of 1909 ; this J., 1910, 451), it is important that the bacterial products be not heated above 60° C., otherwise their activity is diminished ; a temperature about 50° C. is recommended. For the same reason, the treatment with acid or alkali should be effected with not more than 1 per cent. of *N*/1 acid or alkali solution (see also Ger. Pat. 229,355 of 1910 ; this J., 1911, 240).—T. F. B.

Lecithin solutions ; Process for preparing ——. P. Bergell. Ger. Pat. 231,233, June 10, 1910.

Freshly prepared lecithin is dissolved in glycerol. The resulting solutions can be very readily emulsified with aqueous or alcoholic liquids, and may be used for subcutaneous or direct injection, and for other medicinal purposes. The glycerol serves as a preservative of the lecithin.—T. F. B.

Mercury cholate ; Process for preparing ——. J. D. Riedel A.-G. Ger. Pat. 231,396, May 5, 1910. Addition to Ger. Pat. 171,485, Jan. 1, 1905 (see Eng. Pat. 11,180 of 1905 ; this J., 1905, 939).

The decomposition of salts of cholic acid by means of mercuric salts is effected in aqueous-alcoholic solution (see also Ger. Pats. 224,980 and 225,711 ; this J., 1910, 1134, 1271).—T. F. B.

Albumin preparations soluble in water, containing sodium guaiacolsulphonate ; Process for producing ——. Bauer und Co. Sanatogenwerke. Ger. Pat. 231,589, Dec. 14, 1909. Addition to Ger. Pat. 229,183, Feb. 27, 1909 (see this J., 1911, 240).

Solutions of the monosodium salts of the mixed sulphonic acids, obtained by the sulphonation of guaiacol at 100° C., are treated with the sodium salt of animal or vegetable casein or an albuminate ; the product is evaporated to dryness at a low temperature, preferably *in vacuo*, or the albumin-sodium guaiacolsulphonate may be precipitated from its aqueous solutions by means of ether-alcohol, etc. ; alternatively, the aqueous solution of sodium guaiacolsulphonate is treated with an ether-alcohol suspension of the albuminoid, and the product filtered off and dried. —T. F. B.

Lecithin, lecith-albumin, and their by-products ; Process of obtaining —— *out of raw material containing lecithin.* J. Habermann and R. Ehrenfeld, Brünn, Austria-Hungary. U.S. Pat. 987,133, March 21, 1911.

See Fr. Pat. 390,683 of 1908 ; this J., 1908, 1176.—T. F. B.

Organic fatty-acid compounds ; Process of manufacturing new ——. H. Rossner and W. Cotton, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 988,032, March 28, 1911.

See Eng. Pat. 13,790 of 1908 ; this J., 1909, 519.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Latent images obtained by means of silver chloride or bromide emulsions ; Differentiation of —— *by chemical development.* A. and L. Lumière and A. Seyewetz. Comptes rend., 1911, 152, 766—768.

The sodium salt of quinone-monosulphonic acid may be used as a means for distinguishing gelatinochloride from gelatinobromide emulsions ; though it is ordinarily an oxidising agent, it acquires reducing properties in presence of sodium sulphite. A solution of 10 grms. of the quinonesulphonate and 50 grms. of anhydrous sodium sulphite in 1 litre of water will develop a normally exposed gelatinochloride image in a few minutes, but will have no effect on a gelatinobromide image, even if over-exposed, after half-an-hour ; a chlorobromide image is reduced, but to a much smaller extent than the chloride image. Photographic developers containing amino-groups do not act in this way, neither does quinol nor catechol. Pyrogallol in presence of sulphite is the only developer which could be used in place of the solution mentioned, but the distinction is not so well defined as with sodium quinonesulphonate.—T. F. B.

Patents.

Sensitised plates, films, papers, etc., for use with Röntgen rays. G. Bucky. Ger. Pat. 230,964, March 11, 1909.

Ordinary photographic plates, films, papers, etc., are rendered insensitive to daylight whilst retaining their sensitiveness for Röntgen rays, by incorporating with them one or more dyestuffs which absorb all actinic light rays ; either the whole of the plate, etc., may be impregnated with the dyestuff, or the sensitive film (or the whole plate) may be covered with a dyestuff film composed of starch, gelatin, etc.—T. F. B.

Coating picture-films ; Method of ——. W. A Daniels, Assignor to National Waterproof Film Co., Chicago. U.S. Pat. 987,437, March 21, 1911.

See Eng. Pat. 24,556 of 1909 ; this J., 1910, 1228.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Nitrates and nitric esters [gun-cotton, etc.] ; Commercial valuation of ——. M. Marqueyrol and D. Florentin. Bull. Soc. Chim., 1911, 9, 231—240.

Determinations of the nitrogen in nitric esters such as gun-cotton, etc., by Lunge's nitrometer were found to give lower results than those obtained by Schlœsing's method. This is due to the reaction between the mercury and the concentrated sulphuric acid used, resulting in the formation of sulphur dioxide (this J., 1898, 795) and the gradual reduction of the nitric oxide into nitrogen and nitrous oxide. By employing, however, acid of 94—94·5 per cent. strength, very accurate results were obtained with Lunge's nitrometer as modified by Horn (this J., 1893, 185). In the case of metallic nitrates the water used to dissolve the salt sufficiently reduces the strength of the acid.—A. Sbld.

Explosives ; Permissible —— *tested prior to Jan.* 1, 1911. C. Hall. U.S. Dept. of the Interior, Bureau of Mines, Miners' Circular 2.

The following explosives have now been added to the "permissible" list (see this J., 1909, 1274 and 1910, 783) :—Bental Coal Powder No. 2 ; Bitumenite Nos. 3, 4, 5, and 7 ; Coalite Nos. 2 DL and 3X ; Coal Special Nos. 2W, 3W, 4, and 5LF ; Collier powder Nos. 5 special, 5LF, X, 2LF, 3, 6LF, and 8LF ; Nitro-low-flame Nos. 1 and 2 ; Titanite Nos. 7P and 8P ; Trojan coal powders B, C, D, E, and F.

The circular also contains the tests for permissible explosives (this J., 1909, 1274) and the precautions necessary when using them.

Comparative study of inflammable powders with respect to inflammability. Taffanel and Durr. *See* IIa.

Patents.

Explosive. J. B. Bronstein, Oakland, Cal. U.S. Pat. 986,900, March 14, 1911.

The explosive contains 76—88 parts of ammonium nitrate, 6—12 of a crystalline carbohydrate and 6—12 of a finely divided oxidisable metallic substance (*e.g.*, iron pyrites). A mixture containig 82·2 per cent. of ammonium nitrate, 9 of sugar, and 8·8 of iron pyrites is specially claimed. —J. H. L.

Explosive. N. Ceipek, Vienna. U.S. Pat. 988,244, March 28, 1911.

A mixture of ammonium nitrate with 6 per cent. of carbonised turmeric powder, 4 per cent. of trinitrotoluene, and 3 per cent. of sodium chloride. Carbonised cereal flour may also be added.—A. S.

XXIII.—ANALYTICAL PROCESSES.

Gases disengaged from the walls of tubes of glass, porcelain and silica. M. Guichard. Comptes rend., 1911, **152**, 876—879.

In studies on the extraction of gases from metals heated *in vacuo*, and in methods of analysis based on the absorption of gas by solids heated in tubes of glass, porcelain or silica, it is important to ascertain what errors may arise from the disengagement of gas from the walls of the tubes. The most precise method of determining the disengagement of gas from the walls of the tubes consists in following, at a given temperature, the variations of pressure produced in the apparatus, by means of a MacLeod's gauge. It was found that tubes of Jena glass give, in the cold, at low pressure, a negligible disengagement of gas. The gases which can be extracted from doubly glazed tubes of porcelain are of extremely variable quantities. Opaque tubes of silica are visibly seamed with minute canals containing gases.—R. C. P.

Lime and magnesia: Separation of ——. E. Murmann. Monatsh. Chem., 1911, **32**, 105—115.

The author finds that trustworthy results, in the separation of lime from magnesia, may be obtained if the slightly acid solution containing the calcium and magnesium salts be treated with ammonium chloride and oxalic acid and then rendered nearly neutral to methyl orange by the addition of either aniline, pyridine, or quinoline. The calcium oxalate is precipitated completely in the cold within 10 minutes. This process has the advantage over the ammonia-ammonium oxalate method that correct results may be obtained with concentrated solutions of magnesium salts containing relatively small quantities of calcium salts. Precipitation of the lime from acetic acid solution with the addition of mercuric chloride, and the sodium sulphate method, yielded unsatisfactory results. (See also this J., 1910, 1085.)—W. P. S.

Calcium; Separation of strontium from ——. L. Moser and L. Machiedo. Chem.-Zeit., 1911, **35**, 337—338.

Nitric acid (sp. gr., 1·45) is found to dissolve 190 mgrms. of strontium nitrate per litre. Rawson's method for the separation of strontium and calcium, depending upon the insolubility of this nitrate in cold concentrated nitric acid (this J., 1897, 113), is regarded, therefore, as unreliable.
—F. Sodn.

Aluminium, chromium and iron; Quantitative precipitation of ——. E. Schirm. Pharm. Zentralh., 1910, [22]. Collegium, 1911, 99—100.

The hydroxides of these metals, as usually precipitated by ammonia, are voluminous and difficult to wash. Other metals also are co-precipitated and the hydroxides may pass through the filter in the colloidal form. The method proposed is as follows. The solution containing 0·1—0·2 grm. of the metals is, if acid, neutralised with ammonia as far as this is possible without precipitation, and diluted to 250 c.c. 20 c.c. of a 6 per cent. solution of ammonium nitrite are added and the solution is heated to boiling until the smell of nitrogen oxides is not apparent. After heating on the water-bath for $\frac{1}{4}$—$\frac{1}{2}$ hour, the finely divided precipitate is washed several times with hot water by decantation, filtered through a filter of 11 cm. diam., dried, ignited in a Rose's crucible and weighed. If, in the original solution, there is more ammonium salts than 1 per cent. in 250 c.c., the precipitation is not complete after longer boiling. In this case ammonia must be added drop by drop, after boiling off oxides of nitrogen until their odour is just perceptible; the solution is then heated in the water-bath and the operation completed as above.—D. J. L.

Ash; Exact method of determining —— in the analysis of vegetable and animal matter. E. Fleurent and L. Lévi. Comptes rend., 1911, **152**, 715—718.

The authors have studied the extent and nature of the loss of phosphorus which occurs in an ordinary ash determination and have also worked out a method in which this loss is avoided. The loss is found to vary in amount, from 7—49 per cent. of the total phosphorus, and is due partly to the action of carbon and silica and partly to the volatilisation of phosphorus compounds with the fat. The following method of determination is recommended:—Fat is first removed, if necessary, and the material is charred in a platinum crucible at as low a temperature as possible; the mass is powdered and returned to the crucible and moistened with a solution (or milk) of lime containing 0·04—0·15 grm. of calcium oxide for 10 grms. of material taken, according to the proportion of phosphorus present; this mixture is then evaporated to dryness, and the determination is finished by Schlœsing's method (careful calcination in a current of carbon dioxide and then in a slow stream of oxygen), the weight of lime used being deducted from the ash.—F. Sodn.

Sulphur and halogens; Determination of —— in organic substances. J. Marcusson and H. Döscher. Chem.-Zeit., 1910, **34**, 417—418.

The Hempel-Graefe method (see this J., 1893, 181; 1904, 563) proposed by Graefe for the determination of sulphur in coals, mineral oils, etc., has been modified by the authors and is recommended as a generally applicable process for the determination of sulphur and halogens in organic substances. The modified method consists essentially in burning the substance in an atmosphere of oxygen, in presence of sodium hydroxide solution, in a stoppered glass bottle, encased in a wire gauze envelope. For holding the substance a small platinum cylinder, 18 mm. diam. and 11 mm. high is used: the side walls of the cylinder are perforated and a small external side tube is provided by which the cylinder is supported on a wire depending from the stopper of the bottle. After filling the bottle with oxygen and pouring in 100 c.c. of a 10 per cent. solution of sodium hydroxide, the bottle is closed by a cork. The substance (about 0·3 grm.) is then placed in the platinum cylinder, which has been lined with cotton wool, and is covered with a layer of cotton wool. Easily volatile liquids are dropped on to cotton wool contained in a small glass tube as described by Graefe (this J., 1904, 563). The cylinder is then placed in position on the wire and a piece of thread is wound round the latter so that one end projects into the platinum vessel, whilst the other reaches to the level of the stopper. The thread is then set alight and the stopper inserted in the bottle, and held in place during the first period of rapid combustion. About one hour after the combustion is complete, the contents of the bottle are removed and the halogens or sulphur determined in the usual way as silver halide or barium sulphate.—A. S.

Examination of asphaltum. Marcusson. *See* IIa.

Detecting animal sizing in paper. Differentiation between gelatin and casein. Levi. *See* V.

Report of Special Committee of Amer. Soc. Civil Eng. on uniform tests of cement. *See* IX.

Determination of lead in zinc ores. Merrill. See X.

Viscosity of liquids used for the mechanical separation of minerals. Clerici. *See* X.

Determination of caoutchouc as tetrabromide. Hinrichsen and Kindscher. *See* XIV.

Testing tanning extracts. Gansser. *See* XV.

Analysis of dégras. Fahrion. *See* XV.

Determination of water-soluble matter in sole and upper leather. Gödel. *See* XV.

The peroxydase of cows' milk and the reaction with paraphenylenediamine. Nicolas. *See* XIXa.

Saccharin [in mineral waters, etc.] in Egypt. Muller. *See* XIXa.

Polarimetric determination of nicotine in tobacco juice and tobacco. Von Degrazia. *See* XIXb.

Determination of cinchona alkaloids, and quinine silicotungstate. Javillier and Guérithault. *See* XX.

Reactions of quinic acid. Guyot. *See* XX.

Separate determination of theobromine and caffeine. Monthulé. *See* XX.

Assay of pepsin. Portes. *See* XX.

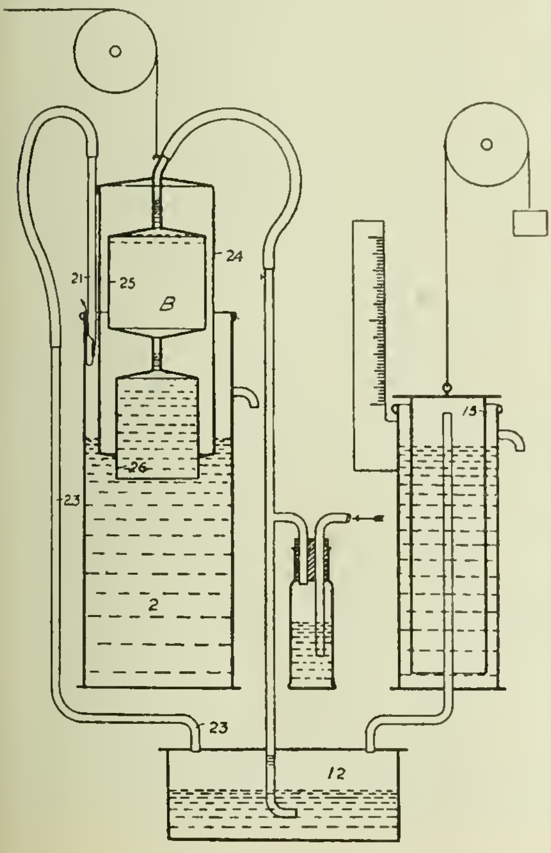
Determination of arsenic in atoxyl and arsacetin. Rupp and Lehmann. *See* XX.

Commercial valuation of nitrates and nitric esters. Marqueyrol and Florentin. *See* XXII.

Patents.

Gas analysis apparatus. J. F. Simmance and J. Abady, London. Eng. Pat. 26,168, Nov. 10, 1910.

A bell, *B*, consisting of upper and lower compartments 25, 26, contained within an outer cylindrical vessel, 24 is caused to rise and fall periodically, drawing in a volume of gas on the up-stroke and expelling it through an absorbent liquid, 12, to a recording bell, 15, on the down-stroke. A vent pipe, 21, is carried by the vessel, 24, and during the first part of the down-stroke the gas expelled from the container escapes from the absorber, 12, through the pipe, 23, connected with the vent, 21, but as soon as the latter has become immersed to the proper depth in the liquid in the vessel, 2, the gas passes to the recording bell, 15. In this manner the pressure is reduced to standard conditions irrespective of any variation of pressure at the source of supply of the gas to be analysed.—H. H.



Unsaturated hydrocarbons in air; Process for detecting ——. L. Zuccoli. Ger. Pat. 230,749, Feb. 9, 1910.

The air to be tested is passed through a starch-iodine solution, the colour of which is discharged by unsaturated hydrocarbons. The apparatus consists of a pump and a tube containing the reagent, these being connected by a valved tube which serves not only for the passage of the air to be tested but also for the removal of the reagent. —A. S.

Air and gases; Apparatus for testing —— *by the change of colour of a liquid reagent.* M. Arndt. Ger. Pats. 231,117, and 231,118, Nov. 21 and 23, 1909.

The patents relate to methods in which the air or gas is tested by means of a coloured liquid reagent. A scoop or ladle, operated mechanically, is caused at intervals to withdraw small measured quantities of the reagent from a receptacle and to transfer the liquid thus withdrawn to the thread, ribbon, rod, or the like, which is exposed to the air or gas to be tested. According to the second patent, the scoop is fixed to one end of a bar which is rotated by means of clockwork or similar mechanism, and the thread or ribbon to which the reagent is transferred, consists of a number of separate pieces, one above the other, the upper end of each piece being in a small bowl into which the reagent drops from the lower end of the next higher piece.—A. S.

Gas-calorimeter; Recording ——. C. H. and F. G. Beasley, Smethwick, and R. H. Bradbury, Oldbury, Assignors to Parkinson and W. and B. Cowan, Ltd., Birmingham. U.S. Pat. 987,537, March 21, 1911.

See Eng. Pat. 16,647 of 1909; this J., 1910, 1040.—T. F. B.

Colour estimation; Apparatus for ——. J. W. Lovibond, Salisbury. U.S. Pat. 987,148, March 21, 1911.

See Eng. Pat. 23,746 of 1909; this J., 1910, 652.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Surface-tension between water and oil; Influence of the acidity of the aqueous solution on the ——. W. Reinders. Van Bemmelen-Festschrift, 333—341. Chem. Zentr., 1911, 1, 944.

By addition of varying quantities of sodium hydroxide to solutions of phosphoric acid, solutions were prepared which were all $N/10$ with respect to total phosphoric acid, but which contained different relative proportions of free and combined phosphoric acid. The surface tension between oil and these solutions was then determined at 18° C. by the falling drop method. It was found that there is a parallelism between the weight of the drops and the logarithm of the hydrogen ion concentration of the solution. If the former be plotted as a function of the latter, a line is obtained which is straight in the middle, but at higher hydrogen ion concentrations bends to the left and at lower concentrations to the right, and then follows the direction of the axis of hydrogen ion concentrations. Different oils behave in a similar manner. With unrefined oils and oils to which oleic or stearic acid have been added, however, the size of the drops is smaller; indeed, when the acid-content of the aqueous solution is high, drops are no longer formed, the oil flowing in a continuous stream. Stearic acid has a more pronounced effect than oleic acid. Stable emulsions are obtained only when the surface tension is very small.—A. S.

Trade Report.

Customs treaty between Great Britain and Japan. [Cd. 5556.] Foreign Office.

An agreement between these countries was signed in London on April 3, whereby British goods imported into Japan receive preferential treatment. The item of direct interest to the chemical trade is as follows :—

Paints :

4. Other :

A. Each weighing not more than 6 kilos., including the weight of the receptacle, duty not exceeding 4·25 yen per 100 kin. (including receptacles).

B. Other, duty not exceeding 3.30 yen per 100 kin.

It is also provided that Great Britain will continue to admit free of duty ten kinds of Japanese produce, including camphor and camphor oil and rape-seed oil.

It is further stated that caustic soda produced on a manufacturing scale and being the ordinary caustic soda of commerce, such as that styled 60 per cent., 70 per cent., and 76—77 per cent., will not be classed as refined, and will be subject to duty under tariff No. 163 (2).

Customs tariff of Bulgaria. Board of Trade J., March 30, 1911.

The following are among the alterations made in the Bulgarian Tariff :—

Cottonseed oil imported for industrial purposes, after denaturing, shall be dutiable at 5 fr. per 100 kilos.

Pine resin, coal and coke for heating, essence of roses, vegetable materials for tanning, alkali hydroxides and carbonates, manganese peroxide, sodium and aluminium sulphate, alums, sodium and potassium chlorides (for use as manure), sodium nitrate, potassium and sodium bichromates, and sulphur, are to be free of duty. Magnesium carbonate is dutiable at 1 fr. per 100 kilos., magnesium chloride at 2 frs., gypsum at 5 frs., and saccharin at 100 frs. per 100 kilos.

Books Received.

Simmance and Abady's Copyright Tables of Corrections for Harcourt's 10-Candle Pentane Lamp. Alexander Wright and Co., Ltd., 1, Westminster Palace Gardens, Artillery Row, Victoria Street, London, S.W. 1911. Price £2 2s.

Ten tables, stiff cardboard, gilt-edged, containing all Simmance and Abady's corrections for atmospheric conditions of Harcourt's ten-candle pentane lamp. The tables each measure 13½ ins. long by 12¼ ins. wide, and are contained in a cloth case, so made that it may be conveniently suspended for reference to the tables.

Electrical Engineering Abstracts. Published by the International Institute, 57—58, Chancery Lane, London, W.C. 1910.

This is one of the seven sections of the Journal of the International Institute of Technical Bibliography, published monthly, viz. :—Section I., Mechanical engineering. II. Electrical engineering. III. Civil engineering. IV. Mining and metallurgy. V. Applied chemistry. VI. Supplement. VII. Military engineering (including aerial navigation). Subscription per section, 24s. per annum, post free. The abstracts consist of brief bibliographic notices. It is stated that the Journal is not intended to replace any of the existing technical periodicals, but to assist those desirous of finding articles of sdoeail value to themselves.

Crystallography and Practical Crystal Measurement. By A. E. H. Tutton, D.Sc., F.R.S. Macmillan and Co., Limited, St. Martin's Street, London. 1911. Price 30s.

8vo volume, containing 933 pages of subject-matter with 720 illustrations, and an alphabetical index. The subject is treated under two chief heads. I. Morphological and II. Physical.

I. Morphological. (i.) Nature of crystals. (ii.) Preparation and selection of measurable crystals, etc. (iii.) Goniometer. (iv.) Measurement of crystal angles. (v.) Crystal axes, etc. (vi.) Zones, and their teaching. (vii. and viii.) Formulæ for the calculation of crystal angles, etc. (ix.) Crystals as homogeneous structures. (x.) Crystal symmetry, etc. (xi. to xxiv.) Cubic, tetragonal, rhombic, monoclinic and other systems, with practical examples of each. (xxv.) Drawing of crystals. (xxvi.) Composite crystals and twinning. (xxvii.) Planes of cleavage, etc. (xxviii.) Goniometry, etc. (xxix.) Density of crystals, and its determination. II. Physical. (xxxiv. to xlix.) Optical studies of crystals. (l to lii.) Crystallographic microscope, etc. (liii.) Thermal expansion of crystals and its determination. (liv.) Elasticity of crystals and measurement. (lv.) Hardness of crystals and liquid crystals.

New Ideas on Inorganic Chemistry. By Dr. A. Werner. Professor of Chemistry in the University of Zürich. Translated, with the author's sanction, from the second German edition, by E. Percy Hedley, Ph.D. Longmans, Green and Co., 39, Paternoster Row, London, New York, Bombay, and Calcutta. 1911. Price 7s. 6d.

8vo volume, containing 268 pages of subject matter. The text is subdivided and arranged as follows :—I. The elements. II. Chemical compounds. III. Units of valency. IV. Considerations on affinity and valency. (i.) Compounds of the first order. (ii.) Compounds of higher order. (iii.) Isomerism in inorganic compounds.

Färbemethoden der Neuzeit. Von Professor Max Bottler. Verlag von Wilhelm Knapp. Halle a. S. 1910. Price M. 12.

Large 8vo volume, containing 281 pages of subject matter, and an alphabetical index. The subject-matter is classified under the following heads :—I. Survey of the most important of the more recent dyestuffs. II. Classification of the dyestuffs. III. Wool. IV. Textile materials in wool dyeing V. Silk. VI. Cotton. VII. Vat dyes. VIII. Sulphur dyestuffs. IX. Half-wool dyeing, etc. X. Textile materials of the cotton, and half-wool dyeing industries. XI. Half-silk. XII. Wool-silk. XIII. Dyeing of linen, half-linen, hemp, and ramie. XIV. Dyeing of jute, koko-fibre, piassava, sisal and manila-hemp.

Laboratoriumsbuch für die Kaliindustrie. Von Dr. L. Tietjens und Dr. H. Roemer. Verlag von Wilhelm Knapp. Halle a. S. 1910. Price M. 3.60.

8vo volume, containing 72 pages of subject matter with 8 illustrations, a bibliographic list of references, and an alphabetical index of subjects. The treatment of the subject may be gathered from the following divisions of the text :—I. Analytical reagents and apparatus necessary. II. Sampling, etc. III. Salts of the German potash industry. IV. By-products of the German potash industry. (*a*.) Bromine. (*b*.) Magnesium chloride. (*c*.) Kieserite. V. Potassium nitrate. VI. Potassium salts, etc. VII. Appendix. Methods of determination, including the official method of the German Agricultural Research stations. Methods of reduction. Neubauer's method.

Features of Producer Gas Power-Plant Development in Europe. By R. H. Fernald. U.S. Bureau of Mines, Bulletin 4. Government Printing Office, Washington.

8vo booklet containing chapters on the use of anthracite, coke, bituminous coal, brown coal briquettes, and peat in gas-producers, and on the use of blast-furnace or coke-oven gas. Descriptions are given of plants in Great Britain, Holland, Germany and Sweden.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

Patent Specifications may be purchased at the Sale Branch of the Patent Office, Quality Court, Chancery Lane, London, W.C., fifteen days after the date on which acceptance of the complete specification is advertised. The price is 8d. each.

I.—GENERAL PLANT; MACHINERY.

Applications.

8533. Pauling. Drying of gases or vapours.* April 5.

8573. Royston (Pearlman). Rotary furnaces.* April 6.

8694. Mueller. Cooling towers and the like.* April 5.

8850. Crossley. Filter presses. April 10.

8858. Bailey and Hartley. Filter presses. April 10.

9040. Goodwin and Booth. Filtering and washing apparatus. April 11.

9228. Gobbi. Filters. [Fr. Appl., April 21, 1910.]* April 13.

9258. Linden. *See under* XIX.

Complete Specifications Accepted.

8142 (1910). Stott. Drying machines. April 12.

8303 (1910). Cotterell. Apparatus for distilling water and other liquids. April 12.

8875 (1910). Feld. Apparatus for subjecting gases or vapours to the action of liquids. April 20.

8884 (1910). Tattersall. Apparatus for evaporating, cooling, and moistening fluids. April 20.

14,279 (1910). Daubiné. Drying air. April 12.

14,767 (1910). Grace. Discharging solid matter from filter presses and pressure filters. April 12.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

8279 and 8280. Pyzel. Sweating-out truck and pans for sweating out from crude paraffin or like mixtures substances which melt at different temperatures. [Divided Appls. on 22,313, Sept. 26, 1910.]* April. 3.

8284. Lyle. Continuous destructive distillation of small or finely divided vegetable substances. April 3.

8630. Shenton. Manufacture of carbon dioxide and hydrogen. April 7.

8650. Clapham. Apparatus used in purifying gas. April 7.

8725. Koppers. Convertible gas retorts and coke ovens. [Ger. Appl., April 15, 1910.]* April 7.

8835. Green. Gas producers.* April 10.

8996. Lüdecke, and Imperial Lamp Works. *See under* XI.

9099. Wilson. Gas producers.* April 12.

9105. Rigby and Testrup. Wet carbonising apparatus and the like. April 12.

9209. Bone, Wilson, and McCourt. Combustion of gaseous or gasified fuel. April 13.

9358. Beimann. Production of liquor containing ammonium chloride in the carbonisation of coal and the like. April 15.

Complete Specifications Accepted.

8379 (1910). Lloyd, and Simon-Carves Bye-Product Coke-Oven Co. Treatment of coke oven and like gases. April 12.

9494 (1910). Woodall and Duckham. Heating vertical retorts. April 20.

10,400 (1910). Campbell. Suction gas producers. April 12.

16,631 (1910). Duckham. Delivery of volatile products from gas retorts, coke ovens, etc. April 20.

20,245 (1910). Falding and Cathcart. Purification of gas and recovery of values present as impurities. April 12.

20,409 (1910). Taylor. Purifying or decolorising crude petroleum, fatty substances, etc. April 20.

24,283 (1910). Ernst. Gas producers. April 12.

27,450 (1910). Farnham. Gas producers. April 20.

III.—TAR AND TAR PRODUCTS.

Applications.

8727. Soly and Davier. Industrial recuperation of benzine or its homologues. [Fr. Appl., Nov. 24, 1910.]* April 7.

9111. Newton (Bayer und Co.). Manufacture of anthraquinone derivatives. April 12.

9168. Soly and Davier. Apparatus for the recuperation of benzine and its homologues. [Addition to No. 8727 of 1911.]* April 12.

Complete Specifications Accepted.

17,100 (1910). Fendler and Frank. Rendering halogen-hydrocarbons soluble in dilute soap solutions. April 12.

17,639 (1910). Bartel. Treatment of tar to obtain oils having a high percentage of bitumen. April 12.

24,872 (1910). Ellis (Soc. Chim. des Usines du Rhone). Manufacture of *o*-nitrobenzaldehyde. April 20.

IV.—COLOURING MATTERS AND DYES.

Applications.

8294 and 8295. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. April 3.

8305. Durand, Huguenin, und Co. Manufacture of leuco dyestuffs of the gallocyanine series. [Ger. Appl., April 11, 1910.]* April 3.

8474. Holliday and Sons, Ltd., Turner, and Dean. Manufacture of black colouring matters. April 5.

8590. Newton (Bayer und Co.). Manufacture of azo dyestuffs suitable for preparing lakes. April 6.

8704. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds and colouring matters of the anthracene series. April 7.

8900. Imray (Soc. Chem. Ind. in Basle). Manufacture of halogenised vat dyestuffs. April 10.

9003. Act.-Ges. f. Anilinfabr. Monoazo dyestuffs. [Ger. Appl., July 4, 1910.]* April 11.

9004. Act.-Ges. f. Anilinfabr. Manufacture of black cotton dyestuffs. [Ger. Appl., Oct. 26, 1910.]* April 11.

9116. Meister, Lucius, und Brüning. Manufacture of vat dyestuffs. [Ger. Appl., April 25, 1910.]* April 12.

9112. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters containing sulphur. April 12.

9257. Meister, Lucius, und Brüning. Manufacture of vat dyestuffs. [Ger. Appl., June 16, 1910.]* April 13.

Complete Specifications Accepted.

11,044 (1910). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of hair dyes and their application. April 12.

17,143 (1910). Cons. f. Elektrochem. Ind. Production of indoxyl, its derivatives and homologues. April 12.

28,677 (1910). Bloxam (Chem.Fabr. Griesheim-Elektron). Manufacture of orange to red cotton dyestuffs. April 12.

2233 (1911). Act.-Ges. f. Anilinfabr. Manufacture of yellow wool dyestuffs. April 12.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

8313. Verein. Glanzstoff-Fabr. Conversion of formyl esters of cellulose or their solutions in formic acid into solid plastic solutions. [Ger. Appl., May 18, 1910.]* April 3.

8614. British Thomson-Houston Co. (General Electric Co.). Purification of fibrous material. April 6.

8638. Dorner. Utilisation of maize straw.* April 7.

9336. Palatine Artificial Silk Yarn Co. (Ditzler). Manufacture of artificial silk and like products. April 15.

Complete Specifications Accepted.

132 (1910). Arledter. Process for electrically sizing paper. April 12.

8539 (1910). Bals. Preparation of cellulose. April 12.

8647 (1910). Merckens and Manissadjian. Non-inflammable transparent films. April 20.

9269 (1910). Wickel. *See under* VI.

24,382 (1910). Ellis (Chem. Fabr. von Heyden). Manufacture of cellulose esters of fatty acids. April 20.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

8260. Ainley. Machines for treating with liquids textile piece goods, warp yarns, etc. [Addition to No. 19,135 of 1909.] April 3.

8288. Fenny (Bemberg A.-G.). Width-dyeing piece-goods in a short bath.* April 3.

8315. Leech. Treatment of textile fabrics. April 3.

8378. Copley. Preparing fibres for treatment with liquids. April 4.

8424. Jaumandreu. Baths for treating textiles in the form of threads, cords, hanks, and fabrics.* April 4.

8733. Trotman. Waterproofing fabrics. April 8.

8887. Fortuny. Printing on fabric, paper, or other material. [Fr. Appl., May 24, 1910.]* April 10.

9073. Sackville. Finishing, filling, and colouring textile fabrics. April 12.

Complete Specifications Accepted.

9028 (1910). Bell. Mordants and reducing agents for dyeing and printing woollen piece goods, yarn, etc. April 20.

9090 (1910). Krokert. Printing woven fabrics. April 20.

9269 (1910). Wickel. Producing dry coloured coatings on webs of paper and fabric. April 20.

9321 (1910). Cox. Printing warps and the like. April 20.

11,044 (1910). Bloxam (Act.-Ges. f. Anilinfabr.). *See under* IV.

12,527 (1910). Ransford (Soc. de la Manuf. d'Indiennes E. Zundel). Finishing of fabrics. April 20.

12,551 (1910). Copley. Mercerising cotton or vegetable fibres. April 20.

14,272 (1910). Newton (Bayer und Co.). Production of fast shades on fibres and fabrics. April 12.

15,819 (1910). Becke. Production of multi-coloured effects in spun and woven goods. April 12.

3228 (1911). Baudot. Wool washing or degreasing machines. April 20.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

8317. Dittmar. Manufacture of chemically pure phosphoric acid. [Addition to No. 8094 of 1910. Ger. Appl., Jan. 5, 1911.]* April 3.

8503. Bergius. Preparation of superoxides of the alkaline earths. [Ger. Appl., April 18, 1910.]* April 5.

8512. Ashcroft. Decomposition of salts of the alkali metals, and production of amides, cyanamides, cyanides, hydrates, and alkali metals. April 5.

8528. Boult (Cox). Treatment of sulphuric acid.* April 5.

8630. Shenton. *See under* II.

8706. Weston. Evaporation of brine for making salt. April 7.

8936. Radcliff. *See under* X.

8986. Winstanley. Manufacture of ammonia and its salts. April 11.

9174. Thwaites. Treatment of copper liquors. April 13.

9260. Ges. f. Linde's Eismaschinen. Separation of hydrogen from mixtures of gases. [Ger. Appl., Sept. 3, 1910.]* April 13.

9273. White. Manufacture of iodides and bromides. April 13.

9293. Thompson. Manufacture of certain compounds of alkali metals. April 13.

9358. Beimann. *See under* II.

Complete Specifications Accepted.

7746 (1910). Sauer. Production of hydrogen. April 12.

21,268 (1910). Weaver Refining Co., and Neill. Manufacture of acid phosphates and phosphoric acid from bones and the like. April 20.

23,158 (1910). Pietzsch and Adolph. Manufacture of hydrogen peroxide. April 20.

24,413 (1910). Heys (Nitrogen Co.). Separation of nitrogen from air. April 12.

VIII.—GLASS; CERAMICS.

Application.

9244. Pilkington. Glass furnaces.* April 13.

Complete Specifications Accepted.

8535 (1910). Gregory. Furnaces for drawing glass. April 12.

10,966 (1910). Dressler. *See under* IX.

20,502 (1910). Burckhardt. Moulding of fused quartz and the like. April 12.

IX.—BUILDING MATERIALS.

Applications.

8368. Allsebrook and Robertson. Manufacture of artificial building materials. April 4.

8468. Koenman. Preservation of wood.* April 5.

9272. Julians, and British Stone and Marble Co. Manufacture of artificial stone. April 13.

Complete Specifications Accepted.

10,966 (1910). Dressler. Production of glazed, enamelled, or analogous surfaces on tiles, bricks, etc. April 20.

16,096 (1910). Mason. Manufacture of refractory bricks, blocks, tuyères, etc., used in connection with furnaces for smelting metals. April 20.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

8320. Tjaaland. Alloy for cutting instruments, tools, etc. [Appl. in Norway, April 8, 1910.]* April 3.

8362. Hughes. Annealing or heat treatment of metals and alloys. April 4.

8498. Mackie and Forwood. Manufacture of steel. April 5.

8794. Ranson. Extraction of zinc from ores. April 8.

8840. Stobie. Manufacture of ferrochrome of low carbon contents. April 10.

8894. Feodosieff. Cementation of steel. April 10.

8897. Feodosieff. Manufacture of chrome steel. April 10.

8936. Radcliff. Treatment of complex radium ores. [Australian Appl., Feb. 7, 1911.]* April 10.

9030. Spencer. Manufacture of iron ore blocks or briquettes. April 11.

9031. Solomon. Smelting or refining metals, etc. April 11.

9227. Smart. Aluminium alloys. April 13.

9370 and 9371. MacNaughton, and Metals Extraction Corporation, Ltd. Extraction of tin from ore. April 15.

9372. Blandy, and Metals Extraction Corporation, Ltd. Extraction of tin from its ores. April 15.

Complete Specifications Accepted.

676 (1910). Bourcoud. Manufacture of iron and other metals. April 20.

9082 (1910). Cowper-Coles. Electro-deposition of iron. April 20.

10,790 (1910). Fries. Flux for use in soldering aluminium. April 12.

16,096 (1910). Mason. *See under* IX.

18,272 (1910). Hicks. Blast furnaces. April 20.

29,723 (1910). Johnson (Heraeus). Alloys of platinum. April 20.

XI.—ELECTRO-CHEMISTRY.

Applications.

8901. Stassano. Electric furnace.* April 10.

8996. Lüdecke, and Imperial Lamp Works (Brimsdown), Ltd. Electric furnaces for treating metal filaments. April 11.

8998. Lake (Florence). Electric furnaces.* April 11.

9070. Fischer. Electric furnaces. April 12.

Complete Specifications Accepted.

15,166 (1910). FitzGerald. Electric furnaces. April 12.

19,805 (1910). Reid. Means for regulating electrodes in electric furnaces. April 20.

207 (1911). Heil. Galvanic batteries. April 20.

XII.—FATS; OILS; WAXES.

Applications.

9023. Lake (Blakeman). Oils and fats and compounds therefor.* April 11.

9027. Lake (Blakeman). Oils and compounds thereof.* April 11.

Complete Specifications Accepted.

20,409 (1910). Taylor. *See under* II.

22,605 (1910). Morgenstern. *See under* XVIII.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Application.

8590. Newton (Bayer und Co.). *See under* IV.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

8261. Bailey and Bailey. Production of a substitute for indiarubber compounds. April 3.

8987. Howard. Production of soft resilient rubber.* April 11.

9045. Sauer and Gössel. Artificial indiarubber and its production from soya oil. [Ger. Appl., April 12, 1910.]* April 11.

9115. Scott. Treatment of waste rubber. April 12.

9156. Gall. Apparatus for treating plastic substances such as rubber or coagulable latices with liquids or solvents. April 12.

Complete Specification Accepted.

14,251 (1910). Banchieri. Devulcanisation of indiarubber. April 20.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

8318. Bartels. Manufacture of artificial horn from casein. [Addition to No. 21,750 of 1910.]* April 3.

8678. Falvey. Making leather. April 7.

9320. Williamson. Preparation of leather for mechanical purposes. April 15.

Complete Specifications Accepted.

3140 (1911). Boehringer Sohn. Process for deliming hides. April 20.

7639 (1911). Reidel. Artificial leather. April 12.

XVI.—SOILS; FERTILISERS.

Complete Specifications Accepted.

21,268 (1910). Weaver Refining Co., and Neill. *See under* VII.

22,851 (1910). Coates. Fertilisers. April 20.

XVII.—SUGARS; STARCHES; GUMS.

Application.

8381. Barker (Henning Process Sugar Extraction Co.). Manufacture of sugar.* April 4.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

8494. Phillips. Utilisation of waste from malt liquors and the like. April 5.

8946. O'Brien (Betriebs u. Studien Ges. f. Alkoholarmes Bier). Removing the coagulable albumen and allied substances in fermented beer and manufacture of beer containing little or no alcohol.* April 11.

Complete Specifications Accepted.

8652 (1910). Forster and Finitzer. Fermenting process. April 20.

22,605 (1910). Morgenstern. Process for obtaining alcohol or alcoholic matters from wool fat. April 20.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

8769. Adams. Filter for liquid purification. April 8.

8815. Klein. Means for treating coffee beans. [Addition to No. 24,793 of 1910.]* April 8.

9047. Triquet. Apparatus for sterilising liquids by ultraviolet rays. [Fr. Appl., Nov. 14, 1910.]* April 11.

9214. Bray, Curtis, and Telford. Flavouring preparation.* April 13.

9258. Linden. Mechanical and chemical treatment of liquids, especially water.* April 13.

Complete Specifications Accepted.

14,127 (1910). Henri, Helbronner, and von Recklinghausen. Sterilisation of liquids. April 20.

14,611 (1910) and 3766 (1911). Vasey. Production of soluble protein or albumen from meat fibre or other insoluble protein matter. April 20.

22,251 (1911). Waddington. Treatment of sewage. April 20.

26,783 (1910). Nogier. Apparatus for sterilising liquids by ultra-violet rays. April 12.

30,378 (1910). Savary-Carlier. Purification of water by heating. April 12.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

9359. Meister, Lucius, und Brüning. Manufacture of a dimethylphenylbenzylammonium sulphonic acid. [Addition to No. 7204 of 1911. Ger. Appl., Aug. 30, 1910.]* April 15.

9360. Meister, Lucius, und Brüning. Manufacture of a dimethylbenzylammonium monosulphonic acid. [Addition to No. 7204 of 1911. Ger. Appl., Nov. 21, 1910.]* April 15.

Complete Specification Accepted.

2344 (1911). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of santalol and menthol ethers. April 12.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Complete Specifications Accepted.

8647 (1910). Merckens and Manissadjian. *See under* V.

19,554 (1910). Ruth. Manufacture of colour screens for colour photography. April 20.

XXII.—EXPLOSIVES; MATCHES.

Application.

8968. Ugalde. Explosive. April 11.

Complete Specification Accepted.

22,525 (1910). Boult (Stillwell). Machines for packing nitroglycerine compounds or similar explosives into cartridge cases. April 20.

XXIII.—ANALYTICAL PROCESSES.

Complete Specification Accepted.

15,408 (1910). Tresize and Sheppard. Photometers. April 12.

Journal of the Society of Chemical Industry.

No. 9, Vol. XXX. MAY 15, 1911. No. 9, Vol. XXX.

Official Notice.

ANNUAL GENERAL MEETING, 1911.

In accordance with the provisions of By-law 64, notice is hereby given that the Annual General Meeting will be held in the Montgomery Hall, Sheffield, at 10.30 a.m., on Wednesday, July 12th, 1911. A programme of the proceedings will be issued later.

In accordance with the provisions of By-law 24, notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting. The only Ordinary Member of Council eligible for re-election to that office is Mr. W. J. Leonard, under By-law 32.

Dr. Rudolph Messel has been nominated to the office of President under By-law 20; Sir William Crookes, O.M., F.R.S., Mr. H. Hemingway, and Dr. G. G. Henderson have been nominated Vice-Presidents under By-law 21; and Mr. Walter F. Reid has been nominated a Vice-President under By-law 20. Mr. Thomas Tyrer has been appointed Hon. Treasurer, and Dr. J. Lewkowitsch, Hon. Foreign Secretary under By-law 35.

Members are hereby invited to nominate, on or before May 23rd next, fit and proper persons to fill four vacancies among the Ordinary Members of Council under By-law 24. Forms for this purpose can be obtained, on application, from the Secretary of the Society.

By-law 23:—An ordinary member of Council shall be nominated by ten or more members upon Form B in the Schedule, a copy of which form shall be furnished by the Secretary upon the written or verbal request of any member, but a member shall not be eligible to sign more than one such nomination form, and the member nominated shall sign the declaration set forth on the form. A nomination shall be declared invalid by the Council if:

a. The member thereon nominated is disqualified for election, or ineligible to be elected, as provided by the By-laws.

b. The nomination is not made on the authorised printed form or substantially not in the manner directed thereon.

c. The nomination form is signed by less than ten members not disqualified or not ineligible to nominate as provided by the By-laws.

d. The nomination form is not received before or upon the day appointed therefor.

e. The member nominated has not signed the declaration printed upon the form.

A member whose nomination aforesaid is declared to be invalid shall receive notice thereof from the Secretary, and shall not be submitted for election.

Charles G. Cresswell,
Secretary.

Canadian Section.

Meeting held at Kingston, Ontario, on Friday, February 24th, 1911.

PROF. W. LASH MILLER IN THE CHAIR.

THE MANUFACTURE OF EXPLOSIVES.

BY DR. LEO F. GUTTMANN.

USE OF PERMITTED EXPLOSIVES.

BY C. J. COLL.

THE CARE, HANDLING, AND USE OF EXPLOSIVES.

BY E. W. MONK.

New York Section.

Meeting held at Chemists' Club on Friday, March 24th, 1911.

DR. C. F. MCKENNA IN THE CHAIR.

THE NATURE OF THE COMBINATION BETWEEN FIBRE AND DYE.

BY JEROME ALEXANDER.

Dreaper and Wilson have observed (this J., 1908, 28, 57) that the colour-changes produced by immersing in dilute acid fibres dyed with sensitive dyes, vary considerably with the nature of the fibre. Thus with cotton the changes were about the same as those produced in aqueous solutions of the dyestuffs in question, whereas silk and wool showed colour-changes of a different nature.

In a paper presented to the Seventh International Congress of Applied Chemistry, I pointed out that after the addition of protective colloids (gelatin or gum arabic) to solutions of benzopurpurin, dilute acids produced colour-changes analogous to those observed in the dyed animal fibres, silk and wool.

In the case of a pure dilute solution of benzopurpurin, the addition of dilute mineral acids quickly changed the colour from bright red to dark blue, reminding one of the change of pure colloidal gold. Stronger acid coagulated the dye, which settled out of solution but which could be re-dissolved with restoration of the original colour, by neutralising the acid with alkali. The same solution of benzopurpurin, to which gelatin or gum arabic had been added, gave with dilute mineral acids a claret-red solution. More concentrated acid changed the shade to chocolate-brown, without, however, causing any precipitate.

As previously planned (see Trans. Am. Inst. Chem. Eng., 2, 222) I have examined these colour-changes in the ultra-microscope, and results seem to throw some interesting light on the nature of the combination between dyed fibre and dye.

A very dilute solution of benzopurpurin shows in the ultra-microscope a field full of ultramicrons which, from their brilliancy and motion, appear to be about 50—60 $\mu\mu$ in size. When a little acid is allowed to diffuse in under the cover glass, the ultramicrons gradually gather together into clumps or groups, whose motion decreases as their size increases, until the whole dye is deposited on the slide in coagulated masses of bright ultramicrons. Stronger acid causes instant coagulation in large masses.

When, however, acid is added to the dye solution containing gelatin or gum arabic, no change is produced unless the acid be strong enough to cause a more or less extensive agglutination of ultramicrons into small groups of two or three, which, however, still have sufficient motion to keep afloat. Gelatin has apparently much greater protective action than gum arabic.

Test-tube tests showed that starch exerts very slight protective action, for the colour-changes produced in solutions of benzopurpurin containing large quantities of thin starch paste were very pronounced, resembling those of dyed cotton fibres. It would seem, therefore, as I previously stated, that the variation in the colour-changes produced by immersing in dilute acid the different fibres dyed with benzopurpurin *is due to their difference in protective action on the "adsorbed" dye.*

This brings us to a consideration of the much mooted question of the nature of the combination between fibre and dye.

I need hardly refer to the extensive literature on this subject or repeat the arguments of those who support the principal theories of dyeing. There is no doubt but that *some* kind of a combination does occur, and in this case, as in all others, the nature of the combination must depend upon the state of subdivision of the combining substances. Thus absolutely dry chlorine does not unite chemically with absolutely dry sodium; but the presence of a little water ionises or subdivides both into particles that combine to form sodium chloride. If the reacting particles are atoms, molecules, or ions, we have, or may have, true chemical combination. If the reacting particles are composed of *small masses* of atoms, molecules, or ions which vary in size, the so-called force of "chemical attraction" is not exerted to the same degree, nor with the same regularity, but it is nevertheless able to produce the indefinite and irregular compounds known as absorption or colloid compounds. If the combining substances are in a still coarser state of subdivision, we may have a simple physical mixture.

Now in the case of dyes we have two factors to consider: the state of subdivision of the fibre or substratum, and the state of subdivision of the dye. We should not be surprised, therefore, to find that heat and dilute alkali, which generally exercise a subdividing or deflocculating action on the particles of dye in solution, should cause a closer union of dye and fibre. How considerable this effect is, has been pointed out in a recent paper of Dreaper and Wilson (this J., 1909, **29**, 1432), who found that Acid Anthracene Red was much more firmly held by silk when dyed at 100° C. than when dyed at 18° C. In fact, the authors state "that from a practical point of view, high temperature of the dyebath is the essential factor in order that the dye may be fixed by the fibre and not merely adsorbed." Dreaper and Wilson also found that in the presence of sodium carbonate an increased percentage of dye in the dyebath was necessary in order to secure the standard shade (see this J., 1909, **29**, 1433). "These results," they state, "are as interesting as unexpected, and give no support to the idea that acid dyebath is necessarily essential when dyeing animal fibres with ordinary acid dyes, nor to the suggestion that the free colour acid must be present in the dyebath. The dye is fixed under conditions which seem to give little support to the Perrin electrical theory of dyeing, or to the theory which assumes ionisation of the dye in the dyebath, but the alkali may play some part in determining an altered state of solution, or aggregation of the particles which may be favourable to dyeing."

Ultramicroscopic examination shows that the alkali does in fact cause a marked change in the state of aggregation of the dissolved dye. A dilute solution of Acid Anthracene (Chromate) Red (Cassella) exhibits in the ultramicroscope a field which, although showing many ultramicrons, would indicate that part of the dye is in a very fine state of subdivision, if not in true solution. Dilute acid caused no flocculation, but seemed to bring the dye into more perfect solution. Upon dissolving some of the dye in *N*/20 sodium carbonate, the field showed quite a few large coagulated masses of ultramicrons, which evidently represented only part of the dye, because a beaker of this alkaline solution upon standing yielded but a very slight sediment. Besides, the alkaline solution showed a rather more marked Tyndall effect than the neutral aqueous solution. Very concentrated alkali (sodium carbonate) caused most of the dye to flocculate and settle out of solution.

These observations were made at ordinary room temperature, and cannot, therefore, be compared with the results of Dreaper and Wilson, which were made at 100° C. I found, however, that upon heating, the dye which had been flocculated by the concentrated alkali went into solution again, but settled out once more as the solution cooled.

It is evident, then, that the state of the dye in solution is much altered by both alkali and change in temperature. It is further possible that the dye is flocculated upon and within the fibre by *adsorbed* alkali, so that, as Dreaper and Wilson found, it is not readily removed by alkaline soap, although alcohol dissolves it to a larger extent. I hope to make ultramicroscopic examination of the dyed fibres and the heated dye solutions, which will perhaps give further information as to the state of the dye on the fibre. By watching the actual process of the fixation of the colour, it may also be possible to detect changes in the substratum or fibre.

DETERMINATION OF LEAD IN ALLOYS CONTAINING ANTIMONY AND TIN.

BY A. G. BLAKELEY AND E. M. CHANCE.

PROBABLY the best known and most useful methods for the determination of lead are based upon the isolation of this metal as its sulphate. This separation, usually so simple and definite, leaves, however, much to be desired when antimony and tin are present in appreciable proportions. In this case the precipitate of lead sulphate is contaminated by varying amounts of the basic salts of these interfering metals, which make its filtration extremely troublesome, interfere with its subsequent solution, and totally prevent its gravimetric estimation.

Walker and Whitman* have published a method by which certain of these difficulties have been obviated. It has been the experience of the writers, however, that while this method is excellent for the determination of relatively large percentages of lead, its accuracy is doubtful when determining small quantities. Tin does not appear to interfere. Antimony, on the other hand, when present in any great quantity, irrespective of the percentage of lead, renders the results of questionable value. The inaccuracy appears to be due to the co-precipitation with the lead chloride of basic antimonic chloride. For example, a Babbitt metal containing 15 per cent. antimony and 83 per cent. lead gave the following values for lead by this method: 90·57 per cent., 90·72 per cent., 92·04 per cent., 92·10 per cent., 95·29 per cent., 102·30 per cent. It might seem highly desirable, therefore, to remove the antimony and tin from solution before attempting the isolation of the lead. Probably the most efficient means at our disposal for effecting this separation is the method of A. Rossing,† in which the lead is obtained as sulphide. This precipitate is either washed from the filter and dissolved in nitric acid, the separated sulphur filtered off, and the filter washed with the acid, or is treated with nitric acid directly on the filter.‡ Even so apparently simple a procedure still presents difficulties, for the separated sulphur almost invariably occludes some unattacked sulphide, as well as some little sulphate, formed by direct oxidation. Moreover, the filter paper tenaciously retains sulphate produced through the same agency.

Lord§ has suggested a device whereby these sources of error are obviated. By this method the filter containing the impure lead sulphide is dried, the sulphide detached, the filter burned, the dried sulphide added to the ash, and the whole gently ignited. The oxides thus obtained are then dissolved in nitric acid and treated with sulphuric acid as usual. Though this method is of undoubted merit, it might seem rather laborious and time-consuming.

The writers have found that the preceding difficulties may be eliminated by treating the filter paper containing the lead and other insoluble sulphides obtained after the Rossing separation, in a flask with nitric acid. Sulphuric acid is then added, and the contents of the flask boiled until all nitric acid is expelled and most of the organic matter destroyed. Solid potassium permanganate is then added, and the boiling continued for a moment to destroy all remaining organic matter. The excess of permanganate is removed after dilution by boiling for a few moments with a little sulphurous acid or sodium bisulphite. The lead is determined, after the solution of its sulphate in sodium acetate, by A. H. Low's very accurate dichromate method,‖ portions of which are subsequently quoted.

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* Jour. Ind. and Eng. Chem., **1**, 519. See also Olsen, Quant. Chem. Anal., 3rd Ed., p. 140.

† Treadwell, 2nd Ed., Vol. 2, p. 220.

‡ Stillman, Eng. Chem., 3rd Ed., p. 395.

§ Notes on Metallurgical Analysis, 2nd Ed., p. 217.

‖ Technical Methods of Ore Analysis. 3rd Ed., p. 331.

The procedure in detail is as follows: Treat 0.5 grm. of the finely divided alloy, or such quantity as will contain about 0.3 grm. of lead in a 250 c.c. beaker with a minimum of aqua regia, or 5 : 1 hydrochloric acid and potassium chlorate. After solution evaporate the contents of the beaker to a pasty consistency on a steam or water bath. Add 5 c.c. of concentrated hydrochloric acid and warm, then 15 or 20 c.c. of water. A few crystals of tartaric acid may be added at this point. Now add 20 per cent. sodium hydroxide in slight excess, disregarding any precipitate which may form. Add 50 c.c. of sodium sulphydrate, or more if required to produce an excess, and warm gently on steam or water bath with occasional stirring for half an hour. At this point the separated sulphides should be perfectly flocculent and should subside readily. Decant through an 11 cm. C. S. and S. filter No. 597, and wash by decantation with hot water containing 10 c.c. of the sodium sulphydrate per litre. The precipitate is finally entirely transferred to the filter, and washed until 15 c.c. of the filtrate give a separation of milky sulphur containing no coloured sulphides when acidified with acetic acid. Now transfer the filter and precipitate to a 500 c.c. Jena Erlenmeyer flask. Add 25 c.c. of 2 : 3 nitric acid and boil, best over the free flame, manipulating the flask in a holder, until the filter is entirely disintegrated and no black particles remain. Add 15 or 20 c.c. of concentrated sulphuric acid, and continue the boiling until white fumes of sulphuric anhydride appear, and the filter paper is thoroughly carbonised. Care must be taken here to continue the boiling until no solid carbonaceous matter remains, and the sulphuric acid has acquired a black or caramel colour, a procedure which requires only four or five minutes at the most. Remove the flask from the flame, allow to cool slightly, and cautiously add 0.1 or 0.2 grm. of pulverised potassium permanganate, and heat again. Repeat these operations until the brown colour of the sulphuric acid is entirely destroyed, and the acid is coloured slightly pink or green. Allow to cool, and add 50 c.c. of water, bring to a boil, and drop in sulphurous acid or a 10 per cent. solution of sodium bisulphite while boiling, until the colour due to the excess of permanganate is completely discharged. Allow the flask to stand hot for 15 minutes, then cool to room temperature with the addition of 25 c.c. of alcohol and filter. Wash with cold 10 per cent. sulphuric acid, concluding with one wash of pure cold water. It is by no means necessary nor desirable to transfer all of the lead sulphate to the filter. The C. S. and S. No. 551 black filter is admirably adapted to use here, for with the white filters it is often difficult to be certain that all of the lead sulphate has been removed in the subsequent operations. Place the flask containing the remaining lead sulphate under the funnel, open the filter carefully, laying it against the inside of the funnel, so that its whole interior is exposed, and wash its contents into the flask with a boiling solution of sodium acetate contained in a wash bottle. The greatest care must be taken that every trace of lead sulphate is removed. Now add sodium acetate solution to the contents of the flask, and warm until the whole of the lead sulphate has dissolved and the solution is perfectly bright and clear. In case there is a persistent turbidity, an incomplete sulphide separation is indicated. Add 20 per cent. sodium hydroxide drop by drop to the solution, until a cloud forms, which just does not redissolve. If the percentage of lead is low, it is advisable to add a few drops of phenolphthalein and add the alkali until a pink colouration is produced. Now add acetic acid drop by drop until the solution just clears or the colour of the phenolphthalein is discharged. Add 10 c.c. of a 10 per cent. solution of potassium dichromate (the powdered commercial article), heat the mixture to boiling, and boil gently for one or two minutes or until the precipitate becomes of a deep orange colour and settles fairly well on removing from the heat. Longer boiling does not harm, but is unnecessary. Filter through an 11 cm. filter and wash filter and precipitate ten times with a hot dilute solution of sodium acetate (50 c.c. of a cold saturated solution of the commercial salt diluted to 1 litre), using perhaps 5—6 c.c. each time. Now again place the clean flask under the funnel, remove and open the filter as before, and wash the precipitate back into the flask with a jet of cold dilute hydrochloric acid (1 : 2). Continue the washing until every trace of residual lead chloride is dissolved, and no trace of colour remains on the filter. Dilute the filtrate with cold water until the flask is nearly two-thirds full, and add 2 c.c. of a 50 per cent. solution of potassium iodide. Mix gently and titrate without delay (to avoid possible loss of iodine by volatilisation) with standard sodium thiosulphate solution until the brown colour becomes faint; then add sufficient starch liquor to produce a strong blue colour, and finish the titration very slowly, finally a drop at a time, allowing each drop a little time to produce its full effect, until the solution becomes a clear pale green with no tinge of blue. The end point is sharp, but care must be exercised or it may easily be passed by a drop or two.

Standardise the thiosulphate solution on pure lead foil. Dissolve 0.3 grm. of lead foil in a little 2 : 3 nitric acid contained in a 200 c.c. flask. Boil the solution, add 5 c.c. of concentrated sulphuric acid evaporate to fumes of sulphuric anhydride, cool and add 50 c.c. of water. Boil for a moment and cool again with the addition of 25 c.c. of alcohol. After filtration treat the washed lead sulphate as described above.

A close approximation to its lead value may be obtained by multiplying the normality of the thiosulphate by 0.06799.

"Bismuth[*] in small amounts does not interfere with the above method, since it remains in solution as sulphate when the lead sulphate is filtered off. When, however, several per cent. of bismuth are present, an indefinite amount is liable to remain with the lead as basic sulphate and raise the result. The bismuth may be detected during the neutralisation of the sodium acetate solution by the failure of the white cloud to redissolve in excess of acetic acid. In such a case add a few drops of phenolphthalein solution, make again slightly alkaline with the sodium hydroxide, then faintly acid with acetic acid, add the dichromate, and boil for a minute or so as usual. Now remove from the heat and add about 2 grms. of citric acid dissolved in a little water and mix by agitating. Any bismuth chromate will go into solution at once. Filter without delay, lest the composition of the lead chromate change somewhat by standing in the hot acid mixture, and finish as usual." Solutions required:—

Sodium sulphydrate: 500 grms. sodium sulphide are dissolved in 1 litre of water. Portions of this solution are saturated with hydrogen sulphide, and filtered as required for use.

Sodium thiosulphate: The usual $N/10$ solution.

Sodium acetate: 90 grms. lead-free sodium acetate and 8 c.c. of 99·5 per cent. acetic acid per litre.

REPORT OF SEVERAL CASES OF POISONING BY THE VAPOUR OF BENZOL.

BY CHARLES GLASER.

I had occasion during the summer of 1909 to examine a number of cases of accidental poisoning at one of our leading tin can factories. The officers of the company, desiring that others should profit by their experience, have given me permission to bring the matter to the notice of the public.

Two reports on the Baltimore cases were furnished, one by the attending physician, Dr. L. V. Selling, published in the Johns Hopkins Bulletin, February, 1910, the other by myself, published in the same Bulletin, January, 1911.

The accidents, of which two proved fatal, were caused by the prolonged inhalation of vapours of the c.p. benzol of the trade. By comparing the two reports it is seen that the medical side has based its case on the assumption that the vapours of benzol *per se* should be held responsible, while the chemical evidence points to an accumulative poisonous action of small quantities of nitrobenzol, as wholly or in a contributory way responsible for the cases. Before any of the patients were taken dangerously ill, they all appeared to be suffering from severe anæmia. In fact, everybody around the premises where benzol was used, was found to be in a more or less anæmic condition. When a case took a turn for the worse, symptoms of purpura hæmorrhagica became prominent, as will be seen in Dr. Selling's report.

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[*] Technical Methods of Ore Analysis. 3rd Ed., p. 334.

Since cases of pernicious anæmia are rather frequent among employees of certain industrial establishments, it appears probable that chronic poisoning due to the action of either benzol vapour alone, or to benzol vapour more or less laden with nitrobenzol, occurs more often than is generally realised. As the reports on the Baltimore cases show, the question is far from definitely settled, and it is highly desirable to get as much positive information in other cases as can be collected, in order to throw light on the dangers surrounding the industrial uses of benzol.

It is probably correctly stated in the literature that benzol itself is a poison. But we have also in the Baltimore cases strong evidence that poisonous action was only observed from a time when, as shown in the writer's report, minute quantities of nitrobenzol were present.

If additional material along the same lines can be collected, it will become the duty of chemists in charge of benzol works to make sure that their benzol is always free from even traces of nitrobenzol. As the occurrence of the latter is probably entirely accidental, it would become necessary to prevent the use of benzol-drums for temporary storage of nitrobenzol or substances containing it, and their re-use later for benzol without efficient cleaning.

On the other hand, if additional evidence supports the view that benzol vapours alone are responsible, the attention of benzol makers and benzol users must be drawn to this fact and such measures of precaution insisted on, as to eliminate the danger.

The protection is particularly necessary for employees of tender years. In the Baltimore cases severe and fatal results occurred only among young girls between 14 and 18 years of age, while older persons, particularly men, suffered only from anæmic symptoms without further serious complications.

THE DEVELOPMENT OF THE SUGAR INDUSTRY.

BY AUGUST VON WACHTEL.

Scottish Section.

Meeting held at Glasgow, on Tuesday, 21st February, 1911.

PROFESSOR THOMAS GRAY IN THE CHAIR.

THE LIME IN BASIC SLAG. A CORRECTION AND ADDITION.

BY JAMES HENDRICK, B.SC., F.I.C.

In a paper communicated to this section in 1909 on the lime in basic slag (this J., 1909, 28, 775—778) it was shown that there is a much smaller percentage of free lime in ordinary commercial samples of basic slag than is commonly represented, and that calcium carbonate is practically absent. At the same time it was shown that there is in such slag a considerable amount of "lime available as a base," that is, lime which is capable of neutralising acidity in the soil and of acting as a base during nitrification. It was pointed out that what is desired in the soil is not free alkali, but lime in a form such as carbonate, in which it is not free and does not render the soil strongly alkaline, yet is available to neutralise acidity when required.

An endeavour was made to measure the available base in basic slag, and different methods were tried for this purpose. In one of these the amount of citric acid neutralised when shaken with basic slag in the cold was measured and calculated into its equivalent of lime. Another method used was to distil solutions of ammonium sulphate and ammonium chloride with the slag, and estimate the basicity from the amount of ammonia given off. This is the method which was used to the greater extent in the paper. Ammonium sulphate is extensively used as a fertiliser. It undergoes nitrification in the soil, with the production of nitric and sulphuric acids. In order that its action may not be harmful by rendering the soil sour these acids must be neutralised as produced. Ammonium sulphate was therefore fixed on as a suitable substance for measuring how far basic slag could neutralise acid produced in the soil, for when it is distilled with slag, ammonia is given off freely and the sulphuric acid is neutralised by the bases supplied by the slag. After the paper was published it was pointed out to me that sufficient notice had not been taken of the fact that when dilute solutions of ammonium salts are distilled, ammonia is given off from them in very appreciable quantities.* It appeared possible, therefore, that the ammonia obtained in my previous experiments might have been given off, in large part at any rate, not because of the basic action of the slag, but on account of hydrolysis of the ammonium salts used. Further investigation was therefore undertaken to find how far the previous experiments were vitiated by this overlooked source of error.

In Veley's paper on the hydrolysis of ammonium salts it is shown that with ammonium chloride hydrolysis is "nil or inappreciable," while with ammonium sulphate hydrolysis is considerable and depends on the dilution. This serves to explain what was found in my original experiments, namely, that more ammonia was obtained when slag was distilled with ammonium sulphate than when it was distilled, under equal conditions, with an equivalent amount of ammonium chloride. (See Table III. of 1909 paper.) The differences found were not very great, and did not affect my general argument, but it would probably have been better had the figures obtained from ammonium chloride been relied on in preference to those from ammonium sulphate.

The details of the method used to determine the lime available as a base by distillation with ammonium sulphate are given in my former paper, p. 776. One grm. of basic slag was slowly distilled with 1 grm. of ammonium sulphate dissolved in 200 c.c. of water. At the end of 1½ hours the distillate which was collected in standard acid was titrated. A further 100 c.c. of water was added through a tapped funnel to the ammonium sulphate and slag mixture, and the distillation continued for a further hour. Another 100 c.c. of water was then added and the distillation again continued for an hour, and this was repeated till the total time of distillation was 5½ hours. The ammonia distilled over in each period was estimated separately.

Four of the samples of slag tested in my earlier work were still available. The origin of these samples is described in my earlier paper. They are indicated in what follows by the same numbers as were used in that paper. These samples were distilled as before with a solution of ammonium sulphate, but a blank with a similar solution of ammonium sulphate without slag was carried on at the same time in a similar apparatus. The results are shown in Table I. In this table, as in the tables in the previous paper, the results are calculated into percentages of lime in the basic slag used. For comparison the results previously obtained for the same samples with ammonium sulphate and with ammonium chloride are given.

Table I. shows that the blanks in all cases gave an amount of ammonia which, when stated as its equivalent in lime, amounts to only a very small percentage of the slag. When the percentage of lime obtained in the blank is subtracted from the total, the remainder corresponds in most cases as closely as can be expected in experiments of this kind with the percentages previously found by distillation with ammonium chloride. In these experiments differences in the rate of distillation, and in the apparatus, cause differences in the result. When we take into account that the present series of experiments was carried out more than a year after the first and with different apparatus, the agreement may be considered good.

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* See "A Study of Comparative Affinities in the Case of Certain Salts of Ammonium, Sodium, &c.," by Watson Smith. This Journal, 1896, **15**, 3—7.

The Hydrolysis of Ammonium Salts, by Victor Herbert Veley, Chem. Soc. Trans., 1905, **87**, 26—33.

TABLE I.

Available base in basic slag, by distillation with ammonium salts. Estimated as lime.

Sample. No.		1½ hours distillation.			5½ hours distillation.		
		With ammonium sulphate.		With ammonium chloride.	With ammonium sulphate.		With ammonium chloride.
		Previous estimation.	New estimation.		Previous estimation.	New estimation.	
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1.	Distillation with slag	21·28	21·90	19·90	28·30	25·53	26·47
	Blank	—	1·17	—	—	1·49	—
	Difference	—	20·73	—	—	24·04	—
3.	Distillation with slag	12·93	10·37	—	19·31	15·55	—
	Blank	—	1·04	—	—	1·30	—
	Difference	—	9·33	—	—	14·25	—
4.	Distillation with slag	8·45	9·77	8·90	15·23	14·99	14·37
	Blank	—	0·86	—	—	1·07	—
	Difference	—	8·91	—	—	13·92	—
5.	Distillation with slag	16·40	17·68	16·60	24·05	23·28	22·71
	Blank	—	0·86	—	—	1·14	—
	Difference	—	16·82	—	—	22·14	—

It is shown later that no ammonia is given off when a blank is done with ammonium chloride under the conditions of these experiments.

When my attention was drawn to the fact that my previous experiments took no account of the hydrolytic dissociation of ammonium salts in dilute solution, some blank determinations were made to find out in a preliminary way the magnitude of any error which might thus have been introduced into my work. The results obtained in different blanks not only gave greater amounts of ammonia than had been expected, but they were wildly discordant. This led me to suspect that the glass of the flasks used was not without action. The flasks used for these first blanks were of Jena glass, and had previously been used for nitrogen determinations by the Kjeldahl method, in which the distillations were of course carried on in presence of excess of caustic soda. The flasks had been well washed out with water before being used for the blanks. They were next boiled for a considerable time with dilute sulphuric acid, washed, and the blanks again repeated. Quite different results were now obtained. Much less ammonia distilled over and the results obtained from different flasks were concordant. Table II. shows some of the results obtained in these tests.

TABLE II.

Distillation of ammonium sulphate from glass flasks previously used in Kjeldahl determinations.

One grm. of ammonium sulphate in water distilled for	1.		2.		3.		4.	
	Ammonia.	Equivalent in lime.	Ammonia.	Equivalent in lime.	Ammonia.	Equivalent in lime.	Ammonia.	Equivalent in lime.
	grm.	grm.	grm.	grm.	grm.	grm.	grm.	grm.
1½ hours	0·0043	0·0072	0·0065	0·0107	0·0182	0·0299	0·0052	0·0086
5½ ,,	0·0117	0·0193	0·0121	0·0199	0·0487	0·0790	0·0064	0·0107

TABLE III.

Effect of glass. Ammonia given off.

One grm. of ammonium sulphate in water distilled for	Jena glass flasks.			Bohemian glass flasks.		
	New.	Boiled with 5 per cent. caustic soda.		New.	Boiled with 5 per cent. caustic soda.	
		3 hours.	6 hours.		3 hours.	6 hours.
	grm.	grm.	grm.	grm.	grm.	grm.
1½ hours	0·0039	0·0056	0·0052	0·0043	0·0048	0·0061
5½ ,,	0·0061	0·0117	0·0095	0·0104	0·0104	0·0121
Acidity of residue in flask equal to ammonia	0·0060	0·0065	0·0065	0·0063	0·0053	0·0058

No. 4 in Table II. was a blank carried out in the same flask as was used in No. 3. The only difference was that when used for No. 3 the flask, which had previously been used for an unknown number of Kjeldahl distillations with excess of soda, was merely washed out with water; before being used for No. 4 it was cleaned by boiling dilute sulphuric acid in it and then washing. Whereas in No. 3 ammonia was still being given off at the end of 5½ hours in appreciable quantity, no appreciable quantity of ammonia was obtained in No. 4 after 3½ hours distillation.

A number of experiments were made in order to investigate further the effect of the distilling flask used on the evolution of ammonia. The results of these are shown in Tables III. and IV. A number of new Jena and Bohemian glass flasks were taken. These were of similar size and shape to the Jena glass flasks used for all the previous determinations. Two new Jena glass flasks gave blanks similar to that in No. 4, Table II., with the previously used Jena glass flask boiled out with dilute sulphuric acid. After the distillation the residue left in the flask was acid, and when it was titrated with $N/10$ alkali the acidity was found to correspond with the amount of ammonia obtained by distillation. With the new Bohemian flasks a different result was obtained, distinctly more ammonia being given off on distillation than from the Jena glass flasks. Whereas from the Jena glass flasks no appreciable amount of ammonia was given off after 3½ hours distillation, from the Bohemian glass the ammonia continued to be given off in small but appreciable quantities even at the end of 5½ hours distillation. As before, the residue left in the flask was acid, but the acidity did not correspond with the ammonia given off, but, as shown in the last line in Table III., was considerably less than the equivalent of that ammonia.

The flasks, both Jena and Bohemian, were then boiled with a dilute solution of caustic soda for 3 and 6 hours respectively, after which they were well washed out with water. A solution of 1 grm. of ammonium sulphate was then distilled from them in the usual way. The results are shown in Table III. There is very little alteration in the amount of ammonia obtained as compared with the new flasks in the case of the Bohemian flasks. In the case the Jena flasks, on the other hand, there is a considerable increase in the amount of ammonia obtained, but there is no increase in the acidity of the liquids left in the flasks after distillation.

These experiments indicate that Jena glass in which alkaline soda solutions have been boiled act a feebly basic part, and neutralise part of the acid liberated when a solution of ammonium sulphate is distilled. New Bohemian glass flasks act quite similarly. In both these cases alkali which has been combined with the silica of the glass is no doubt slowly given up to the solution. In this respect the glass acts like basic slag, though to a much less extent. A copper flask was found to act similarly. Table IV. gives the result of four distillations carried out from such a flask. In all cases ammonia continued to be given off in small quantity to the end of 5½ hours distillation. The liquid left in the flask after the distillations always contained copper in solution.

TABLE IV.

Ammonia given off on distillation from a copper flask.

One grm. of ammonium sulphate in water distilled for	1.	2.	3.	4.
	grm.	grm.	grm.	grm.
1½ hours	0·0052	0·0043	0·0043	0·0052
5½ ,, ...	0·0126	0·0139	0·0160	0·0143

Ammonium chloride solution was distilled from Jena glass flasks which had been freshly boiled out with dilute sulphuric acid and washed. The conditions were similar to those of previous experiments, and the ammonium chloride taken for each experiment, 0·811 grm., was equivalent to 1 grm. of ammonium sulphate. A mere trace of ammonia was obtained in the distillates. The quantity was too small to be estimated by titration in the usual way. The residue left in the flasks after 4½ hours distillation was not appreciably acid. No volatilisation of ammonia, therefore, measurable by the methods used in these experiments, took place when ammonium chloride was distilled under the conditions of these experiments. As pointed out above, any objection which may be taken to the experiments with ammonium sulphate recorded in my previous paper, does not apply to those with ammonium chloride.

In conclusion, these further experiments show that the conclusions of my former paper are not materially affected by the fact that ammonia is volatilised when a dilute solution of ammonium sulphate is boiled. Indeed, these further experiments provide further evidence in favour of my conclusion that there is in basic slag a considerable proportion of lime capable of acting as a base in the soil, and neutralising acids produced in the soil, and that a part of this lime is readily liberated and will probably readily act in the soil as a base, while other portions are liberated with greater difficulty and slowly. My further conclusion was that as the conditions are complex it is impossible to draw any line and state an exact percentage of basic lime in slag, except in terms of a strictly defined method of determining it. It may be concluded from what is stated in this paper that distillation with a solution of ammonium chloride provides a better method of determining the available base in slag than distillation with a solution of ammonium sulphate.

Finally, the glass of the vessels used for distillation in experiments on ammonium salts may have a very appreciable influence especially if alkaline solutions have previously been boiled in the glass. As has been shown above, the alkali given up by the distilling flask itself may account for a much greater liberation of ammonia from ammonium sulphate than the hydrolysis of the salt in solutions such as are dealt with in these experiments.

NOTE.—Since the above was written, I have had the privilege of reading the interesting paper read before the London Section on February 20th (this Journal, 1911, 253—256) by Watson Smith, on "(I.) Ammonium Sulphate and its Instability. II. The Hydrolytic Dissociation of Ammonium Salts," and the discussion on that paper. The criticisms of Mr. Watson Smith on my former paper are quite justified, and have been fully dealt with above. In the discussion Dr. Veley also criticised my paper. No doubt when he made his criticism he had not the paper before him, and spoke from memory. He has quite misunderstood or forgotten what was the problem which I set out to elucidate by my experiments on the distillation of ammonium salts with basic slag. If he will look through what is written above he will find that I was not endeavouring to measure the "free lime" in basic slag, and he will also find that the other parts of his criticism had been anticipated and answered.

FIELD TRIALS WITH NITROGENOUS MANURES FROM THE ATMOSPHERE.

BY JAMES HENDRICK, B.SC., F.I.C.

This paper contains an account of experiments carried out under the auspices of the Aberdeen and North of Scotland College of Agriculture, on the use and value as manures of calcium cyanamide (lime nitrogen or nitrolime) and nitrate of lime. Field and pot experiments with these manures were begun in 1905 and carried on every season till 1910, and show that both nitrolime and nitrate of lime are excellent and active manures, though each has certain properties which are to its disadvantages for practical use in the field. The manurial action of nitrates is already well known. The nitrate hitherto used in practice has been sodium nitrate, but it might be anticipated that combination with lime, which is itself of use in the soil, would not make the nitrate of lower value than if in combination with soda. The experiments show that in certain soils, at any rate, nitrate of lime is, weight for weight of nitrogen, of somewhat greater manurial value than nitrate of soda.

Cyanamide, on the other hand, is a new and unfamiliar manure, the value of which had to be proved, as no substance like it had previously been used as a manure.

The results of experiments on corn crops during the three years, 1905, 1906, and 1908 are summarised in Table I.

TABLE I.

Results of field experiments on grain. Crop per acre.

Manure.	1905. Average of 2 Experiments.		1906. Average of 3 Experiments.		1908. Average of 8 Experiments.		Average of Preceding 13 Experiments.	
	Grain.	Straw and chaff.	Grain.	Straw and chaff.	Grain.	Straw and chaff.	Grain.	Straw and chaff.
	lb.	cwt.	lb.	cwt.	lb.	cwt.	lb.	cwt.
1. No manure	2495	26¼	2348	33¼	2064	26	2196	27¼
2. Superphosphate and potash salt ...	2645	28¾	2532	37¼	2061	26	2260	29
3. No. 2 and nitrate of soda	2975	34¼	2747	41¼	2443	33	2595	35¼
4. No. 2 and sulphate of ammonia .	3060	32¼	2747	42	2541	36	2668	37
5. No. 2 and calcium cyanamide ...	3005	32	2807	43	2551	32¾	2680	35
6. No. 2 and nitrate of lime	—	—	3121	43¼	2702	37	2816	38½
7. No. 2 and calcium cyanamide ...	2945	32½	2847	44¼	2579	32¼	2697	35¼

In each year the same dressing of superphosphate and potash salts was given to each of the plots 2 to 7. This was given to ensure that sufficient phosphate and potash was present in an available form to permit the nitrogenous manures applied to plots 3 to 7 to exert their full effect. Each of the plots, 3 to 7, received an equal dressing of nitrogen, but given in different forms. The dressing in each year was equivalent to about 1 cwt. of sulphate of ammonia per acre. In 1905 nitrate of lime was not used, as this manure was not then obtainable. In each year two plots received calcium cyanamide. In 1905 and 1906 the cyanamide was applied to plot 5, ten days to a fortnight before the seed was sown, while it was applied to plot 7 at the same time as the seed. In no case was any distinct difference noted. The germination of the seed did not appear to be retarded or injured when the cyanamide was applied on plot 7 along with the seed.

In 1908 two different varieties of calcium cyanamide prepared by different processes were used, that prepared by the process of Frank and Caro on plot 5, and that prepared by the process of Polzeniusz on plot 7. As the table shows, the results obtained on these two plots were practically the same.

No experiments are recorded for 1907, though a number were carried out in that year. The results obtained, however, are not worth recording, as in some cases the plots were ruined and in all cases the results were vitiated by the disastrous harvest of that year. So far as any conclusions could be drawn from the appearance of the plots during the growing season, and from such weights of crops as were obtained, the results were in general agreement with those obtained during the other years.

In each year the results given are the average of two or more experiments. The limitations of field experiments have often been discussed. It is sufficient to say that it is not safe to hold the results of any single field experiment as reliable. The number of factors not under control is so great that even in the most carefully conducted experiments the probable error of any single result is high.* It is only by repeating experiments and averaging that reliable figures can be obtained. It will be seen that the results of the three years are in general agreement. It was also found that, though there were the considerable individual variations which are always found in field experiments, in a rough way the individual experiments were in agreement with the averages. In 1909 a somewhat similar series of experiments was carried on, but only one plot received calcium cyanamide. The results, which are in close general agreement with those obtained in other years, are shown in Table II.

The results of all these experiments indicate that, weight for weight of nitrogen, the new manures are quite comparable in their effects on grain crops with the well known manures, nitrate of soda and sulphate of ammonia.

On the average nitrate of lime has in each year given better results than any of the other manures. In general, Scottish soils are not naturally well supplied with lime. Many of the soils in the North-East of Scotland are very deficient in this substance. The superior effect of nitrate of lime as compared with nitrate of soda containing an equal amount of nitrogen is probably to be explained by the lime as well as the nitrate having had a beneficial effect on the crop.

TABLE II.

Average of seven experiments, 1909. *Results per acre.*

No.	Manures.	Grain.	Straw and chaff.
		lb.	cwt.
1.	No manure	2,533	43¼
2.	Superphosphate and potash salt ..	2,615	50¼
3.	Same as 2 and nitrate of soda ..	3,023	55¼
4.	,, ,, sulphate of ammonia	3,026	53¼
5.	,, ,, nitrate of lime	3,128	53¼
6.	,, ,, calcium cyanamide	2,847	49¼

In pot experiments results were obtained which were in the main similar to those of the field experiments. One important difference may, however, be noted. When calcium cyanamide was applied along with the seed in the restricted conditions of pots it nearly always injured and retarded the germination. On the other hand, as has already been stated, no such effects were noted in the field experiments.

It was always noticeable that when cereals were grown in pots of sand and had to depend on the artificial manure supplied for their nitrogen, the pots manured with nitrate of lime were distinctly darker in colour and more vigorous in growth than those manured with nitrate of soda, sulphate of ammonia, or calcium cyanamide, and that although all the pots were well supplied with lime in the form of carbonate.

Although it was found that cyanamide applied with the seed in field experiments did not injure the germination, it was also found that it is not suitable for application as a top dressing to growing plants. It spots and injures the foliage, especially of the broader and softer leaved plants. In the case of young and tender plants such injury may be serious if the calcium cyanamide is top dressed on them. It was found that when it is top dressed on a mixed crop of grass and clover, the clover especially is injured.

On the other hand nitrate of lime is specially suitable for top-dressing, and that will probably be its principal use in agriculture. As it is a hygroscopic substance it soon liquefies and finds its way into the soil even if no rain falls. In this respect it has an advantage over all other nitrogenous manures in use. In other respects its hygroscopic nature is a serious disadvantage and will to some extent interfere with its ready adoption by farmers. Unlike other manures it has to be packed in barrels instead of in bags. Bags are more convenient to handle than barrels. When the barrels are opened the contents must be used at once or they soon set to hard masses and then become wet.

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* See "The Interpretation of Experimental Results," by T. B. Wood and F. J. M. Stratton. J. of Agric. Science, **3**, 417—440.

The results given above indicate that when they are actually applied to the soil, both nitrate of lime and calcium cyanamide are manures of great value and activity, but there are a number of other properties which have to be taken into account in judging of their suitability for general agricultural use, and of the likelihood that they will become popular with farmers and manure manufacturers, and so come extensively into use. The readiness with which nitrate of lime absorbs moisture and becomes wet is a property which will interfere with its use for many purposes, such as the manufacture of mixed manures, and will prejudicially affect its popularity with farmers. On the other hand, calcium cyanamide is an unpleasant substance to handle. It is dry and dusty, and the dust is not only unpleasant but may be actually dangerous if breathed. Though it does not become wet, it alters on exposure to the air, and if mixed with soluble phosphates it reverts them to the insoluble state, a property which will seriously interfere with its use for the manufacture of mixed manures.

When put up in sacks nitrate of lime at once begins to absorb moisture, but it is a considerable time before it actually becomes so wet as to be unfit for use, unless it is directly exposed to wet. In experiments carried on during the winter 1908–9 in an ordinary cold cellar comparable with such a store as a careful farmer might use for manure, it was found that even in quite small bags nitrate of lime could be kept for two or three weeks without running to waste or even becoming too wet to sow. After a few weeks, however, it always began to waste by escaping through the bags in liquid form.

It was mixed with dry peat dust and bagged in that form, but it was found that it became wet and ran to waste even more rapidly than when stored alone.

Mixtures with other manures, such as superphosphate, bone flour, and potash salts, rapidly became damp and sticky. After a few days any such mixture got into an unsowable form.

Where nitrate of lime is sown by hand it liquefies on the hands of the sower and causes cracks and sores on the skin. When used in any quantity nitrate of lime would require to be sown by a machine, or if sown by hand the sower would require to use rubber gloves or some other means of protecting the hands.

Calcium cyanamide when stored also absorbs moisture from the air, but the moisture enters into combination with the lime and other substances contained in the manure which does not become damp. In addition to moisture it also absorbs carbon dioxide from the air. After a time it becomes lumpy, and in time the whole mass may set into a hard lump. In my experiments calcium cyanamide stored in small bags in a cellar under the same conditions as nitrate of lime gained in weight nearly as rapidly as nitrate of lime. After a few weeks it became lumpy. After several months' storage it became a hard solid lump, but never showed any sign of becoming damp.

During storage the percentage of nitrogen diminishes. This is mainly on account of the gain in weight, but a small loss of nitrogen also takes place. This is a point to which those who deal in cyanamide would require to attend. In one experiment the nitrogen fell from 17·4 per cent. to 13·6 per cent. in four months. At the same time the weight of material in the bag increased about 16·8 per cent. These figures show that the fall in percentage of nitrogen was mainly due to the increase in weight.

When mixed with superphosphate or any other soluble phosphate, considerable heat is given off and the phosphate is to a large extent reverted or rendered insoluble.

No loss of nitrogen was detected in such mixtures, but the nitrogen gradually changes in condition to a considerable extent, and a part of it passes into the form of ammonium compounds. On keeping, such mixtures gradually become hard. Calcium cyanamide may be mixed without loss of any part of its manurial value with basic slag, with bone meal or steamed bone flour, and with potash manures. All such mixtures are apt to become hard after a time.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Explosions; Compressed air ——. W. L. Saunders. Eng. and Min. J., 1911, 91, 713—714.

Compressed air may easily become charged with inflammable vapours, through the use, in the compressors, of lubricants having too low a flash-point, or if the pipe-lines are not regularly drained, especially at low points, where oil, etc., is liable to accumulate. Cases have occurred where pipe-lines have been shattered through the ignition, probably by the heating due to compression, of such accumulations of inflammable vapour. The use of kerosene for cleaning air-pipes is condemned for this reason. By inspecting, at regular intervals, the interior of the compressors, and of the whole compressed air system, the above accidents can be avoided.—R. W. N.

Patents.

Raising and forcing liquids. H. A. Humphrey, London. Eng. Pat. 7152, March 22, 1910.

The claim is for improvements in methods of operating the pumps described in Eng. Pats. 20,736 of 1906, and 18,594, 18,595, 19,341 and 25,638 of 1907 (this J., 1908, 436; see also this J., 1910, 75). The sudden increase of pressure developed by the ignition of a preliminary combustible charge is caused to force liquid from the combustion chamber into a second chamber and to produce sufficient pressure in the latter to drive a charge of air therefrom through a carburetting chamber containing heavy oil or other combustible liquid. The air becomes saturated with the "atomised" oil and the mixture is forced by the pressure into the combustion chamber, where it is ignited by the still burning preliminary charge or by the highly heated products of the combustion of such charge. The object in view is to obtain higher mean pressures and a longer working stroke and at the same time to allow a wider range of fuels to be used.—W. H. C.

Raising or forcing liquids. H. A. Humphrey, London. Eng. Pat. 7824, March 31, 1910.

The claim is for a method of adjusting the combustible charge in pumps in which the charge is drawn in by a column of liquid moving away from the combustion chamber and compressed by the return of the column

of liquid (see this J., 1910, 75). A quantity of combustible gaseous mixture greater than is required is drawn in, and the excess is rejected through a special valve by the return flow of the column of liquid. The valve through which the excess is rejected is closed by the liquid when it reaches a predetermined height. The excess is forced under pressure into an auxiliary chamber from which it returns to the combustion chamber at the next intake period.
—W. H. C.

Measuring the flow of liquids in closed conduits. F. Simpson and A. R. T. Woods, Liverpool. Eng. Pat. 7249, March 23, 1910. Addition to Eng. Pat. 21,769, Sept. 24, 1909 (this J., 1910, 1289).

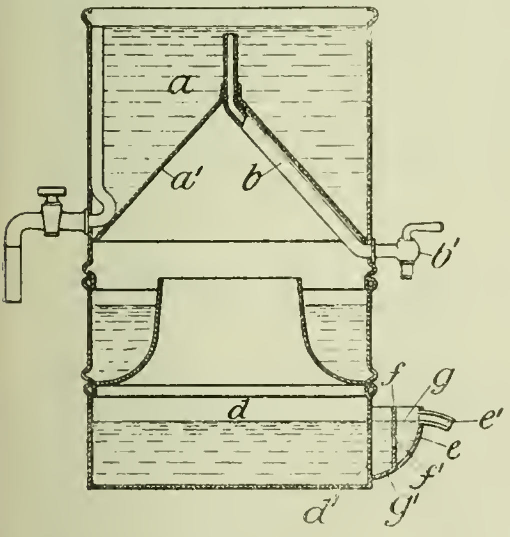
In order to prevent the column of liquid in the rising column of the gauge, described in the original patent, from being driven over the bend, a U-tube filled with mercury is arranged in series with the gauge, so that should the difference of pressure exceed a predetermined amount, the rise of the mercury in one of the legs of the U-tube shuts off the connection between the main and the gauge. The interior of the U-tube is fitted with adjustable liners to vary the volume of the legs, or a similar variation may be effected by a spindle of varying diameter in one of the legs.—W. H. C.

Separating dust and other impurities from air or other gases. K. Edwards and F. W. Parkinson, Belfast. Eng. Pat. 7998, April 2, 1910.

The air containing the dust is caused to bubble through water seals in a number of annular superposed troughs, the superposition being adopted in order to increase the number of outlets for the gas.—W. H. C.

Distilling apparatus. J. R. Greenhalgh, London. Eng. Pat. 11,063, May 4, 1910.

The heated cooling water from the cooler, *a*, flows down through the pipe, *b*, affixed to the underside of the conical condensing surface, a^1, and is discharged through the tap, b^1, into the outer space, *g*, of the feed-cup, *e*. The latter has an overflow, e^1, and a partition, *f*. The water passes through the aperture, f^1, into the inner space, g^1, and thence through the aperture, d^1, into the boiler, *d*. The latter is heated from below by suitable means, and the gaseous products of combustion pass under the feed-cup, e.—W. H. C.



Still. J. T. Davis, Oakland, Cal. U.S. Pat. 988,445. April 4, 1911.

The still comprises a casing having a number of horizontal heating-pipes and a V-shaped perforated trough located above the uppermost pipe. A removable horizontal partition is fitted across the middle section of the casing below another of the horizontal heating pipes, with a second V-shaped perforated trough forming part of it, situated immediately above the heating-pipe below. The liquid to be distilled is run into the upper trough and is evaporated as it descends over the heated pipes.—H. H.

Sieving, screening, or riddling of powdered, granular or pulverulent substances. J. Jenkins, Liverpool. Eng. Pat. 12,453, May 23, 1910.

The material (*e.g.*, flour) to be sifted is fed on to an inclined screen which is so supported by spiral springs that after it has been tapped or struck, it is free to vibrate in any direction.—W. H. C.

Evaporating, volatilising or distilling liquids and solids. T. McClelland, jun., Glasgow. Eng. Pat. 15,263, June 25, 1910.

The heat necessary to evaporate, volatilise or distil the substance is communicated to the same by means of granular carbon or other non-metallic resistance material which is heated by the passage of an electric current through it and is in direct contact with the material to be treated.—W. H. C.

Concentrating in vacuo; Column for ——. A. Fernbach. Fr. Pat. 422,163, Oct. 17, 1910. Under Int. Conv., Oct. 18, 1909.

The apparatus, shown in Fig. 1, consists of a cylindrical shell, 5, surmounted by a dome, 6, connected with an exhauster: the shell can be cooled externally by streams of water from the pipe, 8. Four vertical supports, 2,

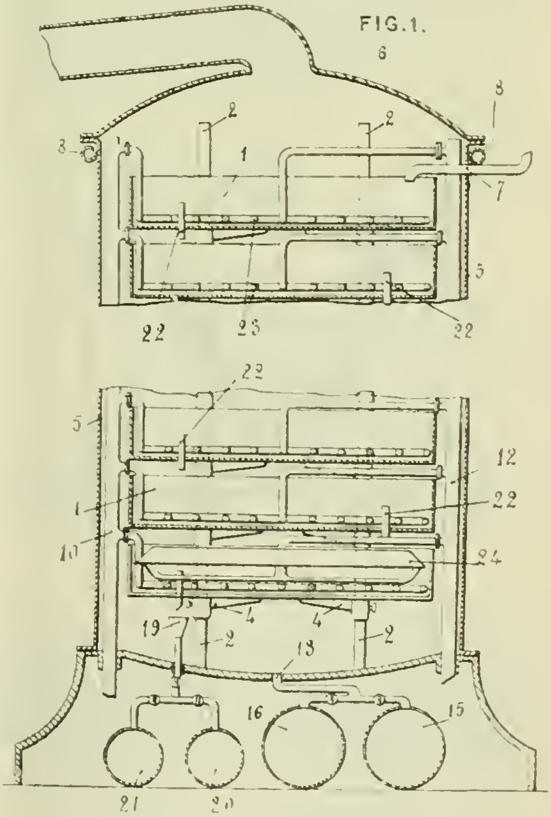


FIG. 1.

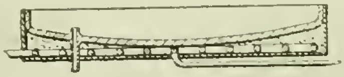


FIG. 2.

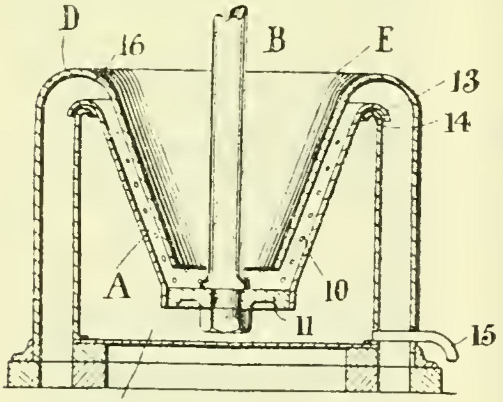
carry on lateral arms, 4, a number of trays, 1, each provided with a heating coil, 23, in the bottom. The liquid to be concentrated enters by the pipe, 7, and descends from tray to tray by the overflow pipes, 22, finally passing away through the funnel, 19, into the receptacles, 20 or 21. The heating is effected by a stream of hot water which passes up the pipe, 10, round the coils and away by pipe, 12; each tray is provided with a hood, 24, to prevent loss of liquid during evaporation. The vapours condense on the cooled walls, 5, and are drawn off at the bottom through the opening, 13, into the receptacles, 15 or 16. In cases where it is inadmissible to bring the liquid to be concentrated into contact with the coils or other metal parts, trays of glass or porcelain may be substituted, the arrangement in such cases being shown in Fig. 2. The apparatus is adapted for concentrating fruit juices and pharmaceutical extracts.—B. G. McL.

Concentrating liquids to high densities; Apparatus for ——. J. F. P. Kestner. Fr. Pat. 422,811, Nov. 18, 1910. Under Int. Conv., Dec. 14, 1909.

A modification of Fr. Pat. 361,524 (this J., 1906, 874) which is necessary when it is desired to concentrate liquids to a very high degree. The difficulty arising, is due to the relatively large volume of vapour produced compared with the volume of the concentrated liquid, and is overcome by increasing the velocity in the last ascending tubes, whereby the free-way is augmented owing to the concentrated liquid being forced to form very thin layers on the tubes. The final tubes are always descending. —B. G. McL.

Drying machines; Centrifugal ——. W. C. Mitchell, Sydney, Nova Scotia. Eng. Pat. 18,743, Aug. 9, 1910.

The material to be dried is fed continuously into the conical hopper, E, formed by the inwardly turned edge of the outer casing, D, of the machine, and falls on to the bottom, 11, of the conical basket, A, rotated by the shaft, B. Owing to the centrifugal force the material rises up the conical side of the basket, the moisture passing through the perforations, 10, into the chamber, C, from which it overflows through the pipe, 15, and the dried material passes over the curved lip, 13, of the basket which projects over the inwardly curved edge, 14, of the casing, C. —W. H. C.



Ice; Process of making ——. G. K. Davol, San Francisco, Cal. U.S. Pat. 988,316, April 4, 1911.

The water is brought into contact with a liquid of greater specific gravity with which it will not mix, such as mercury, and the temperature of the latter reduced below the freezing point of water. Alternatively the heavy liquid may be cooled before the water is added to it.—H. H.

Kilns. J. T. Underwood, Kachelmacher, Ohio. U.S. Pat. 988,411, April 4, 1911.

A gas-fired kiln having a number of heating chambers is fitted with a by-pass duct, in addition to the flue, by means of which the discharge of any one chamber can be connected with the intake of any other.—H. H.

Carboy holder. C. E. Torrey, New York. U.S. Pat. 988,675, April 4, 1911.

The carboy is suspended in a box or casing by two sets of flexible metallic strips, the strips of one set being attached to opposite points of the top edges of the box and passing under the carboy so as to support its weight, and the strips of the other set passing straight across the bottom of the box to prevent lateral movements of the carboy. All the strips are connected by a single rivet where they cross below the centre of the carboy.—H. H.

Filtration of liquids through a tissue; Framework of expanded metal for ——. F. Chêne. Fr. Pat. 422,191, Oct. 29, 1910. Under Int. Conv., Nov. 2, 1909.

Claim is made for the use of expanded metal as a framework for filtering tissues. The network is made into frames of convenient size and covered externally with the filtering tissue, the filtration taking place through the frame. Owing to the form of the expanded metal, the tissues are supported at each corner of the mesh, thus preventing the possibility of the two sides of the tissue from touching each other.—B. G. McL.

Absorption towers; Arrangements for uniformly distributing liquids in ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 421,952, Oct. 28, 1910. Under Int. Conv., Jan. 6, 1910.

It is proposed to overcome the difficulties of evenly distributing the absorbing liquids in towers used for the washing of gas, the absorption of acids and in rectifying columns by substituting for the usual packings sections of filtering material. These may take the form of layers of sand, charcoal, powdered metal, etc., or plates, columns or tubes of porous material such as burnt clay, porous cement, etc.; in each case at the lower side of the filters a large number of points are arranged where the filtered liquid collects and drops on to the tray below. The filtering media arrest particles of solid matter which, thus removed, do not tend to promote channelling; the capilliary action of the filters cause an even spreading of the liquid over the whole area. Vertical tubes are suitably arranged for the upward passage of the gas.—B. G. McL.

Pasty material; Machine for tempering, cooling, heating or drying —— *more especially chocolate.* E. L. A. Savy. Fr. Pat. 422,275, Nov. 7, 1910. Under Int. Conv., Jan. 15, 1910.

The machine consists of a double-walled revolving drum supported on a hollow axle the interior of which is connected with the space between the walls by four insulated radial tubes. The air or other fluid, brought to the desired temperature by heating or cooling in some convenient manner, enters at one end of the axle, passes down the four radial tubes, each of which communicates with the jacket on one-quarter of the periphery, and returns through the drum, leaving the apparatus through the other end of the axle. Surrounding the drum is a stationary circular casing in which the heated or cooled air is also caused to pass in a direction contrary to the rotation of the drum. The rim of the drum is circularly grooved, the nature of the groovings, which may be triangular, rectangular or dove-tailed, being adapted to the nature of the material to be treated. The material is fed to the drum by a hopper and smooth adjustable roller, the relative speeds of the drum and the roller being such that the material is all carried away in the groovings, whence, after about three-quarters of a revolution, it is removed to a worm-conveyor by means of a scraper; small grooved rollers may be operated in contact with the rim in order to expose fresh surfaces of the material under treatment. The machine, which is suitable for any pasty material which will adhere to the drum, is more particularly intended for the preparation of chocolate previous to moulding. —B. G. McL.

Separating solids by means of a liquid; Processes and apparatus for ——. F. I. du Pont, Wilmington, Del., U.S.A. Eng. Pat. 17,594, July 25, 1910.

See Fr. Pat. 419,072 of 1910; this J., 1911, 120.—T. F. B.

Liquid separation of solid constituents; Process for the ——. F. I. du Pont, Wilmington, Del., U.S.A. Eng. Pat. 17,601, July 25, 1910.

See Fr. Pat. 419,073 of 1910; this J., 1911, 120.—T. F. B.

Separating solids by means of a liquid; Processes for ——. F. I. du Pont, Wilmington, Del., U.S.A. Eng. Pat. 17,625, July 25, 1910.

See Fr. Pat. 419,078 of 1910; this J., 1911, 120.—T. F. B.

Separators; Centrifugal ——. M. Pedersen. Fr. Pat. 421,958, Oct. 28, 1910.

See Eng. Pat. 21,862 of 1909; this J., 1910, 1362.—T. F. B.

Drying grains and the like; Machines for ——. F. Wertenbruch, Meissen, Saxony, and F. Wertenbruch, Sheffield. Eng. Pat. 24,185, Oct. 19, 1910.

See U.S. Pat. 986,107 of 1911; this J., 1911, 478.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Surface combustion and its industrial applications. W. A. Bone. J. Gas Lighting, 1911, **114**, 22—24, 98—101.

A mixture of hydrogen and oxygen in stoichiometrical proportions, the ignition temperature of which is, at atmospheric pressure, about 550° C., will combine very slowly at considerably lower temperatures, but the rate of combination is insufficient to cause any self-heating of the mixture. Thus two sets of conditions are possible, namely combination below the ignition point slowly and without flame, and at temperatures above the ignition point rapidly and with flame. The presence of large surfaces, which may be caused by the introduction of porous solid material into the gas mixture, has the effect of causing a very great increase in the velocity of combination at temperatures well below the ignition point (see this J., 1909, 512). The author reviews the earlier work on the subject and goes on to show by injecting a highly-explosive mixture of coal-gas and air on to red-hot nickel gauze, incandescent fire-clay and asbestos, that this accelerating influence of surfaces is not confined to temperatures below the ignition point, but that by causing, under suitable conditions, mixtures of combustible gases and air, in the proper proportion for complete combustion, to come in contact with large incandescent refractory surfaces, flameless combustion ensues, producing a more intense combustion at the surface, which is raised to a high degree of incandescence, whereby a large proportion of the potential energy of the gaseous mixture is converted into radiant heat. The conditions obtaining are not those of a homogeneous system in which the velocity of the chemical change is dependent on the order of the reaction, but those of a heterogeneous system in which combustion is taking place only in layers in contact with the surface and in which the governing factors are: the actual rate of combustion at the surface, which is probably infinitely great in comparison with all other factors; the diffusion velocities of the initial and final gases; the rate of "activation" by the surface of the gases constituting the mixture; the physical texture of the surface and the retarding effect of inert films of gas at the surface (see this J., 1909, 512). The "activating" action of the surface, which is still a somewhat obscure phenomenon, is markedly increased by previously treating it with the combustible gas at the temperature at which the subsequent surface combustion takes place. In the commercial application of this process a slight excess of air is employed; any kind of available combustible gas can be used, the maximum temperature attainable being dependent on the calorific power of the particular gas used. The gaseous mixture is caused to pass through a porous refractory diaphragm (or column) at a speed capable of preventing back-firing, the gas being lit as it emerges; when the surface attains a sufficient temperature the flame disappears and surface combustion proceeds (see this J., 1910, 1448). Owing to the fact that the combustion takes place within $\frac{1}{8}$ inch from the outside of the surface, the amount of heat radiated responds instantly to the quantity of combustible supplied. Such incandescent surfaces can be technically applied to the evaporation of liquids by radiation from above, to muffle and crucible heating, and to the heating of rooms, in which case a nickel gauze is placed about $\frac{1}{4}$ inch in front of the diaphragm which, besides improving the appearance, alters the wave length of the radiations and increases the total radiative effect; the slight excess of air in the gaseous mixture increases the durability of the nickel gauze. The application to steam-raising in a multi-tubular boiler (this J., 1911, 406) combines high duty with high efficiency. The following figures were obtained by the author from a test, using Leeds town-gas on a small ten-tube boiler the exit gases from which were utilised in a feed-water preheater.

Pressure of mixture entering boiler tubes	17·3 in.
Pressure of products entering feed-water heater	2·0 in.
Pressure of steam	100 lb. per sq. in.
Corresponding temperature	168° C.
Temperature of gases leaving boiler tubes	230° C.
,, of gases leaving feed-water heater	95° C.
,, of water entering feed-water heater	5·5° C.
,, of water leaving feed-water heater	58° C.
Evaporation per sq. ft. of heating surface per hour from and at 100° C.	20 lb.

Heat Balance.

Gas burnt per hour at 0° C. and 760 mm.	996 cu. ft.
Net calorific value	562 B.Th. U.
Heat supplied to boiler per hour	559,800 B, Th. U.
Water evaporated per hour	450·3 lb.
Water evaporated from and at 100° C. per hour	550 lb.
Heat transmitted to water per hour	527,800 B.Th.U.
Ratio $\frac{527,800}{559,800}$	= 0·943

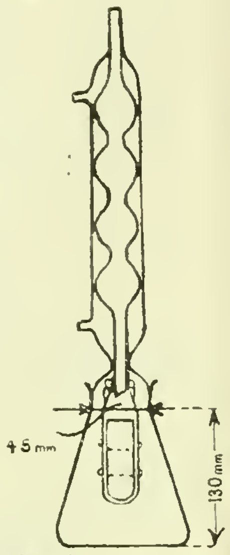
The products of combustion contained 10·7 per cent. of carbon dioxide, 1·6 of oxygen, and 87·7 of nitrogen; no trace of hydrogen, carbon monoxide or methane could be detected. Complete combustion was attained with only 0·5 per cent. of oxygen in the exit gases. The high rate of transmission of heat is shown by the evaporation gradient, 65 per cent. being transmitted in the first foot of the tubes, 25 per cent. in the second foot and 10 per cent. in the last foot. The power expended in overcoming the pressure in the tubes is estimated at 4 per cent. of the total efficiency, giving a net efficiency of 90 per cent. At a sacrifice of about 5 per cent. in efficiency the duty may be increased by 50 per cent. without unduly straining the boiler.—B. G. McL.

Lubricating oils; Automobile and gas engine ——. F. Schwarz and H. Schlüter. Chem.-Zeit., 1911, **35**, 413—415.

A number of oils which had proved suitable in practice, and also some which were unsuitable, were examined, and their density, viscosity, and flash-point determined, but these properties gave no indication as to which oils were suitable. In the case of cylinder oils, which must leave no residue in the engine cylinder, and should not give an objectionable odour to the exhaust, it was found that extraction with acetone at ordinary temperatures removes the harmful constituents of the oil. The part of the oil which was insoluble in acetone amounted to 66 to 93 per cent. of the whole, and had a higher flash-point and ignition temperature and lower density and viscosity at 20° C. than the original oil. A rough test of the suitability of a cylinder oil can therefore be made by determining the proportion insoluble in acetone.—A. T. L.

Tarry substances insoluble in ether and alcohol; Determination of —— in mineral cylinder oils. D. Holde and G. Meyerheim. Chem.-Zeit., 1911, **35**, 369—370.

The use of the apparatus (in which all cork connections are obviated) shown in the figure, enables concordant results to be readily obtained in the extraction of the paraffin wax from dark cylinder oils:—The thoroughly mixed sample (about 5 grms.) is dissolved in 25 times its volume of ether, and the solution treated with 12½ times the volume (of the oil) of 96 per cent. alcohol, added drop by drop. The flask is then well shaken and allowed to stand for 5 hours at 15° C., after which the liquid is filtered, and the filter washed with alcohol-ether (1 : 2) until oily substances are no longer removed. The residue of tar and paraffin wax is dissolved in benzene, the solution evaporated, and the residue dried for 10 minutes at 105° C., and weighed. It is next dissolved in ether (10 c.c.), and the solution poured on to a mixture of about 10 to 15 grms. of ignited coarse-grained sand with about 2 grms. of pure dry coarse bone charcoal which has previously been extracted with alcohol. After evaporation of the solvent, the residual mass is introduced into a cartridge, which is attached to the bottom of the reflux condenser by means of platinum wires as shown in the figure, and is extracted with boiling absolute alcohol, until the extract, when cooled and shaken, no longer shows any flocculent particles of paraffin wax. The extract is then evaporated, and the residue of paraffin wax dried for 10 minutes at 105° C. and weighed. The difference between the two weights gives the amount of tarry substances.—C. A. M.



Asphaltum insoluble in a mixture of alcohol and ether; Determination of —— in mineral lubricating oils. H. Loebell. Petroleum, 1911, **6**, 774—775.

In Holde's method of determining asphaltum in mineral oils (*Unters. d. Mineralöle*, 1909), 5 grms. of the sample are dissolved in 137·4 c.c. of ether, the solution treated with 68·7 c.c. of 96 per cent. alcohol, and the resulting precipitate filtered after standing for 5 hours at 15° C., and washed with alcohol-ether (1 : 2) until free from oil, after which it is dissolved in hot benzene, the solution evaporated, and the residue weighed. The author shows that it is extremely difficult to remove all traces of oil from the precipitated asphaltum, and that even when absolute alcohol is used, from 20 to 40 washings are required before the precipitate becomes constant in weight. To obtain more reliable results, he has modified the method as follows: Five grms. of the oil are dissolved in 140 c.c. of ether, and the solution treated with 70 c.c. of 96 per cent. (by weight) alcohol, and allowed to stand for 5 hours at 15° C., after which the precipitate is separated in a Gooch's crucible, washed, and dissolved in hot benzene. A plug of dry cotton wool is placed in the benzene solution, which is then evaporated, and the residue is taken up with more cottonwool. The whole of the cotton wool is now placed in a cartridge of filter paper and extracted for about 2 hours beneath a reflux condenser with 60 to 80 c.c. of absolute alcohol. Finally the cartridge is extracted with benzene, the solution evaporated, and the residue dried for a short time at 105° C., and weighed. In comparative tests of five different oils the results obtained by this modification were invariably much lower than those given by the original method (*e.g.*, 1·6, 2·1, and 0·8 per cent. as against 2·9, 3·8, and 1·8 per cent. respectively), whilst the asphaltum was usually much harder. The question of consistence can thus only be dealt with when the asphaltum has been completely freed from oil and paraffin wax. Since the amount of residue is too small for a determination of the m. pt. it is recommended that the residue should be tested with the point of a needle and classified as hard, soft pitch-like or oily.—C. A. M.

Distillation products of lignite and coal; Detection of —— in the presence of natural asphaltum and petroleum residues. H. Loebell. Chem.-Zeit., 1911, **35**, 408—409.

Graefe's diazo-benzene chloride test (this J., 1906, 422) for the distillation products of lignite and coal may in exceptional cases be inconclusive owing to the reaction with the phenols not being sufficiently sharp. Thus, in the case of certain samples examined by the author, the filtered extract obtained by boiling 0·2 to 0·5 grm. of the finely powdered asphaltum with 5 to 10 c.c. of *N*/1 sodium hydroxide solution gave, on treatment with a few drops of a freshly prepared hydrochloric acid solution of diazobenzene chloride, a yellowish brown precipitate without imparting any marked red colouration to the supernatant liquid, whilst in other cases only a faint orange colouration was obtained. The nature of the sample may be identified, however, by its behaviour towards acetone. Thus if about 2 grms. of bitumen are heated on the water-bath with an equal quantity of sand, and the cold mixture shaken with acetone, a colourless (or at most faint yellow) solution will be obtained in the case of natural asphaltum or petroleum pitch, and there can then be no question of the presence of phenols. But if a red-brown or dark red solution is obtained, the presence of products of the distillation of lignite or coal is indicated, an addition of as little as 1 or 2 per cent. of either imparting a perceptible brown colouration to the acetone. In such cases the liquid is filtered, the filtrate evaporated to expel the acetone, and the residue tested by Graefe's method. The results of experiments indicated that it might be possible to extract from asphaltum by means of acetone the whole of the added tarry products, and from the amount, sp. gr. and other properties of the substances soluble in acetone to ascertain whether light petroleum oil (sp. gr. 0·880—0·900) or other products of greater consistency were present in appreciable quantity. The test with acetone has proved particularly useful in the examination of samples of asphaltum mastix, which only give a faint reaction in Graefe's test. The phenols in these products must be present in the free condition, and not in the form of sparingly soluble calcium phenolate, as suggested by Marcusson, since otherwise they could not be extracted so readily by an indifferent solvent such as acetone.—C. A. M.

Patents.

Artificial fuel; Manufacture of —— from ashbin refuse. H. G. Coales, Market Harborough. Eng. Pat. 17,246, July 20, 1910.

The refuse is ground and screened so as to separate the incombustible ingredients. It is then incorporated with measured quantities of heated pitch and gas tar in a revolving mixer, cooled to a suitable temperature and briquetted in a machine of the "Yeadon" type in which the briquettes are compressed from both sides. The briquettes are suitable for domestic purposes, for boiler furnaces, or for suction gas plant.—A. T. L.

Fuel; Mixtures for treating ——, for increasing combustion. A. J. Laliberte, Montreal, Canada. Eng. Pat. 19,555, Aug. 20, 1910.

Cinders, or grades of coal poor in carbon, are sprinkled with a solution containing 1½ lb. of potassium chlorate, ¼ to 1 oz. of potassium permanganate, and 2 to 16 oz. of sea salt dissolved in 40 galls. of water. This quantity is sufficient for the treatment of 5 to 7 tons of fuel.—A. T. L.

Peat charcoal; Process and apparatus for manufacture of ——. L. A. H. Galvaire. Fr. Pat. 422,300, Jan. 15, 1910.

The greater part of the water mixed with the peat is removed in a filter-press and the material is then fed by rollers into a comminutor where the fibres are subjected to a cutting and grinding action and are finally compressed together to form briquettes. These are dried and carbonised in a coke oven, the tar, gas, and ammonia being recovered in the usual way.—H. H.

Coke ovens and the like; Gas-fired ——. O. Benninghoff and A. Klönne, Dortmund, Germany. Eng. Pat. 8174, April 5, 1910.

In ovens of the type comprising inclined coking chambers, with vertical heating flues in each dividing wall separated into two groups by a central partition, the front groups of flues, adjacent to the lower part of the coking chambers, need to be the more highly heated, and these are supplied with gas directly from distributing chambers beneath the flues. The groups of flues adjacent to the upper parts of the coking chambers are connected with the gas-distributing chambers by passages controlled by dampers. The distributing chambers can be shut off from the gas supply as desired. Further control of the heating is effected by means of dampers at the upper ends of the vertical heating flues, these dampers being operated through horizontal passages in the stepped roof of the oven.—A. T. L.

Coke-oven. W. J. Kearns, Dunbar, Pa. U.S. Pat. 987,993, Mar. 28, 1911.

The trunnel-head of the coke-oven is surrounded by an annular cooling-chamber and communicates with a gas-flue situated above the latter. A passage inclined upwards extends from the front of the oven into the annular chamber; and a second cooling-chamber, communicating with the first, is situated immediately below the gas-flue. An elevated passage is provided at the rear of the second chamber for the escape of the cooling medium, the flow of which is regulated by baffles suitably disposed within the chamber.—W. E. F. P.

Retort furnace. C. Westphal, Berlin. U.S. Pat. 988,842, April 4, 1911.

A retort furnace consists of a thin inner retort, an outer retort formed of a series of annular members, and supporting plates projecting from the separate members of the outer retort and bearing against the outer surface of the inner retort, so as to allow of the expansion of the latter without affecting the other parts of the furnace.
—H. H.

Gas producers of the suction type. J. A. Weil, London. Eng. Pat. 6755, March 17, 1910.

To permit of the use of sea-water, or other impure water, for raising steam for the generator, the water is heated under atmospheric pressure in a tubular heater, by the exhaust gases from the engine. The hot water is pumped to the top of an air-saturating tower through which hot air from the casing of the generator passes on its way to the latter.—A. T. L.

Water-gas plant; Utilisation of fine breeze and other similar fuel of small grades in ——. The K. and A. Water-Gas Co. Ltd., and H. E. Smith, London. Eng. Pat. 7420, Mar. 24, 1910.

In water-gas plant of the kind described in Eng. Pat. 2750 of 1901 (this J., 1902, 331), having twin generators and working with alternate "run" and "blow" periods, small fuel is utilised by feeding it into the generators continuously during the gas-making periods. The feed may be controlled by a valve actuated by the pressure of the steam passing to the generator or by the pressure in the water-gas plant.—A. T. L.

Gas [Carburetted hydrogen] for heating, lighting, and power purposes; Apparatus for manufacturing ——. A. C. Tessier, Paris. Eng. Pat. 22,127, Sept. 23, 1910. Under Int. Conv., Oct. 7, 1909.

The apparatus comprises a hydrogen generator, a purifier, a carburettor and a gas-holder. The hydrogen is obtained by the action of acid on a metal, the acid being forced by the gas into a chamber above the generating chamber when the consumption of gas ceases. To retain the acid in this chamber while charging the generating chamber with metal, a valve is provided and this valve is connected by an acid-proof cable with a lever outside the generator, so that the valve can be held in the open position when the generator is in action. For this purpose the end of the lever may be brought beneath a catch, and the cable may be clamped against its guide by a set screw.—A. T. L.

Gas producing furnace. E. von Maltitz and H. B. Barnhart, Chicago, Ill. U.S. Pat. 988,580, April 4, 1911.

The furnace is fitted with an inverted conical main grate dipping into a rotatable water pan, and with a central tube which projects from the pan into the furnace and carries a small conical grate at the top, opposite the main grate. Projecting arms on the tube serve to remove the ashes continually. The air supply is taken partly from an air chamber surrounding the main grate and partly from the central tube. The tube and the attached arms are cooled by water circulation, and a water-cooled ring is situated above the main grate.—H. H.

Gas producers for hot gases. E. Fleischer. Fr. Pat. 422,699, Oct. 24, 1910.

The major portion of the gas formed in a gas producer is drawn off at a temperature of about 1000° C. from the hottest zone of the producer, while the smaller portion, which has been partly cooled by its passage through the upper layers of fuel, is drawn off at the top in the usual manner. The hot gas may be used as a heating and reducing agent, for example, in the production of hydrogen by passing it in admixture with water vapour over iron oxide in a chamber, which does not require to be externally heated, or it may be used as a fuel giving a temperature on burning of over 2000° C.—H. H.

Gas manufacture; Condenser for use in ——. Soc. du Gaz de Paris. Fr. Pat. 422,269, Nov. 7, 1910.

The condenser consists of a tall cylindrical chamber containing a cooling compartment in the upper portion fitted with cooling water pipes and baffles, and a tar-separating compartment in the lower portion fitted with an inclined partition dipping into the tar at the bottom of the compartment and having a number of slits with baffles arranged behind each slit. The gas enters at the top and after being cooled in the upper compartment is caused to flow through the slits where the tar deposits upon the baffles and runs downwards. The area of the slits may be adjusted by means of sliding rods adjusted from the outside and adapted to close the slits.—H. H.

Gas purifiers. Robert Dempster and Sons, Ltd., and J. W. Broadhead, Elland, Yorks. Eng. Pat. 19,573, Aug. 22, 1910.

The grids are composed of rows of loose bars laid upon bearers, the bars of one row overlapping those of the adjoining row or rows, as described in the provisional specification of Eng. Pat. 12,894 of 1910 (this J., 1911, 273). To prevent movement of the bars, metal plates or clips with upturned flanges are laid along the bearers to receive the ends of the bars.—A. T. L.

Rotary gas-washer. A. Stolte, Zweibrücken, Germany. U.S. Pat. 988,908, April 4, 1911.

The casing of a rotary gas-washer is in the form of two conical drums built out from either side of a central fan casing. A cylindrical drum, mounted on a shaft passing through the casing, carries blades projecting into close proximity with the walls of the fan casing and of the drums. Gas and washing liquid are introduced at both sides of the casing, the gas being drawn off from the periphery of the fan casing in the centre and the liquid from the lower edges of the outwardly inclined drum casings.—H. H.

Coal-dust and the like; Process for the binding of ——. E. M. Heckel, Marseilles. Eng. Pat. 8664, April 11, 1910.

See Fr. Pat. 402,247 of 1909; this J., 1909, 1187.—T. F. B.

Gas; Method of and apparatus for producing ——. E. E. Slick, Pittsburg. Eng. Pat. 8178, April 5, 1910.

See U.S. Pats. 957,006 and 957,007 of 1910; this J., 1910, 684.—T. F. B.

Gas producers and method of working them. J. and W. Stewart. Fr. Pat. 422,578, Nov. 15, 1910. Under Int. Conv., Nov. 19, 1909.

See Eng. Pat. 26,858 of 1909; this J., 1910, 1193.—T.F.B.

Distilling shale and other bituminous substances; Apparatus for ——. J. Noad. Fr. Pat. 422,309, Nov. 8, 1910.

See Eng. Pat. 18,334 of 1909; this J., 1910, 1148.—T. F. B.

Ore and coal washer. Eng. Pat. 25,490. *See* X.

Crude oil [petroleum] soap or soap lye. Eng. Pat. 14,942. *See* XII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Retorts for distillation of coal; Arrangement of ——. Soc. d'Eclairage, Chauffage et Force Motrice. Fr. Pat. 422,320, Nov. 8, 1910.

Existing retort furnaces of the mechanical feed type with recuperative gas heating from two rows of burners, which are frequently arranged so that the distillation is complete in six or eight hours, are adapted for prolonged distillation, up to 24 hours, by replacing the batches of nine retorts commonly employed by six larger retorts containing a correspondingly greater quantity of coal packed to a greater depth. The retorts may be built up of annular sections or of a number of flat plates of refractory material, and are spaced apart by small transverse walls.—H. H.

Separation of tar and ammonia from distillation gases; Process and apparatus for the direct ——. W. Müller. Fr. Pat. 421,905, Sept. 9, 1910.

The hot gases pass direct into a scrubber formed of a double cylinder, the inner cylinder containing a large number of baffles and the outer annular space being clear. Water sprays are introduced at the top of both chambers. About three-quarters of the hot distillation gases are caused to pass through the outer chamber before entering the inner one, but the last quarter is conducted through a separate pipe direct into the inner chamber at about the middle of its height. The purified gases at a temperature of 70° or 80° C. pass to the ammonia separator through a pipe into which warm sulphuric acid is sprayed. A further quantity of sulphuric acid is introduced into the separator so as to cause a current of liquid to flow transversely across the top of the vessel, meeting a number of movable baffles hanging from the cover and passing round oblique perforated baffles arranged in the middle of the vessel. On the opposite side of the separator is arranged a froth separator which removes the top layer of froth and turns the main current of liquid back along the bottom of the vessel. Steam pipes are arranged in the walls of the separator. The ammonium sulphate crystals collect in a well at the bottom of the separator and are removed by an ejector.—H. H.

Gas from dry distillation of coal, wood, peat, etc.; Process for condensing tarry vapours in ——. H. Püning. Fr. Pat. 422,023, Oct. 31, 1910. Under Int. Conv., Nov. 12, 1909.

The tarry matters suspended in coal gas, etc., are deposited by means of an electric discharge through the gas. To obtain a complete separation the arrangement must be such that all parts of the gas are subjected to the discharge, and an enlarged surface for the deposition of the tar must be provided, as by flattening the pipe, fitting grids therein, etc. Different qualities of tar may be obtained by carrying out the process in stages, for example at 300°, 250°, 200°, and 150° C.—H. H.

Filaments and mantles for incandescent gas lighting; Process for impregnating ——. G. Bagrachow, Paris. Eng. Pat. 18,084, July 29, 1910.

Filaments or mantles made of incombustible or refractory material, or of metallic threads, are coated with rare earths by dipping them in a solution of the earths in alcohol or ether, the solvent being set alight and allowed to burn during the process.—A. T. L.

Incandescent mantles; Manufacture of —— *from artificial silk.* J. Dlougovsky. Fr. Pat. 422,643, Nov. 16, 1910.

The woven or knitted fabric is washed with slightly ozonised water, dried, impregnated with a solution containing thorium and cerium salts, again dried, and then heated in a stove through which a current of ozonised air is passed. The mantle is again washed and dried, and is finished in the usual manner.—A. T. L.

Incandescent electric lamps; Exhaustion of ——. F. Harrison, London. Eng. Pat. 10,870, May 3, 1910.

The lamp bulb containing phosphorus, or arsenic, is exhausted by a vacuum pump and is sealed off, and the gases remaining in the bulb are removed by passing a current through the filament and suitably heating the phosphorus or arsenic while the bulb is placed in the field of an induction coil or high tension transformer so as to produce the "blueing" or "Edison" effect in the bulb. The process is specially suitable for lamps intended to be used at voltages lower than 30 volts.—A. T. L.

Metallic filaments for electric incandescent lamps; Decarbonisation of ——. The Westinghouse Metal Filament Lamp Co., Ltd. First Addition, dated Oct. 26, 1910, to Fr. Pat. 412,443, Feb. 9, 1910 (this J., 1910, 1001). Under Int. Conv., Nov. 12, 1909.

Commercial filaments from which the carbon has not been completely eliminated are treated by the process described in the main patent.—A. T. L.

Filaments for incandescence lamps; Manufacture of ——. The Westinghouse Metal Filament Lamp Co., Ltd. First Addition, dated Oct. 29, 1910, to Fr. Pat. 414,257, March 30, 1910 (this J., 1910, 1195). Under Int. Conv., Nov. 3, 1909.

The patent is for an improved mercury contact device for use in the manufacture of continuous tungsten filaments by the process described in the main patent. The drop of mercury through which the filament passes is supported by surface tension in a central orifice in an amalgamated copper block. This central orifice is surrounded by an annular groove communicating with it by lateral passages, and this groove is open at the bottom to an orifice larger than the central one. The groove is filled with mercury until the quantity is as much as can be supported by the surface tension. With this arrangement the mercury surfaces in contact with the filament are concave, a condition which is found to be advantageous. The copper block is supported in a larger block provided with a cooling coil.—A. T. L.

Lighting; Method of —— *based on the action of an electric current on phosphorescent sulphides in an atmosphere of rarefied gas, and apparatus therefor.* E. Urbain, A. Feige, and C. Scal. Fr. Pat. 422,405, Jan. 17, 1910, and First Addition, dated Jan. 28, 1910.

(1). A white light suitable for illuminating purposes is emitted when a current is passed through a Geissler tube containing zinc sulphide or other phosphorescent sulphide. The tube may contain air, hydrogen, or other gas, but the best results are obtained with helium and the gases of the argon family. The sulphide may be on the interior surface of the tube or on any suitable support. (2). According to the Patent of Addition, radioactive zinc or other phosphorescent sulphide is used, and the lamps have a higher efficiency.—A. T. L.

Metal filaments for incandescence electric lamps; Process for decarburising ——. The Westinghouse Metal Filament Lamp Co., Ltd. First Addition, dated Oct. 27, 1910, to Fr. Pat. 412.048, Jan. 29, 1910. Under Int. Conv., Nov. 12, 1909.

See Eng. Pat. 5388 of 1910; this J., 1911, 410.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Patents.

Tar from coal, wood, petroleum, etc.; Process for treating —— *to produce pitch for agglomerating purposes.* The Calor Co., Ltd. Fr. Pat. 422,408, Jan. 17, 1910.

See Eng. Pat. 2901 of 1910; this J., 1911, 350.—T. F. B.

Derivatives of the anthraquinone series; Manufacture of ——. F. Ullmann, Charlottenburg, Germany. Eng. Pat. 16,272, July 7, 1910.

See Ger. Pats. 224,982 and 227,324 of 1909; this J., 1910, 1098 and 1368.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Leuco bases and dyestuffs derived from diphenylethylene. P. Lemoult. Comptes rend., 1911, **152**, 962—964.

The author has previously shown that certain alkyl derivatives of *p.p*-diaminodiphenylethylene such as the compound $CH_3 \cdot CH : C(Dm)_2$ (Dm representing $—C_6H_4N(CH_3)_2$) are leuco bases yielding dyestuffs on oxidation in dilute acid solution with sodium nitrite (see this J., 1908, 936; 1909, 1119). It is found that only those derivatives having a hydrogen atom linked to the ethylenic carbon and having the constitution $RHC : C(Dm)_2$, are true leuco bases yielding dyestuffs of great colouring power. Derivatives having the constitution $R_2R_1C : C(Dm)_2$, however, on treatment with sodium nitrite and dilute acid yield compounds with extremely weak dyeing power; they are therefore regarded as pseudo-leuco bases.—A. Sbld.

Azafran; The dyestuff contained in the root of ——. C. Liebermann. Ber., 1911, **44**, 850—851.

This root, which occurs in Paraguay, is used for colouring fats. The colouring matter is extracted with boiling benzene and the name Azafrin is assigned to it. It separates in orange red crusts which on crystallisation form warty microscopic needles melting at 214° C. It is sparingly soluble in ether but readily so in benzene, alcohol, acetic acid or chloroform and also in molten fats with a deep yellow colour. It is insoluble in water and only partly so in alkalis or ammonia in the cold but dissolves on boiling. It dyes wool yellow and shows affinity for certain metallic mordants (bismuth, lead, yttrium, zirconium and thorium). It gives a blue colour with sulphuric acid which turns to violet on addition of alcohol. It does not contain nitrogen or methoxyl or ethoxyl groups but appears to contain one hydroxyl group. Analyses gave C=75·04, 75·08, 75·06; H=8·92, 8·65, 8·66 per cent. and molecular weight=448, 462. It is being further investigated.—J. C. C.

Patents.

Dyestuffs; Manufacture of ——. R. B. Ransford, London. From L. Cassella und Co., Frankfort, Germany. Eng. Pats. 12,921, May 27, 1910, and 22,306, Sept. 26, 1910.

Di- or tri-anthraquinonylimides when heated with aluminium chloride are transformed into dyestuffs which give very fast shades on cotton. *Example* 1. 10 kilos. of α-anthraquinonyl-1-aminoanthraquinone mixed with 20 kilos. of anhydrous aluminium chloride are heated to 200°—220° C. until a sample dissolved in concentrated sulphuric acid gives a reddish violet colour which does not increase in intensity. The aluminium chloride is then removed by treatment with hot water. The dyestuff gives a brownish yellow vat from which cotton is dyed in brownish olive shades. *Example* 2. αα-dianthraquinonyl-1 : 5-diaminoanthraquinone when similarly treated gives a dyestuff which forms an orange red vat producing yellowish brown shades on cotton. If the amount of aluminium chloride be increased to 50 kilos. and the temperature to 240° C., a pure orange dyestuff is obtained, and if αα-dianthraquinonyl-1 : 8-diaminoanthraquinone is used, the resulting dyestuff gives greenish blue shades on cotton. *Example* 3. 10 kilos. of β-anthraquinonyl-α-aminoanthraquinone are similarly heated with 40 kilos. of aluminium chloride. The dyestuff produced gives brown shades and if ββ-dianthraquinonyl-1 : 5-diaminoanthraquinone is used the resulting dyestuff dyes cotton in purplish brown shades. *Example* 4. 10 kilos. of αα-dianthraquinonyl-1 : 5-diaminoanthraquinone are suspended in 120 kilos. of nitrobenzene and after adding 30 kilos. of aluminium chloride the solution is heated to 160° C. The dyeing properties of the product are as mentioned in example 1.
—J. C. C.

Indoxyls and Indigo colouring matters; Preparation of ——. A. Rahtjen, Hamburg, Germany. U.S. Pat. 984,442, Feb. 14, 1911.

Indoxyls and Indigo derivatives are prepared by electrolysing arylglycines. Example: 100 parts of a molecular mixture of sodium and potassium hydroxides are mixed with 30 parts of potassium acetylphenylglycine-o-carboxylate and the mixture heated to 220°—260° C. and fused in the cathode chamber of a suitable electrolytic cell. The anode chamber may be charged with the same molecular mixture of the alkali hydroxides alone. A current of 4—6 volts and 2—5 ampères per sq. decimetre may be employed. The operation is continued until for each molecule of substance a little more than one atom of alkali metal has been set free; this point is ascertained by calculation. The molten mass, after cooling, is added to water and the Indigo colouring matters prepared in the usual way. The yield is about 70 per cent. of the theoretical.—J. C. C.

Vat [anthracene] dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,142, May 17, 1910.

See Addition of Sept. 17, 1910, to Fr. Pat. 362,140 of 1906; this J., 1911, 350.—T. F. B.

Dyestuffs of the anthracene series; Process for preparing red —— *suitable for wool dyeing.* Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 422,047, Nov. 2, 1910. Under Int. Conv., Dec. 23, 1909.

See Eng. Pat. 1212 of 1910; this J., 1911, 275.—T. F. B.

Indoxyls and indigo dyestuffs; Process for preparing ——. A. Rahtjen. Fr. Pat. 422,425, Oct. 11, 1910.

See U.S. Pat. 984,442 of 1911; preceding.—T. F. B.

Acidylarylaminonaphtholsulphonic acids and azo dyestuffs derived therefrom; Process for preparing ——. L. Cassella und Co. Fr. Pat. 422,784, Jan. 27, 1910.

See Eng. Pat. 6153 of 1910; this J., 1911, 16.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Acetylcellulose; Colloidal nature of ——. E. Knoevenagel. Z. angew. Chem., 1911, **24**, 504—505.

Triacetylcellulose is insoluble in water, and very slightly soluble in most organic liquids; but it swells in many mixtures of organic liquids, and in aqueous solutions of organic and of some inorganic substances. Placed in 0·05 per cent. aqueous solution of methylene blue, these swollen acetylcelluloses adsorb the colouring matter with speeds roughly proportional to the degrees of swelling. The same amount of adsorption which would require months with the original acetylcellulose is effected in a few minutes with the swollen substance. Not only colouring matters, but other organic and even inorganic substances, are similarly affected as to their adsorption by acetylcellulose. The substances (alcohol and water, alcohol and acetic acid, etc.) used as fixing media in staining histological preparations are precisely those which produce the strongest swelling in acetylcellulose. Hence no doubt various colloid substances in the animal and vegetable kingdoms exhibit this property like acetylcellulose, and they take up the stains by reason of their previous swelling. No doubt this property has much to do with resorption and secretion in the living organism. The speed of saponification of the acetylcelluloses by aqueous alkalis is also proportional to the degree of swelling; highly swollen acetylcelluloses are completely saponified at the ordinary temperature by $N/2$ potassium hydroxide in a few hours. —J. T. D.

Cellulose; Nitrous esters of ——. M. Marqueyrol and D. Florentin. Bull. Soc. Chim., 1911, **9**, 306—309.

The authors discuss the statement of Nicolardot and Chertier (this J., 1910, 1299) that nitrous esters of cellulose are produced when viscose "silk" is treated with nitrous gases in presence of nitric acid. The properties which are claimed to be most characteristic of these nitrous esters, *viz.*, insolubility in acetone and the production of nitrites on treatment with alkali hydroxides, are quite consistent with the view that they are ordinary nitrates of low degrees of nitration. Moreover, the authors have prepared nitrates, which correspond in all respects with the nitrites of cellulose described by Nicolardot and Chertier, by treating artificial silk with nitric acid containing an excess of urea nitrate, which would absolutely preclude the existence of nitrous acid in the mixture. In the authors' opinion the claim that nitrous esters of cellulose have been prepared cannot be substantiated.—J. F. B.

Sulphite wood-pulp mill at Ragnit, Germany; Report on the discharge into the River Memel of the waste lyes from the proposed ——. J. H. Vogel. Papierfabr., 1911, **9**, 438—440.

The author has reported on the possible pollution of the River Memel by the effluents from a sulphite pulp mill which it is proposed to erect at Ragnit. The mill would produce 40 tons of cellulose per 24 hours, and the amount of effluents per second would consist of: 3·47 litres of waste lye, 9·26 litres of cooling, rinsing and washing waters, and 200 litres of manufacturing water. The flow of the river at low water is calculated at 200 cub. m. per second, and the river having numerous curves, it is assumed that perfect admixture would be attained at a distance of 8 km. from the works, the dilution of the waste lyes being then 45,000-fold. Under these conditions any injury to the Tilsit waterworks, situated at a distance of 14 km., is amply provided against, and destruction of fish and the growth of fungus are considered to be quite out of the question. In addition to the manufacture of wood pulp, it is proposed to bleach 10 tons of cellulose daily for the manufacture of paper, the bleaching effluents being mixed with the sulphite lyes and assisting their oxidation. The reporter recommends that the discharge be allowed under the following conditions: The strong waste lyes and the wash-waters used on the pulp for rinsing in the boiler itself, are to be collected in a reservoir of 1000 cub. m. capacity, from which they are to be mixed, after cooling, with the constantly flowing, clarified waste water from the manufacturing operations, and the diluted effluent discharged into the river. The manufacturing waste water and the used bleaching lyes are only to be admitted to the main effluent pipe after they have been so clarified from fibre that the maximum amount of suspended matter does not exceed 100 mgrms. per litre. The main discharge pipe must extend at least 5 metres into the river, and must be provided with perforations for a length of 3 metres at the end in order to avoid the discharge of a dense column of polluted liquid.—J. F. B.

Waste products from chemical industries. Fachini. *See* XII.

Patents.

Artificial silk; Making spinnerets for use in the manufacture of ——. C. Woegerer. Assignor to Art Fibre Co., Norristown, Pa. U.S. Pat. 988,424, April 4, 1911.

Spinnerets for the manufacture of artificial silk are prepared by fusing metallic filaments into the circumference of a glass core, fusing this core in the discharge tube, and then corroding away the metallic filaments by a suitable acid. A number of spinnerets may be made from a single core by cutting the core with its embedded filaments into a number of discs. Filaments other than metal may be used, provided the material is not fusible at the fusion point of glass and can be removed by dissolving.—J. F. B.

Coated yarns; Spinneret for the manufacture of ——. Soc. Franç. de la Viscose. Fr. Pat. 421,900, Jan. 4, 1910.

The spinneret consists of a tapered metal tube with an orifice at each end, and is connected by way of a T-piece with a supply of the coating material [*e.g.*, dissolved cellulose] maintained under a constant pressure by a pump. The yarn to be coated enters the tapered tube at the narrow end and, passing through the coating solution, emerges at an orifice screwed on to the other end. This orifice is pierced in a cap which is screwed over a perforated plate, the latter being attached directly to the T-piece. This plate, which is situated at only a short distance from the orifice in the cap, contains, besides the perforations necessary to permit the flow of the liquid, an accurately centred V-shaped perforation, which guides the yarn so that it emerges exactly in the centre of the spinning orifice; thus the coating is produced perfectly uniform, and the yarn cannot scrape against the edge of the orifice.—J. F. B.

Cellulose formates; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 422,542, Nov. 14, 1910. Under Int. Conv., Dec. 8, 1909.

Cellulose or any modified derivative of cellulose is treated with concentrated formic acid and sulphuryl chloride or chlorosulphonic acid, with or without the addition of zinc chloride: 100 parts of 95 per cent. formic acid and 5 parts of zinc chloride are mixed with 10 parts of sulphuryl chloride, 20 parts of dry cotton are stirred in and, after 5—6 hours, the syrupy solution is poured into water. The product is soluble in formic acid, zinc chloride solution and pyridine.—J. F. B.

Cellulose products; Process of manufacture of brilliant ——. Comp. Franç. des Applications de la Cellulose. Fr. Pat. 422,565, Jan. 21, 1910.

The specification relates to the composition of a new coagulating bath for the preparation of threads, films, etc., from solutions of cellulose in cuprammonium solution. This bath contains approximately 100 parts of a 30 per cent. solution of sodium hydroxide and 10 parts of calcium sucrate, mixed at a temperature of 50°—60° C. The mixture, when ready for use, should have a slightly cloudy appearance.—J. F. B.

Rosin size for paper; Process of dissolving ——. J. Barat. Fr. Pat. 422,061, Nov. 3, 1910.

The usual method of preparing an emulsion of rosin size for paper manufacture, *i.e.*, by injection with direct steam, is stated to have a tendency to injure the sizing properties of the rosin without this defect being apparent in the prepared emulsion. According to this specification, a solution of rosin soap and fresh water are withdrawn from separate vessels by means of a compression pump, and an intimate emulsion is then prepared by allowing the highly compressed liquid to escape suddenly into a storage tank.

A sieve is fixed vertically across the vessel in which the rosin soap is prepared, in order to hold back impurities from the discharge orifice.—J. F. B.

Marbled papers; Production on the paper-machine of ——. Farbw. vorm. Meister, Lucius, und Brüning. Fr. Pat. 422,462, Nov. 11, 1910; Under Int. Conv., Oct. 26, 1910.

Marbled colours are produced on the paper in the course of formation on the paper-machine wire by allowing a froth, *e.g.*, produced from a solution of soap, containing a dissolved dyestuff, to fall very gently on the moving web of paper. The coloured soap solution is contained in a trough above the wire of the machine, air is blown into the solution and the froth overflows in regulated quantity through a slit in the hooded cover. This froth runs down an adjustable board and falls on the paper. The bubbles of froth are broken, before they are carried forward to the dandy-roll or couch press, by the application of a fine spray of water.—J. F. B.

Paper pulp; Manufacture of —— from fibres, textiles, waste papers, wood-waste, and similar materials. L. Herz. Fr. Pat. 422,490, Nov. 12, 1910.

The material is digested with a solution containing sodium hydroxide and a volatile alkali, digestion being effected in a vessel provided with rotary and fixed mixing arms. The digested material is thence discharged into a mill consisting of two corrugated rollers, under the pressure of which knots and hard portions are broken down. From the rollers the pulp passes into a centrifugal machine consisting of a rotary perforated drum revolving inside a fixed drum. By means of gear wheels, vertical shafts provided with stirring arms are caused to revolve at differential speeds inside the centrifugal drum; a brush is also caused to sweep the perforated walls of the drum, and in certain cases, this brush may be made to push the material between two compressing rolls mounted on vertical shafts like the stirrers. In this machine the pulp is macerated and washed until free from alkali. If desired, an insulating material, a substitute for cork, may be prepared by mixing the pulp with starch-paste and chromic acid.—J. F. B.

Spun silk; Process of treating the raw material of —— and the products obtained thereby. T. Inouye, Shizuoka-ken, and T. Mochida, Tokyo. Eng. Pat. 6785, March 17, 1910. Under Int. Conv., July 15, 1909.

See Fr. Pat. 416,627 of 1910; this J., 1910, 1371.—T. F. B.

Vegetable fibres, such as those of capok, calotropis procera, asclepiadeæ, etc.; Process for treating brittle —— to render them capable of being dyed uniformly or utilised for spinning. E. G. Stark. Fr. Pat. 422,636, Jan. 24, 1910.

See U.S. Pat. 962,173 of 1910; this J., 1910, 940.—T. F. B.

Threads, wires, and bands; Manufacture of lustrous ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 13.100, May 30, 1910.

See Addition of June 11, 1910, to Fr. Pat. 408,370 of 1909; this J., 1910, 1371.—T. F. B.

Artificial threads; Process of manufacturing ——. E. Bechtel, Assignor to Hanauer Kunstseide-Fabrik, Hanau, Germany. U.S. Pat. 988.430, April 4, 1911.

See Ger. Pat. 220.711 of 1907; this J., 1910, 556.—T. F. B.

Hydrated cellulose; Production of ——. A. Pellerin, Neuilly-sur-Seine, France. Eng. Pat. 7748, March 30, 1910.

See Fr. Pat. 410,776 of 1909; this J., 1910, 811.—T. F. B.

Celluloid-like material; Non-inflammable ——. W. Merckens and H. B. Manissadjian, Basle, Switzerland. Eng. Pat. 8646, April 9, 1910. Under Int. Conv., April 13, 1909.

See Fr. Pat. 414,679 of 1910; this J., 1910, 1199.—T. F. B.

Solvents for pyroxylin and the like; Process for making ——. H. V. Walker, Newark, U.S.A. Eng. Pat. 22.309, Sept. 26, 1910.

See U.S. Pats. 972.952 and 972,953 of 1910; this J., 1910, 1332 and 1299.—T. F. B.

Cellulose [from Hedychium Coronarium]; Manufacture of products of a basis of ——. H. P. Vieira. Fr. Pat. 422,064, Nov. 3, 1910.

See Eng. Pat. 29,582 of 1910; this J., 1911, 485.—J. F. B.

Paper; Process for removing printers' ink from printed —— by means of bleaching substances having an alkaline action. H. Henkel, Dusseldorf, and O. Gessler, Augsburg, Germany. U.S. Pat. 988,874, April 4, 1911.

See Ger. Pat. 215,312 of 1908; this J., 1910, 18.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Basic dyestuffs with tannin; Compounds of ——. A. Sanin. Z. Farben-Ind., 1911, **10**, 81—83, 97—99.

When solutions of Chrysoidine, Diamond Magenta, Crystal Violet, Brilliant Green and Victoria Blue, are mixed with a solution of tannin, compounds are formed in each case containing equal molecules of the dyestuff and tannin. The compounds are precipitated in the presence of sodium acetate. They are very insoluble in water, but are dissolved by solution of tartaric acid. There is some evidence to show that adsorption takes place to a small extent between these compounds on the one hand and the dyestuff or tannin on the other.—J. C. C.

Malt enzymes and their employment in the textile industries. R. J. May. J. Soc. Dyers and Col., 1911, **27**, 88—92.

Diastatic preparations are of utility in the following branches of the textile industry: *Sizing.* A thick mixture of starch and water is poured in a thin stream into boiling water with continual stirring; after cooling the paste to 160° F., malt extract is added, and the mixture well stirred until it becomes thin and transparent. The liquid is then boiled to stop any further action and the other ingredients are now well stirred in. Cotton and woollen warps thus sized possess a good feel, are full, thick and smooth, run easily and are not dusty. *Size for cotton warps.* The following proportions are given: Farina 75 lb., malt extract 1 lb., wax 5 lb., tallow 5 lb., water 100 galls. *Finishing.* The mixture of soluble starch, dextrin and maltose, obtained by the action of malt extract on starch, forms practically an ideal base for all finishes. Saccharification must, however, not be allowed to proceed too far, or the finished goods may become limp owing to the hygroscopic nature of the sugar. The following recipes are given: *Finish for twills:* Farina, 400 lb., malt extract 6 lb., oleine oil, 50 per cent., 4½ galls., water 120 galls. *Finish for repps:* Farina 190 lb., malt extract 2½ lb., water 100 galls.; after conversion of the starch, 20 lb. of I. C. starch and 2½ galls. of oleine oil are added. *Finish for heavy pocketings:* Farina 400 lb., malt extract 6 lb., oleine oil, 2½ galls., soap softening, 25 lb., Glauber's salt, 80 lb. *Stripping and degumming.* The filling even in heavy cloth is removed with comparative ease, by passing the cloth through or steeping in an enzymic solution and then passing through boiling water in a "jig." *Preparation of cloth for mercerisation.* Treatment of the goods, after singeing, with a malt solution materially reduces the time required for "scouring"; there is less risk of felting and the lyes remain clear. *Preliminary treatment before bleaching.* An enzymic bath is of great service in the production of a clean bleach by its action on the pectinous matters present in new cotton and linen. The fibres are rendered more absorbent and less chemical treatment is required. *Thickenings for printing colours.* These are prepared similarly to the bases for finishes and sizes. They possess great binding power and adhesiveness to the cloth. After printing any excess of starchy matter can be removed by "malting" and the colours brightened. In determining the value of malt extracts for textile purposes the liquefactive power should be determined by either the Pollak or Lintner-Sollied method (this J., 1903, 826, 1370) in addition to the determination of the saccharifying power by the ordinary Lintner method. —A. Sbld.

Starch; Some properties of —— relating to its stiffening power. W. Harrison. J. Soc. Dyers and Col., 1911, 27, 84—88.

When starch suspensions are heated to just above the swelling point and then cooled, the swelled granules can be separated by centrifuging, and the volume of the deposit is stated to be proportional to the viscosity, no matter what starch is used. A simple method of comparing the stiffening power of different samples of a starch is based on these observations. 1 per cent. aqueous suspensions of each are heated simultaneously on the water-bath to a few degrees above the temperature of swelling (60° C. in the case of potato starch), with careful mixing but without shaking. After cooling to the ordinary temperature, 15 c.c. of each solution are centrifuged in tubes graduated to 1/10 c.c. The volumes of granules deposited represent the comparative stiffening powers. The relation between the viscosity and the volume of separated granules is represented by the equation :—

$$\text{Viscosity} = 1 + \left(4{\cdot}75 \times \frac{\text{Volume of granules}}{\text{Total volume of solution}}\right)$$

The results obtained compared with those given by a capillary tube viscosimeter are given in the following table :—

Starch.	Wheat.	Wheat.	Maize.	Rice.	Rice.	Potato.	Sago.	Sago.	Tapioca.	Tapioca.	Potato.
Volume of granules	0·75	1·6	1·7	2·2	2·75	2·9	3·75	4·0	4·4	5·5	5·3
Viscosity by viscosimeter	1·23	1·50	1·29	1·70	1·86	1·91	2·21	2·29	2·44	2·8	3·2
,, calculated from formula..	1·22	1·51	1·54	1·70	1·87	1·92	2·19	2·27	2·40	2·74	2·68

The low result obtained with the viscosimeter in the case of maize starch is found to be caused by the fatty matter present; the results agree if the starch be extracted with alcohol and ether. Owing to the viscous nature of potato starch solutions the results cease to agree when the viscosity reaches 3; but it was ascertained that the volume of swelled granules deposited is proportional to the amount of starch used, unless that volume approaches 100 per cent. of the total. As the viscosity increases quite out of proportion to the percentage of this starch, it is probable that the volume of swelled granules represents the stiffening power more accurately. If the suspensions be heated too long or shaken, fine particles may be set free which cannot be separated centrifugally, which is also the case with soluble starch; for accurate determinations the granules of starch should be swelled, but no starch should be present in the surrounding liquid. In the case of potato starch the comparison should be repeated several times on account of the great variation in the size of the granules. Alkali, if present, causes high results. As different starches swell at different temperatures and the stiffening depends also on the duration of the heating, the above method is not applicable for the quantitative comparison of different types of starches.—A. Sbld.

Erratum.

This J. 1911, p. 416, col. 2, l. 27 from top, delete the word "these."

Patents.

Bleaching by the oxygen of air; Process of ——. R. Müller. First Addition, dated Nov. 5, 1910 (under Int. Conv., Mar. 11, 1910) to Fr. Pat. 414,821, April 14, 1910 (this J., 1910, 1200).

If the material to be bleached is liable to be tendered by over-oxidation, it is necessary to prevent it from coming into direct contact with air during the bleaching process. This can be effected as follows: 60 kilos. of cotton and 1000 litres of a 1 per cent. solution of sodium carbonate containing 20 grms. of manganese sulphate are put into an autoclave, taking care that the cotton is completely covered. The lye is then heated for 2 hours under a pressure of 2 atmospheres, air being excluded. A current of air at a pressure 1—1·5 atmospheres greater than the steam pressure is next directed on to the surface of the lye until the bleaching operation is completed. The lye is then run off and the cotton is washed, treated for a minute with a 0·5 per cent. solution of sodium bisulphite to remove the precipitated manganese hydroxide, washed again and finally dried. Tests are given for determining when the bleaching is completed.—P. F. C.

Brown to olive shades on the fibre; Production of ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 412, Jan. 6, 1911. Under Int. Conv., May 30, 1910.

The azo dyestuffs obtained by tetrazotising one molecule of a *m*- or *p*-aminobenzene-azo-1-amino-8-naphtholsulphonic acid and then combining the tetrazo-compound with two molecules of resorcinol or with one molecule of resorcinol and one molecule of a metadiamine, give, when dyed and developed on the fibre with suitable diazo-compounds, olive to brown shades of good fastness to light and washing. The dyeings can also be discharged to a pure white. —P. F. C.

Dyeing; Process of ——. P. Besnier, New Orleans, La. U.S. Pat. 988,300, April 4, 1911.

A fixing powder for use in the dyeing of fabrics is prepared by heating whilst stirring 25 parts of salt, 10 parts of Glauber's salt, 1 part of "lye" and 1 part of naphthalene The product is cooled and powdered.—P. F. C.

Dyeing apparatus. J. C. Evenden and C. Frohlich, Amsterdam, N.Y. U.S. Pat. 988,633, April 4, 1911.

The material to be dyed is packed inside perforated receivers which are arranged near to opposite ends of a closed rectangular dye-vat. A closed supply tank is arranged above this dye-vat and communicates with it by means of four pipes, two of them entering the vat at opposite ends and the other two at points between the two receivers. Each of these pipes is provided with stop-cocks. The dye-liquor is circulated through the material by means of a piston which is arranged inside the vat in the space between the receivers and has a cross-section equal in area to that of the dye-vat.—P. F. C.

Dyeings on velvet; Process and machine for fixing ——. M. Fargeat. Fr. Pat. 422,112, Jan. 11, 1910.

The pile of the material is successively treated with solutions containing 50 c.c. of glacial acetic acid in a litre of benzene and 50 c.c. of ammonia in a litre of alcohol, the velvet being dried after each operation. To apply the solutions to the material they are forced into semicylindrical vessels having their rounded surfaces (which are perforated), tightly wrapped in flannel or some other absorbent material. The solution passes through the perforations, saturates the flannel and, when the velvet is passed, face downwards, over the round part of the vessel, is finally transferred to the material. A separate vessel is kept for each solution.—P. F. C.

Indigo dyeing with a hydrosulphite vat; Process of —— and a machine with a large output for applying it. C. Rachou and E. Chaumat. Fr. Pat. 422,414, Jan. 18, 1910.

The material to be dyed, such as loose wool or raw cotton, is worked for 20 minutes in a long rectangular tank containing a hydrosulphite-indigo vat. It is then taken up by an automatic lifting device comprising a number of forks fixed to a revolving axis and is deposited evenly on an endless band which delivers it quickly to a pair of rollers so that the excess of dye liquor is expressed before oxidation has time to set in. The squeezed material falls from the rollers on to another endless band and is then delivered into a rectangular washing tank and automatically raked along it. A current of water is made to flow through this tank in the opposite direction to that in which the material travels. The dye liquor expressed by the squeezing rollers falls into a reservoir and thence flows through a pipe which redelivers it into the dye-tank at the end most remote from the rollers. By means of a tube which dips into this reservoir, small quantities of hydrosulphite solution can be added to the expressed liquor before it returns to the dye-tank so as to reduce any indigo which has become oxidised by contact with air. The dye-tank may be fitted with a vertical perforated plate, movable horizontally, having an area equal to the cross-section of the tank, in order to drive the impregnated material towards the lifting device.—P. F. C.

Dyeing machine having winches to which a pendulum motion can be imparted. C. Lumpp et Cie. Fr. Pat. 422,712, Jan. 26, 1910.

The material to be dyed is carried by a number of winches arranged above a dye-vat. A compound motion can be imported to each winch, firstly, the simple reversible rotatory movement and secondly a regular oscillation of the whole winch about an axis external to itself. Each winch can be lifted out of action at will by means of a piston worked by hydraulic pressure.—P. F. C.

Oxidation chamber for Aniline Black dyeing. Soc. Marchal et Falck. Fr. Pat. 422,613, Nov. 16, 1910.

This apparatus comprises a chamber divided into two parts by a perforated horizontal partition, underneath which are arranged closed steam coils and a number of fan-like devices for keeping the heated air in continuous circulation, thus ensuring regularity of temperature throughout the apparatus. In the upper part of the chamber the material to be aged is arranged according to its nature; yarns for example are suspended over sticks, whilst raw cotton is evenly spread out on trays. The air as it becomes charged with the acid vapours liberated during the "ageing" process is withdrawn from the chamber by means of fans suitably disposed in ventilating shafts.—P. F. C.

Printing rollers for textile fabrics and the like; Manufacture of ——. I. Iwanoff, Moscow, Russia. Eng. Pat. 8122, April 4, 1910.

The required pattern is engraved on a zinc plate, the length of which is equal to the periphery of the roller. A sheet of hard lead alloy of the same size is next laid upon the engraved surface and both sheets are passed through pressure rollers in order to obtain an embossed impression on the lead sheet. The relief plate thus obtained is wrapped round a wooden roller with the pattern towards the inside and the adjacent edges are soldered together forming a lead cylinder which is next withdrawn from the wooden roller and coppered on the inside by electrolysis from a copper sulphate solution. It is then placed concentrically round a hollow iron roller and the space between the roller and the coppered cylinder is filled with cast hard lead or other suitable material, so that after the removal of the outer lead casing, a printing roller is obtained ready for use.—P. F. C.

Yarns and fabrics; Process for rendering —— *resistant, impermeable and fireproof.* M. Boucherie. Fr. Pat. 422,917, Nov. 24, 1910.

The material to be treated is loosely arranged inside a metallic cylinder from which air is withdrawn by means of a pump. The liquor suitable for the treatment is then allowed to flow into the cylinder and thoroughly saturate the material, which, after the excess of liquor has been removed, is finally dried. (See also Fr. Pat. 401,746 of 1908, this J., 1909, 1132).—P. F. C.

Dyeing yarn; Apparatus for ——. J. M. Payne and G. G. Wallace. Fr. Pat. 422,827, Nov. 21, 1910.

See U.S. Pat. 976,830 of 1910; this J., 1911, 354.—T. F. B.

Discharges on vatted grounds and sulphonic derivatives of organic ammonium bases. Badische Anilin und Soda Fabrik. Second Addition, dated Nov. 18, 1910, to Fr. Pat. 414,937, April 19, 1910. Under Int. Conv., April 15, June 7, July 2, Aug. 6 and 12, and Oct. 7, 1910.

See Eng. Pats. 15,722 and 17,099 of 1910; this J., 1911, 206.—T. F. B.

Starched linen or similar articles; Process for treating —— *to give them a permanent glazed and washable surface.* A. A. A. Zimmer. Fr. Pat. 422,763, Nov. 18, 1910.

See Eng. Pat. 24,006 of 1909; this J., 1911, 21.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Calcium oxalate; Some reactions of ——. W. O. de Coninck and A. Raynaud. Bull. Soc. Chim., 1911, 9, 301—306.

When calcium oxalate is treated with chlorine, bromine, or iodine and heated to a suitable temperature, reaction takes place quantitatively according to the equation: $CaC_2O_4+2R=CaR_2+2CO_2$. When heated in presence of the dry vapours of hydrochloric or hydrobromic acid the halogen salt of calcium is produced, together with a mixture of carbon monoxide and carbon dioxide. With nitric acid, the reducing properties of calcium oxalate are manifested by the evolution of nitrogen peroxide together with carbon dioxide. When calcium oxalate is heated alone, the water of crystallisation is given off at a temperature slightly above 100° C.; at incipient redness carbon dioxide is first formed and its evolution continues for some time with slight carbonisation of the mass. Only at a bright red heat is carbon monoxide produced, its evolution being quite sudden and violent. When heated with sand, the reaction is purely one of oxidation, no carbon monoxide is formed, and the residue consists of calcium silicates. With boric anhydride and titanic anhydride a similar reaction takes place. With stannic anhydride, carbon monoxide is produced as well as the dioxide; the production of calcium stannate is not very pronounced. With other metallic oxides, such as uranic, ferric, bismuthic oxides, red lead, lead, manganese and barium peroxides, no carbon monoxide is formed, but the oxides of higher degrees of oxidation are reduced to corresponding oxides of lower degrees of oxidation, whilst carbon dioxide is evolved. In the case of antimonic oxide with an excess of calcium oxalate, some metallic antimony is formed.—J. F. B.

Radium preparation; A new highly active ——. A. Fischer. Pharm. Post, 1911, 44, 193—194. Chem. Zentr., 1911, 1, 1190—1191.

It is stated that at the Neulengbach radium works, the radium is obtained directly in the form of crude sulphate by a combined extraction process—the so-called acid and alkaline fusion. In this way, 10,000 kilos. of pitchblende residues can be treated and crude radium chloride obtained in six weeks, and low-grade ores containing 3, 6, 10 and 15 per cent. of uranium oxide, which cannot be treated by the Curie-Debierne process, are rendered available for radium manufacture. Experiments on living skin showed that radium emanation enters the organism mainly by inhalation. The Neulengbach works furnishes for experimental purposes preparations which in sterile sodium chloride solutions exhibit activities of up to 300,000 Mache units (see this J., 1910, 447) per 10 c.c.—A. S.

Residues containing actinium from the manufacture of radium [from pitchblende]; Chemical examination of the ——. C. Auer von Welsbach. Z. anorg. Chem., 1911, 69, 353—391. (See this J., 1911, 129.)

The author gives an account of the first part of an investigation, carried out for the "Radiumkommission der kaiserl. Akademie der Wissenschaften in Wien," of about 1800 kilos. of the residual "hydrates" obtained in the working up of 10 tons of uranium pitchblende residues for the preparation of radium salts (compare Haitinger and Ulrich, this J., 1908, 917). About 120 kilos. were first treated by a very complicated process (the "sulphate process") by which the radioactive substances were isolated, in part, without any operations involving ignition. In this portion of the paper a description is given of what the author terms the "hydrate process," which was very largely used in the investigation for the separation of different rare earths or groups of rare earths. It is briefly as follows:—When the rare earths are precipitated as oxalates, the first precipitates contain many other elements besides those of the cerium and ytterbium groups. The oxides obtained by gentle ignition of the oxalates, if not too rich in cerium or thorium, dissolve easily in warm nitric acid, the solution being mostly coloured red by ceric salts. The latter are reduced to cerous salts by careful addition of very dilute oxalic acid solution, and any heavy metals present are precipitated by hydrogen sulphide in acid solution. The faintly acid solution, rich in ammonium nitrate, is then treated with the hydrates obtained by precipitating a portion of the solution with cold ammonia, or it may be treated directly with dilute (1 : 20) ammonia, with vigorous stirring. On boiling the mixture, the precipitate interacts with the salts in solution, and basic or hyper-basic salts are separated. By effecting fractional precipitations in this way, separate constituents or groups of constituents can be obtained almost quantitatively: iron is precipitated most easily, then thorium, uranium, scandium, ytterbium, other elements of the ytterbium group, and finally elements of the cerium group, the last being lanthanum.

From the experience gained with the "sulphate process," a simpler "oxalate process" was devised, of which three modifications were used. About 40 kilos. were treated by the first experimental modification, and about 400 kilos. by the second, as described below. The radioactivity of the different fractions was measured in most cases by means of an electroscope, the activity of uranium oxide (U_3O_8) being taken as unit: "very feebly radioactive" signifies 1—10 units; "feebly radioactive," 10—20; "radioactive," 20—50; "strongly radioactive," 50—100; "very strongly radioactive," 100—1000; "highly radioactive," 1000—10,000; and "enormously radioactive," more than 10,000 units.

Oxalate process.—The "hydrates" were treated with concentrated hydrochloric acid, and the residue of calcium and lead sulphates, etc., filtered off and extracted with hydrochloric acid. The solution was treated with water and dilute ammonia to precipitate the bismuth (bismuth precipitate I.), and the filtrate from this concentrated. The brown precipitate which formed was digested with oxalic acid, and the solution added to the main solution. The residual oxalates were ignited and dissolved in nitric acid, and the solution containing rare earths reserved for purification with the main quantity at a later stage. The main solution was treated with excess of oxalic acid, and the precipitated oxalates ignited. The oxides were dissolved in nitric acid, reduced, freed from heavy metals by hydrogen sulphide, and treated by the "hydrate process" (see above) until the last precipitate was only feebly radioactive (thorium-containing hydrates I.). The filtrate from the oxalates was fractionally precipitated with dilute ammonia, and the precipitates (fractions 1—10), containing much basic ferric oxalate, were digested with oxalic acid (oxalic acid digestion liquors, 1—10). The main solution was then precipitated twice more with ammonia (fractions 11 and 12), and these precipitates also digested with oxalic acid (digestion liquors 11 and 12). The twelve oxalate precipitates (termed "after-precipitations") were all more or less radioactive. Fractions 1—5 were combined, ignited, warmed with nitric acid, and filtered, the insoluble matter being further treated later. The nitrate solution was treated with hydrogen sulphide, and then twice precipitated by the "hydrate process," the mother liquor, rich in calcium, being then treated with ammonia, the precipitate dissolved in nitric acid, and the solution precipitated with oxalic acid. Fractions 6 and 7 were treated in an analogous manner. Fraction 8 was more strongly radioactive, and the nitrate solution obtained as described was subjected to three "hydrate precipitations." The first precipitate was radioactive, the third almost inactive. Fractions 9 and 10 were richer in bismuth. Part of the bismuth was separated from the nitrate solution, after concentration, by treatment with water and dilute ammonia, and then the same method as before was followed, five "hydrate precipitations" being made, the last precipitate still possessing radioactivity. The nitrate mother-liquor was precipitated fractionally from strongly acid solution with oxalic acid: the two first precipitates were almost inactive; the third was radioactive (due to actinium). The bismuth precipitate (see above) was strongly radioactive; it was dissolved in nitric acid and re-precipitated with water, this precipitate being almost inactive. The filtrate when precipitated with ammonia, gave a strongly radioactive hydrate. Fractions 11 and 12 were rich in uranium; four "hydrate precipitations" were made and the feebly radioactive precipitates were dissolved in nitric acid, and uranyl nitrate crystallised fractionally. The uranium precipitates were almost inactive. The mother liquors from the "hydrate precipitations" were precipitated with ammonia, the precipitate dissolved in nitric acid, and uranyl nitrate crystallised from the solution: the crystals were almost inactive. The mother liquor was united with that obtained previously and diluted with water, and after filtering from precipitated calcium fluoride, the solution was precipitated with ammonia. After three precipitations the solution was free from uranium. The feebly radioactive precipitates were not completely soluble in nitric acid. The insoluble portion from the first precipitate consisted of silicofluorides (silicofluorides I.): it contained lanthanum, ytterbium, cerium, etc., and some calcium, and was very strongly radioactive. The corresponding portions from the second and third precipitates were feebly radioactive. All the nitrate solutions of earth metals from the fractions 1 to 12 were reserved.

Bismuth precipitate I.—This was dissolved in hydrochloric acid and the solution precipitated first with water and then with dilute ammonia. The mother liquor was precipitated with ammonia, the separated hydrates digested with oxalic acid, and the oxalates collected, the mother liquor being reserved. The first bismuth precipitate was again dissolved in hydrochloric acid, and the solution precipitated in succession with water, dilute ammonia, and ammonia, as before. The precipitated hydrates were digested with oxalic acid, and the oxalates collected and ignited. The radioactive oxides were dissolved in nitric acid, and the solution treated with hydrogen sulphide and then precipitated by the "hydrate process." The first two precipitates were again digested with oxalic acid, and the oxalates collected. The oxalate solution was precipitated with ammonia, and the oxalates treated as before. The second and third precipitates from the original nitrate solution were treated in the same way as the first. The residual nitrate solutions of earth metals from the various operations were united and fractionally precipitated with oxalic acid, the oxalates were ignited, and the oxides dissolved in nitric acid, the solution being reserved.

Residues from the "after-precipitations" insoluble in nitric acid. The residues from fractions 1 to 5, 9, and 10 were extracted first with sulphuric acid and then with hydrochloric acid. The residues from fractions 6, 7, 11, and 12 were extracted directly with hydrochloric acid, and the matter left undissolved from 6 and 7 was treated with sulphuric acid. The different solutions were separately precipitated with ammonia, the separated hydrates were dissolved in nitric acid, and the solution precipitated by the "hydrate process." The radioactive hydrates were dissolved in nitric acid, precipitated with oxalic acid, and after-precipitated with ammonia (strongly radioactive precipitates). The oxalate mother liquors were reserved, the nitrate solutions from the "hydrate process" were precipitated with oxalic acid, the oxalates ignited, and the oxides dissolved in nitric acid, the solution being reserved.

Thorium-containing hydrates I. The yellow amorphous strongly radioactive mass gave off penetrating rays, and produced much emanation; it appeared luminous in the dark. It was treated with nitric acid, and the strongly acid solution partly neutralised with ammonia, a white inactive precipitate being obtained. On further addition of ammonia, a yellow, strongly radioactive precipitate and then a brownish radioactive one were obtained. The mother liquor on further addition of ammonia yielded a precipitate containing cerium. The second and third precipitates were dissolved in nitric acid, the solution precipitated with oxalic acid, and the oxalates extracted with ammonium oxalate, the thorium-containing solution obtained being united later with the main portion. The nitrate solution containing most of the thorium was precipitated with oxalic acid, and the mother liquor precipitated with ammonia. The oxalates derived from these precipitates were together treated with ammonium oxalate; the insoluble matter was very feebly radioactive. The thorium ammonium oxalate solution was treated with nitric acid, yielding a white, very strongly radioactive oxalate, which produced much emanation. The oxalate mother liquors, containing much uranium, were neutralised with ammonia, evaporated, and allowed to crystallise. Double ammonium oxalates containing iron separated first, then salts free from iron, and finally nearly pure uranium ammonium oxalate. All of these were dissolved and re-precipitated with ammonia: the hydrates from the fractions containing a little iron were radioactive; those from the nearly pure uranium salts were almost inactive. When dissolved in nitric acid, the solution evaporated, and the residue treated with water, only a small portion, containing silicon, zirconium, etc., but free from thorium, remained undissolved. The whole of the thorium ammonium oxalate solutions, together with those from previous operations, were now united, dissolved in boiling ammonium oxalate solution, and the solution allowed to crystallise, seven series of fractional crystallisations being made for the isolation of the thorium compounds. After the fifth series, the radioactivity of the final mother liquors decreased. The first fractions of the series were double ammonium oxalates of the rare earths. The first fraction of the fourth series was very feebly radioactive; the first and second fractions of the fifth series were feebly radioactive. The first fractions of the sixth and seventh series were strongly radioactive; they contained scandium and erbium, but no thorium. The final thorium ammonium oxalate fractions were nearly pure; these salts were the carriers of the radioactivity; they did not crystallise so readily as ordinary thorium salts. The fractions rich in thorium were dissolved, united with the thorium mother liquors, and treated with water. Very strongly radioactive crystalline oxalates separated from the solution: they contained scandium, ytterbium (50 per cent.), erbium, and about 5 per cent. of thorium. They were dissolved in ammonium oxalate and again treated with water. The clear solution from the oxalate precipitate was poured off, and treated with nitric acid, yielding a very strongly radioactive precipitate which was added to the other thorium salts. The oxalate precipitate, together with the double ammonium oxalates previously mentioned, was dissolved, and the solution fractionally crystallised. The first fraction free from thorium, was very strongly radioactive. The mother liquor was treated with water, the scandium precipitate produced being very feebly radioactive. The mother liquor from the scandium precipitate when acidified with nitric acid gave a very small quantity of a very strongly radioactive precipitate. The results just described show that certain ytterbia earths when separated from thorium-ionium solutions, possess radioactive properties; this activity, however, disappears almost completely after some months. All the thorium liquors were now precipitated with nitric acid: the precipitated thorium ammonium oxalate contained considerable quantities of scandium. The precipitates were decomposed by heating with ammonia, the solution evaporated, and after further separation as double ammonium oxalate, precipitated with ammonia. The filtrate from this precipitate was free from thorium and yielded an almost inactive residue on evaporation. The precipitated thorium hydrate (more correctly ammonium thorate) was strongly radioactive. It was dissolved in nitric acid: from the solution oxalates separated after a short time. These were again decomposed by ammonia and the treatment repeated until no separation took place from the nitric acid solution. From the nitrate solution, thorium ammonium nitrate was separated by fractional crystallisation. The solution was evaporated on the water-bath until an adherent crystalline crust separated on the bottom of the containing dish. The hot liquor was then poured off and the process repeated. After a few series of such crystallisations, all the scandium was left in the final mother liquor. The first crystalline fraction was re-crystallised twice from water, whereby the acid salt was converted into the neutral salt; about 10 grms. were obtained. The oxide obtained by strong ignition was pure white and highly radioactive; spectroscopic examination showed only thorium. A sample of it examined by St. Meyer and v. Schweidler (see Anz. kaiserl. Akad. der Wiss., 1909 [14], 239) was found to contain about 0·25 per cent. of Boltwood's ionium. The thorium ammonium nitrate crystals, which contained some occluded mother liquor, became opaque after some time and developed an odour of oxides of nitrogen. When they were dissolved in water, considerable quantities of an odourless and colourless gas were evolved. The faintly yellowish mother liquor from the last fraction of thorium ammonium nitrate crystals was treated with sulphuric acid. The precipitate produced appeared luminous in the dark. When treated with water an inactive residue containing scandium remained undissolved. The solution was treated with ammonium sulphate and concentrated, when white crystals containing scandium and about 20 per cent. of thorium separated: these were decomposed with ammonia and the hydrates reserved. The solution was precipitated with ammonia and boiled: the white precipitate contained ytterbia elements, a little thorium, and very little scandium: the solution was evaporated and the residue ignited: it contained a little thorium and no scandium, and was strongly radioactive. The second fraction of thorium ammonium nitrate was reserved as the acid salt. The mother liquor was precipitated with ammonia, and the precipitate reserved. All mother liquors containing earth metals were evaporated and the residues ignited. The first mother liquor from the second fraction of the thorium series yielded a very small quantity of an enormously radioactive black residue, which was taken up with nitric acid: the platinum dish even after vigorous scouring was still radioactive. From the strongly radioactive solution, on addition of ammonia, a just perceptible flocculent precipitate separated, which was filtered off: the filter was enormously radioactive, a strongly rubbed glass rod being completely discharged in about 1 second at a distance of about 5 cm. The activity of this slight precipitate was estimated to be several thousand times as great as that of the most active pure thorium (ionium) oxide, but it rapidly fell off, being reduced to approximately half its original value after 4 hours. The filtrate from this precipitate when treated with ammonium oxalate, gave a very small quantity of an enormously radioactive precipitate: the filtrate from this was evaporated and the residue ignited, leaving a scarcely visible but enormously radioactive residue. The radioactivity of all these products was only transient, falling off more or less rapidly: only those products which contained thorium retained their radioactivity undiminished. Attempts to obtain from the thorium (ionium) oxide described above, products richer in ionium, proved unsuccessful.

Ignition experiments with pure thorium (ionium) oxide. (*a*) A porous thread obtained by burning off a cotton thread impregnated with a nitrate solution, was heated in the hottest part of a Bunsen flame for 10 hours, but suffered no loss of radioactivity. A similar result was observed after heating it for half-an-hour in an oxyhydrogen flame. (*b*) A thin rod of the oxide of about 1 mm. cross-section was burnt dense and hard, and then suspended in the hottest portion of an electric carbon arc; after one minute the surface was lightly glazed and after 3 minutes the rod began to shrink considerably; after a longer period, particles began to split off. No diminution of radioactivity could be observed.

Working up of the remaining fractions containing thorium. (*a*) *Oxalates from the bismuth precipitations.*—These were boiled with concentrated nitric acid until decomposition of the oxalates commenced, when the mixture was evaporated, the residue ignited, digested with nitric acid, dissolved in water, and precipitated with nitric acid. The meta-salts were extracted with sulphuric acid: the white sulphate was highly radioactive. When dissolved in water, a small quantity of a highly radioactive residue containing thorium and silicon was left. The clear sulphate solution was fractionated by heating; no concentration of ionium occurred. The pure thorium fractions were united and precipitated with oxalic acid. All the liquors were treated as described below. (*b*) *Hydrate precipitates from the "after-precipitations."* (*c*) *Some active hydrates from the "iron hydrate" from the bismuth precipitations.* These products, along with the liquors from (*a*), were treated together. They gave a clear, deep yellow nitrate solution which was precipitated twice with oxalic acid. The oxalates yielded brown, strongly radioactive oxides, rich in cerium. The nitrate solution was reduced with alcohol and fractionally precipitated with ammonia. The first yellow precipitate was dissolved in nitric acid and precipitated with oxalic acid, yielding a strongly radioactive oxalate. The second, very feebly radioactive, precipitate was dissolved, reduced and treated with sufficient ammonia to precipitate about one-quarter of the bases present: the precipitate was very feebly radioactive. The oxalates prepared from the third and fourth precipitates, produced in faintly acid solution, were greenish and, at first, only very feebly radioactive, but the activity increased considerably even during the first 24 hours. They were ignited, the oxides dissolved in nitric acid, the ceric salts reduced by alcohol, and the solution precipitated with ammonia until colourless: the yellow precipitate was strongly radioactive. It was dissolved in nitric acid and precipitated with oxalic acid from strongly acid solution, a small quantity of a strongly radioactive precipitate being produced, which was added to the other reserved thorium precipitates. The radioactivity of the residues, which contained disintegration products of actinium, rapidly diminished. The whole of the thorium oxalate fractions were dissolved in hot ammonium oxalate solution, and the solution fractionated, in order to separate the sparingly soluble constituents. The combined thorium liquors were precipitated with nitric acid: the mother liquor from this precipitate, on treatment with ammonia, yielded nearly pure scandium oxalate. The thorium ammonium oxalate was decomposed with ammonia: after repeating this treatment three times a residue insoluble in nitric acid, and containing thorium, separated from the clear solution. The thorium ammonium nitrate solution was evaporated, yielding needle-shaped crystals which gradually became turbid. The mother liquor was coloured faintly pink owing to the presence of erbium. Gases have since been evolved continuously from these preparations. In applying the "hydrate process" of fractionation, mentioned repeatedly, the precipitations were continued so long as the separated hydrates were radioactive. In most cases this occurred very soon, but in some instances radioactive hydrates were obtained even after five precipitations, and when the mother liquors from the precipitates were made strongly acid and fractionally precipitated with oxalic acid, the radioactive constituents became concentrated in the oxalate mother liquors, for on gradually neutralising the latter with ammonia, very strongly radioactive precipitates were obtained. These, and also the hydrate precipitates, were examined separately. (*a*) *Hydrate precipitates.*—Third fourth, and fifth precipitates from the nitrate solution, from fraction 9—10 of the "after-precipitations." They were dissolved in nitric acid and fractionally precipitated with oxalic acid from strongly acid solution. The first and second fractions, constituting the main quantity, were nearly inactive. The third fraction, precipitated after partial neutralisation of the solution, was pure white and strongly radioactive: the mother liquor, which was very strongly radioactive after 24 hours, gave a small quantity of a very feebly radioactive precipitate when made basic, and the final liquor, when evaporated and the residue ignited, left a very small quantity of a feebly radioactive substance. The foregoing reactions show that the radioactive constituent is fairly easily soluble in acid, but forms a sparingly soluble oxalate in acid ammonium oxalate solution. (*b*) *Oxalates obtained from the hydrate mother liquors.*—These were ignited, and the oxides, containing lanthanum, calcium, etc., and a trace of neodymium, were dissolved in dilute nitric acid. The solution when treated with two drops of sulphuric acid, yielded traces of a feebly radioactive precipitate, which later became inactive. The first trace of precipitate produced on adding ammonia was radioactive, but later became inactive. On adding more ammonia an abundant radioactive precipitate was produced, the activity of which increased slowly: after 8 months the substance was very strongly radioactive. The ammoniacal liquor was treated with ammonium oxalate, and yielded a strongly radioactive precipitate, which was very strongly radioactive after 24 hours. The mother liquor, after 8 months, was only "radioactive"; it was evaporated and the residue ignited. The residue, though scarcely visible, was very strongly radioactive. It was collected on damp filter paper, which was then incinerated, leaving a highly radioactive ash, which, however, after 6 months, was only feebly radioactive. The primary radioactive substance contained in the above fractions, appears not to be identical with that contained in the manganites (see later).

Working-up of the rare earth nitrate liquors free from ionium.—These contained almost exclusively cerite earths, being derived from the chief precipitation and the "after-precipitations" of fractions 1 to 10. They were treated separately but in the same way. The hydrates precipitated by ammonia were oxidised in the air, and dissolved in nitric acid; the cerium salts were separated, dissolved in nitric acid, and after addition of ammonium nitrate, crystallised as ceric ammonium nitrate; the crystals were recrystallised several times; they were inactive. The mother liquors from the cerium precipitates were treated with ammonium nitrate, and a series of fractional crystallisations made from acid solution until the first fractions were free from neodymium; these were reserved. The final mother liquors of the ceric series were somewhat radioactive, as also were the final liquors of the lanthanum didymium series and the hydrates precipitated therefrom. The lanthanum fractions were united in threes, dissolved in water, treated with ammonia and silicofluoric acid and boiled. The first precipitate was strongly radioactive, the second radioactive, the third very feebly radioactive, and the fourth nearly inactive. After precipitation with silicofluoric acid similar fractions from the two series were united. The final liquors from the two ceric ammonium nitrate series, the basic precipitates from the final liquors of the lanthanum series, and the final liquors from the lanthanum series of the after-precipitations were treated in the same way as the lanthanum fractions, and also gave several radioactive precipitates.

Examination of the silicofluoride precipitates. (*a*) *Third precipitation of the lanthanum series of the after-precipitations.* It was decomposed by potassium hydroxide, the mixture filtered, and the insoluble matter washed, oxidised in the air, and treated with cold nitric acid: cerium meta-salts and silica remained in the residue. The strongly acid solution was precipitated with ammonia: the inactive precipitate contained cerium and lanthanum. The solution was treated with a little sulphuric acid, the precipitated barium sulphate being highly radioactive. The insoluble matter containing cerium meta-salts and silica (see above) was digested with water: the residual silica was inactive. The brown solution was precipitated with nitric acid, the radioactive precipitate containing lanthanum and cerium was dissolved in water, the solution evaporated, and the residue digested with nitric acid. After 12 hours a portion had dissolved, and the solution was added to the other cerium-lanthanum liquors. The residue, soluble in water, was strongly radioactive and contained lanthanum, cerium, and fluorine. (*b*) *First precipitation of the lanthanum series of the chief precipitation.* This was treated in the same way as (*a*), and also yielded a highly radioactive barium sulphate precipitate. The meta-salts insoluble in nitric acid were decomposed again with potassium hydroxide, but even then the decomposition was not complete. The solution was inactive and when treated with nitric acid, again yielded meta-salts, which contained fluorine and were strongly radioactive. The whole of the mother-liquors from the barium sulphate precipitations were evaporated and the residue ignited. The final, strongly radioactive residue was taken up with water, decomposed with sodium carbonate, dissolved in nitric acid, and precipitated with sulphuric acid; the precipitate was highly radioactive. The residual, fluorine-containing meta-salts remained permanently radioactive, and must contain a primary radioactive substance. The cerium-lanthanum hydrates, free from fluorine, remained permanently almost inactive. The remaining precipitates of the lanthanum series remained permanently radioactive. The precipitates obtained from the final liquors of the cerium ammonium nitrate series of the main precipitation behaved, in part, in a similar manner: the first precipitate, brown, containing yttrium and cerium, but no thorium and lanthanum, was strongly radioactive after six months; the second, pink precipitate, containing yttrium, cerium, and a little erbium, and the third precipitate, also pink, and containing yttrium and cerium, were feebly radioactive after six months. Since the first precipitate, possessing strong permanent radioactivity, contains neither thorium nor lanthanum, the presence of a new, primary radioactive substance is indicated. All the other silicofluoride fractions from the after-precipitations lost their radioactivity almost completely in the course of several months.

Working up of the oxalic acid digestion liquors. These were fractionally precipitated with dilute ammonia, whereby a nearly quantitative separation of the constituents was effected. The precipitates from the digestion liquors from fractions 1 to 10 contained :—(1) calcium and iron—feebly radioactive; (2) silicon, aluminium, and calcium—feebly radioactive; (3) silicon, calcium, and aluminium—very feebly radioactive; (4) calcium, silicon, aluminium, and zinc—very feebly radioactive; the remaining fractions were inactive, or nearly so. The first four precipitates, feebly or very feebly radioactive, were treated with a large quantity of cold oxalic acid solution; a portion remained undissolved. The solution was concentrated and whilst hot, was nearly neutralised with ammonia, a yellow precipitate containing ammonium oxalate being produced. The solution was evaporated and two fractions of crystals coloured pink by manganese and slightly radioactive, were separated. The portion of the original precipitate insoluble in oxalic acid, which contained rare earths and actinium and its disintegration products, was gently ignited in an iron dish, and the residue of oxalates partly converted into oxides was warmed with nitric acid, which partly dissolved it. The solution was treated with hydrogen sulphide, very feebly radioactive sulphides being precipitated. On heating the solution sulphur was precipitated: this was feebly radioactive at first, but soon became inactive. On concentrating the residual nitrate solution containing principally rare earths, a radioactive precipitate containing oxalate was formed. The residue left on dissolving the oxides in nitric acid was radioactive and consisted principally of silica. It was heated with hydrochloric acid, the resulting chlorides were moistened with concentrated hydrochloric acid, gently warmed, extracted with water and filtered. The chloride solution was treated with ammonia, yielding a very strongly radioactive precipitate containing calcium and a trace of bismuth. The filtrate was evaporated and the residue ignited: the final residue, containing calcium and a trace of strontium, was very strongly radioactive and gave large quantities of emanation and strongly penetrating rays. The precipitate produced by ammonia was boiled with dilute sulphuric acid and taken up with water. The solution was evaporated, whereupon almost inactive calcium sulphate separated. The mother liquor was diluted and treated with ammonia; the white precipitate, practically free from metals other than bismuth, was very strongly radioactive, and its activity soon increased considerably: after 12 hours it was highly radioactive. All the ammonium oxalate solutions from the preceding operations, were treated with excess of ammonia, evaporated, and the residue ignited: the final residue was very strongly radioactive. It was boiled with water containing sulphuric acid, filtered, the residue again heated with sulphuric acid and repeatedly extracted. The solution was evaporated and the residue taken up with water. The calcium sulphate left undissolved was strongly radioactive: it was dissolved in dilute nitric acid, and calcium sulphate separated fractionally; the calcium sulphate was very feebly radioactive, and the solution radioactive. The experiments described above show that certain disintegration products of actinium can be separated from accompanying calcium by crystallisation of the sulphates from nitric acid solution, and can be removed from the resulting solution by a precipitate of bismuth oxalate produced therein. A method for the preparation of the pure disintegration products is thus foreshadowed, since the quantitative separation of the bismuth from such precipitates presents no difficulties. *Nitrate solution of rare earths.* This contained lanthanum, etc., and calcium and iron. It was precipitated with oxalic acid from strongly acid solution, yielding a white very feebly radioactive oxalate precipitate. After-treatment with ammonia produced a feebly radioactive precipitate. The earths obtained by ignition of the precipitate containing ammonium oxalate were dissolved in nitric acid, a strongly radioactive residue containing manganese being left. The nitrate solution was precipitated with ammonia, and the hydrates were washed and dissolved in excess of dilute nitric acid, the earths being then precipitated from the solution by oxalic acid. All of the calcium ammonium nitrate liquors were united: on standing very strongly radioactive calcium manganite separated. The solutions from the oxalate precipitations were precipitated with dilute ammonia, and then evaporated with ammonium oxalate and made basic by addition of ammonia: two pink fractions of crystals were obtained containing manganese and some magnesium and zinc and very feebly radioactive. The author mentions that the experiments were interrupted owing to an accident, and when they were resumed after several months, the radioactive characters of the different preparations had completely altered. Nearly all the fractions which had been obtained from products containing calcium and which at first were highly radioactive, had lost nearly the whole of their activity, whilst the activity of the earth oxalate fractions which, shortly after their precipitation, were very feebly radioactive, had increased in a remarkable manner. The digestion liquors from fractions 11 and 12 were worked up in the same way as those from fractions 1 to 10. Here also actinium-containing fractions were obtained, and these, together with those obtained in previous operations, were reserved in order to be treated with similar fractions from the main quantity (1200 kilos.) of the original material, the working up of which is to be described in a subsequent communication. Spectroscopic examination of many of the different fractions obtained in the course of the investigation indicated the presence of new elements.

For the comparison of the radiation intensities of radioactive fractions of similar character, the author devised a kind of radioactivity balance. It consisted essentially of two similar electroscopes, provided with mirror scales. The electroscopes were fixed on a stand, about 40 cm. apart, and at the height of the observer's eyes, a thick iron plate, fastened to the common base plate being placed between them. All conducting parts of the apparatus were made of platinum. On small pieces of platinum of a few sq. cm. area, hollow moulds about 2 mm. high were soldered by means of gold, and these could be covered to any desired extent. The substance to be tested was pressed into the mould by an accurately fitting die and then smoothed over. These moulds were used only for the less costly and less strongly radioactive substances. For all highly radioactive and enormously radioactive fractions, small hollow cylinders were used which could be disposed on small spikes soldered in the middle of the pieces of platinum. The bores of the cylinders, which were of different sizes, stood to one another in definite ratios in a similar manner to the weights of a balance.

The ignition of residues containing ammonium salts, which had to be done frequently during the investigation, proved a troublesome operation when conducted in the usual manner, and the platinum crucibles were also attacked. To overcome these difficulties, the solution containing ammonium salts was, before evaporation, treated with ammonium oxalate if it did not already contain a sufficient quantity of this salt. The evaporation residue was placed in the middle of a shallow platinum dish, which was then heated rapidly to incandescence at one side. The mass in the crucible ignited and burned calmly without melting and without much spirting. In the case of large quantities it is advisable to cover the dish with a very thin sheet of platinum, and if volatile oxides are likely to be formed, a small quantity of sulphuric acid is added to the solution before evaporation.—A. S.

Caesium mercuric chlorides; The double —— forming from acetone. H. W. Foote and F. L. Haigh. J. Amer. Chem. Soc., 1911, **33**, 459—462.

In a previous investigation (J. Amer. Chem. Soc., 1910, **32**, 618) upon the formation of double salts which form hydrates when crystallised from water, it was found that the substitution of another solvent for water may result in the production of salts of a different type. The authors have now examined a series of anhydrous double salts (the caesium mercuric chlorides) by the same method and with the same object. The members of the present series have the formulæ: $CsCl,5HgCl_2$; $CsCl,2HgCl_2$; $CsCl,HgCl_2$; $2CsCl,HgCl_2$; and $3CsCl,HgCl_2$, and whether water or acetone be employed as solvent the same anhydrous double salts are formed.—W. E. F. P.

Yttrium potassium oxalate. L. A. Pratt and C. James. J. Amer. Chem. Soc., 1911, **33**, 488—492.

From the examination of mixtures of yttrium and potassium oxalates by the solubility method, the authors conclude that only one double oxalate of these metals, having the formula, $Yt_2(C_2O_4)_3,4K_2C_2O_4,12H_2O$, exists at 25° C. and that this compound can exist in contact with an aqueous solution of potassium oxalate of concentration greater than 27·5 grms. per 100 of water. This conclusion is opposed to the observations of Cleve and Hoeglund (Bull. Soc. Chim., 1873, 193—201 and 289—297) by whom two double oxalates of these metals were described, one being as above and the other having the formula, $Yt_2(C_2O_4)_3,K_2C_2O_4,H_2O$.—W. E. F. P.

Water; Decomposition of —— by ultra-violet rays. A. Tian. Comptes rend., 1911, **152**, 1012—1014.

When water is submitted to the action of ultra-violet rays it is decomposed into hydrogen and hydrogen peroxide; the latter, in turn, is decomposed and oxygen is liberated, the ultimate effect of the action of the rays on water being identical with that of electrolysis. The volume of the gases liberated diminishes gradually, namely, from 25 cb. mm. per hour at the commencement of the experiment to 3 cb. mm. per hour, and the gas contains only about 1 per cent. of oxygen during the first half-hour; the proportion of oxygen then increases. This appears to be due to the fact that hydrogen peroxide is first formed, and only when this begins to be decomposed is oxygen evolved. When the quantity of hydrogen peroxide becomes constant (*i.e.*, when the amount formed is equal to that which is decomposed) the liberated gas contains 2 vols. of hydrogen to 1 vol. of oxygen. The decrease in the volume of the gas after a time may be due to the action of the hydrogen upon the hydrogen peroxide or to the combination of the hydrogen with the oxygen; the latter reaction has been found to take place under the influence of ultra-violet rays (see this J., 1910, 24).—W. P. S.

Bismuth salts; Action of hydrogen and sodium peroxides on ——. J. Hanus and O. Kallauner. Z. anorg. Chem., 1911, **70**, 232—239.

By the interaction of bismuth nitrate solution and an ammoniacal solution of hydrogen peroxide, or by the addition of sodium peroxide to a cold solution of bismuth nitrate, neutralised by sodium hydroxide, yellow products are obtained, and sodium peroxide, when added to a hot bismuth solution, gives yellow to dark brown precipitates, according to the amount of reagent added. An examination of the products has shown, in all cases, the presence of active oxygen (in addition to hydroxide and nitrate), the percentage present increasing generally with an increase in the concentration of the hydroxyl ions and also with the temperature and the proportion of oxidising agent used. The products are decomposed by sulphuric acid with the liberation of oxygen.—F. Sodn.

Mercuric oxychlorides. Driot. Comptes rend., 1911, **152**, 958—962. (See also this J., 1889, 916; 1890, 329; 1906, 653; 1907, 433; 1908, 279.)

The following oxychlorides were obtained by saturating a series of mercuric chloride solutions of varying concentration with mercuric oxide for 8 hours at the boil, rapidly filtering and allowing the filtrates to cool (but in the case of the stronger solutions not below the temperature of saturation of the particular mercuric chloride solution); the precipitates which then separated were washed with alcohol. Only four were obtained, viz.:—$HgCl_2,3HgO_2$ (fine needles varying in colour from yellow to black according to their size), $HgCl_2,2HgO$ (small black rhombohedra), $HgCl_2,HgO$ (amorphous yellow powder), and $2HgCl_2,HgO$ (yellowish white crystals). No allotropic modifications of any were observed. The second oxychloride was also obtained in the dry way.—A. Sbld.

Manganese-oxide-silicic acid; Investigation of the system ——. F. Doerinckel. Metallurgie, 1911, **8**, 201—209.

Fourteen melts of manganese oxide and silica were made, varying from 20—60 molecules per cent. of silica, and cooling curves were taken. These are given, together with the equilibrium diagram based on them. It is shown that tephroite (Mn_2SiO_4) and rhodonite ($MnSiO_3$) were synthesised and that the melts obtained consisted of varying proportions of those two minerals. Seven micro-photographs of sections of the products showing these constituents illustrate the paper.—A. H. C.

Manganese dioxide sol; Colloidal —— and its behaviour with hydrogen peroxide. G. Bredig and A. Marck. Van Bemmelen-Festschrift, 342—355. Chem. Zentr., 1911, **1**, 1190.

By the action of hydrogen peroxide on a solution of potassium permanganate, without addition of acid or alkali, evolution of oxygen and reduction of the permanganate take place, and a deep brown liquid containing colloidal manganese dioxide is produced. The solution used should not contain more than 1·6 per cent. of permanganate and the hydrogen peroxide solution not be stronger than 3 per cent. Potassium hydroxide is removed from the colloidal solution by dialysis. The colloidal manganese dioxide is coagulated by prolonged heating, by most electrolytes (not by potassium permanganate) and by carbon dioxide; the coagulation is prevented by addition of gelatin. If the sol be frozen for a long time, it is coagulated irreversibly. Under the influence of the electric current the colloidal manganese dioxide travels towards the anode. Freshly precipitated and washed manganese dioxide, whilst still moist, dissolves to some extent, in 30 per cent. hydrogen peroxide at —20° C., yielding a colourless liquid, which evolves oxygen freely at the ordinary temperature, manganese dioxide being precipitated: the electrical conductivity of the solution is higher than the sum of the conductivities of manganese dioxide sol and hydrogen peroxide. The catalytic decomposition of hydrogen peroxide by manganese dioxide sol only takes place when the concentration of manganese dioxide exceeds a certain value depending on the temperature and the concentration of hydrogen peroxide, *e.g.*, at 25° C., for 4·83 grm.-mols. of hydrogen peroxide, 0·00057 grm.-mol. of manganese dioxide, and for 0·68 grm.-mol. of hydrogen peroxide, 0·00028 grm.-mol. of manganese dioxide per litre. Addition of potassium hydroxide accelerates the decomposition, but disodium phosphate and water which has been shaken with phosphorus injure the catalytic activity of the manganese dioxide. Manganese dioxide sol will also act as a catalyst in the reduction of mercuric chloride by alkaline hydrogen peroxide: the colloidal mercury produced, in turn, exerts catalytic action on the decomposition of the hydrogen peroxide.
—A. S.

Colloidal sulphur solutions; Preparation of —— of different degrees of dispersion by fractional coagulation. S. Odén. Z. Chem. Ind. Kolloide, 1911, **8**, 186—193.

If sodium chloride solution be added, drop by drop, to a clear colloidal sulphur solution, prepared for example by the action of acid on sodium thiosulphate solution (compare Raffo, this J., 1908, 747), the turbidity which forms around the drops of sodium chloride disappears again at first, but when a certain concentration of sodium chloride is reached, the turbidity persists, and if the solution then be allowed to stand, a coagulum separates. If the concentration of sodium chloride be further increased, the amount of coagulum also increases, the sulphur concentration of the solution falling at first gradually, then very rapidly, and later again gradually nearly to nil; the sodium chloride concentration at which the sulphur concentration begins to fall rapidly corresponds with the so-called "Schwellenwert" in the irreversible coagulation process of typical suspension colloids. For small concentrations of sodium chloride, the coagulation is reversible, and the coagulum will dissolve in water to a clear solution. For much larger concentrations this is no longer strictly the case, the coagulum on treatment with water yielding a milky liquid, which although stable contains larger particles than the original clear solution. With turbid solutions of this kind, coagulation begins at smaller concentrations of sodium chloride than in the case of clear solutions. Starting from this fact that the higher the degree of dispersion of a sulphur hydrosol the greater the concentration of sodium chloride needed to effect coagulation, the author succeeded in separating a colloidal sulphur solution into fractions of different degrees of dispersion, *i.e.*, containing particles of different dimensions, by a system of fractional coagulation. The colloidal sulphur solution was prepared by passing sulphur dioxide and hydrogen sulphide alternately into water according to the directions of Debus (Chem. Soc. Trans., **53**, 278) and the "Wackenroder's liquid" thus obtained, containing excess of sulphur dioxide, was allowed to stand. The coagulum which separated was removed by centrifuging; the liquid was then completely coagulated by sodium chloride, and the coagulum formed also separated. Both coagulums were then dissolved separately in water, and the solutions thus obtained were fractionally coagulated, 2*N* sodium chloride solution being added until a perceptible coagulum was produced, and then after allowing to stand, the liquid separated by centrifuging, and again treated with sodium chloride, and so on. The different coagulums were dissolved in water and the colloidal solutions thus obtained coagulated fractionally in a similar manner, until a series of nine fractions was obtained, each containing particles of fairly uniform size.—A. S.

Precipitation of aluminium hydroxide in granular form. Taylor. *See* XXIII.

Formation of hypoiodites and their action on sodium thiosulphate. A source of error in certain iodine titrations. Batey. *See* XXIII.

Conveyance of acids in carboys. Railway classification. *See* Trade Report.

Patents.

Sulphuric anhydride; Process of making ——. J. McFetridge, Vandergrift, Pa. U.S. Pat. 988,646, April 4, 1911.

A thin stream of finely divided metallic sulphides is injected, together with a regulated volume of air, into a furnace of which the temperature is sufficiently high to rapidly convert the sulphur into sulphur dioxide, and the metals into oxides. It is claimed that the gases are freed from arsenic by the suspended metallic oxides, which, by catalytic action, also effect the conversion of the sulphur dioxide into sulphur trioxide.—W. E. F. P.

Drying gases or vapours [concentrating nitric acid]; Process for ——. Salpetersäure Ind.-Ges. G.m.b.H. Fr. Pat. 422,902, Nov. 23, 1910.

The gases or vapours are dried by means of a desiccating agent, liquid or solid, the temperature of which is not allowed to exceed that of the gas or vapour to be dried. The process applied to the concentration of nitric acid consists in bringing the moist vapours into contact with concentrated sulphuric acid; in absorbing the moisture the temperature of this latter rises considerably and if allowed to rise above a certain temperature it evolves moisture instead of absorbing it, consequently the acid is cooled and kept below 130° C., the heat being utilised to vapourise the nitric acid passing to the dryer.

—B. G. McL.

Sodium carbonate; Manufacture of ——. A. Colson. Fr. Pat. 421,179, Dec. 11, 1909.

Sodium nitrate, phosphate, or sulphate is substituted for sodium chloride in the ammonia-soda process. Free ammonia and carbon dioxide are recovered from the mother liquors by evaporation, and the ammonium nitrate, phosphate, or sulphate from the evaporated mother liquors is utilised as such for agricultural purposes. (See also this J., 1910, 187.)—O. R.

Salt from brines; Process of manufacturing —— *by evaporation.* S. M. Lillie, Philadelphia, Pa. U.S. Pat. 988,002, March 28, 1911.

Granular salt is produced by evaporating brine in a closed pan, and this is then delivered to a suitably heated open pan, in which brine (*e.g.*, the same brine transferred) is evaporated, the salt from the closed pan, as modified by contact with the evaporating brine in the open pan, being made to mix with the salt formed in the latter, and the mixture being finally removed from the brine.—F. Sodn.

Calcium ferrite and phosphorus pentoxide; Process of making ——. S. Peacock, Chicago, Ill., Assignor to American Cyanamide Co., New York. U.S. Pat. 988,137, March 28, 1911.

A mixture of "iron oxide" and calcium phosphate (containing sufficient calcium oxide to react with the iron oxide and with any alumina and silica that may be present) is heated to a temperature which is high enough to bring about the reaction, forming calcium ferrite ($CaFe_2O_4$) and phosphorus pentoxide, and to volatilise the phosphoric oxide formed, but insufficient to cause complete fusion of the mass. For instance, 2000 lb. of phosphate rock are heated with 2435 lb. of ferric oxide to about 1400° C.

—F. Sodn.

Sapphires; Process of producing synthetic ——. A. V. L. Verneuil, Paris, Assignor to L. Heller and Son, New York. U.S. Pat. 988,230, Mar. 28, 1911.

The process consists in fusing a mixture of aluminium, iron, and titanium oxides; for example, by heating the sulphates of these metals. (Compare this J., 1910, 210.)

—F. Sodn.

Ammonium phosphate; Process of making primary ——. S. Peacock, Chicago, Ill., Assignor to American Cyanamide Co., New York. U.S. Pat. 988,734, April 4, 1911.

A mixture of finely divided acid calcium phosphate and ammonium sulphate in aqueous solution is maintained at a temperature below 80° C. The solution obtained by filtration, containing the mixed ammonium phosphates, is then concentrated to a degree sufficient to ensure the conversion of the secondary, into the primary, phosphate. Provision is made for the recovery of the ammonia liberated during the concentration process.—W. E. F. P.

Nitrous vapours diluted with mixtures of nitrogen and oxygen; Process of recovering —— *by cooling.* Soc. Le Nitrogène. Fr. Pat. 421,022, Oct. 1, 1910.

A small quantity of a solvent, which freezes below −50° C., boils above +50° C., and is capable of dissolving nitrogen peroxide without attacking it, is introduced into the refrigerating portion of an apparatus, in which nitrogen oxides are prepared by igneous synthesis from mixtures of nitrogen and oxygen. Such solvents are carbon tetrachloride, chloroform, pentachlorethane, or any mixtures of the same; by dissolving the nitrogen peroxide, before the latter can form a non-conducting crust on the outside of the freezing appliance, the above-mentioned solvents maintain the continued efficacy of refrigeration. The addition of finely divided carbon, such as animal charcoal, to the gases before cooling, is said to render condensation and solution of nitrogen peroxide possible at a higher temperature than when such addition is not made. —O. R.

Nitrous vapours, or nitrogen oxides diluted by inert gases; Process of recovering ——. Soc. Le Nitrogène. Fr. Pat. 421,313, Dec. 18, 1909.

NITROUS vapours, especially nitrogen oxides formed by igneous synthesis from atmospheric air, are cooled by passing through a temperature-interchanger, similar to the appliance used in the liquefaction of gases. By compressing the gases to a certain pressure, and allowing them to expand to one-sixth of this pressure in the interchanger, 90 per cent. of the nitrogen oxides are recovered in the liquid and solid forms, from gaseous mixtures containing 1 per cent. of nitrogen oxides, calculated as nitric oxide. It is preferable to free the inert gases, with which the nitrogen oxides are diluted, from moisture and carbon dioxide before compressing the mixture, and a nitrogen peroxide solvent, such as a chloro-derivative of a saturated hydrocarbon (see preceding abstract), may be used to wash out the apparatus after refrigeration, or may be added in small quantities to the gaseous mixture, before admitting the latter to the temperature-interchanger.—O. R.

Formates; Process of preparing ——. O. L. A. Dubose. A. D. Luttringer, and H. Denis. Fr. Pat. 421,227, Dec. 15, 1909.

MOIST carbon monoxide is brought into contact with a gaseous or vapourised base, such as ammonia, a methylamine, pyridine, or the like, in the presence of a catalytic agent, and heated to a temperature of 90°—165° C. at atmospheric pressure. Suitable catalytic agents are pumice-stone or asbestos impregnated with copper, titanium, vanadium, nickel, iron, platinum, or their oxides or salts.—O. R.

Sulphites; Process of manufacturing ——. R. Friedrich and F. Hirsch. Fr. Pat. 421,610, Oct. 19, 1910. Under Int. Conv., Nov. 29, 1909.

METALLIC oxides, hydroxides, or carbonates are crushed and mixed with a predetermined, suitable quantity of water, and directed in a continuous manner, with constant agitation, against a counter-current of sulphur dioxide. The amount of water added to the raw material, and the relative motion of the latter and the sulphur dioxide current, are so regulated as to cause the heat of the reaction to leave the required proportions of sulphur dioxide and water in the finished product.—O. R.

Hydrogen; Production of ——. O. Dieffenbach and W. Moldenhauer, Darmstadt, Germany. Eng. Pat. 7718, Mar. 30, 1910. Under Int. Conv., July 7, 1909.

IN the preparation of hydrogen by the action of steam upon carbon by processes in which the temperature of decomposition is lowered, and the formation of carbon monoxide prevented, by the use of carbon impregnated with an alkali hydroxide or carbonate, claim is made for the employment of other alkali compounds—such as chlorides and sulphates—for the same purpose. The fuel is impregnated with a solution of the alkali compound and dried, or, if practicable, the fuel is coked after the addition of such compound. Claim is also made for the supply, along with the steam, of a comparatively small amount of oxygen for the purpose of maintaining the required temperature inside the decomposition apparatus. —W. E. F. P.

Hydrogen; Continuous process of manufacturing —— by the progressive decomposition of hydrocarbons, and apparatus therefor. R. P. Pictet. Fr. Pat. 421,838, Oct. 26, 1910.

AN endothermic hydrocarbon, such as acetylene, is passed through a tube, the front portion of which is heated to about 500° C., at which temperature the gas dissociates into its elements with the evolution of a large quantity of heat. The latter raises the temperature of the tube sufficiently to dissociate fresh quantities of acetylene without the further application of external heat. The rear portion of the tube is surrounded by a refrigerating appliance, and the products of decomposition, hydrogen and lampblack, are passed into a suitable apparatus for their separation. In the same way exothermic hydrocarbons, such as petroleum vapours, mixed with steam, may be decomposed with the formation of hydrogen and carbon monoxide; in this case the combination of nascent carbon and oxygen supplies a portion of the heat required by the reaction, the balance, which is required to dissociate steam and hydrocarbon, being supplied by external heating. By admitting a regulated quantity of oxygen, the combination of the latter with nascent carbon may be made to provide all the heat required by the reaction, it being then only necessary to heat the hydrocarbons initially to their temperature of dissociation. The apparatus may conveniently consist of a steel, iron, or porcelain tube, one portion of which is heated by means of a gas furnace, and the other cooled by water, or by a liquid hydrocarbon, the vapours of which are afterwards admitted to the tube for their dissociation. The tube is provided with the conduits necessary for the admission of the raw materials and for the withdrawal of the products of dissociation, these conduits being preferably composed of "pure iron" covered with nickel: the lampblack is separated by washing, by means of filters, or by the aid of the apparatus described in Fr. Pat. 421,839 of 1910. —O. R.

Solid carbon dioxide; Apparatus for the manufacture and manipulation of ——. L. B. Hall, London. Eng. Pat. 10,378, April 28, 1910.

A METAL cylinder for demonstration purposes in which solid carbon dioxide is formed by the expansion of the compressed gas, is fitted with a large removable conical nozzle at the end, preferably of transparent material. The nozzle is closed by a cap on the end of a rod passing through the cylinder and normally pressed on its seating by a spring. Upon removal of the spring the rod can be operated by hand to press the solid carbon dioxide into the transparent nozzle.—H. H.

Sulphuric acid from smelter gases; Method of making ——. P. A. Newton, London. From J. P. Channing, New York. Eng. Pat. 12,137, May 17, 1910.

SEE U.S. Pat. 962,493 of 1910; this J., 1910, 960.—T. F. B.

Lithium sodium citrate; Process for the preparation of chemically pure ——. I. Szirmay, Budapest. Eng. Pat. 4376, Feb. 22, 1910. Under Int. Conv., Feb. 22, 1909.

SEE Fr. Pat. 413,161 of 1910; this J., 1910, 1105.—T. F. B.

Metallic oxides; Method of obtaining solutions or quasi-solutions of certain ——. Z. Cartwright, Ilford. U.S. Pat. 988,692, April 4, 1911.

SEE Eng. Pat. 24,842 of 1908; this J., 1910, 24.—T. F. B.

Aluminium fluoride and other aluminium compounds; Processes for making ——. H. Lage. Fr. Pat. 421,903, July 30, 1910.

SEE U.S. Pat. 957,754 of 1910; this J., 1910, 756.—T.F.B.

Hydrosulphites; Process for producing anhydrous ——. Kinzlberger und Co. Fr. Pat. 422,241, Nov. 5, 1910. Under Int. Conv., Nov. 25, 1909.

SEE Eng. Pat. 25,872 of 1910; this J., 1911, 422.—T. F. B.

Hydrogen; Manufacture of ——. O. Dieffenbach and W. Moldenhauer, Darmstadt, Germany. Eng. Pat. 7720, March 30, 1910. Under Int. Conv., Sept. 27, 1909.

SEE Fr. Pat. 417,929 of 1910; this J., 1911, 86.—T. F. B.

VIII.—GLASS; CERAMICS.

Glass; Distinction of different kinds of ——. F. Toggenburg. Schweiz. Woch. Chem. Pharm., 1911, **49**, 105—108. Chem. Zentr., 1911, **1**, 1157—1158.

FOR distinguishing different kinds of glass the author recommends the microchemical tests of Mylius and

Groschuff (this J., 1910, 628), with certain modifications, especially the use of a platinum instead of a porcelain crucible. Of a number of different kinds of glass obtained in Zürich, Vienna normal glass was identified as a potassium-sodium-lead silicate, a thermometer glass as sodium-zinc silicate, a refractory glass tube as sodium-aluminium-barium silicate, Jena apparatus glass as sodium-calcium-zinc borosilicate, and Rhenish apparatus glass as potassium-aluminium-zinc-magnesium borosilicate.—A. S.

Melting-point of mixtures of quartz and Zettlitz kaolin; Influence of metallic oxides on ——. G. Flach. Sprechsaal, 1911, **44**, 171—173, 187—188, 205—207, 219—222.

The experiments were carried out in a muffle similar to that used by Simonis and Rieke (Sprechsaal, 1906), and the melting points were determined by Seger cones. Richter's law does not govern the melting point of mixtures of metallic oxides or carbonates with quartz and kaolin. The eutectics the author found contain more alumina than the normal 1·0 Al_2O_3, 12·4 Si O_2, except in the case of lithium which requires a minimum of 10 per cent. of silica. Similar decreases of temperature cause similar separation of eutectics. The carbonates of the alkaline earths have a greater fluxing value the less silica is present until a minimum is reached. Magnesia, which Richter and Bischof claimed to be the most powerful flux, is really less so than the carbonates of cobalt, nickel, iron, and calcium. In mixtures rich in silica, 5 per cent. of magnesia acts as a flux, but further additions have the opposite tendency. The alkali oxides, except lithia, do not form eutectics and follow Richter's law. Carbonates of the iron group have approximately the same fluxing influence and when present up to 10 per cent. favour eutectic formation. These carbonates of the iron group, and also that of copper, give melting-points higher in a reducing than in an oxidising atmosphere. Beryllium and cadmium carbonates and stannous oxide are about equivalent in fluxing value. Carbonates of lead and bismuth lower the melting points of silicates more than any other carbonate used in equivalent quantity. Bismuth forms rose-coloured silicates, the colour varying in intensity with the amount of bismuth present. The author gives the formulæ of some 36 eutectics which he formed with the various oxides.—H. H. S.

Enamel; Coefficient of expansion of —— *in relation to chemical composition.* M. Mayer and B. Havas. Sprechsaal, 1911, **44**, 188—190, 207—209, 220—222. (See this J., 1909, 1199.)

To obtain the coefficient of expansion the authors used Fuess's method in which the expansion of bars of the material is measured directly by means of a very sensitive lever. The bars were heated by steam playing on them in a glass vessel. This method gives results agreeing with those obtained by Le Chatelier's, which is a modification of Fizeau's and consists in measuring the displacement of Newton's rings. It has long been known that the chemical composition of enamels governs their physical, as well as refractory, properties, but only qualitative results were available, such as the facts that alkalis increase, and silica and boric anhydride decrease, the coefficient of expansion. Winkelmann and Schott showed in 1894 that the coefficient of a glaze is additive of those of the individual oxides, and they give the following values for cubical expansion per degree C. in millimetres $\times 10^{-7}$:—Na_2O, 10·0; K_2O, 8·5; CaO, 5·0; Al_2O_3, 5·0; BaO, 3·0; PbO, 3·0; As_2O_5, 2·0; Li_2O, 2·0; P_2O_5, 2·0; ZnO, 1·8; SiO_2, 0·8; MgO, 0·1; and B_2O_3, 0·1. The authors confirm these figures within 2 per cent., except that for lead oxide which they make 4·2, thereby putting lead above barium in the list. These figures are really only strictly comparable in glazes similar in composition. The question then arose whether the coefficients of expansion of enamels containing opacifiers were also additive. For this purpose the authors started with the glaze of formula: $4{\cdot}5SiO_2,1{\cdot}5B_2O_3,0{\cdot}5Al_2O_3,1{\cdot}5Na_2O$, and they supplement Winkelmann and Schott's list with these values: Na_3AlF_6, 7·4; NaF, 7·4; ThO_2, 6·3; Cr_2O_3, 5·1; BeO, 4·7; CoO, 4·4; AlF_3, 4·4; CeO_2, 4·2; PbO, 4·2; TiO_2, 4·1; Fe_2O_3, 4·0; NiO, 4·0; Sb_2O_5, 3·6; CaF_2, 2·5; MnO, 2·2; CuO, 2·2; ZnO_2, 2·1; SnO_2, 2·0. It follows that the coefficient of an enamel is increased by alkalis, alumina and fluorides, and decreased by silica and borate, but the other necessary properties of elasticity, fusibility and resistance to acid allow very little play in the chemical composition. Iron has a coefficient of 4·2 and other metals still higher, so that the cover enamel has an expansion 25—30 per cent. less than the metal. The undercoat should act as a corrective in coefficient. Grünwald states that by the use of cobalt oxide the undercoat may be made to have a coefficient very like that of iron, but the authors cannot agree that so small a content of cobalt oxide, 0·5 per cent., could exert such influence. They prefer an undercoat with a smaller coefficient, and make both undercoat and cover as thin as possible in order to retain elasticity sufficient to meet changes of temperature. Saglio suggested (1898) raising the coefficient of the enamel to that of iron and even other metals by a high content of fluorspar, rutile or cryolite. But fluorspar has a coefficient of only 2·5, rutile is impracticable, and cryolite is only admissible in an enamel up to 18 per cent., which gave a coefficient of 3·8, as compared to the 4·2 of iron. The resistance to acids is greatly weakened by substituting boric oxide for silica and alkalis for alkaline earths.—H. H. S.

Patents.

Clay; Process for drying ——. C. F. Mendham, London. From P. Simcock, Hong-Kong. Eng. Pat. 8208, Apr. 5, 1910.

The wet material, containing from 45 to 50 per cent. of moisture, is spread in layers of small thickness upon a concrete or other suitable floor and allowed to dry until the moisture content is reduced to about 25 per cent. It is then fed into a cutting machine of any known type, in which it is reduced to small lumps or coarse powder, and from which it is conveyed to a suitable drying apparatus. Claim is also made for a cutting machine (for use in the process) in which the teeth of one cutting roll are adapted to pass between those of another cutting roll. —W. E. F. P.

IX.—BUILDING MATERIALS.

Portland cement clinker; A study of the constitution of ——. *(Preliminary report on the ternary system $CaO—Al_2O_3—SiO_2$).* E. S. Shepherd, G. A. Rankin and F. E. Wright. J. Ind. Eng. Chem., 1911, 3, 211—227.

Having established the general boundaries of the different phases occurring throughout the entire diagram of of the ternary system: $CaO—Al_2O_3—SiO_2$, together with the course of the boundary curves, the authors state that, within the limits set by Richardson, Portland cement clinker (when in equilibrium) may exist in the following combinations depending primarily upon relatively small changes in the quantity of lime present.

I.	II.	III.	IV.	V.
CaO 3CaO, SiO_2 3CaO, Al_2O_3	3CaO, SiO_2 2CaO, SiO_2 3CaO, Al_2O_3	2CaO, SiO_2 3CaO, Al_2O_3 5CaO, $3Al_2O_3$	2CaO, SiO_2 5CaO, $3Al_2O_3$ CaO, Al_2O_3	2CaO, SiO_2 2CaO, Al_2O_3, SiO_2 CaO, Al_2O_3

Richardson's typical cement corresponds to class II; classes III and IV are predicted from the data obtained; class V, occurring only in cements low in lime, is regarded as tentative. The authors observe that if solid solutions are formed in the ternary system they are limited in extent and are not sufficient to affect the optical properties of either silicate, the lime or the aluminate. They find that, apparently, ferric oxide does not form solid solutions with lime or the compounds, $3CaO,SiO_2$; Ca_2SiO_4, or $3CaO,Al_2O_3$, although some action (the nature of which has not yet been studied) appears to occur between ferric oxide and the compound, $5CaO,3Al_2O_3$. In reviewing previous work upon the binary systems, reference is made to tricalcium silicate of which no indication has yet been obtained in mixtures of pure lime and pure silica, although it is produced when alumina is added to mixtures of appropriate lime-silica concentration. The authors have succeeded in isolating this compound and have also discovered a new and probably unstable form of the orthosilicate.—W. E. F. P.

Cement trade of Great Britain. Times, April 29, 1911. [T.R.]

The export records of the British cement trade are available for 55 years; but import records have only been kept since 1897, and for the first three years even these were kept only in values, quantities being unrecorded. Reducing all the records to averages, we get the following:—

—	Exports.		Imports.		Excess of exports.	
Five Years.	Thous. Tons.	Thous. £	Thous. Tons.	Thous. £	Thous. Tons.	Thous. £
1856–60	58	167	—	—	—	—
1861–65	99	251	—	—	—	—
1866–70	133	329	—	—	—	—
1871–75	216	589	—	—	—	—
1876–80	239	605	—	—	—	—
1881–85	363	833	—	—	—	—
1886–90	561	1,105	—	—	—	—
1891–95	465	827	—	—	—	—
1896–00	357	640	—	170*	—	470
1901–05	370	627	246	375	124	252
1906–10	672	1,034	101	129	571	905

*Four years only—1897—1900.

For the first 35 years the exports made continuous and substantial progress, but in the early nineties a severe check was experienced, apparently the result of foreign competition, for a few years afterwards the foreign product began to invade our own markets where hitherto it had not been sufficient to secure separate notice by the Board of Trade. The first year they were recorded, 1897, the imports amounted in value to £42,000, against £647,000 worth of the product sent abroad by us. But for six years the imports rapidly increased, so that in 1903 they reached £410,000, as against our own exports of £677,000. However, in the last five years of the above table the quantity imported was reduced by nearly 60 per cent., while the exports of British cement increased by nearly 100 per cent. The result is that the average exports of 672,000 tons are now considerably larger than they have ever been before. This success has been achieved largely by a cheapening of production. In the first five years of this century exports averaged about £1 14s. per ton; while imports averaged less than £1 11s. In the second five years exports averaged about £1 11s. and imports about £1 6s. This readjustment of prices has evidently regained for our shippers the command of the export trade, as well as of the home trade, for this is the record achieved since 1904:—

—	Exports.		Imports.		Excess of exports.	
	Thous. Tons.	Thous. £	Thous. Tons.	Thous. £	Thous. Tons.	Thous. £
1904 ...	385	632	273	393	112	239
1905 ...	456	720	235	300	221	420
1906 ...	658	997	172	222	486	775
1907 ...	764	1,268	114	151	650	1,117
1908 ...	598	956	94	115	504	841
1909 ...	598	887	64	81	534	806
1910 ...	741	1,062	61	78	680	984

The destination of exports during the periods 1900—1904 and 1904—1909 are given below, the figures for 1910 not yet being available:—

To.	Quantity Thousand tons.		Value. Thousand £	
	1900–4	1905–9	1900–4	1905–9
Holland	2·9	5·3	6	9
Portuguese East Africa ...	3·5	11·1	6	17
Spain	1·8	2·5	3	4
Egypt	18·3	33·2	32	50
China	0·4	5·6	1	10
Japan	0·5	5·2	1	10
U.S.A.	17·1	49·5	34	80
Mexico	7·1	22·7	10	31
Chile	8·7	19·8	15	31
Brazil	6·2	40·8	12	66
Uruguay	2·8	7·3	5	12
Argentina	17·1	54·3	30	86
Other countries	9·6	21·7	23	36
Total foreign countries....	96·0	279·0	178	442
British possessions........	254·0	336·0	439	524
Grand total............	350·0	615·0	617	966

To sum up, the cement industry in its general aspect appears more favourable than it has ever done before. In the records available there is no sign of any inherent weakness, and the growth of the ferro-concrete building industry that may be expected in the immediate future provides a strong element of hope for the cement trade.

Patents.

Artificial stone; Process for producing ——. W. E. Barrett, Wimbledon, and W. G. Renwick, Anerley, Surrey. Eng. Pats. 11,242, May 6, 1910, and 28,264, Dec. 5, 1910.

Granular material (stone, slate or slag) is mixed with hot cream of lime, the proportion of dry lime in the mixture being about 10 per cent. by weight. Whilst still warm, the mixture is made into blocks and subjected to a pressure of from 500 to 2000 lb. per sq. in. Being of about the same hardness as chalk, the material so produced is easily workable, and, after being fashioned as desired, is dried and carbonated. The latter operations are conducted at a temperature of about 120° F. in a cylindrical steel chamber provided with steam pipes, an exhaust being employed to facilitate the drying. When the pieces are sufficiently dry for carbonation (after about 10 hours) the passage of steam through the heating pipes is stopped, and warm, moist carbon dioxide (either pure or mixed with air) is admitted to the chamber under a pressure determined by the thickness of the pieces under treatment. —W. E. F. P.

Bricks for building purposes. J. Funge, Belfast. Eng. Pat. 12,886, May 27, 1910.

Bricks and other red clay goods are formed by mixing bog ore with clay in the proportion of about 2 or 3 oz. of the ore to each brick. The composition of the bog ore is given as:—Organic matter and water 29·15 per cent., silica 1·0, ferric oxide 59·75, and alumina 10·1 per cent. —H. H.

Wood; Process of treating ——. K. Koenman, New York. U.S. Pat. 987,888, Mar. 28, 1911.

Wood is first saturated with ammonia solution, and then after withdrawing the ammonia solution, is repeatedly soaked in clear water, until practically all soluble matter has been removed, after which it is dried at about 100° C. Air may be excluded during the saturating process. —F. Sodn.

Portland and like cements; Manufacture of ——. T. Holden, Bristol. Eng. Pat. 4358, Feb. 22, 1910.

In a system of cement manufacture by purely mechanical means, measuring apparatus is provided for regulating the amounts of limestone, clay, and fuel supplied to the kilns. The limestone is fed to a grinding-mill and the ground material delivered by an elevator to a revolving sieve, from which the powder drops into a cylindrical hopper fitted with a pair of alternately reciprocating shutters adapted to supply regulable quantities, dependent upon the distance apart of the shutters, to the mixer beneath. Similar apparatus supplies clay to the mixer, the slurry formed by passing the mixed material through roller mills being carried by a conveyor to a chamber above the kiln. Fuel is carried by another conveyor to a similar chamber, and the amounts of slurry and fuel supplied to the kiln beneath are regulated by the number and size of the pipes leading from these chambers to the kiln. The clinkered cement is passed on a conveyor to the roller mill, and the ground material sifted and carried to the storage bins.—H. H.

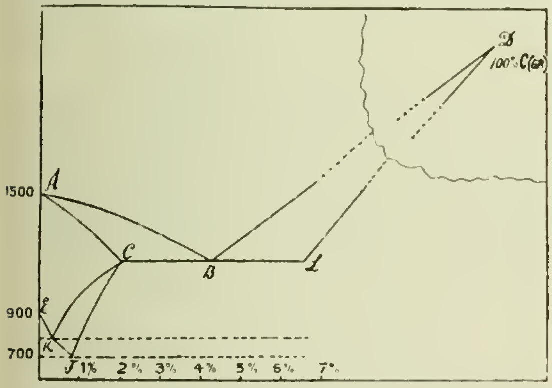
Rock material, especially the raw materials for cement making; Process for preparing by wet methods ——. Amme. Giesecke und Konegen A.-G. Fr. Pat. 422,846, Nov. 22, 1910. Under Int. Conv., Nov. 22, 1909.

See Eng. Pat. 27,568 of 1910; this J., 1911, 212.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron-carbon system; Considerations on the ——. A. Baykoff. Rev. Mét., 1911, 8, 315—319.

From a study of the solidification of iron containing four to five per cent. of carbon, with the formation of either grey or white cast iron, it is concluded that the separation of graphite and cementite takes place along the same line (BD) of the equilibrium diagram, and that cementite is not a chemical compound but a solid solution of iron and carbon. In order to confirm this view, cementite, separated by the action of dilute sulphuric acid in the absence of air upon a steel containing 1·94 per cent. of carbon, 0·07 of silicon, 0·005 of phosphorus, 0·013 of sulphur, and traces of manganese, and which after washing and drying in the absence of air was shown to contain 93·34 per cent. of iron and 6·67 of carbon, and pure iron were burnt in a calorimetric bomb with oxygen under twenty-five atmospheres pressure. From the results obtained it is shown that the equation $3Fe + C\ (graphite) = Fe_3C$ is not accompanied by any sensible evolution of heat. In accordance with this view it is suggested to modify the equilibrium diagram so that AB (see fig.) is the line of separation of mixed crystals of γ-iron and carbon, rich in iron (austenite), and BD is the line of separation of mixed crystals rich in carbon (graphite), and the term *moissanite* is suggested for the latter.—A. H. C.



Mild steel; The production of —— in the electric furnace. F. Doubs. Stahl u. Eisen, 1911, 31, 589—592.

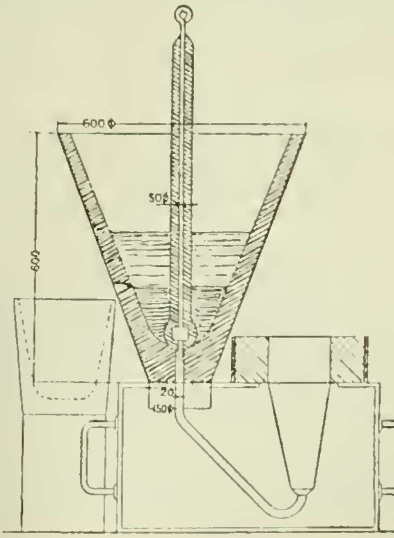
Where water is available to supply the necessary electric current, the electric furnace can compete very favourably with small and medium-sized Martin furnaces for the production of mild steel, whether the charge is cold or already melted. Where good coke is dear, the electric furnace can compete also with the coke-fired crucible furnace for the production of tool steel, and even with the cupola for melting. The author has investigated the working of the Héroult, the Nathusius, and the Keller furnaces, and gives tables showing cost of working, nature of charge, and the composition of the steels produced. He recommends electrodes of circular cross-section with water-cooled connections. Especially with large furnaces, it is an advantage to have the electrodes with their gear supported independently of the furnace, and to have the furnace suspended on trunnions, so that it may be tilted through an angle of 90° for pouring. These advantages, together with uniform heating, preventing the formation of "sows," are possessed by the Nathusius and the Keller furnaces. It is stated that the durability of hearths with embedded electrodes is excellent.—T. St.

Nickel steel castings. S. Kern. Chem. News, 1911, **103**, 169.

At the foundry of the New Admiralty in Russia it is the practice to introduce a quantity of nickel into the crucible steel in order to obtain perfect soundness in castings which have to be subjected to heavy strains. The crucibles are heated in coke furnaces, the charge for each being 100 lb. and consisting of 10·53 per cent. of puddled iron containing 0·07 per cent. of carbon and traces of manganese, 43 per cent. of punchings from the rivet holes in soft shipbuilding plates, 44 per cent. of rivet steel in ends and chippings, 1 per cent. of nickel and 0·15 per cent. of 80 per cent. ferro-manganese. The castings are poured five hours after the furnace is fired, there being added to the melted steel, before removing the crucibles, 0·6 per cent. of ferrosilicon containing 10 per cent. of silicon, and 0·65 per cent. of silicospiegel containing 10 per cent. of silicon and 18 per cent. of manganese. Before pouring each crucible receives 0·07 per cent. of aluminium. The resulting steel contains carbon 0·43, nickel 0·72, manganese 0·60, and silicon 0·37 per cent. After annealing, the steel mechanically tested gives about 50 tons per sq. inch of absolute resistance and 10—12 per cent. elongation in 2 inches. It is interesting to note the loss in nickel in melting crucible steel.—J. A.

Iron-chromium alloys; Studies on the —— with particular reference to their resistance to the action of acids. P. Monnartz. Metallurgie, 1911, 8, 162—176, 193—201.

Twenty-one iron-chromium alloys, free from carbon, and containing from 3·8 to 98·2 per cent. of chromium, were prepared by the Goldschmidt reaction, using ten per cent.



less aluminium than theoretically required in order to prevent its presence in the alloy. A specially designed furnace was used (see fig.) in which the crucible employed was perforated at its base, being plugged by a movable magnesia stopper, and communicating with the gate of a casting box leading to the bottom of the mould which could be heated. A hole was also made at the side of the crucible by which the slag could be run off. Before casting, the slag crust was pierced and the metal then run into the mould from beneath, thus obtaining a casting free from blow-holes. A series of cooling curves of the alloys is given, and the mechanical properties were investigated. Whereas the iron-chromium alloys are usually regarded as being very hard, it is shown that the alloys up to seventy per cent. of chromium, free from carbon, can be both bored and turned on the lathe, and that while the effect of the addition of carbon was to harden the alloy, yet a further increase of chromium lowered the hardness. The behaviour of the alloys towards acids, particularly towards nitric acid and nitric acid containing sodium chloride, was investigated. The author classifies the metals with regard to their acid-resisting properties into two groups. (1) That containing the noble metals and certain alloys the resistance of which latter depends on the presence of metallic compounds. These do not resist the action of nitric acid with the exception of platinum. Gold in the finely divided state is readily attacked by nitric acid, and both gold and platinum are dissolved by nitric acid containing sodium chloride. The presence of oxygen greatly influences the solubility of the noble metals in nitric acid. (2) That including those metallic substances which in the presence of oxygen have a high resistance towards acids depending upon their assumption of the passive state, the existence of which depends on the presence of oxygen. The resistance to acid is destroyed by hydrochloric acid or chlorides, and increases with the concentration of oxygen. With regard to the iron chromium alloys free from carbon, it is shown that: (1) In alloys containing from 1 to 4 per cent. of chromium the resistance to dilute nitric acid decreases and to concentrated nitric acid increases with rising chromium content. (2) In alloys containing 4 to 14 per cent. of chromium the resistance against dilute nitric acid increases rapidly with the chromium content. (3) In alloys containing 14 to 20 per cent. of chromium the resistance increases proportionately to the chromium content. (4) In alloys containing 20—40 per cent. of chromium the resistance is the same as that of chromium. They dissolve readily in cold very dilute nitric acid containing five per cent. of sodium chloride. (5) Alloys containing from 40—100 per cent. of chromium are resistant against pure nitric acid, and also against the dilute nitric acid solution of sodium chloride even on boiling. The 65 per cent. chromium alloy has the maximum passivity. Previously the passive metals had always possessed bad repute as to mechanical properties, but alloys having now been found having very good mechanical properties and extremely high passivity, these should find their industrial application.—A. H. C.

Waste gases; Purification of —— in German iron works. R. Pokorny. Times Eng. Suppl., April 12, 1911.

THE annual output of pig-iron in Germany is 13 million metric tons; in the production of each ton of iron 150,000 cb. ft. of gas having a calorific value of 96 B.Th.U. per cb. ft. are evolved. Forty per cent. of this is used for heating purposes, the remaining 60 per cent. being available for conversion into power. In working the blast-furnaces 45 per cent. of this power is utilised, leaving 55 per cent. or 500,000 H.P. available for distribution. The production of this power (910,000 H.P.) from the waste gases is equivalent to an annual saving of 7,300,000 tons of coal. At present a total of 650,000 H.P. is being produced with large gas-engines running on blast-furnace gas. The most widely adopted method of gas cleaning consists in conducting the gas through a wide tube to so-called "dry-catchers," in which the heavy particles, which are largely impregnated with iron, are deposited by gravitation; thence the gas, with a dust-content of from 2·62 to 3·5 grains per cb. ft., passes into large vertical cylindrical cooling chambers, constructed of steel-plate, placed in series. The gas enters at the bottom, and travelling upwards with moderate velocity, encounters a downward spray of cold water which effects a further removal of dust. The gas now passes at a temperature of about 77° F. to one or more blowers working in parallel series, with a water spray, in which by dynamic action the dust content is reduced to about 0·13 grain per cb. ft. at which stage it is used for heating stoves and for boiler fires. For use in gas-engines it is further purified by treatment in a second set of blowers with water-spray injection, by which treatment the dust is reduced to from 0·008 to 0·003 grain per cb. ft., and by subsequent treatment in a moisture absorbing apparatus. The largest gas-refining plant of this kind is in operation at the Deutscher Kaiser Iron and Steel Works at Bruckhausen on the Rhine. Here some 14,128,000 cb. ft. of gas are treated hourly, about one-half of which with a dust-content of about 0·108 grain per cb. ft. is used for heating purposes, the other half, with a dust-content of 0·0108 grain per cb. ft. being used in gas-engines. The power required for this treatment is 1800 H.P., and 400,000 gallons of water are consumed hourly. The water after use is treated in settling ponds, cooled, and again utilised. At the Halbergerhütte at Saarbrücken, in Lorraine, a system of dry-cleaning, treating 176,600 cb. ft. of gas per hour, has been in operation since March, 1910, with excellent results. The gases which leave the furnaces at from 175° to 250° F. are collected in a trunk main and conducted into a large vertical cylindrical chamber, where the velocity of the flow is much reduced, and where they are dry-cooled to 120° to 140° F. Thence they pass to a superheating vessel, which is warmed by means of steam heat, or by the exhaust from the gas-engines, where they are raised in temperature from 20 to 40 degrees, and so freed from moisture. They are then drawn through conical filters formed of cotton fabric by means of induced draught furnished by blowers. As, however, these filters soon become choked up, they are cleaned periodically by causing a current of compressed gas to pass through them in the reverse direction, the filter bags being at the same time agitated; this process takes place automatically every four minutes. By this process it is found possible to reduce the amount of dust to 0·004 grain per cb. ft. and even less. Allowing for capital, interest, wages, water, and power, the first process costs about one penny per 10,000 cb. ft. of gas treated; the second process costs under one halfpenny. Owing to blockages and insulation caused by the use of uncleaned gas for heating stoves and firing boilers, an immense saving has been effected by the use of cleaned gas for these purposes.—B. G. McL.

Galvanised iron; Method for testing ——, to replace the Preece test. W. A. Patrick and W. H. Walker. J. Ind. Eng. Chem., 1911, 3, 239—242.

ACCORDING to Preece's method, the test-piece is placed in solution of copper sulphate under standard conditions and the number of one-minute immersions necessary to produce a bright, adherent film of copper on the piece is regarded as an accurate measure of the thickness of the zinc coating. The authors recommend the use of a slightly basic solution of lead acetate as affording more reliable results; the solution is prepared by dissolving 400 grms. of crystallised lead acetate in one litre of water, agitating the solution with 4 grms. of finely powdered litharge until most of the latter is dissolved, and diluting the clear, decanted solution to 1·275 sp. gr. at 15·5° C. The weighed test-piece is immersed in the solution for periods of not less than 3 minutes at a time (the adherent lead being removed after each immersion) until a bright surface of iron is obtained. The piece is then re-weighed to obtain the weight of the zinc coating removed, or the latter is calculated from the quantity of lead deposited; in the former case, if iron is found in the acetate solution, the amount is determined and allowed for.—W. E. F. P.

Silicon; Determination of —— in vanadium and molybdenum metals and their iron alloys. W. Trautmann. Z. angew. Chem., 1911, 24, 635—636.

THE silica separated from solutions obtained by dissolving vanadium and molybdenum alloys in acids contains molybdenum trioxide or vanadium pentoxide and consequently high results are found in silica estimations. This error may be avoided by washing the separated silica with hot dilute hydrochloric acid. In presence of vanadium a 10 per cent. solution of the acid should be used. If molybdenum only is to be removed, a 5 per cent. solution is sufficient.—J. A.

Iron-antimony alloys. A. Portevin. Rév. Mét., 1911, **8**, 312—314.

Swedish iron containing 0·03 per cent. of carbon, 0·12 of manganese, and 0·07 of silicon was fused with antimony containing 0·5 per cent. of lead, 0·42 of arsenic, 0·1 of tin, traces of iron and sulphur, and no copper or bismuth, in a Tammann furnace to obtain alloys containing from 1·19 to 9·2 per cent. of antimony. Differential heating and cooling curves gave the following results :—

Iron.	Antimony.	Critical points ° C.	
Per cent.	Per cent.	Heating.	Cooling.
98·77	1·19	793	790
97·55	2·42	798	796
94·58	5·29	800·	798
93·50	6·50	797	794
90·68	9·20	800	798

The polished alloys were etched in a solution of potassium copper chloride containing hydrochloric acid. Those containing up to 5·29 per cent. of antimony showed the same appearance as iron; the alloy containing 6·5 per cent. of antimony was a heterogeneous solid solution with small white areas; the alloy containing 9·2 per cent. showed the white areas of the special constituent.—A. H. C.

[Gold] Zinc-dust precipitation. A. J. Clark. Min. Mag., 1911, **4**, 289—292.

Besides oxidising the zinc-dust, undue exposure to the air results in the formation of calcium carbonate by the combination of the carbonic acid of the air with the calcium hydroxide dissolved in the solutions. This is often brought about by agitation with compressed air. Should the water-supply be drawn from a limestone formation, precipitation of carbonate may take place, even though no air be used, owing to the calcium hydroxide of the solution reacting with the bicarbonate contained in the water. This precipitation of calcium carbonate lowers the efficiency of the zinc-dust. It is suggested that the calcium carbonate gathers about the particles of zinc as nuclei, thus shutting them off from further action. Abolition of the mixing-cone, with its air-agitation, led to a decrease of 35 per cent. in the zinc consumption per ton of solution. To ensure a regular feed of zinc-dust without the use of a mixing-cone, a simple feeding device is recommended in which the bottom of the zinc-hopper is formed by the surface of a slowly rotating cylinder, which carries the dust out through an adjustable feed-gate, whence it falls into a cylinder and is carried by a stream of solution to the pump. The good results obtained with new feeders are to be ascribed rather to the omission of agitation with air than to any advantage of the actual feeding device. The triangular shape of press appears to require less zinc than the square type.—R. W. N.

Gold [alloys]; Quantitative analysis of —— by means of ether. F. Mylius. Z. anorg. Chem., 1911, **70**, 203—231.

It has been found that the known solubility of gold chloride in ether may be utilised for the accurate analysis of gold alloys, especially coinage, in which the gold may be determined with a loss of not more than 0·01 per cent. The solution of the alloy in dilute *aqua regia*, after filtering off any silver chloride, is repeatedly extracted with ether (the presence of the free acid being necessary), and the ethereal extract is dealt with as below; the aqueous layer may then be used for the detection or determination of other metals. For the extraction, the solution should contain 5—10 per cent. of metal and 5—10 per cent. of total hydrochloric acid; the shaking is repeated 4—5 times, a total volume of 50 c.c. of ether being used for 20 c.c. of solution containing 1 grm. of metal; 10 c.c. of water are added to the ethereal extract, the ether is distilled off, and the residual solution is warmed for some minutes with sulphurous acid, after which the precipitated gold is filtered off, washed, ignited, and weighed. Gold may thus be separated from all other metals, and the method furnishes a simple means for the preparation of very pure gold, containing less than 0·001 per cent. of impurity. For very accurate determinations, the principal portion of the gold is removed from the solution by two extractions with ether; the aqueous layer is then concentrated, the chlorides are converted into sulphates, and the residual gold precipitated by sulphurous acid or hydrazine; the precipitate is then dissolved in a small volume of acid and the solution is extracted several times with ether. As an example, a detailed analysis of gold coinage and suitable apparatus therefor are described, the detection or determination of small quantities of silver, lead, iron, arsenic, antimony, tellurium, nickel, platinum, palladium, and iridium being discussed, and analyses of the gold coinage of various countries as effected by this method, being given; all the coins examined contained, besides copper and silver (0·2—0·4 per cent.), very small percentages of lead, iron, platinum, and palladium, and a trace of arsenic. An analysis of certain brittle coins pointed to the presence of a slight excess of lead as the possible cause of brittleness. In the course of the investigation it was found that hydrochloric acid is able to dissolve gold in the presence of cupric chloride; the compound, $CuAu_2Cl_8,6H_2O$, was also prepared, in the form of very soluble lustrous olive-green prisms, by evaporating a solution containing cupric chloride (1 mol.) and chlorauric acid (2 mols.).—F. Sodn.

Noble metals; Some electrical and mechanical properties of alloys of the ——. W. Geibel. Z. anorg. Chem., 1911, **70**, 240—254.

Determinations of electrical conductivity, temperature coefficient, thermoelectric potential (compared with platinum), and tensile strength have been made with the alloys of palladium and silver, palladium and platinum, platinum and iridium, platinum and gold, and platinum and silver, and the results are given in the form of tables and curves. The electrical conductivity and temperature coefficient of the platinum-iridium alloys show a regular decrease from 0—35 per cent. of iridium (the limit studied), and the tensile strength a regular increase; the curves indicate the formation of an uninterrupted series of mixed crystals. The thermoelectric potential, which is positive towards platinum, is at a maximum with 20 per cent. of iridium up to 600° C.; it then rises gradually to 30 per cent. of iridium at 1200° C. Heating causes a regular softening with alloys containing less than 10 per cent. of iridium, but, with a larger proportion, the tensile strength is increased by heating up to about 750° C., at which temperature a maximum is observed; similar phenomena were observed with the platinum-silver alloys. The ductility of the platinum-iridium alloys is increased by heating, the effect being specially marked if the iridium content be small.—F. Sodn.

Sampling ores from Cobalt mines. F. W. Pugsley. Eng. and Min. J., 1911, **91**, 776.

After crushing down the ore, all unbroken nuggets are screened out and melted. The ingots thus obtained are sampled by drilling. The ore is dumped in a ridge, and divided into two parallel ridges. These are thrown together and divided again several times. Each of the two ridges in its turn is similarly divided, and then sampled by taking alternate shovelfuls and repeating the operation. When sufficiently reduced, the sample is finished on a Jones divider and by coning and grinding. A disc grinder is preferred, as it does not cause separation of the "metallics." Separation of rich fines is prevented by sprinkling the sample.—R. W. N.

Mineral production of Canada in 1910. Board of Trade Journal, April 20, 1911. [T.R.]

THE following statistics of the mineral production (quantities sold or shipped) of Canada during the year 1910, with comparative figures for the preceding year, are taken from a preliminary report issued by the Canadian Department of Mines, Ottawa. The figures for 1909 are definitive; those for 1910 are subject to revision :—

Product.		1909.		1910.	
		Quantity.	Value. (*a*)	Quantity.	Value. (*a*)
METALLIC—			Dols.		Dols.
Antimony ore	Tons*	35	1,575	—	—
Antimony, refined	Lb.	61,207	4,285	—	—
Cobalt (*i*)	,,	—	94,609	—	—
Copper (*b*)	,,	52,493,863	6,814,754	56,598,074	7,209,463
Gold	Oz.	453,865	9,382,230	—	10,224,910
Pig-iron from Canadian ore (*c*)	Tons*	149,444	2,222,215	104,906	1,651,321
Iron ore (exports)	,,	21,956	61,954	114,449	324,186
Lead (*d*)	Lb.	45,857,424	1,692,139	32,987,508	1,237,032
Nickel (*e*)	,,	26,282,991	9,461,877	37,271,033	11,181,310
Silver (*f*)	Oz.	27,529,473	14,178,504	31,983,328	17,106,604
Zinc ore	Tons*	18,371	242,699	—	—
Total, metallic		—	44,156,841	—	49,169,826
NON-METALLIC—					
Arsenic	Tons*	—	67,446	1,502	75,328
Asbestos	,,	63,349	2,284,587	75,678	2,458,929
Asbestic	,,	23,951	17,188	24,707	17,629
Chromite	,,	2,470	26,604	—	—
Coal	,,	10,501,475	24,781,236	12,796,512	29,811,750
Corundum	,,	1,491	162,492	1,870	198,680
Felspar	,,	12,783	40,383	15,719	47,867
Fluorspar	,,	—	—	2	15
Graphite	,,	864	47,800	1,243	59,087
,, artificial	,,	257	—		
Grindstones	,,	4,275	54,664	3,847	43,936
Gypsum	,,	473,129	809,632	513,313	939,838
Magnesite	,,	330	2,508	328	2,493
Mica	,,	369	147,782	—	143,409
Mineral pigments—					
Barytes	,,	179	1,120	—	—
Ochres	,,	3,940	28,093	4,813	33,185
Mineral water		—	175,173	—	175,173
Natural gas (*g*)		—	1,207,029	—	1,312,614
Peat	Tons*	60	240	771	1,735
Petroleum (*h*)	Brls.	420 755	559,604	315,895	388,550
Phosphate	Tons*	998	8,054	1,319	11,780
Pyrites	,,	64,644	222,812	55,925	192,263
Quartz	,,	56,924	71,285	88,205	91,951
Salt	,,	84,037	415,219	84,092	409,624
Talc	,,	4,350	10,300	7,112	22,308
Tripolite	,,	—	—	22	134
Total, non-metallic		—	31,141,251	—	36,438,278
STRUCTURAL MATERIAL AND CLAY PRODUCTS—					
Cement, Portland	Brls.	4,067,709	5,345,802	4,753,975	6,414,315
Clay products—					
Brick		—	4,919,375	—	5,930,630
Sewer pipe, fireclay, drain tile, &c.		—	1,531,465	—	1,669,370
Lime	Bush.	5,592,924	1,132,756	5,721,285	1,131,407
Sand and gravel (exports)	Tons*	481,584	256,166	624,824	407,974
Stone—					
Granite		—	454,824	—	634,783
Limestone		—	2,139,691	—	2,303,804
Other products		—	753,270	—	940,571
Total structural material and clay products		—	16,533,349	—	19,432,854
,, all other non-metallic		—	31,141,251	—	36,438,278
Total non-metallic		—	47,674,600	—	55,871,132
,, metallic		—	44,156,841	—	49,169,826
Estimated value of mineral products not reported		—	—	—	—
Grand total		—	91,831,441	—	105,040,958

Dollar=4s. 1½d.

*The ton used throughout is that of 2,000 lb.

(*a*) The metals copper, lead, nickel, and silver are, for statistical and comparative purposes, valued at the final average value of the refined metal. Pig-iron is valued at the furnace, non-metallic products at the mine or point of shipment, and structural material and clay products at the point of shipment.

(*b*) Copper content of smelter products and estimated recoveries from ores exported, at 12·982 c. per lb. in 1909, and 12·738 c. per lb. in 1910.

(*c*) The total production of pig-iron in Canada in 1909 was 757,162 tons, valued at 9,581,864 dols., of which it is estimated that 607,718 tons, valued at 7,359,649 dols., should be credited to imported ores. The total production in 1910 was 800,797 tons, valued at 11,245,630 dols., of which it is estimated that 695,891 tons should be credited to imported ores.

(*d*) Refined lead and lead contained in base bullion exported, valued in 1909 at 3·690 c. per lb., and in 1910 at 3·75 c. per lb., the average prices for the respective years at Toronto.

(*e*) Nickel content of matte produced at 36 c. per lb. in 1909 and 30 cents per lb. in 1910 (the average minimum quotations for nickel in New York less 10 per cent.). The value of the nickel contained in matte was, in 1909, as returned by the operators, 2,810,748 dols., or an average per lb. of 10·7 c.

(*f*) Estimated recoverable silver at 51·503 c. per oz. in 1009, and 53·486 c. per oz. in 1910.

(*g*) Gross returns for sale of gas.

(*h*) Quantity on which bounty was paid, valued at 1·33 dols. per barrel in 1909, and 1·23 dols. in 1910

(*i*) Value received by shippers of silver cobalt ores for cobalt content

Copper converting; Basic ——. C. B. Neel. Eng. and Min. J., 1911, **91**, 707—708.

Large converters are used: about 26 ft. long and 10 ft. diameter, with a maximum capacity of 65 tons of copper per charge. The actual amount of copper produced per charge is about 35 tons. Provided sufficient excess silica be thereby introduced, any variety of flux can be successfully used in the basic-lined converter. The slag must be thin and fluid, as pouring is the only available means of removing it. The appearance of the flame is not a guide to the progress of the operation, but the length of time and the appearance of the copper on the punching-bar give the required indications for the correct working of the process. It is important to maintain the proper temperature, as on this depends the economical working of the converters. The charge finishes hotter in a basic converter than in an acid one. The initial charge of a converter is composed of matte and silicious flux. After each blow more matte and flux are added, and this is continued until the desired size of charge is attained. The final fluxing of the remaining iron requires care, as at this point a very fluid slag is a necessity.—R. W. N.

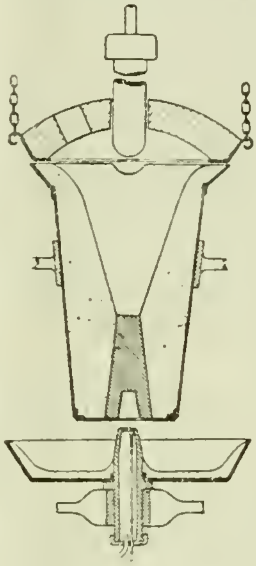
Zinc distillation. G. A. Wettengel. Met. and Chem. Eng., 1911, **9**, 198—201.

The author describes the advantages of his rotating zinc furnace (U.S. Pat. 901,405), which consists essentially of a steel shell provided with two tyres supported on rollers so that it can be rotated to any desired position. The inside of the shell is lined with tile, with suitable shelves for supporting the retorts. The pipes supplying gas and air to the burners are attached to and rotate with the furnace. The furnace is placed for charging so that the retorts are vertical (mouth upwards). They can then be charged mechanically by means of hoppers with very considerable advantages, since the ore may be charged dry and with greater uniformity, and the furnace need not be cooled down to the same extent as for hand charging. After rotating to working position the condensers are luted on and the temperature raised to distillation point. If it is desired to withdraw the metal, the mouths of the condensers are lowered about 15°, when the metal flows out into a trough. The charge may then be re-mixed somewhat by bringing the retorts back to the vertical before continuing the distillation. This agitation renders it unnecessary to reserve a portion of the charge from the front of the retort for the next operation. When the charge is exhausted and condensers removed, the retorts are rotated till they are mouth downwards, and the residue runs away into a hopper. After cleaning and recharging as before, the retorts are again brought into the horizontal position, but this time in the opposite direction so that they are now 180° from the previous operating position. This treatment avoids sagging of the retorts and prevents their perforation by the accumulation of corrosive slag, since the slag melts off from the upper (previously the lower) part of the retort and is run out with the residue. The slags do not accumulate on the bottom of the retort and thus impair its heat transmission and capacity, while the uniformity of temperature and general treatment adds greatly to its life. In present practice a retort is replaced after one month, while in the rotating furnace it will last as a rule more than four months.—W. H. P.

Nickel-zinc separation in German silver and other alloys; Method for ——. La V. W. Spring. J. Ind. Eng. Chem., 1911, **3**, 255—256.

From a weighed portion of the alloy tin is removed by nitric acid, lead as sulphate, copper by electrolysis and iron by ammonia, as usual. After the addition of 5 grms. of ammonium chloride, the solution is exactly neutralised with hydrochloric acid and a quantity of dimethylglyoxime (0·4 grm. for every 0·1 grm. of nickel supposed to be present) is added, dissolved in a little alcohol. Ammonia solution is then added, drop by drop, until the liquid smells slightly ammoniacal, and the solution is heated and maintained just below the boiling point for about half an hour. The mixture is filtered hot through counterpoised filters or on a weighed Gooch crucible, and the nickel glyoxime ($NiC_8H_{14}N_4O_{11}$, containing 20·31 per cent. of nickel) washed with hot water and dried at 105° C. to constant weight. For the zinc determination, the filtrate is made just acid with strong hydrochloric acid, of which 10 c.c. excess are then added. After boiling for ten minutes to decompose the excess of dimethylglyoxime used, 10 grms. of microcosmic salt are added, followed by exact neutralisation with ammonia and hydrochloric or acetic acid, and heating to just below the boiling point until the resulting precipitate becomes granular. After filtration under suction, the precipitate is washed with hot water, ignited in a porcelain crucible and weighed as zinc pyrophosphate.—W. E. F. P.

Crucible furnace; Electric —— *for melting and pouring metals.* W. Borchers. Metallurgie, 1911, **8**, 209—211.



The furnace (see fig.) consists of an iron crucible lined with ignited magnesite or other non-conductor of heat and electricity. The bottom is perforated by the bath electrode which consists of the metal required to be melted and is moulded to fit over an electrode surrounded by a tray which can be kept cool. The other electrode pierces the lid, which is removed when it is desired to pour the metal, and the whole crucible is lifted from off the lower electrode.—A. H. C.

Antimony; Volumetric method for ——, *in alloys.* G. S. Jamieson. J. Ind. Eng. Chem., 1911, **3**, 250—251.

The process is an adaptation of the iodate method devised by L. W. Andrews (J. Amer. Chem. Soc., 1903, 25, 756) to the examination of antimony alloys such as "hard lead" and solder. 0·5 grm. of the alloy, contained in a 200 c.c. Erlenmeyer flask, is heated with 10 c.c. of concentrated sulphuric acid until decomposition is complete. The solution is boiled gently for about two minutes after the lead sulphate has become white, allowed to cool, diluted with 15 c.c. of cold water and allowed to cool again. After the addition of 15 c.c. of 1 : 1 hydrochloric acid, the mixture is shaken thoroughly and the lead sulphate is filtered off on a Gooch crucible and washed with small quantities of the same hydrochloric acid. The filtrate is transferred to a stoppered bottle of about 250 c.c. capacity, and 5 c.c. of chloroform, 15 c.c. of strong hydrochloric acid and 5 c.c. of iodine monochloride solution are added. After agitation, followed by standing for about five minutes, the liberated iodine is titrated with standard potassium iodate solution until the chloroform is just decolourised after thorough agitation. The time required for an analysis is about an hour; and for a second titration the same chloroform may be used after pouring off the supernatant liquid. The potassium iodate solution contains 3·5667 grms. per litre, each c.c. corresponding to 0·00400 grm. of antimony; the iodine monochloride solution is prepared by dissolving 10 grms. of potassium iodide and 6·44 of potassium iodate in 75 c.c. of water in a stoppered bottle, adding 75 c.c. of strong hydrochloric acid and a globule of chloroform, and adjusting the latter to a faint iodine colour by agitation and the addition of dilute potassium iodide or potassium iodate solution as required. It is important that, in the solution being titrated, the strength of the hydrochloric acid be maintained as nearly as possible at the 1 : 1 point. Arsenic, if present, is precipitated by hydrogen sulphide after the separation of the lead sulphate; the excess of hydrogen sulphide is removed from the solution by means of a current of air before the precipitate is filtered off.—W. E. F. P.

Grease [from metals]; Electrolytic removal of ——. A. Barth. Chem.-Zeit., 1911, **35**, 356—357.

THE electrolytic method of removing grease from metallic objects, as a preliminary to electrolytic galvanising, is coming largely into use. The metal objects are used as cathode in a saline solution, the anode being either of iron or carbon. It was for some time considered that the action was a saponification of the grease by the liberated alkali. This, however, while undoubtedly true as regards saponifiable matter, does not explain the effectiveness of the process for the removal of paraffin, mineral oil and wax, and other non-saponifiable bodies. The results are ascribed to a mechanical disruption of the greasy coating by the bubbles of hydrogen. This also explains why the electrolytic method is more rapid than any depending solely on saponification, even in the case of saponifiable matter. The bath should be at such a temperature that the grease or oil to be removed is at or above its melting-point. A hot bath also allows of the use of a current at the usual 3 to 4 volts tension, whereas a cold bath requires about 2 volts more. The salts recommended for the bath are sodium and potassium carbonates, and potassium cyanide. Potassium salts are preferable to those of sodium: the latter should never be used alone. A 3 per cent. solution is strong enough.—R. W. N.

[Metals] Chemical and physical effects of pressure applied uniformly in all directions. G. Spezia. Atti R. Accad. scienza di Torino, **45**; N. Jahrb. Mineral., 1911, **1**, 8—10. Chem. Zentr., 1911, **1**, 1172.

SPRING has stated that certain ductile metals can be united to form alloys by means of high pressure alone. The author exposed to a pressure of 8000 atmospheres for one month, fine powder (filing dust) of silver, copper, and a mixture of silver and copper, in three layers, separated by copper plates, in a steel cylinder of 2 cm. diameter. The powder was converted into a compact mass which could be filed, cut, and polished, but etching experiments showed that neither welding nor alloying had occurred. It is concluded therefore that pressure alone is not sufficient to cause union of two metals, but that, in accord with Roberts-Austen's view, a certain temperature must first be attained. That intimate contact alone is not sufficient to induce combination is borne out by the copper deposits at Keweenaw Point, where copper and silver have been in intimate contact during geological periods of time, without the slightest diffusion having taken place. The author also controverts Spring's view that metals subjected to a pressure applied uniformly in all directions become plastic, semi-fluid, or even fluid. He points out that whereas at 13° C. and a pressure of 700 atmospheres, wax will flow through an opening just as water does, yet when the pressure is applied uniformly in all directions, the wax does not become liquid when exposed to a pressure of 9900 atmospheres for 12 days. The author shows that in Kahlbaum's experiments, the results of which were held to show that pressure applied uniformly to a substance caused an increase of volume, the pressure was not actually applied uniformly in all directions: a prism of wax in water subjected to a uniformly applied pressure of 8000 atmospheres for 6 days underwent no alteration. With regard to the decrease of density observed by Spring and Kahlbaum in the case of lead, copper, and other metals when exposed to high pressures applied uniformly in all directions, it is pointed out that the density was not determined until after the pressure had been released, and it appears probable that the decrease of density should be attributed to elasticity effects.—A. S.

Metallography; Preparing metal fragments for ——. M. Le Gris. Rev. Mét., 1911, **8**, 335—339.

SMALL fragments of a metal such as turnings or filings, which are often the only pieces available, may easily be polished for microscopical examination by the following method. Holes from 3·6 to 10 mm. in diameter are bored in pieces of brass rod of from 12 to 15 mm. diameter and 1·0 cm. thick, or for larger specimens brass tubing may be used. The brass holders are made hot, and the holes filled with gum lac, and when cold the surface is filed level with the brass. The specimens are placed on the gum and warmed by means of a hot wire, thus embedding them; when cold they may be polished in the usual manner. The etching liquid, especially if an alcoholic solution, is applied by means of a fine glass tube. Six microphotographs of very small specimens illustrate the paper.—A. H. C.

Alloys; Electrical conductivity of ——. *Bibliography* (1827—1910). W. Broniewski. Rev. Mét., 1911, **8**, 328—334.

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(4), 1910, **32**, 291. R.S. at 18° C. of AgSb, BiSb, BiTe, SbTe, SeTe, SnTe. *Kurnakow*, *Pouchine*, and *Senkovski*, Z. anorg. Chem., 1910, **68**, 123. R.S. and coef. temp. between 25° and 100° C. of AgCu. *Geibel*, Z. anorg. Chem., 1910, **69**, 38. R.S. and coef. temp. from 0° to 260° C. of AuPd. *Broniewski*, Comptes rend., 1910, **150**, 1754. Curves of the conductivity and of the coef. temp. between 0° and 100° C. of AgAl. *Brooks*, Phys. Zeits., 1910, **11**, 471. Experimental verification of Liebenow's theory (1897). *Guertler*, Phys. Zeits., 1910, **11**, 476. Polemical with Rudolfi.—A. H. C.

[*Abbreviations*. R.S.=specific resistance; coef. temp.=coefficient of temperature of the resistance.]

Determination of manganese by the sodium bismuthate method. Brinton. *See* XXIII.

Patents.

Steel; Process for the manufacture of ——. S. S. Wales, Munhall, Pa., Assignor to Carnegie Steel Co., Pittsburg, Pa. U.S. Pat. 987,840, Mar. 28, 1911.

To a mass of iron oxide and fluxing material, previously heated in a regenerative open-hearth furnace, a quantity of molten pig-iron is added. After removal of the slag, and a further addition of fluxing material, the bath of metal is electrically heated and converted into finished steel in the same furnace.—W. E. F. P.

[*Iron and steel*] *Cementation; Process of* —— *and apparatus therefor.* Soc. des Etablissements Partiot. Fr. Pat. 421,961, Oct. 28, 1910.

The pieces to be carburised, and the cementation powder are separately raised to the required temperature in communicating parts of the apparatus and then brought together, the pieces being submerged in the powder. Under these conditions the action commences at once, the degree of cementation being determined entirely by the time of contact. Claim is also made for the application of the above principle to cementation processes in which the pieces are immersed in suitable gases.—W. E. F. P.

Iron and steel; Manufacture of ——. Elektrostahl G. m. b. H. Fr. Pat. 422,493, Nov. 12, 1910. Under Int. Conv., Mar. 26, 1910.

After preliminary treatment to bring the carbon content of the iron to an amount lower than that desired in the final product, the metal is transferred to an electric furnace in which it is covered with a mixture containing oxygen capable of entering into chemical action. This covering mixture is composed of lime, sand, manganese, and iron ore, or of lime, iron ore, and fluorspar, according as the furnace hearth is acid or basic; and the charge is heated to fusion after the addition of the desired amount of carbon in the form of "carburite"—a metallic product containing calcium carbide. In the basic process the sulphurous slag is removed before the application of the fluorspar mixture.—W. E. F. P.

Iron and mild steel; Process for hardening ——. S. de Karasseff. Fr. Pat. 422,545, Nov. 14, 1910.

The bars of metal are embedded in 40 per cent. of their weight of a powder composed of 10 per cent. of potassium ferrocyanide, 20 of barium carbonate, 20 of calcium carbonate, and 50 of wood charcoal, and heated to a temperature of 1150° C., one hour's heating being allowed for each mm. thickness of the bars. It is stated that the metal so obtained, which is malleable and ductile, acquires a high degree of hardness on tempering, and is suitable for the manufacture of tools.—W. E. F. P.

Lead sulphides; Metallurgy of zinc-bearing ——, *with or without small admixtures of other metals.* E. A. Ashcroft, London. Eng. Pat. 7329, Mar. 23, 1910.

Lead concentrates and certain intermediate products obtained in the classification of refractory sulphide ores, such as those of Broken Hill, are treated with a fused metallic chloride (such as lead chloride, zinc chloride, or a mixture of zinc and sodium chlorides) whereby the lead sulphide is converted into lead chloro-sulphide which is then separated and electrolysed. When lead chloride is employed, the zinc sulphide, gangue, etc., present float upon the surface of the melt, and are removed by skimming; the operation may be conducted over a bath of molten lead for the purpose of extracting the silver. When zinc chloride or the mixture of this with sodium chloride is used, the proportions employed are such as to allow the zinc sulphide, gangue, etc., to separate out at the bottom of the melt.—W. E. F. P.

Sulphides; Metallurgy of metal ——. E. A. Ashcroft, London. Eng. Pat. 7444, Mar. 24, 1910. (See also this J., 1901, 1216.)

On mixing sulphides with fused metallic chlorides, and subjecting the melt to the action of chlorine or chloride of sulphur, the sulphides are converted into chlorides, sulphur being liberated. Iron and manganese are volatilised as chlorides prior to the recovery of the zinc by electrolysis. The volatilised chlorides of iron and manganese are treated with a caustic soda solution and the resulting salt electrolysed, thus recovering the chlorine gas and regenerating the caustic soda solution. The gangue should as far as

possible be removed from the sulphides before treatment. Lead and silver sulphides are decomposed and eliminated prior to the treatment with chlorine or chloride of sulphur.
—R. W. N.

Sulphides ; Metallurgy of metal ——. E. A. Ashcroft, London. Eng. Pat. 7536, Mar. 26, 1910.

After separation of the gangue, the mixture of the sulphides is treated with a fused metallic chloride, and the melt electrolysed at a low temperature. This results in the formation of chlorides of sulphur, with liberation of the metals. The chlorides of sulphur are subsequently made to react with metallic sulphides, producing sulphur and metallic chlorides, which latter are returned to the electrolytic bath. From a zinc-bearing mixture, the iron is removed by fractional electrolysis over molten lead, separating as an alloy. A subsequent electrolysis of the melt at an appropriate temperature results in the production of metallic zinc and chloride of sulphur.—R. W. N.

Sulphide minerals ; Process for roasting ——. C. Gabrielli. Fr. Pat. 422,928. Nov. 24, 1910. Under Int. Conv., Nov. 30, 1909.

During the roasting of the ore or product a mixture of sulphur dioxide and air is made to pass through the partly oxidised material which, at this stage, is kept at a carefully regulated temperature. Instead of using sulphur dioxide and air, some of the raw material may be introduced at the same stage of the process, the object in either case being to sulphate the metal (*e.g.* copper) which it is desired to extract and convert other metals (*e.g.* iron) into oxides. The sulphur dioxide evolved during the process is utilised for the manufacture of sulphuric acid, and it is claimed that a very efficient extraction of the metal is obtained by leaching the roasted material with water or dilute acid.
—W. E. F. P.

Copper ; Process for improving the mechanical and electrical properties of ——. Electrochemische Werke G. m. b. H., Berlin. Eng. Pat. 7657, Mar. 29, 1910. Under Int. Conv., Mar. 30, 1909.

Calcium or molybdenum, or both, are added to electrolytic copper in place of the usual phosphorus or aluminium-magnesium alloys. If present singly, up to 1 per cent., or if both be present, any quantity or proportion up to 0·35 per cent. of each, may be present. The products containing calcium, molybdenum, or both, may also contain from 0·5 to 2 per cent. of tin. It is claimed that in this manner hard-drawn wire can be produced with a conductivity of 94·5, and a tensile strength exceeding 48 kilos. per sq. mm.—R. W. N.

Copper ; Process of refining molten ——. Comp. Française pour l'Exploit. des Proc. Thomson-Houston. Fr. Pat. 422,441, Oct. 26, 1910.

The molten copper is treated with from $\frac{1}{30}$ to $\frac{1}{10}$ per cent. of boron which, it is claimed, removes the dissolved gases (oxygen, nitrogen, carbon monoxide, etc.,) from the metal and thus prevents the formation of blow-holes in the castings. Either pure boron or a mixture of boron with its lower oxides may be employed, the requisite amount of either material being introduced (in a copper capsule) into the metallic bath, which is then well stirred.
—W. E. F. P.

Copper, nickel and other metals ; Direct manufacture of ——. H. A. G. Cinille. Fr. Pat. 421,990, Oct. 29, 1910.

The matte is treated with suitable fluxes in an electrically heated converter, the tuyères of which are so arranged as to ensure the thorough mixing and agitation of the charge by the blast. It is claimed that at the high temperature employed, highly silicious slags, otherwise unworkable, are rendered perfectly fluid, thus fluxing the iron oxide and impurities and producing very rich mattes or coarse metals in a single operation, without damaging the lining of the converter. Nickel mattes, after removal of the iron as described are treated with a reducing, calcareous slag which eliminates the remaining sulphur, resulting in the production of a coarse metal extremely rich in nickel. Claim is also made for the direct treatment of ores, which, after preliminary reduction with carbon in the converter, are ultimately treated as described.
—W. E. F. P.

Electroplating apparatus. T. R. Canning, Birmingham. Eng. Pat. 18,695, Aug. 8, 1910.

The apparatus is adapted to be fixed to the wall of an electroplating tank for the reception of small articles without the necessity of wiring them in the usual manner. It comprises a perforated earthenware or other non-metallic receptacle, carried at the extremity of an inclined shaft, so that the receptacle dips into the electrolyte where it may be rotated, and finally, when the work is complete, removed from the tank without disturbing the framework which carries it. This is accomplished by having at the end of the inclined rotating spindle a pair of arms carrying a ring in which the receptacle is supported. The ring is so arranged that it can swing relatively to its supporting arms and be fixed in an inclined or in a horizontal position. When in the latter position, the receptacle can be lifted out.—W. H. P.

Electroplating apparatus. H. E. Pucklitzsch, Ludwigsburg, Germany. Eng. Pat. 29,473, Dec. 19, 1910.

The claim is for electrolytic apparatus in which tubes, rods, etc., may receive a metallic deposit. The tubes are placed on two oppositely rotating conveyer worms of reverse thread forming the cathodes, and thus conveyed through the bath. To produce a change in the points of contact between material and conveyers, the latter are (1) inclined to each other, and (2) provided with projections sloping towards the delivery end of the bath, which raise and rotate the tube or rod which is being coated. To facilitate the escape of air and gases the worms are made of unequal diameter or unequal lengths. To modify the thickness of the deposit, the speed of the worms and consequently the time of immersion is modified. The worms are provided with an outer metallic envelope insulated from a core, the current being conducted to the envelope from the exterior by means of rubbing contacts. Alternately the current may be conducted to the insulated inner core and thence to the outer envelope by means of conducting screws or other connections through the insulation. At the discharge ends of the worms are arranged helically discharge arms of different lengths which lift the tube or rod, and then incline it, allowing the liquid to return to the bath, and finally raise the plated article on to a shoot from which it passes to a truck or other receptacle. If tubes are also to be plated on the inside, insulated core anodes are arranged, which make rubbing contact with laterally mounted conducting bars.
—W. H. P.

Furnaces ; Tilting calcining orr oasting ——. O. H. S. Lockyer, London. From T. Edwards, Ballarat, Australia. Eng. Pat. 23,430, Oct. 10, 1910.

In general construction, the body of the apparatus is similar to that described in Eng. Pats. 28,464 of 1903 (this J., 1904, 1150) and 21,198 of 1910 (this J., 1911, 367). The ore discharged from the working hearth into the channel below is removed from the same by a push conveyor; means are provided whereby the tilting of the furnace may be altered as required, either by hand or mechanically; and both the push conveyor and the tilting mechanism are operated from the shaft by which the rabble-shafts are rotated. To facilitate the introduction and withdrawal of the rabbles, and to prevent the passage of fumes from the hearth through the rabble-shaft openings, the latter are fitted with boxes. In each opening, one box extends upwards from the crown of the working hearth flue, while the other extends downwards from the crown of the upper flue and overlaps the upper part of the lower box; the boxes and the spaces between their overlapping portions are packed with suitable material.—W. E. F. P.

Ore and coal washers. H. W. Falker, Ashland, and F. Schultz and J. F. Wagner, Tamaqua, Pa., U.S.A. Eng. Pat. 25,490, Nov. 2, 1910.

THE washer consists of a jig-screen to which a gyratory motion can be imparted, and which is suspended within the tank. The feed-end of the screen is stepped, imparting a rolling motion to the entering material, and thus facilitating the separation of the heavier from the lighter portions thereof. An accumulation of slate or other heavy material at the discharge-end of the bed opens, by its weight, a discharge-gate which allows it to fall into the tank, whence it is removed by a conveyor. The lighter portions of the material are discharged on to a conveyor after passing over a perforated lip-plate through which the fine and slush drop into the tank.—R. W. N.

Classification of ores ; Settling apparatus for the ——. J. Van N. Dorr, Denver, Colorado, U.S.A. Eng. Pat. 28,500, Dec. 7, 1910.

THE apparatus consists of an inclined trough provided with a reciprocating rake upon which a number of parallel teeth are disposed normally to the sides of the trough. By the out-stroke of the rake the material settling in the trough is intermittently moved towards the upper or discharge end, the rake being raised above the material on the in-stroke. The bottom of the trough is provided, at the discharge end, with an inserted screen forming the upper part of a suction filter, over which the material passes before being finally discharged ; the even distribution of the material over the screen is effected by means of an adjustable short tooth suitably disposed upon the rake. For the removal of the last portions of "slimes," perforated pipes are located near the discharge end of the trough through which water is forced upwardly as the material passes over them; and by means of a spraying device attached to the rake, the displacement of solvent (cyanide, etc.) from the material is effected during the distribution of the latter upon the screen. The trough may be divided longitudinally into two parts provided with separate rakes operating alternately in opposite directions.—W. E. F. P.

Ores : Apparatus for treating ——. E. B. Goodwin, Ward, Colo. U.S. Pat. 988,458, April 4, 1911.

THE ore is pulverised—by a stamp-mill or otherwise—in the presence of a solvent, and the pulp is conveyed, for fine grinding, to an "arastra" also supplied with the solvent. From the "arastra" the material passes to a travelling filtering frame upon which it is subjected to mechanical compression to facilitate the separation of the solution containing the values. In suitable cases means are provided for the direct extraction of the values from the pulp upon the filtering frame.—W. E. F. P.

Ores ; Process of treating ——. I. A. Braddock, Haddonfield, N.J., Assignor to W. C. Codd, Baltimore, Md., N. A. Kestler and D. E. Anthony, Washington, D.C. U.S. Pat. 987,850, March 28, 1911.

Two vessels communicating with each other are adapted to rotate together about a common horizontal axis. The ore is contained in the first and larger vessel, through the middle of which a hot blast passes horizontally. By the rotation the ore is alternately raised above and allowed to fall through the blast to the bottom of the vessel until it becomes sufficiently pulverised to be carried by the blast into the second vessel. The latter is charged with a suitable solvent, upon the surface of which the stream of pulverised ore is made to impinge.—W. E. F. P.

[Sulphide] Ores ; Process of concentrating ——. W. M. Sanders, Marion, Ky. U.S. Pat. 988,737, April 4, 1911.

AFTER preliminary concentration to effect the separation of calcite, the sulphide ore is subjected to further concentration by flotation in a non-acid solution, the latter being adapted to react upon the ore to produce bubbles and capable of reacting upon calcite.—W. E. F. P.

Tin-plate waste ; Process for cleaning ——, before recovering the tin by means of chlorine. C. von der Linde, Crefeld, Germany. Eng. Pat. 26,415, Nov. 14, 1910. Under Int. Conv., Nov. 15, 1909.

THE waste is compressed into packets before treatment, the packets being piled up in a closed vessel in which the washing liquid is repeatedly forced through them by pressure or suction. Although by this means substances insoluble in the washing liquid are not removed by elutriation as in ordinary processes, it is claimed that, as such impurities are completely deprived of fat and oil, and are not actually attached to the metal, the subsequent chlorination of the waste (which is effected in the same vessel) is in no way retarded.—W. E. F. P.

Metal castings ; Process of producing sound ——. L. Weiss, Barmen-Rittershausen, Germany. U.S. Pat. 982,326, Jan. 24, 1911.

ZIRCONIUM to the extent of at least 1 per cent. is added to the molten casting metal. The zirconium is introduced in the metallic form or in combination with other elements such as carbon, silicon, iron, nickel, molybdenum, or chromium.—W. E. F. P.

Metal from blast-furnace dust ; Apparatus for recovering ——. H. C. Parker, Ironton, Ohio. U.S. Pat. 987,739, March 28, 1911.

THE apparatus (designed for sintering ore dust expelled from blast furnaces) consists of a closed, horizontal, rectangular chamber provided with a row of fireplaces on each of its longer sides. From each fireplace a vertical up flue extends within but not to the top of the chamber ; and a corresponding but independent down flue (situated behind and at some distance from the up flue) extends through the base of the chamber into an exit channel below. The spaces between the several flues being charged with the ore dust, communication between the up and down flues is effected at the upper part of the chamber, and the products of combustion are continuously conveyed through the apparatus.—W. E. F. P.

Alloys ; Electrolytically refining ——. A. G. Betts, Troy, N.Y. U.S. Pat. 987,947, March 28, 1911.

TWO metals, such as iron and nickel, are dissolved by subjecting the alloy as anode to an electrolytic action in an aqueous solution of an electrolyte, afterwards depositing in separate compartments two alloys of nickel and iron in different proportions, by maintaining in each compartment a different condition of the electrolyte and interchanging the solutions in the two compartments.—B. N.

Metals from their ores ; Electrolytically extracting ——. W. D. Rennie, Hackensack, N.J., Assignor to Universal Ore Reduction Co., Phœnix, Ariz. U.S. Pat. 988,210, March 28, 1911.

THE ore in a powdered state is distributed throughout the body of an electrolyte by subjecting it, whilst in suspension, to a continuous lifting and distributing pressure, and then allowing it to descend under the influence of gravity alone, an electric current being passed through the liquid. The agitator comprises a tube attached to the inside of the bottom of the electrolytic vessel, through which steam, air, or other gas under pressure is passed, and at the top of the tube a deflector for effecting a radial distribution of the powder.—B. N.

Manganese ; Process of manufacturing metallic ——, and aluminium fluoride. W. S. Rockey and H. Eldridge, New York. U.S. Pat. 988,509, April 4, 1911.

A MIXTURE of dry manganese fluoride, metallic aluminium, and calcium fluoride (the latter to act as flux) is heated to a suitable temperature in a crucible or tilting hearth. The quantity of fluoride employed is to be sufficient to ensure the complete covering of the resulting metallic manganese by the flux, with which latter the metal is poured into the mould, and beneath which it is allowed to cool before removal.—W. E. F. P.

Slag; Process for preventing the formation and premature fusion of —— in furnaces. Eisenwerk Jagstfeld G.m.b.H. Fr. Pat. 421,974, Oct. 29, 1910.

Gases or vapours such as steam, carbon dioxide, or hydrocarbons, which absorb heat by their dissociation, are injected into the furnace at the affected zone or zones.
—W. E. F. P.

Pig iron; Process for making ——. S. G. Martin. Fr. Pat. 421,927, Oct. 28, 1910.

See U.S. Pat. 975,625 of 1910; this J., 1910, 1458.—T.F.B.

Steel; Manufacture of ——. A. Reynolds, London. Eng. Pat. 29,482, Dec. 16, 1909.

See U.S. Pat. 963,652 of 1910; this J., 1910, 959.—T. F. B.

Steel; Unmagnetisable ——. F. Kohlhaas. Fr. Pat. 422,239, Nov. 5, 1910.

See U.S. Pat. 981,575 of 1911; this J., 1911, 135.—T. F. B.

Metals of the alkalis or of the alkaline earths; Production of ——. W. G. Heys, Manchester. From Nitrogen Co., Ossining, N.Y., U.S.A. Eng. Pat. 20,386, Sept. 1, 1910.

See Fr. Pat. 420,744 of 1910; this J., 1911, 369.—T. F. B.

Separating pulverised ore or other comminuted solid matter from liquid; Means for ——. A. J. Arbuckle, Johannesburg. U.S. Pat. 988,535, April 4, 1911.

See Eng. Pat. 24,402 of 1909; this J., 1910, 702.—T. F. B.

Metallic alloy. G. Jacquier. Fr. Pat. 421,736, Oct. 22, 1910.

See Eng. Pat. 20,601 of 1910; this J., 1911, 494.—T. F. B.

Lead and zinc from ores and slags; Process and rotary furnace for extracting ——. E. Dedolph. Fr. Pat. 421,910, Sept. 30, 1910.

See U.S. Pat. 959,924 of 1910; this J., 1910, 826.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Carborundum furnace; Temperature measurements in an experimental ——. H. W. Gillett. J. of Phys. Chem., 1911, 15, 213—303.

The author has made an extensive inquiry into the forms of pyrometer which may be used for the accurate determination of temperatures from 1700°—2500° C. in a carborundum furnace. The three instruments used were (1) a Wanner pyrometer which was made specially sensitive over the range described, (2) a Morse thermo-gauge (Holborn-Kurlbaum pyrometer) whose method of calibration was examined and improved, (3) a specially improved form of Thwing radiation pyrometer, all three being calibrated against a spectrophotometer. For temperature measurement a carborundum tube was fixed with one end in the middle of the furnace, this end being closed by a graphite plug which was found to give true black-body radiation for all three pyrometers. By making this tube double walled and applying gentle suction in the annular space, it was possible to suck out the fumes which would otherwise have rendered observations impossible. The use of a carborundum tube was found specially convenient because its temperature gradient was more nearly that of the furnace than that of a graphite or carbon tube. The cooling effect of the current of air used to suck out the fumes was negligible and it was found easy to apply a correction for the thickness of the plug. Working in this way with the three pyrometers the temperature of formation of siloxicon was found to be 1540° C.±30°, that of carborundum 1820° C.±20°, and the decomposition temperature of carborundum 2220° C.±20°. A study of the composition of the charge for the furnace led to the conclusion that an excess of carbon was desirable.
—W. H. P.

Rapid determination of nickel and cobalt with a gauze cathode and stationary anode. Benner and Ross. See XXIII.

Patents.

Liquids and semi-liquids; Apparatus for the electrical treatment of ——. V. M. Wright, Cleveland, Ohio. U.S. Pat. 987,845, March 28, 1911.

The apparatus comprises a trough-shaped box with its interior surface lined with aluminium constituting an electrical conductor, a series of non-conductive baffle-bars of slate located upon the bottom of the box, and a conductive bar of carbon disposed longitudinally upon the slate baffle-bars. The top edges of the box carry a series of wood-fibre bars, over which is disposed a hard rubber bar, which supports aluminium electrodes, each of these being of an inverted U-shape with its free ends on each side and in contact with the carbon bar. These aluminium electrodes are connected with one terminal of the current, and the internal lining with the other terminal.—B. N.

Furnaces; Electric ——. J. Thomson, New York. Eng. Pat. 15,164, June 23, 1910. Under Int. Conv., Sept. 1, 1909.

See U.S. Pat. 950,879 of 1910; this J., 1910, 436.—T. F. B.

Furnaces; Revoluble or oscillatory electric ——. J. Thomson, New York. Eng. Pat. 15,165, June 23, 1910. Under Int. Conv., Sept. 1, 1909.

See U.S. Pat. 950,880 of 1910; this J., 1910, 436.—T. F. B.

Furnace process; Electric ——, and electric furnace. C. Hering, Philadelphia. U.S. Pat. 988,936, April 4, 1911.

See Fr. Pat. 419,715 of 1910; this J., 1911, 221.—T. F. B.

Furnaces; Electric ——. J. Härdén. Fr. Pat. 422,374, Nov. 10, 1910. Under Int. Conv., Nov. 12, 1909.

See Eng. Pat. 26,251 of 1909; this J., 1910, 885.—T. F. B.

Furnaces; Electric ——. J. Härdén. Fr. Pat. 422,375, Nov. 10, 1910. Under Int. Conv., Nov. 12, 1909.

See Eng. Pat. 26,266 of 1909; this J., 1910, 763.—T. F. B.

XII.—FATS; OILS; WAXES.

Waste products from some chemical industries. S. Fachini. L'Ind. Chimica, 1911, 11, 76—79.

The article deals with the utilisation of the chrysalids from the manufacture of silk and of the waste from the manufacture of tomato sauce for the recovery of the oil contained therein. The author first recommends for use in oil-extraction processes generally, the employment of heated carbon dioxide gas instead of steam for the expulsion of the last traces of volatile solvent from the residue and from the oil. A brief description of a closed system is described, the carbon dioxide being circulated continuously through the extractor, a condenser where the volatile solvent is condensed, and a superheater by which the gas is heated to 100°—105° C. It is stated that the residue in the extractor can be freed from any odour due to traces of the solvent by passing over it superheated alcohol vapour.

Oil from silk worm chrysalids. The annual production of fresh silk cocoons in Italy during the period 1899—1908, was about 53,899,000 kilos., yielding about 16,000,000 kilos. of waste chrysalids, of which at present nearly the whole is subsequently used directly as manure. The chrysalids contain 20 per cent. of oil (see this J., 1907, 24,622; 1908, 411,455), and if this were extracted, using the system described above, the residue would possess a manurial value equal to or greater than that of the material before extraction.

Tomato waste. In this case also the author recommends extraction of the oil contained in the tomato seeds, but instead of drying the crude material as proposed by Accomazzi (this J., 1911, 95), he suggests as a more economical method, agitating the waste with water, and allowing to settle, whereupon the seeds fall to the bottom. From the wet seeds the greater part of the water can be removed in a centrifugal machine, after which they can be easily dried and the oil recovered by pressing or by extraction.—A. S.

Saponification value of fats and waxes; Determination of the ——. L. W. Winkler. Z. angew. Chem., 1911, **24**, 636—638.

The author suggests that the ethyl alcohol used in making the alcoholic potash for saponification value determinations may with advantage be replaced by propyl alcohol, as its higher boiling point increases the rapidity of saponification and does away with the necessity for a reflux condenser.—J. A.

Fats and oils; Determination of the total soluble fatty acids in ——. A. Bruno. Ann. Chim. analyt., 1911, **16**, 138—139.

Five grms. of the sample are boiled with 25 c.c. of $N/1$ alcoholic potassium hydroxide solution for 15 minutes, and the excess of alkali is then titrated with $N/2$ hydrochloric acid, using phenolphthalein as indicator. This operation is carried out in a flask bearing a mark on its neck, the capacity of the flask up to the mark being 151·8 c.c. at a temperature of 50° C. A further quantity of the acid is then added sufficient to combine with the whole of the alkali used, and the contents of the flask are diluted to the mark with water at a temperature of 50° C. After mixing, the contents are cooled to 15° C., and 50 c.c. of the aqueous solution (one-third of the whole) are withdrawn, and titrated. The acidity found is due to the soluble fatty acids present.—W. P. S.

Miscibility curves of liquids; Use of —— in the examination of codliver oil. E. Louïse. J. Pharm. Chim., 1911, **3**, 377—385.

The author's method of analysis (this J., 1907, 932; 1909, 892; 1910, 438) has been applied to the examination of codliver oil. The acetone used for obtaining the miscibility curves was diluted with water (less than 5 c.c. per litre) so as to give a miscibility temperature of 7° C. with the standard petroleum oil used in the former experiments. The oils to be tested were kept at 0° C. for 24 hours and then filtered through glass wool, and the filtrate dried *in vacuo* over sulphuric acid for 24 hours to remove all traces of water. They were then mixed with 20 c.c. of the acetone in weighed quantities of 3 to 20 grms., and the miscibility temperatures obtained with the increasing weights plotted in curves. It was found that in the case of 15 samples of colourless codliver oil the curves followed almost the same course, and the miscibility temperatures, were all below 0° C., whereas brown codliver oils had somewhat different curves and gave miscibility temperatures above 0° C. Pale and yellow oils gave results intermediate between these extremes. The curves of miscibility thus obtained were quite independent of the iodine values or refractometer readings of the different samples. —C. A. M.

Crude glycerin; Analysis of ——. Report by O. Hehner, J. Allan, J. B. McArthur, W. H. Phillips, P. Tainsh, F. Tate, and J. L. Buchanan. Jan. 31, 1911.

A general meeting of makers of crude glycerin, held in London in July 1909, resolved that it was desirable to standardise the tests of crude glycerin, and appointed a committee to make investigations and report. The expert committee has been able to work in conjunction with similar committees in America, France, and Germany, and the methods detailed have their unanimous support, and are recommended as international standards.

Sampling.—A sampler has been devised with the object of overcoming the objections to the glass tube usually employed. It consists of two brass tubes, one fitting closely inside the other. A number of ports are cut out in each tube in such a way that when the ports are opened a continuous slot is formed which enables a complete section to be taken throughout the entire length of the drum. By this arrangement the sampler is filled almost instantaneously with the glycerin. There are also a number of ports cut at the bottom of the sampler which render it possible to take a proportion of the salt at the bottom of the drum. The instrument is so constructed that all the ports, including the bottom ones, can be closed simultaneously by the simple action of turning the handle at the top; a pointer is arranged which indicates on a dial when the sampler is open or closed. In using the sampler it is introduced into the drum with the ports closed, and when it has touched the bottom the ports are opened for a second or two and then closed. After withdrawing the sampler, the sample is discharged into the receiving vessel by opening the ports. When the drum contains settled salt, the ports must be opened before the sampler is pushed through the salt, thus enabling a portion to be included in the sample. It is, however, almost impossible to obtain a correct proportion of salt after it has settled in the drum, and it is therefore recommended that the drum should be sampled before the salt has settled. A mutually approved person shall sample with the sectional sampler, then seal the drums, brand them with a number for identification, and keep a record of the brand number. The presence of any visible salt or other suspended matter is to be noted, and a report of same made in the certificate, together with the temperature of the glycerin. Each drum must be sampled.

1. *Determination of free caustic alkali.*—Weigh 20 grms. of the sample into a 100 c.c. flask, dilute with approximately 50 c.c. of freshly boiled distilled water, add an excess of neutral barium chloride solution, 1 c.c. of phenolphthalein solution, make up to the mark, and mix. Allow the precipitate to settle, draw off 50 c.c. of the clear liquid, and titrate with $N/1$ acid. Calculate to percentage of Na_2O existing as caustic alkali. 2. *Determination of ash and total alkalinity.*—Weigh 2 to 5 grms. of the sample in a platinum dish, burn off the glycerin over a luminous argand burner or other source of heat giving a low flame temperature, the temperature being kept low to avoid volatilisation and the formation of sulphides. When the mass is charred to the point that water will not become coloured by soluble organic matter, lixiviate with hot distilled water, filter, wash, and ignite the residue in the platinum dish. Return the filtrate and washings to the dish, evaporate, and carefully ignite without fusion. Weigh the ash. Dissolve the ash in distilled water and titrate total alkali, using as indicator methyl orange cold, or litmus boiling. 3. *Determination of alkali present as carbonate.*—Take 10 grms. of the sample, dilute with 50 c.c. of distilled water, add sufficient $N/1$ acid to neutralize the total alkali found at (2), boil under a reflux condenser for 15 to 20 minutes, wash down the condenser tube with distilled water free from carbon dioxide, and titrate back with $N/1$ sodium hydroxide, using phenolphthalein as indicator. Calculate the percentage of Na_2O. Deduct the alkali found in (1). The difference is the percentage of Na_2O existing as carbonate. 4. *Alkali combined with organic acids.*—The sum of the percentages of Na_2O found at (1) and (3) deducted from the percentage found at (2) is a measure of the Na_2O or other alkali combined with organic acids. 5. *Determination of acidity.*—Take 10 grms. of the sample, dilute with 50 c.c. of distilled water free from carbon dioxide, and titrate with $N/1$ sodium hydroxide and phenolphthalein. Express in terms of Na_2O required to neutralize 100 grms. 6. *Determination of total residue at 160° C.*—For this determination the crude glycerin should be slightly alkaline with sodium carbonate, not exceeding the equivalent of 0·2 per cent. of Na_2O, in order to prevent loss of organic acids. To avoid formation of polyglycerols this alkalinity must not be exceeded. Ten grms. of the sample are weighed into a 100 c.c. flask, diluted with water and the calculated quantity of $N/1$ hydrochloric acid or sodium carbonate added to give the required degree of alkalinity. The flask is filled to 100 c.c., the contents mixed, and 10 c.c. measured into a weighed

Petrie or similar dish 2·5 in. diameter and 0·5 in. deep, which should have a flat bottom. In the case of crude glycerins abnormally high in organic residue, a smaller quantity is to be evaporated, so that the weight of organic residue does not materially exceed 30 to 40 mgrms. The dish is placed on a water bath (the top of the 160° C. oven acts equally well) until most of the water has evaporated. From this point the evaporation is effected in the oven. Satisfactory results are obtained in an oven measuring 12 in. cube, having an iron plate ⅜ in. thick lying on the bottom to distribute the heat. Strips of asbestos millboard are placed on a shelf halfway up the oven. On these strips the dish containing the glycerin is placed. If the temperature of the oven has been adjusted to 160° C. with the door closed, a temperature of 130° to 140° C. can be readily maintained with the door partially open, and the glycerin, or most of it, should be evaporated off at this temperature. When only a slight vapour is seen to come off, the dish is removed and allowed to cool. An addition of 0·5 to 1 c.c. of water is made, and by a rotary motion the residue brought wholly or nearly into solution. The dish is then allowed to remain on a water bath or top of the oven until the excess water has evaporated and the residue is in such a condition that on returning to the oven at 160° C. it will not spit. The time taken up to this point cannot be given definitely, nor is it important. Usually two to three hours is required. From this point, however, the schedule of time must be strictly adhered to. The dish is allowed to remain in the oven, the temperature of which is carefully maintained at 160° C. for one hour, when it is removed, cooled, the residue treated with water, and the water evaporated as before. The residue is then heated again for one hour, after which the dish is allowed to cool in a desiccator over sulphuric acid and weighed. The treatment with water, etc., is repeated until a constant loss of 1 to 1·5 mgrms. per hour is obtained. *Corrections to be applied to the weight of the total residue.*—In the case of acid glycerins a correction must be made for the alkali added. 1 c.c. to *N*/1 alkali represents an addition of 0·022 grm. In the case of alkaline crudes a correction should be made for the acid added. Deduct the increase in weight due to the conversion of the sodium hydroxide and carbonate to chloride. The corrected weight, multiplied by 100, gives the percentage of total residue at 160° C. Preserve this residue for the determination of the non-volatile acetylisable impurities. 7. *Organic residue.*—Subtract the ash from the total residue at 160° C. Report as organic residue at 160° C. It should be noted that alkali salts of organic acids are converted to carbonates on ignition, and that the CO_3 radical thus derived is not included in the organic residue. 8. *Moisture.*—Two to three grms. of very pure bulky asbestos freed from acid-soluble material which has been previously dried in a water oven is placed in a small stoppered weighing bottle of about 15 c.c. capacity. The weighing bottle is kept in a desiccator furnished with a supply of concentrated sulphuric acid, under a pressure equivalent to 1 to 2 mm. of mercury, until constant in weight. From 1 to 1·5 grms. of the sample is then carefully dropped on the asbestos in such a way that it will be all absorbed. The weight is again taken and the bottle replaced in the desiccator under 1 to 2 mm. pressure until constant in weight. At 15° C. the weight is constant in about 48 hours. At lower temperatures the test is prolonged. The sulphuric acid in the desiccator must be frequently renewed.

Acetin process for glycerol determination.—This process is the one agreed upon at a conference of delegates from the American, British, French and German Committees, as the process to be used (if applicable) whenever only one method is employed. On pure glycerins the results are identical with those of the bichromate process. For its application the crude glycerin should not contain over 50 per cent. of water. *Reagents required.*—(*A*)—*Best acetic anhydride.* This should be carefully selected. A good sample must not require more than 0·1 c.c. of *N*/1 NaOH for saponification of the impurities when a blank is run on 7·5 c.c. Only a slight colour should develop during digestion of the blank. (*B*)—*Pure fused sodium acetate.* The purchased salt is completely fused in a platinum, silica or nickel dish, avoiding charring, powdered quickly and kept in a stoppered bottle or in a desiccator. It is most important that the sodium acetate be anhydrous. (*C*)—*A solution of caustic soda for neutralising, of about N/1 strength, free from carbonate.* This can be readily made by dissolving pure sodium hydroxide in its own weight of water (preferably water free from carbon dioxide) and allowing to settle until clear, or filtering through an asbestos or paper filter. The clear solution is diluted with water free from carbon dioxide to the strength required. (*D*)—*N*/1 caustic soda, free from carbonate. Prepared as above and carefully standardised. Some caustic soda solutions show a marked diminution in strength after being boiled; such solutions should be rejected. (*E*)—*N/1 acid.* (*F*)—*Phenolphthalein solution.* Dissolve 0·5 per cent. of phenolphthalein in alcohol and neutralise the solution.

Method of analysis.—Into a narrow-mouthed flask (preferably round-bottomed), capacity about 120 c.c., which has been thoroughly cleaned and dried, weigh accurately and as rapidly as possible 1·25 to 1·5 grms. of the glycerin. Add first about 3 grms. of the anhydrous sodium acetate, then 7·5 c.c. of the acetic anhydride, and connect the flask with an upright Liebig condenser. For convenience the inner tube of this condenser should not be over 50 cm. long and 9 to 10 mm. inside. The flask is connected with the condenser by either a ground glass joint (preferably) or a rubber stopper. If a rubber stopper is used it should have had a preliminary treatment with hot acetic anhydride vapour. Heat the contents and keep just boiling for one hour, taking precautions to prevent the salts drying on the sides of the flask. Allow the flask to cool somewhat and through the condenser tube add 50 c.c. of the distilled water, free from carbon dioxide, heated to about 80° C., taking care that the flask is not loosened from the condenser. Time is saved by adding the water before the contents of the flask solidify, but the contents may be allowed to solidify and the test proceeded with the next day without detriment. The contents of the flask may be warmed to, but must not exceed, 80° C. until the solution is complete except a few dark flocks resulting from organic impurities in the crude glycerin. Cool flask and contents without loosening from condenser. When quite cold, wash down the inside of the condenser tube, detach the flask, wash off the stopper or ground glass connection into the flask. Filter the contents of the flask through an acid-washed filter into a Jena-glass flask of about 1 litre capacity. Wash thoroughly with cold distilled water free from carbon dioxide. Add 2 c.c. of phenolphthalein solution (F), then run in a caustic soda solution (C) or (D) until a faint pinkish yellow colour appears throughout the solution. This neutralisation must be done most carefully; the alkali should be run down the sides of the flask, the contents of which are kept rapidly swirling with occasional change of motion until the solution is nearly neutralised, as indicated by the slower disappearance of the colour developed locally by the alkali running into the mixture. When this point is reached, the sides of the flask are washed down with water free from carbon dioxide, and the alkali subsequently added drop by drop, mixing after each drop until the desired tint is obtained. Now run in from a burette 50 c.c. or a calculated excess of *N*/1 sodium hydroxide (D), and note carefully the exact amount. Boil gently for 15 minutes, the flask being fitted with a glass tube acting as a partial condenser. Cool as quickly as possible and titrate excess of alkali with *N*/1 acid (E) until the pinkish yellow, or chosen end point colour just remains. A further addition of the indicator at this point will cause a return of the pinkish colour; this must be neglected, and the first end point taken. From the *N*/1 sodium hydroxide consumed, calculate the percentage of glycerol, after making the correction for the blank test described below. 1 c.c. of *N*/1 sodium hydroxide = 0·03069 grm. of glycerol. The coefficient of expansion for *N*/1 solutions is approximately 0·00033 per c.c. for each degree C. A correction should be made on this account if necessary. As the acetic anhydride and sodium acetate may contain impurities which affect the result, it is necessary to make a blank test, using the same quantities of acetic anhydride and sodium acetate as in the analysis. After neutralising the acetic acid, it is not necessary to add more than 5 c.c. of the $N/1$ alkali (D) as that represents the excess of alkali usually left after saponification of the triacetin in the glycerol determination. *Determination of the glycerol value of the acetylisable impurities.*—The total residue at 160° C. is dissolved in 1 or 2 c.c. of water, washed into a clean acetylising flask of 120 c.c. capacity and the water evaporated. Now add anhydrous sodium acetate and proceed as in the glycerol determination before described. Calculate the result to glycerol.

Bichromate process for glycerol determination. Reagents required. (*A*)—*Pure potassium bichromate* powdered and dried in air free from dust or organic vapours, at 110° C. to 120° C. This is taken as the standard. (*B*)—*Dilute bichromate solution.* 7·4564 grms. of the above bichromate (A) are dissolved in distilled water and the solution made up to one litre at 15·5° C. (*C*)—*Ferrous ammonium sulphate.* Dissolve 3·7282 grms. of potassium bichromate (A) in 50 c.c. of water. Add 50 c.c. of 50 per cent. (by volume) sulphuric acid, and to the cold undiluted solution add from a weighing bottle a moderate excess of the ferrous ammonium sulphate, and titrate back with the dilute bichromate (B). Calculate the value of the ferrous salt in terms of bichromate. (*D*)—*Silver carbonate.* This is prepared as required for each test from 140 c.c. of 0·5 per cent. silver sulphate solution by precipitation with about 4·9 c.c. of $N/1$ sodium carbonate solution (a little less than the calculated quantity of $N/1$ sodium carbonate should be used; any excess of alkali carbonate prevents rapid settling). Settle, decant and wash once by decantation. (*E*)—*Subacetate of lead.* Boil a pure 10 per cent. solution of lead acetate with an excess of litharge for one hour, keeping the volume constant, and filter while hot. Disregard any precipitate which subsequently forms. Preserve out of contact with carbon dioxide. (*F*)—*Potassium ferricyanide.* A very dilute solution containing about 0·1 per cent. *Method of analysis.*—Weigh 20 grms. of the glycerin, dilute to 250 c.c. and take 25 c.c. Add the silver carbonate, allow to stand, with occasional agitation, for about 10 minutes, and add a slight excess (about 5 c.c. in most cases) of the basic lead acetate (E), allow to stand a few minutes, dilute with distilled water to 100 c.c. and then add 0·15 c.c. to compensate for the volume of the precipitate, mix thoroughly, filter through an air dry filter into a suitable narrow-mouthed vessel, rejecting the first 10 c.c., and return filtrate if not clear and bright. Test a portion of the filtrate with a little basic lead acetate, which should produce no further precipitate. (In the great majority of cases 5 c.c. is ample.) Occasionally a crude glycerin will be found requiring more, and in this case another aliquot portion of 25 c.c. of the dilute glycerin should be taken and purified with 6 c.c. of the basic acetate. Care must be taken to avoid a marked excess of basic acetate. Measure off 25 c.c. of the clear filtrate into a glass flask or beaker (previously cleaned with potassium bichromate and sulphuric acid). Add first 12 drops of sulphuric acid (1 : 4) to precipitate the small excess of lead as sulphate, then 3·7282 grms. of the powdered potassium bichromate (A). Rinse down the bichromate with 25 c.c. of water and allow to stand with occasional shaking until all the bichromate is dissolved. Now add 50 c.c. of 50 per cent. sulphuric acid (by volume) and immerse the vessel in boiling water for two hours and keep protected from dust and organic vapours, such as alcohol, till the titration is completed. Add from a weighing bottle a slight excess of the ferrous ammonium sulphate (C), making spot tests on a porcelain plate with the potassium ferricyanide (F). Titrate back with the dilute bichromate. From the amount of bichromate reduced calculate the percentage of glycerol. 1 grm. of glycerol is equivalent to 7·4564 grms. of bichromate; and 1 grm. of bichromate to 0·13411 grm. of glycerol. *Notes.*—(1) It is important that the concentration of acid in the oxidation mixture and the time of oxidation should be strictly adhered to. (2) Before the bichromate is added to the glycerin solution it is essential that the slight excess of lead be precipitated with sulphuric acid as stipulated in the process. (3) For crude glycerin practically free from chlorides the quantity of silver carbonate may be reduced to one-fifth and the basic lead acetate to 0·5 c.c. (4) It is sometimes advisable to add a little potassium sulphate to ensure a clear filtrate.

Instructions for calculating actual glycerol content.—(1) Determine the apparent percentage of glycerol in the sample by the acetin process as described. The result will include acetylisable impurities if any be present. (2) Determine the total residue at 160°C. (3) Determine the acetin value of the residue at (2) in terms of glycerol. (4) Deduct the result found at (3) from the percentage obtained at (1) and report this corrected figure as glycerol. If volatile acetylisable impurities are present these are included in this figure.

Notes and recommendations.—Experience has shown that in crude glycerin of good commercial quality, the sum of water, total residue at 160° C., and corrected acetin result comes to within 0·5 of 100. Further, in such products the bichromate result agrees with the uncorrected acetin result to within 1 per cent. In the event of greater differences being found, impurities such as polyglycerols or trimethylene-glycol are present. Trimethylene-glycol is more volatile than glycerol; it can therefore be concentrated by fractional distillation. An approximation to the quantity can be obtained from the "spread" between the acetin and bichromate results of such distillates. Trimethylene-glycol shows by the former method 80·69 per cent. and by the latter 138·3 per cent. expressed as glycerol. In valuing crude glycerin for certain purposes it is necessary to ascertain the approximate proportion of arsenic, sulphides, sulphites, and thiosulphates. The methods for detecting and determining these impurities have not formed the subject of this investigation.

Recommendations by Executive Committee.—If the non-volatile organic residue at 160° C. in the case of a soap lye crude glycerin be over 2·5 per cent., *i.e.*, when not corrected for carbon dioxide in the ash, then the residue shall be examined by the acetin method, and any excess of glycerol found over 0·5 per cent. shall be deducted from the acetin figure. In the case of saponification, distillation and similar glycerins, the limit of organic residue which should be passed without further examination shall be fixed at 1 per cent. In the event of the sample containing more than 1 per cent., the organic residue must be acetylated, and any glycerol found (after making the deduction of 0·5 per cent.) shall be deducted from the percentage of glycerol found by the acetin test.—J. A.

PATENTS.

Edible fat. J. Stadley, London. Eng. Pat. 10,429, April 28, 1910.

A FAT suitable for culinary purposes is prepared by mixing together butter, 14lb.; veal fat, 42 lb.; pork fat, 56 lb.; mutton fat, 28 lb.; beef fat, 112 lb.; sesamé oil, 14 lb.; and cottonseed oil, 14lb. The butter and the fats are melted separately, strained, and then mixed with the oils at a temperature of about 30° C. The butter and mutton fat may be subjected to centrifugal action before use in order to free them from excess of moisture.—W. P. S.

Fat; Apparatus for extracting —— from garbage and similar material by means of volatile solvents. J. B. Livingston, New Haven, Conn., U.S.A. Eng. Pat. 12,234, May 18, 1910. Under Int. Conv., May 28, 1909.

THE material to be extracted is introduced into a cylindrical rotatable chamber provided with a series of perforated pipes for steam and the solvent (naphtha) which pass horizontally from end to end of the chamber and may be independently controlled. These steam and solvent pipes, the perforations in which are preferably in an upward direction, rest upon channel irons, which are shorter than the length of the casing and are supported in grooves in brackets at each end and by transverse beams, so that they may expand or contract longitudinally. Beneath the perforated bottom in the chamber is a series of discharge chambers into which the solution of the fat passes through a straining medium, the several outlets of which chambers are controlled by valves and are connected with a single discharge pipe. When the extraction is complete, the solvent remaining in the material is removed by steam introduced through the steam pipe and escaping through at outlet pipe at the top connected with a suitable condenser.—C. A. M.

Crude oil [petroleum] soap or soap lye; Process for manufacturing ——. O. Cassel, K. Raab, and R. Steininger, Vienna. Eng. Pat. 14,942, June 21, 1910. Under Int. Conv., March 11, 1910. Addition to Eng. Pat. 14,844 of 1910.

An addition of montanic acid may take the place of the montan wax claimed in the previous patent (this J., 1910, 435) for effecting a fine division of the crude oil in the soap.—C. A. M.

Soap; Method of perfuming ——. A. Janoušek. Fr. Pat. 422,752, Nov. 18, 1910.

The soap is incorporated, before solidification, with a suitable proportion of a "fruit ester" or mixture of such esters, *e.g.*, amyl acetate, butyl isoacetate, etc.—C. A. M.

Glycerin; Manufacture of —— *in a continuous cycle.* Soc. Anon. de la Stéarinerie H. Bollinckx. Fr. Pat. 422,770, Nov. 19, 1910.

The mixture of soap and free fatty acids resulting from the hydrolysis of fats by means of lime, metallic hydroxides, etc., in an autoclave, is separated into its constituents and the separated soap used for the treatment of a further portion of fat, and so on for each subsequent operation. In this way a certain proportion of free fatty acids is obtained each time, and the process of liberating the fatty acids from the soap is obviated.—C. A. M.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Guignet's green. L. Wöhler and W. Becker. Z. angew. Chem., 1911, **24**, 484—487.

In the authors' former communication (this J., 1908, 865) the sp. gr. of this substance was erroneously given as 3·3; it should have been 2·9. This is a mean sp. gr., for the substance is not absolutely homogeneous, different portions varying slightly in their water-content. The lower value of 2·74, obtained by Munkert, is attributed by the authors to Munkert's sample having contained more water than corresponds to $Cr_4O_3(OH)_6$. Eibner and Hue (Farben-Zeit., 1910, **51**, 2106, 2157, 2213, 2268, 2319) have lately questioned the correctness of the formula, $Cr_4O_3(OH)_6$, and suggest the formation of another hydrate, $Cr_4O(OH)_{10}$, whilst also pointing out that the green produced by the aid of borax has a variable composition. The authors regard this variability as simply due to the presence of impurities, and point out that whilst the addition of water to the compound, $Cr_4O_3(OH)_6$, does not alter its properties, the removal of water from it by further dehydration causes a complete alteration in colour and other properties, and that whilst hydrates may exist, as do hydrates of sulphuric acid (H_2SO_4), for example, the formula of the substance should represent its composition in its least hydrated form. Moreover, the intermediate product isolated by the authors in preparing the green from potassium bichromate by means of boric acid had the formula, $Cr_4O_3(B_4O_7)_3$, corresponding to $Cr_4O_3(OH)_6$. Eibner and Hue object to the authors' view that the difference between Guignet's green and the gray-violet hydrate is one of "hydrate-isomerism" and suggest that Guignet's green may be formed from the other hydrate by condensation or polymerisation. It appears to the authors, however, that if that were the case, the vapour-pressure of water from it at a given temperature should be less than that of the simpler hydrate, whereas that of Guignet's green is greater than that of the gray-violet hydrate.—J. T. D.

Petroleum; Frey's method of determining —— *in turpentine oil.* H. S. Shrewsbury. Analyst, 1911, **36**, 137—138.

From the results of experiments with mixtures of petroleum oil (kerosene) and turpentine oil it is shown that Frey's method (this J., 1908, 346) is only applicable when the percentage of petroleum oil lies between 30 and 70; and, even then the agreement is probably to be attributed to a chance compensation of different errors.—C. A. M.

Turpentine adulteration; Detection of ——. U.S. Dept. of Agric., Bureau of Chemistry Bulletin. Oil, Paint, and Drug Rep., April 17, 1911. [T.R.]

The following are suggested as specifications for three standard grades of turpentine:—

Standard or No. 1 turpentine should have a specific gravity at 20° C. of from 0·862 to 0·870; a refractive index at 20° C. of from 1·468 to 1·476; 95 per cent. should distil below 170° C., and a layer of not less than 200 mm. should be required to equal in colour the Lovibond yellow glass No. 1. On polymerisation with 38-normal sulphuric acid the residue should not exceed 1 per cent., should be reddish in colour and viscous, and its refractive index at 20° C. should be from 1·500 to 1·520. An unadulterated turpentine which does not agree with these requirements may properly be regarded as not of standard or No. 1 quality.

Second quality or No. 2 turpentine should have a specific gravity of 20° C. of from 0·862 to 0·875; a refractive index at 20° C. of from 1·468 to 1·480; 90 per cent. should distil below 170° C., and a depth of not less than 100 mm. should be required to equal the Lovibond yellow glass No. 1. The polymerisation residue must not exceed 1 per cent. and must have a refractive index of not less than 1·50.

Third quality or No. 3 turpentine should have a specific gravity at 20° C. of from 0·865 to 0·889; a refractive index at 20° C. of from 1·468 to 1·485; 60 per cent. should distil below 170° C., and a depth of not less than 50 mm. should be required to equal the Lovibond yellow glass No. 1. The polymerisation residue must not exceed 1 per cent. and must have a refractive index of not less than 1·500.

The following are the tests for adulteration:—

"Straight" wood turpentines are readily distinguished from gum turpentines by their odour, or when they have been very carefully refined, by the odour of the first fraction, or of the residue from fractional distillation. One or both of these portions have the peculiar "sawmill smell," and the residue has a camphoric and somewhat nauseating odour characteristic of wood turpentine, which is quite different from the mild, sweet fragrance of gum turpentine.

Destructively distilled wood turpentine and also rosin spirits are more readily distinguished from gum spirits by their odour than is wood turpentine prepared by steam distillation, and they also give distinguishing colour reactions when mixed with sulphurous acid as suggested by Herzfeld or with hydrochloric acid (the presence of tin or zinc is not necessary) as suggested by Grimaldi. When steam-distilled wood turpentine has been carefully refined so that 90 to 95 per cent. of it distils at from 155° to 170° C., both of these colour tests are practically useless.

Turpentine adulterated with more than 10 to 20 per cent. of coal-tar oils, or of gasoline or kerosene which have not been deodourised, may usually be readily detected by the characteristic odour of the mixture. The odour of rosin spirits, while quite distinctive, is difficult to detect in mixtures with turpentine. The presence of petroleum oils is also indicated by bubbles or "beads" persisting for a few moments on the surface of the turpentine shaken in a partly filled bottle.

The presence of more than about 10 per cent. of kerosene or similar mineral oils is readily detected by the spot which a few drops of the sample placed on white paper leaves on drying. Gasoline and other light mineral oils do not leave this spot.

It is possible so to adulterate turpentine that neither the specific gravity, refractive index, or flash point is materially altered. Such careful adulteration is rare, but as adulterants cannot invariably be detected by making these determinations, and further, as mineral oil is the most probable adulterant, it is more rational at once to polymerise the suspected sample, note the volume, colour and consistency of the unpolymerised residue, and determine its refractive index.

If rosin spirits is present in notable quantities, it may be detected by the amount of residue on polymerisation in conjunction with lowered initial boiling point and the deep colouration produced by mixing portions of the original turpentine of the first fraction with sulphurous acid and with hydrochloric acid.

If the initial distilling temperature of the turpentine is less than 154° C. and the original sample gives a reddish colour with sulphurous acid and a greenish red with hydrochloric acid, and the residue from polymerisation is less than 5 per cent., it is probable that the sample is adulterated with rosin spirits. An odour of rosin spirits in the sample, or in any fraction, would be confirmatory, and all tests should be repeated on the first fraction obtained with a fractionating column. At best the detection of small amounts of rosin spirits is very difficult, and the procedure outlined may often fail to detect its presence.

The presence of marked quantities of coal-tar oils, benzol, toluol, and xylol is detected by the odour, the lower initial distilling temperature, *i.e.*, between 80° and 155° C., and by further examination of the first fractions which distil below 155° C. The rise of temperature on shaking during polymerisation is also indicative of the nature of the sample. Coal-tar and petroleum oils do not raise the temperature more than 35° or 40° C., when mixed with sulphuric acid. When the temperature of turpentine mixed with 38 normal sulphuric acid does not rise above 50° or 60° C., mineral oil, coal-tar oil, or some other oil than turpentine is present in large quantities. The older the sample of turpentine, the greater, or at least the more rapid, the rise of the temperature of the mixture.

Non-volatile oils are easily detected by a distillation test.

Patents.

Wood: Apparatus for extracting products from ——. The Southern Manufacturing Co. Fr. Pat. 422,833, Nov. 21, 1910.

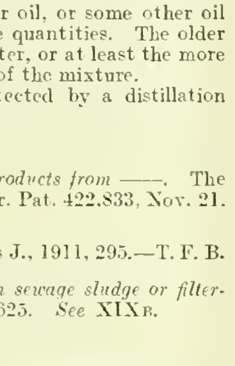
See U.S. Pat. 982,631 of 1911; this J., 1911, 295.—T. F. B.

Lamp black or vegetable black from sewage sludge or filter-pressed cake. Eng. Pat. 9625. *See* XIXB.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Raw rubber; Proposed uniform method of carrying out comparative tests for the valuation of——. F. Frank. Gummi-Zeit., 1911, 25, 990—992.

The proposals described were made to the German section of the International Rubber Testing Committee, and comprise viscosity determinations of solutions of the raw rubber, and vulcanisation tests. The apparatus described for the determination of viscosity consists of a pear-shaped glass vessel, A, with side tubulure, B (fitted with a ground-in stopper), and provided with an aluminium valve-rod, D, sliding through guides, and ground to fit the lower opening of the glass vessel, which ends in a metal tube, E, forming the outlet. The pear-shaped solution-holder, A, fits, by means of a ground-glass joint, G, into the top of the graduated receiver, H. The escape of air from this vessel while the solution is flowing into it is provided for by means of holes in the ground-glass joint at I. In carrying out the test, 200 to 500 grms. of the raw rubber are cut up, softened in hot water for 30 minutes, washed as rapidly, and with as little working as possible on the rollers, run into a sheet "as thin as paper," and dried in a dark room without artificial heat. The washing process should not occupy more than 20 minutes. Any variations in detail from the standard method must be carefully noted. The solution recommended is a 3 per cent. solution in commercial xylol of sp. gr. 0·867—0·869 at 15° C., 90 per cent. distilling between 135° and 140° C. The sample, consisting of 9—15 grms. of dry rubber, is cut up fine, allowed to soak in about 100 c.c. of xylol for a short time, then stirred and the final weight made up by the addition of more xylol, after which the solution is agitated at intervals until homogeneous. This should not take more than 30 hours in all. For the preparation of the solution a dark-glass jar of about 1 litre capacity, fitted with a metal screw-cap through which a stirrer passes, or simply a brown-glass litre bottle, with glass stopper, may be used. The solution vessel should in either case be tared before use. Measurements are carried out at 20° C. The pear-shaped vessel is filled to the 200 c.c. mark, the valve-rod lifted, and the time taken for the solution to fill the receiver up to the 100 c.c. mark—(in a footnote 200 c.c. is recommended)—is accurately noted. A second determination should be carried out after the solution has stood in a dark place for 8 to 10 days. It is suggested that glycerin of sp. gr. 1·25 should be used to standardise the apparatus. For the vulcanisation tests the remainder of the rubber sample is mixed with 8 or 10 per cent. of sulphur and vulcanised, in the form of a sheet, 5 mm. thick, either always in a press or always in a vulcanising pan, for either 1 hour at 4 atmospheres or 1 hour at 3 atmospheres. The vulcanised sheet is tested chemically for combined sulphur—difference between total and acetone-soluble sulphur—and mechanically, in the form of rings of 5 × 4 mm. section, punched or cut out from the sheet. The Schopper-Dalén apparatus is recommended for the mechanical tests by the members of the German section, but it is not desired to enforce the use of this apparatus.—E. W. L.



Rubber: The nitrosites of —— and their application in analysis. P. Alexander. Z. angew. Chem., 1911, 24, 680—687. (See also this J., 1907, 422, 538.)

The author claims that the researches of Gottlob (see this J., 1908, 81) working under Harries, have not invalidated his conclusions. (1) Gottlob has not demonstrated that Harries' nitrosite "C" is a definite compound, $(C_{10}H_{15}O_7N_3)_2$. (2) Under the conditions of experiment laid down by Alexander carbon dioxide is again shown to result. By heating the nitrosite, up to 86·7 per cent. of the theoretical amount of carbon dioxide can be obtained. This explains the loss in weight observed by Korneck (see this J., 1910, 1321) on heating to 80° C. Alexander considers that a compound, $C_9H_{12}O_6N_2$, thus results. (3) The reaction is applicable for quantitative work, but the factor for nitrosite: rubber obtained by Harries and his scholars can only be regarded as empirical. The process can no longer be fully recommended for determination of rubber in vulcanised rubber, but it yields good results for the coefficient of vulcanisation. Hinrichsen has stated that difficulties arise when the mineral fillers contain sulphur. The author claims on the contrary that the advantage of the method lies in the ease with which the nitrosite can be separated from the mineral fillers by solution in acetone and filtration.—H. E. P.

Vulcanisation; Theory of cold ——. B. Bysow. Z. Chem. Ind. Kolloide, 1911, 8, 209.

The previous work of the author (see this J., 1910, 770) has been criticised by Hinrichsen and by Potts, who suggested that the results might be affected by the moisture present, in that insoluble sulphur might be formed and then adsorbed by the rubber. Experiments are described which show that when moisture is present, whether in the rubber or in the benzene, less combined sulphur is found in the rubber after extraction with acetone.—H. E. P.

Gum-chicle and its sources. O. Sperber. Tropenpflanzer, 1911, 15, 220—223.

The species *Achras Sapota* which yields the latex from which chicle is prepared, is indigenous to Mexico and Central America, the largest quantities of the gum being produced in the Southern States of Mexico, Yucatan, Chiapas, Campeche, Vera Cruz and Oaxaca. The tree grows to a height of from 40 to 50 feet, with a stem 35 to 40 inches in diameter, and will yield in a year 30 to 35 lb. of chicle. The wood of the tree is dark-red, and may easily be mistaken for mahogany. Tapping is practised throughout the year with the exception of the rainy season (3 or 4 months), the natives using a machete to make V-cuts through the bark but not into the bast. The latex rapidly darkens and thickens when exposed to the air, and in this condition is heated in a vessel until a compact mass is formed. A good worker can produce 5 to 6 quintals of 45 kilos. of chicle per month. For this he is paid 14 to 15 pesos (28s. to 30s.). The selling price varies from 50 to 55 pesos (100s. to 110s.) per quintal. In order to avoid the high tariff of (about) 4d. per lb. into the United States, the greater part of the chicle produced is exported to Canada, where it is further dried (losing 50 per cent.), and thence into the United States for the manufacture of chewing gum. In 1909 the imports into the U.S.A. amounted to 5,450,139 lb., in value over £417,000, and the amount is continually increasing. The manufacture of chewing gum consists simply in grinding the chicle and heating it with more or less pleasant smelling and tasting substances such as vanilla, orange essence, etc., pressing it into moulds, and drying. Experiments in planting the tree have been made; 400 trees to the acre are planted, and it is generally assumed that an 8 to 10 year old tree, with a diameter of 12 to 15 inches, will yield from 5 to 6 lb. of chicle per annum. The tree requires good, deep, calcareous, loamy soil, and a rainfall of about 90 inches.—E. W. L.

Patents.

Synthetic india-rubber or rubber-like material; Production of ——. G. Lilley, London. Eng. Pat. 29,277, Dec. 14, 1909.

The synthetic india-rubber, or rubber-like body, is produced by heating "mesoprene," prepared as described below, either alone, as by floating it on water heated to 100° C., or in presence of sulphuric acid or its decomposition products, or hydrochloric acid, or sulphur dioxide which may be passed through the dry heated mesoprene. "Mesoprene" is the name given to a product obtained by heating the "basic principle of india-rubber" or a body containing the same, at a temperature below 200° C. under pressure, either alone or in presence of some added substance or substances, such as (1) mesoprene, (2) alcohol, or other rubber precipitant, (3) a liquid hydrocarbon mixture, obtained as a by-product in the production of mesoprene, (4) an acid. The "basic principle" may be treated with air or oxygen before subjecting it to the action of heat. Any unconverted substance is removed by distillation, the residue in the still constituting mesoprene, which is freed from water by drying *in vacuo* at 100° C. The distillate, or a portion of it, constitutes the liquid hydrocarbon mixture referred to under (3) above. The "basic principle of india-rubber" is obtained by subjecting the vapour of turpentine or a selected fraction or fractions of the distillate from the crude turpentine exudation to a temperature of about 500°—600° C., condensing the products and separating the more volatile constituents by fractionation, preferably selecting the portions distilling below 90° C., in which isoprene and other hydrocarbons suitable for the purpose of the invention are present.
—E. W. L.

Caoutchouc; Manufacture of —— *and an intermediate product* [*isoprene*]. F. E. Matthews and E. H. Strange, London. Eng. Pat. 29,566, Dec. 17, 1909.

Isoprene is produced by the condensation of acetone with ethylene (or a mixture of acetylene and hydrogen), for example by passing a mixture of the substances through a heated tube, with or without the aid of a catalyst. In this process the acetone may be replaced by a di-halogen derivative of propane, preferably β-dichloropropane. The isoprene may be polymerised to caoutchouc in any known or suitable way.—E. W. L.

Drying and like machines [*for rubber*]. T. Cockerill, Colombo, Ceylon. Eng. Pat. 5855, March 9, 1910.

The sheet of rubber, newly deposited from the latex, is passed between two travelling belts and is dried by passing the belts and rubber round a series of heated cylinders.
—W. H. C.

Rubber; Apparatus for drying and smoking ——. G. W. Sutton, Stevenage, Herts. Eng. Pat. 6934, March 19, 1910.

The rubber is supported on racks in a closed chamber, provided with doors, windows, and ventilators at the top. The chamber has an open lath floor, below which run the ducts for conveying cold or warm air or smoke into the chamber. The ducts are provided on their under sides with nozzles, pointing downwards on to inverted V-shaped ridges, which act as spreaders. Air or smoke is blown in through the ducts by means of a fan. The air may be heated by previous circulation in a chamber containing steam pipes supplied with steam from a boiler. The furnace of the boiler may be used as the source of smoke, green wood or palm leaves being employed as fuel. The supply of air or smoke is regulated by means of valves.—E. W. L.

Rubber; Process of manufacturing cellular ——. H. Dogny and V. Henri. Fr. Pat. 422,118, Jan. 11, 1910.

Sheets of unvulcanised rubber, some or the whole of which are perforated, are glued together, and the mass surrounded by an envelope of semi-vulcanised rubber impervious to air or gas. Such air or gas is now forced into the mass—*e.g.*, through a metallic tube (which has been glued between the sheets of rubber), after which the tube is withdrawn and the opening closed to prevent the escape of the air. The mass may then be moulded and vulcanised, without fear of distorting any portion of it. The same end may be obtained by placing in each pocket between the rubber sheets a capsule of supple material (*e.g.*, a mixture of glycerin and gelatin treated with formalin), so as to allow the gas to have access to each pocket.
—C. A. M.

Rubber, guttapercha, balata, and analogous substances; Apparatus for removing foreign matter from ——. The Crude Rubber Washing Co., Ltd., and M. M. Dessau. Fr. Pat. 422,342, Nov. 9, 1910. Under Int. Conv., May 31, 1910.

See Eng. Pat. 13,201 of 1910; this J., 1911, 499.—T. F. B.

Rubber, guttapercha, balata, and analogous substances; Apparatus for removing foreign matter from ——. The Crude Rubber Washing Co., Ltd., and M. M. Dessau. Fr. Pat. 422,402, Nov. 11, 1910. Under Int. Conv., June 2, 1910.

See Eng. Pat. 13,425 of 1910; this J., 1911, 499.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Tannins. IV. Galloylellagic acid. M. Nierenstein. Ber., 1911, **44**, 837—840.

The following tannin derivatives precipitate gelatin: the methyl ester of gallic acid, digallic acid, luteic acid in pyridine, ellagitannic acid (this J., 1910, 708), and tetragalloylellagic acid. The latter substance has been prepared by treating ellagic acid in alkaline solution with tricarbomethoxygalloyl chloride, and warming the product with pyridine. It has the composition $C_{42}H_{22}O_{24}$, and crystallises from water and pyridine in yellowish needles, decomposing at 297°–300° C. When warmed with dilute sulphuric acid it yields ellagic acid. On acetylation it yielded a mixture of substances, from which triacetylgallic acid was isolated.—F. Shdn.

Colloids; Simultaneous coagulation of two ——. F. W. Tiebackx. Z. Chem. Ind. Kolloide, 1911, **8**, 198—201.

If acid be added to aqueous solutions containing gelatin and gum arabic, simultaneous coagulation of both the colloids occurs within certain limits of acid concentration. For instance, with 2 c.c. of a 0·5 per cent. solution of gelatin and 2 c.c. of a 2 per cent. solution of gum, coagulation is produced by 2 c.c. of $N/40$ hydrochloric acid, whilst with 2 c.c. of either $N/25$ or $N/125$ acid the solution after becoming turbid clears again. For a given acid the concentration at which coagulation begins and that at which the solution again becomes clear on addition of more acid both depend mainly upon the quantity of gum present, the concentration of gelatin apparently having little influence. The strongest coagulation is obtained when about equal quantities of gum and gelatin are present: for example, both colloids are almost completely coagulated on adding 50 c.c. of 6 per cent. acetic acid to a mixture of 400 c.c. of a 0·4 per cent. solution of gelatin and 100 c.c. of a 2 per cent. solution of gum. The coagulum consists of an adsorption compound of acid, gelatin, and gum; under the microscope the gelatin appears to be enclosed by the gum, and it is the latter by which the acid is chiefly adsorbed. On washing the coagulum thoroughly or on drying at 110° C., the acid is removed. The acid may be replaced by salts, especially by carbonates, tartrates, citrates, phosphates, and, acetates, less readily by sulphates, chlorides, bromides and iodides; the order of activity of the cations in this respect is $Na > K > NH_4 > Mg > Zn$. The coagulum gives the usual reactions for both gum and gelatin. It "swells" in solutions of potassium hydroxide and of salts and in excess of acid. The order of efficiency of salts (at 1, 0·5, and 0·25 grm.-mol. concentration) in producing "swelling" is:—anions: $I > Br > Cl > SO_4 > CO_3$; cations: $K > Na$, alkalis > alkaline earths > $Zn > Mg$. In strong saline solutions and in solutions of $\frac{1}{8}$ grm-mol. concentration or less, the "swollen" transparent coagulum becomes opaque again.—A. S.

PATENT.

Elastic masses; Process for producing —— from agglutinants, such as gelatin, and solvents. W. Plinatus. Fr. Pat. 422,419, Aug. 22, 1910. Under Int. Conv., Sept. 6, 1909.

SEE Eng. Pat. 9609 of 1910; this J., 1910, 1322.—T. F. B.

XVI.—SOILS; FERTILISERS.

Rothamsted Experiment Station; Annual Report for 1910. A. D. Hall. Harpenden, 1911.

THE experimental plots have shown the following results: *Broadbalk Field*, sown with wheat, suffered during the winter and after June (1910). The yield was extremely low, 7·5 bushels per acre on the unmanured plots and only 28 bushels on the dunged portion. The proportion of offal corn was exceptionally high, and the straw about the average. *Half Acre Plot*, with wheat without manure (fallowed alternate years), produced about 9 bushels per acre, little more than on the Broadbalk (unmanured), owing probably to the wet winter. *Hoos Field*, with barley, showed a yield much below the average, with a high proportion of offal grain and a low weight per bushel. Superphosphate showed an exceptional increase, phosphoric acid having its main effect in wet and cold seasons. The two wet seasons have made the barley plots very weedy. *Park Grass Plots* gave much smaller crops than usual, and the proportion of leguminous herbage was very small. *Mangold Field*, sown April 15th to 18th, gave a good plant on all the plots except on those receiving sodium nitrate and ammonium sulphate, which were re-sown May 31st. The weather favoured these second sowings, and they were not behind the rest at harvest. The yield was higher than usual, though not so good as in 1909 and 1907. The usual attack of *Uromyces betæ* on the high nitrogen plots was very marked. *Adgell Field* (clover and bare fallow) gave a poor first crop on June 21st with an exceptional aftergrowth, the total of the two crops being higher than ever before. *Little Hoos Field*, with wheat, gave an even plant but a very small yield, which naturally indicated no appreciable differences between the manurial residues from previous years. In this field the trials of the new nitrogenous fertilisers were repeated, but the yields were all too low to give the results any importance. Calcium nitrate and cyanamide gave poor results, sodium nitrate being the most effective source of nitrogen. On the same field plots of mustard, vetches, crimson clover, and rape have been grown and ploughed in, to ascertain which would have the best effect in preparing the ground for a subsequent straw crop. Vetches gave an exceptional crop, and the leguminous crops had a markedly superior effect on the yields of both wheat grain and straw. The wheat following the green manuring was remarkably free from the blight which was elsewhere prevalent. In the laboratory pot experiments have been continued, comparing the continual growth of certain plants with the same plants in rotation. The method of experiment does not, however, promise to answer definitely the question as to what is the effect of a plant upon the soil in which it grows, whereby it makes the soil less fitted to support a second growth of the same plant.—W. H. P.

Sulphur requirements of farm crops in relation to the soil and air supply. E. B. Hart and W. H. Peterson. J. Amer. Chem. Soc., 1911, **33**, 549—564.

THE authors have found that average crops of cereal grains and straws remove about two-thirds as much sulphur trioxide as phosphorus pentoxide from the soil; the grasses of mixed meadow hay remove about equal quantities of these ingredients; while the amount of sulphur trioxide removed by members of the *Cruciferæ* (as the cabbage and turnip) is twice or three times that of the phosphorus pentoxide extracted. Normal soils were found to contain from 0·033 to 0·140 per cent. of sulphur trioxide, the total quantity present in an acre-foot being from 1000 to 3000 lb.—an amount equivalent to that of the phosphorus pentoxide present. In soils which had been cropped for 50—60 years, practically without manuring, an average loss of 40 per cent. of the original sulphur content was indicated; but in soils to which farm manure had been regularly and liberally applied the sulphur content was well maintained. The amount of sulphur trioxide annually supplied to the soil by rain water being from 15 to 20 lb. per acre (according to observations made at Madison, Wis., U.S.A.), and the annual loss of this constituent by drainage being about 50 lb. per acre (as computed from data obtained at Rothamsted, England), it would appear that the atmosphere cannot serve as a complete compensating factor for loss of sulphur trioxide by cropping and drainage combined. The authors therefore conclude that in all systems of fertilisation for the production of farm crops, provision should be made for the renewal of the sulphur trioxide, as well as of the more usually recognised constituents of the soil. —W. E. F. P.

Soils; Analyses of characteristic North-west (U.S.A.) timber ——. J. S. Jones. J. Ind. Eng. Chem., 1911, **3**, 246—247.

As a class, pine forest soils are usually regarded as being poor in the essential elements of plant nutrition; but the examination of several districts embraced in the timber belt of north Idaho has shown that the soils of this area are well supplied with all the necessary elements and are, moreover, exceptionally rich in phosphoric acid. Although these soils contain substantial amounts of calcium, they generally have a slightly acid reaction, but may be brought into a good state of cultivation by the application of finely-crushed limestone.—W. E. F. P.

Phosphoric acid soluble in citric acid; Volumetric determination of ——. L. Wuyts. Ann. Chim. analyt., 1911, **16**, 134—137.

THE process described by De Molinari (this J., 1903, 166) may be applied to the determination of that portion of the phosphoric acid in phosphatic materials which is soluble in citric acid solution, provided that, in the case of samples containing sulphur compounds, the hydrogen sulphide be expelled by treatment with hydrochloric acid. Ten c.c. of the solution (obtained in the usual way by treating 5 grms. of the sample with 500 c.c. of a 2 per cent. citric acid solution) are mixed with a few drops of hydrochloric acid and evaporated to dryness; erroneous results are obtained if the mixture be only boiled until hydrogen sulphide ceases to be evolved. The residue is then taken up with nitric acid and the determination carried out as described (*loc. cit.*).—W. P. S.

Manures for the sugar cane and their application. Van Deventer. *See* XVII.

Colourimetric method for the determination of phosphoric anhydride. Passerini. *See* XXIII.

Patent.

Fertiliser, and process of making same. S. Peacock Chicago, Ill., Assignor to American Cyanamid Co. New York. U.S. Pat. 988,894, April 4, 1911.

A fertiliser consisting of a mixture of calcium phosphate and calcium cyanamide and either substantially free from lime or containing lime, may be obtained by treating commercial calcium cyanamide with phosphoric acid in sufficient quantity to convert the whole (or at least half) of the free lime into calcium phosphate, the temperature being meanwhile kept below a point at which any substantial quantity of ammonia would be expelled.—C. A. M.

XVII.—SUGARS; STARCHES; GUMS.

Sugar cane; Manures for the —— and their application. W. van Deventer. Paper read before the 9th Congress of the Algemeen Syndicaat van Suikerfabrikanten in Nederl.-Ind., held at Soerabaia, Java, in March, 1911.

As the result of field trials in Java with different varieties of cane, the author comes to the following general conclusions respecting the value of various manures: Ammonium sulphate has hitherto proved the most suitable manure for cane. The amount to be used is dependent on the soil and on the variety of cane; while the time at which it should be applied also depends upon the soil and variety of cane. Its method of application is not of primary importance, provided it be not mixed with alkaline substances. Chili saltpetre is inferior to ammonium sulphate, except in dry seasons, when it appears to be superior. Earth nut cake has a lower nitrogen value than ammonium sulphate, and is not an economical manure. Peruvian guano, because of its high cost, and low nitrogen value, is likewise unprofitable, so far as Java is concerned. Double superphosphate is the most economical phosphoric acid manure for Java, and should be applied early. Potassium sulphate has been shown to be unsatisfactory on both heavy and light soils, even in admixture with a sufficiency of nitrogen. Boiler ash and defecation scum have both been found of value as sources of phosphoric acid; while molasses has given good results, though its action is not fully understood (see also this J., 1910, 1467).—J. P. O.

Sugar beet; Nitrogenous constituents of the —— and their behaviour during the process of raw sugar manufacture. J. E. Duschsky, I. R. Minz, and W. P. Pawlenko. Z. Ver. deut. Zuckerind., 1911, 341—361.

In amplification of their previous work in this direction (this J., 1911, 145), the authors during the 1910—1911 campaign carried out investigations in three different Russian factories, each of which operated defecation in a different manner. By the following table, summarising the results (expressed in percentages of the total nitrogen) of their experiments, it is shown that there is a gradual elimination of the protein, the ammonia, and the amide nitrogen, with a corresponding increase of the "objectionable nitrogen" (*cf.* this J., 1911, 101), so that finally the entire nitrogen is present in this melassigenic form:—

	Protein nitrogen.	Ammonia and amide nitrogen	"Objectionable nitrogen."
Beet	58·8	5·8	35·4
Diffusion juice ...	23·8	10·7	65·5
First saturation juice	4·6	12·4	83·0
Third saturation juice	1·7	7·3	91·0
Thick-juice	1·6	1·1	97·3

Since the ordinary defecation and saturation process is capable of yielding juices that are free, or practically free, from protein nitrogen, it is useless to employ purifying agents with the object of eliminating this form of impurity.—J. P. O.

Cane juices; Laboratory experiments on the double liming of ——. J. J. Hazewinkel. Archief Suikerind. Nederl.-Ind. (Java), 1911, 19, 166—174.

In double liming, tempering is effected in two separate operations. For the first, enough lime is added to make the juice slightly acid to litmus, heat being afterwards applied until a compact, thick layer of scum rises to the surface, leaving a liquor below, which is considerably clearer and lighter in colour than the original juice. In the second operation, the scum is separated, and the clear juice treated with lime to alkalinity, heated, and finally allowed to settle in the usual way. On investigating this proposed method of working, the author found from laboratory experiments that the thick-juices thus obtained were always lighter in colour and more brilliant than those resulting from ordinary direct tempering. With abnormal juices, however, the new process is not to be recommended, since then a large amount of lime is necessary to effect a sufficient clarification. It is proposed to experiment with double liming on the technical scale, and in so doing to use round tanks provided with an outlet at the bottom to facilitate the separation of the scum in the first tempering operation.—J. P. O.

Reducing sugars; Determination of —— in cane sugars for the refinery or direct consumption. C. Muller. Bull. Assoc. Chim. Sucr. Dist., 1911, 28, 640—641.

When determining less than 0·5 per cent. of reducing sugar volumetrically, the process may be rendered more sensitive by adding a known amount of invert sugar, account of which is taken in calculating the result. Twice the normal sugar-weight of the sample under examination is washed into a 100 c.c. flask, dissolved, defecated with 2 c.c. of normal lead acetate solution, and cooled. Twenty c.c. of a solution containing 5 grms. of invert sugar per litre are next added, the liquid mixed, neutralised, made up to the mark, and filtered. The filtrate is titrated in the usual way, against 5 c.c. of Fehling's solution, for cane sugars polarising 98° to 99° V. Finally the percentage of reducing sugar in the sample is calculated from the following formula:

$$\frac{\dfrac{n \times 0{\cdot}005 \times 100}{N} - 0{\cdot}100 \times 100}{2\,PN}$$

in which P is the normal sugar weight; n, the number of c.c. of Fehling's solution used; and N the number of c.c. read on the burette. Results obtained in this way are stated to agree well with those obtained by the gravimetric process.—J. P. O.

Cane molasses; Determination of sucrose in ——: Use of hydrochloric acid and urea for the direct polarisation. H. Pellet. Int. Sugar J., 1911, 13, 206—207.

In reference to a recent article on the analysis of beet molasses by J. P. Ogilvie (this J., 1911, 62—64), it is pointed out that although the hydrochloric acid direct polarisation is the same as the sulphurous acid direct polarisation in the case of beet products, this does not hold good for cane molasses, owing to the difference in the nature of the impurities. In cane molasses there may be present from 10 to 30 per cent. of reducing sugar, and the effect of the sulphurous acid in increasing the lævo-rotation of this is not the same as that of hydrochloric acid. It is emphasised that Andrlik's hydrochloric acid and urea solution is indispensable for effecting the correct estimation of sucrose in cane molasses, since if it be not used, and the direct polarisation be taken in a solution made alkaline with basic lead acetate, the polarisation after inversion is not due solely to hydrolysed sucrose, a plus error being caused by the action of the hydrochloric acid used for inversion on the reducing sugar (especially on the lævulose), already present in the sample. This may be proved by making a 2·5 per cent. solution of reducing sugar, containing lævulose and dextrose in the proportions of 35 and 65 per cent. respectively. This liquid on polarisation will be found to be slightly dextro-rotatory, but on adding Andrlik's solution the plus polarisation will be diminished to zero, or may even become lævo-rotatory, depending on the amount of hydrochloric acid present. An extreme case is given of a fodder beet juice containing 2·44 per cent. of reducing sugar, but no sucrose. On defecation with basic lead acetate a direct reading of + 0·5° V. was obtained, but after heating with hydrochloric acid under the conditions of the Clerget determination the reading became zero. Here the direct reading represented the excess of the rotation of the dextro-rotatory reducing sugar over the rotation of the lævo-rotatory reducing sugar. On treatment with hydrochloric acid the dextro-rotation had disappeared, and the rotation became zero, although no sucrose had been present.—J. P. O.

Pauly pre-evaporator ; The question of decomposition [*of sucrose*] *in the* ——. J. J. Hazewinkel. Archief Suikerind. Nederl.-Ind. (Java), 1911, **19**, 65—72.

IT has been thought that, owing to the high temperature used, some decomposition of sucrose may take place in the Pauly juice-heater. In order to decide this point, the author has carried out a large number of experiments, using an apparatus of the following dimensions: total heating area, 150 sq. m. (1614 sq. ft.); total height, 4·7 m. (15·4 ft.); total number of tubes, 652; height of the calandria, 2·6 m. (8·5 ft.); and diam. of the calandria, 2 m. (6·2 ft.). Other data were: steam pressure 1·2 to 1·4 of an atmosphere; and maximum pressure of the vapour from the juice, 0·55 atmosphere, while the tube plates were of bronze and the tubes of brass. In each of the tests made, samples of the juice entering and leaving the heater were taken every 15 minutes, and determinations made of the Brix (refractometrically), the polarisation, the Clerget value, and the glucose factor, the samples taken on leaving the apparatus being reduced before analysis to the same density as those entering. As a result it was found that in each case there was no appreciable difference in either the polarisation, the Clerget value, or the glucose factor, the variations being —0·03, + 0·01, and —0·03 respectively. In conclusion it is stated that "it may therefore be accepted that in the Pauly, with a pressure of 1·2 to 1·4 of an atmosphere, there is no appreciable decomposition, either in the form of inversion, or from destruction of glucose."—J. P. O.

White sugars ; Iron content of ——. D. R. Holm. Archief Suikerind. Nederl.-Ind. (Java), 1911, **19**, 14—20.

PREVIOUSLY, the author has shown that the degree of contamination of a sugar with iron is considerably influenced by the degree of acidity of the massecuite and by the presence of reducing substances in the massecuite. With Javan sugars resulting from acid working it was found that the iron content was much less than with sugars obtained by the neutral method of working, from which it follows that sulphitation of the thick-juice to a large extent prevents the crystallising out of the iron with the sugar. In explanation of this, it is pointed out that the primary rôle of the sulphurous acid is to decompose the complex compounds of iron and sucrose, and that the reducing action of this acid plays a secondary part. Experiments demonstrating that this is so, and that acids having no reducing action are capable of preventing the contamination of the sugar with iron, are described. Iron, however, is not always the cause of the grey colour of sugars. It is pointed out that, in the case of white Javan sugars destined for the Indian market, the colour may be due to mechanical impurities coming from the sides of the juice-tanks, of the pans, of the worms, or of the massecuite pipes.—J. P. O.

Dextrose ; Decomposition of —— *by light.* P. Mayer. Biochem. Zeits., 1911, **32**, 1—9.

NEUBERG has shown that certain organic substances are rendered susceptible to the action of light by the presence of various metallic salts (this J., 1908, 1043; 1910, 1035). The author describes experiments on the influence of light on solutions of dextrose (1—5 per cent. concentration) made slightly alkaline with sodium carbonate (0·01—0·10 per cent. concentration). The solutions, contained in stoppered quartz or glass flasks, were placed in a dark room and exposed to the rays from a Heraeus quartz lamp; various control experiments were also made. The experiments show that with concentrations of sodium carbonate which do not affect, or only slightly affect, the rotatory power of the solution when the latter is merely kept at a temperature of 37° C., exposure to light causes a very marked decrease of rotation in the course of two hours. Exposure to light also accelerates the decomposition of dextrose in a solution rendered alkaline with sodium hydroxide. If no alkali is added to the dextrose solution, the latter is not affected by exposure to light. Various workers have observed that the formation of acids is the chief feature of the action of alkali on sugars (cp. Nef, this J., 1910, 1264). The decomposition effected by the action of light on a solution of dextrose rendered slightly alkaline with sodium carbonate follows a different course, aldehydes, glucosone, and only traces of volatile acids (formic and butyric acids) being formed.—L. E.

Honey ; Biological analysis of ——. [*Determination of enzymes*]. E. Moreau. Ann. Falsif., 1911, 4, 145—148.

THE author measures the quantity of invertase and amylase in honey by determining the amounts of invert sugar produced by the enzymes as the result of the action of the latter on sucrose and starch, respectively. The enzymes are first separated from the honey by mixing 10 grms. of the sample with 2 or 3 c.c. of water and pouring the fluid into 100 c.c. of absolute alcohol; the mixture is then submitted to centrifugal action, the supernatant liquid is decanted, the precipitated enzymes (containing small quantities of proteins, dextrin, and sugars) are taken up with a certain quantity of water which has been boiled and cooled, and the solution is filtered. These operations are repeated on another quantity of 10 grms. of the sample, and the final solution obtained is boiled; this solution serves as a control. Both solutions are now neutralised by the addition of $N/10$ sodium hydroxide, methyl-orange being used as indicator, and then acidified by the addition of 1·5 c.c. of a 1 per cent. formic acid solution. Five c.c. of a 10 per cent. sucrose solution are now added to each solution, and the volumes are made up with sterile water to 100 c.c.; as a small quantity of reducing sugars derived from the honey is still present in the solutions, 5 c.c. of these are titrated with Fehling's solution. To prevent the action of bacteria, 5 drops of toluene are added to the solutions, and the latter are maintained at a temperature of 25°—30° C. for 4 days. The reducing sugars formed are then determined, and the difference between the results gives the amount of reducing sugar produced by the invertase; this quantity may be expressed in grms. per 100 grms. of the honey. Twenty-five samples of honey were examined as to their invertase-content, the results obtained varying from 1·05 to 12·02 grms. of reducing sugar per 100 grms. of honey. Amylase may be determined in a similar way, the sucrose solution being replaced by starch-paste and the mixtures being kept at a temperature of 45°—50° C. for 24 hours. Twelve samples of honey examined yielded from 0·60 to 3·68 per cent. of reducing sugars due to the action of amylase. Further experiments showed that the action of invertase is almost completely inhibited when the honey is heated to 80° C. for 1 hour, and that the enzyme is destroyed by heating to 100° C. Amylase is similarly affected by heat.—W. P. S.

Honey ; Analysis of ——. H. Witte. Z. Unters. Nahr. Genussm., 1911, 21, 305—374.

CONTINUING his investigation on the composition and methods of analysis of honey (see this J., 1910, 105), the author now gives the results of the analysis of 49 samples of pure honey, 25 samples of artificial honey, 12 samples of honey of doubtful purity, and 19 samples of adulterated honey; these results, together with the behaviour of the honeys towards certain qualitative tests, are recorded in the form of eight separate tables. The limits mentioned previously (*loc. cit.*) are slightly altered as regards some of the constituents of pure honeys. The quantity of water present should not exceed 20 per cent., whilst the acidity of native (German) honey usually lies between 0·06 and 1·2 per cent. The quantity of ash is generally from 0·1 to 0·35 per cent., but may sometimes be as little as 0·065 per cent. The sucrose should not exceed 6 per cent., a larger amount than this indicating that the honey is "unripe," that the bees have been fed on sucrose, or that the honey is adulterated; the author considers that "unripe" honey and that produced by sugar-feeding are not normal honeys. Sucrose may be inverted by means of honey at a suitable temperature, and it is not possible, by analysis to detect the presence of such inverted sugar. The nitrogenous substances vary in amount from 0·25 to 0·55 per cent.; artificial honey seldom contains more than 0·22 per cent. of nitrogenous substances. The catalase test and the *p*-phenylenediamine test proposed by Auzinger (this J., 1910, 291) do not yield very definite evidence as to the purity of honey, but the diastase test described by the same author is useful provided that the honey examined has not been strongly heated. Fiehe's reaction (this J., 1908, 1127), in conjunction with the diastase test, is of great value in ascertaining the purity of a sample of honey, but it must be remembered that artificial honey may sometimes give a negative reaction with the test and that genuine honey which has been heated for a long time will yield a positive reaction. Honey which has only been heated in the usual manner during its preparation occasionally yields faint colourations with the test, but these cannot be mistaken for the cherry-red colouration given by artificial honey. The author concludes by mentioning that all the data obtained during the analysis of a sample of honey ought to be considered in conjunction with each other before an opinion is expressed as to the character of the sample.—W. P. S.

Honey; Examination of —— especially with respect to its nitrogenous constituents. R. Lund. Mitt. Lebensmittelunters. u. Hyg., 1911, **1**, 38—58. Chem. Zentr., 1911, **1**, 1158—1159.

The author determined the nitrogenous constituents of numerous samples of natural and artificial honey, determinations being made of the total nitrogen by Kjeldahl's method, and of albumin-nitrogen, amide-nitrogen, and ammonia-nitrogen by the methods given in "*Schweizerisches Lebensmittelbuch.*" Artificial honeys usually contain little or no albumin-nitrogen; in both natural and artificial honeys the amount of ammonia-nitrogen is so small as to be negligible. For the determination of albumin, the author prefers a sulphuric acid solution of phosphotungstic acid to tannin as a precipitant (compare Witte, this J., 1910, 108). 20 c.c. of a filtered 10 per cent. solution of the honey are treated with 5 c.c. of the reagent (2 grms. of phosphotungstic acid dissolved in 20 grms. of sulphuric acid, 1 : 4, and 80 grms. of water) in a graduated tube, the mixture is diluted to 40 c.c. with water, carefully mixed, and allowed to stand for 24 hours, whereupon the volume of the precipitate is read; this varies between 0·6 and 2·7 c.c. for natural honeys and from 0 to 0·5 c.c. for artificial honeys. In the case of artificial honeys to which albuminous substances have been added, Bräutigam's differentiating reactions are useful (see Pharm. Zeit., 1902, **47**, 109).—A. S.

Honey; Use of Fiehe's reaction as a preliminary test for ——. W. Hartmann. Z. Unters. Nahr. Genussm., 1911, **21**, 374—375.

Instead of applying Fiehe's reagent (this J., 1908, 1127) to the ethereal extract of the honey, 2 c.c. of the reagent may be added directly to 1 grm. of the sample which has been spread at the bottom of a porcelain basin. Artificial honey (invert sugar) yields the characteristic pink colouration, whilst a negative result is obtained in the case of pure honey. Only the colouration which develops immediately should be taken into account, as the hydrochloric acid contained in the reagent inverts the sucrose of the honey after a time and causes the gradual development of a colouration.—W. P. S.

Honey; The volatile acids of ——. A. Heiduschka and G. Kaufmann. Z. Unters. Nahr. Genussm., 1911, **21**, 375—378.

Determinations of the amount of formic acid occurring in the volatile acids obtained from honey showed that this acid does not constitute the whole of the volatile acidity; in some cases, only about one-half of the volatile acidity consisted of formic acid. Two methods were employed in determining the formic acid, namely, the mercuric chloride process (this J., 1910, 1189) and the sulphuric acid process (measurement of the carbon monoxide produced); by the former method honey was found to contain from 0·0060 to 0·0100 per cent. of formic acid, and by the latter method from 0·0050 to 0·0072 per cent. Larger quantities of volatile acids were obtained after the honey had been saponified, showing that a portion of the acids, including formic acid, was present as esters. After saponification, the mercuric chloride process yielded from 0·0118 to 0·0229 per cent., and the sulphuric acid method from 0·0096 to 0·0208 per cent. of formic acid. In the case of one sample of honey the amount of formic acid found by the mercuric chloride method was slightly more than the total amount of volatile acid, but this was probably due to the presence of other reducing substances.—W. P. S.

Some properties of starch relating to its stiffening power. Harrison. *See* VI.

Patents.

Sugar juices; Rapid and continuous process for the defecation of —— combined with evaporation. J. B. P. Hénot. Fr. Pat. 422,114, Jan. 11, 1910.

The juice is treated with lime in suitable reservoirs and, after a preliminary heating if necessary, passed through an evaporator (heated by steam at 110°—120° C.) in which it circulates rapidly and from which it emerges defecated and somewhat concentrated. It is then ready to be decanted, filtered or otherwise treated, before going to the multiple-effect apparatus.—J. H. L.

Dextrin; Process and apparatus for the manufacture of ——. H. Wulkan, Budapest, Hungary. Eng. Pat. 7032, March 21, 1910.

The new process is continuous and produces dextrins containing the normal proportion of water, which products obtained by other methods acquire only after storage. About 5—6 per cent. of the starch is intimately mixed with the amount of acid (0·2—0·4 per cent.) necessary for the whole of the starch. The acid is used in as concentrated form as possible and the acidulated starch forms therefore a practically dry powder which can be mixed readily and completely with the remainder of the starch. When the mixture so obtained is charged into a heated vesssel containing dextrin in motion, it is dextrinised almost instantaneously and the finished product, having lost practically no moisture, can be withdrawn at the same rate as the acidified starch is supplied. Apparatus for carrying out the process is also claimed. The dextrinising vessel is heated by a steam jacket and contains stirring machinery. The finished product is withdrawn by a door at the bottom, whilst acidified starch mixture is fed continuously into the top from one or more mixing vessels (also provided with stirring machinery), passing on its way, through a pair of rolls which break up any small lumps.—J. H. L.

Glucose; Process of making a product resembling —— from cellulosic and ligneous materials. W. P. Cohoe. Fr. Pat. 420,959, Sept. 23, 1910.

See U.S. Pats. 985,725 and 985,726 of 1911; this J., 1911, **441**.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Dextrose and lævulose; Selective power of vegetable cells towards ——. L. Lindet. Comptes rend., 1911, **152**, 775—777.

When yeasts, previously cultivated in dextrose and lævulose solutions respectively are grown in a sugar solution (dextrose, lævulose or invert sugar), that previously grown in dextrose shows a more powerful fermenting power and reproductive activity than that previously grown in lævulose; that is to say in a given time it uses up more sugar and grows better. On the other hand when equal weights of yeast of similar origin are grown side by side in dextrose and lævulose, the total quantity of sugar which disappears is the same in each case, but somewhat more yeast—about 1·2 to 1—is formed in the lævulose solution. It is evident in the two instances that the yeasts use for reproduction a quantity of sugar proportional to the final weight and if in the case of lævulose there is more sugar utilised for growth, it results that with dextrose more sugar is utilised for respiration and the formation of alcohol and carbon dioxide. In fact the yeast uses up dextrose more readily than lævulose and in contact with dextrose it has a greater zymatic activity. This series of experiments would indicate that in the same time dextrose furnishes less yeast than lævulose. It has been controlled by a third series in which yeast was grown under comparable conditions in either dextrose or lævulose or in mixtures of the two in unequal quantities. As in the first series the amount of yeast was less as the proportion of dextrose was smaller. To explain the apparent contradiction it is suggested that with yeast grown in dextrose the zymatic function predominates so much over the reproductive function that the yeast is not allowed time to grow; the available sugar is utilised so quickly that not enough remains to elaborate the cells which the yeast is capable of forming. The predominance of one of these functions over the other is less marked in the case of lævulose and the yeast has time to grow. This applies to the second series, when, as in the first and third experiments, unlimited sugar is present, the yeast grown in dextrose has the greater functional activity. Yeast which is able to vegetate in both sugars grows more readily in lævulose, but ferments more readily in dextrose solution. Barley embryos in Raulin's solution (see Pharm. J., 1899, July 22, 162) containing invert sugar consume dextrose preferentially in the proportion of 1·7 to 1. There is a greater development of stalk and root in lævulose solution than in dextrose, owing again to the fact that the former is fermented less rapidly and therefore more is available for growth. Precisely similar results are obtained with *Aspergillus niger* and *Penicillium glaucum* which for the same weight of sugar consumed show greater growth in lævulose than in dextrose.
—E. F. A.

Wine; Chemistry and analysis of ——. C. von der Heide and W. J. Baragiola. Landw. Jahrb. 1910; Woch. Brau., 1911, **28**, 166—167.

The paper is a record of a very comprehensive investigation of wine, and contains also a critique of the present analytical methods. An attempt has been made to balance the individual constituents against the extract, ash-content, etc., and various alterations in the usual methods of analysis are suggested in consequence. It is recommended that the extract should in all cases be determined indirectly, for by the direct method there occur losses, not only of volatile acids but probably of some lactic acid, and according to Bischkopf, of glycerol. The usual differentiation of acids in wine is wrong and untenable, and the authors advance new principles for the determination of free, partially saturated and completely saturated acids. Experiments on the viscosity of wines confirm results obtained by other workers, and show that this property cannot be used for the determination of alcohol-content, but its measurement is of practical value in judging viscous wines. The trustworthiness of the usual analytical methods was tested by applying them to a natural wine and also to an artificial mixture prepared in accordance with the results of a complete analysis of the same wine. Neither by chemical nor physical analytical methods was it possible to distinguish satisfactorily between the natural and the artificial product.—J. H. L.

Amino-acids; Transformation of —— into hydroxy-acids by mould-fungi. F. Ehrlich and K. A. Jacobsen. Ber., 1911, **44**, 888—897.

It has already been shown (see this J., 1905, 683; 1907, 480; 1909, 848; 1910, 835) that when yeast is grown in media containing fermentable sugar and amino-acids, the amino-group of the latter is replaced by hydroxyl and sometimes the carboxyl group is also removed. The experiments have now been extended to other organisms. It is found that wild yeasts and mycoderma yeasts ("*Kahmhefen*") behave like culture yeasts in this respect. Moulds show considerable differences. Those moulds which are capable of growth in media containing only amino-acids, break down the latter completely, under these conditions. Thus, by long growth of *Penicillium glaucum* and *Aspergillus niger* in tyrosine solutions without sugar, all substances capable of giving a reaction with Millon's reagent finally disappear from the media. Even when sugar is present the various moulds exhibit marked differences, some breaking down the amino-acids more completely than others. Details of experiments carried out with *Oidium lactis* are given. All naturally occurring α-amino-acids are attacked by this organism provided suitable mineral and carbohydrate nourishment is present. In dilute solutions, after 4—5 weeks of growth, no trace of amino-acid remains as a rule. The corresponding hydroxy-acid is produced almost quantitatively according to the equation:—

$$R.CHNH_2.COOH + H_2O = R.CHOH.COOH + NH_3.$$

No ammonia can be detected in the solution; it is probably utilised by the organism for the synthesis of proteins. No evolution of gas occurs and only minute traces of alcohol are formed. By the action of *Oidium lactis* hydroxy-acids corresponding to *l*-tyrosine, *d.l*-phenylalanine and tryptophane were prepared by the authors and studied. Whilst a number of moulds behave like *Oidium lactis* towards amino-acids, others produce besides the corresponding hydroxy-acids, alcohols derived from these by elimination of the carboxyl group. Thus *Monilia candida* converts tyrosine into about equal quantities of *p*-hydroxyphenyl-lactic acid and *p*-hydroxyphenylethyl alcohol. Certain moulds of the *Mucor* group convert amino-acids only into the corresponding hydroxy-acids whilst others effect a further breakdown of the molecule. It is probable that hydroxy-acids, produced thus readily by moulds, are more widely distributed in nature than has hitherto been suspected. They occur indeed in many kinds of cheese, probably owing to the action of *Oidium lactis*.—J. H. L.

Urease; Technical application of ——. T. Takeuchi. Chem.-Zeit., 1911, **35**, 408.

Urease is present in the seeds and germs of many plants and is especially abundant in soya beans (this J., 1910, 36), whilst ordinary beans and peas contain much less. Thus when a solution of 2 grms. of urea in 100 c.c. of water containing a little toluene was digested for 17 hours at 15° C. with 0·5 grm. of powdered soya bean there was liberated 1·08 grm. of ammonia, or nearly the theoretical amount. Quite recently a small factory has been established in Yokohama for the manufacture of ammonium sulphate from urine which is collected daily from the houses. A mixture of 1000 parts of the urine with one part of soya bean powder is allowed to stand for 20 hours with frequent stirring, after which alkali is added, and the ammonia distilled and neutralised with sulphuric acid. A profit of M. 200 (nearly £10) per day is said to be made by this factory.—C. A. M.

Erratum.

This J., 1911, page 440, col. 1, l. 27 from top, and the line above formulæ, *for* "k_6" *read* "k_1."

Patents.

Malt; Manufacture [*steeping*] *of* ——. O. Winde, Lutzschena-Leipzig, Germany. Eng. Pat. 29,071, Sept. 13, 1910.

Apparatus is claimed for the washing and aeration of barley in steeping tanks. The ventilation, after discharge of the water, is effected by suction of air, and in order to secure as uniform aeration as possible, devices are included for maintaining large air spaces in the goods so that the air drawn in has a large surface to act upon. Vertical ventilating pipes, widened at the bottom in the shape of funnels, are connected rigidly with the suction pipe. If the tank is tall, there are attached also to the upper portions of the ventilating pipes, funnel-shaped screens (inverted) under which air spaces are maintained, the ventilating pipes being perforated under these screens. The arrangement for washing the goods consists of washing pipes passing up through some or all of the ventilating pipes and having at their lower ends (which protrude below the ventilating pipes) a device by which compressed air is admitted intermittently according to the strokes of the pump. By this means the mixture of grain and water is carried up the washing pipes and distributed from their upper ends in such a way as to secure the best mixing of the contents of the tank.—J. H. L.

Malt grist; Process and apparatus for producing —— *for making malt mash.* K. Maxaner. First Addition, dated Nov. 16, 1910 (under Int. Conv., Dec. 3, 1909), to Fr. Pat. 416,512, May 28, 1910 (see this J., 1910, 1404).

After passing the first pair of rolls the grist is sifted into fine meal, grits and husk. The fine meal is removed, whilst the grits and husk undergo further milling separately by two distinct series of rolls and sieves.—J. H. L.

Wort filter. V. Kamp. Fr. Pat. 422,585, Nov. 15, 1910.

The patent relates to the form of the shoots by which the mash enters the individual filtering chambers and also that of the conducting channel which supplies the shoots. The conducting channel is rectangular in section, being broader than high. In order that the filtering chambers may be as narrow as possible, for efficiency in washing, the shoots leading into them are narrower at the bottom where they enter the chambers than at the top. The upper opening of each shoot is as wide as the conducting channel and inclined so as to receive the goods more easily. The sloping walls of these shoots may also be provided with projecting veins or saddle-shaped prominences, which distribute the mash as uniformly as possible as it enters the chambers.—J. H. L.

Brewing; Compound for use in ——. L. Stein, New York. U.S. Pat. 981,325, Jan. 10, 1911.

A mixture of salts of alkaline earths (preferably calcium sulphate and magnesium phosphate) with suitable acids, such as phosphoric or lactic acid, is added to brewing liquors in order to procure the right degree of acidity during mashing, and at the same time to prevent extraction of undesirable constituents of the husk. The liquors after treatment will in most cases contain about 50 parts of acid and 500 parts of alkaline earth salts per million.
—J. H. L.

Fermented liquids; Treatment [*conditioning*] *of* ——. C. H. Fleming, Southport. Eng. Pat. 20,058, Aug. 29, 1910.

Unfinished or unconditioned beer is conditioned in barrels in the premises of the consumer by retaining in it, during the whole period of storage and consumption, some of its natural carbonic acid and other volatile matters, by maintaining artificially on the surface of the liquid in the barrel, carbon dioxide introduced from outside under a pressure higher than that of the atmosphere.—J. F. B.

Beverages prepared from fruit-juices; Process of manufacturing —— *in such a manner that they may be preserved.* H. Zwick. Fr. Pat. 422,281, Nov. 7, 1911.

Substances which produce an unpleasant flavour in beverages when the latter are pasteurised, and which cause the beverages to become turbid subsequently, may be removed by treating the completely or partially fermented beverage with about 0·5 per cent. of its weight of kaolin, fuller's earth, or similar mineral substance, at a temperature of about 45° C. The temperature, the duration of the treatment, and the quantity of mineral employed vary according to the kind of beverage. The beverage may then be heated to a temperature of 100° C., either directly, or after clarification.—W. P. S.

Spirits; Process for manufacturing purified potable ——. P. A. Brangier, Aguew, Cal., U.S.A. Eng. Pat. 18,928, Aug. 11, 1910.

See U.S. Pat. 969,332 of 1910; this J., 1910, 1174.—T. F. B.

Erratum.

This J. 1911, 504; col. 2, l. 4 from bottom, *for* "Dixon" *read* "Dickson."

XIXa.—FOODS.

Baking powder and self-raising flour; Presence of calcium sulphate in ——. J. M. Hamill. Report to the Local Gov. Board, 1911, Food Report No. 13, 1—16.

Calcium acid phosphate containing large quantities of calcium sulphate as an impurity is used to a considerable extent by makers of self-raising flour, confectioners, wholesale cake-makers, etc.; less commonly, this low-grade phosphate is an ingredient of baking powders sold as such to the public. The calcium acid phosphate employed for these purposes always contains sulphate to a greater or less extent according to the method of its preparation; some samples contain not more than 2 or 3 per cent., whilst in others the amount of calcium sulphate may be as much as 50 per cent. of the whole, or even more. It does not appear that the consumer gains any benefit, since the "improvement" claimed to be due to the presence of calcium sulphate would ordinarily mean that an inferior grade of flour was supplied in place of flour of a better quality. Nor can the presence of calcium sulphate in a baking powder be justified on the ground that it serves as a "filling"; such a concession would only lead to the addition of calcium sulphate to baking powder, a procedure which would not be to the interests of the consumer or of the more reputable manufacturers of this article. Apart from any administrative action which may be adopted, it is recommended that manufacturers of acid phosphates should not prepare an article, for sale as a food ingredient, which contains more than 10 per cent. of calcium sulphate; users of calcium acid phosphate should in all cases stipulate that the amount of calcium sulphate in the phosphate they purchase does not exceed 10 per cent. Vendors of baking powders containing acid phosphates should see that the powders do not contain any higher proportion of calcium sulphate than would be contributed by a commercial acid phosphate containing 10 per cent. of calcium sulphate. They should not receive or sell such baking powders under descriptions which may lead the purchaser to believe that he is buying preparations of tartaric acid or cream of tartar. It is also recommended that it would be desirable if the local authorities under the Sale of Food and Drugs Acts would from time to time invite reports from the Public Analyst as to the amounts of calcium sulphate in acid phosphates, baking powders, and self-raising flours purchased in the district, and the institution of proceedings should be considered in cases where there is a conspicuous excess of the impurity. The statement that calcium sulphate is converted into sodium sulphate in the loaf is not borne out by experiment. A portion of a loaf baked with a powder containing pure calcium acid phosphate, calcium sulphate, and sodium bicarbonate far in excess of the neutralising power of the phosphate, was dried, powdered, and shaken up with chloroform; a heavy sediment of mineral matter was obtained which contained no calcium carbonate, and in which only one-fourth of the total combined sulphuric acid was present as sodium sulphate. To whatever extent the formation of sodium sulphate may occur during baking, the combined sulphuric acid will be reconverted into calcium sulphate when it reaches the stomach.—W. P. S.

Flour; The bleaching of —— and the addition of so-called "improvers" to flour. J. M. Hamill. *The chemical changes produced in flour by bleaching.* G. W. Monier-Williams. Reports to the Local Gov. Board, 1911, Food Report No. 12, 1—65.

After giving an account of various bleaching processes, etc., the Report deals with bleaching and so-called flour "improving" in relation to Public Health and the general interests of the consumer. As in the case of preservatives and other deleterious substances added to food in small quantities, great difficulties beset the experimental investigation of the effect of small amounts of nitrogen peroxide on the properties of flour and on the health of the consumer, and the results which have been obtained by different workers are in many respects inconclusive and contradictory (see this J., 1908, 377, 1218; 1909, 1327). Reviewing these statements, and taking into consideration the results of an investigation by Monier-Williams (see below), the writer of the Report is of opinion that the alterations in, and the additions to, flour which result from a high degree of bleaching by nitrogen peroxide cannot be regarded as free from risk to the consumer, especially when regard is had to the inhibitory effect of the bleaching agent on digestive processes and enzymes. Attention is drawn to the fact that certain countries have made regulations with the object of discouraging or prohibiting the manufacture of bleached flour (see this J., 1909, 157). Many of the objections to the bleaching of flour may be applied to the addition of "improvers" to flour. Substances such as phosphates, phosphorus pentachloride, hydrofluoric acid, etc., have been suggested as "improvers," but the indiscriminate addition of certain of these substances to flour must be regarded as being most dangerous to health. It does not appear desirable that such an indispensable foodstuff as flour, the purity and wholesomeness of which are of first importance to the community, should be manipulated and treated with foreign substances, the utility of which, from the point of view of the consumer, is more than questionable.

The record of experiments given in the second part of the Report show that the action of nitrogen peroxide on flour, in quantities up to 300 c.c. of nitrogen peroxide per kilo. of flour, results in the destruction of the golden-yellow tint of the flour; after several days the more highly bleached samples became decidedly yellow, whilst those treated with from 30 to 100 c.c. of nitrogen peroxide per kilo. became still whiter, the maximum bleaching effect being attained within these limits. The amount of nitrous acid or nitrites present in freshly bleached flour is approximately proportional to the amount of nitrogen peroxide employed, and corresponds to from 30 to 40 per cent. of the total nitrogen absorbed. The proportion of nitrites present decreases considerably after the lapse of a few days in the case of highly bleached flours. About 60 per cent. of the total nitrogen introduced as nitrogen peroxide into flour may be recovered as ammonia, a short time after bleaching, by reducing the aqueous extract of the flour with a copper-zinc couple. In highly-bleached flours a considerable increase in the amounts of soluble proteins and soluble carbohydrates takes place; the quantity of soluble nitrogen may be doubled. This appears to be due to the solubility of gliadin in nitric acid of certain concentrations; the simultaneous increase of soluble carbohydrates would seem to point to an intimate relationship between the gliadin and certain carbohydrates in flour. After some time, the oil in highly-bleached flour undergoes very considerable alteration and assumes the characteristics of an oxidised oil. About 6 or 7 per cent. of the nitrogen introduced as nitrogen peroxide is absorbed by the oil. The absorption of nitrogen peroxide by flour does not appear to be accompanied by the formation of free nitrogen or of diazo compounds. Whilst sodium nitrite was not found to have any inhibitory action on the salivary digestion of starch, the rate of digestion was greatly retarded if the starch had been treated previously with nitrogen peroxide. Bleaching was also found to have an inhibitory effect on the salivary digestion of flour.—W. P. S.

Condensed milk; Analysis of sweetened ——. A. Backe, A. Wiborg, and E. Röer. Analyst, 1911, **36**, 138—141.

The degree of uniformity of the contents of a tin of sweetened condensed milk depends upon the consistency, the size of the crystals of lactose which invariably separate, and the time during which the tin has remained undisturbed. The separation of fat takes place very slowly, but in the case of the lactose microscopic crystals are formed even when the milk does not have a gritty taste, and after thinning the milk with water a large proportion of the lactose may be separated in the centrifugal machine. As a rule there is also a slight separation of sucrose, but to a smaller extent and in the form of larger crystals than the lactose, so that it sinks to the bottom more rapidly. The analyses of the different zones in the tin show that these factors may have a great influence upon the results given by an insufficiently mixed milk. In the case of milks which were fairly thin and not gritty, analysed at intervals of 15 days and 2½ months after preparation, the average figures for the different zones showed that a thorough mixing of the contents of the tin would insure fairly accurate results. The analysis of a rather thick condensed milk 4½ months after manufacture showed that, although less separation of the various constituents had occurred, it was more difficult to obtain a homogeneous sample. The following results were obtained with a thin milk (not gritty) which had stood for 7 months after its preparation :—

	Top zone. One-tenth.	Second zone. One-sixth.	Third zone. One-sixth.	Fourth zone. One-sixth.	Fifth zone. Remainder.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Fat	12·00	10·03	9·49	9·04	8·12
Proteins (Bordas' method)	8·83	8·73	8·54	8·49	8·70
Lactose	6·04	10·43	11·47	12·53	16·43
Sucrose	44·23	43·80	43·55	42·82	41·88

The decrease in the amount of sucrose was only apparent, and the percentage was reduced in accompaniment with that of the water. The amounts of all the constituents in the lower zones were lowered by the increase in the lactose. When the milk is very thin and gritty a solid layer is formed at the bottom of the tin, and in order to obtain a uniform sample it is then necessary to dissolve the whole of the contents in water. As a rule the percentage of sucrose among the separated lactose crystals is very small. It is possible that some amount of separation of the different constituents may take place during the manufacture of condensed milk, and this would account for the slight differences in composition of the contents of different tins of milk prepared at the same time.—C.A.M.

Milk products; Composition and valuation of dry ——. A. Burr. Milchwirtschaft. Zentr., 1911, **7**, 118—133. Chem. Zentr., 1911, **1**, 1234.

Commercial dry milk products vary widely in composition, especially with respect to their content of water and of fat. The author recommends the formulation of official standards. For the determination of fat in milk powders by the Röse-Gottlieb process, 1 grm. of substance is used in the case of cream and whole milk preparations, and 2 grms. in the case of skim milk and whey preparations; a double extraction is necessary. Water is determined by drying 2—3 grms. at 100° C. Five grms. are used for the

determination of the ash, and 1 grm. for the determination of nitrogen by Kjeldahl's method (factor, 6·37). In 22 samples of cream-powders the water content varied between 0·92 and 8·21 per cent. The percentages of fat in these samples were in many cases too low, being frequently only little higher than that of a good whole milk powder. A powder prepared from 10 per cent. cream should contain at least 50 per cent. of fat (reckoned on the dry substance): in the 22 samples examined, the percentage varied between 30·23 and 53·52, and only in three cases was more than 50 per cent. found. In 38 samples of whole milk powders the water varied between 1·2 and 10·04 per cent., and the fat between 22·89 and 32·41 per cent. According to the author, whole milk powders should contain at least 25 per cent. of fat (reckoned on the dry substance). Not one of the whole milk powders examined was satisfactory with respect to solubility. In 20 samples of skim milk powders the water varied between 2·62 and 13·88 per cent., and the fat between 0·63 and 4·18 per cent. The solubility of these products was better than that of the whole milk powders. "Sweet whey powder" is prepared in the United States from the whey obtained in cheese manufacture; it is completely soluble in water. Two samples contained: water, 2·20, 2·210; fat, 1·70, 1·63; proteins, 14·48, 14·01; lactose, 75·57, 75·44; ash, 8·38, 8·99 per cent., the proportions of the constituents other than water being reckoned on the dry substance. The dry substance of 37 samples of whole milk powders contained: proteins, 23·79—34·09; lactose, 31·63—45·13; ash, 5·48 7·54 per cent. The author states that scarcely a single sample of those examined could be regarded as entirely satisfactory, this being attributable to special, at present unexplained properties which the dried milk appears to possess and which considerably affect its durability and solubility.
—A. S.

Milk; Determination of phosphorus in ———. E. Fleurent and L. Lévi. Comptes rend., 1911, 152, 1015.

The authors point out that, whilst the loss of phosphorus compounds during the ignition of such substances as milk is practically negligible when compared with the total quantity of phosphorus present. The quantity of phosphorus thus lost cannot be ignored in determinations of the organic phosphorus compounds in milk, for although the loss may only amount to 3·9 per cent. of the total quantity, about 21·3 per cent. of the phosphorus present in organic combination disappears during the ignition. (See also this J., 1911, 505 and 510.)—W. P. S.

Bananas; [Ripening of ——]. K. Yoshimura. Z. Unters. Nahr. Genussm., 1911, 21, 406—411.

The author allowed green bananas to remain in a warm place, and after three different periods of time analysed a portion of the peeled fruit. The results are stated to show that: (1) the tannin present in the fruit plays no part in the ripening process; (2) the starch is converted first into sucrose, and the latter is subsequently partly or wholly inverted by the action of an invertase; (3) no other sugars besides sucrose and invert sugar are present in the fruit.
—A. S.

Cornus paniculatum; Examination of the fruits of ——. G. Sheets. Chem. News, 1911, 103, 172—173.

The fruits of *Cornus paniculatum* collected at Mount Vernon, Iowa, contained, when dried, 79 per cent. of sugars, mainly lævulose, and about 11 per cent. of an oil resembling cocoanut oil.—J. A.

Waste products from chemical industries. Fachini. *See* XII.

Patents.

Flour; Manufacture of —— [*treatment with water, reagents, etc.*]. F. H. Loring, London. Eng. Pat. 6721, March 17, 1910.

The flour is allowed to fall on to the surface of a rapidly rotating drum mounted horizontally in a closed chamber; the water or reagent solutions being supplied to the surface of the drum at a point before the flour inlet. A rotating wire brush, an elongated air-nozzle, and a rubber pad or band, all in contact with the drum, remove droplets of water and equalise the aqueous film before the moist part of the drum comes into contact with the flour. The greater portion of the flour is thrown off the drum immediately after contact and is collected in a suitable receptacle, whilst small adhering particles are removed by means of an air-spray situated at the lower part of the drum. A second form of the apparatus is described in which the flour is allowed to fall through a cylindrical chamber surrounding a vertical drum. The latter is rotated rapidly and water contained in its interior is forced through openings in its sides, these openings being fitted with porous plugs. Cooled air may be admitted to the apparatus, if desired.—W. P. S.

Saccharomyces [*yeasts*]; *Process of cultivating and manufacturing* —— *for bread-making.* P. L. E. Piot. Fr. Pat. 422,403, Jan. 17, 1910.

Cereal grains, either crushed or in their whole state, are mixed with from 20 to 50 per cent. of their weight of water containing ordinary yeast or pure cultures of yeast. The mixture is placed in a suitable chamber, and is stirred or turned over many times a day to prevent the mass from becoming over-heated. The temperature should preferably be maintained between 16° and 20° C., and, in any case, must not be allowed to exceed 30° C. After 4 or 5 days the grains will have become coated over with yeast cells, and the mass is then washed with water. A turbid solution is obtained from which particles of grain, starch, etc., are separated by suitable means (decantation, straining, etc.), and the yeast is then obtained in the form of a paste by passing the solution through a filter-press; this paste may be filled into suitable receptacles or pressed into cakes. During the cultivation of the yeast the mass may be aerated and yeast-foods may be added, and the cereal grains may be replaced by malted grains, distillery or brewery residues, potatoes, artichokes, tapioca, and the like.—W. P. S.

Flour; Bleaching of ——. Times, April 22, 1911. [T.R.]

At a general meeting of the Incorporated National Association of British and Irish Millers held in London on April 21st, the following resolution was passed:—

(1) "That in the opinion of this association wheaten flour sold as such without any qualifying designation should be the unbleached and untreated produce of properly cleaned and 'conditioned' wheat only.

(2) That a Board of Reference consisting of several highly qualified physiologists, chemists, and business men should be appointed by the Government to consider—

(*a*) Whether flour may properly be submitted to bleaching processes;

(*b*) Whether flour may be treated with substances which are not 'foreign' to wheat flour or bread;

(*c*) If so, to determine what substances are natural to wheat, flour, or bread, and within what proportions such substances are permissible;

(*d*) To consider the desirability of adding substances as 'yeast foods' and to determine what may be used as such and within what proportions they may be used;

(*e*) To consider under what designation or designations flours may be sold for commercial purposes.

(3) That the Board of Reference should from time to time review its conclusions and make new or revised recommendations."

Column for concentrating in vacuo. Fr. Pat. 422,163. *See* I.

Machine for tempering, cooling, heating, or drying pasty material, especially chocolate. Fr. Pat. 422,275. *See* I.

Edible fat. Eng. Pat. 10,429. *See* XII.

XIXb—WATER PURIFICATION; SANITATION.

Street-dirt in city sewers; The quantity of ——. H. de B. Parsons. Engineering, 1911. **91**, 438—439.

In connection with the sewerage problem of the City of New York the author made an estimate of the quantity of polluting matter from the streets which flowed into the harbour through the sewers. The amount of this polluting matter can only be determined approximately, as it varies according to the rainfall, and is affected by the street-cleaning methods, the characteristics of the various districts, and by the efficiency of the catch-basins to retain the dirt. The regular street-sweeping operations removed about 20 per cent. of the dirt on the streets, leaving the remainder to be washed into the sewers by subsequent flushing with water, and it was assumed that the rainfall on 45 days every year would be sufficient to wash the whole of the dirt into the sewers. The cities of New York, Hoboken, Jersey City, and Bayonne, contain 2000 miles of paved streets, having an area of 35,870,000 sq. yards, and 1950 miles of sewers with catch-basins; there are about 136,000 horses and mules in these cities, of which it was estimated that 112,000 were on the sewered streets and 24,000 on unsewered streets each day for 8 hours. A number of analyses showed that street-dirt, on the average, contains 31 per cent. of inorganic (mineral) matter and 69 per cent. of organic matter, including moisture. The quantities of polluting matters coming from the streets through the sewers into the harbour waters per year were calculated to be as follows:—Inorganic dirt, 36,573,500 lb.; organic dirt, including moisture, 52,347,500 lb.; animal fæces, including moisture, 29,158,500 lb.; animal urine, 2,146,000 galls.—W. P. S.

Report on the discharge into the river Memel of the waste lyes from the proposed sulphite wood pulp mill at Ragnit, Germany. Vogel. *See* V.

Patents.

Lamp black or vegetable black; Manufacture or recovery of carbon as —— from sewage sludge and sewage filter-pressed cake. J. H. Wright, Shipley, Yorks. Eng. Pat. 9625, April 20, 1910.

The sludge, either alone or mixed with cheap oily materials, etc., is burnt in a furnace, the air supply to which is insufficient for complete combustion of the material. The dense smoke from the furnace is conducted through a long flue to a chimney, the flue being provided with low partitions at intervals; fabrics may also be suspended in the flue. The finer portions of the black which are not condensed in the first compartments of the flue, may be caused to condense by subjecting them, at the end of the flue away from the furnace, to a current of electricity of high tension. The mineral matter remaining in the furnace may be used as a manure, or employed in place of sand in making mortar.—W. P. S.

Nightsoil and other refuse; Apparatus [dryer] for treating ——. Soc. Anon. des Nouveaux Agglomères Combustibles, St. Ouen, France. Eng. Pat. 15,287, July 1, 1910. Under Int. Conv., May 17, 1910.

A furnace for drying nightsoil or other refuse consists of a number of chambers communicating with one another through intermediate regulating chambers; the latter can be placed in communication with the outer air or with a hot-air chamber fed from a furnace. The material is placed in the chambers and the connections between the chambers are so regulated and changed that the material is subjected to a current of air the temperature of which is increased as required.—W. P. S.

Sewage, waste-water, etc.; Apparatus for the biological purification of ——. Cie. Industrielle D'Assainissement. First Addition, dated Jan. 5, 1910, to Fr. Pat. 410,217, March 8, 1909 (this J., 1910, 838).

The septic chamber of the apparatus may be divided into two compartments by means of a partition in which there are upwardly-inclined orifices. The liquid passes from the second of these compartments into the oxidising or filtering portion of the apparatus through tubes fitted at the top of the dividing wall; these tubes are bent downwards into the liquid contained in the septic compartment and openings in the wall above these tubes allow the gases to escape from the septic compartments. The air supply to the filter layers is admitted through inclined tubes in the wall of the filter chamber.—W. P. S.

Water or other liquids; Apparatus for use in or in connection with the purification of ——. W. Jones, Pontypridd. Eng. Pat. 10,394, April 28, 1910.

An apparatus for the addition of aluminium sulphate solution, etc., to water flowing under pressure through a conduit consists of a vertical iron cylinder filled with solid aluminium sulphate or other reagent, a perforated plate supporting a layer of gravel being placed at the lower end of the cylinder in order to prevent the outlet pipe from becoming choked. The cylinder is placed above the water conduit, and a supply of water from the latter is conducted through a pipe to the top of the cylinder; as this water passes downwards through the cylinder it dissolves a portion of the aluminium sulphate and the resulting heavy solution flows into the conduit through a pipe connecting the lower end of the cylinder with the conduit. Valves and a water-meter are fitted on the pipe supplying the cylinder with water so that the quantity of water passing through the cylinder may be regulated; the cylinder is also provided with a man-hole, an air-outlet tap, and a sludge-cock.—W. P. S.

Water; Apparatus for heating and purifying or softening ——. C. Erith, London. Eng. Pat. 24,992, Oct. 27, 1910.

Hard water for use in steam boilers is conducted from a tank through a heating apparatus situated in the main flue of the furnace; the water is thus heated to a temperature of about 180° F. and is then conducted to a softening apparatus, where it is treated with a single reagent and heated by means of steam to 210° F. The treated water is now pumped through a second chamber placed in the main flue where its temperature may be raised to from 250° to 300° F. before it is admitted to the boilers. This method of heating the water prevents the formation of scale in the heating chambers, and is suitable for employment in connection with the apparatus described in Eng. Pat. 6946 of 1904 (this J., 1905, 39).—W. P. S.

Sterilising liquids; Use of metals in the electric arc for ——. E. Urbain, A. Feige, and C. Seal. Fr. Pat. 422,404, Jan. 17, 1910.

See Eng. Pat. 4795 of 1910; this J., 1911, 442.—T. F. B.

Sewage and waste waters from distilleries or breweries; Treatment and utilisation of ——. A. Dickson, and Fertilizers, Ltd. Fr. Pat. 422,584, Nov. 15, 1910.

See Eng. Pat. 20,558 of 1909; this J., 1910, 1078.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Medicinal plants; Annual variation in potency of ——. J. Burmann. Schweiz. Woch. Chem. Pharm., 1911. **49**, 6—9.

Systematic determination of the chief alkaloidal active principles for four successive years, from 1907 to 1910, with typical medicinal plants grown in the same locality, shows that these have undergone a marked deterioration in potency, specially in 1909 and 1910. This is attributed to the low temperatures and deficient sunshine during those years. Rain, as such, is stated not to affect the amount of active principles materially, except in so far that its presence coincides with that of cloudy weather. The results are summarised thus:—

Plant.	Active principle.	Year.			
		1907.	1908.	1909.	1910.
		Per cent.	Per cent.	Per cent.	Per cent.
Aconitum napellus	Aconitine	0·104	0·100	0·042	0·054
Atropa belladonna	Atropine	0·094	0·082	0·045	0·046
Colchicum autumnale seeds	Colchicine	0·190	0·160	0·144	0·148
Digitalis ambigua	Digitoxine	0·134	0·120	0·067	0·069
Digitalis purpurea	Digitoxine	0·078	0·063	0·033	0·037
Ergot	Cornutine	0·30	0·26	0·25	0·22

Incidentally, it is noted that the must of grapes from the same vines, which in 1906 had the sp. gr. 1·091, showed the following lower densities in the four succeeding years:—1·087, 1·081, 1·079, and 1·080.—J. O. B.

Strychnine; Substances which mask the chromate reaction of ——. E. Mameli. Gaz. chim. ital., 1911, **41**, I., 329—334.

The author points out that a large number of organic substances are capable of masking the colour reactions by which strychnine is usually identified, *viz.*, Otto's reaction (violet colour with a crystal of bichromate in sulphuric acid solution) and Mandelin's reaction (blue-violet colour with ammonium vanadate in sulphuric acid solution, passing to reddish violet and red on standing or on addition of water). Phenols and aromatic amines, and their derivatives are especially active in masking these colour reactions. In toxicological work, therefore, care should always be exercised that the strychnine is free from interfering substances before applying identification tests. As an example it is mentioned that no characteristic reactions could be obtained with a mixture of strychnine, phenacetin, and *p*-phenetidine, but the strychnine was readily identified in the residue left after washing the mixture repeatedly with hot water, in which the alkaloid is only sparingly soluble (1 in 2500).—A. S.

Digitalis; Distribution of digitoxine in ——. A. Barensten. Ons Orgaan, 1910; Pharm. Zeit., 1911, **56**, 128.

Plants about 75 cm. high were examined by the Keller-Fromme method. The amount of crude digitoxine obtained from the radical leaves was 0·527 to 0·531 per cent.; from the flowers, 0·563 to 0·585 per cent.; from the seeds, 0·215 to 0·229 per cent.—J. O. B.

Duboisia hopwoodii [Pituri] and piturine. E. Senft. Pharm. Praxis, 1911, [1]; Pharm. Zeit., 1911, **56**, 128.

The narcotic action of this Australian solanaceous plant is due to a volatile liquid alkaloid, having a powerful odour, like that of coniine. It is distinguished from the latter base by not giving a turbidity when its solutions are warmed, and on the addition of chlorine solution. It is distinguished from nicotine by its reactions with platinum chloride, gold chloride, iodine and mercuric chloride. The method of isolating the base, and its reactions are described.—J. O. B.

Star anise oil; Abnormal ——. T. H. Durrans. Perfumery and Essent. Oil Record, 1911, **2**, 60—61.

A sample of suspected oil of star anise, of a well known brand, had the following characters:—Sp. gr. at 15°/20° C., 0·9831; optically inactive; $n_D^{21°} = 1{\cdot}5524$; congealing point approximately 13° C.; melting point, 15° C.; boiling point, 213° C.; soluble 1 : 3 in 90 per cent. alcohol. Amount of fractions b. p. 225°—235° C., barely 80 per cent. Extended examination of various fractions of the oil failed to give indication of added adulterant. The oil is therefore probably an abnormal distillate, or an oil partially deprived of anethol, or an old oil.—J. O. B.

Bergamot oil; New adulterant for ——. E. J. Parry. Perfumery and Essent. Oil Record, 1911, **2**, 59.

A compounded oil is being freely offered on the Continent as an adulterant for bergamot oil. It is a greenish brown oil, having a sweet odour; when mixed with an equal volume of pure oil, the odour was very similar to that of the genuine article. This oil had the sp. gr. 0·8885 at 15° C.; $[\alpha]_D = +36°$: $n_D^{25°} = 1{\cdot}4720$; apparent ester value, 40 per cent.; fixed residue 6·2 per cent. It appears to be a mixture of limonene, linalool, terpenyl acetate, and an ester of the type of ethyl citrate. It is manufactured in Paris and is being sold in the bergamot districts of Southern Italy. Its presence in several parcels of bergamot oil has already been indicated.—J. O. B.

Essential oils; Constituents of ——. *The oil of the false camphor tree. The occurrence of myrtenal and perilla-aldehyde in nature.* F. W. Semmler and B. Zaar. Ber., 1911, **44**, 815—819.

The oil from the false camphor tree was found to contain about 25 per cent. of perilla-aldehyde (this J., 1911, 154). After purifying, it boiled at 99°—104° C. at 9 mm., had the sp. gr. 0·965 at 18° C., $n_D = 1{\cdot}50803$, and $[\alpha]_D = +135{\cdot}6°$. The oxime melted at 102° C. The same oil yielded 6 per cent. of an aldehyde boiling at 89°—92° C. at 11 mm., and with the sp. gr. 0·9859 at 20° C., $n_D = 1{\cdot}50618$, and $[\alpha]_D = +13{\cdot}6°$. This proved to be identical with myrtenal, $C_{10}H_{14}O$ (this J., 1907, 485). Myrtenal and perilla-aldehyde stand to one another in the same relation as pinene to limonene.—F. Shdn.

Antipyrine and tin chlorides; Double compounds of ——. C. Astre and J. Vidal. Bull. Soc. Chim., 1911, **9**, 309—312.

If 10 grms. of stannous chloride be dissolved in 100 c.c. of hydrochloric acid of 21° Bé. diluted with an equal volume of water, and this solution be added drop by drop to a similar solution of 10 grms. of antipyrine, a white precipitate is formed. By working at 100° C. the same substance is obtained on cooling, in the form of large crystals. The same crystals are formed by placing sheet-tin in a solution of antipyrine in hydrochloric acid. In this compound the tin exists entirely in the stannic condition, a similar conversion having also been observed in the case of ferrous chloride, which combines with antipyrine to yield a double compound of ferric chloride. The tin compound is insoluble in water and organic media, but soluble in hot hydrochloric acid and in concentrated sulphuric and nitric acids with displacement of the hydrochloric acid. It gives a yellow sulphide with hydrogen sulphide, a white precipitate with ammonia, insoluble in an excess of the reagent, a white precipitate with alkali hydroxides soluble in excess, a white precipitate with mercuric chloride soluble on heating; it decolourises permanganate, it gives a yellow precipitate with gold chloride without any signs of reduction and does not form a precipitate with potassium iodide nor with oxalic acid. The antipyrine in the compound may be detected by the red colouration with ferric chloride, green colourations with Mandelin's reagent and with sodium nitrite, and a brick-red precipitate with the iodide and bismuth reagent. A somewhat similar precipitate is obtained with stannic chloride and antipyrine, the crystals in this case being microscopic and elongated. Analyses of these compounds showed that the product obtained with stannous chloride had a composition expressed by the formula $(C_{11}H_{12}N_2O)_4SnCl_4.4HCl$, and that with stannic chloride by the formula $(C_{11}H_{12}N_2O)_3SnCl_4.3HCl$.—J. F. B.

Adenine ; Recovery of ——. G. De F. Barnett and W. Jones. J. Biol. Chem., 1911. **9.** 93—96.

The difficulties met with in the recovery of adenine from its picrate, are avoided in the following process. A solution of adenine picrate in 10 per cent. ammonia, so diluted that it contains 0·5 per cent. of adenine, is treated with a solution of silver chloride in ammonia. A coloured gelatinous precipitate is produced containing the adenine, whilst nearly all the picric acid remains in solution. The precipitate is removed, suspended in boiling water and decomposed with hydrochloric acid. The hot solution is filtered to remove the silver chloride, and allowed to cool, when a small amount of adenine picrate is deposited, and is filtered off. The filtrate is shaken out with ether, neutralised with sodium hydroxide, and the adenine precipitated with copper sulphate and sodium bisulphite The copper compound is decomposed with hydrogen sulphide, and after filtering and evaporating, the adenine is crystallised from hot 5 per cent. sulphuric acid. About 90 per cent. of the adenine can be recovered in this way. —F. Shdn.

Ephedrine and pseudoephedrine. P. Rabe. Ber., 1911, **44,** 824—827. (See this J., 1889, 724.)

Both ephedrine and pseudoephedrine when converted into ammonium bases, yield on decomposition trimethylamine and a compound. $C_9H_{16}O$ (this J., 1906, 606). The ammonium base of ephedrine when decomposed gave 1-phenyl-2-methylethylene oxide, boiling at 201°—207° C. (corr.), and with $[\alpha]_D = +65{\cdot}84°$ at 16° C. When this oxide was heated in alcoholic solution with aqueous methylamine in a water-bath under pressure, condensation took place, a base being formed. The hydrochloride of this base, $C_{10}H_{15}ON.HCl$, began to melt at 148°, the melting being complete at 165° C. It had $[\alpha]_D = +24{\cdot}2°$. The author states that ephedrine and pseudoephedrine are optical isomerides of 1-phenyl-2-methylamino-propane-1-ol, especially as they show the typical "hydramine fission" (this J., 1909, 541).—F. Shdn.

Formic acid ; Quantitative determination of ——. H. Franzen and F. Egger. J. prakt. Chem., 1911, **83,** 323—325.

The authors propose a further modification of the method already published (this J., 1909, 1222), which yields equally accurate results and is more readily carried out. Instead of neutralising the hydrochloric acid formed, the reaction is allowed to proceed in the presence of an excess of sodium acetate. A solution is prepared containing 200 grms. of mercuric chloride, 300 grms. of sodium acetate and 80 grms. of sodium chloride in 1 litre of water, the liquid being allowed to settle for two days before use, and then decanted from the slight precipitate. In performing an analysis the formate is dissolved in about 1 litre of water, and for every 0·5 grm. of formic acid, 50 c.c. of the above solution are added, and the mixture kept for 3—3½ hours in a boiling water bath. The subsequent procedure is similar to that already described. The concentration of the formic acid must not exceed 0·5 grm. per litre.—R. V. S.

Patents.

Tuberculin and serums for tuberculous bacilli ; Preparation of ——. V. Henri and A. Helbronner, Paris, and M. von Recklinghausen, Bas Meudon, France. Eng. Pat. 7669, March, 29, 1910.

Improved preparations of tuberculin and serums for use against tuberculous bacilli are made by subjecting tuberculin or cultures of the bacilli to the action of ultraviolet light.—F. Shdn.

Mineral waters, or artificial saline waters, cordials, and similar preparations ; Manufacture of —— [*use of radium-treated water*]. H. H. Hewitt, London. Eng. Pat. 7954, April 2, 1910.

The salts employed in making artificial saline waters are dissolved in water which has been treated with a radium salt or been subjected to radium emanation, and the solution is then charged with carbon dioxide under pressure. The radio-active water may be obtained by adding 1 mgrm. of a soluble radium salt to 100 galls. of water, by suspending in the water a porous receptacle containing radium carbonate or sulphate, or by placing in the water a hermetically sealed vessel containing radium bromide. For making "radio-water" on a large scale, the water may be passed through a filter consisting of a mixture of 1 part of pitchblende residue and 10 parts of vegetable charcoal.—W. P. S.

Antimony for use as a therapeutic substance ; Manufacture of finely divided ——. R. H. A. Plimmer, London. Eng. Pat. 13,755, June 7, 1910.

Antimony trichloride or other salts of antimony in acid solution are treated with zinc, when the antimony is precipitated in a finely divided condition. After purifying and drying, the substance can be used for injecting into the tissues or blood-vessels.—F. Shdn.

Quinine ; Manufacture of esters of the hydrohalogenic addition products of ——. G. W. Johnson, London. From Verein. Chininfabr. Zimmer und Co., Frankfort on Maine, Germany. Eng. Pat. 15,560, June 28, 1910.

See U.S. Pat. 978,792 of 1910 ; this J., 1911, 109. An alternative method for preparing these compounds consists in treating the hydrohalogen addition products of quinine with chlorides, anhydrides, or phenol esters of acids.—T. F. B.

Mercuric compounds substituted in the nucleus of alkylated or halogenated benzoic acids ; Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,049, Dec. 2, 1910. Under Int. Conv., March 21, 1910.

Claim is made for the production, manufacture, and use of mercuric compounds of alkylated or halogenated benzoic acids substituted in the nucleus. The acids in question are heated with mercuric oxide or salts of mercury, or the mercury salts of the acids in question are heated under varying conditions.—F. Shdn.

Tuberculosis ; Manufacture of a remedy for ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 16,632, July 12, 1910. Under Int. Conv., July 22, 1909.

See Ger. Pat. 223,758 of 1909 ; this J., 1910, 1228.—T. F. B.

Albuminous compounds of guaiacol sulphonates ; Preparation of ——. A Busch, Brunswick, and J. A. von Wülfing, Berlin. Eng. Pat. 30,129, Dec. 28, 1910. Addition to Eng. Pat. 29,787, Dec. 20, 1909.

See Ger. Pat. 231,589 of 1909 ; this J., 1911, 509.—T. F. B.

Formaldehyde compound and process of making same. W. Osborne. Assignor to Chem.-Pharm. Laboratorium "Sahir," Munich, Germany. U.S. Pat. 988,733, April 4, 1911.

See Eng. Pat. 25,138 of 1909 ; this J., 1910, 516.—T. F. B.

p-Alkyloxyphenylethyl alcohols, and also ω-p-alkyloxyphenylethylamines and their N-alkyl derivatives ; Process for producing the chlorides of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 422,868, Nov. 22, 1910. Under Int. Conv., March 1, 1910.

See Eng. Pat. 26,615 of 1910 ; this J., 1911, 508.—T. F. B.

Column for concentrating in vacuo. Fr. Pat. 422,163. *See* I.

XXII.—EXPLOSIVES ; MATCHES.

Nitroglycerin ; The crystalline form of ——. S. Nauckhoff. Z. ges. Schiess- und Sprengstoffw., 1911, 6,, 124—125.

The author agrees with Kast in placing the freezing point of nitroglycerin at 13·3° C., and thus correcting his former figure of 12·3° C. The nitroglycerin used for the experiments was crystallised from ethereal solution. He does not agree with Kast in finding any difference between the freezing point and the melting point of nitroglycerin, nor has he been able to prepare a labile nitrate, which Kast states melts at 2·5° C. On lowering the temperature to 0° C., nitroglycerin crystallises in long needles in the rhombic system. It crystallises from ethereal solution in the same system, but the longer and shorter axes of the crystals are, in this case, much more nearly uniform in length.—G. W. McD.

Patents.

Explosive. G. M. Peters, Cincinatti, and M. F. Lindsley, King's Mills, Ohio, Assignors to The King Powder Co., Cincinnati, Ohio. U.S. Pat. 988,590, April 4, 1911.

Ammonium nitrate (30 parts), nitrocellulose (30), potassium chlorate (30), and nitrobenzene (10 parts).—G. W. McD.

Explosive. H. Maxim, Hopatcong, N.J. U.S. Pat. 988,799, April 4, 1911.

A mixture of lead oxide, silicon and ammonium nitrate agglutinated with an explosive colloid containing nitrocellulose.—G. W. McD.

Explosive. J. B. Bronstein, Allentown, Pa. U.S. Pat. 988,858, April 4, 1911.

A nitrostarch powder containing from 10 to 70 per cent. of marble dust.—G. W. McD.

Explosive. Sprengstoffwerke Dr. R. Nahnsen und Co., A.-G. Fr. Pat. 422,492, Nov. 12, 1910. Under Int. Conv., May 11, 1910.

Claim is made for the use of double silicides (particularly of the double silicide of calcium and aluminium) to the extent of from 5 to 20 per cent., as an ingredient of explosives. The following compositions are mentioned as suitable :—Ammonium nitrate (95 parts) and the double silicide of calcium and aluminium (5 parts). Ammonium nitrate (73·8 parts), dinitrotoluene (12·6 parts), woodmeal (3·6), and the double silicide of calcium and aluminium (10 parts).—G. W. McD.

Explosive material ; Manufacture of an ——. Nitroglycerin Aktiebolaget. Fr. Pat. 422,727, Nov. 11, 1910. Under Int. Conv., Nov. 26, 1909.

The explosive is plastic and consists of 31 parts of a jelly containing liquid nitrotoluene (96 per cent.) and collodion cotton (4 per cent.). mixed with ammonium perchlorate (43 parts) and sodium nitrate (26 parts).—G. W. McD.

High explosives ; Apparatus and process for charging or loading projectiles with ——. H. Maxim, New York. U.S. Pats. 988,798, 988,885, and 988,886, April 4, 1911.

(1) The explosive is melted in a jacketed cylinder and flows, under pressure, into the shell through a flexible pipe, attached to a plug in the base of the shell. (2) A confined body of plastic explosive is subjected to pressure and forced into the projectile. (3) The explosive, whilst in a plastic condition, is first forced to the front end of the shell. The remainder of the shell, towards the base, is then charged whilst maintaining a central passage which is afterwards filled up.—G. W. McD.

XXIII.—ANALYTICAL PROCESSES.

Specific gravity ; Quantitative analysis of mixtures by means of differences in ——. H. Friedenthal. Ber., 1911, 44, 904—908.

The author discusses the application of differences in density to the separation of the ingredients of mixtures. The usefulness of the method is greatly increased by the employment of centrifugal force for the actual separation. The investigation of blood, milk, urine, etc., can be considerably simplified by grinding the dried residue, freed from fat, as finely as possible and separating it into fractions of different density. For the separation of salts, carbohydrates and proteins (after removal of fat), bromoform or methylene iodide is suitable. By mixing the former with xylene, liquids of all specific gravities from 2·9 to 0·7 may be obtained, and very fine adjustments of density are possible by alterations of temperature. The actual separation may in many cases be carried out quantitatively in an ordinary separating funnel. When centrifuging is necessary the author employs for the separation a thick-walled glass vessel, having in the middle a cock, the hole through which is of the same bore as the interior of the glass vessel. The cock has no external handle (which might break off during centrifuging) but is turned by a key fitting into an angular hole. In this way certain separations, very tedious by chemical methods, such as that of sodium chloride from potassium chloride may be readily carried out. A much more remarkable use can be made of differences in density, however, by employing centrifugal machines of very high speed. With a centrifuge making 10,000 revolutions a minute and having a centrifugal force of 800 million dynes, it is possible to separate the casein quantitatively from cows' milk in three hours. The other milk-proteins remain dissolved in the opalescent liquid. The casein is not quite pure ; it contains some lecithin and iron ; but this is the first separation of proteins effected centrifugally. The milk fats separate under these conditions in a solid and a liquid layer. A separation of saturated from unsaturated fats may be readily carried out by treatment with iodine followed by centrifuging. Bromination or iodination appears in many cases a very convenient means of increasing specific gravity and so effecting quantitative separations. Many colloids are precipitated from solution by centrifuging at a very high speed, and micro-organisms are completely thrown down from suspension. Centrifugal machines of 36 cm. diameter and 20,000—30,000 revolutions per minute are now manufactured, and others of higher speed are projected.—J. H. L.

Fluorine ; Method for the determination of ——. G. Starck. Z. anorg. Chem., 1911, 70, 173—177.

A large excess (about 200 c.c.) of a cold saturated solution of lead chloride is added to the neutral fluoride solution (about 50 c.c., containing 0·1 grm. of fluoride reckoned as the sodium salt), and the heavy precipitate thus produced, after standing, preferably overnight, is filtered off and washed, first with an almost saturated solution of lead chloride and then with water ; it is finally dried for 2 hours at 140°—150° C. and is either weighed as the compound, PbFCl, or dissolved in nitric acid and the chlorine determined by a known method, the corresponding weight of fluorine being calculated.—F. Sodn.

Sulphur ; Determination of —— by Carius' method. G. Anelli. Gaz. chim. ital., 1911, 41, I., 334—341.

Experiments with pure sulphur showed that Carius' method invariably gave high results, and this was found to be due to the action on the glass of the sulphuric acid produced, silica being formed and weighed along with the barium sulphate finally obtained. Accurate results can, however, be obtained if the sulphur or substance containing sulphur be heated with a mixture of nitric acid and barium nitrate instead of with nitric acid alone. In the case of such substances as bitumens, the possible presence of sulphide and of graphitic carbon in the product after heating with nitric acid and barium nitrate must be taken into consideration.—A. S.

Hypoiodites; Formation of —— and their action on sodium thiosulphate. A source of error in certain iodine titrations. J. P. Batey. Analyst, 1911, **36**, 132—137.

When an excess of iodine solution is added to a mixture of an antimonious compound with sodium bicarbonate, and the excess of iodine titrated with standard thiosulphate solution, the results frequently differ from those obtained by direct titration of the antimonious salt. To obtain results in agreement by the two methods it is necessary to keep the amount of sodium bicarbonate in the indirect titration below the limit of 1 to 1·5 grms. to each 0·15 grm. of antimony, any excess of sodium bicarbonate above this proportion causing the results to be inaccurate. On the other hand, Rochelle salt may take the place of sodium bicarbonate, and provided sufficient is present, its amount does not affect the results. The cause of the inaccuracy with sodium bicarbonate has been found to be due to the production of some sodium hypoiodite, which then reacts with the thiosulphate and ultimately produces sulphate as in the equation—

$$Na_2S_2O_3+4NaOI+2NaOH=2Na_2SO_4+4NaI+H_2O,$$

so that more iodine is consumed than in the formation of sodium tetrathionate. This formation of sodium hypoiodite is checked by the presence of free carbon dioxide; and since, in the conversion of antimonious to antimonic compounds by means of iodine the free hydriodic acid produced reacts with the bicarbonate and liberates carbon dioxide, the latter if present in sufficient ratio to the amount of sodium bicarbonate, will prevent the formation of hypoiodite, and the consequent oxidation of the thiosulphate to sulphate instead of to tetrathionate.
—C. A. M.

Copper; Determination of —— by means of hypophosphorous acid. J. Hanus and A. Soukup. Z. anorg. Chem., 1911, **70**, 282—293.

An investigation of Mawrow and Muthmann's method of determining copper (this J., 1896, 381) has shown that its apparent accuracy is due to a compensation of errors. The copper undergoes partial oxidation on the one hand, and, on the other, is incompletely precipitated or redissolved after precipitation, even when a large excess of the reagent is employed; the quantity of copper dissolved or remaining in solution depends on the concentration of the hydrogen ions and upon the length of time during which the precipitated metal is exposed to the air and the oxidised copper to the acid solution. Satisfactory results may be obtained by careful neutralisation (repeated during precipitation), if boiling be not too prolonged, but this is troublesome; the addition of sodium acetate or tartrate is useless. The method is not regarded as suitable for the accurate determination of copper and especially for its separation from other metals.—F. Sodn.

Manganese; Determination of ——, by the sodium bismuthate method. P. H. M.-P. Brinton. J. Ind. Eng. Chem., 1911, **3**, 237—239.

Having observed that, in certain series of analyses, the results obtained for manganese by the bismuthate process were consistently a little lower than those afforded by other methods, the former process was investigated to determine the cause of the discrepancy. It was found that, in standardising the permanganate solution used in the process, a consistently higher value was obtained by titration against manganous sulphate than by the use of sodium oxalate or iron. Manganous sulphate is regarded as the correct standard for the purpose; but, sodium oxalate being undoubtedly more convenient, the author suggests the use of pure Sörensen sodium oxalate and the adoption of the empirical factor 0·1656, instead of the theoretical factor 0·16024, for converting the oxalate figure into that for manganese. The author corroborates Blair's statement that, for small amounts of manganese, the bismuthate is the most accurate process known; but, in the treatment of ores, is of opinion that decomposition by hydrochloric and sulphuric acids is preferable to that by hydrofluoric and sulphuric acids, and quite as accurate. Fusion with sodium peroxide is recommended for the treatment of refractory ores.
—W. E. F. P.

Titanium; Sensitiveness of the colourimetric determination of ——. R. C. Wells. J. Amer. Chem. Soc., 1911, **33**, 504—507.

The experiments recorded were made to establish the range of concentration affording the greatest accuracy in the determination of titanium by the hydrogen peroxide method. The colourimeter devised by Steiger was used in making the comparisons, each test comprising two final settings obtained by working from opposite directions. The concentration of the solution varied from 0·3 to 20·0 mgrms. of titanium dioxide per 100 c.c. and all the solutions contained about 3 per cent. of sulphuric acid and 2 of "dioxygen." It was found that the accuracy of the comparison is practically constant for concentrations ranging from the strongest down to about 1·5 mgrm. of titanium dioxide per 100 c.c. The change in concentration required to produce a perceptible difference in intensity between two solutions, at favourable concentrations, was found to be about 6·5 per cent., this figure being in agreement with that deduced by other workers from similar observations upon chromium and copper solutions. The author concludes that, with suitable precautions, the accuracy of the colourimetric comparisons is about 2 per cent.—W. E. F. P.

Calcium and strontium; Sulphite method for separating and identifying ——. J. I. D. Hinds. J. Amer. Chem. Soc., 1911, **33**, 510—514.

The identification and qualitative separation of calcium and strontium is stated to be greatly facilitated by the use of a freshly prepared and nearly saturated solution of sodium sulphite. Both metals are precipitated by this reagent in neutral solutions, but in the presence of acetic acid a fairly complete separation is effected on boiling, the calcium remaining in solution. The strontium sulphite precipitate is always contaminated with calcium, the latter being sometimes sufficient to mask the indication for strontium in the flame test; but this difficulty, it is claimed, may be surmounted by testing a calcium salt side by side with the sulphite precipitate in the same flame. Barium is precipitated by sodium sulphite in both neutral and acid solutions and must be eliminated before the above separation is attempted. A method of analysis for the examination of the barium group is appended.
—W. E. F. P.

Nickel and cobalt; Rapid determination of —— by means of the gauze cathode and stationary anode. R. C. Benner and W. H. Ross. J. Amer. Chem. Soc., 1911, **33**, 493—504.

A series of experiments is described in which a cathode of platinum gauze and a stationary anode were employed in various electolytes of nickel and cobalt. The current used varied from 3 to 5 ampères at from 4 to 7 volts, the electrolytes employed being those of the sulphate, acetate, formate and carbonate of ammonium, the acetate and formate of sodium, and cyanide of potassium. The results indicated that the rapid determination of nickel and cobalt by this method is quite satisfactory with most of the electrolytes commonly employed, the cyanide electrolyte being a notable exception. For all electrolytes which can be used in ammoniacal solution, the rate of deposition of the metal was found to be practically the same, being scarcely affected by the quantity of ammonia present. In acid solutions the rate of deposition was slower and decreased slightly as the acidity increased. For the same current, the rate of deposition upon the gauze cathode was found to be somewhat slower than is the case with processes employing mechanical agitation.
—W. E. F. P.

Aluminium hydroxide; Precipitation of —— in the granular form. W. E. Taylor. Chem. News, 1911, **103**, 169.

If ammonia is added to the solution containing the aluminium at 66° C. and the liquid is then boiled, instead of adding the precipitant to the boiling solution as is the common practice, the aluminium hydroxide is obtained in a granular state. The tedious filtration usually associated with the gelatinous form of this precipitate is thus avoided. —J. A.

Phosphoric anhydride; Colourimetric method for the determination of ——. N. Passerini. Gaz. chim. ital. 1911, 41, I., 182—186.

The proposed method depends upon the colouration produced by phosphomolybdic acid with gallic acid, this colouration being yellow, orange, or red according to the quantity of phosphomolybdic acid, and very stable. The method may be applied directly to minerals, but substances rich in organic matter (*e.g.*, soils) must first be calcined at a dull red heat. 10 grms. of the substance are moistened with water and boiled for 1 hour with 30 c.c. of concentrated nitric acid (40 c.c. if the substance is rich in lime). After allowing to settle, the turbid liquid is poured off, and the residue is washed several times by decantation with small quantities of boiling water. The solution and washings are cooled, made up to 250 c.c., and filtered through a dry filter. 50 c.c. of the filtrate are evaporated, the residue is heated for 1 hour on the water-bath, taken up with nitric acid and boiling water, the solution cooled, diluted to 50 c.c., and filtered. 25 c.c. of the filtrate are treated with 2 c.c. of a 75 per cent. solution of ammonium nitrate and 25 c.c. of the ordinary molybdic reagent, and after 24 hours the ammonium phosphomolybdate is collected on a small filter, and washed with water containing 1 per cent. of nitric acid until the washings no longer give a colouration with gallic acid. The precipitate is then dissolved in the least possible quantity of ammonia solution (1 : 4), diluted to about 100 c.c., boiled to expel excess of ammonia, cooled, and made up to 100 c.c. A standard solution is prepared by treating 10 c.c. of a solution of dicalcium phosphate (1·9153 grms. of the pure salt dissolved in water containing 1 per cent. of nitric acid to 1 litre) with 2 c.c. of a 75 per cent. solution of ammonium nitrate and 25 c.c. of the molybdic reagent, and after 24 hours, filtering, washing the precipitate with 1 per cent. nitric acid, dissolving it in ammonia and making up to 1 litre: this solution contains 0·01 mgrm. of phosphoric anhydride per c.c. For making the colourimetric comparison, a known volume of this standard solution is boiled to expel excess of ammonia, made up to its original volume, and 1, 1·5, or at the most 2 c.c. are run into one of two tubes which have been previously charged with 15 c.c. of water and 2 c.c. of a cold saturated solution of gallic acid. Into the other tube, the solution prepared from the material under examination is run in from a burette until the colours in the two tubes are alike. The method is recommended especially for the accurate determination of small quantities of phosphoric anhydride.—A. S.

Determination of tarry substances insoluble in ether and alcohol in mineral cylinder oils. Holde and Meyerheim. *See* IIA.

Determination of asphaltum insoluble in a mixture of alcohol and ether in mineral lubricating oils. Loebell. *See* IIA.

Detection of distillation products of lignite and coal in the presence of natural asphaltum and petroleum residues. Loebell. *See* IIA.

Distinction of different kinds of glass. Toggenburg. *See* VIII.

Method for testing galvanised iron to replace the Preece test. Patrick and Walker. *See* X.

Analysis of gold [alloys] by means of ether. Mylius. *See* X.

Determination of silicon in vanadium and molybdenum metals and their iron alloys. Trautmann. *See* X.

Sampling ores from Cobalt mines. Pugsley. *See* X.

Method for nickel-zinc separation in German silver and other alloys. Spring. *See* X.

Volumetric method for antimony in alloys. Jamieson. *See* X.

Determining the saponification value of fats and waxes. Winkler. *See* XII.

Determining total soluble fatty acids in fats and oils. Bruno. *See* XII.

Use of miscibility curves in the examination of cod liver oil. Louïse. *See* XII.

Analysis of crude glycerin. *See* XII.

Frey's method of determining petroleum in turpentine oil. Shrewsbury. *See* XIII.

Proposed uniform method of carrying out comparative tests for the valuation of raw rubber. Frank. *See* XIV.

Nitrosites of rubber and their application in analysis. Alexander. *See* XIV.

Volumetric determination of phosphoric acid soluble in citric acid. Wuyts. *See* XVI.

Determination of reducing sugars in cane sugars for the refinery or for direct consumption. Muller. *See* XVII.

Determination of sucrose in cane molasses; use of hydrochloric acid and urea for direct polarisation. Pellet. *See* XVII.

Biological analysis of honey. [Determination of enzymes.] Moreau. *See* XVII.

Analysis of honey. Witte. *See* XVII.

Examination of honey, especially with respect to its nitrogenous constituents. Lund. *See* XVII.

Fiehe's reaction as a preliminary test for honey. Hartmann. *See* XVII.

Chemistry and analysis of wines. Von der Heide and Baragiola. *See* XVIII.

Analysis of sweetened condensed milk. Backe and others. *See* XIXA.

Determination of phosphorus in milk. Fleurent and Lévi. *See* XIXA.

Substances which mask the chromate reaction of strychnine. Mameli. *See* XXX.

Determination of formic acid. Franzen and Egger. *See* XX.

Patents.

Colour-measuring device. F. Hellige, Freiburg, Germany. Eng. Pat. 20,692, Sept. 5, 1910.

In apparatus of the type in which a coloured liquid to be tested is placed in a wedge-shaped glass vessel and the latter moved about until the colour of a certain depth of the liquid matches that of a standard liquid placed beside the wedge, a Helmholtz double glass plate is employed for eliminating the dividing line between the liquid serving for comparison and the liquid to be examined.—H. H.

Cork; Treatment of ——. M. Grünzweig, Ludwigshafen-on-the-Rhine, Germany. U.S. Pat. 982,950, Jan. 31, 1911.

The process consists in evaporating volatile products from comminuted cork to an extent equal to from 30 to 50 per cent. of the weight of the untreated cork, by passing a stream of gas at 600° to 700° C. into intimate contact with the cork and controlling the time of action so that the temperature of the cork does not rise above 400° C. The operation is preferably carried out in a rotary kiln, and the cork is withdrawn therefrom by a helical conveyer working in a long tube in which the cork cools before issuing into the atmosphere. It is stated that the chemical and physical condition of the cork are improved and its volume increased by the process.—H. H.

Trade Report.

Conveyance of acids in carboys. Railway classification.

Interviews have taken place at the Railway Clearing Office between representatives of the acid trade and the railway companies on the question of the conveyance of acids in carboys, and, as the result, the companies have decided to insert a clause embodying a definition of the term carboy, also instructions as to loading, in the General Railway Classification of Goods as follows:—

Definition of carboys.—The term "carboy," as used in this classification, means a globular bottle of not more than 12 gallons capacity,* made of glass not less than $\frac{1}{8}$ inch thick in any part, free from striæ and bubbles, carefully annealed, and with the initials of the maker on the neck.

Packing.—The carboy must be firmly packed in a hamper of iron or wickerwork, with a minimum thickness of $\frac{1}{2}$ inch of straw packing between the hamper and the carboy. This packing must be renewed as soon as it loses its elasticity, and the hamper must be kept in good repair.

Loading.—Full loads.—All carboy-hampers to be tied together, any space remaining at end or sides of waggon to be filled tightly with suitable packing. *Small consignments.*—Carboy-hampers to be tied together, the carboys to be loaded at one end of the waggon, and secured there either by a retaining bar, or by tying the carboy-hampers to the waggon-ends with rope.

In view of the large number of carboys broken in transit, chemicals, in carboys, must not be loaded on the top of other goods, or in the same waggon with goods named in the foregoing paragraph, or any other goods liable to be damaged in the event of the breakage, or leakage of the contents, of the carboy.

All carboys must be securely bunged or stoppered and luted, except when containing hydrochloric acid, in which case tightly fitting straw bungs may be used if they be securely tied over with string.

Nitric acid. Packing.

Nitric acid or aquafortis.—In stoneware jars protected by wickerwork. In bottles, packed in cases or boxes. The interstices between the bottles must be filled with kieselguhr, or with other material on which the acid has no chemical action: not with sawdust, straw or other like substance. Sulphuric acid, inflammable liquid, or other chemical which, by contact with nitric acid, might cause fire or explosion, must not be packed in the same case or box.

Nitric acid or aquafortis, not exceeding 1·420 sp. gr.—In glass carboys not exceeding 12 gallons in capacity.

A suggestion was made that the companies should provide for a packing consisting of half sand and half sawdust as an alternative to kieselguhr, but after experimenting with varying mixtures of the two articles mentioned, the companies cannot see their way to adopt the alternative packing.

The companies appreciate the consideration and assistance which has been given by the trade in connection with the question generally, and state that in framing the above regulations they have endeavoured to avoid anything which might be considered unnecessarily to interfere with the convenience of the trade; it is hoped that the arrangements which have been made will ensure that safer conveyance of the traffic which will prove of mutual benefit to all concerned.

Books Received.

Traité d'Analyse des Substances Minérales. Par Adolphe Carnot, Inspecteur général des Mines en retraite, Directeur hon. de l'Ecole des Mines de Paris. Tome Troisième. Métaux (Première Partie). H. Dunod et E. Pinat, Editeurs, 47 and 49, Quai des Grands-Augustins. 1910. Price 27.50 fr.

This third volume is devoted to the complete analytical study of the metals of the alkali-, and alkaline-earth groups, of the rare earths, and of the metals belonging to the iron group. It is of 8vo size, and contains 892 pages of subject matter, with 28 illustrations, and an alphabetical index of subjects. The subject matter is subdivided as follows:—I. Potassium. II. Cæsium. III. Rubidium. IV. Sodium. V. Lithium. VI. Barium. VII. Strontium. VIII. Calcium. IX. Magnesium. X. Aluminium. XI. Glucinum. XII. Zirconium. XIII. Thorium. In the case of all these, descriptions are given of (i), Occurrence in nature, Properties. (ii), Reactions of salts. (iii), Methods of determination. (iv), Separations. XIV. Metals of the rare earths (cerium-, terbium-, and yttrium groups). XV. Uranium. Determination, Methods of separation. Uranium minerals. Pitchblende. Phosphates. Carnotite, etc. XVI. Radium. Extraction and properties. Polonium and actinium. XVII. Water analysis. XVIII. Chromium. XIX. Manganese. XX. Iron. XXI. Cast irons and steels. Metallographic examination. Constituents. Analysis.

Introduction to Chemistry. By Wilhelm Ostwald. Authorised Translation by Wm. T. Hall and Robt. S. Williams, Massachusetts Institute of Technology. First edition. John Wiley and Sons. New York. 1911. $1.50 net. Chapman and Hall, Ltd., London.

8vo volume, containing 358 pages of subject matter, with 74 illustrations, and an alphabetical index of subjects. The general plan of the work may be derived from the following chapter headings:—I. Substances and mixtures. II. Physical transformations. III. Solutions. IV. Chemical reactions. V. Oxygen and hydrogen. VI. Halogens and salts. VII. Sulphur and the alkaline earth metals. VIII. Nitrogen and related substances. IX. Carbon. X. The earth's crust. XI. Heavy metals of the iron group. XII. Heavy metals of the copper group. XIII. Tin, gold, and platinum.

The Chemistry of Synthetic Drugs. By Percy May, B.Sc. Longmans, Green, and Co., 39, Paternoster Row, London, New York, Bombay, and Calcutta. 1911. Price 7s. 6d.

8vo volume, containing 220 pages of subject matter, and an alphabetical index of subjects. A list of abbreviations is given, and a glossary of chemical and medical terms. The text is classified as follows:—I. Theories of action. II. Effect of various elements and radicals. III. Chemical changes of drugs in the organism. IV. Narcotics and general anæsthetics. V. Antipyretics and analgesics. VI. Alkaloids. VII. Atropine and the tropeïnes. VIII. Morphine and Isoquinoline groups. IX. Adrenaline, etc. X. Phenol derivatives (antiseptics). XI. Other organic antiseptics. XII. Iodoform and its substitutes. Iodine and bromine compounds. XIII. Inorganic antiseptics. XIV. Arsenic and antimony compounds. XV. Purine derivatives (diuretics), and uric acid solvents. XVI. Purgatives, and substances acting on the gastro-intestinal tract. XVII. Other substances, as glucosides, camphor, glycerophosphates and their congeners.

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* For liquids not exceeding 1·2 sp. gr. carboys up to 14 gallons capacity may be used.

Die neue Welt der flüssigen Kristalle, und deren Bedeutung für Physik, Chemie, Technik, und Biologie. Von O. Lehmann, Professor der Physik an d. Technischen Hochschule zu Karlsruhe. Akademische Verlagsgesellschaft m. b. H. Leipzig. 1911. Price M. 12.

8vo volume, containing 383 pages of subject matter, with 246 illustrations, and an alphabetical index of subjects. The matter is subdivided into groups as follow:—I. Answers the question "What is a Crystal?" II. Defines anisotropic phenomena. III. Molecular directing orce. IV. Optical anisotropic phenomena. V. Intrinsic behaviour of a crystal on bending. VI. Is an amorphous mass formed on crushing? VII. Is polymorphism possible? VIII. Crystals and living existence. IX. The rystallisation microscope. X. Crystallites and mixed crystals. XI. Temperature and crystalline change. XII. Double saturation and absorption phenomena. XIII. The three states of aggregation of a substance. XIV. What is an amorphous substance? XV. Isomorphous and anomalous mixed crystals. XVI. True amorphous bodies are not "phases," (*i.e.*, cannot re-form themselves after solution in gases or liquids). XVII. Plastic crystals. XVIII. Are there liquid crystals? XIX. Formation-power according to design, and confluent crystals. XX. Physically homogeneous crystalline liquids. XXI. Crackng, and formation of twin crystals. XXII. Optical peculiarities of thick liquid crystals. XXIII. Substances of varied liquid states. XXIV. Chemical microscope for hermic analyses. XXV. Apparently living crystals. XXVI. Growth and development of the living state. XXVII. Latent life and soul. XXVIII. Atomic souls. XXIX. Muscular power. XXX. Self-purification of iquid crystals. XXXI. Liquid crystals and magnetism, etc.

*New Books.

Adressbuch der gesamten Glasindustrie Europas. Bd. : Deutschland 1911. (X, 295, XVI u. 44 S.) kl. 8°. Leipzig, Schulze and Co. Cloth M. 5.

Adressbuch der deutschen Gummi-, Guttapercha- u. Asbest-Industrie nebst verwandter Geschäftszweige, wie Kabel-, Celluloid- u. Linoleum-Industrie. Mit e. alphabet. Firmen-Register nebst Bezugsquellen-Liste u. Inserenten-Verzeichnis. 9. Ausg. 1911. (V, 81, 524 u. 31 S.) 8°. Berlin, Union, Zweigniederlassg. Cloth M. 6.

Béhal, A., et A. *Valeur*, Traité de chimie organique d'après les théories modernes. T. II, f. 2 (complément de l'ouvrage). 8°, 625 p. Paris, O. Douin et fils. Les 2 vol. 1911. 40 fr.

Beltzer, F. J.-G., La chimie industrielle moderne. T. II. Métaux, chimie organique. 8°, VIII, 798 p., 101 fig. Paris, Soc. d'édit. techniques. 1911. 20 fr.

Benrath, Dr. Alfr.: Chemische Konstitutionsbeweise. Kritische Studien. (79 S.) gr. 8°. Heidelberg, Carl Winter. 1911. M. 2.

Bohle, H., and D. *Robertson*: Transformers, a Treatise on the Theory, Construction, Design, etc., etc. 8vo, pp. 370. C. Griffin. London. 1911. Net 21s.

Breyre, Ad.: Les mines à l'Exposition internationale et universelle de Bruxelles de 1910. 36 p., 41 fig. Paris, H. Dunod et E. Pinat. 1911. 4.50 fr.

Brooks, A.: Mineral Resources of Alaska. Report on Progress of Investigations in 1909. (U.S. Geol. Survey, Bull 442.) 8 Plates and Engravings. 8vo, pp. 432. W. Wesley. London. 1911. Net 4s.

Callendar, H. L. and H. *Moss*: On the Absolute Expansion of Mercury. 4to, sd. Dulau. London. 1911. Net 2s.

Census of Production (1907). Preliminary tables summarising the results of the returns received under the Census of Production Acts, 1906. Part VIII. [Cd. 5621.] Wyman and Sons, Fetter Lane, E.C. Price 5½d. This part includes particulars relating to indiarubber factories and workshops; cement factories and workshops, and asbestos and boiler covering factories and workshops.

Chalon, P. F.: Les explosifs modernes, 3e édit. rev. et augm. In-8°, 217 fig. Paris, Ch. Béranger. 1911. 25 fr.

Collins, H. F.: The metallurgy of lead. 2nd edit. 8vo 9¼ × 6¼, 558 p. London, C. Griffin. 1911. 21s.

Colson, A.: Contribution à l'étude de la chimie, supplément de l'ouvrage de A. Ladenburg, in-8°. Paris, A. Hermann et fils. 1911. 3 fr.

Ehrsam, R.: Formules des mélanges et procédés de fabrication des graisses industrielles pour machines et véhicules et des produits d'entretien pour usines et manufactures, in-8°. Paris, Ch. Béranger. 1911. 10 fr.

Fenchel, Dr. Ad.: Metallkunde. Ein Lehr- u. Handbuch f. Fabrikanten, Werkmeister u. Gewerbetreibende der gesamten Metallindustrie. (VIII, 236 S. m. 111 Abbildgn.) gr. 8°. Hamburg, Boysen and Maasch. 1911. M. 6; cloth M. 6.60.

Fiebelkorn, Dr. M.: Hydraulischer Kalk u. Zement in Süd-Frankreich. [Aus: "Ton-Industrie-Ztg."] (74 S. m. Abbildgn.) gr. 8°. Berlin, Tonindustrie-Zeitg. 1911. M. 5.

Fischer, E.: Neuere Erfolge u. Probleme der Chemie Experimentalvortrag. 8°, 30 S. Berlin, J. Springer. 1911. Pf. 80.

Frühling, Dr. R.: Anleitung zur Untersuchung der f. die Zuckerindustrie in Betracht kommenden Rohmaterialien, Produkte, Nebenprodukte u. Hilfsubstanzen. 7. umgearb. u. verm. Aufl. (XVIII, 535 S. m. 140 Abbildgn.) gr. 8°. Braunschweig, F. Vieweg and Sohn. 1911. M. 15; cloth M. 16.

Gmelin u. Kraut's Handbuch der anorganischen Chemie. Unter Mitwirkg. hervorrag. Fachgenossen hrsg. v. Proff. C. Friedheim u. Dr. Frz. Peters. 7. gänzlich umgearb. Aufl. gr. 8°. Heidelberg, Carl Winter. 1911.

> I. Bd., 3. Abtlg. Phosphor, Bor, Kohlenstoff, bearb. v. Dr. A. Gutbier. Die kristallograph. Angaben v. Dr. H. Steinmetz. (XXXIX, 907 S.). M. 35; cloth M. 38.
>
> IV. Bd., 1. Abtlg. Zink, Cadmium u. Indium, bearb. v. Dr. W. Roth, die Nachträge hrsg. unter Benutzg. der Vorarbeiten v. Dr. F. Schaar-Rosenberg; Gallium, bearb. v. Dr. H. Grossmann, die Nachträge wie vor; Germanium, bearb. v. Dr. W. Prandtl, die Nachträge wie vor; Zinn u. Thallium, bearb. v. Dr. O. Schlenk, auch in den Nachträgen.—Die kristallograph. Angaben v. Dr. H. Steinmetz. (LXX, 1056 S.). M. 42; cloth M. 45.

Groth, P.: The Optical properties of crystals. Being selected parts of the "Physical crystallography." Transl. by B. H. Jackson. 8vo. London, Chapman and Hall. 1911. 15s.

Grüner, Dr. P.: Kurzes Lehrbuch der Radioaktivität. 2., vollständig umgearb. Aufl. v. "Die radioaktiven Substanzen u. die Theorie des Atomzerfalles." (IV, 119 S. m. 20 Fig.) gr. 8°. Bern, A. Francke. 1911. M. 2.50.

Guild, Fk. N.: The mineralogy of Arizona. 183 p. Easton, Pa., Chemical Pub. 1911. $1.

Handbuch der Kali-Bergwerke, Salinen u. Tiefbohrunternehmungen. Jahrg. 1911. (XXI, 794 S.) 8°. Berlin, Finanzverlag G. m. b. H. 1911. Cloth M. 12.

Harris, G.: Oil and Gas in Louisiana. With a Brief Summary of their Occurrence in Adjacent States. (U.S. Geol. Survey, Bull. 429.) 22 Plates and Engravings. 8vo, pp. 192. W. Wesley. London. 1911. Net 4s.

Hart, E. Bret, and W. E. *Tottingham*: General agricultural chemistry. 12°, 334 p., il. Madison, Wis., E. B. Hart. 1911. $1.50.

Hayes, C., and W. *Lindgren*: Contributions to Economic Geology. Part 1, Metals and Non-Metals, except Fuel. (U.S. Geol. Survey, Bull. 430.) 14 Plates and Engravings. 8vo, pp. 653. W. Wesley. London. 1911. Net 6s.

Hilditch, T. P.: A Concise History of Chemistry. Cr. 8vo, pp. 274. Methuen. London. 1911. 2s. 6d.

Jackson, W.: Dictionary of English and Spanish Technical and Commercial Terms used principally in the Iron, Steel, Hardware and Engineering Trades. 12mo, pp. 164. Spon. London. 1911. Net 2s. 6d.

Jahrbuch der deutschen Braunkohlen-, Steinkohlen- und Kali-Industrie. 1911. XI. Jahrg., bearb v. B. Baak. gr. 8°, XLVI, 283 S. m. Abbildgn. u. 1 Karte. Halle, W. Knapp. 1911. Cloth M. 6.

Joly, A., et R. *Lespieau*, Chimie générale. Métalloides; par A. Joly et R. Lespieau. 8e édition, conforme aux programmes de la classe de mathématiques spéciales et des examens d'entrée aux Écoles polytechnique, normale et centrale. 552 p. avec fig. Paris, impr. Lahure; libr. Hachette et Cie. 1911. 5 fr.

Jörgensen, Alfr.: Microorganisms and fermentation. 4th edit. 8vo, $8\frac{3}{4}\times5\frac{1}{2}$, 502 p. London, C. Griffin. 1911. 15s.

Kelly's Directory of Merchants, Manufacturers and Shippers of the World. 1911. 4to. 30s.

Ditto, with Alphabetical Index of British and Colonial Trades. 4to. Kelly's Directories. London. 1911. 36s.

Krainik, S.: L'évolution de la répression des fraudes et falsifications alimentaires, pref. du Paul Cazeneuve. 8°. Paris, Larose et Tenin. 1911. 6 fr.

Küster, Dr. F. W.: Logarithmische Rechentafeln f. Chemiker, Pharmazeuten, Mediziner u. Physiker. Im Einverständnis m. der Atomgewichtskommission der deutschen chem. Gesellschaft u. der internationalen Atomgewichtskommission f. den Gebrauch im Unterrichtslaboratorium u. in der Praxis berechnet u. m. Erläutergn. versehen. 11., neu berechnete Aufl. (107 S.) kl. 8°. Leipzig, Veit and Co. 1911. Cloth M. 2.40.

Ladenburg, A.: Histoire du développement de la chimie depuis Lavoisier jusqu'à nos jours, trad. par A. Corvisy, 2e édit. augm. par A. Colson, in-8°. Paris, G. Hermann Fils. 17 fr.

Lampa, Ant.: Farbe u. Teilchengrösse v. kolloidalen Goldlösungen. [Aus: "Sitzungsber. d. k. Akad. d. Wiss."] (6 S.) gr. 8°. Wien, A. Hölder. 1910. 35. Pf.

Le Blanc, M.: Lehrbuch der Elektrochemie. 5. verm. Aufl. gr. 8°, VIII, 331 S. Leipzig, O. Leiner. 1911. M. 6; cloth M. 7.

Ley, Dr. H.: Die Beziehungen zwischen Farbe u. Konstitution bei organischen Verbindungen. Unter Berücksicht. der Untersuchungsmethoden dargestellt. (Abhandlungen aus Physik u. Chemie.) (VIII, 246 S.) gr. 8°. Leipzig, S. Hirzel. 1911. M. 7; cloth, M. 8.

Liesegang, F. P.: Handbuch der praktischen Kinematographie. Die verschiedenen Konstruktions-Formen des Kinematographen, die Darstellg. der leb. Lichtbilder sowie das kinematograph. Aufnahme-Verfahren. (2. umgearb. u. verm. Aufl.) (VII, 322 S. m. 135 Abbildgn.) gr. 8°. Leipzig, E. Liesegang. 1911. M. 8.

Mecklenburg, W.: Grundbegriffe der Chemie. Eine Einführg. in die Lehre v. den Nichtmetallen. 8°, 85 S. m. Abbildgn. Leipzig, Th. Thomas Verl. M. 1; cloth M. 1.60.

Molisch, H.: Uber die Fällung des Eisens durch das Licht u. grüne Wasserpflanzen. [Aus: "Sitzungsber. d. k. Akad. d. Wiss."] (26 S. m. 1 farb. Taf.) gr. 8°. Wien, A. Hölder. 1910. 90 Pf.

Nádai, Dr. A.: Untersuchungen der Festigkeitslehre m. Hilfe des thermoelektrischen Temperaturmessverfahrens. (51 S. m. Abbildgn.) Lex. 8°. Berlin, E. Ebering. 1911. M. 2.50.

Nahrungs- u. Genussmittel sowie Gebrauchs-gegenständen f. das Deutsche Reich; Beiträge, experimentelle u. kritische, zur Neubearbeitung der Vereinbarungen zur einheitlichen Untersuchung u. Beurteilung von ——. 1. Bd. Hrsg. vom kaiserl. Gesundheitsamte. [Aus: "Arbeiten a. d. kaiserl. Gesundheitsamte."] (V, 266 S.) Lex. 8°. Berlin, J. Springer. 1911. M. 4.

Noyes, W. Alb.: Organic chemistry for the laboratory. 2nd ed., rev. and enl. Easton, Pa., Chemical Pub. 1911 il. 8°. $2.

Oechsner de Coninck, W.-F.: Leçons sur les fermentations. 2e édit. rev. et augm. 8°, 133 p. Paris, Masson et Cie. 1911. 2.50 fr.

Ostwald, Wo.: Grundriss der Kolloidchemie. 2. völlig umgearb. u. wesentl. verm. Aufl. 1. Hälfte. gr: 8°. VI, 329 S. m. zahlreichen Textfig. u. Taf. u. m. 1 Portr. v. Thomas Graham. Dresden, Th. Steinkopff. 1911. M. 9.

Pearson, H. C.: The rubber country of the Amazon; a detailed description of the great rubber industry of the Amazon Valley, which comprises the Brazilian states of Pará, Amazonas and Matto Grosso, the territory of the Acre, the Montaña of Peru and Bolivia, and the southern portions of Colombia and Venezuela. N.Y. India Rubber World. Front. il. maps, 8°. 1911. $3.50.

Schmidt, Geo.: Abriss der Petroleumgeologie Rumäniens (insbesondere an der Erdöllinie Gura-Draganesci-Campina-Bustenari u. ihrer Fortsetzung nach Osten). Nach amtl. Quellen u. eigenen Beobachtgn. gemeinverständlich dargestellt. Mit 1 (farb.) geolog. Karte. (34 S.) Lex. 8°. Berlin (-Schöneberg), Verlag f. Fachliteratur. 1911. M. 2.

Schulze, Günth.: Quecksilberdampf-Gleichrichter. [Aus: "Helios."] (16 S. m. Fig.) gr. 8°. Leipzig, Hachmeister and Thal. 1911. 50 Pf.

Scott, W. G.: White paints and painting materials: source and manufacture; composition and properties; uses and formulas; physical tests and chemical analysis. XXVI., 500 pp., il., pls. tabs. Chinton, Wis., U.S. Scott. 1911. $3.50.

Senter, G.: Outlines of Physical Chemistry. 2nd Edition, revised. Cr. 8vo, pp. 406. Methuen. London. 1911. 5s.

Sherman, H. C.: Chemistry of Food and Nutrition. Cr. 8vo. Macmillan. London. 1911. Net 6s. 6d.

Skita, Dr. A.: Ueber die wichtigsten Faserstoffe, ihre Unterscheidung u. Untersuchung. Auszug aus dem Vortragszyklus: Ueber Textil-Industrie. [Aus: "Ztschr. f. Krankenanstalten."] (29 S. m. Abbildgn.) 8°. Leipzig, F. Leineweber. 1911. M. 1.

Smith, C. A. M.: A Handbook of Testing Materials, 8vo, pp. 296. London. 1911. Constable. Net 6s.

Smith, P.: Geology and Mineral Resources of the Solomon and Casadepaga Quadrangles, Seward Peninsula, Alaska (U.S. Geol. Survey, Bull. 433). 16 plates and engravings. 8vo, pp. 234. W. Wesley. London. 1911. Net 4s.

Soap Makers' Directory, The: 1911. 8vo, board. Simpkin. London. 1911. Net 2s.

Thiel, Dr. A.: Der Stand der Indikatorenfrage. Zugleich e. Beitrag zur chem. Theorie der Farbe. [Aus:

"Sammlg. chem. u. chemisch-techn. Vorträge."] (111, 116 S. m. Fig. u. 1 Tab.) Lex. 8°. Stuttgart, F. Enke. 1911. M. 3.60.

Thiele, Dr. Johs.: Uber den Verlauf chemischer Reaktionen. Rede. (Rektoratsreden der Universität Strassburg 1910) (28 S.) gr. 8°. Strassburg, J. H. E. Heitz. 1911. M. 1-20.

Tutton, A. E. H.: Crystals. The International Scientific Series. Cr. 8vo, pp. 312. K. Paul. London. 1911. 5s.

Uhlig, V.: Die Eisenerzvorräte Oesterreichs. Bericht der geolog. Gesellschaft in Wien f. den XI. internationalen Geologenkongress in Stockholm. [Aus: "Mitteilgn. d. geol. Gesellsch."] (S. 434—477 m. 1 farb. Karte u. 6 farb. Taf.) gr. 8°. Wien, (F. Deuticke). 1910. M. 3.

Vigneron, H.: Electrochimie et électrométallurgie. 8°, 288 p., 82 fig. Paris, L. Geisler. 1911. 5 fr.

Voller, A., u. B. *Walter*: Ueber den Helium- u. Argongehalt des Erdgases v. Neuengamme. [Aus: "Jahrb. d. hamb. wiss. Anstalten, 5. Beiheft."] (14 S. m. 1 Taf.) Lex. 8°. Hamburg, Gräfe and Sillem. 1911. M. 1.20.

Wachter, M.: Die Fabrikation der Gummidrähte Kabel. Mit 136 Abbildgn., mehreren Tab. sowie e. Sachregister. (V, 163 S.) gr. 8°. Berlin, Union, Zweigniederlassg. 1911. M. 6; Cloth M. 7.

West, P. C. H.: The modern manufacture of Portland cement; a handbook for manufacturers, users, and all interested in Portland cement. N.Y., McGraw-Hill, il. fold. pls. 8°. 1911. $4 n.

Windaus, A.: Untersuchungen üb. Colchicin. II. (Aus der medizin. Abteilg. des Universitäts-Laboratoriums Freiburg i. B.) (27 S.) gr. 8°. Heidelberg, Carl Winter, 1911. M. 1.

Ziegenberg, R.: Die elektrische Ozontechnik. [Aus: "Helios."] (73 S. m. 35 Abbildgn.) gr. 8°. Leipzig, Hachmeister and Thal. 1911. M. 1.50.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding list can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

Patent Specifications may be purchased at the Sale Branch of the Patent Office, Quality Court, Chancery Lane, London, W.C., fifteen days after the date on which acceptance of the complete specification is advertised. The price is 8d. each.

I.—GENERAL PLANT; MACHINERY.

Applications.

9599. Thompson. Mixing and drying machines.* April 20.
9640. Matthews, Pim, and Strange. Means for effecting chemical reactions. April 20.
9681. Titterton. Apparatus for mixing or effecting the circulation of liquids or semi-liquids in vessels. April 21.
9736. Merz. Extraction apparatus. [Austrian Appl., Oct. 8, 1910.]* April 21.
10,053. Wright. *See under* VII.
10,070. Burrows. *See under* VII.
10,259. Schwabacher. Apparatus for bringing gases into contact with liquids.* April 27.
10,413. Wilson. Apparatus for filtering liquids. [Addition to No. 433 of 1910.]* April 29.

Complete Specifications Accepted.

9098 (1910). Sanford. Clarifying or separating liquids. April 26.
10,610 (1910). Irwin, and Johnson and Co. Filter presses. May 3.
12,736 (1910). Guillaume. Distilling and rectifying apparatus. May 3.
12,831 (1910). Leune. Machine for the centrifugal treatment of liquids. April 26.
13,328 (1910). Richmond, and Lister and Co. Centrifugal emulsors. May 3.
19,325 (1910). Kindermann. Destruction and deodorisation of smoke. May 3.
20,794 (1910). Bayer. Method for purifying and cooling gases. May 3.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

9471. Comp. d'Agglomeres d'Anthracite pur, and Besson. Manufacture of composite solid fuel.* April 18.
9550. Birault and Riché. Treating refuse and other poor combustible materials to produce fuel gases. [Fr. Appl., April 30, 1910.]* April 19.
9623. Jaubert. *See under* VII.
9632. Hiby. Purification of gases produced by the carbonisation of coal. April 20.
9646. Forward. *See under* IX.
10,119. Armstrong and Mordan. *See under* III.
10,228. Eastick. Apparatus for generating gas and obtaining salts as by-products. April 27.
10,303. Hansen. Manufacture of metallic filaments for electric incandescent lamps. April 28.
10,325. Bronder. Gas for illuminating and like purposes and process for making it.* April 28.

Complete Specifications Accepted.

10,871 (1910). Harrison. Manufacture of filaments for incandescent electric lamps. May 3.
10,872 (1910). Harrison. Exhaustion of incandescent electric lamps. May 3.
11,415 (1910). Kitsee. Metallic filaments for electric lamps. May 3.
13,187 (1910). Behrens and Behrens. Separation of carbonic acid from gaseous mixtures. May 3.
15,250 (1910). Kassner and Stanelle. Generation of combustion products under high pressure. April 26.
16,984. (1910). Dunlop. Gas producers. May 3.
20,794 (1910). Bayer. *See under* I.
23,459 (1910). Still. Coke ovens. April 26.
23,559 (1910). Frambs, and Bender und Frambs Ges. Gas producers. May 3.
26,772 (1910). Paterson and Twycross. Preparation of charges of limed coal for distillation in gas retorts. May 3.

III.—TAR AND TAR PRODUCTS.

Applications.

9403. Carron. Separation of the oils from the pitch of tar. April 18.
9520. Flürscheim. Manufacture of nitro-derivatives of aniline and its homologues. April 19.
10,119. Armstrong and Mordan. Solidification of hydrocarbon oils. April 26.

Complete Specification Accepted.

4158 (1911). Act.-Ges. f. Anilinfabr. Manufacture of acidylated sulphurised anthraquinone derivatives. May 3.

IV.—COLOURING MATTERS AND DYES.

Applications.

9431. Newton (Bayer und Co.) Manufacture of vat dyestuffs. April 18.

9433. Newton (Bayer und Co.). Manufacture of azo dyestuffs and process of developing them on the fibre. April 18.

9529. Bayer und Co. Production of azo dyestuffs on the fibre. [Ger. Appl., Aug. 2, 1910.]* April 19.

9841. Meister, Lucius, und Brüning. Manufacture of anthraquinone dyestuffs. [Addition to No. 24,920 of 1909.]* April 22.

10,335. Imrie (Anilinfarben u. Extract-Fabr. vorm. J. R. Geigy). Manufacture of dyestuffs of the triphenylmethane series. April 28.

10,383. Huband and Huband. Production of concentrated liquid colouring matters. April 29.

Complete Specifications Accepted.

9620 (1910). Newton (Bayer und Co.). Manufacture of substantive azo dyestuffs. May 3.

9968 (1910). Imray (Soc. Chem. Ind. in Basle). Manufacture of yellow to orange-red azo dyestuffs. April 26.

12,433 (1910). Newton (Bayer und Co.). Manufacture of azo dyestuffs. April 26.

12,528 (1910). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of dyestuffs of the anthraquinone series. May 3.

16,517 (1910). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of thioindigo and its derivatives. May 3.

20,110 (1910). Imray (Meister, Lucius, und Brüning). Manufacture of a blue vat dyestuff of the anthraquinone series. May 3.

20,216 (1910). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of azo dyestuffs for chrome-mordanted wool. May 3.

22,288 (1910). Meister, Lucius, und Brüning. Manufacture of isolated alkali salts of indoxyl and its derivatives. April 26.

24,571 (1910). Rahtjen. Preparation of indoxyls and indigo colouring matters. April 26.

24,871 (1910). Soc. Chim. des Usines du Rhone. Manufacture of indigo, its homologues and substitution products. April 26.

27,639 (1910). Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of monoazo dyestuffs specially suitable for the preparation of pigment colours. May 3.

28,680 (1910). Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of substantive disazo dyestuffs. May 3.

28,681 (1910). Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of an azo dyestuff. May 3.

73 (1911). Act-Ges. f. Anilinfabr. Manufacture of azo dyestuffs. May 3.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Complete Specifications Accepted.

9866 and 10,962 (1910). White. Apparatus and means for removing potash from wool. May 3.

10,075 (1910). Castle. Combination for sizing and finishing purposes. April 26.

26,567 (1910). Hubers. (Radvanyi-Riegler and Linder). Resistive paper mass for industrial purposes. April 26.

27,600 (1910). Verein. Glanzstoff-Fabr. Recovery of copper from the washing water obtained in making artificial products from cuprammonia cellulose. April 26.

2524 (1911). Gimlette and Capps. Non-inflammable fabric. May 3.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

9432. Newton (Bayer und Co.). Production of blue shades on wool. April 18.

9433. Newton (Bayer und Co.). *See under* IV.

9842. Meister, Lucius, und Brüning, and others. Fixation of anthraquinone dyestuffs. [Addition to No. 24,920 of 1909.]* April 22.

10,195. Turner, Turner, and Robinson. Method and means for proofing and clearing felt hats. April 27.

Complete Specifications Accepted.

10,075 (1910). Castle. *See under* V.

10,792 (1910). Roberts and Turner. Method and means for bleaching textile fabrics and the like. May 3.

12,998 (1910). Newton (Bayer und Co.). Process for producing discharge effects. May 3.

1727 (1911). Muller. Bleaching process. May 3.

2232 (1911). Act.-Ges. f. Anilinfabr. Production of black dyeings on the fibre. May 3.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

9461. Taraud and Truchet. Recovery of the nitrous products in the manufacture of sulphuric acid by the chamber process. [Fr. Appl., April 18, 1910.]* April 18.

9609. Vis. Manufacture of ammonium sulphate.* April 20.

9623. Jaubert. Preparation of hydrogen by auto-combustion. [Fr. Appl., May 21, 1910.] April 20.

9682. Nobel's Explosives Co., Ltd., and Cross. Production of oxides of nitrogen. April 21.

10,052. Sulman, and Metals Extraction Corporation, Ltd. Deposition of metallic salts from solutions.

10,053. Wright. Concentrators for ammonia or the like. [U.S. Appl., May 2, 1910.]* April 25.

10,070. Burrows. Method of evaporating brine or other liquids containing solids in solution. April 26.

10,228. Eastick. *See under* II.

10,338. Ralph, and Sulphates, Ltd. Manufacture of copper compounds or solutions thereof. April 28

Complete Specifications Accepted.

9869 (1910). Justice (Duron and Hartmann). Manufacture of sulphuric acid. April 26.

22,319 (1910). Salpetersäure Ind.-Ges. Production of nitric oxide from mixtures of nitrogen and oxygen. May 3.

26,835 (1910). Bergmann und Simons, and Lindgens und Söhne. *See under* XIII.

403 (1911). Friderich. Manufacture of nitric acid. May 3.

VIII.—GLASS; CERAMICS.

Application.

10,418. Landau und Co., and Rosenzweig. Manufacture of white enamels. [Austrian Appl., June 8, 1910.]* April 29.

IX.—BUILDING MATERIALS.

Applications.

9646. Forward. Manufacture of asphalt from petroleum residuum or from crude petroleum.* April 20.

10,022. Clark and Morgan. Apparatus for testing the tensile strength of bitumen, asphalt, cement, etc. April 25.

Complete Specifications Accepted.

9608 (1910). Lake (Welin, Davit, and Lane and De Groot Co.). Art of waterproofing wood. April 26.

18,338 (1910). Rhodin. Manufacture of white hydraulic cement. May 3.

19,866 (1910). Gebr. Siemens und Co. Manufacture of fireproof electrically-conductive materials. April 26.

27,142 (1910). Kesler. Manufacture of artificial stone. May 3.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

9525. Mackenzie and Harrison. Apparatus for cleaning blast furnace and other gases. April 15.

9542. Strohmenger. Local carburising or case hardening of iron and iron alloys. April 19.

9592. Boothby. Process of annealing crucibles used for steel melting. April 20.

9901. Soc. Anon. des Ciments Portland Artificiels de Buda. Treatment of pulverulent ores of iron and manganese. [Belg. Appl., April 23, 1910.]* April 24.

9941. Specialfabr. f. Aluminium Spulen u. Leitungen. Production of electrically insulating layers or coatings on metal. [Addition to No. 20,634 of 1910. Ger. Appl., April 25, 1910.]* April 24.

9968. Whitfield. Electrolytic production of antimony from antimony ores or compounds.* April 25.

9998. Cowper-Coles. Coating iron and steel with zinc. April 25.

9999. Cowper-Coles. Hot galvanising. April 25.

10,143. Dewar. Treatment of oxidised copper ores or products. April 26.

10,328. Trifonoff and Gardner. Treatment of antimony and arsenic ores.* April 28.

Complete Specifications Accepted.

7303 (1910). Härdén. Reduction of metals from their oxides or other compounds. May 3.

9108 (1910). Lucertini. Production of armour plates and other steel articles without case hardening. April 26.

9511 (1910). Jones and Mitchell. Decarburising armour plates which have not been super-carburised. April 26.

10,199 (1910). Thiel. Converter processes. May 3.

18,945 (1910). Coln-Musener Bergwerks Akt.-Ver. Treatment of manganese ores to produce ferro-manganese. April 26.

20,669 (1910). Woud. Coating iron sheets, plates, etc., with aluminium. May 3.

22,016 (1910). Johnson (Chem. Fabr. Griesheim-Elektron). Purification of magnesium and its alloys. April 26.

27,467 (1910). Rhein.-Nassauische Bergwerks u. Hutten A.-G. Retorts for distilling zinc and like volatile metals. April 26.

29,184 (1910). Durville. Aluminium bronze. April 26.

XI.—ELECTRO-CHEMISTRY.

Applications.

9633. Imray (Shawinigan Carbide Co.). Electrodes for electric furnaces.* April 20.

9649. Benkö. Carbon electrode for galvanic batteries.* April 20.

9652. Bussey (Planiawerke A.-G. f. Kohlenfabr. Ratibor). Carbon electrode for electric furnaces.* April 20.

10,142. Threlfall. Electrolytic cells.* April 26.

10,156. Benkö. Electrolytic cells.* April 26.

10,231. Röchling'sche Eisen und Stahlwerke, and Rodenhauser. Electric furnaces. [Ger. Appl., Dec. 13, 1910.]* April 27.

Complete Specifications Accepted.

9858 (1910). Reid. Material for electrical insulation. April 26.

9897 (1910). Härdén. Electric furnaces. April 26.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Application.

10,368. Boult (A/S Norske Titanfarve-Verker). Manufacture of yellow pigments from ilmenite or titaniferous iron ores.* April 28.

Complete Specification Accepted.

26,835 (1910). Bergmann und Simons, and Lindgens und Söhne. Conversion of metallic lead into lead oxide. May 3.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

9600. Bridge. Machines for washing, macerating, creping, and similarly treating india-rubber.* April 20.

9721. Perkin and others. *See under* XX.

9722. Perkin, Weizmann, Matthews, and Strange. Synthetic manufacture of caoutchouc-like bodies. April 26.

10,216. Heistrich Nachf. Extraction of india-rubber. [Ger. Appl., July 23, 1910.]* April 27.

10,420. Desouches, Riasse, and Duron. Manufacture of artificial india-rubber or similar elastic material. [Fr. Appl., Nov. 28, 1910.]* April 29.

Complete Specification Accepted.

26,932 (1910). Dogny and Henri. Manufacture of mixtures of caoutchouc and other plastic substances. April 26.

XV.—LEATHER; BONE; HORN; GLUE.

Application.

9462. Voedisch, Streets, and Kreismann. Removal and recovery of chrome salts from leather, leather scrap, or offal.* April 18.

Complete Specification Accepted.

21,750 (1910). Bartels. Manufacture of horn substitutes from casein. April 26.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

9412. Epstein. Maturing or the like. April 18.

9774. MacFarlane. Malt extracts. April 22.

Complete Specifications Accepted.

9980 (1910). Steffen. Manufacture of alcohol and nourishing food for animals from potatoes. May 3.

12,736 (1910). Guillaume. *See under* I.

3245 (1911). Hoffmann. Preparation of brewers' wort. May 3.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

9478. Deutsche Milchwerke. Production of albumen from Japanese soya. [Ger. Appl., April 18, 1910.]* April 18.

9660. Nogier. Apparatus for sterilising liquids by ultra-violet rays. [Fr. Appl.. Dec. 22, 1910.]* April 20.

9680. Enock. Manufacture of food products from the soja bean. April 21.

10,215. McDougall, McDougall, and McDougall. Insecticides, sheep dips, vermifuges, etc. April 27.

10,233. Von Skorzewski. Increasing the disinfecting effect of the smoke of vegetable cakes. [Ger. Appl., April 27, 1910.]* April 27.

10,381. Huband and Huband. *See under* XX.

10,382. Huband and Huband. Manufacture of a flavouring base from butter. April 29.

Complete Specifications Accepted.

850 (1910). Schmidt. Water purification apparatus. April 26.

9980 (1910). Steffen. *See under* XVIII.

25,882 (1910). Henri, Helbronner, and von Recklinghausen. Apparatus for destroying bacteria in water-supply systems. May 3.

2735 (1911). Billon-Daguerre. Integral sterilisation of liquids, gases, etc. May 3.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

9721. Perkin, Matthews, and Strange. Manufacture of dihalogen derivatives of paraffin hydrocarbons and of caoutchouc-like bodies therefrom. April 21.

9740. Meister, Lucius, und Brüning. Manufacture of 1-*p*-dimethylaminophenyl-2.3.4 - trimethyl - 5 - pyrazolone. [Ger. Appl., May 4, 1910.]* April 21.

10,381. Huband and Huband. Production of highly concentrated essences. April 29.

10,427. Wessigk. Extraction of oils from citrus and other like fruits. April 29.

Complete Specifications Accepted.

10,361 (1910). Ostwald and Ostwald. Regulation of changes in organic bodies due to autoxidation and polymerisation. April 26.

13,756 (1910). Plimmer. Manufacture of a therapeutic substance. May 3.

24,865 (1910). Heinrici. Production of alkaloids from the poppy and related plants. April 26.

27,049 (1910). Schrauth and Schoeller. Manufacture of mercurised compounds of carboxylic esters. May 3.

28,871 (1910). Ges. f. Chem. Industrie in Basel. Manufacture of salts of halogenised fatty acids of high molecular weight. April 26.

877 (1911). Muller. Manufacture of products of yohimbine. May 3.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

9511. Jacobs. Printing photographs on aluminium, copper, tin, silver, or their alloys. April 19.

10,390. Johnson and Holt. Photographic printing paper, plates, and films. April 29.

Complete Specifications Accepted.

12,252 (1910). Sury. Colour photography on paper from one plate. May 3.

25,751 (1910). Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Process of intensifying or toning silver-salt photographic images. May 3.

XXII.—EXPLOSIVES; MATCHES.

Applications.

9742 and 9743. Ceipek. Manufacture of safety explosives.* April 21.

Complete Specification Accepted.

22,030 (1910). Himalaya. Manufacture of safety explosives. May 3.

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Birmingham Section.

Meeting held at Birmingham University on Thursday, March 2nd, 1911.

T. SLATER PRICE, D.SC., PH.D., F.I.C., IN THE CHAIR.

THE ESTIMATION OF SULPHIDES IN ALKALI CYANIDE.

BY E. C. ROSSITER, A.C.G.I., F.I.C.

During the past year it became apparent that the methods of estimating sulphide in alkali cyanide were apt to produce very different results when employed by different operators in different parts of the world. I therefore commenced an examination of the various methods employed, with the object of ascertaining the reason for these differences, and of determining the respective accuracy of each method; and the following notes contain the results of experiments which have been made with this object in view.

The examination has been confined to three methods, one of which has been described by T. Ewan (this J., 1909, 10) with whom (by the courtesy of the Cassel Cyanide Company) I was enabled to compare notes during the early stages of these experiments. The second is that described by G. W. Williams (J. Chem. Metall. Soc. S. Africa, 1905, 6, 170; this J., 1906, 137); and much used on the Rand, and the third, one which has been used in the Laboratory of the British Cyanides Company, and which I shall call the "mercury method."

I would here point out that as commercial sodium cyanide (130 per cent. KCN) contains from 0·01 per cent. to 0·05 per cent. of sodium sulphide, and as the presence of larger quantities than this in the cyanide is considered, by certain consumers, to be deleterious to its use for gold extraction, it is of great importance that an accurate method of determining small quantities of sulphide should be forthcoming.

The Mercury method depends on the insolubility of mercuric sulphide in cyanide solutions. A saturated solution of mercuric chloride (5 c.c.) is added to the solution of the cyanide (10 grms. in 50 c.c. of air-free water) and the mixture warmed until the mercuric sulphide has coagulated. When the method was first used the mercuric sulphide was collected on a Swedish filter paper, washed with water, dried at 110° and weighed, and a correction was made by adding 0·01 per cent. of sodium sulphide to the result.

The Williams method is described as follows:—"Two portions of 5 grms. each of the sample to be tested are dissolved in 100 c.c. of previously boiled distilled water. To one portion about 0·5 grm. of lead carbonate is added, the liquid well shaken for a few minutes and filtered, the filtrate forming a check solution free from sulphides, but otherwise, especially with regard to incidental impurities, similar to the actual sample to be tested. 50 c.c. of each solution are then placed in Nessler tubes, and 1 c.c. of alkaline plumbate, prepared by digesting litharge in 5 per cent. sodium hydroxide solution is added. A solution of sodium sulphide containing 1 mgrm. per c.c. is added to the check solution from a burette until the colour in the two tubes is matched. The colour is distinct and immediately attains its maximum intensity" (this J., 1906, 137).

Dr. Ewan describes his method as follows:—"10 grms. of the powdered cyanide are stirred quickly with 15 c.c. of ordinary water breaking up any lumps with a glass rod, any small undissolved residue usually goes into solution during the titration; lead nitrate solution is then run in quickly so long as it produces a visible increase of colour, after this it is added gradually, the solution is tested by placing drops of it in contact with drops of lead nitrate solution absorbed by thick blotting paper. The result is corrected by multiplying it by 1·25 or, more simply, by using a lead nitrate solution containing 2·4 grms. per litre and taking 1 c.c. of it as equivalent to 0·01 per cent. of potassium sulphide (=0·0071 per cent. of sodium sulphide) in the cyanide" (this J., 1909, 12).

Of these three methods two are open to the criticism that a correction has to be made in order to obtain a sufficiently accurate result, while an examination of the Williams method at Oldbury disclosed the fact that the strengths of the solutions mentioned above were too great for cyanides containing more than 0·02 per cent. of sodium sulphide, because a precipitate of lead sulphide was formed which made it impossible to compare the coloration of the two solutions. Moreover, when a smaller quantity of cyanide (2 grms. in 100 c.c.) is taken the following results, which were obtained by myself and two of my assistants, show that this method suffers under the disadvantage of most colorimetric methods in that the personal equation largely determines the results obtained.

SERIES 1.

Sodium sulphide added.	Sodium sulphide found.	Error.	
per cent.	per cent.	per cent.	
0·0123	0·0140	+0·0017	By E. C. R.
0·0157	0·0167	+0·0010	
0·0228	0·0269	+0·0041	
0·0175	0·0193	+0·0018	
0·0254	0·0210	−0·0044	By H. F.
0·0223	0·0207	−0·0016	
0·0207	0·0186	−0·0021	
0·0223	0·0196	−0·0027	By W. D.
0·0284	0·0217	−0·0067	

In view of the defects in all three methods I endeavoured to ascertain the causes to which they were due. As Dr. Ewan has pointed out that his method is influenced by atmospheric oxidation, and as oxidation probably affects all three methods, more or less, the following experiments to determine the effect of oxidation on the sulphide in cyanide were made.

The preparation of cyanide free from sulphide.—For these experiments it was necessary to prepare a solution of cyanide free from sulphide and lead. A large sample of cyanide was taken and the sulphide estimated in it by either of the three methods. 500—1000 grms. of this sample were then dissolved in air free water and treated with the calculated quantity of lead nitrate or lead acetate. After thorough mixing a small portion of the solution was filtered and the clear filtrate tested for lead or sulphide, and according as the presence of lead or sulphide was detected, a standard solution of sodium sulphide or lead nitrate or acetate was added, until after filtration a sample of the solution showed no coloration on the addition of either sodium sulphide or lead nitrate or acetate solution. The solution was then filtered and made up to volume as required. As will be shown later on the presence of nitrate has the effect of greatly accelerating the oxidation of the sulphide so that, except where otherwise stated, lead acetate was used to prepare cyanide free from sulphide.

Limits of accuracy.—The value of a cyanide solution so prepared depends on the accuracy with which the presence of sulphide and lead can be detected. This was determined as follows:—200 c.c. of the sulphide and lead free cyanide solution, containing 100 grms. of cyanide, were treated with a standard sodium sulphide solution until a distinct coloration of sulphide of lead was obtained when about 2 c.c. of the solution were treated with a drop of lead nitrate solution in a test tube. 0·2 c.c. of sulphide solution was required, containing 0·000174 grm. of sodium sulphide, that is less than 2 per 1,000,000 of sulphide can be easily detected. Another 200 c.c. of the cyanide solution were then treated in the same manner with standard lead nitrate and a distinct reaction for lead was observed with 0·2 c.c. of the lead nitrate solution containing lead nitrate equivalent to 0·00013 grm. of sodium sulphide, that is less than 2 per 1,000,000 of the lead equivalent can be easily detected. These quantities are within the limit required for the determination of sulphide by the methods described in this paper.

Oxidation of the sulphide in solutions of cyanide.—When a solution of cyanide containing from 10 to 20 grms., or even more, in 500 c.c. of water which has not been previously freed from air, is allowed to remain exposed to the air for a comparatively short time, all the sulphide is oxidised, and the addition of a solution of lead causes no coloration to appear. If, however, the cyanide is dissolved in a closed flask in water which has been previously freed from air, by boiling it in the usual two flask arrangement, then the oxidation which takes place when this solution is allowed to remain exposed to the air in lots of 50 c.c. in Nessler cylinders is remarkably slow. This is plainly evident from the results tabulated in Series 2, in which the sulphide was determined by Williams method (modified as described later on), in four pairs of samples of 50 c.c. each in Nessler cylinders. Three separate sets of cyanide solution were thus examined.

SERIES 2.

Time exposed to the air in minutes.	Sodium sulphide.	Oxidation.
	per cent.	per cent.
(1) 5	0·0289	0
15	0·0289	0
30	0·0229	20·7
60	0·0289	0
(2) 5	0·0341	0
15	0·0305	10·5
30	0·0294	13·7
60	0·0294	13·7
(3) 5	0·0341	0
30	0·0341	0
60	0·0329	3·5
90	0·0305	10·5

As an estimation takes at the most only 15 minutes, it is evident from these results that provided the water used is free from air the influence of oxidation can be neglected.

Further light on the oxidation of the sulphide was obtained during the experiments on the Ewan method and on the Mercury method.

Dr. Ewan states that the results obtained by titration with lead nitrate should be corrected by +20 per cent. to obtain the correct figure, and he concludes from his experiments that this correction is necessary to compensate for the oxidation which takes place. My experiments confirm this to some extent, but as will be apparent later, they point to the influence of oxidation affecting the result by +10 per cent. more nearly than +20 per cent. Measured quantities of standard sodium sulphide solution were added to portions of cyanide solution freed from sulphide by lead nitrate, and the sulphides titrated by standard lead nitrate as described by Dr. Ewan making a correction of +20 per cent. All the results were low, the mean error being − 8·1 per cent. of the sulphide present (Series 7). A similar solution of cyanide was then freed from sulphide by precipitation with lead acetate and another series of experiments made with it. All the results, when a 20 per cent. correction was used, were then high, the mean error being +10 per cent. (Series 7). A similar result was obtained when examining the mercury method, the error in the presence of nitrate being −14 per cent., and in the absence of nitrate −4·5 per cent. (see Series 3). It seems fair to assume from these results that oxidation is accelerated in the presence of nitrate and that in the absence of nitrate or other oxidising agent, the effect of oxidation by exposure of the solution to the air can be neglected. This accelerating action of the lead nitrate was pointed out by Dr. Ewan.

Estimation of the sulphide by the mercury method.—From the results of the experiments described above it appeared that the effect of oxidation could be disregarded as far as this method was concerned, and on examining the causes which made a correction of 0·01 per cent. necessary I found that the cyanide solution dissolved some of the filter paper. Previous extraction of the filter papers with cyanide solution did not remedy this. Various other filtering materials were tried, but all were found to be more or less soluble in cyanide solution.

The method adopted finally is as follows:—10 grms. of the cyanide are dissolved in 50 c.c. of air free water and filtered, and 5 c.c. of a saturated solution of mercuric chloride added. The mixture is warmed until the mercuric sulphide has thoroughly coagulated. It is then cooled and made just acid with hydrochloric acid (1 acid to 1 water), whereby the filtration is made in a slightly acid solution of salt and the dissolving action of cyanide on the filter paper is avoided. The precipitate is allowed to settle, and collected in a small Gooch crucible. The filter in the Gooch crucible is made by placing a double filter paper (Munktell's Swedish) under the porcelain plate, another double filter paper above the plate and finally by drawing a few filter paper fibres, in suspension, through the filter so as to stop any minute holes. The crucible and filter are dried and weighed, the precipitate collected by the aid of a vacuum of about 4 inches of mercury, and then dried at 110° and weighed.

The chief difficulty in working with this method is in making the filter bed in the Gooch crucible, and this is especially the case when dealing with cyanides containing only about 0·01 per cent. of sodium sulphide, for then the precipitate is obtained in a very finely divided state. The oxidation of the sulphide during the test must be small, for it is limited to the oxidation which takes place during the solution and filtering of the cyanide, an operation which takes from 3—5 minutes only, but unless care is taken to obtain the mercuric sulphide well coagulated and to cool the solution before adding the hydrochloric acid, sulphuretted hydrogen is evolved and the determination thereby rendered inaccurate. This evolution of sulphuretted hydrogen is due to a slight action of the hydrochloric acid on the colloidal mercuric sulphide.

The following estimations of known quantities of sulphide added to cyanide solutions previously freed from sulphide by treatment with lead nitrate and lead acetate show the degree of accuracy which may be expected by the mercury method and also the effect of the presence of nitrate on the results.

SERIES 3.

Actual sodium sulphide.	Found.	Error.
With Cyanide freed	from sulphide with	lead nitrate.
per cent.	per cent.	per cent.
0·032	0·030	−0·002
0·024	0·020	−0·004
0·028	0·022	−0·006
0·036	0·031	−0·005
0·035	0·040	+0·005
0·019	0·015	−0·004
0·023	0·019	−0·006
0·029	0·023	−0·006
With Cyanide freed	from sulphide with	lead acetate.
0·0230	0·0200	−0·0030
0·0230	0·0208	−0·0022
0·0320	0·0302	−0·0018
0·0320	0·0286	−0·0034
0·0363	0·0353	−0·0010
0·0273	0·0282	+0·0009
0·0273	0·0285	+0·0012
0·0363	0·0356	−0·0007

Estimation of the sulphide by the Williams method.—The objection to this method has already been described as depending on the operator's ability to match the colours in the two solutions. This difficulty is probably due to the conditions of the formation of the colloidal lead being different, in one case the lead solution is added to the sulphide solution, when a clear orange brown coloration is caused, and in the other the sulphide solution is added to the lead solution, when the colour is greyish brown and slightly turbid. To avoid this difference the method was therefore modified as follows:—

A preliminary test is made and the quantity of standard sulphide solution noted; a further 2 grms. of the cyanide sample are then taken and divided into halves as usual, but before adding the alkaline lead solution, the standard sulphide solution is added to the half of the cyanide treated with lead carbonate up to within 0·3 to 0·2 c.c. of the amount required in the preliminary test and the alkaline lead solution is then added to both halves and the titration finished until the coloration of the two solutions is equal. The colorations in the two halves of the solution are then both clear orange brown and can be more easily compared. I also prefer to use a standard sulphide solution containing about 0·0002 grm. of sodium sulphide per c.c., that is one-fifth the strength recommended by Williams. The results obtained were accurate as is seen by Series 4.

SERIES 4.

Cyanide taken for each test 2 grms.

Sodium sulphide added.	Sodium sulphide found.	Error.
per cent.	per cent.	
0·0200	0·0200	0
0·0256	0·0252	−0·0004
0·0268	0·0268	0
0·0346	0·0360	+0·0014
0·0296	0·0277	−0·0019
0·0245	0·0249	+0·0004
0·0300	0·0296	−0·0004
0·0231	0·0203	−0·0028

Even with the weak (·0002) standard sulphide solution only from 1 to 1·9 c.c. of the sulphide solution was used for each titration. The end point must therefore be determined to within about 0·1 c.c. in order to get within a 6 per cent. error. As a rule this can be done but it is an objection to the method that such a small difference in the amount of standard sulphide solution can make so large a difference to the result.

Estimation by the Ewan method.—This method is used at the works of the British Cyanides Company, as follows: 10 grms. of cyanide are weighed into a Nessler cylinder 1¼ inches diam. and 15 c.c. of tap water or 50 c.c. of water free from air are added. Without waiting for the cyanide to dissolve the solution is titrated with a solution of lead nitrate containing 2·7 grms. of lead nitrate per litre. The cyanide dissolves as the titration proceeds and the solution is accelerated by grinding with a glass rod having a boss melted on to the end. The end point is determined when a drop of the solution on thick filter paper no longer shows sulphide when brought into contact with a drop of lead nitrate solution. In finding the end point, the colour of the lead sulphide takes a little time to develop, but the titration is not delayed for this; when the titration is approaching the end point the lead nitrate is added 0·1 c.c. at a time, and after each addition, a test is made on filter paper strips, which are afterwards examined, the end point being taken at 0·1 c.c. above that at which a coloration of lead sulphide is finally detected. The lead nitrate solution is taken as equal to 3 grms. of lead nitrate per litre or 1 c.c. =0·0071 per cent. of sodium sulphide on the cyanide sample: that is a correction of +10 per cent. is made.

I have attempted to estimate the necessary correction, and to determine the causes, which make this correction necessary, in the following ways. A determination of the quantity of sulphide which it is possible to detect in cyanide solution by bringing a drop of the solution in contact with lead nitrate on filter paper was made by taking 10 grms. of cyanide, freed from sulphide by lead acetate, in 50 c.c. of air free water and saturating it with hydrogen, then adding standard sulphide solution drop by drop until a drop showed sulphide with a drop of lead nitrate on filter paper. Two experiments showed that 1·7 c.c. of a sulphide solution containing 0·000175 grm. of sodium sulphide per c.c. were required. This means that, when testing a cyanide containing 0·02 per cent. of sodium sulphide, the result may be low by 6 per cent. owing to the limit of sensitiveness in determining the end point.

A comparison was then made of the sodium sulphide solution, the lead nitrate, and the standard iodine solution used for standardising the sulphide solution. A concentrated sodium sulphide solution was prepared from electrolytic caustic and sulphuretted hydrogen, and from this the standard solution was obtained by adding 5 c.c. to 2 litres of water previously freed from air. It was carefully standardised with iodine making the titration in a closed flask and determining the correction necessary for any thiosulphate by titration with iodine, after treatment with lead carbonate. During the titration with iodine no water was added other than that already present in the sulphide solution.

200 c.c. of the sulphide solution were then treated with the quantity of powdered lead nitrate calculated from the iodine titration and the mixture examined for excess of sulphide or lead. Three experiments were made and in only one was there excess of either, when sulphide amounting to 0·58 per cent. was present.

The sulphide solution was then titrated with the standard lead solution. But the lead sulphide would not coagulate completely as it does in the presence of cyanide, and it was necessary to filter a small portion of the solution in order to determine the end point. In consequence the titration took about 30 mins. to complete, giving the sulphide ample opportunity to oxidise.

The results were as follows:—

SERIES 5.

By Iodine.	By Lead Nitrate solution sodium sulphide in 1 c.c.	Error Sulphide present.
		per cent.
0·000858	0·000693	—19·2
0·000858	0·000747	—12·9
0·000858	0·000769	—10·3
	Mean	—14·1%

These results show that when powdered lead nitrate is used to estimate sodium sulphide in solution a correct result is obtained, which was to be expected, and that with lead nitrate solution, where the mixture remains with excess of sulphide for some time oxidation takes place, and after 30 mins. this oxidation amounts to about 14 per cent.

The method of estimation with powdered lead nitrat described later on was then employed for determining the correction which is necessary in the Ewan method.

The following results were obtained:—

SERIES 6.

Sodium sulphide by addition of solid lead nitrate.	Sodium sulphide by the Ewan method allowing 20% as correction.	Difference.
per cent.	per cent.	per cent.
0·0482	0·0530	+ 9·0
0·0267	0·0333	+16·0
0·0324	0·0350	+ 8·0
0·0303	0·0330	+ 8·9
0·0304	0·0369	+21·0
0·0314	0·0361	+14·9
0·0322	0·0390	+21·0
0·0340	0·0397	+16·7
Mean difference		+14·4

When these results are considered in conjunction with those obtained in Series 9, which show that the method of treatment with solid lead nitrate gives accurate results, it appears that the Ewan method with a +20 per cent.

correction gives results too high by about 14 per cent. or the correction should be about +6 per cent.

Further experiments were then made to determine the necessary correction as follows:—

A solution of cyanide was prepared containing 10 grms. in 50 c.c. of air free water and was freed from sulphide by precipitation with the exact quantity of lead nitrate. A similar solution was also made in which the sulphide was precipitated by lead acetate. Lots of 50 c.c. of these solutions were taken, a known quantity of sulphide added and this sulphide estimated by titration with the standard lead nitrate making a correction of +20 per cent. The following results were obtained:—

SERIES 7.

Sodium sulphide added.	Sodium sulphide found allowing 20 per cent. correction.	error on sulphide present.
With Cyanide	freed from sulphide by	lead nitrate.
Per cent.	per cent.	Per cent.
0·0271	0·0232	− 14·3
0·0340	0·0319	− 6·2
0·0443	0·0426	− 3·9
	Mean error	− 8·1
With Cyanide	freed from sulphide by	lead acetate.
0·0448	0·0482	+ 7·6
0·0411	0·0447	+ 8·8
0·0358	0·0411	+14·8
0·0297	0·0319	+ 7·5
0·0243	0·0277	+13·9
	Mean error	+10·1

The influence of nitrate on the results is most marked. And as cyanides do not contain nitrate the necessary correction should be calculated from those results in which lead nitrate was not used to prepare the cyanide free from sulphide. The series of results obtained by treatment of cyanide samples with solid lead nitrate agree very closely with those obtained in the preceding series, as follows:—

From Series 6 with solid lead nitrate the correction + 6 per cent.
From Series 7 the correction +10·1 per cent.
Mean + 8·0 per cent.

In order to have a convenient working figure for the Ewan method, I take 10 per cent. as the necessary correction and use a lead nitrate solution containing 2·7 grms. of lead nitrate per litre. 1 c.c. of this solution is then taken as equal to 0·0071 per cent. of sodium sulphide on the cyanide sample.

I have, however, noticed that the determined correction varies considerably. The preceding figures were obtained in the summer with a good light, but when I determined my correction in the winter I found it to be +15 per cent. Three of my assistants obtained corrections of +11 per cent., +15 per cent. and +19 per cent. respectively. It is therefore necessary for each operator to determine his own personal error from time to time before using the method.

Influence of light on the estimation.—There remains one important condition to be discussed in regard to this method and that is the question of light. It is evident from the end point being determined by allowing a drop of the test solution to run into a drop of lead solution on filter paper that it is necessary to be able to detect a very faint yellow stain of lead sulphide on the white filter paper. To do this a good light is necessary. The following determinations were made to obtain some idea of the difference in the results obtained in good daylight and in incandescent light.

SERIES 8.

Test by daylight, sodium sulphide	Test by gas-light, sodium sulphide	Difference.	difference.
per cent.	per cent.		per cent.
0·051	0·036	−0·015	29
0·053	0·037	−0·016	35
0·033	0·028	−0·005	15
0·033	0·029	−0·004	12
0·033	0·030	−0·003	9

These results show how necessary it is to have good daylight for this method and that probably results obtained on dull days have a tendency to be low.

Estimation of sulphide with powdered lead nitrate.—It will be seen from the foregoing experiments that the estimation of sulphide in the presence of alkali cyanide by means of solid powdered lead nitrate was likely to give accurate results, and I therefore proceeded to test this as follows:—

A solution of cyanide freed from sulphide by means of lead acetate was prepared, and to 200 c.c. of this solution containing 100 grms. of cyanide, a known quantity of sodium sulphide was added. This sulphide was then estimated by adding a slight excess of solid lead nitrate and titrating the excess of lead nitrate with a standard sulphide solution. The end point was determined when, after filtering, a small quantity of the mixture no longer showed the presence of lead on the addition of sulphide. The following results were obtained:—

SERIES 9.
100 grms. of cyanide taken for each titration.

Sodium sulphide added.	sodium sulphide found.	Error.	Error on sulphide present.
Per cent.	Per cent.		Per cent.
0·03550	0·03487	−0·00063	1·8
0·02667	0·02570	−0·00097	3·6
0·04445	0·04429	−0·00016	0·4
0·03111	0·03060	−0·00051	1·6
0·03478	0·03548	+0·00070	2·0
0·02609	0·02557	−0·00052	2·0

These results are remarkably even and as good as can be desired, and I therefore proceeded to subject this method to the following severe test:—

Nine samples of cyanide were taken of which six were tested by me and six by one of my assistants independently of one another. The results were handed in sealed envelopes to Mr. Kenneth Chance together with the samples. He then obliterated the marks on the sample and returned them under new marks for re-test without disclosing the original tests. The re-tests were then handed to Mr. Chance as before in sealed envelopes and the following table shows the results of all the tests made.

SERIES 10.

Sample.	Tests by E. C. R.		By H. J. H.		Mean test.	Maximum variations.	Difference from mean.	
	Original.	Re-test.	Original.	Re-test.			Actual.	Per cent.
1.	0·0169	—	0·0182	—	0·01755	0·0013	0·00065	3·7
2.	0·0347	—	0·0360	0·0345	0·0351	0·0015	0·0009	2·6
3.	0·0274	0·0300	0·0290	—	0·0288	0·0026	0·0014	4·9
4.	0·0125	0·0110	—	—	0·01175	0·0015	0·00075	6·4
5.	—	0·0155	0·0168	—	0·01615	0·0013	0·00065	3·9
6.	0·0686	—	—	0·0677	0·06815	0·0009	0·00045	0·7
7.	—	0·0208	0·0207	—	0·02075	0·0001	0·00005	0·2
8.	0·0174	—	—	0·0165	0·01695	0·0009	0·00045	2·6
9.	—	—	0·0227	0·0206	0·02165	0·0021	0·00105	4·8
					Average difference from mean	.. ..	0·0007	3·3

There is no doubt that these results would have agreed more closely but for the great difficulty of sealing up a large sample of cyanide so that no trace of moisture is present, for in the presence of moisture the sulphide in a cyanide sample is slowly oxidised. In every case but one the re-test after the samples had been kept several days came lower than the original, and this was especially the case in the samples Nos. 4 and 9 where there was a slight vacuum in the sample bottles when opened.

All these tests were made during the month of January, and no regard was paid to the question of light, the tests being carried out when required whether it happened to be in daylight or gaslight, and the close agreement of these results speaks highly for the accuracy of the method.

Comparison of the four methods.—I then proceeded to compare the accuracy of the four methods which I have described.

Five samples of commercial cyanide were taken and tested by all four methods by my assistant and myself independently with the following results:—

The close agreement of the tests by the solid lead nitrate method with one another and with the mean of all the tests is worthy of note and led me to undertake a further comparison of the four methods as follows:—

A solution of cyanide was prepared free from sulphide and lead, and to portions of this solution known quantities of sulphide were added by one of my assistants, and I then made the determination with the results which appear in Series 12. In the same manner I gave to one of my assistants cyanide solutions containing known quantities of sulphide and his results are also included.

SERIES 11.

Percentage of sodium sulphide in the cyanide.

Sample No.	Ewan method.		Mercury method.		Williams method.		Solid lead nitrate.		Mean of tests by solid lead nitrate.
	E. C. R.	H. J. H.	E. C. R.	H. J. H.	E. C. R.	H. J. H.	E. C. R.	H. J. H.	
A	0·0192	0·022	0·0218	0·020	0·0195	0·0193	0·0207	0·0195	0·0201
B	0·0234	0·026	0·0299	0·025	0·0234	0·0239	0·0246	0·0232	0·0239
C	0·0192	0·021	0·0201	0·015	0·0179	0·0185	0·0199	0·0210	0·0204
D	0·0234	0·026	0·0252	0·021	0·0228	0·0229	0·0237	0·0235	0·0236
E	0·0270	0·023	0·0245	0·035	0·0217	0·0248	0·0265	0·0261	0·0263

Taking the last figure, *i.e.* the mean of the two tests by the solid lead nitrate method as the correct test the following table shows the variations from this figure.

A	− 0·0009	+ 0·0019	+ 0·0017	correct	− 0·0006	− 0·0008	+ 0·0006	− 0·0006	
B	− 0·0005	+ 0·0021	+ 0·0060	+ 0·0011	− 0·0005	correct	+ 0·0007	− 0·0007	
C	− 0·0012	+ 0·0006	− 0·0003	− 0·0054	− 0·0025	− 0·0019	− 0·0005	+ 0·0006	
D	− 0·0002	+ 0·0024	+ 0·0016	− 0·0026	− 0·0008	− 0·0007	+ 0·0001	− 0·0001	
E	+ 0·0007	+ 0·0017	− 0·0018	+ 0·0087	− 0·0046	− 0·0015	+ 0·0002	− 0·0002	

SERIES 12.

Powdered lead nitrate method.

Results by E. C. R.			Results by H. J. H.		
Sodium Sulphide added.	Sodium Sulphide found.	Error.	Sodium sluphide added.	Sodium Sulphide found.	Error.
per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
0·0310	0·0322	+ 0·0012	0·0270	0·0281	+ 0·0011
0·0250	0·0250	0	0·0230	0·0238	+ 0·0008
0·0210	0·0216	+ 0·0006	0·0200	0·0194	— 0·0006
0·0170	0·0183	+ 0·0013	0·0250	0·0201	+ 0·0011
0·0290	0·0286	— 0·0004	0·0300	0·0306	+ 0·0006
Williams' method.					
0·0281	0·0286	+ 0·0005	0·0318	0·0297	— 0·0021
0·0387	0·0360	— 0·0017	0·0275	0·0254	— 0·0021
0·0323	0·0318	— 0·0005	0·0212	0·0223	+ 0·0011
0·0254	0·0254	0	0·0297	0·0276	— 0·0021
0·0371	0·0392	+ 0·0021	0·0233	0·0212	— 0·0021
Ewan's method.					
0·0260	0·0241	— 0·0019	0·0299	0·0297	— 0·0000
0·0388	0·0376	— 0·0012	0·0171	0·0195	+ 0·0024
0·0175	0·0177	+ 0·0002	0·0222	0·0240	+ 0·0020
0·0299	0·0291	— 0·0008	0·0256	0·0257	+ 0·0001
0·0299	0·0277	— 0·0022	0·0342	0·0335	— 0·0007
Mercury method.					
0·0163	0·0175	+ 0·0012	0·0199	0·0212	+ 0·0013
0·0318	0·0292	— 0·0026	0·0318	0·0309	— 0·0009
0·0238	0·0279	+ 0·0041	0·0238	0·0212	— 0·0026
0·0186	0·0235	+ 0·0049	0·0258	0·0212	— 0·0046
0·0242	0·0272	+ 0·0030	0·0358	0·0356	— 0·0002

Summary.—When I commenced the examination of the various methods of determining the quantity of sulphide present in alkali cyanides which I have described in this paper, I was under the impression that by the mercury method estimations could be made at least as accurately as by any other method, and that it might, therefore, be recommended for standard use, as it had not the defects of the other two methods in the liability to differences in tests due to circumstances beyond the control of the operator. This investigation, however, has shown that the estimation of sulphide by a mercury salt cannot be relied upon for a greater degree of accuracy than 0·005 per cent. of sodium sulphide.

On the other hand, provided that sufficient care is taken to insure the formation of the lead sulphide in a colloidal form the Williams method may be relied upon to within 0·0025 per cent. of sodium sulphide, and the test recommended by Dr. Ewan gives results of an equal degree of accuracy, when the "personal error" of the operator has been determined beforehand. But both these methods remain open to the criticism that the determinations made by them are influenced by external circumstances such as the light in the laboratory and the individuality of the operator, and I consider that for standard use they are to that extent unsatisfactory.

I therefore submit that what I have termed the powdered lead nitrate method of estimation has advantages over these other methods in that it can be relied on to determine the quantity of sulphide present to about 0·001 per cent. or one part in 100,000, that it is not influenced by circumstances external to the test, and that the large quantity of cyanide used in the test decreases the chance of error due to sampling. The process is best carried out as follows:—

The sample of cyanide is tested by the Ewan method, and from the result obtained the quantity of lead nitrate required to precipitate the sulphide in 100 grms. of the sample is calculated. 100 grms. of the sample are weighed out and treated with about 10 per cent. more lead nitrate than is required to precipitate the sulphide and 200 c.c. of air free water. The mixture is stirred and gently warmed in a beaker until all the cyanide is dissolved: a small quantity is then filtered into a test tube and a drop of standard sodium sulphide solution added in order to prove the presence of excess of lead nitrate. If excess of lead nitrate is not present, then another 100 grms. of the cyanide sample must be treated with a larger quantity of lead nitrate. The excess of lead nitrate is then estimated by adding standard sodium sulphide until a small sample of the solution after filtration no longer shows a trace of lead on the addition of a drop of sulphide solution. If the cyanide contains only 0·015 per cent. of sodium sulphide then 150 or 200 grms. are taken for the test so that a reasonably large quantity of lead nitrate is required. The lead nitrate is finely powdered and dried in a desiccator over sulphuric acid before use. Pure lead nitrate as supplied by any reputable laboratory furnishers is used, and its purity should be tested by treatment with a carefully standardised sodium sulphide solution as described previously in this paper.

I have pleasure in acknowledging the able assistance of Mr. H. J. Hodsman in conducting the final tests of the methods and of Mr. W. C. Davis in some of the preliminary work and am indebted to the British Cyanides Co., Ltd., for permission to publish the results, and specially to Mr. Kenneth M. Chance for his suggestions in the drafting of this paper.

DISCUSSION.

Mr. F. H. **ALCOCK** suggested that the yellowish-brown colour which was assumed by silver when deposited electrolytically from cyanide containing sulphide, might be utilised as a test for the sulphide.

Mr. **ROSSITER**, in reply, said the darkened appearance of cyanide solution when titrated with silver nitrate was a good indication of the presence of sulphide. But it was not a good way of estimating sulphide because the silver sulphide was slightly soluble. He would not use sodium plumbate because it was of indefinite composition whereas lead nitrate was a definite salt which was easily obtained and weighed out. He had received a letter from Dr. Ewan with regard to the solid lead nitrate method describing some experiments he had made. He did not use boiled water, and allowing for that Dr. Ewan's results agreed well with his results. They emphasised one point: that it was advisable not to use too great an excess of lead in that method because the tendency was to get the results rather high. That was due to the fact that lead sulphide in the presence of cyanide oxidised fairly rapidly, and there was a big bulk of solution containing sulphide of lead in suspension, and if one had to make, perhaps, a dozen determinations before finding the end point some of the sulphide was inclined to oxidise, which was, of course, opposed to accurate results.

Dr. **EWAN**, in discussing his results, says:—

"It seems possible that the colloidal lead sulphide precipitated by a lead solution may be more readily oxidised than the black coagulated precipitate produced by the solid lead nitrate."

Further, in comparing the solid lead nitrate method with his own method, Dr. **EWAN** says:—

"My own method gives lower results, which may be due to the defective January light. The lower results obtained by using a larger excess of solid lead nitrate and larger quantities of (unboiled) water will doubtless be familiar to you and are of course only what is to be expected in view of your discovery of the accelerated oxidation in presence of nitrate. The 10 per cent. excess which you recommend appears to be quite safe.

"After reading the complete description of your process I take it that you do not filter off the lead sulphide before titrating back the excess of lead. Presumably using boiled water and the small excess of nitrate that is not necessary.

"The results you give regarding the variations in the personal error of different observers and the effect of light show that my method can only be regarded as a convenient way of obtaining an approximate result. In all cases where a really accurate result is required I shall in future have no hesitation in using your solid lead nitrate method, but for the large number of tests required in the daily control of manufacturing operations I would prefer my own method on account of its greater rapidity, especially since you have shown so clearly that with proper precautions it may be made sufficiently accurate. I gather that you take practically the same view of the situation."

Mr. Rossiter added that he quite agreed with Dr. Ewan as regards the lead nitrate methods.

London Section.

Meeting held at Burlington House on Monday, May 1st, 1911.

MR. E. GRANT HOOPER IN THE CHAIR.

THE TESTING OF CREOSOTE.

BY C. EDWARD SAGE, F.I.C.

The analysis of impure substances for commercial purposes must always yield unsatisfactory results if no uniform method of testing is adopted. With creosote analysis it is continually found that different chemists report results which are not in agreement, and such variations are nearly always explained when the methods of analysis are investigated.

In the United States the Department of Agriculture has done a great deal of work with the object of finding satisfactory and uniform tests for a product which is of so great importance in several industries; but in Great Britain each manufacturer or works chemist has his own particular method of testing, and every buyer, contractor or engineer has a specification which meets his own requirements.

The creosote produced in different parts of Great Britain varies in composition for three reasons:—(1) The methods of gas production or coal distillation differ; (2) The nature of the coal employed varies in each district; (3) The method of tar distillation adopted may vary in many details.

Great Britain is the chief producer and shipper of creosote, and it seems anomalous that we have no universal standard methods of analysis such as are in use in so many other chemical industries. We work on uniform lines in the testing of chemical manures, cement, tanning materials, and some oils, and at the present time there is an opportunity for tar chemists in Great Britain to unify the methods of analysis of such an important product as coal tar creosote.

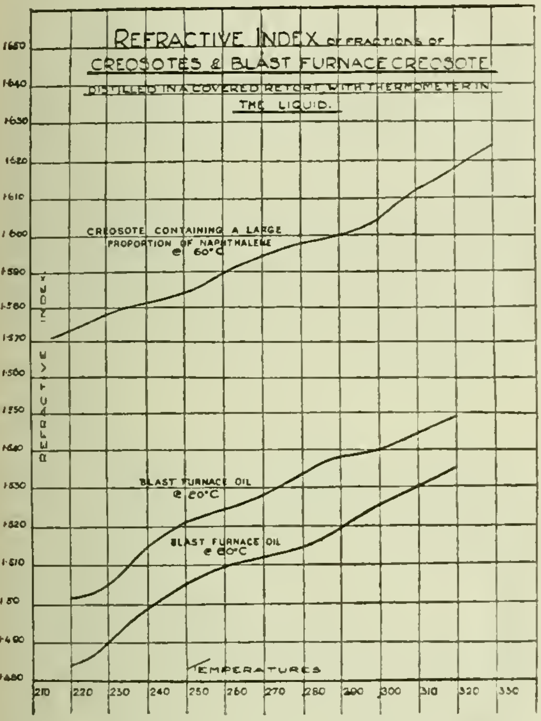
The very name "creosote" needs careful definition, for the word may be applied to a product made from gas tar, wood tar, oil gas tar, producer gas tar, and coke oven tar; and although many years ago creosote was always a wood tar product, now the name "creosote," outside of medical circles, always means the coal tar product unless it is qualified in some way.

The complete analysis and series of tests for any one sample of creosote may not all be required for the information of one of the parties who may handle or use it, but at some time the results of a complete examination will be necessary. The chief considerations in any examination are: the physical conditions of the oil, the approximate composition, and the freedom from admixture with other oil. The information is needed for the guidance of the tar distiller, the seller, the buyer, the shipping or transporting company, the insurance company, the timber creosoter, the railway engineer, or the manufacturer of disinfectants or other products. The analysis has to settle the questions, whether the oil is of suitable quality or up to standard requirements, and how best it can be handled for transport; and no information for the future guidance of timber preservers is available unless the relative proportions of the constituents of the creosote are stated.

I venture, therefore, to offer the following suggestions as the basis for a discussion of the most suitable standard to adopt.

A specification for creosote may be drawn up to suit the requirements of any particular use to which the oil is to be put, but it would be useless to try to make one uniform specification for all creosotes. The oil in some parts of Great Britain differs entirely from London creosote, so I should only attempt to standardise methods of testing and not the product, which is necessarily a mixture of impure products.

Any specification for creosote should be prefaced by the words:—"The creosote must be the product of the destructive distillation of bituminous coal and free from admixture with other oils.



Sampling.—Too much importance cannot be attached to this preliminary operation, for all the subsequent results depend upon its proper performance. To ensure an approximately uniform sample the bulk must be liquefied, and the sample should then be drawn from different parts of a tank. Not less than 6 half-gallon quantities should be removed and bulked, and then at least three separate cans should be filled and sealed. Creosote, from a number of barrels, can only be sampled with an iron, and the difficulties of attaining uniformity are greatly increased by such a method.

Buyers of creosote in any quantity should specify the method of sampling and always keep more than one sealed sample in reserve, for the repeated warming of a can always causes some variation in its water contents.

Physical tests.

Specific gravity.—To ensure uniformity this can only be taken at some higher temperature than the mean average.

Samples are often quite solid at 15° C., and I would suggest 60° C. as the most suitable. The method of ascertaining the relative density should be by weighing 100 c.c. and comparing with water at 60° C., or else by means of a Westphal balance.

Expansion coefficient.—100 c.c. of the oil should be measured into a flask marked at 100 c.c. on the neck and graduated in one-tenths of a c.c. up to 106 c.c. The volume should be first adjusted to 100 c.c. at 40° C. and the flask then warmed in a water bath to 80° C., and the volume at that temperature measured and recorded.

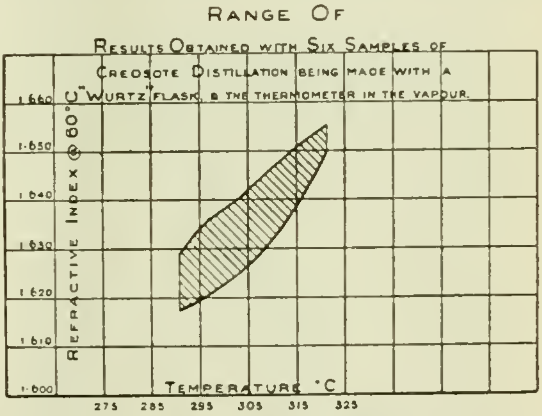
The factor most commonly employed is an expansion of 1 per cent. for a rise of every 22½ ° F., but this is not true for all creosotes or for high temperatures as well as low ones.

I have plotted the curves obtained when heating samples from 20° C. to 80° C. and the range falls within very narrow limits, and my results show that the increase in volume is 1 per cent. for each 13·3° C., or approximately 1 per cent. for every 24° F.

The American Railway Engineering and Maintenance of Way Association, in a report on wood preservation, have recommended the measurement of creosote by weight, and in dealing with barrels or small lots this is undoubtedly the more accurate method, but in dealing with tank cars the measurement of dimensions is so easy that a volume statement seems more convenient than one of weight. In either case, however, the specific gravity enables us easily to convert one into the other system.

Flash point.—Some specifications mention the Abel test, but I would point out the unsuitability of the instrument for any temperatures above 150° F. Its water jacket prevents its use above 100° C., and for that reason the Pensky-Marten apparatus is more suited to creosote. In no test for creosote is the importance of a fresh representative sample more important. A sample which has been heated up several times may give entirely different results to that obtained when it is first opened. The information is usually required by insurance companies, and it is highly important that the test be made uniformly. The oils which I have tested flashed between 186° C. and 190° C.

Fluidity or condition.—For shipping requirements it is necessary to know the condition of the creosote. It is not easy, or in some cases possible, to determine the lowest temperature at which a sample remains fluid; the creosote may not deposit any "salts" for days and then begin to solidify, or it may solidify almost as soon as it is cooled.



The requirements of the case are usually met by determining whether the whole of the oil is fluid at any selected temperature say for instance 40° C.; and, by keeping 100 c.c. of the oil at 15° C. for 6 hours and stirring occasionally after adding a crystal of naphthalene. The result can then be specified as:—"fluid," "quite solid," "some salts deposited" or any other condition which may present itself.

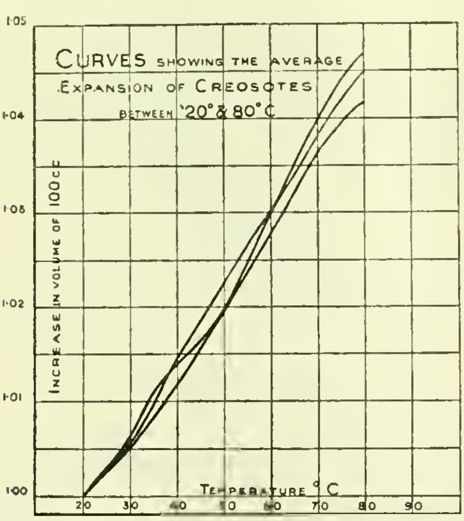
Solubility in benzol.—A limit should be set to the amount of insoluble matter. The test is easily made with creosote containing no water, but, in the presence of water, filtration is impeded. 100 grms. should be filtered, whilst hot, through a tared filter paper and the filter afterwards washed with benzol in a Soxhlet tube until the benzol runs away clean. The filter is then dried and weighed. Many samples contain only traces of insoluble carbon, but in no case should more than 0·25 per cent. be passed without comment.

Viscosity.—I have obtained no useful information from the determination of this factor, and the results are entirely dependent on the clean condition of the oil and its freedom from drops of water. When timber with a fine grain is to be creosoted, the presence of traces of insoluble carbon make far more difference than any slight difference in viscosity possibly could.

Distillation.—No test of creosote is complete without a fractional distillation of the oil, and no item of a test gives rise to more differences between buyers and sellers, because of the lack of uniformity in the method of distillation. In 1902 and during subsequent years I was engaged with Mr. T. A. Ellwood in the fractionation of both coal-tar and wood-tar creosote, for purposes which required far greater precision than the commercial tests. At that time we found a long-necked retort the best vessel to use for coal tar creosote in the preliminary distillation. For the distillation of wood tar creosote I prefer a Wurtz flask, and for blast furnace creosote the same flask with a side tube low down in the neck.

For general purposes, to meet the requirements of all grades of coal tar creosote, a retort is the most suitable vessel for the distillation, but to obtain uniform results, the retorts must be of uniform size and the position of the thermometer in the liquid must be specified.

The retorts must be of hard glass and should have a capacity of 8 fluid ounces (up to the bend), and the shape should be such as to allow a free escape of the vapours. Messrs. J. J. Griffin and Sons, Ltd., make these retorts in Rhenish glass, which stand the high temperatures required. Dean and Bateman* suggest the use of a distilling flask of the Hempel type, with a long neck and a column of beads, for fractionating the creosote, and in an earlier paper, a three-bulb distilling flask such as is used in England for the distillation of essential oils, and known as a Schimmel three-bulb flask. The objection to both of these is better observed in practice than it can be explained, but the chief fault is that with oils containing a very high proportion of naphthalene and varying quantities of water, the distillation must be pushed very rapidly to prevent the water carrying over naphthalene in the first fractions and to prevent the naphthalene from solidifying in the side tube.



Shrenk, Fulks, and Kanmer† advise the use of an 8 ounce retort and cover it up completely with asbestos card. They, however, put the thermometer above the liquid in the retort.

My own experience is that results agree to within 2 per cent. when the thermometer is placed in the liquid, and the results are not always so reliable with the thermometer out of the liquid, because of variations in the vapour cooled by draughts.

There is no direct relationship between the figures obtained with any sample in the two ways, with the thermometer inside and outside of the boiling liquid. One result cannot be compared with another, for no two samples agree in any particular difference between the two methods.

I therefore favour the use of an asbestos-covered retort (although a tin can with its side cut out is just as accurate) and the position of the bulb of the thermometer is to be in the liquid less than half an inch from the bottom of the retort.

To obviate corrections of temperature it is well for all workers to use thermometers of the same pattern, then we may agree to eliminate the correction needed for the emergent column or we can all use the same factor. The thermometer shohld have a range of 190° C. to 360° C.

The fractionation of creosote is made with a view of ascertaining the relative proportions of water, light oils, creosote oils, heavy oils, and undistilled residue. The presence of any considerable quantity of water causes irregular distillation of the early fractions, and for this reason it should be specified that if a creosote contains more than 1 per cent. of water, it should be first distilled to remove water and any oil which distils separated from the water and returned to the dry oil before proceeding with the distillation. The fractions collected in any particular test can be as conveniently measured as weighed, provided the measurement is made at a specified temperature. In order that all fractions shall be fluid the oil should be measured at 60° C. I have seen so many specifications for the distillation of creosote that I feel it would be useless to suggest one which would please everybody, but the most useful points are :—

Distillate up to	210° C.
,, between	210—235° C.
,, ,, ...	235—270° C.
,, ,, ...	270—315° C.
Residue not distilling at	315° C.

Water.—This is determined by measuring the volume in the first fraction distilled. Any difficulty in reading the dividing line between oil and water can be remedied by the addition of 5 c.cm. of solvent naphtha to the distillate.

Some limit should always be fixed for the amount of water in a creosote, and it is always customary to make allowance for water present in bulk shipments of oil when the amount exceeds a specified limit.

Naphthalene.—This should be estimated in the fractions distilling below 270° C., and not in the entire oil, by filtering the cooled distillate through filter cloth and pressing between bibulous paper. By this means a fairly accurate result is easily obtained. Mann* has suggested a method of determination by means of what he designates the "latent heat point." His method is useful when examining creosote of fairly uniform quality, but an admixture of other oil would upset the curve which he has plotted.

Tar acids.—These should be determined by shaking out with a 15 per cent. caustic soda solution and subsequent acidification and measurement at 60° C. The creosote itself will not yield satisfactory results and it is usually sufficient to shake out the fractions distilling up to 315° C. Phenols are present in the higher boiling fractions, but they are frequently sticky semi-solid bodies and not easily measured.

Some very precise method of stating the amount of "tar acids" is needed, for the figures given are often very misleading.

Pyridine bases are a most important factor for consideration by manufacturers of sheep dips and disinfectants. I usually determine the bases in the fractions distilling below 315°.

Residue undistilled.—This fraction of creosote may or may not have a particular interest to a purchaser. Many timber creosoting works ask for oil with a high proportion of high boiling fractions, and then it is of importance that the residue should be examined. In order that creosote may easily enter timber it is needful that it shall not contain any high proportion of pitchy residue, and so that softness of this residue may be assured it is often necessary to use a blend of creosotes.

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* U.S. Department of Agriculture: Forest Service Circular, No. 112.

† American Railway Engineering and Maintenance of Way Association, Bulletin No. 65.

* This J., 1910, **29**, 732.

Sulphonation.—In the United States, petroleum fractions are sometimes found present in creosote; English creosote cannot naturally contain any high proportions and many contracts limit the sulphonation residue to 0·25 per cent. of the creosote.

Paraffins exist naturally in the high boiling fractions of coal tar and of anthracene oil, but I have only found the following proportions in creosotes:—

London Creosote........	A.	0·05	per cent. paraffin.
,, ,, ...	B.	0·14	,, ,,
,, ,, ...	C.*	0·2	,, ,,
North of England Creosote		·3 to 5	,, ,,
Blast Furnace Creosote ..		0·3 to 0·5	per cent.
High-boiling blast Furnace Creosote		4·6	,,
,, ,, Special Creosote......		6·0	,,

The identification of paraffin is made easy by determination of the refractive index of the sulphonation residues, and the differentiation of petroleum distillates from blast furnace creosote and coal tar creosote is rendered possible also by measurement of the refractive index of the fractions of the oils.

In common with most oils, the paraffins have a refractive index verging on 1·45 at the lower limit and 1·5 at the higher one, whereas blast furnace creosote distillates obtained during testing have a range from 1·48 to 1·54, and coal tar distillates from 1·57 to 1·63 or even higher.

The method of distillation makes a great difference in the figure for refractive index at any particular temperature, but I have included in the accompanying graphs the refractive index of the fractions of six samples of creosote distilled in a Wurtz flask with the bulb of the thermometer in the vapour, and those of blast furnace creosote and coal-tar creosote distilled in a retort with the thermometer bulb in the liquid. The refractive index of paraffins can so often be taken at 20° C. that I have included the figures for blast furnace distillates at that temperature.

I feel convinced that it is safe to recommend that all creosotes which are pure coal tar distillates should conform to the following requirements:—That when distilled from an 8 ounce retort, covered during the distillation, with the bulb of the thermometer in the liquid, the fractions distilling above 300° C. should have a refractive index above 1·6.

Creosote is so largely used for the preparation of sheep dips and disinfectants that its germicidal properties are often of first importance to purchasers. The average germicidal value of London creosotes for *B. typhosus* is nearly twice that of crystallised carbolic acid, and the tar acids contained in creosote vary within wide limits. In the course of some hundreds of tests I have been led to form the opinion that it is often the impurities in a sample which give it its specific bactericidal properties, and not so much the percentage of "tar acids." As a fungicide it is difficult to measure comparatively the value of creosote, but I am only anticipating matters slightly when I state that a biological test of creosote will be needed in the near future.

In conclusion I have to thank Mr. Wallace C. Nickels for much valuable information, and to express my indebtedness to the Governors of Battersea Polytechnic for many facilities which they have afforded me during the preparation of my paper.

Discussion.

Mr. V. **Blagden** asked Mr. Sage to explain whether the last method which he described would detect the presence of blast furnace creosote mixed with coal tar creosote. That matter would interest the trade very materially, and if Mr. Sage had succeeded in discovering a reliable and easy test on that point they would all be deeply grateful to him.

Dr. J. **Lewkowitsch** said he was not quite sure whether the author put these methods forward as methods that ought to be adopted. He gathered Mr. Sage laid rather more stress upon the determination of naphthalene than one would as a rule. The determination would he thought, be a faulty one, and would range within very wide limits; he would, therefore, have expected Mr. Sage would have laid more stress upon the determination of the tar acids, because, rightly or wrongly, some of the value of the oil was ascribed to them, and they could be fairly easily extracted. As they all knew emulsions were obtained by shaking out with caustic soda. The method adopted 30 or 40 years ago was to dilute with low boiling tar fractions and use caustic soda solutions of low specific gravity. Then a clear separation was obtained, all the tar acids were in the alkaline solutions, and no further difficulty was encountered. The pyridine bases would, of course, offer no difficulty. With regard to the refractive index, Mr. Blagden had already touched on the crucial point—how were they going to differentiate between mixtures? Too much reliance was still placed upon the refractometer, or rather upon the deductions from its indications, which were accurate enough; but when mixtures were obtained, one was entirely at sea and did not know how to interpret the refractive readings. In his opinion it was not worth all the trouble spent upon it. Lastly, he could not agree with the method of fixing the thermometer in the liquid and relying upon the boiling point thus obtained. The matter had been threshed out 20 or 30 years ago. The results obtained were hopelessly wrong; and, in his opinion, the best and only reliable way was to put the thermometer into the vapours as they left the vessel. By the employment of such a method he was afraid the discrepancies of which they heard were only too easily explained.

Mr. W. J. A. **Butterfield** expressed his agreement with what Dr. Lewkowitsch had said with regard to the position of the thermometer. In distilling these products he had frequently observed that a thermometer placed in the liquid would suddenly run up even 200° C., while a thermometer in the vapour would rise only some 20 or 30 degrees—that was with the higher fractions of such products. With regard to the distinction between blast furnace creosote and coal tar creosote he thought that a careful fractionation and a comparison of the specific gravities of the fractions was on the whole the best criterion of the mixture. Mr. Sage had spoken of the determination of specific gravity, and proposed to take it uniformly at 60° C. That depended upon the creosote. If the creosote were described as being free from solid crystals of naphthalene at a particular temperature, it seemed only reasonable to determine the specific gravity at that temperature. There was no object in determining the specific gravity at a much higher temperature than that at which the oil was fully liquid. The point named by the author was very convenient undoubtedly for most creosotes for pickling timber. But there were many uses for creosote oil in which it was requisite that it should be free from naphthalene crystals at a much lower temperature. He need only specify the use of the oil for washing gas for the extraction of naphthalene, and its use for thinning pitch for preparing pitch macadam for roads. A recent specification issued by a Government department mentioned a temperature of 20° C. for the determination of the specific gravity, and it prescribed that the oil should be free from solid matter, and remain so for a definite period—in that case half-an-hour was named—at the particular temperature. He agreed fully with the author that it was highly desirable that there should be a certain degree of uniformity in the methods of testing creosote oil; but the points on which uniformity rested must depend upon the specification, and he thought where the specification, for instance, said that the oil should be free from solid matter at 20° C. it was absurd to take the specific gravity at 60° C. So much must depend, in the testing, on the conditions of the specification with which the oil had to comply.

The **Chairman** said that in discussing the question he proposed more or less systematically to take the points as they had been introduced by the reader of the paper. In the first place, however, they would all agree that there were two broad classes of creosote. First, creosote which was used for the creosoting of wood, and, secondly, creosote which was intended either for such special purposes as had been alluded to by Mr. Butterfield, or for the manufacture of sheep dips and disinfectants. He did not propose to say anything about the latter class. Such creosote stood alone, and the character should depend, as Mr. Butterfield had said, upon the particular specification to which it was supplied, and that again depended upon the use to which the creosote was to be put. But if he was right in concluding that the most important use of creosote was undoubtedly that of creosoting timber, then he thought they might largely confine their attention that evening to a consideration of what were the desirable features in creosote intended for that purpose; and he was inclined to think the time had nearly come when they should take a step forward from the old position in which the matter had been very largely left up to the present time, and which was based on the specification originally drawn up by the late Dr. Tidy. It had been generally accepted that the creosote should contain not less than 25 per cent. of matter non-volatile at 600° F., which is roughly the same temperature as the 300° C. taken by Mr. Sage. But he would ask, ought not the proportion of naphthalene always to be taken into account when one is considering the suitability of a particular sample? He would urge that if there were an appreciable amount of naphthalene that ought to be added to the amount of relatively solid matter, which is represented by the non-volatile at 316° C. or 600° F., and be viewed as the total solid matter. If this were accepted considerable importance then attached to the determination of the naphthalene. The creosoter aimed at saturating his wood as nearly as possible with something that would not wash out. It was an old theory, but he thought he might venture to say that it was an exploded idea, that the tar acids were the valuable constituents in creosote intended for application to wood. It had been shown, some 30 years ago, in a paper read before that society by Mr. Boulton, that within a comparatively brief time after creosoted wood had been embedded in the earth the whole of the tar acids had gone. But the theory upon which the appreciation of the old tar acids was based rested, he thought, upon a misconception. The idea, in Dr. Tidy's phrase, if he remembered rightly, was that the tar acids coagulated the albuminoids of the wood. He did not think the albuminoids had now quite the same importance from that point of view, because in the light of the biological knowledge of the present day, if you excluded micro-organisms, then protein matter was no more liable to decay than carbohydrate substances. He would lay it down that what was needed in a creosote was a maximum amount of solid matter, made up, in the first place, of the constituents non-volatile at 316° C. and of naphthalene. With these there was required just enough tar oil to act as a solvent so as to permit of the solid constituents being carried efficiently into the wood in the process of creosoting. If he was wrong on that point, he would like some practical man to correct him. If they agreed upon that point then the testing of creosote resolved itself into a determination of the two solids, as he had called them, with something like an accurate determination of the amount of water, and the amount of what he might call tar oils, though of course he did not say that the determination of the tar acids should be neglected.

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* This residue possessed a refractive index 1·4710 at 60° C.

Now, taking Mr. Sage's order, he would first say that as regards his definition he entirely agreed, and he also agreed generally about the sampling and as to proportion insoluble in benzol, that is to say, this last should be an exceedingly small amount. As to standard methods he felt that if they were to make progress they must not lay down hard and fast or so-called standard methods. The chemists concerned should confer and with a system of tender samples there ought to be no difficulty in each side deciding whether tender sample and bulk were alike or differed. On the question of specific gravity he felt there was no more convenient temperature for this determination than 15·5° C., or 60° F. It was a temperature which was most general and which was easily maintained in the laboratories of the United Kingdom. If one remarked "Yes, but the creosote very often includes a considerable amount of solid matter," he would point out that this solid matter was readily dissolved on the sample being raised to a temperature of say 100° F., and when this was done a considerable time elapsed before the naphthalene again separated out. There was, therefore, not the slightest difficulty in determining the specific gravity of creosote at 60° F., or 15·5° C., with a specific gravity bottle. At all events, he had never found any difficulty, and he would urge all those who were interested in creosote not to be led into determining the specific gravity at a higher temperature than 60° F. merely because a sample of creosote as received contained solid naphthalene. Then as to a description of the condition of the sample as received. He had never found any difficulty about that. Almost invariably a sample stood at least overnight in the laboratory before it was touched. He suggested that all that they needed to do was to register the condition of the sample when they started the examination. If, however, there was any point in this matter being systematised he thought that the sample might be just completely liquefied on receipt and then be allowed to stand all night, the temperature and condition being noted in the morning. Then it would be registered as "solid, temperature so and so," or "half-solid," or "almost wholly liquid with traces of solid matter." No doubt, from the point of view of handling, the actual physical condition of the creosote was an important matter. He had never had to handle creosote on a large scale, and therefore had no experience, but he thought there must be a very radical disadvantage in having to handle drums or casks of solid matter which required to be heated before the creosote could be got into the creosoting tank. Therefore he quite agreed that the physical condition of the sample ought to be registered, though it did not convey any reliable information as to the condition to be expected under other circumstances such as standing for comparatively long periods at relatively low temperatures. With regard to the expansion coefficient, though from the laboratory point of view he saw no advantage in the determination, it was possibly useful from the point of view of transit. How far that was a serious difficulty he had no means of knowing, and he had no reason to quarrel with the suggestion which the reader of the paper had placed before them. With regard to flashpoint, he thought there was a certain amount of loose talk about "Flash-point by the Abel test." As regards the Pensky-Martin apparatus it was practically the Abel apparatus adapted merely for higher temperatures. Within his experience, no difficulty had ever arisen, because there was no question of its flashing at a dangerous temperature. Undoubtedly, however, if a flash-point determination were called for, the Pensky-Martin apparatus was the one that should be used. Mr. Sage had suggested with reference to the question of fluidity a standing period of six hours. He (the Chairman) had already said something on that point, and he would only add that from the point of view of use it was only necessary that the creosote should be fluid at the temperature at which it was employed. It was usual to specify that the creosote should be completely fluid at 90° F. or 95° F., and within his experience all ordinary commercial creosotes satisfied this requirement. The time within which naphthalene would separate varied with the composition of the creosote without affecting the question of suitability, whilst, as he had already said he thought the condition at ordinary temperatures was best observed and recorded at the time of examination. With reference to the question of distillation he was pretty closely in agreement with Mr. Sage, except on the one point which had already been dealt with by previous speakers, viz., the position of the thermometer. There was, however, one suggestion he might make in connection with this part of the examination. Using a Wurtz flask of the kind described by Mr. Sage, but of 250 c.c. capacity, and with a delivery tube 1½ inches above the base of the neck and the top of the thermometer bulb level with the side tube, he suggested the advisability of weighing both the flask and the quantity of creosote taken for distillation, the latter being approximately 100 c.c. To the neck of the flask a small piece of wire was attached, and there was then no difficulty in weighing the flask, first empty and then after the creosote was added. On the distillation commencing, they at once encountered the question of water. If the volume of water was large (and within his experience that happened only very occasionally), the only way to obtain an average sample was to determine the volumes of creosote and water and make the analysis on the separated creosote. Where such a separation of water was made, it of course did not represent the whole of the water—for once an emulsion of creosote and water was formed it was most persistent and was not to be got out by even long standing. But, again, he did not think that very often arose. Within his experience from 1 to 4 per cent. of water was about the maximum that was normally met with, and he thought it well to conduct the distillation in such a manner that the first fraction up to a temperature of about 160°, and until the distillate was clear, was always collected in a separate receiver. There was then no difficulty in arriving at the actual proportion of water. Some little care was required in getting the water out without serious bumping, but that difficulty could be got over. When the distillating vapour reached the temperature of 316° C. or 600° F. the flask with the residue was weighed after cooling, so that the amount of non-volatile matter was correctly ascertained, and with a regulation of the time occupied in the distillation there was no difficulty in obtaining concordant results. He thought one should always note and record the character of the non-volatile residue, as in his opinion it to a very large extent indicated the origin of the creosote. A normal creosote from a gas works tar was a soft solid with semi-crystalline structure. If, on the other hand, it was blast furnace tar it was always more or less fluid, and if it included a certain amount of pitchy matter then it was also fluid, but very thick and black.

That brought him to another point, viz., the detection of paraffin substances and certain soft pitchy bodies. He did not know whether the process he suggested was novel or not, though he had never seen any reference to it. He had observed that the kind of oil to which he had just referred—one containing soft pitch-like or paraffin substances non-volatile at 316° C., and not of the crystalline character of normal creosote—was easily distinguished by its degree of insolubility in alcohol. A normal creosote was almost wholly soluble in from three to nine volumes of methylated spirit. The proportion of spirit beyond three volumes did not make any very appreciable difference, but he preferred to use nine volumes of alcohol. If the creosote contained this pitchy or solid paraffin matter it was also usually indicated in the original sample by the way in which the creosote clung to a glass vessel, whilst a normal creosote oil with less viscosity and colour did not cling, and at once left the glass clean and practically colourless. Normal creosote yielded an insoluble in alcohol of less than 1 per cent.—frequently it was only two or three-tenths—but others gave 2 per cent., occasionally going up to 4 per cent., and, in rare cases, reaching as high as 16 per cent. One of the most valuable points dealt with by Mr. Sage was the determination of the proportion of naphthalene. He fully agreed that the determination must be made on the distillate and not on the original creosote. He thought, however, that the time had come when a more accurate determination of the naphthalene was necessary than had been hitherto general. The method usually practised was to merely separate without any special attention the solid which crystallised out from the distillate. But by cooling to −10° C. a very much more complete separation was obtained. The method to be recommended was to filter through linen on a Buchner funnel with the aid of the pump. If the distillate indicated that the proportion of naphthalene was large, it was filtered at once without special cooling. The filtrate was then cooled to bring out a further quantity which was once more filtered off, and finally the filtrate was cooled to −10° C. and again filtered. When the proportion of naphthalene was large if one proceeded to cool the distillate at once, the liquid became so thick that there was considerable difficulty in effecting any filtration. As each portion of naphthalene was got on the filter it was pressed by a glass stopper which just fitted the Buchner funnel, and the comparatively dry naphthalene was removed from the linen to a beaker in which it was weighed, this being done before the next filtration was commenced. In the later filtrations the Buchner funnel was itself surrounded by the cooling mixture used to reduce the temperature of the successive filtrates. In this way a filtrate which remained clear at −10° C. was obtained and the separated naphthalene was so firm and dry that it did not liquefy at the room temperature of say 60°—65° F.

It might well be asked, how much of the total naphthalene does the quantity so separated represent? Well, that obviously varied with the proportion of what might be called pure tar oil, for, of course, this remained saturated with naphthalene at −10° C. If the tar oil taken by difference from the other constituents was high, a considerable proportion of the total naphthalene might remain dissolved, but where the proportion of tar oil was low then the naphthalene retained in solution was about balanced by the tar oil retained by the pressed naphthalene which had been separated. There was, therefore, here a good practical determination, such a proportion in fact as ought to be taken into consideration and reported. The chemist, however, he thought, might well go further and determine, by means of picric acid, the total naphthalene and other substances precipitated by picric acid in the distillate after the removal of the tar acids. This he had himself done for a long time past, and he thought that the practice ought to be adopted more generally. There was no difficulty in this determination by means of picric acid, but he had already taken up so much time that he would not further go into the matter.

With reference to the determination of the tar acids and pyridene bases, he did not think any difficulty now arose. With reference to a point made by Mr. Blagden, he would suggest there were means of distinguishing a blast furnace creosote from a normal coal tar creosote. First the tar acids or phenoloids of the blast furnace creosote were as a rule of a much higher boiling point than those obtained from ordinary gas tar; and, secondly, as far as his experience went, he had found that the residue non-volatile at 316° C. from a blast furnace oil was very small, and was liquid. Naphthalene, of course, might be added, and its presence, therefore, was not indicative; but if one got a small and soft residue non-volatile at 300° C. with a high proportion of high boiling phenoloids, the origin of the creosote was pretty clearly shown. With reference to sulphonation and the determination of the refractive index, he had never found any occasion actually to apply these, but he agreed with Dr. Lewkowitsch as to the difficulty of drawing conclusions from a refractive index when there was a mixture of substances. Probably sulphonation was more applicable in countries like the United States than in the United Kingdom.

Mr. **Sage**, in reply, said most distinctly and emphatically that in the majority of cases it was possible to determine the presence of blast furnace creosote in coal tar creosote. Dr. Lewkowitsch had pointed out the difficulty they all met with in dealing with a mixture of substances, but if they took the whole of the distilled fractions and determined their refractive index, they would find that if there was as much as 7 to 10 per cent. of blast furnace creosote present, it would bring the refractive index outside the range shown in his (Mr. Sage's) diagrams. He thought members would find that, if they worked upon these lines, they would be amply repaid. Mr. Butterfield had remarked that it was possible to determine the presence of blast furnace oil in creosote by taking the specific gravity of the fractions. If the sample was sufficiently large to admit of this, it was perfectly correct, and what the Chairman had said as to the amount of "tar acids" was also true. All those items helped to define the presence of blast furnace creosote in the oil. He would suggest, however, that there was another way, and that was by making the distillates alkaline and shaking with air, then noticing the colour produced as absorption of oxygen proceeded. It was a long method of procedure, but the results usually left little room for doubt. He did not lay as much stress on the determination of naphthalene as Dr. Lewkowitsch appeared to think, although he was fully cognisant of the value of naphthalene as a timber preservative, and he thought that of the solids in creosote it was one of the most valuable. He had on several occasions dissolved naphthalene in "tar acids" and used it for timber. It preserved the wood but did not give the nice brown colour which was expected of creosoted timber. With regard to Dr. Lewkowitsch's remarks as to the position of the bulb of the thermometer, he wished he could agree with him. In fractional distillations of anything else he always used the thermometer with its bulb in the vapour but many years practical experience suggested to him that he always got better results the other way, namely, with the thermometer bulb in the boiling creosote. It was a matter which, above all others, needed definite settlement, and personally he was agreeable to either method if only it could be specified and adopted generally.

As to Mr. Butterfield's other query, he was in general agreement as to the point raised by him.

Dr. Tidy's specification, mentioned by the Chairman, was one of those antiquities which they all turned up reverently when they wanted to read what other chemists had to say about creosote. He fully agreed with what the Chairman had said with regard to the volatility and wash-out-ableness of tar acids in creosote, which was used for pickling timber, but he would suggest that it was not only these tar acids and naphthalene in creosote which acted as preservatives. The high boiling fractions contained some phenoloids, as well as anthracene, and these being of a thick sticky nature, ought to have some beneficial preservative effect. Mr. Hooper mentioned the temperature at which some of these things boiled. He had separated the tar acids from blast furnace oil on many occasions and he could assure Mr. Hooper that, with his thermometer well above 320° C., he still had a lot of residue left in the flask. (The Chairman: Was the thermometer in the liquid?) Mr. Sage explained that in his fractionation of tar acids it was not in the liquid but the bulb was opposite the outlet tube in a Wurtz flask. Mr. Hooper had mentioned that there were no particular Board of Trade regulations with regard to the flash point of creosote. The Insurance Companies, however, held the whip hand in these matters, and it would also be found that timber used in the work of the underground railways must not be creosoted; that if it was preserved in any way it must not be by means of creosote. He believed that many engineers present would confirm his remarks on that point. Recently he had to determine the solubility of some of the products of creosote in alcohol, and he could confirm what Mr. Hooper had said, namely, that it was a valuable method of distinguishing one variety of creosote from another. Preferably, he added a little acetic acid to the alcohol so that any basic substances which were present would form more soluble compounds. His standard solution of picric acid was seldom used except for determining very small amounts of naphthalene in naphthas, and he was not favourably impressed with the idea of a volumetric determination in creosote by means of picric acid. The determination of naphthalene was of great importance to buyers and it was ridiculous to attempt to determine it on the undistilled sample of creosote when it was known how soluble the naphthalene was in the high boiling fractions.

A MODIFICATION OF RASCHIG'S THEORY OF THE LEAD-CHAMBER PROCESS.

BY EDWARD DIVERS.

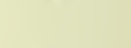
The theory in its different forms.

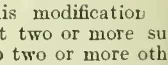
Raschig's theory of the nature of the changes by which sulphur dioxide passes into sulphuric acid, in the lead-chamber process, has, in its published forms, twice undergone revision at its author's hands. In its first form (*Annalen*, 1887, **241**, 242) sulphurous acid and nitrous acid are represented as uniting to form dihydroxylaminesulphonic acid, and this as interacting with more nitrous acid to produce nitric oxide and sulphuric acid, while, in the second form of the theory (Z. angew. Chem., 1904, **17**), the intermediate substance is considered to be nitrososulphonic acid or dehydrated dihydroxylaminesulphonic acid. In this form of the theory, also, the equation, $ONSO_3H+HNO_2=2NO+H_2SO_4$, is broken up into $ONSO_3H+H_2O=ONH+H_2SO_4$, followed by $ONH+HONO=H_2O+2NO$. In the third form of the theory (Z. angew. Chem., 1905, **18**, 1310; this J., 1911, 166), this equation is still divided into two, but in a different way: $ONSO_3H+HONO=ON(OH)SO_3H+NO$ and $ON(OH)SO_3H=H_2SO_4+NO$, with the effect of making a material change in the details of the theory. Some such change had, in fact, become necessary, through the recognition by the author of this paper in 1903 (Trans. Chem. Soc., 1904, **85**, 108) that the substance which gives colour to the "purple acid," met with occasionally, along with nitric oxide, in the Gay-Lussac tower (Carpenter and Linder, this J., 1902, 1492), might be identical with the blue-violet substance studied by Sabatier (Compt. rend., 1896, **122**, 1417, 1479, and 1537, **123**, 255).

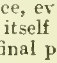
A further modification of the theory.

Even the latest presentation of the theory leaves it open to serious, if not destructive, criticism, but a simple modification of it gives it a form which, it would seem, must compel general acceptance. In this form the theory is expressed by the twofold equation $2HNO_2+SO_2=H_2N_2SO_6=2NO+H_2SO_4$, in which $H_2N_2SO_6$ is a substance decomposing into nitric oxide and sulphuric acid, as fast as it is produced by the union of sulphur dioxide with nitrous acid or its equivalent in water and oxides of nitrogen. It is, very probably, that which gives the colour to "purple acid" and is here assumed to be such. But, should the identity be disproved, the existence, even though transitory, of a substance of the indicated composition would still have to be inferred.

The name, found appropriate for it and introducing the least innovation, is nitroxysulphuric acid, in serial nomenclature with nitroxysulphurous acid, the acid of Pelouze's salt, with which it is related in composition and constitution. This relation is, perhaps, best shown by the table:—

Nitroxysulphuric acid. $H_2N_2SO_6$,  $HO\overset{O}{\underset{O}{N}}NSO_3H$;

Nitroxysulphuric acid, $H_2N_2SO_5$,  $H\overset{O}{\underset{O}{N}}NSO_3H$.

For ease of writing, the symbols for the bivalent radical, dinitrosyl,  $\overset{O}{\underset{O}{N}}N$, will be generally given throughout this paper as $—(N_2O_2)$.

Interaction implies combination.

The fundamental position, in this modification of Raschig's theory, is that, in order that two or more substances should chemically change into two or more other substances, they have first to become one substance, or, at least, one system of atoms and activities, potentially a substance, even though it may fail, through instability, to realise itself as such. This substance then decomposes into the final products of the change. Accordingly, it is impossible to accept such an equation as $2HNO_2+SO_2=2NO+H_2SO_4$ as a correct expression of fact, unless it is put forward with the implication that the substance, $H_2N_2SO_6$, is formed in between.

To assert, with Wentzki (Z. angew. Chem., 1910, **23**, 1707; **24**, 392) and others, that nitric peroxide can oxidise sulphur dioxide, without uniting with it, is the same as to say that nitric peroxide oxidises or gives oxygen to sulphur dioxide. The nitric peroxide, if it can be said to "give" anything, can only give itself, that being all it is. It itself is not oxygen, being throughout and exclusively nitric peroxide; it is not an agent, having either oxygen or anything not itself in its possession, which it is ready to produce, when it is called upon to do so. Notions like that entertained by Wentzki are indeed common, but seem to be wholly due to misapprehension of the significance of chemical notation and of its limits.

It is the author alone who now gives it, as the fundamental position in Raschig's theory, that the interaction of substances means their union into one complex, to begin with. Raschig himself has not done so; yet he went near it when he launched his theory, in 1887, with the assertion, emphasised by italics, that the behaviour of sulphurous acid towards nitrous acid is no longer to be regarded as a reduction, but as a condensation (here meaning "union"). It is clear, however, that this conception of his theory has not really ever been in his mind; indeed, in his present exposition of the theory, he actually represents nitrous acid as oxidising nitrososulphonic acid, and has, therefore, no desire here to urge that condensation and not oxidation is the form taken by the interaction. Yet it will seem to most chemists that, if nitrous acid can oxidise nitrososulphonic acid, without combining or condensing with it, it can also oxidise sulphur dioxide.

Unless there is insistence on the general applicability of the underlying principle of intermediate combination, it is hard to see why Raschig's theory need be accepted as anything more than a suggestion.

Presence of the intermediate substance should be unnoticeable.

The assertion of necessary intermediate combination is a matter of inference, not something dependent upon direct observation. It may almost be said that the presence of the intermediate substance must be imperceptible, that such a substance will not be one that can be found during normal working. If it could be, no theory of the chamber process would be required; nothing would have to be inferred, for the intermediate stages would be features of the process.

For aught that can be perceived to the contrary, sulphur dioxide, oxygen, and water are at once and directly converted into sulphuric acid, when nitrous acid or its equivalent is present, and not otherwise, although the mode of the activity of the nitrous acid is not evident. In the perfect working of the process, the chemical changes of the nitrous acid are cyclic, under alterations in conditions too slight to be noticeable; so that there is nothing to show in what way it brings about its effects. Only by the study of imperfections in the working, and by outside experiments and observations, have indications been obtained that nitrous acid is as active as the sulphur dioxide and oxygen which become sulphuric acid.

It has then to be recognised that, in the perfect working of the process, it is no more possible for the intermediate substance to accumulate, even sufficiently to make its presence known, than it is for it to be absent altogether. When evidence of the presence of the intermediate substance is obtained, the conclusion must be that the process is working badly, the necessary decomposition not keeping pace with the production.

To find a substance present in the chamber, even when the process is normally working, need not be proof of its presence being essential to the process; it may be only incidental. Not to find a substance present, which, inferentially, is the intermediate substance, is, on the other hand, far from being proof that it is not present to the extent necessary for it to play its part as intermediate substance.

Raschig appears not to take that view of the matter. He decides that nitrososulphuric acid, $NHSO_5$, cannot be present in the lead-chambers, because sulphuric acid of s.g. 1·6, holding nitrous acid dissolved, does not take on a blue colour, when shaken with mercury. The solution does, indeed, give off nitric oxide, but that is not sufficient as evidence. But, then also, the result of the experiment is no proof of the absence of nitrososulphuric acid. The limit of sensitiveness of this test is unknown, but it is certainly one soon reached, since the blue-coloured substance must be, under the conditions here imposed, resolved into sulphuric acid and nitric oxide, as fast as it is formed from the nitrososulphuric acid.

There is also brought, against the belief in the presence of nitrososulphuric acid in the lead-chambers, the fact that, by blowing air through a solution of nitrous acid or of nitrososulphuric acid in such sulphuric acid, the nitrous acid can be all, or almost all, carried away out of the solution. But this, again, proves nothing. It is known that nitrososulphuric acid, when thus dissolved, dissociates largely. So long, however, as some of the resulting nitrous acid remains dissolved, the dissociation will, almost certainly, not be complete, and will become so only when the nitrous acid is all removed.

There is, then, no proof of the absence of nitrososulphuric acid in the lead-chambers, even when the process is going on normally. It is, in fact, most probably present, though there are good grounds for believing, with Raschig, that it is not a substance intervening in the production of sulphuric acid.

The process in the lead-chambers.

In the region of great activity in the first lead-chamber, oxygen is present, according to the usual way of calculating, in about twice the quantity required to convert into sulphuric acid the sulphur dioxide mixed with it. It is with these proportions of sulphur dioxide and oxygen that the process is found to work best. Trials, made by Sauerschnig, of the effect of moderately exceeding this proportion of oxygen in the chambers, the results of which have been published by Raschig (Z. angew. Chem., 1910, 23, 224), show that to make such an increase is injurious. Some explanation, therefore, is wanted of the fact that, for good working, the oxygen has to be double as much as the sulphur dioxide can consume in the process. That explanation can now, for the first time, be given, by applying the results of Raschig's observations upon the oxidation of nitric oxide (Z. angew. Chem., 1907, 20, 701).

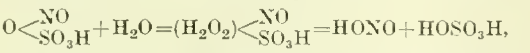
Nitric oxide forms at once with oxygen a peroxide, which has the composition of ordinary nitric peroxide, without being that substance, though it soon becomes changed into it. The difference between the two substances is that the immediate product of atmospheric oxidation of nitric oxide is a nitrous compound, nitrous peroxide, ONO.ONO, similar to, or at least corresponding with, other acid peroxides, as well as hydrogen peroxide, while ordinary nitric peroxide, into which it soon changes, is a nitrosic compound, the mixed anhydride of nitrous acid and nitric acid $ON.O.NO_2$. Whether reacting with water, sulphuric acid, or alkali, the former yields nitrous acid, oxygen being liberated, whereas the latter yields nitric acid and nitrous acid, or its decomposition product, nitric oxide again. These are the facts observed by Raschig. The names given here to the two isomeric substances differ from his. He is also not responsible for their constitutional formulæ or for the application of the facts to the chamber-process, now to be made.

In the nearer end of the first chamber, the nitric oxide, which is constantly being liberated from nitroxysulphuric acid, meets about equal volumes of sulphur dioxide and oxygen, diluted with nitrogen and charged with water vapour of low tension. It has hitherto been necessary, for the theories which take nitrous acid or its anhydride as the active substance, to assume that the nitric oxide combines with only one-half of the oxygen that is mixed with the volume of sulphur dioxide upon which it is, when oxidised, to act. This limitation of its oxidation has either been passed over without any explanation, or, else, drops of sulphuric acid have been supposed to absorb the nitrous anhydride, before further oxidation can happen. This supposition is not only insufficient to satisfactorily account for the fact, in any case, but is quite inadmissible, so long as the presence of this sulphuric acid itself remains unaccounted for. But, if the assumed limitation of the oxidation of the nitric oxide is, after all, not a reality and the nitric oxide does become nitric peroxide, the belief, that nitrous acid or its equivalent is the nitrogen compound that combines with the sulphur dioxide, cannot be upheld, unless Raschig's observations are taken into account. Then the difficulty vanishes; the nitric oxide does actually unite with the full quantity of oxygen, but only to form with it nitrous peroxide, a substance yielding nitrous acid, together with free oxygen. Whether, in the process, the nitrous peroxide first unites with water, $H_2O+ONO.ONO=2HO.ONO$, to form pernitrous acid (like Caro's persulphuric acid), which then decomposes into nitrous acid and oxygen, $2HO.ONO=2HO.NO+O_2$, or whether water, nitrous peroxide, and sulphur dioxide at once interact to form pernitroxysulphuric acid, $H_2N_2SO_7$ or $HO.O(N_2O_2)SO_3H$, which then decomposes into nitroxysulphuric acid and oxygen, cannot be determined. In either case, the nitric oxide, which results from the decomposition of the nitroxysulphuric acid, finds in this oxygen only half as much as it requires.

It also cannot be said, whether nitroxysulphuric acid condenses before it decomposes to form the nuclei of the mist-particles or decomposes before it can condense, in which case the mist-particles must consist of sulphuric acid from the first. Adoption of the latter alternative seems preferable.

Another matter for consideration in connection with the lead-chamber process is how two molecules of nitrous acid or their equivalent can combine with only one molecule of sulphur dioxide, in an atmosphere in which sulphur dioxide largely predominates. Wentzki (*loc. cit.*) has brought this objection against Raschig's theory and it will hardly be claimed that Raschig has successfully met his objection (Z. angew. Chem., 1910, **23**, 2241). Outside the chambers, when nitrous acid meets excess of sulphur dioxide, one molecule interacts with two of the latter, and the nitrous acid becomes irrecoverable. The answer to this objection is to deny that nitrous acid does or can meet excess of sulphur dioxide in the lead-chambers, since if it did, Wentzki would not only have disproved Raschig's theory, but have presented the lead-chamber process as something inconsistent with facts. The explanation is simple and is found in the nature of the life or dynamics of the mist. Sulphuric acid is ever raining down out of the mist; the mist is ever being renewed by the production of new particles of hydrated sulphuric acid growing into drops. The particles of acid, in coming into being and then growing, are enveloped in an atmosphere of nitric oxide, born with them, both sulphuric acid and nitric oxide being together what, just before, was the vapour of nitroxysulphuric acid in unstable equilibrium. At the moments of its generation and regeneration in the chamber, the nitric oxide, pure and unmixed, meets with and diffuses into much-diluted sulphur dioxide and oxygen. Conversely, the sulphurous chamber-atmosphere diffuses into it. In this mingling of approximately equal volumes, the nitric oxide is in excess of either the oxygen or the sulphur dioxide, because of its single condition and consequently greater molecular density, as against their dilution with nitrogen and each other. Therefore, more than enough of it will be present to form with the oxygen and sulphur dioxide and water, with which it comes in contact, the substance with the highest proportion of nitrogen to sulphur, first, nitrous peroxide, then, nitroxysulphuric acid. The latter substance, moving outwards from its point of origin into contact with more oxygen and sulphur dioxide, must be unaffected by them, as it has been shown to be by Raschig, on the assumption that it is identical with the blue-violet substance, which he regards as being nitrosisulphonic acid, H_2NSO_5, and the author considers to be nitroxysulphuric acid, $H_2N_2SO_6$.

There seems to be nothing in favour of the view that nitrososulphuric acid, $HNSO_5$, is a factor in the production of sulphuric acid, while its formation and decomposition seems clearly to contradict this view. These properties show that nitrososulphuric acid has, most definitely, the constitution of a mixed hemi-anhydride of nitrous acid and sulphuric acid. The equation,—



$$O<\genfrac{}{}{0pt}{}{NO}{SO_3H}+H_2O=(H_2O_2)<\genfrac{}{}{0pt}{}{NO}{SO_3H}=HONO+HOSO_3H,$$

exhibits this constitution. Sulphuric acid unites with nitrous anhydride or its equivalent, to form nitrososulphuric acid, at first in solution and then in crystals; nitrososulphuric acid combines with water to become sulphuric acid and nitrous anhydride or its equivalent. In so far, therefore, as it is present in the lead-chambers, it is there merely as a product of the union of sulphuric acid with nitrous anhydride, and its production and decomposition have no place in the sulphuric-acid process. Other ways in which it is produced teach the same thing as to its constitution:

$$KNO_2+H_2S_2O_7=KHSO_4+(ON)HSO_4;$$
$$2ONCl+Ag_2SO_4+H_2SO_4=2AgCl+2(ON)HSO_4;$$
$$ONCl+H_2S_2O_7=ClSO_3H+(ON)HSO_4.$$

Raschig rejects the long-established constitution for it of a nitrosyl sulphate or, better, a mixed anhydride, and looks upon it as a sulphonic acid, O_2NSO_3H, his only ground for doing so, apparently, being that mercury converts it into a sulphonic compound. But this need not weigh, as will be presently explained.

There is a way in which nitrososulphuric acid can be formed, which cannot be left without notice here, because, thus produced, it has long been held by some to be the intermediate substance in the production of sulphuric acid. It is also the way in which nitrososulphuric acid was discovered, and by which it is readily prepared, namely, by bringing together water (in limited quantity), sulphur dioxide, and ordinary nitric peroxide. The equation required to express the result, $2H_2O+3N_2O_4+4SO_2=4HNSO_5+2NO$, is such as to suggest that the nitrososulphuric acid must be here only a secondary product, due rather to the interaction of nitrous anhydride with sulphuric acid already formed, than to the direct interaction of sulphur dioxide and nitric peroxide. On that most probable interpretation of this production of nitrososulphuric acid, it is nitroxy- or pernitroxysulphuric acid which is formed, and, by decomposition into nitric oxide or nitrous anhydride and sulphuric acid (here, in the absence of more water, pyrosulphuric acid), presents the latter acid to nitrous anhydride or to its equivalent, to form in the normal way the mixed anhydride, nitrososulphuric acid. The course of the change is imperfectly shown in the double equation:

$$2H_2O+3N_2O_4+4SO_2=2H_2S_2O_7+2N_2O_3+2NO= \\ 4HNSO_5+2NO.$$

The conversion of sulphur dioxide and water into nitrososulphuric acid by nitric peroxide alone has, however, very little interest in connection with the lead-chamber process, where nitric oxide would be present with the nitric peroxide during its action. Nothing is better known than that nitric oxide and nitric peroxide act together as nitrous anhydride towards water, sulphuric acid, solution of an alkali, or solution of sulphur dioxide. But the long-current expression, $2H_2O+2NO+N_2O_4+4SO_2+2O_2=4HNSO_5=2H_2S_2O_7+2N_2O_3$, cannot stand criticism. It leaves unexplained, why nitrous anhydride or its equivalent should go into combination and come out again unchanged; why, because of its presence, sulphur dioxide and oxygen should unite; why, in order to form nitrososulphuric acid, it should not unite with sulphuric acid already present, instead of seeking out sulphur dioxides, oxygen, and water in the right proportions to combine with; and why the necessary nitric oxide and oxygen should remain mixed, without combining till called upon to do so by the sulphur dioxide.

The behaviour of the blue-violet substance interpreted, on the assumption that it is nitroxysulphuric acid.

The composition of the as yet unisolated substance, nitroxysulphuric acid, is deduced from the way in which it is formed and the way in which it decomposes. Its formation takes place when sulphur dioxide dissolves in a solution of nitrous acid in sulphuric acid monohydrate (Sabatier, *loc. cit.*). Excluding the possibility of sulphuric acid itself being a component, it will, therefore, be a compound of sulphur dioxide and nitrous anhydride, with or without water. The decomposition of nitroxysulphuric acid is so rapid, that its production does little more than keep ahead of it, one product being nitric oxide and the other sulphuric acid. The production of the latter must of necessity be accepted, for nothing else appears along with the nitric oxide. Therefore, the ratio of nitrous anhydride to sulphur dioxide has to be $N_2O_3 : SO_2$, in order that the substance may become nitric oxide and sulphuric anhydride, $N_2SO_5=2NO+SO_3$. The proportion of water is, most probably, $H_2O : N_2O_3 : SO_2$; if so, the composition is $H_2N_2SO_6$.

The constitution is determined partly by considering the reactions of the substance and partly by comparing these with the reactions of the nitroxysulphites, and those of still less generally known salts, the "nitroxites." Before proceeding to examine the reactions in which nitroxysulphuric acid has part, some reference is therefore necessary, first to the nitroxysulphites and then to the nitroxites.

Potassium nitroxysulphite was described by Pelouze in 1835. Its connection with the present inquiry will at once be seen, when the facts are recalled, that it is formed by the union of nitric oxide, 2NO, with potassium sulphite, and that it decomposes either into these substances again or into nitrous oxide and potassium sulphate. In 1885 (Trans. Chem. Soc., **47**, 203) and again in 1895 and 1896 (*op. cit.*, **67**, 452, 1095, and 1098; **69**, 1610), Haga and the author examined the reduction of the salt by sodium amalgam and also described the sodium salt. This year, Raschig, in his paper to this Section in February, and also in a paper to the Heidelberg Chemical Society in January (Z. angew. Chem., 1911, Feb. 24), mentioned that he had obtained these salts by oxidising sodium hydroxylaminemonosulphonate with permanganate. Haga and the author, from the first, gave the salts the constitution expressed by $K(N_2O_2)SO_3K$, about which all are now agreed. Later on, they gave the paired nitrosyl radicals the constitution shown in the formula, $KON:NOSO_3K$, and named the salts, nitroso- or hyponitroso-sulphates, because by or during sodium-reduction sulphuric acid is obtained. They also found, however, that very much aminemonosulphonate, $NH_2(SO_3K)$, as well as hydrazine, is produced. Moved by the objections taken by Raschig (*loc. cit.*), the author has reconsidered the matter, and now gives the constitution as $KN{<}^{O}_{O}{>}NSO_3K$, and adopts the name, nitroxysulphite.

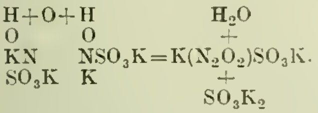
He is able to do this by having come to the conclusion, that the sulphate obtained in the reduction by sodium amalgam, is not derived from that reduction, which lasts for a day or more, but from the spontaneous decomposition always taking place in the salt in contact with water. $K(N_2O_2)SO_3K = N_2O + KO.SO_3K$, one potassium atom taking with it one of the oxygen atoms attached to the same nitrogen atom.

The following equation shows how the reduction of the nitroxysulphite may be formulated :—

$$2KN\overset{O}{\underset{O}{}}NSO_3K + 8H = 2KN(OH)_2 + 2H_2NSO_3K =$$
$$(KON)_2 + 2H_2O + 2H_2NSO_3K,$$

which explains the production of aminesulphonate and hyponitrite, the intermediate, $KN(OH)_2$, being the unknown potassium dihydroxylamine, which transforms to hyponitrite.

The oxidation by permanganate of hydroxylamine-monosulphonate into nitroxysulphite is shown in the following scheme :—



$$\begin{array}{lll} H+O+H & & H_2O \\ O \quad\;\; O & & + \\ KN \quad NSO_3K & = K(N_2O_2)SO_3K. & \\ SO_3K \;\; K & & + \\ & & SO_3K_2 \end{array}$$

Raschig's account of this oxidation, which will be found on p. 170, i. par. 3 of this volume, surely goes counter to facts. When a hydroxylamine is oxidised, it is sometimes the hydroxyl-hydrogen which is attacked, in preference to the amine-hydrogen. The residue to be dealt with, therefore, is $-ONH(SO_3K)$, or, more closely to facts, $-ONK(SO_3K)$, and not $-N(OH)(SO_3K)$. Again, it is contrary to all knowledge of the behaviour of an hydroxylamine- or amine-sulphonate, that it, in Raschig's words, "splits off a sulpho-group, as sulphite, in exchange for hydroxyl." Raschig uses Hantzsch's formula for the nitroxysulphite, namely, $NaON\overset{O}{-}NSO_3Na$, which presents its constitution as that of a *dinitrososulphate*, instead of that of a ***nitroxysulphite***.

Nitroxysulphurous acid, $H_2N_2SO_5$, unknown in the free state, differs from nitroxysulphuric acid by having one atom of oxygen less. Both acids decompose most rapidly into sulphuric acid and an oxide of nitrogen, nitrous oxide and nitric oxide, respectively. The one is formed from (a salt of) sulphurous acid and nitric oxide, the other from sulphurous acid and nitrous anhydride. Nitroxysulphurous acid readily reverts to sulphurous acid and nitric oxide. Nitroxysulphurous acid is produced by a moderate oxidation of hydroxylaminemonosulphonic acid (Raschig); nitroxysulphuric acid (if this is the blue-violet substance) by a stronger oxidation of the same substance (Raschig). It seems, therefore, right to treat the two acids as serially related, the one as a dinitrosyl sulphurous acid and the other as a dinitrosyl sulphuric acid, $H(N_2O_2)SO_3H$ and $HO(N_2O_2)SO_3H$, respectively. The salts of an unsulphonated acid corresponding with nitroxysulphuric acid, are known and some account of this acid will now be given.

Thum, in 1893 (Inaug. Diss. Prag), found that an alkaline solution of potassium permanganate, even when boiling, does not oxidise hydroxylamine into nitrous acid, but only to a substance, presumably $H_2N_2O_3$, halfway in composition between hyponitrous acid and nitrous acid, as determined by volumetric analysis of the solution. He did not isolate the substance or report upon its properties, reserving its examination for future work, not since carried out.

Angeli rediscovered the acid in 1896 (Gazzetta, **26**, ii., 17), and he and his colleagues have described many of its salts. The free acid cannot exist. By Angeli's method, it is best prepared by adding a saturated solution of hydroxylamine hydrochloride to a concentrated solution of sodium methoxide (3 mols.) in methyl alcohol, filtering off sodium chloride, and adding methyl nitrate (1 mol.), when the sodium salt of the acid precipitates. As exhibited by its salts, the composition of the acid is $H_2N_2O_3$. The behaviour of its salts is full of interest, but cannot be considered here. Thum named the acid, azohydroxyl, while Angeli has called it, nitrohydroxamic acid. Neither name is satisfactory. The author would have it called nitroxous acid and considers $HON\overset{O}{\underset{O}{}}NH$ to be the best constitutional formula for it. Nitroxysulphuric acid then takes its place as sulphonated nitroxous acid

$$HON\overset{O}{\underset{O}{}}NSO_3H.$$

Angeli and his colleagues (Atti real. Accad. Lincei, (v.) **10**, ii., 303; Gazzetta, **35**, i., 152) have apparently succeeded in converting hydroxylamine into dihydroxylamine, $(HO)_2NH$, or, perhaps, nitrosyl hydride, $ON.H$, by oxidising it with Caro's acid. They used the acid only after neutralising it with potassium carbonate. It seems permissible to assume that the oxidation would go farther were the free acid used, and then yield $H_2N_2O_3$, instead of H_3NO_2. For, in a similar way, using Caro's acid, Raschig oxidises hydroxylaminemonosulphonic acid into nitroxysulphuric acid (*i.e.*, the blue-violet substance). If, then, the action can be carried farther than only to produce dihydroxylamine, nitroxous acid may be got, as Thum has actually found, when using boiling alkaline permanganate. The two equations seem to support the constitution given to nitroxous acid, and, therefore, to nitroxysulphuric acid. They are :—$HONH_2 + O = (HO)_2NH$ and

$$HON{<}^{H+O+HO}_{H+O+HO}{>}NH = HON\overset{O}{\underset{O}{}}NH + 2H_2O;$$

or, in one equation, $2HONH_2 + 3O = 2H_2O + HO(N_2O_2)H$. Assuming the intermediate production of dihydroxylaminesulphonic acid, Raschig's oxidation of hydroxylaminemonosulphonic acid by Caro's acid is expressed by equations parallel with those just given :—

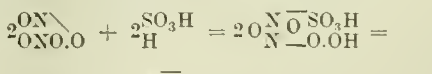
$$HONH(SO_3H) + O = (HO)_2NSO_3H;$$
$$HON{<}^{H \quad\;\; +O+HO}_{SO_3H +O+HO}{>}NSO_3H =$$
$$HON\overset{O}{\underset{O}{}}NSO_3H + H_2O + H_2SO_4.$$

Coming now to the reactions of nitroxysulphuric acid and taking, first those in which it is assumed to be formed and decomposed in the chamber-process, the double equation is: $2HO{\cdot}NO + SO_2 = HO(N_2O_2)SO_2OH = HOSO_2OH + 2NO$, by which is meant to be shown firstly, the always-recurring doubling of NO when chemically active, and then the entrance of the sulphur dioxide as sulphuryl between the dinitrosyl and one of the hydroxyls, according to well-known analogies.

The interaction between nitrous peroxide and sulphur dioxide and water, as it is assumed to occur in the chamber gases, is :

$$2N_2O_4 + 2H_2SO_3 = 2H_2N_2SO_7 = 2H_2N_2SO_6 + O_2;$$

or—

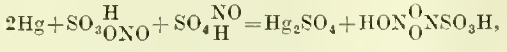


$$2\,{}^{ON\diagdown}_{ONO.O} + 2\,{}^{SO_3H}_{H} = 2\,O{}^{N\,\overline{O}\,SO_3H}_{N\,-O.OH} =$$
$$2O{}^{N\,\overline{O}\,SO_3H}_{N-OH.} + O_2.$$

The effect of nitric acid, in at once destroying nitroxysulphuric acid (Raschig) is shown summarily by the equation:—

$$H_2N_2SO_6+HNO_3+2H_2SO_4=3HNSO_5+2H_2O.$$

The explanation of the conversion of nitrososulphuric acid into nitroxysulphuric acid by copper or mercury requires some introduction. Raschig's presentation of the system, $2Hg+H_2SO_4$, as equivalent to 2H (this vol., p. 167, i., par. 1) is quite unallowable. Wentzki has already pointed this out (Z. angew. Chem., 1911, **24**, 394), but goes on to commit the same error himself, by representing the production of H_2O by 2H as coming from $2Hg+H_2SO_4$. There is no action of mercury, silver, or copper upon cold sulphuric acid, as is well known. These metals are not liberators of hydrogen from water or acids but they act as reducing agents indirectly, by combining with sulphur trioxide to form sulphites, which are then decomposed by sulphuric acid to yield sulphur dioxide and sulphates. Silver dissolves freely in cold fuming sulphuric acid, without evolution of gas, or even odour of sulphur dioxide, for a time. Mercury hardly dissolves but it is freely acted upon in the same way as silver (Trans. Ch. Soc., 1885, **47**, 636). Now, it may confidently be accepted, that mercury will decompose nitrososulphuric acid, since this is a compound of pyrosulphuric acid. In consequence of the property of mercury to form a sulphite with sulphuric anhydride, it will possess the power of producing the sulphonic compound, nitroxysulphuric acid, from the sulphuric compound, nitrososulphuric acid. The equation—



$$2Hg+SO_3{}^{H}_{ONO}+SO_4{}^{NO}_{H}=Hg_2SO_4+HON{}^{O}_{O}NSO_3H,$$

is hardly sufficient to make the point clear, but it is to be understood that, after one molecule of nitrososulphuric acid has been converted by the mercury into mercurous *sulphite* and nitrous acid, just as pyrosulphuric acid is converted by mercury into mercurous sulphite and sulphuric acid, the sulphite and nitrous acid interact with a second molecule of nitrososulphuric acid to become finally mercurous *sulphate* and nitroxysulphuric acid.

The oxidation by Caro's acid (Raschig), by which hydroxylaminemonosulphonic acid is converted into nitroxysulphuric acid, has already been discussed and formulated in the account of nitroxous acid.

The interaction of Raschig's nitrososulphonic acid with nitrous acid would be formulated by the equation, $HO.NO+ON.SO_3H=HO(N_2O_2)SO_3H$.

Improbability that the interaction of nitrous acid and sulphur dioxide takes place in stages.

Finding that two molecules of nitrous acid must interact with one of sulphur dioxide, in the process for making sulphuric acid, and that one molecule of nitrous acid interacts, under other conditions, with two molecules of sulphur dioxide, and being possessed with the notion that a molecule of the one substance should combine or interact with only one molecule at a time of the other substance, Raschig has all along presented his theory in conformity with this view of the order of things. He is, therefore, not content with the theory, so long as it cannot represent the production of sulphuric acid in a series of molecule-to-molecule interactions. Multimolecular equations, even those with only two molecules of one substance, do not exhibit the mechanism of the chemical change; they are no more than merely balanced "arithmetical" (numerical) expressions (this vol., p. 169, col. i., middle par.).

Every chemist will appreciate that standpoint, when appropriately taken. An instance, in which it seems appropriately applied, has already occurred in the present paper, that of the summary equation,

$$2H_2O+3N_2O_4+4SO_2=4HNSO_5+2NO.$$

But it cannot be rightly applied to the equations expressing the theory of the lead-chamber process. Nothing is commoner in chemistry than an interaction between three molecules, each of a distinct substance inactive singly upon either of the other two. More than this, in the chamber-process, the two molecules of nitrous acid may be, and probably are, represented by one molecule of nitrous anhydride; while in converting nitrous acid into sodium hydroxylaminedisulphonate, the two molecules of sulphur dioxide are represented by one molecule of sodium pyrosulphite. Again, even when the two molecules are assumed to be in action on one side, the joint action of the two is, chemically judged, more likely than their successive action. Since nitrous acid tends so strongly to exchange an atom of oxygen for two sulphonic radicals, it is more probable that it will do so completely and at once than in stages. Similarly, since sulphurous acid tends so strongly to form nitroxysulphuric acid, it is more probable that it, too, will do so at once, than in stages: The following equations seem to establish the propriety of treating these interactions as taking place at once, rather than in stages: at once,

$$HO{\cdot}H+2SO_2+HO{\cdot}NO=(HO{\cdot}SO_2)_2NO{\cdot}H\,;$$

$$HO{\cdot}H+(NO)_2O+SO_2=HO{\cdot}SO_2{\cdot}(N_2O_2){\cdot}O{\cdot}H,\ \text{or}$$

$$2HO{\cdot}NO+SO_2=HO{\cdot}SO_2{\cdot}(N_2O_2){\cdot}OH:$$

in stages: first stage, common to either formation,

$$HO{\cdot}NO+SO_2=HO{\cdot}SO_2{\cdot}NO\,;$$

second stage,

$$HO{\cdot}H+SO_2+HO{\cdot}SO_2{\cdot}NO=(HO{\cdot}SO_2)_2NO{\cdot}H\,;$$

$$NO{\cdot}OH+HO{\cdot}SO_2{\cdot}NO=HO{\cdot}SO_2{\cdot}(N_2O_2){\cdot}OH.$$

The whole change in one interaction is even more satisfying in exhibiting the mechanism of the process than the change in two stages; the former is as free from assumption as it well could be, while the latter involves the very questionable assumption of the existence of nitrososulphonic acid. But, in displaying the change in successive stages, there is, for Raschig, the advantage that the reminder is given that the first stage, if it exists, must be the same in the production of hydroxylaminedisulphonic acid as it is in the production of nitroxysulphuric acid.

Attention will now be directed to the two substances, nitrosisulphonic acid and nitrososulphonic acid, in the existence of which Raschig believes, and both of which are, according to him, transitional products in the manufacture of sulphuric acid.

Raschig's nitrosisulphonic acid.

When sulphur dioxide dissolves in sulphuric acid of chamber strength or somewhat above it, holding nitrous acid in solution, it causes two visible phenomena; the colouring of the acid and an effervescence of nitric oxide. If the supply of sulphur dioxide ceases, the colour slowly fades after which the effervescence stops. If nitrous acid remains, the entrance of more sulphur dioxide reproduces the effervescence and the colouring. Effervescence and colouring are, as nearly as can be determined, simultaneous events. The only admissible explanation of these phenomena is the simple one that has been made the text of this paper. It is, that sulphur dioxide unites with nitrous acid to form the blue-violet substance, nitroxysulphuric acid, $H_2N_2SO_6$, which decomposes into sulphuric acid and nitric oxide almost as fast as formed. Raschig has seen things differently and has taken the blue substance to be H_2NSO_5 (that is, the above formula after deducting NO), which decomposes into sulphuric acid and as much more nitric oxide as accompanied its formation.

Nothing is more improbable among matters of inference from chemical phenomena than the existence of nitrosisulphonic acid. It has gained, however, the belief of Lunge and Berl. Wentzki does not consider the blue-violet substance to be active in the process, but he has not refrained from giving it another composition and another name. What he suggests, $H_2N_2S_2O_9$, is also incredible. He supposes that mercury and sulphuric acid can deoxidise nitrosyl, as met with in nitrososulphuric acid, and then, by taking two molecules of this acid and deoxidising one, he gets $O(NOSO_3H)_2$. This is surely opposed to what is known of sulphuric acid, nitric acid, nitrous acid, and mercury. The formula would adapt itself well, however, to explain how the blue-violet acid gives nitric oxide and sulphuric acid:—$O(NSO_4H)_2+H_2O=2NO+2H_2SO_4$.

This is also the one saving quality of Raschig's formula, H_2NSO_5, that it can be broken up into H_2SO_4+NO, although even that helps only to discredit the validity of the formula. Nitric oxide, when, in definitely measurable reactions, it enters into interaction or when it comes out from a decomposition, always does so in a proportion twice that of its formula. Indeed, this must be so, since the formula for its molecule is also that for it as a univalent radical.

The equation, given for its production from sulphur dioxide and nitrososulphonic acid, $HNO_2+HNSO_4=H_2NSO_5+NO$, could only be regarded as displaying the mechanism of its formation, if the intervention of a transition-substance, such as $H_2N_2SO_6$, were to be understood. Instead of this, Raschig now says of the equation, $HNO_2+HNSO_4=H_2NSO_5+NO$, that "no other explanation is conceivable than that the nitrososulphonic acid has here acted as a reducer, and the nitrous acid as an oxidiser," apparently contradicting a statement which he made, in 1887, concerning an analogous case, that not reduction but condensation happens.

As matters stand, it will be seen that, out of the progression of equations,

$$HNO_2+SO_2=HNSO_4\ ;$$
$$HNSO_4+HNO_2=H_2N_2SO_6=H_2NSO_5+NO\ ;$$
$$H_2NSO_5=H_2SO_4+NO,$$

Raschig has omitted the term, $=H_2N_2SO_6$, while the author finds this term indispensable, but combines the first two equations into one, and the last two into another single equation, so that the whole reads as follows:—$2HNO_2+SO_2=H_2N_2SO_6=H_2SO_4+2NO$, the double equation already given. Raschig's $HNSO_4$ would be tolerable, if he could meet Wentzki's objection, already mentioned (p. 596), but it would still be unnecessary and better omitted; his H_2NSO_5 is intolerable not only for the single monatomic molecule of nitric oxide which accompanies it, but also for the defects of its constitution. Were it tolerable, it, too, would still be unnecessary and better omitted.

Because of the otherwise odd valency of the H_2N group, the nitrogen atom has to be made quadrivalent. It gets to be so, Raschig explains, through the oxidising action of nitrous acid upon another nitrous or trivalent nitrogen compound. But such a thing cannot be; at least it is not known to be the case, and cannot be understood to be so. Raschig's iso-N_2O_4, nitrous peroxide, might be effective through its double-oxygen radical, but that is not meant. This need for quadrivalent nitrogen to get a balanced formula has driven Raschig to another anomalous procedure. Since, as he assumes, the system mercury and sulphuric acid, hydrogenises nitrososulphuric acid, this acid must be a compound of quinquevalent nitrogen. That comes to making the statement that in dissolving a nitrite in sulphuric acid its nitrogen is made to change from trivalency to quinquevalency, and that on adding water to the solution, the quinquevalency of the nitrogen changes back to trivalency, a most improbable statement. It is a common vice, to which many otherwise excellent chemists are addicted, to play thus with the valency of nitrogen, perhaps the most obscurely understood valency of any element. We get along very well with an unchanging valency for phosphorus in hypophosphites, phosphites, and phosphates, which we write, respectively, as OPH_2OH, $OPH(OH)_2$, $OP(OH)_3$. Nitrous acid is reduced to hyponitrous acid or nitrous oxide, without the valency of the nitrogen changing. Hydrazine is "reduced" to ammonia without the valency of the nitrogen varying. Nitroxyl may equally well be $-N<\begin{smallmatrix}O\\|\\O\end{smallmatrix}$ as $-N\begin{smallmatrix}\diagup\!\!\!\diagup O\\\diagdown\!\!\!\diagdown O\end{smallmatrix}$

Lastly, the constitutional formula, $ON<\begin{smallmatrix}OH\\SO_3H\end{smallmatrix}$, has nothing to recommend it and owes its invention to the necessity of finding a structure for such a conjunction of atoms. The notion of nitrous acid added to the sulphonic radical without making it into sulphuric acid can hardly be entertained. The only possible analogue to it is peroxylaminesulphonic acid but the analogy is baseless, for this acid, in its salts, is a very marked peroxide $O_2[N(SO_3K)_2]_2$ (Haga, Trans. Ch. Soc., 1904, 85, 84), and one which, though very unstable, has no tendency to form sulphuric acid or nitric oxide.

Raschig's nitrososulphonic acid.

Although Raschig has introduced into his theory of the lead-chamber process, a second intermediate substance, there is no evidence that the first, and formerly the only, intermediately substance, nitrososulphonic acid or dehydrated dihydroxylaminesulphonic acid, now holds, in his estimation, a less important position in the process than it did in the earlier days of the theory. In past years, without having Raschig's theory the least in mind, the author and his colleague, Prof. T. Haga, happened to accumulate new facts, which Raschig found to bear heavily upon the foundations of his theory. In his lecture in 1904 in Heidelberg, he went so far as to say, in effect, of some of these facts, all of which he accepted, that if they established that nitrous acid never acted on only one molecule of sulphur dioxide, his theory would fall to the ground. From what precedes, in the present paper, it will be seen that the author is far from taking Raschig's view of the matter. Raschig's theory, as now slightly modified by the author, stands perfectly well, without the support of any molecule-to-molecule interaction between nitrous acid and sulphur dioxide.

The existence of nitrososulphonic acid is very improbable, but support may be found for it in the fact, already referred to, that dihydroxylamine itself appears to have been obtained, not indeed isolated, but in solution and active as a reagent. It is obtainable not by reducing nitrous acid but by oxidising hydroxylamine (p. 597, col. 2).

The experimental evidence looks very strong against the supposition that sulphur dioxide and nitrous acid have any tendency to unite, molecule to molecule. On the one hand, there is the chamber process, in which it seems certain that $2HNO_2$ or $(NO)_2O_2$ interact with one SO_2. Then, in suitably arranged experiments outside the chamber, it can be shown that, against Raschig's anticipations, one out of two molecules of nitrous acid unites with two molecules of (hydrated) sulphur dioxide, while the other molecule gets none. That is, when expressed by the equation showing the free acids: $2HNO_2+H_2S_2O_5=HNO_2+HON(SO_3H)_2$. Carried out without precautions, the products are sulphuric acid and nitrous oxide, instead of that formulated in the equation. But, in the experiment modified to suit its purpose, sulphur dioxide, not exceeding the required quantity, is to be passed into a mixture of alcohol and an aqueous solution of the potassium salt of the nitrous acid. The action which takes place is expressed by the equation, $3KNO_2+2SO_2+C_2H_6O=KNO_2,HON(SO_3K)_2+C_2H_5NO_2$, the alcohol serving to preserve, as its ester, the nitrous acid, otherwise set free but not wanted for sulphonation. The double salt, formulated in the equation, which is deposited as such by the alcohol solution of potassium nitrite, is at once resolved by water into its component salts. With one molecule of water supposed to be added to it, it would have the ultimate composition that dihydroxylaminesulphonate would have. Now, seeing that it is not this unknown salt, which, from its composition, it might have been; seeing that the sulphur dioxide has gone all to one molecule of the nitrite and neglected the others and that it has actually liberated nitrous acid without sulphonating it, there is in this experiment much evidence that, in circumstances apparently most favourable, the formation of Raschig's molecule-to-molecule compound does not take place.

There is another experiment, the evidence from which seems to be also opposed to the adoption of Raschig's view as to sulphonation by stages. It is true that the sulphur dioxide, present as potassium sulphite, is in great excess, but still, as in the previous experiment, the interaction proves to be that between three molecules of nitrous acid and only two of sulphite. Nitrous fumes are allowed to flow freely upon the surface of solution of normal potassium sulphite kept agitated and very cold. The brown gases are rapidly absorbed and give rise to no effervescence. The products are potassium nitrite and potassium hydroxylaminedisulphonate, formed according to the equation,

$$3HNO_2+2K_2SO_3=2KNO_2+H_2O+K_2HNS_2O_7,$$

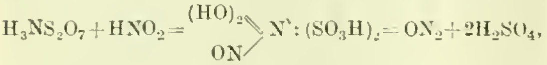
where one-third of the nitrous acid (nitrous fumes and water) suffers all the sulphonation. If there were a tendency that way, the change would be, and could be equally well, that shown by the equation,

$$2HNO_2+K_2SO_3=(HO)_2NSO_3K+KNO_2,$$

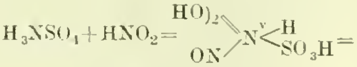
thus yielding the salt of the dihydroxylaminesulphonic acid wanted by Raschig. If, now, to escape from the difficulty that none of it is found, it were assumed that this substance is used up as fast as it is produced, it would have to be accepted that additional potassium sulphite, instead of sulphonating additional nitrous fumes or nitrous acid, elects to further sulphonate the potassium dihydroxylaminesulphonate. Having thus to assume that the second degree of sulphonation is easier to accomplish than the first, one would expect the disulphonation to be, for that reason, one operation only or two simultaneous operations, thus excluding the production of any dihydroxylaminesulphonate.

When potassium pyrosulphite is substituted for the normal sulphite the only difference is that no potassium nitrite is produced. When, lastly, a solution of sulphur dioxide is taken in place of that of potassium sulphite, the result is essentially the same and is expressed by $HNO_2+2SO_2+H_2O=H_3NS_2O_7$. In this form of the experiment, the solution must not only be kept thoroughly cold, but the experiment must not last too long. Directly the supply of nitrous fumes is stopped, a rapid stream of air is to be sent through the solution, to expel the unused sulphur dioxide. If, now, the solution is tested, it gives the reactions for sulphuric acid and for hydroxylaminemonosulphonic acid. The production of the latter acid is, under the circumstances, a proof that hydroxylaminedisulphonic acid has been present and then hydrolysed into the two acids found.

When the addition of nitrous acid, in the shape of nitrous fumes, is continued to excess, in the above experiments, the hydroxylaminedisulphonic acid and hydroxylaminemonosulphonic acid interact with the nitrous acid, that is, unite with it to form some substance of fleeting existence, which decomposes into nitrous oxide and sulphuric acid. This is expressed in the following equations :—



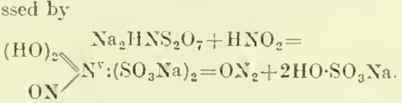
$$H_3NS_2O_7+HNO_2=\begin{matrix}(HO)_2\diagdown\\ ON\diagup\end{matrix}N^v:(SO_3H)_2=ON_2+2H_2SO_4,$$



$$H_3NSO_4+HNO_2=\begin{matrix}HO)_2\diagdown\\ ON\diagup\end{matrix}N^v\begin{matrix}\diagup H\\ \diagdown SO_3H\end{matrix}=$$

$$ON_2+H_2O+H_3SO_4.$$

When the addition of nitrous acid, in excess, is made in the experiment upon solution of the potassium pyrosulphite or preferably on the sodium salt, the interaction is expressed by



$$Na_2HNS_2O_7+HNO_2=$$

$$\begin{matrix}(HO)_2\diagdown\\ ON\diagup\end{matrix}N^v:(SO_3Na)_2=ON_2+2HO\cdot SO_3Na.$$

When, however, the experiment is made with normal potassium or sodium sulphite, in which case potassium or sodium nitrite is also produced in the first stage, only a slight excess of nitrous acid, which may even be replaced by sulphuric acid, is sufficient to start the second stage. The evidence of all these experiments taken together is surely very strong indeed that, when sulphur dioxide meets nitrous acid, not in excess of its molecular proportion, the product is hydroxylaminedisulphonic acid, which then interacts with more nitrous acid.

Raschig's experiment, described in the last seven lines of page 170 and in the first column of page 171 of this volume, in no way weakens this evidence. This experiment consists in letting, with due precautions, an aqueous solution of sulphurous acid flow into nitrous acid solution, with the result, under the conditions of the experiment, that nitrous oxide and sulphuric acid are produced in molecular proportions, thus proving that the sulphurous acid and nitrous acid have interacted also in simple molecular proportions. For, it is also shown that excess of either acid, used in the experiment, remains inactive.

If this experiment made the assumption probable, that the acids interact in single molecular quantities, it would serve thereby to disprove the two-stage part of Raschig's theory, by showing that nitrososulphonic acid is either not produced at all or that it can be present with additional nitrous acid or sulphurous acid and yet be unconverted into the blue-violet compound or into hydroxylaminedisulphonic acid.

To save his experiment from either of these interpretations, Raschig asks for the acceptance of the view, that the action upon nitrososulphonic acid of the second molecule of either nitrous acid or sulphurous acid is too languid to be able to forestall the simple or hydrolytic decomposition of this substance, unless much other acid is present, to retard this decomposition. So long, at least, as no considerable quantity of hydrochloric acid is present, the experiment proves nothing as to the production or not of nitrososulphonic acid. Between the nitrous acid and sulphurous acid taken and the nitrous oxide and sulphuric acid resulting from their interaction, there is no need to interpose the unknown substance, nitrososulphonic acid. Hydroxylaminedisulphonic acid, well known in its salt and certainly producible in this way, meets fully the necessities of the case. Two molecules of sulphur dioxide and water unite with one of nitrous acid to form this substance and then this interacts with the second molecule of nitrous acid to give, as a matter of experience, the final products. Raschig himself has found (Heidelberg lecture) that the mixed acids in equal volumes reduce permanganate for a short time, and this may be evidence of the temporary presence of hydroxylaminedisulphonic or monosulphonic acid.

Using much hydrochloric acid, Raschig shows that the precipitation of the sulphuric acid as barium salt, from the mixed nitrous and sulphurous acids, is a little retarded. But, to account for this, there is, besides the effect of the hydrochloric acid itself, that of hydroxylamine- and amine-sulphonic acids, which markedly retard the precipitation of barium sulphate (Trans. Ch. Soc., 1896, **69**, 1643), and these may well be present.

By having a moderate quantity of sulphuric acid present when the solutions of nitrous acid and sulphurous acid are mixed, Raschig has obtained the interesting result that, even with the sulphurous acid in excess, the interaction takes place between two molecules of nitreus acid and one of sulphur dioxide, as in the chamber process. Raschig finds in this result evidence of the production of nitrososulphonic acid and of its being preserved from hydrolytic decomposition by the sulphuric acid. But that is a purely speculative view. The facts are that the nitrous acid and sulphurous acid interact in such a way as to yield now, not nitrous oxide but nitric oxide and water.

It remains to be pointed out that Raschig's experiment fails to be what it purports to be, the mixture of molecular quantities in solution of nitrous acid and sulphur dioxide. As carried out, the sulphurous acid is in great excess at the beginning of the mixing, equality being reached just at the end of the mixing, if there were no interaction. A 1/5*N* solution of sodium bisulphite (pyrosulphite) is run into a 1/100*N* solution of both nitrous acid and sulphuric acid. The molecular density of the sulphite solution is therefore twenty times that of the nitrous acid solution.

When any two liquids meet, they must have between them a surface of contact, however fluid, across and through which their contents will diffuse. Whatever interaction occurs will take place in presence of, though not necessarily between, the contents of layers of equal thinness on either side of the contact-surface, that is, in presence of the contents of equal volumes, except for differences in their rates of diffusion. The quantities meeting each other are thus in the proportions of the molecular densities of their solutions. This seemingly obvious and most important deduction, enunciated forty years ago by Maumené, is too often neglected, as it has been by Raschig.

Accordingly, in Raschig's experiment, when mixing begins, one molecule of nitrous acid in 1/100*N* solution meets at once, not only one molecule of sulphur dioxide, but also about nineteen equivalents of the very active substance, sodium pyrosulphite in 1/5*N* solution. Then, quickly after, the molecules of nitrous acid come each in contact at once with many molecules of sulphur dioxide, in consequence of the previous interactions having generated additional sulphuric acid. Such being the state of things in the course of this experiment, the substance transitional to the sulphuric acid produced, must here be, not nitrososulphonic acid, but hydroxylaminedisulphonic acid. As diffusion proceeds, aided by shaking, the sulphur dioxide gets all used up, and then more and more of the hydroxylaminedisulphonic acid interacts with the remaining nitrous acid, until one or other is all consumed. The interactions need not be pursued further.

By a simple modification in procedure, Raschig's experiment might be made to be what it is intended to be, but the result could not be expected to prove anything concerning the existence of nitrososulphonic acid.

Summary.

The argument of this paper may be briefly summarised as follows :—

What goes on in the lead-chambers is largely a matter of inference (p. 595), but it may be inferred with certainty that, before sulphuric acid can be produced in the process, there must be combination between sulphur dioxide and nitrous acid or its equivalent (p. 594).

When the process is normally working, the single substance, formed by the combination, must decompose as fast as it is formed. The presence in the chamber of this intermediate substance will, therefore, be unrecognisable (p. 595, col. 1).

Nitrososulphuric acid (nitrosyl sulphate), $HNSO_5$, is not qualified to play the part of the intermediate substance, for it is no more than a compound of nitrous anhydride with sulphuric acid, the mixed hemi-anhydride of the two acids, into which it decomposes again when hydrated. It is not a sulphonic compound (p. 596).

Raschig's nitrososulphonic acid, $HNSO_4$, has probably no existence (p. 599); certainly, it would seem, his nitrosisulphonic acid, H_2NSO_5 cannot exist (p. 598, col. 2).

The intermediate combination will be a substance necessarily equal in composition to that of the substances formulated on either side of the summary equation of the chamber-process. The double equation will, therefore, be $2HNO_2+SO_2=H_2N_2SO_6=2NO+H_2SO_4$ (pp. 594 and 599).

Nitroxysulphuric acid,

$$HO\overset{O}{\underset{O}{N}}NSO_3H,$$

are the name and constitution given to this intermediate substance, in accordance with nitroxysulphurous acid,

$$H\overset{O}{\underset{O}{N}}NSO_3H,$$

given to the acid of Pelouze's potassium salt, to which it is allied, supposing it to be the same as the coloured substance, studied by Sabatier and by Raschig, and seen occasionally in the acid of the Gay-Lussac tower (pp. 596 and 597).

An acid, the salts of which were discovered by Thum and by Angeli and fully described by the latter, appears to be the substance of which nitroxysulphuric acid is the sulphonic derivative. It stands in composition between nitrous and hyponitrous acids, having the formula, $H_2N_2O_3$. The suitable name and constitution for it are nitroxous acid,

$$HO\overset{O}{\underset{O}{N}}NH \text{ (p. 597).}$$

It is no longer necessary to assume that nitric oxide unites with only enough oxygen to form nitrous anhydride, N_2O_3, although much more is present in the chambers. For, by applying the experimental knowledge gained by Raschig, it becomes evident that the nitric oxide does combine with enough oxygen to form a substance of the composition, N_2O_4, which, though it soon becomes ordinary nitric peroxide, behaves, for a time, as the peroxide of nitrous acid, ONO·ONO, yielding, in its interactions, nitrous acid and free oxygen. Thus, the nitric oxide oxidises, as it should, to (iso)N_2O_4, but the product behaves as nitrous acid (p. 595).

The mist in the chambers consists with continual resolution into drops and continual renewal, of minute particles of liquid sulphuric acid, each surrounded with its atmosphere of undiluted nitric oxide, the particle and its atmosphere being joint products of the decomposition of nitroxysulphuric acid. The nitric oxide then becomes nitrous peroxide, nitrous acid, and, completing the cycle, nitroxysulphuric acid again (p. 596).

The present modification of Raschig's theory differs from the original version, mainly as follows : in the original, there are two substances assumed to be intermediate formations, nitrososulphonic acid, $HNSO_4$, and nitrosisulphonic acid, H_2NSO_5, the existence of either being strongly open to question and no more than a matter of opinion ; in the modification, there is but one intermediate substance, nitroxysulphuric acid, $H_2N_2SO_6$, the existence of which is asserted to be a necessary inference. Indeed, the formation of Raschig's nitrosisulphonic acid cannot occur without the intermediate formation of nitroxysulphuric acid (p. 599), while the admission of the existence of this renders unnecessary the assumption of that of either nitroso- or nitrosi-sulphonic acid. The compound equation on p. 599 should serve to show the relations of all these substances and the difference of the two forms of the theory.

Discussion.

Dr. Raschig sent a letter to Dr. Divers in time for it to be presented with the paper, in which he confines himself, for want of leisure, to criticism of some matters collateral with but not touching Dr. Divers's suggested modification of the theory. The following is a translation of the body of Dr. Raschig's letter :—When, in accordance with the constitution you give to Pelouze's nitroxysulphite, you have to maintain that its two nitrogen atoms are not linked together, while, as you know, I have by reduction obtained from it hydrazinesulphonic acid, which beyond doubt contains two atoms of nitrogen linked together, no chemist in the world will agree with you. If you were right to double the molecular magnitude of Fremy's nitrosodisulphonate, while I have established, by extended researches, the formula $ON(SO_3K)_2$, which can only be read with the nitrogen quadrivalent, chemical progress would have to be regarded as made at the desk and not in the laboratory. It shall never come to that with me. I do not know how you can object, as you do, near the end of your paper, to the experiment to prove the union of one molecule of sulphur dioxide with one molecule of nitrous acid, as being incorrectly carried out, because I used a $1/5N$ solution of bisulphite with a $1/100N$ solution of nitrous acid. That was only for convenience at the lecture, where the bisulphite had to be contained in a burette. In my Heidelberg discourse you will see that the experiment had the same success with more dilute solutions of sulphur dioxide and, I may add, that it does not matter whether the sulphur dioxide is added to the nitrous acid or conversely.

I cannot share your views on valency. What I feel is not that trivalent nitrogen changes to quinquevalent, but that the same nitrogen *is* both trivalent and quinquevalent and *can* also be quadrivalent. When ammonia is converted into ammonium chloride, trivalent nitrogen acts as quinquevalent ; when ammonia is led over sodium, the compound, NH_3Na, is formed, in which the nitrogen must be taken to be quadrivalent. Much else in your paper runs counter to my chemical sense. But, in so short a time, I cannot write a detailed reply, particularly as your paper would need a much fuller study than I have yet been able to give to it.

Dr. Divers replies :—(1) Dr. Raschig has too narrow an outlook on the reduction of potassium nitroxysulphite, $K\overset{O}{\underset{O}{N}}NSO_3K$, which with Hantzsch he writes as $KO\overset{O}{N}—NSO_3$. But little hydrazine and no hydrazinesulphonate were obtained from this salt by Haga and himself, and no such ammonia as might, to some extent, represent destroyed hydrazine. Much sulphite is obtained but with it much hyponitrite and nitrous oxide, the presence of which precludes the possibility of the sulphite being a decomposition-product of hydrazinesulphonate. Nitrous oxide and a hyponitrite are both irreducible by sodium amalgam and water ; it is, therefore, tolerably certain that the corresponding part of the nitroxysulphite is also irreducible. As a fact, almost three-fourths of the nitrogen of this salt are obtained on reduction as nitrous oxide and hyponitrite.

Raschig would seem to have overlooked the fact that aminic nitrogen atoms become linked readily with those in union with oxygen or chlorine: $HNO_3+NH_3=N_2O+2H_2O$; $HNO_2+NH_3=N_2+2H_2O$; and his own discovery: $NH_2Cl+NH_3=N_2H_4+HCl$. Here, then, in the break-up of the nitroxysulphite by reduction, must the origin of the hydrazinesulphonate be looked for.

Half the sulphur and one quarter of the nitrogen of nitroxysulphite are obtained by reduction as aminesulphonate, H_2NSO_3K, with nitrous oxide and water as its complement. There is no getting away from the fact that the two linked nitrogen atoms of this nitrous oxide come each from a distinct molecule of the nitroxysulphite. Here, then, if Raschig were right, two atoms of nitrogen, linked in nitroxysulphite, would have to separate, so that one of them might again link itself with another nitrogen atom $2(N—N)$ becoming $\overset{N}{\underset{N}{\cdot\cdot}}+2N$. That seems most improbable.

If its nitrogen atoms were directly linked together, it would be difficult to understand the ready dissociation by heat of nitroxysulphite into sulphite and nitric oxide, since each molecule of the latter is a compound of one atom only of nitrogen.

(2) As authorities are agreed that Fremy's sulphazilate is an oxyaminesulphonate, representing sulphonated nitric peroxide, Haga's name for it, peroxylaminesulphonate, does seem appropriate, whereas to call it a nitroso compound does not. The chemical reactions of nitric peroxide and of peroxylaminesulphonate are concerned exclusively with the bivalent molecules, N_2O_4 or $2NO_2$, and $O_2N_2(SO_3K)_4$ or $2ON(SO_3K)_2$, respectively. What the valencies of the nitrogen atom and the non-sulphonate oxygen atom may be, in the univalent molecules, NO_2 and $ON(SO_3K)_2$, does not seem determinable and does not seem to matter much here. But, that in iso-nitric peroxide and in the bivalent molecule of peroxylaminesulphonate the two nitrogen atoms are trivalent and the two oxygen atoms paired together as a bivalent radical, as in other true peroxides, appears from two sets of facts, at least. (*a*) Isonitric peroxide (nitrous peroxide, $ONO{\cdot}ONO$) interacts with water to give nitrous acid and oxgyen. Hydrolysis (which cannot change the total valency of the two nitrogen atoms, as, for example, ordinary $N_2O_4=N_2O_3+N_2O_5$) resolves peroxylaminesulphonate wholly into three trivalent nitrogen compounds (Haga). (*b*) Since hydroxylaminetrisulphonate is a trivalent nitrogen compound, peroxylaminesulphonate should be the same, it would seem, while, if in the latter the nitrogen atoms were quadrivalent, they should be quinquevalent in the former. If chemically active peroxylaminesulphonate were only $O : N(SO_3K)_2$, a sulphite should combine with it, if at all, to form $KO{\cdot}N''''(SO_3K)_3$, instead of giving hydroxylamined sulphonate and hydroxylaminetrisulphonate:

$$K{\cdot}SO_3K+O_2[N'''(SO_3K)_2]_2=$$
$$KON'''(SO_3K)_2+(SO_3K)ON'''(SO_3K)_2,$$

as it does in fact. It would be strange, if for the first time in experience, the SO_3K should unite with the oxygen rather than with the nitrogen of the radical, $N : O$.

(3) Raschig's experiment with nitrous acid and sulphur dioxide is deemed inconclusive for the reason that there is so great a difference in the molecular strengths of $1/100N$ and $1/5N$ solutions. However mixed, the sulphur dioxide must be in large excess of the nitrous acid it meets.

(4) It is doubtful what reply needs to be made to Raschig's remarks on varying valency, since the author believes himself to be in agreement with most chemists on this subject. It is for Raschig to defend the proposition that sulphuric acid, with no change of valency, interacts with nitrous acid, in such a way as to change the valency of the nitrogen. If nitrous acid were $H{\cdot}NO_2$, no change of valency would occur, but then the exchange of NO_2 with OH is not what would be expected. But, for Raschig, nitrous acid is $HO{\cdot}NO$, not $H{\cdot}NO_2$. Again, it is for him to defend the chemical propriety of such an equation as $HNSO_5+H=H_2NSO_5$, as regards valency, since it seems to the author to belong to no recognised class and to be unable to stand criticism.

The **Chairman** said that, as Dr. Divers had indicated, the debatable point seemed to centre round that blue compound which apparently only made itself apparent when the process was proceeding in a more or less unsatisfactory manner. Whether the composition of that particular body was H_2NSO_5, according to Raschig, or H_2NSO_6, as Dr. Divers had, he thought, very successfully argued, was a matter which they must leave to the experts to decide. There was one point made by Dr. Divers which they were perhaps rather inclined to forget, viz., that the oxidation of one substance by another involved of necessity the union of that body, even although it was a very brief temporary union. It was important to remember that, because in this they had an illustration of a substance which in the brevity of its period of combination was in some respects like a catalyst, but which unlike a true catalyst suffers by its temporary relationship: it formed a very interesting illustration of what he might call a third variety of chemical action.

Mr. W. C. **Reynolds** said they would all agree that the crux of Dr. Divers's new theory, as also Dr. Raschig's, was the blue violet compound, and with regard to that there were three distinct propositions that Dr. Raschig thought he had proved. Firstly, that it existed in a solution under conditions of dilution and temperature at which chamber crystals were not present, and secondly, that it was not formed by the action of sulphur dioxide on chamber crystals (in concentrated sulphuric acid); and thirdly, that it was formed by the union of sulphur dioxide and nitrous acid. In conjunction with one of his colleagues he had been working on this problem, and hoped shortly to be able to place before the Society evidence which he thought would prove conclusively that Dr. Raschig was mistaken in those three propositions, and that the chamber crystals could and did exist in acid very much more dilute than he thought—50 per cent. sulphuric acid—which could be very readily proved. This blue acid could be formed with the greatest ease from the chamber crystals themselves, but was never formed, he believed, under any circumstances except when those chamber crystals were present, and therefore it was extremely probable that they were always formed by the reduction of the chamber crystals. If that fact were established, then he hardly saw where this new substance of Dr. Divers, came in; and it would be very difficult indeed to establish such a formula under these circumstances. There were, however, other considerations, apart from the question of the composition of the violet acid: its properties ought to be taken into account. It was very easy to produce sulphuric acid under conditions of very much greater dilution than were ordinarily carried out in the chambers. It could also be carried out with the greatest ease in presence of dilute nitric acid; and under these conditions neither the chamber crystals, nor this violet acid, had any existence. Again, Lunge showed many years ago (and there was no difficulty in establishing the correctness of his conclusions) that when nitric oxide and a little water with air interact, the sole product of that re-action is nitric acid: and if that were so, it was almost incredible that there should not be in the chambers at any one time (although being rapidly reduced by the sulphur dioxide), very considerable quantities of nitric acid present. But nitric acid, as Raschig himself showed, immediately oxidised this violet acid—that when there was a very small amount of acid added to the solution it immediately oxidised it. It appeared to him that the presence of nitric acid alone put this violet compound out of court, apart from its being nothing more that a by-product under abnormal conditions in the chamber, when there was excess of sulphur dioxide.

Dr. **Divers** said that he agreed with Mr. Reynolds that nitrososulphuric acid, $HNSO_5$, might be present in the lead-chambers. The composition of the blue substance was, as yet, entirely a matter of inference. Should Mr. Reynolds, later on, have the complete paper in his hands, he would no doubt agree that "lead-chamber crystals," being a compound of nitrous acid, the nitrous acid and the sulphur dioxide would be able to form and would have to form nitroxysulphuric acid or something closely allied to it before they could pass, as they do, into sulphuric acid and nitric oxide. It was possible that the blue-violet substance might not be identical with the intermediate substance, Raschig's nitrosisulphonic acid, or his own nitroxysulphuric acid. In any case, its presence in the chambers during normal working should not be evident. The claim of Raschig's theory was that sulphuric acid is formed in the way stated, under the conditions of the lead-chamber process. Sulphuric acid could, it was well known, be formed in other ways, but under conditions unlike those of the chambers, from sulphur dioxide and nitrous acid. In the normally working process, nitric acid was certainly not produced; it was unnecessary therefore to consider its action upon any of the blue substance, that might be in the lead-chambers.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Heat; The flow of —— through furnace walls. W. T. Ray and H. Kreisinger. U.S. Bureau of Mines, Bull. No. 8. 1911, pp. 31.

The experiments were carried out on a tunnel about 35 ft. 6 in. long, 3 ft. wide, with an arched roof of 3 ft. 3 in. radius centred from the middle of the floor. The walls were composed of 9 in. firebrick and 8 in. common brick with a 2 in. air space between; the roof of 9 in. firebrick and 4 in. common brick separated by a 1 in. layer of flake asbestos; the floor of 2 in. firebrick, 3 in. sand and 1½ in. asbestos. The hot gases in the tunnel were supplied from a mechanically fed furnace at one end and passed to a tubular boiler at the other end, air leakage through the walls being reduced to a minimum by keeping the interior of the chamber as nearly as possible at atmospheric pressure. Sets of four thermo couples were placed at intervals in the walls and in the roof, so that the temperatures could be taken in the brickwork, 1 in. from the interior of the tunnel, 1 in. on either side of the air space and 1 in. from the outside in the case of the walls, and 1 in. from the interior, 1 in. on either side of the asbestos layer, and 1 in. from the outside in the case of the roof. After about 19 hours from the start of the test, equilibrium of wall temperature was reached. From several series of readings taken before and after equilibrium was attained, the authors found by computing from the fall in the temperature which took place through the various layers of the roof and walls, that approximately twice as much heat was lost through the side wall as was lost through the roof. They examined their results in the light of the laws of conduction and radiation (Stefan-Boltzmann) for which latter law they have worked out charts showing the amount of heat transferred for all conditions of furnace operations. For brickwork the "co-efficient of net heat exchange" by radiation at 700° C. was 0·5 of that exchanged between two sooted surfaces at the same respective temperatures. Clement and Egy (this J., 1910, 952) found the conductivity of firebrick at 700° C. to be about 0·1158 B.Th.U. per sq. ft. per min. per 1° F. difference in temperature per 1 in. (0·0024 grm.-caloric per cm. per second per degree C). Under the conditions of the experiments where the rate of combustion of fuel was about 900 lb. of coal of 12,000 B.Th.U. per lb. per hour, the heat loss by dissipation through the walls, roof and floor was found to be 4·3 per cent.; this could be materially reduced by the proper selection of material and mode of furnace wall construction. The resistance to heat passage of the air space was very low—that of the asbestos layer very high—compared with that of either brick wall, and the authors show by comparing the relative significance of the laws of radiation and conduction that the insulating effect of the air space, so effective at low temperatures, is lost at higher temperatures by the increase in heat transference which takes place by radiation. The employment of a double wall with an intervening layer of loose solid material such as asbestos, ash, crushed brick or sand is recommended because of its insulating properties and also as it tends by its plasticity to prevent air leakage.
—B. G. McL.

Patents.

Drying machines. O. Stott, Birmingham. Eng. Pat. 8142, Apr. 4, 1910.

The machine, which is specially applicable for drying small metal articles, consists of a horizontal perforated drum capable of being rotated, and surrounded by a stationary casing, the whole being supported on standards at either end. At the end where the dried articles leave the drum, mechanism is arranged to make it possible to lower this end of the apparatus and so to increase the rapidity of passage of the articles through the drum at will, and also, by lowering to the limit, to throw the driving cog-wheels at the other end out of gear and so put the apparatus out of action. Heated air is passed through the drum from the stationary casing, or, if the drum is unperforated, air may be passed directly through it, the connections in each case being flexible. Several dryers may be driven from one shaft, with the air passing through them in series or in parallel.—B. G. McL.

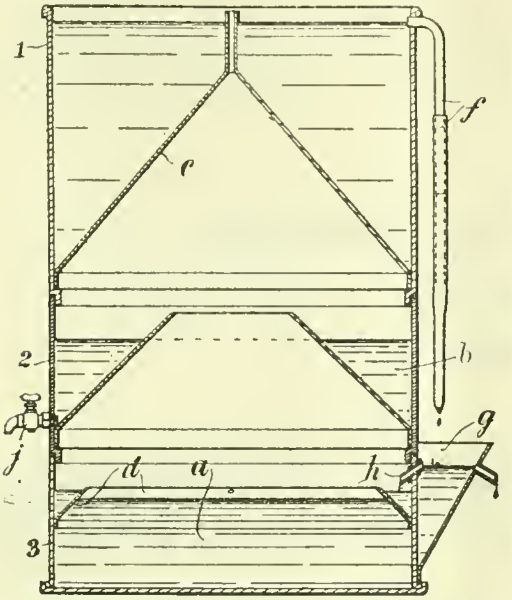
Distilling apparatus. A. G. Waterhouse, New York, Assignor to T. F. Bourne, Montclair, N.J. U.S. Pat. 989,672, April 18, 1911.

The liquid to be distilled is supplied to the boiler through the tubes of a multitubular heater, and enters the upper part of the boiler through a pipe provided with a float valve, so that the level of the liquid in the boiler is kept constant. As the liquid in the boiler becomes concentrated, the temperature rises and heats a "feeler" filled with a liquid which projects into the liquid in the boiler. The expansion of the liquid in the "feeler" causes a spring-controlled valve on the outlet pipe to open, and some of the concentrated liquid flows out of the boiler through the tube space of the heater and heats the liquid which flows through the tubes to take its place.—W. H. C.

Water and other liquids; Apparatus for distilling ——. G. J. A. Cotterell, London. Eng. Pat. 8303, Apr. 6, 1910.

The water or other liquid to be distilled, is caused to flow into the annular vessel, 1, (see fig.), where it serves to cool the condensing surface, *c*; from here it passes by the pipe, *f*, which is preferably external, to the reservoir, *g*, thence passing by the pipe, *h*, to the annular preheating vessel, *d*, in section 3, which supplies water to the still, *a*;

preheating in the annular vessel is claimed to economise the heat required for evaporation. The vessel, *a*, is heated in any convenient manner and the steam condenses on the surface, *c*, the condensed water collecting in the annular vessel *b*, in section 2, whence it is removed through the tap, *j*.—B. G. McL.



Crushing and pulverising materials. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,078, May 4, 1910.

Certain chemicals, *e.g.*, sodium sulphate, burned lime, chromates, etc., which are produced at high temperatures, are required in a pulverised condition and although easily powdered whilst still hot, become tough and difficult to powder when cold. In order to overcome this difficulty, the hot products are delivered direct from the furnace into one end of a horizontal cylinder where they are pulverised and subsequently cooled and discharged from the other end. The material is caused to move forwards through the cylinder either by rotating arms or beaters, which also serve to break up the material, or by rotating the cylinder itself. Any suitable pulverising device may be employed within the cylinder, which is water-jacketed towards the outlet end in order to cool the pulverised material.—W. H. C.

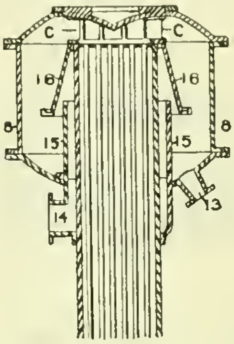
Filter presses and pressure filters; Discharging solid matter from ——. C. J. Grace, Steyning, Sussex. Eng. Pat. 14,767, June 18, 1910.

In filter presses in which the liquor to be filtered is admitted to one end of a filtering cylinder, the filtered liquid escaping through the periphery, it is proposed to remove the cake by closing the filtrate outlet and, by removing a plug at the other end of the cylinder, to force the cake out of the cylinder by increasing the pressure of the incoming liquor. This increase in pressure produces a film of liquid between the cake and the filtering medium, which facilitates the removal of the cake in a relatively dry state. The same object may be attained by the peripheral injection of water.—B. G. McL.

Evaporating-pan. J. W. B. Harry, Svea, Fla. U.S. Pat. 989,354, April 11, 1911.

The pan comprises an oblong rectangular body having a horizontal partition, above the bottom, dividing the pan into an upper evaporating compartment and a lower heating compartment. Transverse partitions extend alternately from opposite sides of the evaporating compartment, forming a zig-zag syrup channel, and transverse channelled partitions extend alternately from opposite sides of the heating compartment, forming a corresponding heating channel. Valved inlet and outlet passages for the syrup and heating channels are provided.—H. H.

Evaporator. P. Kestner, Lille, France. U.S. Pat. 989,982 April 18, 1911.



The mixed vapour and liquid from the centrifugal separator, *c*, of a climbing film evaporator is discharged into a casing, 8. The vapour passes first upwards beneath the depending curtain, 16, and thence downwards through the annular passage, 15, formed around the tube casing, to the discharge, 14. The liquid falls into the bottom of the casing, 8, and is discharged through the outlet, 13. —W. H. C.

Evaporator. J. Parker, Philadelphia, Pa. U.S. Pat. 989,996, April 18, 1911.

The upper end of an evaporator having vertical evaporating tubes has a casing surrounding the upper ends of the tubes and extending downwards around the upper end of the tube casing. A separating chamber is provided which surrounds the above-mentioned chamber and which receives the drainage from it. The separating chamber is provided with a vapour discharge in the upper part, a vapour and liquid separator and a liquid discharge in the lower part. —W. H. C.

Organic and vegetable extracts; Process and apparatus for the rapid concentration to a high degree of substances analogous to ——. J. F. P. Kestner. Fr. Pat. 423,461, Nov. 18, 1910. Under Int. Conv., Dec. 14, 1909.

The process described in Fr. Pats. 361,524 and 422,811 (this J., 1906, 874; 1911, 526) is amplified so as to make it applicable to the degree of concentration and class of material mentioned in the title. It is not so much the raising of the liquid to be evaporated to the necessary temperature, but the maintaining at that temperature which causes decomposition. Owing to the very short time during which the liquid is exposed to this temperature in the apparatus, it is inadvisable in most cases to employ a vacuum, in the absence of which, owing to the increased temperature, the thin film of concentrated liquid flows more rapidly over the surfaces of the tubes. In certain cases, with liquids difficult to dehydrate, a pressure is maintained in the apparatus by connecting the outlet ends of the tubes with a vapour separator, where the pressure is controlled by a loaded valve, and it is recommended to give less height to the tubes by causing each to take two upward and two downward courses in place of one upward and one downward course. The vertical tubes may be heated individually or in sets to different temperatures by means of separate jackets. By previously concentrating the liquid to a high density and then treating it in this apparatus, solid extracts may be obtained. —B. G. McL.

Condensing apparatus. Maschinenfabrik Buckau A.-G. zu Magdeburg. Fr. Pat. 423,156, Nov. 29, 1910.

In partial vacuum evaporations it is important to maintain a constant pressure in the apparatus during the whole course of the operation; with the usual form of exhausting apparatus consisting of a condenser and wet air-pump, the pressure drops appreciably towards the end of the operation, owing to the lessened quantity of steam and air to be dealt with. It is now proposed to employ the steam passing to the condenser in driving a turbine from which are driven the air- and water-pumps. The apparatus consists of a cylindrical casing in the upper part of which, just below the steam entry pipe, is placed on a vertical shaft a turbine of the full diameter of the casing: below this is an inverted conical pipe leading to a surface condenser of cylindrical form, to the outside of which the cooling water is supplied and whence an external pipe conducts the air to the air-pump; the condensed water is removed by a water pump fixed on the turbine shaft at the bottom of the vessel. Beneath the condenser vessel on the same shaft is fixed a rotary wet air-pump of special design which draws the water required from and returns it to a tank placed below. The speed of the turbine and consequently of the pumps being dependent on the quantity of steam (and air) passing from the evaporator, the apparatus is claimed to regulate automatically the pressure in the evaporator.—B. G. McL.

Nickel-lined vessels for large-scale chemical operations. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 422,985, Nov. 12, 1910.

THE price of pure nickel makes its employment for large apparatus prohibitive, and nickel electrolytically deposited on iron is not sufficiently compact, while the use of a solder is suitable only for smaller vessels. The invention consists in interposing between the iron vessel and the nickel lining, which latter need only be ½ mm. in thickness, a layer of several millimetres thickness of lead, tin or an alloy of these metals: this can be accomplished either by first coating the iron with the lead and then inserting the nickel lining, which is heated to the melting point of the lead; or the nickel lining, suitably supported may be placed inside the iron vessel and the molten lead poured in between. Suitable solders may be used for jointing sections of the nickel lining.—B. G. McL.

Regenerative furnaces. F. Bernhardt. Fr. Pat. 423,577, Dec. 12, 1910.

THE arrangement of the pipes conveying the hot air and gas to the furnace are shown in the diagram. The hot gas passes by the pipe, *a*, to the furnace, *c*, which it enters horizontally through the port in the end wall, *b*; the hot air coming from the regenerators, and which may also be caused to absorb heat from the slag in the ash-pit, is passed up two vertical pipes, *d*, into the collecting chamber, *e*, whence it passes into the furnace, more or less vertically, by the flue, *f*; both air and gas pipes are lined with a thin layer of insulating material. An intense combustion ensues at the point of meeting of the gas and air, and the inventor claims that this localising of the combustion, together with the method of introducing the air, increases the life of the furnace lining, the only part of which soon melts away is the tongue, *b*, to which easy access is gained for renewal by removal of the pipes, *a* and *d*. In applying this method of air and gas admission to a tilting Martin furnace, only one air pipe is employed, which is led to the furnace parallel to and above the gas pipe, the air pipe being hinged at the top of the vertical part, while the gas admission port is arranged to slide past the end of the air pipe by a specially designed junction, so that, as the furnace tilts, the gas supply is cut off. Previous to the tilting of the furnace the air pipe is pulled up and away from the furnace by a chain and counter-weight.—B. G. McL.

Fig. 1

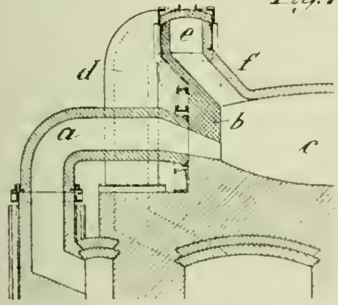
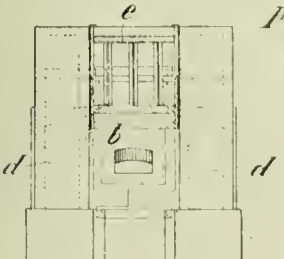


Fig. 2



Gases; Process and apparatus for purifying——. H. A. Brassert and A. G. Witting. Fr. Pat. 423,671, Dec. 15, 1910. Under Int., Conv., April 4, 1910.

THE apparatus, more particularly intended for cleaning blast-furnace gas, consists of a vertical cylindrical vessel the lower end of which is suitably contracted and fitted with a valve for the periodic removal of dust. Passing down the centre of this cylinder to rather more than half way is a wide tube cylindrical at the top and increasing in diameter towards the lower end: round the walls in the middle portion of the cylinder metal bars, rectangular in section, are arranged down which water is caused to flow. The gas enters tangentially at the top and passes round the central tube, the dust particles being thrown by the centrifugal force into the spaces between the metal bars, where they are out of the gas current and from whence they fall to the bottom of the cylinder, aided by the current of water; the circulation of the gas may be assisted by jets of water operating in the same direction as the gas current. The gas continues to circulate with increasing velocity as the area of the cylinder becomes limited by the conical part of the internal tube and, when at its greatest velocity, it is caused suddenly to take an upward course through the central exit pipe, this sudden change in direction causing a further removal of dust along with the excess of moisture. The inventor claims that the apparatus will reduce the dust content of the gas from 20 to 50 grms. per cb. m. down to 10 grms. per cb. m., the efficiency being, within limits independent of the volume of gas passing through the apparatus. Several units may be employed in series and, when the gas is to be used for gas-engines, these may be preceded by a large settling chamber and followed by a gas-washer of the Theisen type.—B. G. McL.

Extraction; Method of —— in which the material is digested in its own water. H. Meyer. Ger. Pat. 232,933, April 30, 1909.

THE process is intended specially for the extraction of glue and fat from animal substances. During the extraction the extract becomes concentrated, and is conducted to a receptacle where it is further concentrated by means of steam from the extractor. The quantity of liquid remaining in the extractor is regulated by means of an outlet tube which is movable vertically.—A. S.

Separation and dehydration of vegetable, animal, or mineral substances by means of electro-osmosis; Process for the ——. B. Schwerin. Ger. Pat. 233,281, Feb. 13, 1910. Addition to Ger. Pat. 181,841, May 2, 1906.

THE process described in the main patent (see Eng. Pat. 10,024 of 1907: this J., 1907, 955) is considerably accelerated, if substances which travel towards the cathode on passage of the electric current, are mixed with an electrolyte of acid character, and substances which travel towards the anode, with one of a basic nature.—A. S.

Gases or vapours; Apparatus for subjecting —— to the action of liquids. W. Feld, Honningen on Rhine, Germany. Eng. Pat. 8875, April 12, 1910.

See U.S. Pat. 983,037 of 1911; this J., 1911, 272.—T.F.B.

Clarifying and separating liquids; Process and apparatus for ——. G. E. Sanford, Chicago, U.S.A. Eng. Pat. 9098, April 14, 1910.

See Fr. Pat. 415,858 of 1910; this J., 1910, 1291.—T. F. B.

Drying air; Process and apparatus for ——. F. A. Daubiné, Maidières, France. Eng. Pat. 14,279, June 13, 1910. Under Int. Conv., July 10, 1909.

See Fr. Pat. 411,270 of 1910; this J., 1910, 959.—T. F. B.

Steam-generators; Compound for preventing the formation of scale, corrosion, and pitting in ——. O. H. Schroeder, London. U.S. Pat. 989,066, April 11, 1911.

See Eng. Pat. 23,618 of 1909; this J, 1910, 1092.—T.F.B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal; The volatile constituents of ——. II. M. J. Burgess and R. V. Wheeler. Chem. Soc. Trans. 1911, **99**, 649—667. (Compare this J., 1910, 1291.)

In continuation of the earlier experiments, the gases evolved from different samples of coal during destructive distillation have been collected separately at different stages of the heating. Samples of a bituminous coal were distilled in an electric resistance tube furnace at the constant temperatures 625° C., 900° C., and 950° C.; a sample of semi-bituminous coal was distilled at 950° C., and a sample of anthracite at 900° C. In each case, the gases were collected separately during successive short intervals of time (5 to 30 seconds). The paraffin hydrocarbons formed by far the largest proportion of the first gases evolved, and even at the higher temperatures, 1 or 2 per cent. of hydrogen, at most, was evolved during the first few seconds of heating. The view is put forward that the true coal substance consists of two compounds, the one less stable to heat and yielding paraffins without hydrogen on distillation, the other more stable and yielding hydrogen and perhaps carbon monoxide. By fractional distillation in a vacuum, at temperatures increasing to 650° C., the paraffin-yielding constituents can be removed, leaving a substance which evolves hydrogen at higher temperatures. It is probable that the different kinds of coal are composed of these two constituents in varying proportions. Since the rate of formation of carbon monoxide during distillation at constant temperature is uniform, and increases with increased temperature, it appears that this gas is formed from the interaction of carbon and steam liberated from hydroxy-compounds in the coal. By extracting the sample of bituminous coal with pyridine (compare Bedson, this J., 1908, 147), a black, porous coke-like residue was obtained, which yielded on distillation at 900° C. chiefly hydrogen, carbon monoxide and carbon dioxide. The pyridine extract, which was of chocolate-brown colour, yielded paraffin hydrocarbons and hydrogen, the percentage of hydrogen increasing with the temperature of distillation. It is suggested that the substance insoluble in pyridine is the more stable constituent of coal referred to above, and is a degradation product of the cellulose of the original plant substance, and further, that the less stable constituent of coal is derived from the resins and gums in the sap of the coal plants, and forms the "cement" of a conglomerate, of which the cellulose derivatives are the base. The paraffin-yielding constituent of coal is identified provisionally with the substance soluble in pyridine.—A. T. L.

Gas-producers. J. E. Dowson. Inst. Mech. Eng., Apl. 28, 1911. Engineering, May 5, 1911, 597—601.

A historical review containing figures relating to the working of various types of gas-producers. With respect to the relative advantages of pressure and suction plants for engine work and assuming that the steam required for addition to the air blast is obtained from the waste heat, the fuel, water and labour costs per H.P. are about equal; the suction plant generally costs less and occupies a smaller ground space than the pressure plant, but the gas produced from a given fuel is richer when a pressure plant is employed. When a suction plant is supplying gas to an engine governed on the "hit and miss" principle, cooling of the fuel bed of the producer ensues during a sustained period of light load or no load, owing to the relatively long interval which elapses between the explosions and consequent passage of air through the fire: this cooling of the fuel bed causes a deterioration in the quality of the gas which makes it imperative that the load must be put on at a rate corresponding to the power of the producer to recover its working temperature. Bituminous fuel should be gasified in such a manner that the gas leaves the producer free from tar. The author referred to his double-zone producer (this J., 1903, 1189), and stated that several plants up to 700 H.P. on this principle are in operation, gasifying fuel containing from 30 to 37 per cent. of volatile matter with 3 to 7 per cent. of ash, and producing a gas containing approximately 24 per cent. of carbon monoxide, 7 per cent. of carbon dioxide, 16 per cent. of hydrogen and 1 per cent. of methane, with a consumption of 1 lb. of fuel per I.H.P. hour inclusive of all stand-by losses. Comparing the stand-by losses of a steam-plant with those of a gas-plant over a working day of 8 hours with 16 hours rest, the figures, varying with the size of the plant, show that this loss is about nine times as high in the case of the steam-plant as in the case of the gas-plant.—B. G. McL.

Gas-producer; The effect of varying proportions of air and steam on a ——. E. A. Allcut. Inst. Mech. Eng., April 28, 1911. Engineering, May 5, 1911, 601—604.

The experiments were on similar lines to those of Bone and Wheeler (this J., 1907, 674; 1908, 1008). A small cylindrical experimental producer, 10 in. internal diameter and 25 in. internal height, surmounted by a fuel hopper and vapouriser was used; the bottom was closed by a flat bar grate, with slits ¼ in. wide, below which the air and steam were led from opposite sides of the casing. In the experiments anthracite was gasified at the rate of about 15 lb. per hour, the proportion of water added to the air blast varying from nothing to 1·14 lb. per pound of fuel gasified. Tests under each set of conditions extended over a period of four hours, temperatures of the gas leaving the producer and, at the close of each test, of the fuel bed at every 3 in. depth from the grate were taken; the volumes of air and gas were measured with a differential pressure gauge; the coal and water were weighed into the producer and vapouriser respectively and gas samples taken at intervals of 30 minutes. From the data obtained the results of calculations showing the distribution of heat, the efficiency obtained, etc., are charted. Contrary to the results obtained by Bone and Wheeler the percentage of hydrogen in the gas did not rise with increase of water fed into the producer, when the latter exceeded 0·75 lb. per pound of coal, corresponding to the decomposition of about 72 per cent. of the total weight of water fed into the producer. This result is very important, as it shows that the maximum amount of steam that can be decomposed by anthracite at a temperature of about 1000° C. is about 0·535 lb. per pound of fuel. It follows that there can be no advantage, but only loss, in pushing up the steam supply beyond 1⅓ lb. of steam per pound of coal for large producers, and about ¾ lb. of steam per pound of coal for small ones; moreover, when, with bituminous plants, ammonia recovery is not attempted, a large excess of steam is not necessary to prevent clinkering. The most significant result of the tests is that the percentage of carbon dioxide remains practically constant in spite of the rise in the quantity of steam introduced, the maximum rise during the whole of the tests being about 2·5 per cent. This is contrary to the usual experience with larger producers and to the results of the tests of Bone and Wheeler. A study of the temperatures of the fuel bed at different depths shows that the temperature for the first 18 in. above the grate is fairly constant at about 1000° C., a temperature at which no carbon dioxide can exist in presence of an excess of carbon; through the next 6 in. above this the temperature falls rapidly to about 600° C., a condition which is favourable to the formation of carbon dioxide by one or all of the reactions expressed by the equations: $C+2H_2O=CO_2+2H_2$; $CO+H_2O=CO_2+H_2$; $2CO=CO_2+C$; and it is the comparative shallowness of this cooler layer which does not allow sufficient time for these reactions to seriously affect the composition of the gas and the efficiency of the producer. Thus the composition of the gas depends largely on the depth and temperature of the cooler layer of fuel lying above the zone of active combustion and on the rapidity of passage of the gas through this layer. The author advocates reducing the fuel depth to such an extent, consistent with the nature of the fuel, that this secondary reaction is eliminated without endangering the primary reduction of the carbon dioxide to carbon monoxide. The maximum efficiency of 76 per cent. which includes the heat used to vapourise the water and calculated on the higher calorific value of the gas, was attained with a water addition of about 0·75 lb. per pound of fuel, the gas then produced having the following composition: 23·5 per cent. of carbon monoxide, 8·5 of carbon dioxide, 13·5 of hydrogen, 0·3 of methane and 54·2 per cent. of nitrogen, and having a gross calorific value of 129·6 B.Th.U. per cb. ft.—B. G. McL.

Oil fields of Japan. Petroleum, 1911, 6, 829—836.

According to an official Japanese publication, "Mining in Japan, Past and Present," the oil fields extend from the western coast of Sachalin in the north, through the western part of the central highlands of Hokkaido, and along the coast of the Sea of Japan, and thence, traversing the provinces of Mutsu, Ugo, Utzen Echigo and Shinano, reach to the coast of the Pacific Ocean in the province of Totomi in the south. There is also an oil field in the northern part of the west coast of Formosa. The following table shows the annual output of crude petroleum in Japan during the 20 years ending 1907:—

Year.	Barrels.	Year.	Barrels.
1888	45,006	1898	319,015
1889	63,490	1899	539,098
1890	61 817	1900	871,740
1891	63,618	1901	1,117,995
1892	82,833	1902	997,543
1893	106,983	1903	1,210,340
1894	172,711	1904	1,220,744
1895	168,873	1905	1,352,574
1896	236,819	1906	1,571,367
1897	262,751	1907	1,727,298

Note.—1 barrel = 42 gallons.

The rapid development of the industry is mainly due to the introduction of the American boring method, which was first tried in 1890. The recent increase in the production is to be attributed to the extended development of the Niitsu field and the deep borings in the Miyagawa district. The chief centre of the industry is in the province of Echigo, which produces about 99 per cent. of the total quantity of petroleum in Japan, whilst more than 90 per cent. of the total output of Echigo is derived from the three oil fields of Higashiyama, Nishiyama, and Niitsu. Until about 10 years ago the oil industry was in the hands of a large number of small companies and individual owners, but has recently been concentrated among a few large companies and individuals. About 86 per cent. of the total oil from Echigo is produced by the Hoden and Nippon Companies, whilst two other companies are responsible for 14 per cent. The oil deposits are found exclusively in the tertiary formation, and the strata consist of an upper layer of loam and clay, sandstone and conglomerates; a middle layer of sandy loam interspersed with sandstone; and a lower layer consisting mainly of sandstone and clays, with tufa and sandstone (containing tufa) at the bottom. The oil-bearing strata consist of sandstone and tufa between layers of clay, and sometimes of clay itself. The depth of the borings ranges from about 60 to 2000 feet, the usual depth being from 600 to 1200 feet. In addition to the American method of boring, a primitive method of manual boring known as *tebori*, and a modification of the Chinese method, *kadzusabori*, in which jointed bamboo is used, are also employed in many of the oil fields. The oil is transported from the wells to the refineries mainly by pipe lines, although many producers still make use of carts or boats. The largest refineries of the province of Echigo are at Kashiwazaki (19,300 barrels per month), Naoetsu (16,900 barrels), Nagaoki (12,500 barrels) and Kashiwazaki, No. 2 (15,900 barrels). There are also numerous small refineries (3400 barrels and less) in the adjoining districts. The annual amounts in barrels of the different products from the refineries of Echigo since 1904 were as follows:—

Year.	Benzine.	Kerosene.	Light oil.	Heavy oil.	Machine oil.	Pitch.
						tons.
1904	26,298	406,929	94,148	453,143	79,931	571
1905	31,888	419,932	116,582	469,170	81,337	695
1906	31,307	460,269	227,541	487,965	86,919	741
1907	34,130	516,157	254,158	547,805	91,982	1,365
1908	34,083	522,524	143,984	226,290	100,728	1,724

Since 1908 a mixture of kerosene and light oil has been used as a lamp oil, and the total quantity of these produced by Echigo is about a third of the total amount (about 2 million barrels) consumed in Japan. Of late there has been an increasing demand for asphaltum. In 1908 6246 tons (worth £11,849) were produced, or about 10 times the output of the preceding year. In addition to this, 261 tons (worth £2291) were imported, mainly from England, as compared with 6575 tons (worth £24,852) in 1907. The only Japanese source of supply is Ryugemura and its environs in Ugo. Asphaltum occurs naturally, in admixture with earthy substances, in the Japanese deposits. Details of the progress of the individual oil-fields are also given.—C. A. M.

The petroleum industry in Japan. Ch. of Comm. J. May, 1911. [T.R.]

The *Osaka Mainichi* says that the total output of petroleum in the oil fields of Echigo province or Niigata prefecture last year, amounted to 42,736,480 gallons, a decrease of 2,369,000 gallons on the figures for the preceding year. Of illuminating oil alone the output last year amounted to 16,871,640 gallons, a decrease of 5,641,280 gallons. The increase shown in the output of machine and heavy oils, however, has contributed greatly to compensating the decrease in the amount of illuminating oil, so that the decrease in the total did not exceed 2,400,000 gallons. Thus there was a heavy decrease in the output of the better quality and an increase in the inferior quality. The decrease of 5,641,280 gallons in the output of illuminating oil is equal to 730,160 cases. Taking the value of each case at 6s., the total value will be £219,048, which amount represents the loss of the revenue from the working of the mine. The loss is compensated for to some extent by the increased output in machine and heavy oils, but, generally speaking, the result of the working is very unsatisfactory. The capital of the Hoden Petroleum Company amounts to £1,500,000 and that of the Japanese Petroleum Company to £1,000,000, and both companies have been paying a dividend at the rate of 30 or 40 per cent. every year. In these circumstances it is feared that the shareholders will not be satisfied unless the companies can pay a dividend at a higher rate than 10 per cent. The petroleum industry in its nature requires more funds invested in it as the operations progress, and if the present unsatisfactory results are continued longer, the companies may be involved in greater difficulties. The principal cause of the decreased output is the conservative policy followed by the two companies, which have been forced to work very cautiously as their capital has increased. All the petroleum companies in Echigo are actively searching for new oil veins. The output of oil during last year, compared with the preceding year, was as follows :—

	1909. galls.	1910 galls.
Benzine	638,440	411,280
Illuminating oil	22,712,920	16,871,640
Light oil	6,563,800	7,765,520
Heavy oil	11,520,880	13,047,400
Machine oil	3,672,160	4,628,560
Total	45,108,200	42,724,400

Mineral oils ; Behaviour of high-boiling ——, on heating in the air. C. E. Waters. J. Ind. Eng. Chem., 1911, **3**, 233—237. (See also this J., 1910, 1365.)

In an investigation conducted along similar lines to those followed by Schreiber (this J., 1910, 202), but independently of the latter, mineral lubricating oils were subjected to a temperature of 250° C. for 3 hours in open or loosely covered flasks. Each test was made upon 10 grms. of oil and, after the heating, the amount of "asphaltic matter" (insoluble in petroleum ether) and the percentage loss by evaporation were determined. It was found that, by heating duplicate samples of the same oil side by side in vessels of similar shape, size and material, fairly concordant results were generally obtained. Considerable discrepancies were, however, often caused by unequal heating, by variations in the rate of interdiffusion of oil vapour and air, and, apparently, by obscure catalytic phenomena influenced by the nature of the material in which the oil was heated. From the results obtained the author is of opinion that the data afforded by the process are sufficiently reliable for the comparison of a limited number of oils with one another, as showing the way in which they may be expected to behave when in actual use.—W. E. F. P.

Asphaltum from Mexican petroleum. D. Lohmann. Chem. Rev. Fett-Ind., 1911, **18**, 107—108.

The author has applied the methods described by Marcusson (this J., 1911, 480) to the examination of the asphaltum derived from Mexican petroleums, which are characterised by containing a high proportion (up to 8 per cent.) of sulphur. A sample was prepared from an oil (the product of two fields) with sp. gr. 0·890 to 0·900 at 15° C., and containing about 10 per cent. of petroleum spirit (benzine), 20 per cent. of lamp oil, and 20 per cent. of asphaltum residue. The asphaltum, which was plastic at the ordinary temperature, was typical of the product sold in large quantities in Europe. It gave the following results on analysis :—Sp. gr. at 15° C., 1·07 to 1·12 ; total bitumen, soluble in carbon bisulphide, 99·8 ; bitumen soluble in carbon tetrachloride, 98·8 ; soluble in "normal benzine," 74 ; volatile hydrocarbons, 76·5 ; carbon, 23·3 ; ash, 0·2 ; and sulphur, 5·5 per cent. Other samples of Mexican asphaltum contained from 2 to 6·2 per cent. of sulphur. Hence, no conclusions can be based upon the proportion of sulphur. The amount of ash in other samples ranged from 0·1 to 0·9 per cent. There are also varieties of natural asphaltum (*e.g.*, gilsonite) containing only 0·5 per cent. of ash. The amount of oily residue in the asphaltum, determined by the method of Marcusson and Eickmann (this J., 1911, 480) and calculated upon the ash-free bitumen, was 32·2 per cent. It was a dark brown transparent oil fairly viscous at 20° C., but free from vaseline-like particles. It contained 2·2 per cent. of paraffin wax when tested by Holde's method. The acid values of the distillates obtained by the method of Marcusson (*loc. cit.*) were as follows :—The first distillate (15 c.c.) was brown and had a sp. gr. of 0·8212 at 15° C. and an acid value of 0·9, whilst the second fraction (15 c.c.) was light brown and had a sp. gr. of 0·8196 and an acid value of 0·42. The residue was a hard glass-like pitch. These results confirm the views of Marcusson upon the acid values of the fractions, but in the author's opinion the values approximate so closely to the limits fixed by Holde and Marcusson (maximum acid value, 1 ; minimum amount of paraffin wax, 2 per cent.) that any deductions from them must be made with caution. Moreover, there are also other kinds of asphaltum prepared from Mexican oils almost devoid of paraffin wax or from oils containing a larger proportion of organic acids, so that further investigation is required to determine to what extent these values will distinguish between natural and petroleum asphaltum. The crude Potrero oil from the recently opened fountain at Tuepam on the East Coast of Mexico approaches more nearly to natural asphaltum, although it must still be regarded as a normal petroleum ; and it seems probable upon theoretical grounds that the distillates of the asphaltum from this oil will show higher acid values.—C. A. M.

Benzene, light petroleum, and paraffin oil ; Solubility of water in ——. E. Groschuff. Z. Elektrochem., 1911, **17**, 348—354.

The solubility determinations were made by shaking together known quantities of the water and hyrdocarbons in a closed vessel, and observing the temperature at which the turbidity disappeared. The hydrocarbons were dried by distillation in presence of fused sodium or the potassium-sodium alloy which is liquid at the ordinary temperature. In the case of the higher-boiling oils the greater portion of the water was first removed by heating to 120°—130° C. At 18° C. the solubility of water in benzene is 0·051, in light (American) petroleum (sp. gr. 0·792 at 20° C., b.pt. 190°—250° C.), 0·005, and in paraffin oil (sp. gr. 0·883 at 18° C., b.pt. 200°—300° C. at 10 mm.), 0·003 per cent. by weight. In all three cases both the solubility and the temperature coefficient of solubility increase with rise of temperature. Comparing equal volumes the moisture content of light petroleum and of paraffin oil, saturated with water, is of the same order as that of air saturated with moisture ; that of benzene is, however, much higher. It was found impossible to dry a commercial transformer oil thoroughly, as considerable decomposition took place both on heating and on treatment with the liquid potassium-sodium alloy at the ordinary temperature. A few solubility determinations with the oil after heating to 120° C., however, indicated that it dissolves from three to five times as much water as light petroleum or paraffin oil, and about one-third as much as benzene does.—A. S.

Detection of graphite in lubricants. Marcusson and Meyerheim. *See* XII.

Patents.

Briquettes ; Agglomerating powdered coal of all kinds for the formation of —— without the use of resin or other binding agent which would cause smoke, etc., during combustion. E. M. Heckel. First Addition, dated Nov. 28, 1910, to Fr. Pat. 402,247, April 20, 1909 (this J., 1909, 1187).

The binding agent described in the main patent is modified by using aluminium-chromium sulphate in place of potassium bichromate and cement.—A. T. L.

Fuel briquettes ; Utilisation of any moist organic residues for the production of ——. L. M. Rousseau. Fr. Pat. 423,664, Feb. 21, 1910.

The organic substance is mixed with tar and pitch in a heated vessel, so that the binder forms an emulsion with the water which is present and so penetrates the whole mass, and the greater part of the water is then removed by pressing.—A. T. L.

Lignite waste ; Process for briquetting ——. L. Röder and A. Peust. Ger. Pat. 233,148, Jan. 14, 1910.

The wet lignite waste is mixed with uncarbonised wood from the coal measures (or other wood) and with hygroscopic salts, especially magnesium chloride, before being dried.—A. S.

Cinders ; Utilisation of ——. Veltener Schwemmstein-Industrie Ges. für Schlackenverwertung. Fr. Pat. 423,467, Nov. 26, 1910. Under Int. Conv., Nov. 27, 1909.

The ashes from domestic fireplaces are separated by centrifugal force in a special separator into combustible matter (cinders) and incombustible matter (ashes) and the former are used for the production of a smokeless fuel. The cinders are first passed through a crusher to reduce the larger pieces to a suitable size, and are separated into various sizes by means of a rotating cylindrical sieve. Each lot is then passed through a centrifugal separator, to separate the heavier combustible part from the light ash. The separator comprises a rotary member which receives the material, and projects it upwardly and outwardly against a parabolic surface. The different portions of the material fall into annular spaces formed by concentric baffles which are highest near the circumference of the separator.—A. T. L.

Vertical retorts ; Heating ——. H. W. Woodall, Lytchett Matravus, Dorset, and A. M. Duckham, Little Bookham, Surrey. Eng. Pat. 9494, April 19, 1910.

In vertical retorts of oblong cross-section, the charge fed in at the end of the longer diameter becomes distributed so that the larger pieces fill the side of the retort farther from the charging shoot, and the gas finds an easier passage at that side of the retort. The vertical heating flues are therefore arranged so that that side of the retort is less highly heated. For this purpose, a series of separate heating flues are provided in the longer walls of the retorts. The gas is admitted at the top of the flues, and the air ports are at different levels in the different flues, so that some of them are heated more strongly than others. In order to heat the lower part of the retorts more highly, a second set of air ports is provided about halfway down the heating flues, and these ports are also at different levels in the different flues.—A. T. L.

Gas retorts, coke ovens, or the like ; Delivery of volatile products from ——. A. M. Duckham, Little Bookham, Surrey. Eng. Pat. 16,631, July 12, 1910.

In a bench of gas retorts, a separate seal-pot is provided for each delivery pipe, and is placed at a lower level than the foul main, so as to seal the end of the delivery pipe in the liquor condensing in the main. The seal-pot is provided with a drainage valve which remains open when the retort is in use. The invention is specially suitable for vertical retorts, in which the delivery pipes are inclined downwards. A more rapid sealing is obtained by admitting ammoniacal liquor to the delivery pipe. —A. T. L.

Suction gas producers. H. Campbell, Halifax, Yorks. Eng. Pat. 10,400, April 28, 1910.

The evaporator of a gas producer consists of an annular water jacket surrounding the lower conical portion of the producer and composed of two annular shells having their upper edges united by a stepped or lipped ring. The portion of the ring enclosing the steam space at the top of the evaporator is protected from the direct heat of the producer by the bottom ring of brickwork. The lower edges of the annular shells are connected by a plate which is corrugated to facilitate expansion. The dead plate or hearth below the producer is formed in two parts and slightly curved for the same purpose.—H. H.

Finely-divided wet fuels ; Carbonisation of ——. A. Blezinger. Ger. Pat. 233.216, April 14, 1910.

The fuel is preheated to such a degree that when charged into the producer, the water and bitumen vapours carried upwards by the producer gas are not condensed on the freshly charged fuel.—A. S.

Coke oven and like gases ; Treatment of ——. E. Lloyd, Sheffield, and Simon-Carves Bye-product Coke Oven Construction and Working Co., Ltd., Manchester. Eng. Pat. 8379, April 7, 1910.

Tar is separated from hot coke oven gases by passing them first through a "static" centrifugal separator, in which the denser and heavier tarry matters separate out by reason of the rotary movement of the gases themselves, and then through a "dynamic" centrifugal separator in which the lighter tarry particles are separa[illegible] rotating blade moving through the gas. A blowing apparatus is employed to draw the gases through the separators if necessary, and tar may be injected to aid the separation.—H. H.

Naphtha from natural gas ; Obtaining ——. G. M. Saybolt, Jersey City, Assignor to Standard Oil Co., Bayonne, N.J. U.S. Pat. 989,927, April 18, 1911.

The natural gas is caused to bubble, at a pressure of not less than 30 lb. per sq. in. above the atmospheric pressure, through a medium capable of absorbing naphtha. This is also under a similar high pressure and is preferably petroleum or some analogous hydrocarbon. The absorbed naphtha is afterwards recovered from the absorbing medium by distillation under atmospheric pressure. —W. H. C.

Mineral oil distillates ; Process for removing the specifically heavy constituents from ——. F. Schwarz. Ger. Pat. 232,794, Oct. 2, 1909.

The distillates are treated with acetone, which dissolves the heavier constituents. (See also this J., 1911, 527). —A. S.

Artificial fuel ; Manufacture of —— and machines therefor. Graigola Merthyr Co., Ltd. Fr. Pat. 423,710, Oct. 13, 1910. Under Int. Conv., Oct. 14, 1909.

See Eng. Pat. 23,555 of 1909 ; this J., 1910, 1365.—T. F. B.

Gas producers. E. U. G. Ernst, Copenhagen. Eng. Pat. 24,283, Oct. 19, 1910. Under Int. Conv., Nov. 2, 1909

See Fr. Pat. 421,596 of 1910 ; this J., 1911, 409.—T. F. B.

Power-gas ; Apparatus for the manufacture of ——. E. Fleischer, Dresden-Strehlen, Germany. U.S. Pat. 990,212, April 18, 1911.

See Eng. Pat. 26,770 of 1904 ; this J., 1905, 324.—T. F. B.

Gases ; Art of producing —— in upright retorts. C. Bolz, Budapest. U.S. Pat. 989.324, April 11, 1911.

See Fr. Pat. 410,411 of 1909 ; this J., 1910, 807.—T. F. B.

Gases ; Treatment of —— for removing carbon monoxide therefrom and replacing it by hydrogen. E. Ellenberger, Biebrich, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort-on-Maine, Germany. U.S. Pat. 989,955, April 18, 1911.

See Eng. Pat. 2523 of 1909 ; this J., 1909, 1116.—T. F. B.

Gas ; Method of purifying —— and recovering values present therein as impurities. F. J. Falding, New York, and W. R. Cathcart, Hackensack, N.J., U.S.A. Eng. Pat. 20,245, May 7, 1910.

See U.S. Pat. 961,763 of 1910 ; this J., 1910, 870.—T. F. B.

Treating the acid tar obtained in refining organic products. Ger. Pat. 233,517. *See* III.

Testing oil in respect to its behaviour towards gases or vapours. Ger. Pat. 232.233. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Artificial silk ; Use of —— in the manufacture of incandescence mantles. E. Müller. Chem.-Zeit., 1911, 35, 479.

Microphotographs of the threads of mantles of cotton, ramie, and artificial silk (Degea silk) taken after the mantles had been burned for 250 and 1000 hours, show that in the case of the artificial silk the separate fibres are still quite distinct, whereas cotton and ramie fibres show marked signs of alteration. Artificial silk mantles are characterised by the great elasticity and toughness of their fibres, and owing to their great durability are particularly suitable for street lamps. Their lighting capacity is fully equal to that of ramie mantles.—C. A. M.

Patents.

Electric glow lamps; Manufacture of ——. H. Malachowski, Berlin. Eng. Pat. 10,041, April 25, 1910. Under Int. Conv., Sept. 3, 1909.

A carbon filament is coated with antimony or arsenic by immersing it in acetic acid and then heating it to a red heat in hydrogen antimonide or arsenide. If mercury vapour is to be present in the lamp, an outer layer of carbon is deposited upon the filament by means of a hydrocarbon.—H. H.

Electric incandescence lamps; Process for the preparation of filaments for —— from refractory metals. Siemens und Halske A.-G. Ger. Pat. 232,260, July 8, 1908.

The refractory metal is alloyed with another metal, and worked up into filaments, which are then heated in an atmosphere capable of converting the alloying metal into a volatile compound, but having no action on the finished filament. For example if nickel be the alloying metal, an atmosphere of carbon monoxide is used.—A. S.

Electric incandescence lamp. O. Schaller. Ger. Pat. 232,665, April 23, 1910.

The incandescence body consists of a metal of high melting point; it is used in the molten state and is so disposed that it forms a closed circuit, which is heated in the known manner by electro-magnetic induction. Aluminium is a suitable metal.—A. S.

Electrode for flame arc lamps. Allgem. Elektrizitäts, Ges. Ger. Pat. 233,125, Aug. 19, 1910.

The electrode consists of titanium carbide (30—40 per cent.), calcium fluoride (25—35), cryolite (12—18), and charcoal (17—23 per cent.). Special claim is made for an electrode consisting of 35 per cent. of titanium carbide, 30 of calcium fluoride, 15 of cryolite, and 20 of charcoal. —A. S.

Photometers. Eng. Pat. 15,408. *See* XXIII.

III.—TAR AND TAR PRODUCTS.

Creosotes for the preservation of wood; Analysis of ——. R. Estor. Les Matières Grasses, 1911, 4, 2209—2210.

The creosote oil sold for impregnating sleepers, etc. contains from 15 to 20 per cent. of phenols (mainly cresols), a little naphthalene in solution, and several liquid hydrocarbons of unknown composition. It distils almost completely between 150° C. and 300° C., and has a sp. gr. of about 1·055 at 15° C. Sometimes it is adulterated by the addition of "green oil," after separation of the anthracene. According to the specification of French industrial societies creosote oil should answer to the following requirements: (1) It should be completely liquid within 30 minutes at 40° C. (2) Its sp. gr. at 50° C. should be equal to 1·015, and about 1·040 to 1·050 at 15° C. (3) It should dissolve completely in benzene. (4) It should contain at least 10 per cent. of tar acids soluble in sodium hydroxide solution of 1·15 sp. gr. (5) It should not deposit more than 25 per cent. of naphthalene or other product solid at 15° C. The specification of "La Comp. des chemins de fer de l'Est" demands:—(1) A sp. gr. not less than 1·050 at 15° C. (2) Not more than 30 per cent. of naphthalene. (3) At least 5 per cent. of phenols. (4) A distillation temperature above 200° C.; the distilled products ought to exceed one-third of the sample. It is commonly accepted that the fraction distilling below 150° C. should be less than 3 per cent.; from 150° to 235° C., less than 30 per cent.; and from 150° to 355° C., more than 85 per cent.—C. A. M.

Carbolic acid [phenol] of the fifth German Pharmacopœia, 1910. E. Schmidt. Arch. Pharm., 1911, **249**, 236—240.

The author states that as a result of examining a large number of samples of phenol, there should be no reddening of sensitive litmus paper by a 1 : 15 aqueous solution of the substance (this J., 1911, 445). Recently samples have appeared, however, which do redden litmus, owing to the presence of minute amounts of benzoic acid. This acid arises from benzonitrile occurring in the coal-tar from which the phenol has been distilled. It is pointed out that the statement that the aqueous solution of the phenol should not redden blue litmus, need not exclude those samples of phenol whose aqueous solutions cause a violet colouration of the litmus paper.—F. Shdn.

Solubility of water in benzene, light petroleum, and paraffin oil. Groschuff. *See* IIa.

Patents.

Coal-tar hydrocarbons; Process for rendering —— soluble in water. J. Simon und Dürkheim. Fr. Pat. 422,953, Oct. 28, 1910.

Coal-tar hydrocarbons, such as the xylenes, pseudocumene, etc., are rendered soluble in water by heating them with a suitable soap, using as little water as possible. For example, 40 kilos. of oleic acid, 40 kilos. of potash lye (20° B.), and 20 kilos. of o-xylene are heated together, with agitation, until a homogeneous product is produced; this will be completely soluble in water, giving a clear solution containing up to 10 per cent. of xylene. The products are also soluble in sea water, and may be used for washing and other purposes, including the drilling, turning, or other similar working of metals.—T. F. B.

Brown-coal tar or generator tar from brown coal; Process for working up —— by treatment with alcohol. A. Riebecksche Montanwerke A.-G. Ger. Pat. 232,657, March 6, 1910.

Brown-coal tars or their distillation products are treated with alcohol in quantity insufficient to dissolve them completely; in this way the resinous constituents and creosote pass into solution and are separated, whilst the insoluble residue can be further treated to produce oils and paraffin.—T. F. B.

Acid tar obtained in refining organic products; Process for treating the ——. C. Dreymann. Ger. Pat. 233,517, February 19, 1910.

The "acid tar" obtained in refining mineral oils, tar oils, montan wax, etc., can be separated into acid and pitch by agitating it with an indifferent liquid.—T. F. B.

o-*Nitrobenzaldehyde; Process for preparing* ——. Soc. Chimique des Usines du Rhône. Fr. Pat. 421,922, Oct. 22, 1910.

When neutral aqueous solutions of salts of o-nitrophenylnitromethane are treated with the calculated quantity of potassium permanganate, good yields of o-nitrobenzaldehyde are obtained. Still higher yields are obtained by adding to the permanganate solution a sufficient quantity of magnesium sulphate (or similar salt) to replace the alkali liberated during the reaction by magnesium hydroxide.—T. F. B.

Phenylaminoanthraquinone; Halogenated carboxylic acids of —— and process for producing them. F. Ullmann. Fr. Pat. 423,328, Dec. 5, 1910. Under Int. Conv. March 14, 1910.

Halogenated carboxylic acids of α-phenylaminoanthraquinone are produced by the interaction of α-chloroanthraquinone with a halogen derivative of anthranilic acid; it is advisable to carry out the reaction in presence of a catalytic agent, such as a copper compound, and also of a substance which will unite with hydrochloric acid. *Example*, 24·2 parts of α-chloro-anthraquinone and 22 parts of bromo-anthranilic acid (NH_2 : COOH : Br=

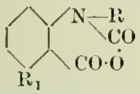
1 : 2 : 4) are dissolved in amyl alcohol; 20 parts of anhydrous potassium acetate, 1 part of copper acetate, and 1 part of powdered copper are added, and the mixture is heated to 160° C. The product is distilled with steam, and the residue treated with hydrochloric acid and finally extracted with toluene: the violet powder then remaining is insoluble in alcohol and benzene, but soluble in pyridine with a violet colouration; its melting-point is above 300° C.—T. F. B.

Carbazole derivative containing sulphur and process for producing it. Act.-Ges. f. Anilinfabr. Fr. Pat. 423,723, Nov. 4, 1910.

A derivative of carbazole, containing about 39 per cent. of sulphur and 6 per cent. of nitrogen, is prepared by boiling together 10 parts of carbazole, 30 parts of sulphur chloride, and 80 parts of glacial acetic acid (or other suitable diluent), under a reflux condenser, for about an hour. A resinous mass at first separates, changing into a porous product, which can be readily pulverised when cold; in this state, it is a yellow powder insoluble in alcohol, ether, and other ordinarily used solvents.—T. F. B.

Anthranilic acids; Process for preparing esters of substituted ——. Badische Anilin und Soda Fabrik. Ger. Pat. 231,962, July 29, 1909.

When isatoic acid derivatives of the constitution,



(where R is hydrogen, alkyl, aryl, or alkaryl, and R_1 a halogen) are treated with esterifying agents, the carbonyl group attached to the nitrogen is split off, whilst that united to the benzene nucleus becomes esterified, substituted anthranilic esters resulting.—T. F. B.

Indoxylcarboxylic acid and indoxyl; Process for preparing ——. F. Michel. Ger. Pat. 232,986, Aug. 3, 1909.

Phenylglycine-*o*-carboxylic acid or one of its alkali salts is fused with a weight of alkali hydroxide which does not greatly exceed that of the phenylglycine derivative; solid paraffin is also added to the mixture as an indifferent diluent, to avoid the partial carbonisation which otherwise occurs at the requisite temperature (300° C.).—T. F. B.

Hydroxy-β-naphthylpyrazolone monosulphonic acids; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 233,068, Jan. 27, 1910.

When β-naphthylpyrazolone disulphonic acids are fused with alkalis, one of the sulphonic groups is replaced by a hydroxyl, hydroxy-β-naphthylpyrazolonemonosulphonic acids being produced. The β-naphthylpyrazolonedisulphonic acids are obtained by condensation of β-naphthylhydrazinedisulphonic acids with acetoacetic ester.—T.F.B.

p-Chloro-m-cresol ($CH_3 : OH : Cl = 1 : 3 : 6$)*; Process for preparing —— by chlorinating pure m-cresol or mixtures of m- and p-cresol.* A. Liebrecht. Ger. Pat. 233,118, March 3, 1910.

Pure *m*-cresol, or the commercial mixture of *m*- and *p*-cresol, is chlorinated, and the product sulphonated; by this means the *p*-chloro-*m*-cresol is converted into its sulphonic acid, whilst the *o*-chloro-*p*-cresol remains unaltered, and can be readily separated, the sulphonic acid forming very sparingly soluble salts. The sulpho group is finally removed by known means. (Compare Ger. Pat. 232,071; this J., 1911, 483.)—T. F. B.

Tar; Treatment of —— for the obtainment of oils containing a high percentage of bitumen. R. Bartel, Halensee, Germany. Eng. Pat. 17,639, July 25, 1910. Under Int. Conv., July 27, 1909.

See Ger. Pat. 227,492 of 1909; this J., 1910, 1368.—T.F.B.

Ortho-nitrobenzaldehyde; Manufacture of ——. G. B. Ellis, London. From Soc. Chim. des Usines du Rhône, ancien. Gilliard, P. Monnet, et Cartier, Paris. Eng. Pat. 24,872, Oct. 26, 1910.

See Fr. Pat. 421,922 of 1910; preceding.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Action of artificial organic dyestuffs on the peptolysis of proteins. Guglialmelli and Damianovich. *See* XIXa.

Patents.

Polyazo dyestuffs; Manufacture of ——. Akt. Ges. für Anilinfabr., Berlin. Eng. Pat. 8967, April 24, 1908. Under Int. Conv., July 6, 1907.

The dyestuffs are obtained by combining a diazotised para-diamine with H-acid in mineral acid solution and allowing the resulting dyestuff to react in alkaline solution with one or two mols. of diazotised *p*-aminophenylarsinic acid; or the diazotised diamine may be combined in alkaline solution with 2 molecular proportions of the product of combination obtained in acid solution from diazotised *p*-aminophenylarsinic acid and H-acid, or by combining one of the diazo-groups of the para-diamine in alkaline solution with this monoazo dyestuff and the other, also in alkaline solution, with H-acid. Benzidine is the para-diamine used in the two examples and the dyestuffs dye cotton in blue shades; they find application in medicine.—J. C. C.

Polyazo dyestuffs dyeing cotton direct; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 232,790, March 20, 1910.

A diazotised amino-acid is combined with symm. *m*-*m*'-diaminodiphenylurea or its homologues, and this product is tetrazotised and combined with a *m*-diamine. The dyestuff thus produced dyes cotton brown to red-brown shades, which are altered to Bordeaux-brown shades, fast to light and washing, on treatment with *p*-nitrodiazobenzene.—T. F. B.

Monoazo dyestuff; Yellow ——. H. Geldemann, Assignor to Akt-Ges. für Anilinfabr., Berlin. U.S. Pat. 988,870, April 4, 1911.

Diazotised 2-chloroaniline is combined with *p*-nitro-1-phenyl-3-methyl-5-pyrazolone. The dyestuff is especially adapted for the manufacture of yellow lakes and pigments. —J. C. C.

Ortho-hydroxyazo-dyestuffs which can be chromed; Production of new ——. Act.-Ges. für Anilinfabr. Fr. Pat. 423,809, Dec. 17, 1910. Under Int. Conv., Aug. 17, 1910.

The diazo-compound of 2-aminophenol or one of its derivatives (for example, picramic acid) is combined in alkaline solution with 2-naphthol-4-sulphonic acid. Using the diazo-compound mentioned, the resulting dyestuff gives on chromed wool a deep greenish black shade.—J.C.C.

Dyestuffs; Manufacture of yellow wool ——. Akt-Ges. für Anilinfabr., Berlin. Eng. Pat. 2233, Jan. 28, 1911. Under Int. Conv., Sept. 23, 1910.

When Acid Yellow is benzylated it yields, according to the conditions, a mono- or di-benzylated product which has a greater colour intensity than the original dyestuff. Example: 100 parts of Acid Yellow are boiled in a reflux apparatus with 600 parts of water, 12 parts of anhydrous sodium carbonate and 32 parts of benzyl chloride. The solution of the monobenzylated compound is evaporated and then dried in a vacuum. In order to obtain the dibenzyl derivative, 22 parts of sodium carbonate and 62 parts of benzyl chloride are used in the above operation. —J. C. C.

Vat dyestuffs of the anthraquinone series; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pats. 232,711 and 232,712, March 10 and April 24, 1910. Additions to Ger. Pat. 229,165, Feb. 6, 1910 (see this J., 1911, 203).

Yellow vat dyestuffs are obtained by heating with sulphur to a high temperature the mono- or di-benzylidine or mono- or di-benzyl derivatives of 2·6- or 2·7-diaminoanthraquinone.—T. F. B.

Azo dyestuffs; Manufacture of yellow to orange-red —— O. Imray, London. From Soc. of Chem. Industry in Basle, Basle. Eng. Pat. 9968, April 23, 1910.

Dyestuffs yielding on animal fibres yellow to orange-red dyeings fast to washing and fulling, are obtained by combining a 1-sulphophenyl-3-methyl-5-pyrazolone, or a 1-sulphophenyl-5-pyrazolone-3-carboxylic acid, or a homologue or nitro or halogen derivative of either of these, with a diazotised (sulphonated or unsulphonated) mono- or diamine of the type, $Ar{\cdot}X{\cdot}Ar_1{\cdot}NH_2$, or $NH_2{\cdot}Ar{\cdot}X{\cdot}Ar_1{\cdot}NH_2$, where Ar and Ar_1 represent respectively C_6H_5 and C_6H_4, or their alkyl, oxyalkyl, halogen, or nitro derivatives whilst X represents S, $S{\cdot}CH_2$, S·CO, SO_2, CH_2, CO, OCH_2, $NH{\cdot}CH_2$, NH·CO, or NH·CO·NH, in the first formula, and S, SO_2, CH_2, OCH_2, $NH{\cdot}CH_2$, NH·CO, or NH·CO·NH in the second. Dyestuffs having similar properties are obtained by combining 1-phenyl-3-methyl-5-pyrazolone, or 1-phenyl-5-pyrazolone-3-carboxylic acid, or a homologue or nitro- or halogen derivative of either, which is not sulphonated, with diazo derivatives of sulphonated mono- or diamines of the above types. A large number of dyestuffs so prepared is described in the specification. —T. F. B.

Azo dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,433, May 21, 1910.

Sulphonic or carboxylic acids of either nitro-aminoazo compounds of the benzene or naphthalene series, in which the nitro and amino groups are in different nuclei, and the amino group is in the *p*-position to the azo group, or of the corresponding diamino-azo compounds in which one hydrogen of one amino group is replaced by an acid radicle, are converted into *p*-urea or *p*-thiourea compounds by treatment with phosgene or thiophosgene or their equivalents, such as perchloromethyl formate or hexachlorodimethyl carbonate; the products are then reduced or saponified to convert the nitro or acidylamino group to the amino group. Nitro-aminoazo compounds produced from diazo compounds and aminonaphthols or their derivatives are excluded from this invention. The resulting compounds dye unmordanted cotton yellow to orange shades, which, on being developed on the fibre, become fast to washing.—T. F. B.

Alkoxyanthrimides; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 232,262, March 17, 1909.

Negatively-substituted anthrimides are converted into alkoxyanthrimides by treatment with alcoholic alkalis. The primary materials may be obtained either by nitrating or halogenating anthrimides, or by the condensation of nitro-halogenanthraquinones with amino-anthraquinones. The products may be used as vat dyestuffs or for the preparation of vat dyestuffs.—T. F. B.

Vat dyestuffs; Manufacture of brown sulphurised —— A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 1729, Jan. 23, 1911.

Vat dyestuffs dyeing cotton in very fast olive brown shades are obtained by heating 1 : 5-dinitroanthraquinone (or the crude dinitroanthraquinone obtained by nitrating anthraquinone) with aqueous sodium sulphide and sulphur to 200° C. for 12 hours under pressure or by similarly heating 1 : 5-diaminoanthraquinone to 230° C. for 20 hours. —J. C. C.

Ortho-oxymonoazo dye; Process of making ——. A. L. Laska, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 987,099, March 28, 1911.

An *o*-hydroxyazo dyestuff is obtained by combining diazotised nitro-aminosalicylic acid ($OH : COOH : NO_2 : NH_2 = 1 : 2 : 4 : 6$) with *p*-cresol. It dyes wool brownish-yellow shades, fast to milling, potting, and light.—T. F. B.

Dyestuffs for cotton; Manufacture of orange ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 422,842, Nov. 21, 1910.

The tetrazo compounds of para-diamines or their sulphonic acids containing the sulphonic group in the ortho-position with respect to the amino-group are combined with one mol. of 1-sulphoaryl-3-methyl-5-pyrazolone and with one mol. of nitro-*m*-phenylene- or tolylene-diamine. For example the dyestuff prepared from benzidinemonosulphonic acid, 1 mol. of 1-*p*-sulphophenyl-3-methyl-5-pyrazolone and 1 mol. of nitro-*m*-phenylenediamine dyes cotton in reddish orange shades fast to light and acids. —J. C. C.

Disazo dyestuff; Substantive ——. A. L. Laska, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 988,000, March 28, 1911.

The tetrazo compound of benzidine or other *p*-diamine is combined, in mineral acid solution, with one mol. of a 1·8-aminonaphtholdisulphonic acid, not containing the sulphonic groups in the *o*-position to the amino or hydroxyl group, and one mol. of a nitro-*m*-diamine of the benzene series. The dyestuff from benzidine, 1·8-aminonaphthol-3·6-disulphonic acid, and nitro-*m*-phenylenediamine dyes cotton brown shades, which are converted into olive-green shades by subsequent treatment with diazotised *p*-nitraniline.—T. F. B.

Disazo dyestuffs; Process for producing substantive ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 422,907, Nov. 23, 1910.

See U.S. Pat. 988,000 of 1911; preceding.—T. F. B.

Monoazo-dyestuffs particularly suitable for the manufacture of lakes; Manufacture of ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 423,117, Nov. 28, 1910.

p-Chloro-*o*-nitraniline or *m*-nitro-*p*-toluidine is diazotised and combined in acid or alkaline solution with 1-phenyl-3-methyl-5-pyrazolone or its homologues or substitution products. The yellow dyestuffs obtained are insoluble in water; they may also be converted directly into lakes by preparing them in the presence of a substratum.—J. C. C.

Azo dyes; Yellow ——. V. Villiger and E. Fussenegger, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 990,173, April 18, 1911.

Yellow dyestuffs are obtained by combining diazotised chloro-derivatives of *o*-nitraniline (*e.g.*, 4-chloro-2-nitraniline) with aceto-acetanilide; the dyestuffs are insoluble in water, fast to light, and on reduction with zinc dust and excess of hot alcoholic alkali yield an undiazotisable acid of m. pt. 207°—209° C. The dyestuff from *p*-chloro-*o*-nitraniline and aceto-acetanilide melts at about 246° C. —T. F. B.

Gallocyanines; Condensation of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 422,720, Nov. 2, 1910. Under Int. Conv., Sept. 15, 1910.

Gallocyanines are condensed with dihydroxytartaric acid or with tartronic acid. The leuco-gallocyanines obtained are more soluble than the ordinary leuco-gallocyanines and the colours obtained by their oxidation dye mordanted wool in bluer shades than do the original dyestuffs. *Example* 1:—35 kilos. of Prune and 26 kilos. of sodium dihydroxytartrate (86 per cent.) are mixed with

50 to 100 litres of water and 35 kilos. of sulphuric acid (25° B.) and the mixture is heated to the boiling point for about 10—20 minutes. The leuco-derivative obtained is precipitated with salt and dried at a low temperature. *Example* 2:—35 kilos. of the hydrochloride of the gallocyanine prepared from gallic acid and nitrosodimethylaniline, 26 kilos. of sodium dihydroxytartrate, 25 kilos. of hydrochloric acid (20° B.) and 100 litres of water are stirred for 3 hours at the ordinary temperature. The whole is then evaporated to dryness under diminished pressure at a temperature not above 100° C.—J. C. C.

Fluorescein dyestuff and process of making same. A. Brunner, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 990,224, April 25, 1911.

Fluorescein dyestuffs containing in the resorcinol nucleus chlorine and another halogen of higher molecular weight (bromine), are obtained by the action of this halogen on florescems containing chlorine in the resorcinol nucleus. Such a fluorescein containing chlorine and bromine, dyes wool, cotton, and silk bright red shades from an acetic acid bath.—T. F. B.

Vat dyestuffs; Manufacture of fast ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 422,202, Nov. 4, 1910. Under Int. Conv., Jan. 26, 1910.

Vat dyestuffs furnishing shades like Alizarin Red are obtained by treating α-anthraquinonyl-5-halogenoanthranilic acids or their substitution products with dehydrating agents. *Example:* 10 parts of α-anthraquinonyl-5-chloroanthranilic acid (prepared by combining 4-chloro-2-aminobenzoic acid with 1-chloroanthraquinone) are added at 25° C. to 200 parts of chlorosulphonic acid and the mixture stirred for half an hour. The whole is then poured on ice and the dyestuff filtered off. With alkaline hydrosulphite it gives a reddish violet vat from which cotton is dyed in yellowish red shades.—J. C. C.

Anthraquinone vat dyestuffs; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 422,956, Oct. 29, 1910. Under Int. Conv., Nov. 1, 1909.

Vat dyestuffs are obtained by treating 4-aminoanthraquinonyl-1-anthranilic acid or acids of the general formula, $NHR.C_{14}H_6O_2.NH.C_6H_4.CO_2H$, with dehydrating agents. *Example:* 25 parts of 1:4-leucodiaminoanthraquinone, 17 parts of an ester of o-chlorobenzoic acid, 1·5 parts of copper chloride, 5 parts of anhydrous sodium acetate and 200 parts of nitrobenzene are boiled under a reflux condenser for 4 to 5 hours. The nitrobenzene is then removed by a current of steam, and an ester of aminoanthraquinonylanthranilic acid remains as a blue powder. This can be directly used for condensation or it may first be hydrolysed to the acid. In the latter case 10 parts of the acid are mixed with 150 parts of chlorosulphonic acid at 35°—40° C. for five minutes. The new dyestuff is separated by pouring the mass on ice. It gives a violet vat with alkaline hydrosulphite from which cotton is dyed in blue shades. A table is given showing the properties of other dyestuffs produced similarly.—J. C. C.

Pheno- or naphtho-anthraquinone-azines; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 232,526, Feb. 26, 1910.

When anthraquinonyl-o-arylenediamines are treated with oxidising agents, pheno- or naphtho-anthraquinone-azines are produced; some of these serve as dyestuffs, and others for use in the preparation of dyestuffs.—T. F. B.

2·2′-Dianthraquinonylurea; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 232,739, Feb. 7, 1909.

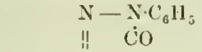
2·2′-Dianthraquinonylurea is obtained by the action of phosgene on β-amino-anthraquinone in presence of a suitable solvent, at a high temperature. It is a yellow vat dyestuff, and may be used for the preparation of other dyestuffs.—T. F. B.

Disazo dyestuffs for cotton, capable of being combined on the fibre; Production of ——. L. Cassella und Co. Fr. Pat. 422,709, Jan. 26, 1910.

The tetrazo derivative of *pp′*- or *op′*-diaminophenylether-o-sulphonic acid is combined with one molecule of a metadiamine or of a *m*-aminophenol and then with a second molecule of one of these or of another basic component. The disazo dyestuffs obtained dye cotton in weak, yellow or yellowish-brown shades, but when the latter are treated with diazo solutions, particularly a solution of *p*-diazonitrobenzene, intense brown shades are produced which are fast to alkalis, acids and water. The compound derived from the above tetrazo compound and two molecules of *m*-phenylenediamine dyes cotton in yellow shades which with diazotised *p*-nitraniline become brown. When *o*-amino-*p*-cresol (1 mol.) and *m*-phenylenediamine (1 mol.) are used, a dyestuff is obtained giving orange shades which are turned to yellowish brown on treatment with the same diazo compound as above, and when *m*-amino-*p*-cresol methyl ether is used instead of *o*-amino-*p*-cresol in the last instance, a similar dyestuff is produced.—J. C. C.

Anthraquinone series; Products of the —— *containing nitrogen, and their production.* F. Ullmann. Fr. Pat. 423,720, Oct. 29, 1910. Under Int. Conv., Nov. 12, 1909.

When anthraquinone-α-carboxylic acid or one of its derivatives reacts with a hydrazine, condensation takes place, the product when using phenylhydrazine having the formula,



$$\begin{array}{ccc} & N - N{\cdot}C_6H_5 & \\ & \| \quad \dot{C}O & \\ C_6H_4 & <\begin{matrix}C\\CO\end{matrix}> & C_6H_3 \end{array}$$

For example, 5 parts of the chloride of anthraquinone-α-carboxylic acid are dissolved in 30 parts of pyridine, 2·4 parts of a 50 per cent. solution of hydrazine hydrate are added, and the mixture is agitated and heated for some time. On adding a dilute solution of 2·5 parts of caustic soda a clear solution is obtained, from which the new condensation product may be precipitated by addition of dilute acetic acid; it is insoluble in water, alcohol, and ether, but soluble in pyridine, aniline, and dilute alkalis. Some of the products may be utilised as dyestuffs, and others for the preparation of dyestuffs.—T. F. B.

Indoxyl, its derivatives or homologues; Production of ——. Consortium f. Elektrochem. Ind., Ges. m. b. H., Nurnberg, Germany. Eng. Pat. 17,143, July 19, 1910. Under Int. Conv., July 30, 1909.

See U.S. Pat. 960,671 of 1910; this J., 1910, 808.—T.F.B.

Alkali salts of indoxyl or its derivatives: Isolated —— *and a process for the manufacture thereof.* Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 22,288, Sept. 26, 1910. Under Int. Conv., Sept. 27, 1909.

See Fr. Pat. 420,947 of 1910; this J., 1911, 412.—T. F. B.

Amino-arylacidylamino-anthraquinones and their acidyl derivatives; Manufacture of ——. F. Henle, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 989,602, April 18, 1911.

See Fr. Pat. 415,683 of 1910; this J., 1910, 1297.—T. F. B.

Vat dyestuffs of the anthracene series; Process for producing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 423,262, Feb. 10, 1910.

See U.S. Pat. 975,863 of 1910; this J., 1911, 276.—T.F.B.

Indoxyls and indigo colouring matters; Process for preparing ——. A. Rahtjen, Hamburg, Germany. Eng. Pat. 24,571, Oct. 22, 1910.

See U.S. Pat. 984,442 of 1911; this J., 1911, 531.—T.F.B.

Indigo, its homologues and substitution products; Manufacture of ——. Soc. Chim. des Usines du Rhône, ancien. Gilliard, P. Monnet, et Cartier, Paris. Eng. Pat. 24,871, Oct. 26, 1910. Under Int. Conv., Oct. 30, 1909.

See Fr. Pat. 421,717 of 1910; this J., 1911, 413.—T. F. B.

[*Azo*] *dyestuffs; Manufacture of orange to orange-red cotton* ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 28,677, Dec. 9, 1910.

See Fr. Pat. 422,842 of 1910; preceding.—T. F. B.

o-Hydroxymonoazo dyestuff; Process for producing an——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 423,010, Nov. 24, 1910.

See U.S. Pat. 987,999 of 1911; preceding.—T. F. B.

Vat dyestuffs of the anthracene series; Process for producing ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 423,004, Nov. 22, 1910.

See Eng. Pat. 28,679 of 1910; this J., 1911, 483.—T. F. B.

Azo dyestuff. O. Günther and L. Hesse, Elberfeld, and A. Zart, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 989,000, April 11, 1911.

See Eng. Pat. 29,458 of 1909; this J., 1910, 1051.—T.F.B.

Azo dyestuff. O. Günther and L. Hesse, Elberfeld, and A. Zart, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 989,001, April 11, 1911.

See Eng. Pat. 28,717 of 1909; this J., 1910, 1050.—T.F.B.

[*Azo*] *dye.* O. Dressel, Elberfeld, R. Kothe, Vohwinkel, and A. Thauss, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 989,953, April 18, 1911.

See Eng. Pat. 11,172 of 1910; this J., 1911, 275.—T. F. B.

[*Azo*] *dye.* O. Dressel, Elberfeld, and R. Kothe and H. Hoerlein, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 989,954, April 18, 1911.

See Addition of July 30, 1910, to Fr. Pat. 414,294 of 1910; this J., 1911, 77.—T. F. B.

Anthraquinone derivatives suitable for use as vat dyestuffs; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 423,913, Dec. 20, 1910. Under Int. Conv., Jan. 13, 1910.

See Eng. Pat. 2106 of 1910; this J., 1911, 412.—T. F. B.

Azo dyestuffs; Process for making ——. H. Levinstein, and Levinstein, Ltd. Fr. Pat. 423,715, Oct. 18, 1910. Under Int. Conv., Oct. 19, 1909.

See Eng. Pat. 23,992 of 1909; this J., 1910, 1296.—T.F.B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Rosin size; Determination of the rosin in ——. Rouyer and Naville. Wochenbl. Papierfab., 1911, **42**, 1532—1533.

The percentage of free rosin in any size may be expressed in terms of total saponifiable rosin, without the necessity of taking a weighed quantity of size or even without standard solutions, provided the equivalent of the acid solution be ascertained in terms of the sodium hydroxide solution. A portion of the size (say 0·5 grm. approximately) is dissolved in warm absolute alcohol; the solution is titrated warm with the sodium hydroxide in presence of phenolphthalein. The alcohol is then evaporated, the neutral size is dissolved in hot water and the rosin is precipitated in the cold, by an excess of the acid solution. The acid liquid is heated near its boiling point and stirred until the rosin coagulates to a solid mass; the liquid is boiled to expel carbon dioxide and then titrated with the sodium hydroxide until the neutral point to phenolphthalein is again established. The ratio between the alcoholic and aqueous titrations gives the ratio between the free and the total rosin of the size. Of course, by this method any unsaponifiable constituents of the original rosin are left out of account. For the determination of the percentage of rosin in the size, the saponification equivalent of the rosin used must either be known or assumed. Then, if the aqueous titration described above be performed with standard $N/10$ solutions, and the quantity of size be accurately weighed out, the percentage of rosin is readily calculated from the quantity of alkali combined with it in its neutral condition.—J. F. B.

Paper-making; Loading materials [*calcium sulphate*] *for* ——. M. von Glasenapp. Papierfabr., 1911, **9**, 469.

When calcined gypsum, in the form of the hemihydrate ($2CaSO_4+H_2O$), is stirred with water, it becomes entirely converted after about an hour, into needle-shaped crystals of the dihydrate. By careful regulation of the temperature it is possible to control the form and size of the crystals within wide limits. In the neighbourhood of 100° C., slender needles, ranging up to 0·6 mm. in length and having approximately the same diameter as cellulose fibres, are obtained. According to the author, when this crystallised form of calcium sulphate is used as a loading material for paper, the crystals act in some degree as mineral fibres in the structure of the sheet, and the loss of solid particles of mineral matter through the meshes of the wire is practically excluded. This advantage is, however, counterbalanced by the loss of loading due to the solubility of the sulphate in water. When 52 kilos. of crystalline calcium sulphate were added to a charge of 262 kilos. of cellulose pulp, only small traces of mineral loading remained in the paper. The use of calcium sulphate as a loading is only practicable, therefore, when the machine backwaters are worked on the system of continuous circulation.—J. F. B.

Paper; The acidity of ——. *Application of the "Hughes' reaction" with potassium iodide.* J. Strachan. Chem. News, 1911, **103**, 193—195.

When sized paper is moistened with a 20 per cent. solution of potassium iodide and exposed to the air, protected from chemical fumes, for about an hour, a colouration is developed owing to the liberation of iodine, blue or brown, according to whether starch is present or not. This is "Hughes' reaction," and the author considers that the liberation of the iodine is brought about by the acid radical of any undecomposed alum or aluminium sulphate which may be present in the paper. He claims to have ascertained that the iodine colouration is approximately proportional to the quantity of undecomposed alum, and expresses the opinion that any paper which shows an intense Hughes' reaction is, on account of the latent acidity of the alum, unsuitable for permanent records.
—J. F. B.

Use of artificial silk in the manufacture of incandescence mantles. Müller. *See* IIb.

Patents.

Softening textile fibres; Process and apparatus for ——. C. Marx, Pfalz, Germany. Eng. Pat. 8523, Apr. 8, 1910.

The layer of fibre is carried by an endless band conveyor underneath a set of sprinklers which discharge a warm oily preparation on to the fibre in a fine spray. It is afterwards led on to a rotating roller which opens the material and then allows it to fall freely in separate bundles on to a second endless conveyor. During the fall, the moistened parts of the fibre, being heavier than the rest, tend to fall underneath, so that by the time the bundles reach the lower conveyor they have rotated through 180° and their unoiled surfaces are now uppermost. Sprinklers are arranged so as to spray the revolving bundles as they fall and also during their journey on the lower conveyor. The latter finally delivers the evenly oiled fibre to an opener.—P. F. C.

Fibrous materials ; Treatment of ——. V., G., V., C. and M. del Prato. Fr. Pat. 423,307, Dec. 3, 1910.

THE process and apparatus described relate to the treatment of fibrous materials by the action of alkalis, bleaching liquor and mechanical pressure for the purpose of retting, degumming and separating the useful fibres. In the case of materials provided with hard parenchymatous tissues, the latter may be crushed in roller mills before the plant is subjected to the action of the chemical baths. The chemical treatment, applied for the retting of flax or hemp and the degumming of various fibres, consists mainly in steeping in hot solutions of sodium carbonate, which may be followed by passage between corrugated rolls to separate the valuable fibres.—J. F. B.

"Cellulose" ; Preparation of —— and its application to industrial purposes. M. Bals, Paris. Eng. Pat. 8539, April 8, 1910.

"CELLULOSE" in the form of wood-flour, used industrially as a covering body in paints and as filling for fire lighters, may be prepared in an extremely fine and uniform state of division by the cross-grain grinding of wood. The quality of the product may be still further improved by further disintegration by a pilon or stamp mill or by dissolving the organic substances usually present in the cellulose by chemical agents or heating the cellulose during the grinding process.—J. F. B.

Cellulose products ; Recovery of copper from the washing waters from —— prepared with cuprammonium. Ver. Glanzstoff Fabriken. Fr. Pat. 423,124, Nov 28, 1910. Under Int. Conv., June 18, 1910.

THE cuprous oxide suspended in the washing waters after the recovery of the ammonia by distillation, is caused to coagulate by adding to the hot, slightly alkaline liquid, a small quantity of a colloid, such as starch, which is injected into the liquid in the form of a "milk" with cold water, using about 1 kilo. of starch per 10 cub. m. of the washing waters. The starch becomes gelatinised, and the coagulated jelly carries down with it all the cuprous oxide, which is then recovered by decantation of the clear liquid.—J. F. B.

Cellulose and its derivatives ; Manufacture of cuprammonium solutions of ——. J. Wetzel. Fr. Pat. 423,510, Feb. 16, 1910.

IN order to obtain a perfect solution of cellulose in cuprammonium, it is necessary that the solvent should contain at least 6 per cent. of ammonia. But once the solution has been made and filtered, it is found that the ammonia may be reduced to 3 per cent. by any convenient means, and the excess of gas may be recovered. The reduced solution thus obtained is capable of being coagulated by water alone, and threads, films, etc., may be produced by delivering the solution of cellulose into water heated to a temperature of 30°—75° C.—J. F. B.

Cellulose obtained by the soda and sulphite processes ; Method of washing ——. R. Woy. Ger. Pat. 233,492, Oct. 11, 1910.

THE removal of the digestion liquor and the washing with water are both effected in a centrifugal machine. In the case of soda cellulose, the greater portion of the lye is recovered in an undiluted condition ; considerably less waste liquor is produced ; and the loss of fibrous matter in the wash-water is almost entirely prevented. The method presents analogous advantages in the case of the sulphite process.—A. S.

Cellulose ; Preparation of fatty acid esters of ——. Chem. Fab. von Heyden. Fr. Pat. 423,197, Oct. 29, 1910.

CELLULOSE is treated with the anhydride of a fatty acid, with or without a diluting agent, in presence of sulphuryl chloride or other "chloride of sulphuric acid." In the preparation of cellulose formate, the anhydride is replaced by concentrated formic acid. Example : 10 parts of cotton, thoroughly dried at 105° C., are heated at 50°—80° C. with 18—20 parts of acetic anhydride, 40—80 parts of glacial acetic acid and 1 part of sulphuryl chloride until the cellulose is completely dissolved. (Compare Eng. Pat. 10,243 of 1903 ; this J., 1904, 557.)—J. F. B.

Celluloid substitutes ; Manufacture of non-inflammable ——. Ver. Glanzstoff-Fabriken. Fr. Pat. 423,774, Dec. 16, 1910. Under Int. Conv., Nov. 1, 1910.

THE formic esters of cellulose obtained by the action of formic acid on artificial silk, or the phosphoformates obtained by the action of formic and phosphoric acids on fibrous cellulose, are precipitated from their solutions in formic acid, in the condition of coherent gelatinous masses, by adding to the solution appropriate precipitating agents, *e.g.* amyl acetate or a mixture of a hydrocarbon (*e.g.* toluene) and alcohol. These coagulated masses are removed and milled under pressure in such a way that they gradually contract and extrude the excess of liquid originally present in them. When the residue acquires a suitable degree of solidity, it is mixed with camphor and further milled, after the manner of celluloid, to produce a plastic and elastic solid.—J. F. B.

Paper ; Process for electrically sizing ——. F. Arledter, Hamburg, Germany. Eng. Pat. 132, Jan. 3, 1910.

THE pulp is mixed with solutions of suitable materials, colloids, resins or metal compounds, and electricity is then conducted through the pulp for the purpose of producing "electrolytic and galvanoplastic effects and electric endosmose." The current is stated to distribute the particles of size uniformly over the fibres by setting up a condition of inverse polarity. The precipitated sizing layer may be protected by size, gelatin, viscose or the like distributed so as to form a covering layer in the finished or unfinished paper.—J. F. B.

Paper ; Removing ink or colouring matter from ——. W. B. Meixell, Sayre, Pa., Assignor to J. B. Stalnaker and T. W. Jenkins, Williamsport, Pa. U.S. Pat. 989,023, April 11, 1911.

INK or colouring matter is removed from paper by beating the paper to a pulp with water, adding a mixture of water and whiting (or earthy matter), beating the mixture and washing the pulp with an excess of fresh water.—J. F. B.

Paper [impregnated with lubricant]. K. E. Rogers, South Manchester, Conn. U.S. Pat. 989,425, April 11, 1911.

PAPER is impregnated with a lubricant, consisting of a soluble fatty acid soap in quantities not exceeding 5 per cent. of the paper material ; the paper has a friction-finished surface.—J. F. B.

Paper ; Preparation of a resistant product for industrial uses from ——. S. Radvanyi-Riegler and B. Linder. Fr. Pat. 423,373, Dec. 6, 1910.

WASTE paper is macerated in cold water for a considerable time, *e.g.* 24 hours, it is then boiled in water and again steeped in cold water for 24 hours. The material is disintegrated, pressed to remove the water and again disintegrated. The mass is mixed with dilute glue solution, dilute starch and boiled starch, together with a further agglutinating agent, such as sodium silicate, and a mixture of zinc chloride and zinc oxide. The mass is milled, moulded and dried, either in the state described above or after incorporation with a suitable mineral loading material.
—J. F. B.

Wool or hair ; Process for the treatment of ——. E. Elsaesser, Langerfeld, Westphalia. Eng. Pat. 16,949, July 16, 1910.

SEE Fr. Pat. 418,082 of 1910 ; this J., 1911. 20 —T. F. B.

Wool washing and degreasing machines. J. Baudot, Tourcoing, France. Eng. Pat. 3228, Feb. 8, 1911. Under Int. Conv., Feb. 9, 1910.

SEE Fr. Pat. 413,442 of 1910 ; this J., 1910, 1102.—T. F. B.

Jute and like fibrous material ; Process of rendering —— woolly. P. Schmid, Basle, Switzerland. U.S. Pat. 990,012, April 18, 1911.

SEE Eng. Pat. 18,479 of 1910 ; this J., 1911, 79.—T. F. B.

Cuprammonia cellulose ; Process for the recovery of copper from the washing water obtained in the manufacture of artificial products from ——. Verein. Glanzstoff-Fabr. A.-G., Elberfeld, Germany. Eng. Pat. 27,600, Nov. 28, 1910. Under Int. Conv., June 18, 1910.

SEE Fr. Pat. 423,104 of 1910 ; preceding.—T. F. B.

Cellulose products ; Process for utilising the washing liquids from the manufacture of —— by the copper process. Verein. Glanzstoff-Fabriken A.-G. Fr. Pat. 423,064, Nov. 26, 1910. Under Int. Conv., June 18, 1910.

SEE Eng. Pat. 27,539 of 1910 ; this J., 1911, 415.—T. F. B.

Film [from cellulose esters] ; Non-inflammable transparent ——. W. Merckens and H. B. Manissadjian, Basle, Switzerland. Eng. Pat. 8647, April 9, 1910. Under Int. Conv., April 13, 1909.

SEE Fr. Pat. 414,680 of 1910 ; this J., 1910, 1228.—T. F. B.

Cellulose esters of fatty acids ; Manufacture of ——. R. E. Ellis, London. From Chem. Fabr. von Heyden, Radebeul, Germany. Eng. Pat. 24,382, Oct. 20, 1910.

SEE Fr. Pat. 423,197 of 1910 ; preceding.—T. F. B.

Solvent for acetylcellulose. T. Becker, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 988,965, April 11, 1911.

SEE Eng. Pat. 16,932 of 1910 ; this J., 1910, 1299.—T. F. B.

Paper mass for industrial purposes ; Resistive —— and process for the manufacture of same. J. Hubers, London. From S. Radványi-Riegler and B. Linder, Budapest. Eng. Pat. 26,567, Nov. 15, 1910.

SEE Fr. Pat. 423,373 of 1910 ; preceding.—T. F. B.

Producing dry coloured coatings on webs of paper and fabric. Eng. Pat. 9269. *See* VI.

Manure and its process of manufacture. Fr. Pat. 423,562. *See* XVI.

Industrial treatment of asphodel. Fr. Pat. 423,043. *See* XVIII.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Weakening of cotton yarns dyed with sulphide dyestuffs. F. Eppendahl. Färber-Zeit., 1911, 22. 44—47, 64—67, 100—102, 126—127, 145—151, 166—168.

AFTER reviewing at length the work of previous investigators, the author gives the results of a series of comparative dynamometric experiments on cotton yarns dyed with different sulphide dyestuffs, with the object of determining the effect on the strength of the yarn of exposure, firstly, under ordinary storage conditions for periods varying from 1—19 months, and secondly, in a warm damp atmosphere for 14—21 days. The preventive efficacy of various after-treatments was also comparatively investigated at the same time. From the results of the experiments the following conclusions were drawn :—(1) Some sulphide dyestuffs are more liable to produce subsequent tendering than others. (2) After-treatment of the dyeings with copper sulphate strongly encourages tendering and should never be used. (3) The risk of subsequent weakening of the material can be largely minimised by an afterchroming, an alkaline finishing or an after-treatment of the dyed material with sodium acetate.—P. F. C.

PATENTS.

Washing and bleaching agent containing an alkali peroxide· Preparation of a —— which is convenient to handle. E. Scheitlin. Fr. Pat. 423,949, Dec. 22, 1910. Under Int. Conv., Dec. 21, 1909.

IF one part of an alkali peroxide is mixed with from two to three parts of rosin, a much more stable product is obtained. By intimately mixing with it 1—10 per cent. of a suitable agent such as ethyl acetate, the rosin is gelatinised and the resulting plastic mass is only decomposed by water at above 80° C. The addition of 10 per cent. of sodium carbonate in turn transforms this product into a solid substance which can be powdered.—P. F. C.

Mercerising cotton or vegetable fibres in the roving, slubbing or sliver or in the form of loosely twisted yarn. J. F. Copley, Thongsbridge, Yorks. Eng. Pat. 12,551, May 24, 1910.

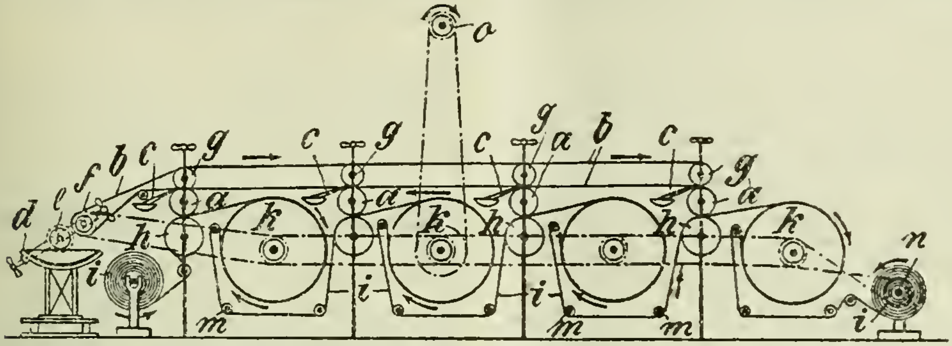
THE roving, slubbing or sliver is treated with mercerising liquor in any ordinary manner. To straighten the fibres they are passed between two sets of tension rollers, and, if desired, the second set, which actually apply the tension, may be mounted on a rotating ring revolving at right angles to the direction in which the rollers themselves turn. In this way that part of the sliver which is between the two sets of rollers and is therefore under tension has a temporary twist imparted to it which runs out however as soon as the material leaves the nip of the last set of rollers. This treatment may precede or follow the washing process. Loosely twisted yarn is mercerised and washed in the form of cops or cheeses and stretched without further twisting. —P. F. C.

Mordants and reducing agents for the dyeing and printing of woollen piece goods, yarns and the like. W. Bell, Paisley. Eng. Pat. 9028, April 14, 1910.

ONE hundred parts of ground peat, 2 parts of dry yeast and 10 parts of wheat flour are mixed with water to a paste and allowed to ferment at 130° F. until all action is over ; 25 parts of the dried and powdered product are fused at 240° F. with 100 parts of powdered sodium or potassium bichromate and 10 parts of powdered sulphur until the bichromate is reduced. The resulting mass constitutes a combination of reducing agent and mordant which may be mixed with suitable dyestuffs and used to dye woollen goods in a single bath.—P. F. C.

Dry coloured coatings on webs of paper and fabric at an accelerated drying speed especially so-called coated papers, calico and the like ; Method and device for producing ——. F. C. Wickel, Paris. Eng. Pat. 9269, April 16, 1910. Under Int. Conv., April 17, 1909.

PRESSURE rollers, *a*, having their surfaces divided into a large number of very small recesses, are supplied with colour by an endless band, *b*, which travels over rollers, *f* and *g*. This band in turn receives the colour from a roller, *c*, revolving in an adjustable colour trough, *d*. The surplus colour on the rollers, *a*, is removed by scrapers, *e*. The pressure of the guide rollers, *g*, on the rollers, *a*, and of the rollers, *a*, against elastic backing rollers, *h*, can be varied at will. The paper or other material, *i*, passes between the rollers, *h* and *a*, then over guide rollers, *m*, and over the drying cylinders, *k*, in such a manner that it enters the next pair of pressure rollers with a dry colour coating. It is finally wound up at *n*. The drying cylinders, *k*, the rollers, *a*, and the colour cloth, *b*, are driven at a uniform speed from the wheel, *o*. In place of pressure rollers, the colour may be sprayed on to the paper by means of colour diffusers.—P. F. C.



Hair dyes and their application. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 11,044, May 4, 1910.

The use of aromatic diamines and particularly of paraphenylenediamine for the production of hair dyes has been restricted by their irritant effect on the human skin. This drawback is removed by incorporating a normal alkali sulphite with the diamine in the proportion of at least one part by weight of crystallised normal sodium sulphite to one part by weight of the diamine. The hair is soaked with a solution of the mixture thus prepared and afterwards developed with hydrogen peroxide solution. Or, alternatively, it may be directly treated with a solution of the diamine and the sulphite to which hydrogen peroxide or some other suitable oxidising agent has been added.
—P. F. C.

Fast shades on fibres and fabrics; Production of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,272, June 13, 1910.

Brown shades fast to washing are produced by oxidation of *p*-aminobenzeneazo-*m*-phenylenediamine on fibres and fabrics. The process consists in padding the fibre with a solution of *p*-aminobenzeneazo-*m*-phenylenediamine containing an oxidising agent (*e.g.*, sodium chlorate), drying and steaming the goods; or in padding the fibre at first with a solution of the aminoazo compound and treating it afterwards with oxidising agents (*e.g.*, potassium chromate); or in first depositing an oxidising agent (*e.g.*, manganese dioxide) on the fibre and then treating the latter with the aminoazo-compound.—E. A. B.

Colour effects; Production of fabrics showing ——. Teinturerie C. Marot. Fr. Pat. 423,535, Dec. 10, 1910.

Before they are woven into the fabric, the yarns which are to be used for effect threads, are impregnated with a solution of a suitable lead salt, so that on drying they are covered with a coating which is resistant to the dye-liquor. After weaving in the treated yarns, which may be either white or coloured, the fabric is dyed in a cold dye-bath and finally soaped hot.—P. F. C.

Vats of the thioindigo group; Process for preparing concentrated ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 231,927, May 15, 1909.

The isolated leuco-alkali salts of thioindigo dyestuffs (or the free leuco compounds to which alkali has been added) are mixed with concentrated soap solution to form concentrated, homogeneous vat preparations. Alternatively, the leuco-alkali salts are mixed with more dilute soap solutions, with or without addition of salting-out agents; after salting out, the reducing solution is at once added, and the concentrated liquid containing soap and leuco-salt separated.—T. F. B.

Dyeing mixed textiles (half-wool, half-silk, etc.) by the single-bath process with substantive or direct dyestuffs; Process for ——. G. C. Dörr. Ger. Pat. 232,696, Jan. 11, 1910.

Potassium or sodium salts of organic acids, such as formic, acetic, lactic, or tartaric acid, are used in place of sodium sulphate for the single-bath dyeing of mixed goods. It is stated that 10 grms. of one of the above salts per litre of dyebath has the same effect as 20 grms. of sodium sulphate.
—T. F. B.

Cotton; Process for preparing —— *for dyeing with basic dyestuffs.* Badische Anilin und Soda Fabrik. Ger. Pat. 233,278, March 11, 1910.

In place of the usual two-bath process, it is now proposed to prepare cotton for dyeing with basic dyestuffs, by treatment with a bath containing tannin, oxalic acid, and an antimony compound.—T. F. B.

Printing of woven fabric. F. Krokert, Halle-on-the-Saale, Germany. Eng. Pat. 9090, April 14, 1910.

Canvas or some similar coarse fabric is either temporarily attached to a stiff backing or is itself stiffened with a starch filling. Colour is next printed on to it by means of a printing machine having rollers which are provided with an elastic coating of rubber, leather or some other suitable material. By this means the colour is uniformly applied over the surface. The canvas may then be partly or entirely coated with powdered fibrous matter and again printed, thus producing a close imitation of Gobelin tapestry effects. If desired, the material may be finally varnished.—P. F. C.

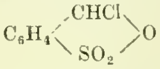
Printing warps and the like; Apparatus for ——. J. Cox, Colne, Lancs. Eng. Pat. 9321. Apr. 18, 1910.

The warp beams are arranged parallel, one above another, preferably supported by brackets fixed to an inclined support. The warps from all the beams are brought together over one guide roller and are led, superposed on each other, round the printing cylinder which is surrounded by the required number of colour printing rollers. After printing, the combined warps pass around a drying cylinder and then through a steam chest or conditioning apparatus. The warps are finally separated and wound on to friction-driven beams. To prevent the unprinted parts of the warps from being overdried and also to condition the yarn, fine sprays of water are discharged into the air just in front of and just behind the drying cylinder.
—P. F. C.

Discharges on vatted grounds and new sulphonic derivatives of organic ammonium bases. Badische Anilin und Soda Fabrik. Third Addition, dated Nov. 18, 1910, to Fr. Pat. 414,937, Apr. 19, 1910. Under Int. Conv., July 2, 20, 22, and 27, Aug. 6, and Sept. 28, 1910.

(1) In the processes described in the principal patent and its first addition (this J., 1910, 1247; 1911, 21) the alkarylammonium compounds containing one or more sulphonic groups may be replaced by compounds containing

other salt-forming groups in either the free or masked state. Example: A discharge colour containing 100 grms. of zinc white, 200 grms. of water, 70 grms. of the ammonium compound from benzyl chloride and dimethylaminobenzoic acid, 150 grms. of "rongalite C," 100 grms. of sodium sulphite, 40 grms. of a 30 per cent. paste of anthraquinone and 340 grms. of thickening, is printed on the vatted ground and the process is completed as described in the principal patent. (2) Very pure discharges can be obtained by the process described in the first addition if a tertiary amine, preferably containing one or more salt-forming groups is added to the discharge colour. Example: A discharge colour containing 70 grms. of zinc oxide, 170 grms. of water, 60 grms of anthraquinone paste (30 per cent.), 80 grms. of the sodium salt of benzyl chloride-*p*-sulphonic acid, 80 grms. of sodium dimethylmetasulphanilate, 120 grms. of "rongalite C," and 420 grms. of thickening (1:1), is printed on a sulphide, indigo or other vatted ground. After printing, the fabric is steamed out of contact with air and then passed through a feebly alkaline bath. (3) Compounds having the general formula RRCH·Halogen (see first addition) can be replaced by compounds having the formula RRC (Halogen)$_2$ and containing one or more salt-forming groups either in the free or the masked state—the term "masked" referring to groups which can be transformed into acid groups. Such compounds are the lactoid compounds of the formula



$$C_6H_4\left\langle\begin{matrix}CHCl\\SO_2\end{matrix}\right\rangle O$$

resulting from the intramolecular condensation of benzylidene chloride-*o*-sulphonic acid, its homologues and derivatives. (4) In place of the above mentioned alkarylammonium compounds, sulphonium compounds containing at least one alkaryl radical can be used if they contain one or more salt-forming groups. (5) All the alkarylic compounds which are applied in the principal patent and the first and third additions to it for the production of discharges can also be applied for the production of reserve effects under vat or sulphide grounds. Example: Cloth, prepared with glucose, is printed with a colour containing 20 grms. of the calcium salt of dimethylphenylbenzylammoniumdisulphonic acid and 80 grms. of gum thickening (1:1). After drying, a colour consisting of 14—15 grms. of indigo B.A.S.F. 20 per cent. and 85—90 grms. of alkaline thickening is applied, and the material is dried, steamed for one minute and then developed in running water. A souring and a final washing complete the process. (See also this J., 1911, 205, 206 and 355.)—P. F C.

Permanent calender finish on fabrics; Process for obtaining a ——. E. A. F. Düring. Fr. Pat. 423,748, Dec. 2, 1910. Under Int. Conv., Jan. 17, 1910.

The material is calendered and then padded in a moderately strong solution of soap in water and alcohol at 40° C. After damping or steaming, the fabric is again calendered, this time at a high temperature. To enhance the lustre, resins or waxes soluble in alcohol may be added to the padding solution.—P. F. C.

Filling and finishing preparation. P. C. D. Castle. Fr. Pat. 423,956, Dec. 22, 1910.

A paste is prepared containing 40 parts of gum tragasol, 25 parts of tapioca starch, 25 parts of maize starch and 10 parts of a jelly-like solution of Iceland moss. If this mixture is evenly spread out in thin sheets and dried, the product is readily soluble in warm water. If borax is added to the paste a more viscous solution is obtained. —P. F. C.

Multi-coloured effects in spun and woven goods; Process for producing ——. M. Becke, Hoechst on Maine, Germany. Eng. Pat. 15,819, July 1, 1910. Under Int. Conv., Aug. 11, 1909.

See Ger. Pat. 228,693 of 1909; this J., 1911, 206.—T.F.B.

Dyeing; Process of ——. R. Ott, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 989,186, April 11, 1911.

See Fr. Pat. 397,659 of 1908; this J., 1909, 792.—T. F. B.

Dyeing half-wool goods; Process of ——. H. Walther, Assignor to Farbenfabr. vorm. F. Bayer und Co., Eleberfeld, Germany. U.S. Pat. 990,023, April 18, 1911.

See Fr. Pat. 395,679 of 1908; this J., 1909, 471.—T. F. B.

Dyeing wound yarn; Apparatus for use in ——. H. Resch, Lörrach, Germany. U.S. Pat. 990,064, April 18, 1911.

See Eng. Pat. 24,404 of 1909; this J., 1910, 19.—T. F. B.

Yarn in hanks; Apparatus for treating —— *with liquid.* A. Clavel, Assignor to Färberei- u. Appreturges. vorm. A. Clavel und F. Lindenmeyer, Basle, Switzerland. U.S. Pat. 990,802, April 25, 1911.

See Fr. Pat. 414,735 of 1910; this J., 1910, 1200.—T.F.B.

Dyeing by means of benzoquinone or a-naphthoquinone dyestuffs; Process of ——. R. Lesser. Fr. Pat. 423,787, Dec. 16, 1910. Under Int. Conv., March 3, 1910.

See Eng. Pat. 876 of 1911; this J., 1911, 417.—T. F. B.

Sizing and finishing purposes; Combination for ——. P. C. D. Castle, Le Houlme, France. Eng. Pat. 10,075. April 25. 1910.

See Fr. Pat. 423,956 of 1910; preceding.—T. F. B.

Fabrics; The finishing of ——. R. B. Ransford. London. From Soc. de la Manuf. d'Indiennes E. Zundel, Moscow, Russia. Eng. Pat. 12,527. May 23, 1910.

See Fr. Pat. 419,203 of 1910; this J., 1911, 206.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sodium carbonate and sodium bicarbonate; Reciprocal solubility of —— *in water.* D. de Paepe. Bull. Soc. Chim. Belg., 1911, 25, 173—177.

The reciprocal solubilities of sodium carbonate and sodium bicarbonate at 25° C., under ordinary atmospheric pressure, are given in the following table, the solubilities of the two salts themselves being:—Carbonate, 28·3 grms., and bicarbonate, 10·3 grms. in 100 grms. of water.

Sodium carbonate. Grms. in 100 grms. of water.	Sodium bicarbonate. Grms. in 100 grms. of water.
27·3	2·1
26·5	4·2
19·2	5·7
12·4	7·3
6·2	9·0
1·0	10·1

From the relation between these results and those which may be calculated, the author concludes that these two salts do not form a double salt at 25° C., and that in concentrated solution they each dissociate into two ions of which one is common to both salts, and not into three ions of which two are common to the two salts.—W. P. S.

Sodium thiosulphate; Manufacture of ——. E. Schütz. Z. angew. Chem., 1911, 24, 721—725.

Fresh Leblanc alkali waste is mixed with waste which has already been oxidised and lixiviated, and the mixture is laid out in heaps and mixed with the requisite quantity of sodium sulphate. The daily formed

heap, in a work producing 17—18 tons of soda-ash daily, will weigh about 37 tons. The heaps are frequently turned over, and watered with the last washings of the treated waste; in 4 to 6 days, according to the weather, the oxidation is complete. The temperature inside the heaps should be about 80° C., and the oxidised heap should show on titration about 26 per cent. of sodium thiosulphate. To the heaps are added the settlings from the clarifying tanks, and the sulphates which separate from the concentrated liquor. The lixiviation of the oxidised waste, which should be begun as soon as oxidation is complete, is carried out in the same way as that of black ash, the waste meeting first with comparatively concentrated liquor, and the fresh water acting on the almost exhausted waste. The exhausted waste is given a final wash with water which is used to moisten the heaps, and is then thrown away; three days' contact of waste and water is usual in the washing. The final liquor (of sp. gr. about 1·20, containing about 380 grms. of sodium thiosulphate per litre) is passed several times down a packed tower, up which proceeds a current of sulphur dioxide gas and air from a small sulphur-burner at the bottom, till it gives only a slight brown colouration with lead acetate solution. For 37 tons daily of original waste about 450 lb. of sulphur are required. Sodium carbonate is then added to faint alkalinity, so as to precipitate the calcium sulphate remaining in solution, and a portion of the mother liquor from the crystallising vats is also brought back to the liquor here. The turbid liquor is now pumped up to settling tanks, whence it flows either directly, or preferably after passage through a porous stone filter, to the evaporating apparatus, where it is concentrated to a sp. gr. of 1·53—1·56. During this process sodium sulphate separates, and is returned to the oxidation process; the liquor then goes into cylindrical vessels with conical bottoms, where it cools to about 40° C., depositing sulphate and a certain amount of muddy sediment (which are afterwards returned to the oxidation process), and is then run into crystallising vats. The mother liquors have a sp. gr. in winter of about 1·3, in summer of about 1·45; sometimes the crystals and the mother-liquors are pink, from arsenic, which is removed by adding a little sulphuric acid, when the hydrogen sulphide produced precipitates arsenious sulphide. Small crystals are obtained by agitating the surface during the whole time of crystallisation by a large wooden spatula. A special form—medium grain—in demand for photographic purposes is made in the rocking pans patented by Bock, and then carefully dried at 30°—40° C. Assuming 12 per cent. of sulphur in the original waste, 77—78 per cent. of this is recovered as thiosulphate; for every 100 parts of sodium thiosulphate, there are needed 76 to 80 of 95 per cent. sodium sulphate, 2—2½ of ammonia-soda, and about 2 of sulphur. The following other processes for manufacturing thiosulphate may be mentioned:—The Mannheim United Chemical Works produce bicarbonate from chloride by the ammonia process which is then treated with an equivalent quantity of sulphur, and sulphur dioxide and steam are blown in; sulphite, and then thiosulphate are formed, and the evolved carbon dioxide goes back into the process, as does also the ammonium chloride formed in the first stage. The same firm also produces anhydrous thiosulphate by passing oxygen or air over dry sodium sulphydrate at 100°—150° C., and dissolving the product in water and evaporating to obtain the crystallised salt. The same result is obtained by passing hydrogen sulphide and air or oxygen over sodium sulphide at 300° C. According to a patent of Sidler, sodium sulphite is fused with sulphur, and the resulting thiosulphate dissolved out by water under a pressure of 2 atmospheres. There is also a patent of Clemm, in which bauxite is heated with sodium sulphate and carbon. The fused mass is lixiviated, the alumina precipitated by sulphur dioxide, and thiosulphate crystallised from the solution.
—J. T. D.

Nitrites; New method of determining ——. E. Rupp and F. Lehmann. Arch. Pharm., 1911, **249**, 214—217.

In order to determine the nitrite in commercial or other samples of sodium or potassium nitrite, use is made of the oxidation of the nitrous acid by means of bromine. 2·5 grms. of the sample of sodium nitrite are dissolved in 500 c.c. of water, and 10 c.c. are measured into a 250 c.c. stoppered bottle. To this are added 50 c.c. each of $N/100$ potassium bromate solution (1·6702 grms. per litre) and potassium bromide solution (6 grms. per litre). The mixture is acidified with 10 c.c. of dilute sulphuric acid, shaken gently and set aside in the dark for 30 minutes. Afterwards 0·5 grm. of potassium iodide is added, the bottle shaken vigorously and titrated with $N/10$ thiosulphate. The number of c.c. of thiosulphate used is subtracted from 30 and the result multiplied by 0·00345 gives the weight of sodium nitrite in 0·05 grm. of the original substance. Care should be taken that about twice as much bromine is used as that theoretically required.
—F. Shdn.

Carbides and silicides. O. Hönigschmid. Z. angew. Chem., 1911, 24, 792—793.

A *resumé* is given of the methods used for obtaining carbides and silicides. Reference is also made to the employment of calcium silicide for the fixation of atmospheric nitrogen and to the use of ferrosilicon as a flux for art castings and as a material for electrodes and evaporating basins.—A. Sbld.

Sulphur and sulphuric acid in the United States. Oil, Paint, and Drug Rep., May 1, 1911. [T.R.]

The Geological Survey Department at Washington has issued a report showing that from a production of 3,147 long tons of sulphur, valued at $88,100, in 1900, the output in the United States has risen to 239,312 long tons, valued at $4,432,066, in 1910. At one time the United States paid $3,000,000 annually for sulphur, most of which came from Sicily. It still imports some sulphur, but exports about an equal amount. The trade is somewhat spasmodic and depends on local conditions. Some sulphur, for instance, has been coming to the Pacific Coast from Japan, but the business cannot be regarded as well established. In 1909, 37,142 tons of sulphur, valued at $736,938, were exported and various grades of it, valued at $549,632, were imported.

Sulphuric acid is now made largely by copper smelters and in one case at least the acid output is more profitable than the production of metal. This has made it possible to work copper mines at a profit when the metal contents of the ore alone would not pay expenses.

The demand for sulphuric acid has exceeded the supply from sulphurous ores and pyrites. In 1909 about 250,000 tons of pyrites were mined and nearly three times as much was imported. There are very large deposits in the country, including New York, California, and Virginia, and it should not be necessary to spend $2,500,000 for foreign pyrites, as was done in 1909. The great sulphur deposits in Louisiana, which did not lend themselves practically to the ordinary processes of mining, now yield immense quantities of commercially pure sulphur, thanks to the inventive genius of Hermann Frasch.

Calafatite, a native aluminium-potassium sulphate. Ch. of Comm. J., May, 1911. [T.R.]

Calafatite, a double sulphate of aluminium and potash, so named after its discoverer, Señor Calafat, was discovered a short distance from Almeria. No work has yet been carried out to show the real nature of the deposits, but the owner is said to have estimated the quantity at 60,000,000 tons. The lode has a run of some three miles. Señor Calafat is erecting works near Madrid to put the mineral to a practical test, and several carloads have been shipped for treatment in the furnaces. The analysis is given as follows:—Sulphuric anhydride 34.77 per cent.; alumina 37.98 per cent.; potash 9.64 per cent.; water, 17.61 per cent.; specific gravity 2.75; hardness, 2.50 to 3.

Patents.

Sulphuric acid; Apparatus for the manufacture of [concentrated]—. O. Proelss, Kansas City, Mo. U.S. Pat. 989,537, April 11, 1911. (Compare U.S. Pat. 963,174; this J., 1910, 148.)

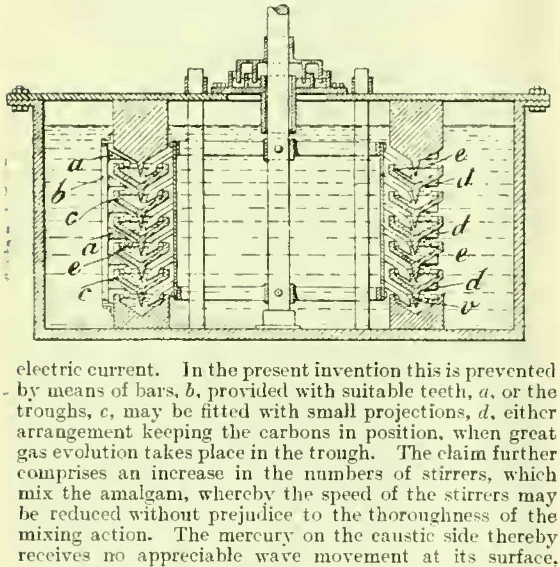
The apparatus consists of a denitrating, a concentrating, and a cooling chamber, conduits for supplying burner gases to the two former, means for discharging the gases from these into the cooling chamber and for mixing them therein, and lead chambers for receiving the cooled gases; means are also provided for supplying weak acid to the cooling apparatus, for conducting it thence into the denitrating chamber, and for supplying the denitrated liquor to the concentrating chamber. There may be several acid supplies, any one of which can be connected with the concentrating tower, and there may be means for controlling the supply of hot gases to the tower, so as to regulate the concentration.—F. Sodn.

Burner-gas; Method of purifying —. C. L. Reese, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 989,801, April 18, 1911.

The burner-gases are cooled, dried by scrubbing with sulphuric acid, and then passed through a dry lime filter. —A. S.

Alkali salts; Electrolytic cells for the electrolysis of—. M. Wildermann, London. Eng. Pat. 26,568, Nov. 15, 1910. Under Int. Conv., Dec. 22, 1909.

In the electrolytic cell described in Eng. Pat. 9803 of 1902 (this J., 1903, 703) there is a tendency for the little carbons, *e* (see Fig.), to become displaced with the passage of the electric current. In the present invention this is prevented by means of bars, *b*, provided with suitable teeth, *a*, or the troughs, *c*, may be fitted with small projections, *d*, either arrangement keeping the carbons in position, when great gas evolution takes place in the trough. The claim further comprises an increase in the numbers of stirrers, which mix the amalgam, whereby the speed of the stirrers may be reduced without prejudice to the thoroughness of the mixing action. The mercury on the caustic side thereby receives no appreciable wave movement at its surface, so that the passage of the liquor from one compartment into the others is prevented.—O. R.



Ammonia from peat; Process of producing —. H. C. Woltereck and the Sulphate of Ammonia Co. Ltd., London. Eng. Pat. 15,285, June 25, 1910.

Air and steam are passed over heated peat with an admixture of part of the exhaust gases, which have been deprived of their ammonia and other by-products; the percentage of oxygen in the gaseous mixture, which is introduced under the grate of the furnace, is kept sufficiently low to prevent the formation of combustible gases, while allowing the temperature of reaction to rise to 600°—800°C. (See also Eng. Pats. 16,504 of 1904 and 27,905 of 1908; this J., 1905, 731; 1910, 276.)—O. R.

Hydrogen peroxide; Manufacture of—. A. Pietzsch and G. Adolph, Munich, Germany. Eng. Pat. 23,660, Oct. 12, 1910. Under Int. Conv., Jan. 8, 1910. Addition to Eng. Pat. 23,158 of 1910, dated Oct. 9, 1909.

A persulphate is distilled in a retort, under diminished pressure, with concentrated sulphuric acid, with formation of hydrogen peroxide and a bisulphate; the former distils over in a concentrated form, and the latter, which is easily separable from the excess of sulphuric acid, may be withdrawn at the same time as a fresh quantity of persulphate is introduced into the retort. The bisulphate, which is formed, may be electrolysed to furnish the persulphate required for the reaction, and the original amount of sulphuric acid serves indefinitely, it being only necessary to introduce water continuously into the retort as the hydrogen peroxide distils over.—O. R.

Sodium sulphate crystals; Process of dehydrating ——. J. Davis, Laramie, Wyo. U.S. Pat. 990,116, April 18, 1911.

The crystals are mixed with a solid comminuted absorbent or porous vehicle which will not dissolve in the melted crystals at temperatures sufficient to dehydrate the latter; the quantity of the porous substance used must be sufficient to prevent the mass from becoming fluid at the temperatures employed. The mixture is caused to travel through a trough in which it is constantly agitated and heated gradually to a temperature sufficient to evaporate the water but not sufficient to melt the absorbent vehicle. —A. S.

Nitrous vapours, such as oxides of nitrogen, diluted with indifferent gases; Process of recovery of——. Le Nitrogène Soc. Anon. First Addition, dated Oct. 1, 1910, to Fr. Pat. 421,313, Dec. 18, 1909. Under Int. Conv., Sept. 23, 1910.

Charcoal (such as animal charcoal, wood charcoal, cocoa-nut charcoal, etc.) is introduced, in a divided state, into the apparatus in which condensation of the oxides of nitrogen by expansion is effected, as described in the principal patent; this assists condensation, and so a smaller reduction in temperature is necessary, and a smaller difference in pressure, therefore, before and after expansion. When an inert liquid is added to the gaseous mixture, it suffices that the liquid should solidify below −25°C. and, for the subsequent separation of the oxides of nitrogen, that its boiling point should be above 50° C. —F. Sodn.

Nitrogen; Process for the separation of oxy-compounds of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 423,760, Dec. 8, 1910. Under Int. Conv., Dec. 11, 1909.

Oxy-compounds of nitrogen, contained in gaseous mixtures, are separated by absorption by means of wood charcoal, and are subsequently recovered from the charcoal by treating this with steam, hot air, or an inert gas, or by means of a vacuum. As an example, 1000 parts by weight of charcoal will absorb 122 parts of nitric acid from a gaeous mixture containing 3 volumes per cent. or 133-174 parts from gas containing 5 volumes per cent. of oxy-nitrogen compounds, and 80 per cent. of the nitric acid can be regenerated.—F. Sodn.

Oxy-compounds of nitrogen, sulphur, chlorine, and salts of the corresponding acids, especially nitric and sulphuric acids, nitrates, nitrites, sulphates, persulphates, chlorates, perchlorates, etc.; Manufacture of ——. L. Devilaine. Fr. Pat. 423,893, Feb. 28, 1910.

Claim is made for the application of the oxidising action of ultra-violet rays to the manufacture of simple oxy-compounds, especially of (1) nitric acid, by the utilisation of atmospheric oxygen and nitrogen—the rays causing a more rapid and complete oxidation of the gases leaving the electric furnace and stimulating the reaction between water and the lower oxides of nitrogen, besides affecting the entering gases, so as to promote reaction in the furnace; (2) sulphuric acid from sulphurous acid and other less oxidised sulphur compounds; and (3) nitrates, persulphates, chlorates, and perchlorates, particularly ammonium perchlorate for use as an explosive.—F. Sodn.

Alkali and alkaline-earth sulphates; Process for reducing—— to their respective sulphides by means of the catalytic action of iron. V. Bollo and E. Cadenaccio. Fr. Pat. 423,228, Nov. 26, 1910. Under Int. Conv., Nov. 29, 1909.

It is stated that in presence of a very small proportion of iron oxide, reduction of alkali or alkaline earth sulphates is effected more rapidly and at a lower temperature than is possible in the ordinary way. The iron may be introduced by intimately mixing the sulphate with a ferrous or ferric salt, if possible in the "wet way," and precipitating the corresponding hydrated oxide in the mass, unless the iron salt used be converted into oxide at a relatively low temperature; or, iron oxide or carbonate may be added directly; the mass is then dried and heated in an appropriate furnace. During the heating of the mixture, in the absence of air, it may be further submitted for a relatively short time to the action of reducing gases, obtained by the dry distillation of coal or other organic matter, or it may be heated (thermo-electrically, for instance) with carbon (coal, coke, etc.) or tar or other organic substance, in addition to iron oxide, though the yield of sulphide is, in this case, less, and longer heating is necessary.—F. Sodn..

Aluminium compounds free from iron; Process for the preparation of——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 232,563, May 27, 1908.

The aluminous material is heated with at least double the theoretical quantity of sulphuric acid. On cooling, aluminium sulphate separates, whilst most of the iron remains dissolved. The aluminium sulphate may be further purified by again dissolving it in hot sulphuric acid.—A. S.

Hydrogen cyanide; Process for converting —— into ammonia. F. Hauff. Ger. Pat. 232,878, Aug. 3, 1910.

Steam is caused to act on hydrogen cyanide, or on gases containing it, at a temperature of at least 1000° C., the reaction vessel being constructed of a material which is incapable of evolving oxygen or of acting as an oxygen carrier. It is stated that by suitably regulating the velocity of the gases, 90 per cent. of the hydrogen cyanide can be converted into ammonia at about 1200° C.—A. S.

Saturator for gases, especially for the manufacture of ammonium sulphate. Berlin-Anhaltische Maschinenbau A.-G. Ger. Pat. 233,518, April 2, 1910. Addition to Ger. Pat. 230,825, Dec. 11, 1909 (this J., 1911, 362)

The gas-inlet tube enters the movable bell (*loc. cit.*) at the top and extends downwards, but does not dip below the surface of the liquor in the saturator. In this way the formation of a saline deposit on the gas-inlet tube is prevented.—A. S.

Nitrogen from air; Separation of——. W. G. Heys, Manchester. From Nitrogen Co., Ossining, New York. Eng. Pat. 24,413, Oct. 21, 1910.

Air, free from moisture and carbon dioxide, is deprived of its oxygen by contact with molten sodium or potassium cyanide, or a mixture of the two, at a temperature of at least 500° C., and the cyanate thus formed is again converted into cyanide by reduction with a metal or carbon. Suitable apparatus for the purpose consists of a copper pot, nearly filled with the cyanide, from the cover of which a bell depends into the material, a heavy wire cloth basket, containing anthracite or other form of carbon, being arranged within the bell. Air or partly purified nitrogen is made to pass slowly and continuously over the surface of the molten cyanide, on the outer side of the bell, and the cyanate thus formed, after diffusing through the molten mass, is reduced by the carbon in the basket; carbon monoxide is thus evolved within the bell, and may be withdrawn without contaminating the nitrogen.—F. Sodn.

Oxygen and nitrogen from air; Process for obtaining —— by means of alkali manganate or permanganate. G. Kassner. Ger. Pat. 233,383, May 29, 1910.

An alkali manganate or permanganate, or a mixture of alkali hydroxide and oxide of manganese, is mixed with an alkali metaplumbate or with substances capable of yielding the same, and is then heated and treated alternately with steam and air. It is stated that by the addition of the plumbate the manganate remains active for a much longer time than without such addition. The quantity of plumbate required is greater the higher the temperature employed.—A. S.

Sulphur; Mining——. H. Frasch, New York, Assignor to The Frasch Sulphur Process Co., Maine. U.S. Pat. 988,995, April 11, 1911.

A fluid, at a temperature above that at which molten sulphur begins to be pasty, is introduced into an underground sulphur deposit, and the sulphur thus melted is raised in a fused state. The fluid may be introduced through the piping of one well and the molten sulphur withdrawn through another; or, the fluid may be introduced through one well, and similar fluid at a lower temperature (above the melting point of sulphur) may be introduced through the second well, through which also the molten sulphur is withdrawn.—F. Sodn.

Sulphuric acid; Manufacture of——. P. M. Justice, London. From A. G. Duron and E. Hartmann, Wiesbaden, Germany. Eng. Pat. 9869, April 22, 1910.

See Fr. Pat. 415,658 of 1910; this J., 1910, 1305.—T.F.B.

Electrolytic cells for the electrolysis of alkali salts; Elements of——. M. Wildermann. Fr. Pat. 422,998, Nov. 17, 1910. Under Int. Conv., Dec. 22, 1909.

See Eng. Pat. 26,568 of 1910; preceding.—T. F. B.

Hydrogen peroxide; Manufacture of——. A. Pietzsch and G. Adolph, Munich, Germany. Eng. Pat. 23,158, Oct. 6, 1910. Under Int. Conv., Oct. 9, 1909.

See Fr. Pat. 421,164 of 1910; this J., 1911, 422.—T. F. B.

Salt; Process of treating——. E. R. Royston, Oxton, Assignor to International Salt Co., Ltd., London. U.S. Pat. 989,056, April 11, 1911.

See Eng. Pat. 12,110 of 1907; this J., 1908, 809.—T. F. B.

Ammonia and ammonium salts; Process of producing——. C. Bosch, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pats. 990,191 and 990,192, April 18, 1911.

See Eng. Pat. 2525 of 1909; this J., 1909, 309.—T. F. B.

Ammonium chloride from ammonium sulphate and common salt; Process for making——. F. A. Freeth and H. E. Cocksedge. First Addition, dated Dec. 5, 1910, to Fr. Pat. 414,682, April 9, 1910.

See Eng. Pat. 86 of 1910; this J., 1910, 1378.—T. F. B.

Sodium hydrosulphite; Process of making——. J. Rosenbek and H. Mirocourt, Lyon, and R. Loup, Caluire, Assignors to Manuf. Lyonnaise de Matières Colorantes, Lyon, France. U.S. Pat. 990,457, April 25, 1911.

See Eng. Pat. 11,906 of 1910; this J., 1910, 1010.—T. F. B.

Alkali cyanides; Manufacture of —— and apparatus therefor. J. W. Swan and J. A. Kendall. Fr. Pat. 422,963, Nov. 4, 1910.

See Eng. Pat. 26,258 of 1909; this J., 1910, 1454.—T. F. B.

Barium oxide; Manufacture of ——. C. Rollin, and Hedworth Barium Co., Ltd. Fr. Pat. 423,644, Dec. 14, 1910. Under Int. Conv., Dec. 28, 1909.

See Eng. Pat. 30,323 of 1909; this J., 1911, 421.—T.F.B.

Hydrogen gas; Method of producing——. F. Sauer, Potsdam, Germany. Eng. Pat. 7746, March 30, 1910.

See Ger. Pat. 224,862 of 1907; this J., 1910, 1148.—T. F. B.

Nitrogen from air; Process for producing——. The Nitrogen Co. Fr. Pat. 423,462, Nov. 21, 1910.

See Eng. Pat. 24,413 of 1910; preceding.—T. F. B.

VIII.—GLASS; CERAMICS.

Kilns for porcelain worked with generator gas from brown coal briquettes. W. Stampe. Sprechsaal, 1911, **44**, 247–248.

The Czerny-Deidesheimer generator fired with brown coal briquettes from Central Germany is said to achieve an economy of 35 per cent. over other processes. The lower part of the generator, including the grate, is placed in water, and the whole is fitted with water-seals so that the production of gas can be stopped or regulated at will. The admission of air is quite under control, and the danger of explosion thereby minimised. One man can work the whole process of firing porcelain. The gas enters by a flue right round the kiln, leading to other flues which debouch into five fireholes. This previous heating favours a high temperature, and it is said that the highest temperatures of the Siemens-Martin process may be attained in a short time. At Weiden, the porcelain is fired to cone 14 (1410° C.), the whole firing taking 13 hours. The gas enters above and air from under the grate, the kiln being previously heated by direct firing to the ignition-point of the gas. Brown coal briquettes are said to be more effective and economical than Bohemian coal. An analysis of the generator gas from these briquettes gave: carbon dioxide, 4·7; oxygen, 0·2; ethylene, 0·8; methane, 3·2; hydrogen, 11·6; and carbon monoxide, 31·2 per cent. The calorific value was 1751, and the temperature 170°—200° C. Kiln firing is always wasteful, but the absence of smoke and the absolute control of the gas renders the present process the most economical.—H. H. S.

Stoneware; Harmful influence of sulphate from commercial salt on firing of ——. M. Schmidt. Sprechsaal, 1911, **44**, 264.

The commercial salt used in salt-glazing usually contains sulphates, which are detrimental to the appearance of the finished ware, especially in an oxidising atmosphere. The thin layer of salt-glaze becomes saturated with sulphates which are either displaced by the silica of the body with evolution of gas and consequent bubbling of the surface, or else a separation of "galls" occurs. Sulphates are especially harmful if salting begins before full fire. The best way to avoid their action is to keep a reducing atmosphere in the kiln till the last stage, when the fires are cleaned and air let through the grates. The sulphates are thereby reduced and eliminated before the kiln is at its highest temperature. But the risk is run that the colour of the body is sacrificed through insufficient oxidation of iron salts in the body. In the cooling kiln undecomposed sulphates are deposited on the walls, take up water, and percolate into the firebrick, where they separate out again. The whole fabric becomes destroyed thereby. Sodium sulphate is more destructive than calcium sulphate.
—H. H. S.

Grecian black enamel; Preparation of —— with natural ferroso-ferric oxide. L. Franchet. Comptes rend., 1911, **152**, 1097—1100.

Brongniart in 1844, following Salvetat, attributed the black lustres of Greek and Roman pottery to manganese oxide. The author confirms the presence of manganese, but states that the quantity is not large enough by itself to cause the colour. Verneuil has recently suggested that the Greeks introduced finely divided metallic iron, prepared by reducing the oxide with carbon. But according to ancient writings natural products were used by potters. The Romans found magnetite in Piedmont and Elba, and the author accordingly used this mineral. He succeeded in reproducing the enamel in an oxidising fire at 850° C., by fluxing 55 parts of quartz sand with 45 of sodium carbonate and grinding the frit with an equal weight of magnetite. Artificial ferroso-ferric oxide does not yield the black colour, which is probably enhanced by the traces of manganese in the natural ore. Small additions of lime do not interfere with the black. The production of the black may have been helped by the organic medium used preventing oxidation to ferric compounds. The Greeks, despite the name of the enamel, did not discover it: it is found in Egypt. The opacity is caused by the presence of more stain than will dissolve in the flux.—H. H. S.

Plaster casts; Washable ——. F. Rathgen. Bericht der XIII Hauptversammlung des deutsch. Gipsvereins, 1911, 50—54.

Moye states that plaster casts may be washed with soap and water, but, according to the author, such a process spoils the contours. It is only possible to do this twice at most, and the author prefers leaving the casts to stand in water saturated with plaster and then taking off the outer scum. Moye also recommends brushing the outside of the casts with a thick paste, but here again the subsequent trimming with a knife is apt to tear the cast. The author finds that casts may be rendered washable by saturating the surface with wax or paraffin or some chemical which renders it less permeable. Treatment of the cast with "zapon" (a solution of nitrocellulose) yields the best results, and when this is done it may be regularly washed with soap and water and a soft brush, but the treatment should be repeated every year or two as the surface cracks. Instead of "zapon," acetylcellulose ("cellon," "cellite") may be used. In the discussion the dirtying of casts was attributed to tobacco smoke as well as to dust and handling. Smoke stains may be removed by alcohol or petroleum spirit.—H. H. S.

Patents.

Quartz and the like; Moulding of ——. F. W. Burckhardt, Bielrich-on-Rhine, Germany. Eng. Pat. 20,502, Sept. 2, 1910.

A tubular bloom of quartz glass is blown, by compressed air or gas, to any desired shape in a mould made in two parts, and so formed that when closed, one end of the bloom is compressed to the extent of entirely obliterating the central bore thereof, while the other end, compressed to a less extent, is firmly closed around a previously inserted blowpipe, by means of which the bloom is then blown to the shape of the mould.—R. W. N.

Hollow bodies open at one end; Manufacture of —— from quartz melted by means of a heated electric resistance. Deutsche Quarzges. m. b. H. Fr. Pat. 422,997, Nov. 16, 1910.

A body of powdered quartz is packed round an electric resistance in the form of a split tube, the two inner ends of which are joined together, while the outer ends project outside the quartz mass and are adapted to be connected with two contact pieces by means of which an electric current is passed up one side of the split tube and down the other. A portion of the quartz melts and adheres to the tube, and can then be removed and expanded by the usual glass-blowing operation.—H. H.

Glass pot and kiln. R. L. Frink, Belle Vernon, Pa., Assignor to Window Glass Machine Co., Pittsburg, Pa. U.S. Pat. 988,454, April 4, 1911.

The glass pot has a pot cavity at opposite sides and a common bottom wall, the central horizontal plane of which is substantially in the plane of the top surface of the kiln. The pot is mounted in the top portion of the kiln, in such a way that either cavity can be turned uppermost and projects in a freely exposed position above the top of the kiln. The contours of the outer surface of the pot and of the wall of the pot opening in the kiln are concentric with the centre of rotation of the pot.—W. C. H.

Glass; Material for use in the manufacture of ——, and manufacture of glass. E. C. Sullivan, Corning, N.Y. U.S. Pats. 990,606 and 990,607, April 25, 1911.

A granular substance prepared by dead roasting a mixture of lead sulphide (galena) and silica, with or without the addition of a calcium compound (lime, limestone, or gypsum), until the sulphur is reduced to not more than 0·05 per cent., is claimed as a material for use in the manufacture of glass.—A. S.

Glazed, enamelled, or analogous surfaces upon tiles, bricks, metal sheets, and the like; Production of ——. C. Dressler, London. Eng. Pat. 10,966, May 3, 1910.

The tiles are fed in batches to an elevator for individual transference to an inclined plane which acts as a magazine and feeds the tiles in edge contact to an endless carrier, over which one or more enamel sprayers are arranged. The delivery end of the carrier is adjacent to the receiving end of a faster-travelling endless carrier, by means of which the tiles, after being coated with liquid enamel, are slightly separated.—H. H.

Aluminous compositions; Preparation of ——. E. Taylor, Brooklyn, N.Y., Assignor to Union Clay Products Co., New York. U.S. Pat. 989,662, April 18, 1911.

Clay, containing sulphur, or to which sulphur has been added, is mixed with partially vulcanised oil, and the mixture is heated to complete the vulcanisation of the oil. —A. S.

Furnaces for drawing glass. V. H. Gregory, Chiswick. Eng. Pat. 8535, April 8, 1910.

See Fr. Pat. 415,870 of 1910; this J., 1910, 1311.—T. F. B.

Clay or the like; Machine for cleaning and sorting ——. M. Bohn, Nagykikinda, Austria-Hungary. U.S. Pat. 988,968, April 11, 1911.

See Eng. Pat. 12,114 of 1909; this J., 1910, 213.—T. F. B.

Electric furnace for the fusion of refractory materials, especially silica, and process of moulding. Addition to Fr. Pat. 396,017. *See* XI.

IX.—BUILDING MATERIALS.

Rock-asphaltum and its uses: Kentucky ——. M. H. Crump. J. Roy. Soc. Arts., 1911, **59**, 566—567.

The material is a fine-grained, sharp silicious sandstone containing from 5 to 25 per cent. of bitumen (maltha). It occurs in the upper beds of the sub-carboniferous formation, about 10 miles west of the celebrated Mammoth Cave. The sand is very hard, and each grain is coated with from 8 to 15 per cent. of bitumen: the commercial product must contain at least 8 per cent. It is found in irregular beds or pockets, from 5 to 20 feet thick, and can often be quarried in open cut. The chief use to which the asphaltum is put is for road-making. The material is put through a jaw-crusher, and then through two sets of rolls, and is thus disintegrated into separate grains. The ground material is spread cold on the prepared macadam surface to a depth of 2 inches, and rolled until the interstices of the broken stone are filled. The cost of bringing a road to grade with 4 inches of broken stone, rolling once, covering with a layer, 1½ inch thick, of rock asphaltum, and thoroughly rolling was 47·63 cents (2s.) per square yard. The asphalt is an excellent binding material for the wearing course, and gives a dustless waterproof surface which resists deformation under load, and is sufficiently plastic to break the blow of a horse's hoof. A mastic is also made by heating 75 per cent. of crushed rock asphalt, 20 per cent. of ground limestone, and 5 per cent. of pure bitumen to about 250° F., and moulding the mixture into 50-lb. blocks, which are used for waterproofing breweries, subways, etc. The cost of surfacing macadam streets is 10 to 20 cents (5d.—10d.) per square yard higher than with ordinary macadam.—W. C. H.

Portland cement; Some thermo-chemical experiments on ——. E. Dittler and L. Jesser. Zentr. Chem. Anal. Hydraul. Zemente, 1910, **1**, 71—78. Chem. Zentr., 1911, **1**, 1329.

A thermal and microscopical study of the sintering process was undertaken. At 1350° and at 1500° C. the process is endothermic, but between 1425° and 1430° C. there is a strongly exothermic reaction. At 1375° C. agglomeration (sintering) of the particles can be observed with the "heat microscope," and at 1425°—1450° C. there is a sudden separation of crystals (alite with a little celite; belite and felite could not be detected). It is preferable to bring the charge of cement materials rapidly into the kiln after heating the latter to 1200° C., rather than to heat up the charge gradually. (See also this J., 1911, 211.)—A. S.

Patents.

Refractory bricks, blocks, tuyères and the like employed in connection with furnaces for smelting metals; Manufacture of ——. H. E. Mason, Horwich, Lancs. Eng. Pat. 16,096, July 6, 1910.

To prevent disintegration of magnesite refractory bricks when subjected to intense heat, a small proportion, such as 5 per cent., of powdered basic slag is added to the calcined powdered magnesite prepared in the usual way.—H. H.

Brick; Method of burning ——. J. Q. Bennett, Cambridge, Mass., Assignor to Boston Brick Co., Boston, Mass. U.S. Pat. 988,299, April 4, 1911.

The method of burning brick consists in "clearing" the kiln by burning coal at the ends of the arches and wood in the centre of the arches, and in introducing air under pressure under the bed of burning coal at each end of each arch, whilst the wood is allowed to burn without the introduction of air beneath it until the kiln is "cleared" and the "water-smoke" is driven off. The pressure of the air which is introduced beneath the burning coal is then materially reduced and this reduced pressure maintained until the kiln is "settled." After the kiln is "cleared," the arches at each end may be fired alternately for a stated period of time, the air introduced beneath the burning coal being under a materially reduced pressure compared with the pressure used whilst the kiln is "clearing," and so maintained until the kiln is settled.—W. C. H.

Bricks; Manufacture of coloured slag ——. Soc. Anon. des Briqueteries de l'Est. Fr. Pat. 423,835, Dec. 19, 1910.

Nine parts of Thomas or similar slag containing as small a proportion of sulphur and manganese as possible are intimately ground with one part of hydraulic lime containing from 10 to 20 per cent. of a coloured metallic oxide or other inorganic colouring material. The mixture is moulded into bricks at a pressure of 150 to 200 atmospheres, subjected to the action of low-pressure steam for three hours, and then dried.—H. H.

Cement-treating process. R. W. Lesley, Haverford, and H. S. Spackman, Ardmore, Pa. U.S. Pat. 988,724, April 4, 1911.

Highly heated cement clinker is run into a receiver which is hermetically closed, and into which water is sprayed into contact with the highly heated material. The high-pressure steam developed in contact with the highly heated clinker material, say 100 to 200 lb. per sq. in., is maintained in the receiver in order to effect the disintegration and ageing of the clinker. The receiver is moved into a treating chamber and subjected together with its contents to the action of high-pressure steam, in order to effect further disintegration and ageing. —W. C. H.

Fireproof electrically conductive materials; Process for the manufacture of ——. Gebr. Siemens und Co., Lichtenberg, Germany. Eng. Pat. 19,866, Aug. 25, 1910. Under Int. Conv., Oct. 4, 1909.

See Fr. Pat. 420,183 of 1910; this J., 1911, 372.—T. F. B.

Analysis of creosotes for the preservation of wood. Estor. *See* III.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Air [for blast furnaces, etc.]; Process for the desiccation of —— by calcium chloride. F. A. Daubiné and E. V. Roy. Iron and Steel Institute, May, 1911. [Advance proof.]

In the process previously described (this J., 1910, 959), the calcium chloride must not be allowed to reach a stage of hydration above that represented by the formula, $CaCl_2+8H_2O$, or liquefaction and loss of efficiency are observed; and the regeneration is not to be carried beyond the concentration, $CaCl_2+H_2O$, since hydrates of greater concentration are found to be "tardy" in operation. The air to be dried is made to traverse each mass of calcium chloride from above downwards, and 240 kilos. of the chloride, spread in a layer 24 cm. deep on a sq. m. of surface, will desiccate 300 cb. m. of air per hour, for 4 hours, under average conditions of 15 grms. of moisture per cb. m.; in order to regenerate the calcium chloride, warm air, at gradually increasing temperatures from about 30° to 200° C., is circulated upwards through the mass for about 2 hours, about 7·500 calories per kilo. of water deposited being necessary. A triplicate apparatus is desirable, so that desiccation, regeneration, and cooling may proceed simultaneously. Experiment has shown that in a well-watched and carefully conducted operation, it is possible to attain a degree of desiccation, such that the hygrometric condition of the air will be, for the average period of passage, only 10—15 per cent. of its saturation value at 15° C. A successful plant for working the process is in operation at the Differdange Steelworks, Luxemburg, desiccating the air (30,000 cb. m. per hour) required for a blast-furnace of 150 tons per 24 hours. The blast is either introduced by a central well and distributed in layers, by means of openings leading to the different superposed reservoirs, emerging into an annular chamber, or it arrives by way of the annular chamber and leaves by the central well. In each apparatus there are ten compartments, the depth of chloride in each being 24 cm., and the total area presented to the passage of the blast 100 sq. m.: the weight of calcium chloride is 24,000 kilos. and its apparent density, 1·0; the cooling surface of the spirals is 170 sq. m. At these works it has been found that air containing 6—8 grms. of moisture per cb. m. before its passage, contains 1—1·5 grms. per cb. m. on emerging from the apparatus, and that each apparatus may, with such air, receive the blast for 6—8 hours, during which period the above figure remains practically constant; regeneration requires 4 hours and cooling 3 hours. Figures are given to show that the desiccation of air is more readily effected by calcium chloride than by means of refrigerating machines, and the cost of installation in the former case is said to be less than a quarter; moreover the expenses of working are less, one man for the day shift and one for the night shift being sufficient to control the plant.

—F. Sodn.

Cast irons; [The "growth" permanent enlargement] of —— after repeated heatings. H. C. H. Carpenter. Iron and Steel Inst., May 1911. [Advance proof.]

In a previous paper (see this J., 1909, 1038) the influence of carbon, silicon, and both dissolved gases and those penetrating from outside, on the growth of cast irons was established. The influence of phosphorus, sulphur, and manganese has now been determined. Phosphorus tends to diminish growth and if 0·3 per cent. be present the growth is lessened by about 3·0 per cent. Sulphur is never present in sufficient quantity to have more than a small influence, which is that of retardation. Manganese retards the growth in all cases. Dissolved gases have no influence on the growth of an iron containing more than 3·0 per cent. of silicon; between 1·75 and 3·0 per cent. they may cause a growth of from one to two per cent., whilst when the silicon does not exceed 1·0 per cent. they may be responsible for 10 per cent. They also have a considerable effect in "close" grey irons, but not in "open" ones. It is again stated, as in the previous paper, that the main cause of growth is the oxidation of the *silico-ferrite* ($FeSi+O_3=FeO+SiO_2$). It is suggested that, if the silicon content be estimated, the following table gives a close approximation to the growth that is liable to take place.

Silicon per cent.	1·00	1·25	1·50	1·75	2·00	2·25	2·50	2·75	3·00	5·25	3·50
Growth per cent.	15·00	18·50	21·50	24·50	27·00	29·00	31·00	32·50	34·00	35·50	37·00

The volume changes in cast irons when repeatedly heated *in vacuo* are discussed, and a graph is given showing the growth *in vacuo* and comparing it with that in air. The two curves bear no relation to one another, and are in fact divergent. The last part of the paper contains an account of experiments devised with the object of obtaining a commercial alloy whose growth after repeated heatings was negligible, and which could be used for annealing ovens, rolls, ingot moulds, etc. It is shown that alloys containing 2·25 to 2·40 per cent. of carbon, 0·40 to 0·48 of silicon, and from 0·51 to 0·935 of manganese gave after 151 heatings a growth of from 7·49 to 3·09 per cent. respectively, while an alloy containing 2·66 per cent. of carbon, 0·587 of silicon, and 1·64 of manganese showed a slight contraction of about 0·13 per cent. This alloy solidifies at 1346° C., is a tough material and its mechanical properties were improved by the treatment. It appears to be suitable for annealing ovens, rolls, fire-bars, grids of muffle furnaces, and probably could be used for ingot moulds in an iron foundry. From the point of view of minimum growth and non-cracking, the most suitable material for ingot moulds for casting steel appears to be a very mild steel.—A. H. C.

Cast irons: The influence of vanadium upon the physical properties of ——. W. H. Hatfield. Iron and Steel Inst., May, 1911. [Advance proof.]

By the addition of a 45 per cent. ferro-vanadium to the molten metal a series of alloys was obtained containing from nil to 0·65 of vanadium, and all containing 2·91 per cent. of combined carbon, no graphite, 0·66 of silicon, 0·28 of manganese, 0·03 of sulphur, and 0·08 of phosphorus. They all showed the normal fracture with the usual cementite pearlite structure of white cast iron. The Brinell test gave a hardness varying from 387 to 430, while the scleroscopic test was constant at 48, there being no evidence of any effect peculiar to the vanadium. The analysis of the cementite carbide obtained by quenching just above the recalescence, and subjecting to electrolytic separation gave the following results:—

Alloy.	Cementite-carbides.		
Vanadium. per cent.	Carbon. per cent.	Vanadium. per cent.	Silicon. per cent.
nil	6·59	nil	0·58
0·138	6·54	0·414	0·26
0·22	6·54	0·66	0·32
0·45	6·53	0·81	0·31
0·65	6·54	1·25	0·31

It is thus shown that not only does the vanadium crystallise in the carbide but it influences the percentage of silicon found in it. A series of heat-treatment experiments were made and the results obtained are illustrated by sixteen microphotographs. It is concluded that the additions of vanadium have a definite influence on the physical properties of cast iron, and which is mainly that of assisting the carbon to persist in the combined state. The persisting carbides do not differ physically from the normal carbide found in cast iron but are rendered more stable by the actual presence of the vanadium.—A. H. C.

Steels of varying carbon content ; Influence of 0·2 per cent. of vanadium on ——. A. McWilliam and E. J. Barnes. Iron and Steel Inst., May, 1911. [Advance proof.]

The authors have examined the properties of a series of seven steels, with carbon varying from 0·09 to 1·32 per cent., and vanadium from 0·16 to 0·23 per cent. The steels were made by the coke-crucible process, cast into ingots of 3 inches square section, and hammered into round bars of 1 inch diameter. They were examined "as received," and after (1) normalising, (2) annealing, (3) quenching from 850° C. in water, and tempering at (*a*) 400° C., (*b*) 500° C., and (*c*) 700° C. The results of the mechanical tests made on each specimen are given, and show the great sensitiveness of these steels to treatment. Heating and cooling curves plotted on the inverse-rate method are given for each steel. The microstructure of the samples is discussed, and reproductions of 11 microphotographs are given.—T. St.

Iron ; Piping of ——. B. Osann. Stahl u. Eisen, 1911, **31**, 673—676.

The accepted view of the production of piping in iron is based on the assumptions (1) that the outer crust which first forms forces out some of the still fluid inner portion, and (2) that the contraction of the crust having come to a standstill, that of the inner fluid still progresses. The author demonstrates that the formation of piping is entirely attributable to the contraction which takes place when the liquid passes to the solid state. If this occurred instantaneously, the contraction would show itself merely in the diminution of linear dimensions. In reality the solidification is not instantaneous. An outer crust is first formed, and this gradually grows (with contraction of the whole) at the expense of the melted portion. When the solidification of the final portion takes place, therefore, a pipe is left. Liberated gas may also assist by opposing the passage of melted metal to fill up the space left by this contraction. The temperature of the melted iron has no influence on the amount of contraction. The author distinguishes between the contraction due to the passage of melted to solid iron ("*Schrumpfung*"), and that which the solid metal afterwards undergoes ("*Schwindung*").
—T. St.

Nickel steels ; Some properties of heat-treated three per cent. ——. A. McWilliam and E. T. Barnes. Iron and Steel Inst., May, 1911. [Advance proof.]

Cube nickel was first melted with pure manganese and cast into an ingot of 3 in. square section and then forged into a 1 in. square bar. Weighed portions of this bar were then used to prepare by the coke crucible process a series of steels containing from 2·90 to 3·15 per cent. of nickel, from 0·06 to 0·91 of carbon, from 0·11 to 0·19 of manganese, and under 0·1 of silicon, 0·03 of sulphur, and 0·02 of phosphorus. The bars which had been forged down to 1 in. in diameter were normalised by heating to 900° C. for thirty minutes and cooling in air. They were annealed at 950° C. for 20 hours in a coal-fired reverberatory furnace, and slowly cooled in the furnace. After heating in a Brayshaw furnace they were quenched in water at 16°—20° C. and then tempered at either 400° C., 500° C., or 650° C. for 15 minutes in a lead bath. The results of the tensile tests are given in a series of fifteen tables, and four sets of heating and cooling curves by the inverse-rate method are given. The Ar_3 point is shown to be very marked, and the existence of the Ar_2 point is clearly shown in steels containing about 2·93 per cent. of nickel and 0·48 to 0·67 of carbon, and the irreversibility of this point is very well shown in all the steels. Twelve microphotographs illustrate the paper, and the microscopical structure of all the steels is discussed.—A. H. C.

Nickel steels ; Magnetic properties of some ——, *with some notes on the structures of meteoric iron.* E. Colver-Glauert and S. Hilpert. Iron and Steel Inst., May, 1911. [Advance proof.]

The authors have investigated the magnetic properties of 5, 25 and 33 per cent. nickel steels quenched at temperatures of 600°, 900° and 1240° C. and slowly cooled from 1250° C. They have also investigated test pieces cooled after the above treatment to −50°, −100° and −180° C. The 5 per cent. steel is hardest (magnetically) when quenched from 900° C., when it is rendered entirely martensitic in structure. This treatment produces maximum coercive force and minimum magnetisability. Quenched from 1240° C. the steel is not nearly so hard, and only partly martensitic. Quenching from 600° C. leaves the magnetic properties almost the same as in the specimen produced by slow cooling. Further cooling to low temperatures had no effect on the magnetic properties of this steel. The changes in a 25 per cent. steel on thermal treatment are very complicated. This alloy is usually accepted as being non-magnetic unless strongly cooled, but this is only true when the steel has not been heated above 600° C. Quenching from 1240° C. produces a material which is strongly magnetic, its permeability being about one-fifteenth that of iron. The authors therefore assume that a magnetic product exists at high temperatures which may be preserved by quenching. This does not exist from 600°—900° C., but possibly tends to reform (if the cooling is very slow) at about 300° C. The latter assumption is necessary because the slowly cooled specimen is more magnetic than those quenched at 600° and 900° C. On cooling below zero the permeabilities all increase. There are some changes at − 50° C. and − 100° C. in the relative positions of the bars, but after cooling to − 180° C. they are in the same order as they were before cooling. There is no sharp point of magnetic change, but the permeability gradually increases from above − 50° C. down to − 180° C. The 33 per cent. steel is scarcely affected magnetically by thermal treatment. It is strongly magnetic and of low coercive force, in spite of the fact that the usual etching agents show a decided γ-iron structure. The conclusion drawn from the whole series is that there is no connection between magnetic properties and microstructure, and particularly that there is no evidence that γ-iron (if it exists) is non-magnetic. Using sulphurous acid as an etching agent, the authors have been able to produce entirely new structures in the alloys examined, a principal point of interest being their similarity to those of meteoric iron. They are of the opinion, as a result of their observations, that there is practically no difference between meteorites and technical iron-nickel alloys.—W. H. P.

Steel ingots ; Notes on the welding up of blow-holes and cavities in ——. J. E. Stead. Iron and Steel Inst., May, 1911. [Advance proof.]

Welding is the crystallization into union of two solid metallic surfaces when they are brought together under suitable conditions, and unless the crystals are common to the two pieces as shown by microscopical examination there is no welding. The conditions necessary for welding are that (1) The surfaces must be clean and free from any foreign infusible substance such as oxide, slag, lime, etc. (2) The surfaces must be in actual contact. (3) Given the other conditions the higher the temperature the more rapid is the welding of the two surfaces. Artificial pipes [illegible] in. long were bored in a steel containing 0·15 per cent. of carbon and after displacing the air with a few drops of petrol were fitted with 1·5 in. taper plugs. The steel was heated to 800° C. and flattened to close up the cavities and was then forged at either 750° C., 950° C., or 1150° C. On examination it was found that at 750° C. there was no welding, at 950° C. there was welding at the lower end only, while the bar heated to 1150° C. was sound from end to end. Steels containing 0·9 and 1·4 per cent. of carbon gave similar results. The results were obtained in the absence of foreign matter, and it is doubtful whether pipe cavities can be so welded, as it is pointed out that the walls of such cavities are coated with oxide scale, and in the case of commercial ingots containing 0·06 per cent. of sulphur they are rich in manganese sulphide and these substances must interfere with the perfect metallic contact of the surfaces on forging. The author discusses the origin of blow-hole cavities, the methods of preventing piping in ingots, and the composition of the gases in the blow-hole cavities, and it is concluded that if the blow-holes in steel ingots are subcutaneous and free from foreign matter, by forging at 1000° C. or above they weld up completely, and that the wash-welding as practised in Sheffield and the heating and rolling of steel ingots for rails and billets effect this.—A. H. C.

Welds ; Some studies of ——. E. F. Law, W. H. Merrett, W. P. Digby. Iron and Steel Inst., May, 1911. [Advance proof.]

The welds produced by the electric arc, resistance, acetylene, water gas and thermit methods of heating were examined by mechanical tests and the microscope. Just as quenching and annealing alter steel in an unmistakeable manner from the microscopical point of view, so the local heating to the high temperature required for mechanically satisfactory welds leaves its impress on the steel, and it is shown that each of the method investigated has its own characteristics. Resistance welds are the least likely to be oxidised and the extruded metal renders good working, while the metal is still plastic, of supreme importance. Arc welds are most prone to oxidation and are very bad for positions subject to corrosion. Flame welds should receive adequate working while heated : water gas welds may be abnormal owing to oxidation, and acetylene welds require annealing in order to break down the crystalline structure. It is pointed out that to secure perfect welding, true fusion must take place, and that there should be no oxidation of the metal at the point of welding.—A. H. C.

Iron ; Action of single and mixed aqueous electrolytes upon ——. J. N. Friend and J. H. Brown. Iron and Steel Inst., May, 1911. [Advance proof.]

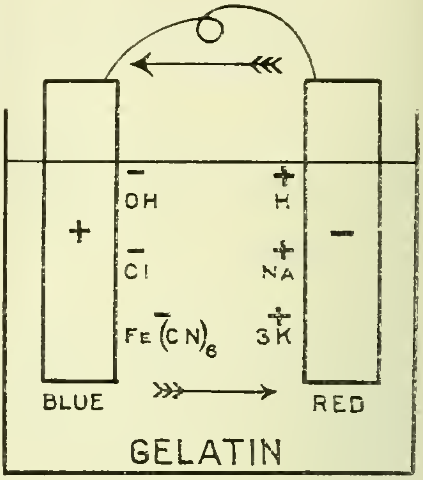
The authors have repeated some of the work of Heyn and Bauer (this J., 1908, 569) using however pure iron foil (Kahlbaum), instead of a commercial variety of the metal. With barium chloride, potassium nitrate, sodium nitrate, magnesium chloride and magnesium sulphate, their results confirm those of Heyn and Bauer, but in the case of the chlorides and sulphates of sodium and potassium they find that at the "critical" concentration, their corrosion effect is undoubtedly greater than that with pure water. This conclusion is in better accord with practical experience than that of the previous workers, who held that these salts retarded the rusting somewhat. The present authors also point out that the use of potassium bichromate in boiler feed waters (see Cushman, this J., 1907, 1201), is attended with some dangers if other salts are present in the water, which is usually the case. The action of bichromate on a neutral salt produces a quantity of free acid which destroys the passivity and accelerates corrosion, *e.g.*,

$$K_2Cr_2O_7 + H_2O + 2NaCl = K_2CrO_4 + Na_2CrO_4 + 2HCl.$$

Quantitative experiments with solutions containing sodium chloride and potassium bichromate in varying concentration show clearly the opposition of the effects of the acid and the bichromate. If the concentration of the sodium chloride is at all large (anything over 5 grms. per litre) the best results are obtained with a bichromate concentration of about 0·1 grm. per litre, and any further addition of bichromate increases the rate of corrosion very considerably. At lower concentrations of sodium chloride, as much as 1 grm. per litre of bichromate may be used. These results are easily understood from consideration of the equilibrium in the above reversible reaction. In a heated solution (95° C.) the results are not quite the same at low concentrations of sodium chloride, since here the 1 grm. per litre bichromate solution promotes corrosion considerably. The adjustment of a suitable solution of bichromate for practical conditions is therefore a rather difficult matter. The use of potassium chromate however is not attended by any development of acidity and its use even in considerable excess has a very considerable effect in preventing rusting both at ordinary temperatures and at 95° C.—W. H. P.

Iron ; The influence of impurities on the corrosion of ——. J. W. Cobb. Iron and Steel Inst., May, 1911. [Advance proof.]

The electrolytic conditions were determined that exist between a bar of Farnley best Yorkshire iron, or a Swedish iron, and a bar of the impurities usually present in iron, when both were immersed in an electrolyte. The bars, connected through a millivoltmeter of 84 ohms resistance, were placed in "ferroxyl" indicator prepared by neutralising with caustic soda an aqueous solution of gelatin which would just set on cooling and adding a little phenolphthalein and potassium ferricyanide. The current was measured and the solution of the iron was shown by the formation of a blue halo around it, and which was accompanied by a pink halo round the impurity, showing the presence of alkali. The iron was found to be deeply corroded just below the surface of the gelatin, but separated from it by a thin region of unaffected iron. This latter region was coloured pink and was electronegative to the deeper regions, and the corrosion is considered to be due to the removal by the oxygen of the air of the polarising effect of the hydrogen formed. Continuation of corrosion necessitates the escape or the oxidation of this polarising film of hydrogen, and also that the initial compound formed by the corrosion of the iron shall not be either of an impervious or of a non-conducting character. Pure iron was found to be electropositive (see fig.) to such impurities as phosphide, sulphide, carbide, oxide, silicate of iron, graphite, and all the alloys of iron tried with the exception of ferro-manganese. Manganese and 80 per cent. ferro-manganese were both electropositive to pure iron, while the sulphide and silicate being both non-conductors gave no current. Every piece of commercial iron showed electrical effects with every other. The corrosion effects were also watched microscopically in a specially designed cell, and under these conditions some deep blue spots were seen to form on all the irons tried, and which were not around any recognisable impurities such as slag or carbon eutectic areas, and which on washing off the gelatin were found to be deeply corroded. No reason could be found for these effects. It is concluded that the presence of an impurity determines so many corrosion centres for iron, and its influence depends more on the quality and distribution of the impurity than on its quantity, and hence the more homogeneous the iron the more resistant it is to corrosion.—A. H. C.



Steel ; Metallography of ——. W. Rosenhain. Engineering, April, 1911, 557.

By the microexamination of fractured tensile test-pieces it is shown that, in the elastic deformation of materials containing pearlite and ferrite, the pearlite stretched and acted as a reinforcement to the ferrite, but beyond the elastic limit the particles stretched so much that they ultimately cracked, the fracture starting from these cracks and running across the ferrite. In fracture by shock the ferrite broke across cleavage planes, the pearlite being isolated. In fracture by fatigue the failure was due to slip, the planes of slip developing into lines of fracture of a crystalline nature, and it is concluded that the belief that vibration renders iron and steel crystalline is incorrect, changes in internal structure not taking place, and that the propagation of fissures is resisted by pearlite, and hence that the higher the carbon content, up to 0·9 per cent., the better the material resists alternating stresses. In dealing with the question of heat treatment, it is suggested that a combination of mechanical and heat treatment is necessary in order to obtain the best results, and that finishing too hot produces a coarse formation and poor material. The hardening and tempering of steel is discussed, and it is pointed out that the hardness is due not only to the allotropic state which the iron assumes at the high temperature but also to the forcible retention of the structure at this temperature and the consequent molecular restraint, as well as in a small degree to the mechanical deformation produced by the contraction of the shell.—A. H. C.

Sulphur in iron and steel ; Volumetric determination of ——. T. G. Elliot. Iron and Steel Inst., May, 1911. [Advance proof.]

The low results often given by the evolution process for the determination of sulphur in iron and steel have been attributed to various causes, and many modifications designed to rectify this defect have been suggested. Results given in this paper show that unless the sample is practically free from hardening carbon the results are considerably too low. In order to bring the steel to the proper condition, the author mixes 5 grms. of drillings with 0·25 grm. of pure finely powdered anhydrous potassium ferrocyanide, and anneals at 750° C. to 850° C. in a closed muffle for 20 minutes. The mixture is wrapped in filter paper, and heated in a small porcelain crucible with the lid on. After cooling slowly outside the muffle, the drillings should still be covered practically completely by the charred filter paper. If the temperature has been too high, or the duration of annealing too great (indicated by the burning away of the paper), low results will be obtained. The evolution process as carried out by the author is as follows :—The annealed drillings are loosely crushed in a glass mortar and transferred to the evolution flask, where they are rapidly dissolved in 50 c.c. of concentrated hydrochloric acid. The evolved gases are passed through a condensing tube containing a little water, and then into a solution of cadmium chloride. (20 grms. of cadmium chloride are dissolved in a little water with the aid of a few drops of hydrochloric acid : ammonia is added until the precipitate of cadmium hydroxide formed completely dissolves ; acetic acid is then added until the solution becomes slightly acid, when a further 20 c.c. are added in excess and the solution made up to 2 litres). When the reaction is over, a measured volume of iodine solution is run into the absorption flask, and the precipitate of cadmium sulphide dissolved by the addition of a little dilute hydrochloric acid. The excess of iodine is then titrated with sodium thiosulphate. The solutions of iodine and thiosulphate are of such strength that 1 c.c. equals 0·005 per cent. of sulphur on 5 grms. of the sample. A blank is performed on the filter paper and the ferrocyanide by treating one portion of 5 grms. of pure iron by the annealing process as described, and another portion direct. The author considers from his experiments that it may be possible, by a proper preliminary treatment, to obtain the whole of the sulphur even from pig iron containing titanium, by the evolution process.—T. St.

Waste gases in German iron works. II. Use in gas-engines. R. Pokorny. Times, Eng. Suppl., April 26, 1911.

Experience with large gas-engines running in German iron works on blast-furnace gas shows the reliability of this mode of power production, and with a well-cleaned gas only some 20 per cent. reserve power is necessary ; in several cases a mean annual output of 85 per cent. of the rating of the engine has been recorded. About 70 per cent. of these engines are on the double-acting four-cycle system with up to 1500 I.H.P. per cylinder, units being represented by two-cylinder tandem or four-cylinder double-tandem engines ; for generating electrical energy these engines run almost exclusively at 94 revs. per min. with a compression of 64 to 71 lb. per sq. in. The thermal efficiency of a gas-driven plant, at least double that of a steam plant, and the convenient and economical method of transmitting power as electrical energy, has led in many iron and steel works to universal electrical driving. The cost of electricity thus produced, inclusive of capital and all other charges, varies between $\frac{1}{16}$ and $\frac{1}{4}$ of a penny per kilowatt-hour according to the nature of the load, and three times as much power is produced compared with that produced by burning the gases under boilers. Iron works not run in conjunction with rolling mills sell their surplus power to electricity companies at from 0·36 to 0·42 of a penny per kilowatt-hour. In Westphalia, where a group of electricity companies works in parallel with the blast-furnaces, uniform loads with economical running are obtained with the minimum of stand-by plant, three-phase alternating current being universally employed.
—B. G. McL.

Carbon in iron blast-furnace slags ; Different forms of ——. H. Fleissner. Oesterr. Z. Berg- u. Hüttenw., 1911, **59**, 103—106. Chem. Zentr., 1911, **1**, 1457—1458. (See also this J., 1910, 277, 760.)

When a large quantity of slag is treated with hydrochloric acid and ammonium fluoride, a portion of the insoluble residue settles much more readily than the remainder. The lighter portion, after being boiled with hydrofluoric acid, consists usually of brown flocks of amorphous carbon. In the case of two slags from Hallberg and Witkowitz respectively, microscopic examination of the lighter portion of the residue showed that it contained, besides amorphous carbon, black crystals of needle shape, with one end thickened in the form of a club. These crystals were not attacked by chlorine, but burned when ignited strongly or in oxygen ; they were probably graphite or graphitite. The insoluble residue from the Witkowitz slag also contained transparent light green crystals, probably silicon carbide.—A. S.

Iron and manganese borides ; Decomposition of commercial —— by water. J. Hoffmann. Chem. Ind., 1911, **34**, 241—243. (See also this J., 1910, 1202 ; and 1911, 420.)

Goldschmidt's iron and manganese borides which the author has previously proved to be heterogeneous in character are slightly and slowly attacked by moist air and by distilled water. The gas evolved is mainly hydrogen containing a little boron hydride. The reactions are probably caused by the presence of compounds poorer in boron than MnB (16 per cent. of boron) and Fe_3B_4 (20·85 per cent. of boron). Since boron hydride is not spontaneously inflammable and the reactions are less pronounced than that of commercial ferrosilicon with water, dangers of transport are not so great. It is also to be noted that the borides prepared by Goldschmidt's process are free from carbon and cannot give rise to acetylene.
—W. H. P.

Cyanamide process ; The —— in the metallurgy of gold. J. C. Clancy. Amer. Electrochem. Soc., Dec., 1910. Met. and Chem. Eng., 1911, **9**, 21—27.

The cyanamide process of gold extraction, covered by U.S. Pats. 976,043, 976,044, and 976,045, Nov. 15, 1910 (this J., 1910, 1459), is specially adapted to the treatment of refractory telluride ores, which can be treated by it without previous roasting or concentration. The ore is crushed to a fineness of about 100 mesh in a solution containing 1 lb. of cyanide, 2 lb. of alkali thiocyanate, 2 lb. of calcium cyanamide, $\frac{1}{2}$ lb. of alkali iodide, and 20 lb. of commercial sodium chloride in each 2000 lb. of water. The pulp (two or three parts of solution to one of ore) is then agitated in an ordinary agitating cone, and an electric current passed through the liquid in order to induce oxidation. Should it be desired to remove the finely-divided sulphide particles, these are allowed to settle by stopping the agitation for a few minutes. They can then be drawn off and run over blankets or similar contrivances, the excess solution returning to the tank. The pulp in the tank should contain 0·1—0·2 lb. of protective alkali per ton of solution. The conductivity of the pulp is adjusted by adding common salt. A current of about 50 ampères per ton of ore is adequate, at 5 to 6 volts. Iron oxide, melted in the electric furnace, was found to be the only satisfactory material for the electrodes. With this substance a current density of over 50 ampères per sq. ft. may be maintained. The tank itself, if of iron, may be used as a cathode. Under these conditions telluride of gold dissolves. About eight hours' treatment under electrolysis usually suffices. At the end of this period sodium hydroxide is added to bring the protective alkali up to 1 lb. per ton, and the cyanide is regenerated by passing the current for a further two hours. The Moore filter is best adapted for use with this process, as it permits of the recovery of practically all of the solution. The experimental work leading up to the above process may be summarised as follows: Alkali hypobromites, hypochlorites, and hypoiodites dissolve tellurium:

$$Te_2+4NaClO+2H_2O=2H_2TeO_3+4NaCl,$$

but the treatment cannot be followed by cyanidation, without previous thorough washing to remove all traces of the hypochlorite. Ammonium persulphate was found preferable to sodium hypochlorite, as it does not oxidise iron sulphide to the same extent, and does not destroy cyanide. It hastened the solution of the gold. It was, however, too expensive. The simultaneous use of cyanide and persulphate failed on a large scale, as ferrocyanide formed and nullified the action of the persulphate. A soluble iodide was then added to the solution containing persulphate and cyanide, resulting in the formation of cyanogen iodide, and the rapid and complete solution of the tellurides.

$$2KI+K_2S_2O_8=2K_2SO_4+I_2$$
$$I_2+KCN=ICN+KI$$

The liberation of iodine by nascent oxygen during the treatment was next tried. Persulphate produced the desired effect, but the manipulation was too difficult. Ozone was tried, and gave excellent results. Ozonised air acting on a solution of a thiocyanate containing an iodide produces cyanogen iodide, and the solution becomes an active solvent of gold.

$$KCNS+KI+4O=K_2SO_4+ICN$$

The installation required to produce sufficient ozone for commercial work would be, however, too large. The electric current was then adopted as a means of producing the necessary oxidation. Very good results were obtained. The action of cyanogen iodide on sulphides contained in an ore during treatment results in the production of potassium thiocyanate. This reacts with potassium iodide, and cyanogen iodide is formed, which reacting on the potassium cyanide, produces potassium cyanate. Experimenting with the object of regenerating cyanide from cyanate, it was discovered that calcium cyanamide in a cyanate solution, after electrolysis of the same, dissolves gold, owing to the formation of cyanide. Even without electrolysing, a solution of calcium cyanamide and an alkali ferrocyanide, on standing for some hours, becomes an active solvent of gold. This provides a cheap means of retreating low-grade material, dumps, etc., which have already been treated by the ordinary cyanide process. Dumps from the cyanide process already contain ferrocyanide or ferrocyanogen compounds, and on such material a solution containing merely 1 lb. of calcium cyanamide per ton, with the requisite amount of lime, gives results equal to these obtained with ordinary cyanide solution. If this mixture be electrolysed, the solution of the gold is extremely rapid. Various other amides gave similar results. Cyanogen iodide added to solution of calcium cyanamide forms a powerful solvent of tellurium and of gold telluride, probably owing to the formation of cyanamidogen iodide: $2ICN+CaCN_2=Ca(CN)_2+I_2CN_2$.—R. W. N.

Adhesiveness [*of gold*]. Hanriot. Bull. Soc. Chim., 1911, **9**, 339—344.

If two sheets of brown gold (this J., 1911, 89) are heated at a temperature within the limits at which transformation to ordinary gold occurs, the sheets stick together when brought into contact in the cold. The adhesion, for which actual contact is necessary, is not observed unless the temperature reaches 300° C.; it reaches a maximum at about 500° C. and ceases at about 650° C. It is purely local, and, when one point on a sheet has become exhausted, is still manifested by other parts of the same sheet. The phenomenon seems analogous to the shrinkage previously observed (this J., 1911, 216) and, moreover, was only observed with gold prepared from an alloy which had been annealed after rolling. The explanation offered is that between 350° and 600° C. brown gold is metastable, tending to transform into ordinary gold, and that when it is touched with a piece of metal already transformed, modification is set up at the point of contact.
—F. Sodn.

Copper alloys; Application of certain modern methods of testing to ——. L. Révillon. Bull. Soc. d'Encour., 1911, **115**, 362—372.

A great variety of copper alloys were submitted to various mechanical tests—tension, hardness, shearing, shock—and the relations among the results of the different tests on the same sample were traced. The conclusion is that, in addition to the tensile test, the tests for shearing, hardness, and shock give very valuable information as to the mechanical qualities of these alloys. From them can be deduced:—(1) An estimate of the purity of the metal, and a figure expressing the fragility which will be very useful in practice. (2) A value for resistance, calculable from the shearing test, expressing very completely the mechanical quality of the metal. (3) Another value, calculable from the hardness test, rendering possible a classification of alloys, even those of bad fracture in the other tests, with regard to external compressive forces.
—J. T. D.

Transvaal mines; Consumption of stores by the ——. Board of Trade J., May 4, 1911. [T.R.]

H.M. Trade Commissioner for South Africa has forwarded a table showing the value of the stores consumed by the mines of the Transvaal during the six months ended 31st December, 1910, together with the value of the imports of these goods into the whole of South Africa (figures for the Transvaal only being unobtainable), during the same period. The following is an extract from this table:—

Classification.	Six months ended 31st Dec., 1910.	
	Value of stores used by mines.	Total imports into British South Africa.
	£	£
Candles	120,249	31,998 *a*
Carbide of calcium	16,166	17,363
Castings of brass and iron	60,672	
Cement	91,113	67,508
Chemicals and assay requisites	79,896	
Coal	867,433	
Coke	10,674	
Cyanide of potassium or sodium	228,546	
Explosives, blasting compounds	741,886	103,831 85,007 *a*
Explosives, detonators and fuse	91,189	94,831 *b*
Iron (bar, angle, galvanised, and sheet)	82,148	
Lead (pig and sheet)	2,073	
Lime (blue and white)	57,116	
Lubricants (oils, grease, and tallows	98,250	
Machinery and machine tools	821,074	
Mercury (quicksilver)	14,861	14,795
Metals (anti-friction)	10,946	
Mill screenings	16,597	
Packing (engine, etc.)	23,866	
Paints, tar, drying-oils, etc.	12,667	
Paraffin	17,088	
Steel, (bar, tool, cast, sheet, hand and rock-drill, etc.)	147,924	
Zinc sheet and discs	69,607	54,625
Total	£6,548,107	

a Considerable local production. *b* Detonators only (*i.e.*, not fuse) are locally made.

Uranium and radium in minerals; Ratio between ——. R. Pirret and F. Soddy. Phil. Mag., 1911, **21**, 652—658.

The authors have arrived at the value $3{\cdot}15 \times 10^{-7}$ for the ratio of radium to uranium in Joachimsthal pitchblende, and, for autunite from Portugal, values ranging from 74 to 24 per cent. of the equilibrium amount were obtained, the West Australian mineral pilbarite showing 64 per cent. The statement by Gleditsch (Comptes rend., 1909, **148**, 1451: **149**, 267), that the ratio for thorianite is 20 per cent. higher than for pitchblende, is not confirmed, and the results of the investigation lend no support to the suggestion that the life-period of ionium is sufficiently extended to cause the equilibrium ratio of radium to uranium to be less in a geologically recent mineral like Joachimsthal pitchblende than in an ancient mineral like thorianite.—F. Sodn.

Patents.

Iron and other metals; Manufacture of ——. A. E. Bourcoud, London. Eng. Pat. 676, Jan. 10, 1910.

It has already been proposed to effect the reduction of ores such as those of iron by means of heated reducing gases, the gases after leaving the reduction furnace being reheated, freed from oxidised compounds by passage over incandescent carbon and finally again heated as they pass back to the furnace (see Eng. Pats. 21,060 of 1905 and 21,770 of 1906; this J., 1906, 1152; 1907, 928). It is now proposed to eliminate moisture and volatile impurities from the mixture of ore and flux by heating the charge in a rotary furnace in contact with heated air, and delivering it dry and hot to the reduction furnace. In addition, reducing gases consisting only of carbon monoxide or of carbon monoxide and carbon dioxide, are employed, the coke supplied to the carbon regenerator being previously dried and heated, and the gases, before entering the reduction furnace, being passed over line. In order to obtain the most economical conditions of heating, atmospheric air is drawn through a stove, heated by the products of combustion from another part of the system and divided into two main currents, one of which is passed partly into the rotary kiln used for the preliminary heating of the charge, the other being diverted partly into the gas producers after it has been cooled and mixed with water vapour, the resulting gas being employed to heat the stoves. The remaining portions of these currents are led into the different stoves, where they serve in the combustion of the producer gases. The charge conveyed directly from the drying furnace to the rotary reduction kiln meets a hot stream of reducing gases going in the reverse direction, the excess gases being passed through a heating stove and thence through the regenerator; or they may be employed again directly after passage through a heating stove situated in front of the reducing furnace, according to the proportion of carbon dioxide it is desired to re-deliver to the furnace. The reduced ore, gangue and flux are allowed to fall into electric melting furnaces situated below the reduction kiln.—C. A. W.

[*Steel*] *Converter; Method of working a* ——. O. Thiel. First Addition, dated Nov. 30, 1910, to Fr. Pat. 415,042, Apr. 20, 1910 (this J., 1910, 1314).

This improvement relates to the proportion to be observed between the portions of the total charge which are treated successively. These are determined by the specific gravity and volume of the slag produced at each stage. As the slag is less than one-third as dense as iron, the space afforded by pouring a given weight of slag will accommodate about three times this weight of iron. Following out this principle in the addition of the successive charges, by proportioning each to the space remaining in the converter, the duty of the latter can be increased by 50 per cent., while the time occupied is decreased. An economy of flux is effected, and less slag is formed, as the iron content thereof is lowered.—R. W. N.

Nickel-steel for firearms. Poldihütte, Tiegelguss-stahlfabr. Fr. Pat. 423,115, Nov. 28, 1910. Under Int. Conv., June 25, 1910.

A steel containing about 10 per cent. of nickel, and of which the carbon content does not exceed 0·25 per cent., is proposed for making the barrels of rifles and guns, as it is strong, easily worked, and is not readily attacked by the decomposition products of nitro-powders. Tungsten, molybdenum, vanadium, etc., may also be added to the steel, singly or together.—R. W. N.

Cast iron; Special —— *and manufacture of the same.* J. Jouanneaux. Fr. Pat. 423,537, Dec. 10, 1910.

An alloy consisting of about 75 per cent. of pig iron and 25 per cent. of steel, and containing about 0·02 per cent. of titanium, is produced by melting the pig iron and steel together in a cupola, and tapping the molten mixture into a ladle containing, in a packet, the appropriate amount of titanium or ferro-titanium. This packet is held down, and stirred in with an iron bar. The resulting metal is homogeneous, and resists fire well, besides having a high degree of resistance to mechanical destruction. It is well suited for firebars, retorts, etc., and also for gear-wheels, rollers, etc. The metal may also be produced by melting pig iron, steel, and titanium simultaneously in a crucible. —R. W. N.

Iron and steel; Process for separating slag from soft —— *in open-hearth furnaces.* K. Stobrawa. Ger. Pat. 232,989, Aug. 2, 1910.

The floating slag is removed by means of blocks of steel which are moved by means of water-cooled levers and are of such dimensions that they penetrate the layer of slag and float on the underlying molten iron.—A. S.

Iron; Electrodeposition of ——. S. O. Cowper-Coles, London. Eng. Pat. 9082, April 14, 1910.

The iron is deposited upon a cathode or mandrel rotating at a "peripheral speed" of from 400 to 600 feet per minute in an electrolyte maintained at 70° to 95° C., and with a current density of from 80 to 100 ampères or more per sq. ft. of cathode surface.—B. N.

Iron; Manufacture of ductile —— *by electrolytic means.* Langbein Pfanhauser-Werke A.-G. First Addition, dated Nov. 4, 1910 (under Int. Conv., Nov. 12, 1909), to Fr. Pat. 407,889, Oct. 14, 1909 (this J., 1910, 636).

Instead of employing hygroscopic salts, non-hygroscopic salts of sodium are added to the electrolyte, and these when combined with a salt of iron form double salts of iron and sodium which are hygroscopic.—B. N.

[*Coating iron with lead-zinc alloy*]. *Ferric articles; Process for combining a permeating metallic protective with the surfaces of* ——. H. J. Lohmann, Jersey City, N.J., Assignor to The Lohmann Co., New York. U.S. Pat. 990,443, April 25, 1911.

Iron articles which are to be coated with a metal of the "lead group" or a lead-zinc alloy, are immersed in a bath containing a "cleaning acid," a mercury salt, and a catalyser such as ammonium chloride; they are next heated in order to decompose the mercury salt, and are finally immersed in the molten coating metal or alloy. —A. S.

Aluminium; Flux for soldering ——. W. Fries, Wilmersdorf, Germany. Eng. Pat. 10,790, May 2, 1910.

The flux consists of 90 parts of a compound of chlorine and zinc, such as hypochlorite or chloride of zinc, and 10 parts of common salt, to which iron oxide, in quantity between 2 and 20 per cent. of the whole mass, has been added. The presence of iron oxide is essential. The flux, with granules of solder, is applied to the surfaces to be united, and on heating, the solder flows well.—R. W. N

Blast furnace. C. Hicks, Alabama City, U.S.A. Eng. Pat. 18,272, Aug. 2, 1910.

THE furnace is surrounded by sectional water chambers, and is surmounted by a dome-shaped superstructure, likewise cooled by water, in which an aperture is provided for feeding the charges into the furnace. The middle, nearly cylindrical, portion of the furnace is composed of firebrick, the water jacket in this case being obtained by means of curved plates provided with flanges which are secured to horizontal projections on the shell. In this way, three or more annular chambers, or sets of chambers, each provided with an inlet and outlet pipe, are obtained. The upper end of the firebrick is bevelled inwardly so as to form a seat for the metallic superstructure. This latter, in the form of a dome, consists of two layers of hollow sections, the upper segmental sections being shaped to follow the curve of the dome. These are secured to one another by bolts and flanges, and each chamber is provided with an inlet and outlet for water, so that the several sections can be fed separately from a pipe passing up the side of the furnace. In addition to the opening at the top, a walled aperture is provided at the side of the dome, through which the gases pass away.—C. A. W.

Furnace; Ore-roasting ——. C. Pfaul, Blasewitz, Germany. U.S. Pat. 989,868, April 18, 1911.

THE furnace of annular form is provided with a helical hearth which passes from top to bottom and so forms several superimposed hearths. In order to agitate the ore, a rake is caused to travel over the hearths by means of a series of rollers with which it engages, these rollers being rotated upon vertical shafts passing down the inner and outer walls of the furnace.—C. A. W.

Bessemer converter; Lateral-blast ——. A. Baillot, Montreal, Canada. U.S. Pat. 989,890, April 18, 1911.

THE converter, which is designed for lateral blowing, comprises a pivoted receptacle similar in shape to the ordinary type except that a large aperture is provided in the bottom or larger end. This aperture is closed by a plug of some brittle material which can be broken away when necessary, a filling of finer material being provided underneath, whilst a removable cover-plate at the bottom of the converter serves to support the whole mass.
—C. A. W.

Furnace; Electrometallurgical ——. F. Louvrier, Mexico. U.S. Pat. 989,169, April 11, 1911.

A CONDENSING chamber is built up within the furnace-body, dividing the interior thereof into two separate chambers. Openings, guarded against the entrance of solids, are provided in the upper part of the walls of the condensing-chamber, to allow of the inflow of volatilised metals. A cooling system is provided within the chamber, and also means of escape for uncondensed vapours.
—R. W. N.

Furnaces for electric fusion of ores. H. B. Lorentzen and Tinfos Papirfabrik. Fr. Pat. 423,288, Dec. 3, 1910. Under Int. Conv., Dec. 4, 1909.

THE hearth of the furnace is divided into two or more sections which are separated by one or more bridges, the latter being narrowed in a direction perpendicular to that of the current. This part of the bridge has thus a small transverse section, and presents to the current a relatively high resistance, the current being compelled to take a longer path through the melted product and the charge. The walls of the bridge present a great surface to the exterior air, with the object of securing efficient cooling. The furnace is provided with a chimney for leading off the gases, and these are brought back into the furnace by suitable channels which traverse the bridges.—B. N.

Furnace; Treatment of metals and ores in the electric ——. C. Grange. Fr. Pat. 423,703, Feb. 22, 1910.

THE materials are mixed during treatment by means of communicating vessels, acting in conjunction with a movement of oscillation of the furnace. In the case of oxides, the processes of reduction and fusion are carried out in one vessel, the necessary heat being furnished by contact with the material in fusion, and the operation of refining takes place in a second vessel, communicating with the first, under the influence of an electric arc and a suitable slag. The impurities in scrap-iron, cast iron, etc., may thus be removed, for the production of alloys of iron and special steels.—B. N.

Magnesium and magnesium alloys; Purification of ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort-on-Maine, Germany. Eng. Pat. 22,016, Sept. 22, 1910.

ACCORDING to Eng. Pat. 23,440 of 1909 (this J., 1910, 1315), magnesium or magnesium alloys were purified by passing hydrogen or other inert gas through the molten metal at 800°—900° C. It has now been found that if the hydrogen or inert gas be moist, the time required for the purification is considerably lessened. By the action of the steam, magnesium oxychloride is formed and floats on the surface of the metal, whence it can be easily removed. It is sufficient to pass the moist gas over the surface of the molten metal.—A. S.

Magnesium and magnesium alloys; Process for the purification of ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 232,581, June 7, 1910.

COMMERCIAL magnesium and magnesium alloys corrode when exposed to the atmosphere mainly owing to the presence of chlorides in the metal. According to the present patent the metal is freed from chlorides by fusing it and bringing it into intimate contact with substances, such as cast iron, charcoal, coke, magnesia, which will take up the fused chlorides without acting on the metal.
—A. S.

Zinc and like volatile metals; Retorts for the distillation of ——. Rheinisch-Nassauische Bergwerks-und Hütten-A.-G., Stolberg, Germany. Eng. Pat. 27,467, Nov. 25, 1910. Under Int. Conv., Dec. 15, 1909.

THE retort, for the recovery of zinc or like volatile metals, by evaporation or distillation, comprises an outer impervious reduction chamber (evaporation chamber) arranged vertically in the furnace, with an inner pervious core or perforated tube passing through the entire length of the reduction chamber, the tube communicating at its upper end with a condenser.—B. N.

Zinc; Distillation of ——. Central Zinc Co., Ltd. Fr. Pat. 423,912, Dec. 20, 1910. Under Int. Conv., Nov. 17, 1910.

SODIUM chloride is brought into contact with the zinc vapours in the anterior portion of the retort or the posterior portion of the condenser, as halogen salts, in the presence of oxides of carbon, decrease the amount of zinc oxide formed, and thereby increase the yield of zinc. Any other catalytic agent having the same effect may be used. It has been previously proposed to mix salt with the charge in the retort for this purpose, but this leads to the formation of volatile chlorides of metals other than zinc, which pass over and contaminate the zinc distillate. According to the present patent, a small quantity of salt may be placed in the neck of the retort, being separated from the charge proper by a layer of coke, or clay fragments. Or the salt may be placed in a receptacle provided for this purpose near the entrance of the condenser, above the level of the condensed zinc.—R. W. N.

Zinc and other volatile metals and metalloids; Process for obtaining —— *from slags and other substances.* P. Prior. Ger. Pat. 232,479, Feb. 18, 1908.

THE process consists in bringing the fused substance into intimate contact with a reducing agent in presence of a current of air, the reducing substance consisting of compact pieces of charcoal which are introduced into the molten charge, or of a powdered or gaseous substance which is blown through the charge. It is stated that lead, antimony, arsenic, etc., besides zinc, can be separated in this way from products containing them, especially from the slags produced in lead and copper smelting processes. —A. S.

Platinum ; Alloys of ——. G. W. Johnson, London. From W. C. Heraeus G. m. b. H., Hanau-on-the-Maine, Germany. Eng. Pat. 29,723, Dec. 21, 1910.

The claim relates to platinum alloys in which osmium, in amount varying from 1 to 20 per cent., is employed in place of iridium. It is stated that two parts of osmium are equivalent to five of iridium in imparting hardness to the platinum, the superiority, as regards elasticity, being still greater. The beneficent effects may, however, be neutralised by the presence of other metals such as iron or copper ; whilst an alloy containing more than 20 per cent. of osmium is brittle and unserviceable. The manufacture of the alloys must be effected in the absence of oxidising conditions, since osmium is highly oxidisable, giving rise to a poisonous fume.—C. A. W.

Metals, such as gold, silver, copper, or nickel ; Art of extracting —— *from their native ores.* W. D. Rennie, Hackensack, N.J., Assignor to Universal Ore Reduction Co., Phœnix, Ariz. U.S. Pat. 989,802, April 18, 1911.

The powdered ore, suspended in water, is circulated continuously between the anodes and cathodes of an electrolytic cell, and a salt, such as fluorspar, is added at intervals to the mixture. The electrolysis is continued until practically all of the metal has been deposited on the cathode.—A. S.

Precious metals, gold and silver ; Mixtures or compositions for use in extracting —— *from their native ores.* W. D. Rennie, Hackensack, N.J., Assignor to Universal Ore Reduction Co., Phœnix, Ariz. U.S. Pats. 989,803 and 989,804, April 18, 1911. (See preceding abstract.)

(1) Water, 2000 lb. ; powdered ore of the metal, 2000 lb. ; fluorspar, 300 lb. ; and "a bromine salt," 15 lb. (2) The same as (1) with the addition of 5 lb. of potassium cyanide.—A. S.

Welding ; Autogenous —— *of copper, nickel, and alloys of these metals.* W. Schieber. Fr. Pat. 423,131, Nov. 29, 1910.

In the usual process of autogenous welding, the metal at the point of junction, having been melted, differs from the original metal in its mechanical properties. According to the present invention this is avoided by heating the pieces to be joined in a flame containing an excess of hydrogen, and uniting them, when at a suitable temperature, by hammering or pressing them together. The reducing flame ensures the absence of any film of oxide which might prevent a good weld from being made.—R. W. N.

Grease from metals ; Removal of —— *by means of circulating volatile solvents.* Martini und Hüneke Maschinenbau-Akt.-Ges. Fr. Pat. 423,281, Dec. 3, 1910.

In the removal of grease from metallic objects prior to the electrolytic galvanising of the same, most methods have the defect that the greasy solvent remains in contact with the objects, and a perfect cleansing is never obtained. It is proposed to obviate this by the use of a volatile solvent maintained constantly in circulation. The apparatus consists essentially of a still, a condenser, and a cleaning chamber, in which the objects to be cleaned are placed, and into which the condensed solvent is sprayed, and whence, after acting on the objects, it returns to the still, carrying with it the removed grease. The objects to be cleaned are thus constantly subjected to a spray of clean solvent ; the grease, etc., accumulating in the still. To avoid danger from the vapours of the benzene or other solvent employed, means are provided for forcing an inert gas, such as carbon dioxide, through the system in such a manner as to carry off to a condenser all vapours present, before opening the apparatus.—R. W. N.

Armour plates and other steel articles ; Process for producing —— *without case-hardening.* A. Lucertini, Terni, Italy. Eng. Pat. 9108, April 14, 1910.

See Fr. Pat. 415,389 of 1910 ; this J., 1910, 1314.—T. F. B.

Armour plates which have or have not been previously supercarburised ; Process for decarburising ——. W. H. Jones, Munhall, and A. F. Mitchell, Pittsburg, Pa., U.S.A. Eng. Pat. 9511, April 19, 1910.

See Fr. Pat. 415,337 of 1910 ; this J., 1910, 1314.—T. F. B.

Steel ; Manufacture of ——. T. J. Heskett, London. U.S. Pat. 990,266, April 25, 1911.

See Eng. Pat. 16,940 of 1909 ; this J., 1910, 1164.—T. F. B.

Converter or vessel for refining iron and steel. B. Talbot, Darlington. U.S. Pat. 990,313, April 25, 1911.

See Eng. Pat. 22,394 of 1909 ; this J., 1910, 1113.—T. F. B.

Iron or steel ; Treatment of —— *to prevent oxidation or rusting.* T. W. Coslett. Fr. Pat. 423,241, Dec. 1, 1910. Under Int. Conv., Dec. 2, 1909.

See Eng. Pat. 28,131 of 1909 ; this J., 1911, 92.—T. F. B.

Steel ; Manufacture of ——. A. Reynolds. Fr. Pat. 423,534, Dec. 10, 1910. Under Int. Conv., Dec. 13, 1909.

See U.S. Pat. 963,652 of 1910 ; this J., 1910, 959.—T. F. B.

Cementation ; Product for ——. H. Rodman. Fr. Pat. 422,551, Dec. 10, 1910.

See U.S. Pat. 949,449 of 1910 ; this J., 1910, 361.—T. F. B.

Manganese ores ; Treatment of —— *for use in the production of ferro-manganese.* Coln-Musener Bergwerks Actien Verein, Creuzthal, Westphalia. Eng. Pat. 18,945, Aug. 11, 1910. Under Int. Conv., Aug. 12, 1909.

See Fr. Pat. 419,144 of 1910 ; this J., 1911, 94.—T. F. B.

Electrolytic iron ; Process for the manufacture of ductile ——. Langbein-Pfanhauser-Werke Akt.-Ges., Leipzig-Sellerhausen, Germany. Eng. Pat. 25,969, Nov. 8, 1910. Under Int. Conv., Nov. 12, 1909. Addition to Eng. Pat. 24,841 of 1909, dated Nov. 3, 1908.

See Addition of Nov. 4, 1910, to Fr. Pat. 407,889 of 1909 ; preceding.—T. F. B.

Aluminium bronze. P. H. G. Durville, Paris. Eng. Pat. 29,184, Dec. 15, 1910. Under Int. Conv., Dec. 31, 1909.

See Fr. Pat. 411,193 of 1909 ; this J., 1910, 959.—T. F. B.

Copper and its alloys ; Improving the conductivity and tensile strength of ——. R. Franke, Eisleben, Assignor to Elektrochemische Werke, Berlin. U.S. Pat. 990,040, April 18, 1911.

See Eng. Pat. 7657 of 1910 ; this J., 1911, 553.—T. F. B.

Tin plate waste ; Process for cleaning —— *prior to detinning by chlorine.* C. von der Linde. Fr. Pat. 422,991, Nov. 14, 1910. Under Int. Conv., Nov. 15, 1909.

See Eng. Pat. 26,415 of 1910 ; this J., 1911, 554.—T. F. B.

Nickel-lined vessels for large-scale chemical operations. Fr. Pat. 422,985. *See* I.

Regenerative furnaces. Fr. Pat. 423,577. *See* I.

XI.—ELECTRO-CHEMISTRY.

Electrical resistance furnace with heating resistance of common metals. H. Seibert. Chem.-Zeit., 1911, 35, 443.

The furnace itself (tube, muffle, or crucible) is surrounded by a jacket, of similar shape, fitting airtight at the ends, leaving a space between, which is filled with hydrogen or some other non-oxidising gas. In this way the destruction by oxidation of the cheaper furnace windings (nickel, iron, and their alloys) is prevented, and the principal objection to their use is removed. The hydrogen may be produced electrolytically by the heating current.—W. H. P.

PATENTS.

Insulation; New or improved material for electrical —— and a new or improved process for the manufacture of the said material. W. F. Reid, Addlestone, Surrey. Eng. Pat. 9858, April 22, 1910.

THE articles are composed of a mixture of 40 to 60 parts by weight of finely-powdered cork, and 40 to 60 parts by weight of linseed oil, which has been subjected to a temperature, usual in preparing boiled oil for painters' use, for such a time that it becomes viscid, and will draw into threads when cool. The articles are treated with paraffin wax or the like, and hardened by exposure to air at about 100° F.—B. N.

Furnaces; Electric ——. J. Härdén, Purley, Surrey. Eng. Pat. 9897, April 23, 1910.

THE furnace is provided with a concave roof, adapted to radiate and reflect, upon the charge, the heat derived from a long electric arc or arcs, which extend over the surface of the charge and conform approximately to the contour of the roof. Each of the electrodes comprises a hollow metal tube with a dome-shaped end or cap, adapted to be cooled by the circulation of a cooling medium. The electrodes are placed in pockets or recesses in the walls of the furnace, and are inclined upwardly with respect to the surface of the charge. Electro-magnets are employed to assist in directing the arcs, so as to produce a curved form.—B. N.

Furnaces; Carbon-holder for electric——. P. L. T. Héroult, La Praz, France, Assignor to Soc. Electro-Métallurgique Française, Froges, France. U.S. Pat. 989,148, April 11, 1911.

THE holder consists of a metal clamp adapted to embrace the carbon, having ears and a clamping-screw for tightening purposes. Cooling-ducts are provided throughout the clamp; these ducts pass into the above-mentioned ears, forming loops which encircle the clamping-screw. The clamp is slitted, internally and externally, to admit of expansion under heat. The slits do not extend through that portion of the clamp in which the cooling-ducts are embedded, and sufficient metal is left to provide the necessary tensile strength.—R. W. N.

Electric furnace. M. R. Conley, Assignor to J. E. Florence, New York. U.S. Pat. 989,568, April 18 1911.

THE furnace, of the resistance type, comprises a melting chamber in the form of a crucible which possesses walls of high electrical resistance. The bottom of this crucible is extended on either side, the two arms obtained forming the body of the furnace and serving for the passage of the current. Composed of material having a relatively low electrical resistance, these arms are smaller in width and depth than the melting chamber which extends above them. The current therefore first traverses the lower walls of the crucible.—C. A. W.

Electric furnace. A. Voelker, Beuel, Germany. U.S. Pat. 989,671, April 18, 1911.

THE furnace comprises a covered hearth provided with a hole in the bottom, in which an electrode is fitted so that it can be moved vertically, the sectional area of the opening being varied at will. A second electrode suspended from the cover is provided with a vertical prismatic cavity in which an extension of the lower electrode, smaller in cross-section than either of the main poles, is made to slide in electrical contact. In this way the circuit includes the two poles and the smaller connection, and the formation of an arc is prevented.—C. A. W.

Furnace: Electric —— for the fusion of refractory materials, especially silica, and process of moulding. L. Clerc and A. Minet. First Addition, dated Nov. 2, 1910, to Fr. Pat. 396,017, Nov. 6, 1908 (this J., 1909, 528).

ONE or more heating tubes are placed in the midst of the space or of the mass to be heated, these tubes being constructed of refractory material, such as refractory earth bauxite, magnesite, alumina, carborundum, etc. The temperature may be modified according to the resistance offered by the material forming the resister, which is more or less compressed between the electrodes in the tubes.—B. N.

Electrodes for electric furnaces, and means of guiding these through the walls of the furnaces. H. A. G. Cinille. Fr. Pat, 421,991. Oct. 29, 1910.

VARIOUS forms of metallic headpieces are described, which may be adapted to fixed electrodes, for the purpose of bringing current to the latter. The headpieces, either square or round, are made in the form of a hollow box, divided by a partition into two compartments, so that water may be circulated from one compartment to the other round one end of the partition. The headpieces may be dovetailed or screwed into the carbon electrodes, and in the latter case the water-jacket and partition may be continued below into the threaded portion. The headpiece may be surrounded by water-jackets, similarly subdivided by partitions, and fitted into the walls of the furnaces, being held in position by suitable metallic spurs, connected with the box, which are embedded in the walls of the furnace.—B. N.

Ionised liquids; Manufacture of——. A. L. C. Nodon. Fr. Pat. 421,933, Jan. 5, 1910.

THE liquid is ionised by the introduction of gas containing free positive or negative ions. The ionisation of the gas may be produced by passing it around one pole from which an electric discharge is taking place, as in an ozoniser, or by the action of radium, a radioactive solution, or by heat, afterwards submitting the ionised gas to the action of one pole of an electrostatic field. The gas may be preserved in the liquid either by solution or by compression. —B. N.

Dielectric films; Process for the formation of —— on electrodes for use in electrolytic apparatus. R. D. Mershon. Fr. Pat. 423,598, Dec. 12, 1910. Under Int. Conv., Jan. 5, 1910.

DIELECTRIC films on electrodes, for use in electrolytic apparatus, are obtained by immersing the electrodes in an acid or other suitable electrolyte, at a temperature which may exceed by 50 to 100 per cent. that to which they will be afterwards submitted, and, if desired, at a higher voltage than the working one. The temperature and the voltage may be raised by successive stages, and the electrodes may be submitted several times to the elevation of temperature.—B. N.

Furnaces; Electric ——. F. A. J. FitzGerald, Niagara, N.Y., U.S.A. Eng. Pat. 15,166, June 23, 1910. Under Int. Conv., Sept. 1, 1909.

SEE U.S. Pat. 950,905 of 1910; this J., 1910, 436.—T. F. B.

Electrodes for electric furnaces; Means for regulating ——. J. H. Reid, Newark, N.J., U.S.A. Eng. Pat. 19,805, Aug. 24, 1910.

SEE Fr. Pat. 419,892 of 1910; this J., 1911, 221.—T. F. B.

Electric furnaces with triphase currents; Method of supplying ——. Soc. Anon. Electrométallurgique (Proc. P. Girod). Fr. Pat. 422,717, Oct. 29, 1910.

SEE Eng. Pat. 3421 of 1910; this J., 1910, 35.—B. N.

Furnace: Electric ——. E. Wassmer. Fr. Pat. 423,755, Dec. 7, 1910. Under Int. Conv., Dec. 9, 1909.

SEE Eng. Pat. 28,819 of 1909; this J., 1911, 495.—T. F. B.

Galvanic batteries. A. Heil, Frankfort-on-Maine, Germany. Eng. Pat. 207, Jan. 4, 1911. Under Int. Conv., Jan. 4, 1910.

See Fr. Pat. 419,770 of 1910; this J., 1911, 221.—T. F. B.

Storage batteries; Method of regenerating ——. C. Luckow. Cologne, Germany. U.S. Pat. 990,661, April 25, 1911.

See Eng. Pat. 29,706 of 1909; this J., 1910, 1258.—T. F. B.

Separation and dehydration of substances by means of electro-osmosis. Ger. Pat. 233,281. *See* I.

XII.—FATS; OILS; WAXES.

Cottonseed oil in France. Oil, Paint, and Drug Rep., May 1, 1911. [T.R.]

A report which Major J. M. Carson, confidential agent of the Commerce Department, sends reviewing the oil seed industry of Marseilles, gives details of the exports of cottonseed from the United States into Marseilles and the increasing competition of copra and peanut products in the oil field. There was a decline, during last year, of more than half or an aggregate of more than 650,000,000 pounds in the sales of American cottonseed cake to European markets. There was also a decline from 1,233,750,000 pounds in 1909 to 640,088,000 pounds in 1910. The report also discusses the competition of peanut and copra products with edible cottonseed and lard oils sent from the United States into the markets of Europe, describes the increasing production of peanut oil in the French territory, and gives some interesting statistics of all imports and exports of the Marseilles market.

Enzymic action of ricinus seed; Reversibility of ——. M. Kransz. Z. angew. Chem., 1911, 24, 829—831.

The incomplete hydrolysis of linseed and olive oils, tallow and butter, by means of the enzyme in the seed of the castor-oil plant, is to be attributed to the formation of a state of equilibrium between the neutral fat, fatty acids, and dilute glycerin, and the consequent reversibility of the enzymic action. Thus in an experiment in which 20 grms. of olive oil had been hydrolysed to the extent of 94·6 per cent. in 48 hours, the emulsion was repeatedly washed with water in a separating funnel to remove the glycerin and the residual liquids again emulsified and allowed to stand. After 15 hours the hydrolysis was completed, and the total yield of fatty acids was 99·6 per cent. The retardation of the hydrolysis by an excess of glycerin was also shown by an experiment in which 10 grms. of olive oil, 4 c.c. of $N/10$ acetic acid, 10 grms. of glycerin, and 2 grms. of the enzyme powder were emulsified together. After 48 hours only 4·4 per cent. of the fat had been hydrolysed. The enzyme powder for the experiments was obtained by grinding castor seeds in a coffee mill, expressing the mass in a porcelain press, and removing the residual oil by treatment with alcohol or benzene. The dry residue was then pounded in a mortar and pressed through sieves of different degrees of fineness. In using this powder to effect a synthesis of glycerol and fatty acid, it was necessary to dilute the glycerin, which otherwise would have a toxic action upon the enzyme. An emulsion of 100 grms. of oleic acid with 100 grms. of anhydrous glycerin and 80 c.c. of $N/10$ acetic acid was mixed, with continual stirring, with 20 grms. of the enzyme powder, and the mixture allowed to stand for 4 days, after which the glycerin was completely removed by washing, the mixture of fat and fatty acid extracted with ether, and the solvent evaporated. The residue had a saponification value of 197·5 and an acid value of 175·4, corresponding to 11·1 per cent. of neutral fat. The latter was separated by neutralising the mixture with alcoholic potassium hydroxide solution, adding an equal volume of water, and extracting the neutral fat with ether. The resulting product was a light yellow oil, which dissolved with difficulty in alcohol, and had an acid value of 0, a saponification value of 180·3, and an iodine value of 88·4. When acetylated it had a saponification value of 232·6, as compared with 209·7 for the acetylated oleic acid, the increased value of the former indicating the presence of mono- or diglycerides. The presence of these was also shown by the proportion of glycerol in the fat, 8·874 grms. yielding 1·198 grm. of glycerin, whilst the theoretical proportions for triolein, diolein, and mono-olein were 0·928, 1·336, and 2·303 grms. respectively. Hence in the reverse action of the lipolytic enzyme of castor seed upon oleic acid, mono- and diglycerides are formed as intermediate stages.—C. A. M.

Soya bean oil. C. Oettinger and F. Buchta. Z. angew. Chem., 1911, 24, 828—829.

Some of the values in the following table of results obtained by the authors differ considerably from the figures recorded by previous observers:—

Soya bean oil.	Sp. gr. at 15° C.	Acid value.	Saponification value.	Iodine value.	Hehner value.	Reichert-Meissl value.	Unsaponifiable matter.	Maumené figure.	Refractive index at 20° C.	Solidification point.
							per cent.	° C.		° C.
Refined	0·9255	0·0	192·9	135·0	95·9	0·45	0·59	87	1·4755	−8 to −16
Common	0·9246	0·41	192·4	132·9	96·0	0·50	0·54	88	1·4750	−8 to −16
Crude	0·9265	5·2	194	135·1	95·8	0·56	0·39	88	1·4745	−8 to −16

Fatty Acids.

Soya bean oil.	Melting point.	Solidification point.	Refractive index at 27·5° C.
	°C.	° C.	
Refined	26	22	1·465
Common	26	22	1·4655
Crude	26	22	1·465

—C. A. M.

Niger seed oil. Utz. Chem. Rev. Fett-Ind., 1911, 18, 106—107.

Samples of crude and bleached niger-seed oil examined by the author gave the following results:—

	Sp. gr. at 15° C.	Refraction n^{15}_{D}	Acid value.	Saponification value.	Reichert-Meissl value.	Iodine value (Hübl-Waller).	Hehner value.	Unsaponifiable matter.	Fatty acids.		
									M. pt.	Refraction n^{40}	Iodine value.
								per cent.	° C.		
Crude oil	0·9252	1·4768	3·7	123·5	0·88	126·8	94·0	1·26	28·2	1·4605	113·9
Bleached oil	0·9250	1·4764	0·45	217·8	3·85	114·0	92.0	0·53	27·8	1·4605	102·3

In Bellier's reaction (resorcinol and nitric acid) the crude oil gave a red-brown colouration, the mixture separating into a red-brown layer of oil and a blood-red acid layer. With the bleached oil the colour of the mixture was orange, whilst the oily layer was yellow and the acid layer blood-red. According to Allen, niger-seed oil dries rapidly at 100° C., but the author finds that even at that temperature the drying process is very slow.—C. A. M.

Rice oil; Composition of ——. M. Tsujimoto. Chem. Rev. Fett-Ind., 1911, **18**, 111—112.

An oil extracted from rice by means of petroleum spirit was of a greenish-yellow colour and gave the following results:—Sp. gr. at 15° C., 0·9273; acid value, 34·75; saponification value, 184·87; iodine value Wijs), 107·60; refractive index at 20° C., 1·4742; and unsaponifiable matter, 4·78 per cent. *Fatty acids* (freed from unsaponifiable matter):—Sp. gr. at 100° C., 0·8523; m.pt. 32·5° C.; neutralisation value, 197·66; and iodine value (Wijs), 107·82. The unsaponifiable matter melted (after recrystallisation from alcohol) at 136°—137° C., and apparently consisted of phytosterol. The solid fatty acids, separated by the lead-ether method, melted at 58·5° C., and had a mean molecular weight of 259·38. Hence they consisted in the main of palmitic acid. The liquid fatty acids consisted of oleic acid and of a linolic acid which yielded a sativic acid melting at 158·5° to 159° C. (instead of the usual 173°—174° C.); hence the existence of an isolinolic acid is inferred. The composition of the total fatty acids was calculated to be approximately as follows: Palmitic acid, 20; oleic acid, 45; and isolinolic acid, 35 per cent. No linolenic acid was detected.—C. A. M.

Oil from the seeds of the ash. W. Bach. Chem.-Zeit., 1911, **35**, 478—479.

The seeds of the ash yielded, on extraction with ether, 9·7 per cent. of a brownish-yellow, fairly viscous oil with an odour of tea. It became turbid at 27·1° C., and yielded a semi-solid mass in the elaïdin reaction. The following values were obtained:—Sp. gr., 0·9181; acid value, 1·71 per cent. (as oleic acid); saponification value, 168·5; iodine value, 129·5; Reichert-Meissl value, 1·68; unsaponifiable matter, 5·52 per cent. *Fatty acids*: Neutralisation value, 181·7; iodine value, 125·8; m.pt. 36·8° C.; and solidification point, 28·6° C. The oil closely resembled sunflower seed oil in its general composition, and was also a semi-drying oil. When exposed for 14 days in a film upon glass it was still "tacky."—C. A. M.

Mangifera indica seeds; Oleodistearin in the fat of ——. J. Sack. Pharm. Weekbl. 1911 [13]. Apoth.-Zeit., 1911, **26**, 302.

The kernels of the seeds contain 47·5 per cent. of water, and 5·2 per cent. of fat, which melts at 36° C.; acid value, 12·3; saponification value, 175; iodine value, 54·5; Reichert-Meissl value, 0·2. The bulk of the fat consists of oleodistearin. By adding alcohol to the ether solution of the fat until turbidity occurs, this crystallises out in fine needles; m. pt. about 44° C.; readily soluble in ether, sparingly so in alcohol.—J. O. B.

Glycerides; Direct synthesis of——. I. Bellucci. Atti R. Accad. dei Lincei, Roma, 1911, [5], **20**, I., 235—238. Chem. Zentr., 1911, **1**, 1348—1349.

In the direct synthesis of glycerides (see this J., 1911, 497), the removal of the water produced is of great importance and if care be taken to effect this and to exclude atmospheric oxygen, for example by a current of an inert gas (dry carbon dioxide), nearly theoretical yields of glycerides can be obtained by heating together stoichiometrical proportions of fatty acid and glycerol at 200°—250° C at atmospheric pressure. The mixture of fatty acid and glycerol should be kept well emulsified by means of a stirrer during the process. In a vacuum, reaction between glycerol and oleic, palmitic, or stearic acid, begins at about 180° C. Direct synthesis *in vacuo* appears to be superior to other methods for the preparation of monoglycerides and mixed glycerides.—A. S.

Glycerides; Synthesis of ——. G. Gianoli. Soc. chim. ital., April 10, 1911. Chem.-Zeit., 1911, **35**, 489.

The author states that the method described by Bellucci and Manzetti (this J., 1911, 497; also preceding abstract) for the direct synthesis of glycerides by heating together fatty acids and glycerin *in vacuo*, has been in use since 1891 in Italy, for the treatment of the so-called sulphur oils, rich in free fatty acids, prepared from olive press-residues. In the first technical experiments, heating at 230°—250° C. in autoclaves was tried, but the products were dark-coloured; somewhat better results were obtained by heating in a current of carbon dioxide, but the process was not satisfactory until heating *in vacuo* was resorted to. Small quantities of oxalic acid have a favourable influence on the process. The reaction is effected in enamelled vessels, but these are not entirely satisfactory. The neutralised oil obtained by this process has an iodine value below 75, and on account of its high viscosity (two to three times higher than that of the original oil), is suitable for addition to mineral lubricating oils. It is used for the preparation of "abietin," a copal substitute.—A. S.

Graphite; Detection of —— *in lubricants.* J. Marcusson and G. Meyerheim. Chem.-Zeit., 1911, **35**, 461—462.

Graphite, when present in lubricating oils, may be separated as an insoluble residue by treating the oil with benzene; whilst in the case of lubricating greases, consisting, *e.g.*, of a mixture of the calcium soap of rape oil with mineral oil, the sample may be heated with a mixture of benzene and absolute alcohol (10 : 1 by vol.). The insoluble residue is washed with the hot solvent and treated with hot hydrochloric acid to remove any lime or calcium carbonate, and the amount of graphite is found by a determination of the carbon. The detection of graphite in tars and pitches is more difficult, owing to the fact that many of these products contain considerable quantities of amorphous carbonaceous substances, which remain with the graphite in the insoluble residue left after the treatment with benzene or chloroform. Hence mixtures of amorphous carbon (lampblack) with finely divided silicates, such as talc, might readily be mistaken for graphite. Fusion with caustic soda was found to be the best means of distinguishing between graphite and amorphous carbon, the former remaining more or less unaffected by the treatment. In applying the test 1 grm. of the residue obtained by extraction of the pitch, etc., is introduced, little by little, into 15 grms. of the fused alkali in a nickel crucible, and the mixture heated for 15 minutes over a Bunsen flame, and finally for some minutes with the blowpipe. The mass is then treated with water, and the insoluble residue washed twice by decantation and then upon a filter, after which it is treated with hot, dilute hydrochloric acid to remove iron hydroxide (from the pitch) and nickel hydroxide (from the crucible), and is dried at 105° C. The residue will have the appearance and properties of graphite. The sharpness of the test varies with the kind of graphite, some varieties being more susceptible to oxidation than others. Hence it is questionable whether as little as 20 per cent. of graphite could be detected with certainty in all cases in admixture with amorphous carbon. In practice, however, the proportion in the residue would usually be greater than this, owing to its becoming concentrated in the residue. Thus in the case of ordinary coal-tar pitch an original addition of 10 per cent. of graphite would have increased to about 30 per cent. in the insoluble residue, whilst the conditions with other tars and pitches would be still more favourable for the detection of the graphite.—C. A. M.

Fatty acids in soaps; Determination of ——. T. Budde. Veröffentl. a. d. Gebiete Militärsanitätsw., Heft 45; Arbb. hyg.-chem. Unters.-Stellen, 1911, IV. Tl., 86—99. Chem. Zentr., 1911, **1**, 1449—1450.

By the following method the percentage of fatty acids in soaps can, it is stated, be determined to within 1—2 per cent. The soap is dissolved in absolute alcohol, the solution filtered, made neutral to phenolphthalein by addition of acid, if necessary, and evaporated to dryness. The residue is dissolved in water, and 25 c.c. of the solution (equivalent to about 0·5—0·8 grm. of soap) are heated to boiling with 25 c.c. of an aqueous solution of copper sulphate. After cooling, the precipitate of the copper salts of the fatty acids is collected on a weighed filter, washed, and dried at 103° C. till of constant weight. The weight obtained is diminished by one-tenth (representing the copper) and then increased by a quantity representing the hydrogen equivalent to the copper.—A. S.

Glycerol; Report on method of determination of ——. E. Probeck. J. Ind. Eng. Chem., 1911, 3. 253—254.

The author regards the bichromate method as generally more satisfactory than the acetin process, the results afforded by the latter being always, in his experience, from 0·2 to 0·5 per cent. below the true value. Both methods are unreliable in the presence of volatile monohydric and dihydric alcohols, these substances being oxidised in the former, or converted into acetyl compounds in the latter, process. As conducted by the author, the determination by the bichromate method is made, together with a blank test, upon the previously neutralised sample. In the blank test the glycerin is evaporated upon a watch glass at 160° C. and the residue is oxidised with the bichromate solution in the same manner and at the same time as the assay portion of the sample. The volume of bichromate solution used in the blank test being deducted from that required in the assay, the percentage of glycerol is calculated from the difference. Correction is thus made for all impurities likely to be present (except volatile monohydric and dihydric alcohols and volatile aldehydes), greater accuracy being ensured by this means than by a preliminary purification of the sample. Volatile aldehydes, if present, must be removed before the addition of the bichromate solution. During the investigation it was shown that glycerol may be heated to 200° C. without suffering polymerisation or decomposition.—W. E. F. P.

Greening of colza seed cake. Bussard. *See* XIXa.

Viburnum lentago fruits. Gillette. *See* XIXa.

Patents.

Halogen-hydrocarbons; Preparation or treatment of —— *to render them soluble in dilute soap solutions.* G. Fendler, Steglitz, and L. Frank, Berlin. Eng. Pat. 17,100, July 18, 1910. Under Int. Conv., July 19, 1909.

See Fr. Pat. 419,235 of 1910; this J., 1911, 222.—T. F. B.

Testing oil in respect to its behaviour towards gases or vapours. Ger. Pat. 232,233. *See* XXIII.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Ochres; Action of heat on ——. A. Bouchonnet. Bull. Soc. Chim., 1911, 9, 345—351.

When ochres are heated to 100°—250° C., the colour deepens gradually to a yellowish brown tint, at 230°—250° C. changing abruptly to red; the colour then becomes darker with rising temperature until at 700°—800° C. it is a reddish-purple; from 800°—950° C. the tint does not alter appreciably, but at 1000°—1100° C. the colour, as a rule, changes abruptly again to the black tint of the magnetic oxide of iron, though in some cases a yellow magnetic variety has been obtained; above 1100° C. the ochres melt. These changes are found to accompany the gradual dehydration of the substance, and, since this proceeds more slowly between 250° and 700° C. than between 700° and 1000° C., the colour of the product, especially below about 350° C., is dependent, to some extent, on the duration of heating; it is also affected by the fineness of grain, but the rate of cooling has little influence. Heating above 900° C. causes marked contraction in the mass. The ochres, especially when rich in alumina, are fairly plastic, but this plasticity is lost by heating to about 800° C.; when exposed to moist air, all slowly reabsorb a considerable proportion of the water lost on heating, but the tints obtained by heating are stable.—F. Sodn.

Madder dyestuffs and lakes. H. Cajar. Z. angew. Chem., 1911, 24, 793.

Madder lakes are stated to be faster to light than those obtained from artificial alizarin. As usually prepared, they are chiefly compounds of alumina and purpurin. They are principally used for artists' colours, and are characterised by their high transparency. Lakes from artificial alizarin (with aluminium hydroxide and Turkey red oil) are best prepared on the small scale. The quality improves with the transparency of the aluminium hydroxide; it is therefore recommended to heat to boiling after precipitation of the alumina by alkali hydroxide; further, it is found that the greater the acidity of the alumina the greater is the covering power of the pigment. These lakes are used in the manufacture of water- and oil-colours for glass painting, in colour plate printing, and in the printing of paper hangings.—A. Sbld.

Linseed oil; Amount of siccatives in ——. Metz. Chem.-Zeit., 1911, 35, 473.

Pure linseed oil varnish, according to a resolution passed by the German Lake and Colour Industry Protection Society, should not contain more than 2 per cent. of siccatives, or if resinates be employed not more than 5 per cent.—A. Sbld.

Resins; The chemistry of ——. G. Grasser. Collegium, 1911, 148—150.

Several kinds of resins, of partly fossil nature, appear in trade under the name of "copal." Different varieties are obtained from South and West America and West and East Africa, the latter region supplying Zanzibar copal. Kauri copal, which is principally in the fossilised state and dug from the ground, is used in the largest quantities. The copals are of a yellowish or greenish colour and have a faint pleasant smell and a bitter taste; they are dissolved by alkali hydroxides, undergoing a chemical change, and are readily soluble in chlorhydrin, amyl alcohol, and amyl acetate. Their solubility in chloroform, ether, alcohol, acetone, and petroleum ether is less and varies with different specimens. Their specific gravity varies between 1·080 and 1·170. As chemical constituents they contain 60—70 per cent. of resin acids, 5—10 per cent. of astringent matter, and a little ethereal oil. The soluble alkali salts obtained from them are precipitated by solutions of metals, giving so-called copal-resin acid metal hydroxides which, dissolved in turpentine or linseed oil, are used as varnishes. The resin becomes fluid at 250° C. and yields a clear yellow distillate between 240° and 260° C., consisting of about 25 per cent. of its total weight. Up to 280° C. about 30 per cent. of a brown-yellow distillate is obtained, and when 335° C. has been reached a red-brown distillate, the remainder consisting of carbon, water, and gaseous products. Dammar resin from Borneo can be saponified in alcoholic solution to the extent of 80 per cent., from which it is inferred that it contains a large quantity of pure resin acid (dammarylic acid). The resin melts rapidly on heating to 118°—123° C., and decomposition begins at 180° C. Elemi is soluble to the extent of 60 per cent. in alcohol, the solution leaving an amorphous mass on evaporation. The portion insoluble in cold alcohol is soluble to the extent of 20 per cent. in the same solvent used hot, and the solution leaves a crystalline residue on evaporation. The resin begins to distil at 150° C., yielding 8 per cent. of an ethereal oil. Impure natural shellac when dissolved in dilute alkali leaves about 9 per cent. of colouring matter in the aqueous solution after precipitation with dilute hydrochloric acid. Mastic is soluble to the extent of 30—40 per cent. in hot alcohol, of which 10 per cent. separates on cooling. A little ethereal oil is obtained on careful heating. Myrrh gives about 55 per cent. of a gummy substance on treating with warm water, and a little ethereal oil on heating. Copaiba balsam gives 50 per cent. of ethereal oil on distillation and 40 per cent. of resin acid on saponification with alcoholic potash and precipitation with dilute hydrochloric acid.—D. J. L.

PATENTS.

Pigments; Manufacture of yellowish green ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 422 843, Nov. 21, 1910. Under Int. Conv., Dec. 11, 1909.

THE para-chloro derivatives of Malachite Green and Brilliant Green, when converted into pigments in the usual way, furnish lakes which are considerably yellower than those given by brilliant green itself, and are purer in shade than mixtures of brilliant green and auramine.
—J. C. C.

Oil paints; Method of manufacturing ——. J. Meurant. Fr. Pat. 423,411, Dec. 8, 1910. Under Int. Conv., April 1, 1910.

PIGMENTS are heated with "catalysing agents" (*e.g.*, soluble salts which readily lose their water of crystallisation on heating), so as to effect a molecular change which increases their covering power and renders them more stable. Thus mixtures of barium sulphate or of zinc oxide or of both with sodium sulphate are heated to a temperature sufficient to expel the water of crystallisation from the sodium sulphate, after which they are cooled and the sodium sulphate removed by washing.—C. A. M.

Triple resinate or sylvate of calcium, zinc, and antimony; Method of manufacture and application of ——. E. Cadoret and E. Deligeon. Fr. Pat. 423,545, Feb. 17, 1910.

A SOLUTION of sodium resinate or sylvate is treated with a suitable mixture of soluble salts of calcium, zinc, and antimony, and the resulting precipitate is collected, washed, dried, and used in the preparation of paints, varnishes, etc.
—C. A. M.

Colouring varnish for metals and similar materials. K. Bedenk. Ger. Pat. 232,624, March 23, 1909.

THE salts of organic colour-bases, together with suitable oxidising agents or sulphur compounds, soluble in alcohol or ether, turpentine oil or aniline oil, are added to the ordinary spirit-, turpentine-, or oil varnish, so that on drying, the colour-base is converted into a dyestuff by oxidation or by the action of the sulphur. It is stated that the colour thus obtained is more transparent and adheres better than when the prepared dyestuff is added to the varnish.—A. S.

Lead oxide, white lead, and red lead; Manufacture of ——. G. V. Barton, Liverpool. U.S. Pats. 988,963 and 988,964, April 11, 1911.

SEE Eng. Pats. 13,458 of 1908 and 4465 of 1909; this J., 1909, 992, and 1910, 87.—T. F. B.

Pigment. Process of making pigments. A. Moffatt, Indianapolis. U.S. Pats. 990,155 and 990,156, April 18, 1911.

SEE Eng. Pat. 22,033 of 1910; this J., 1911, 294.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber production; Future —— *of plantations in the East.* Gummi-Zeit., 1911, 25, 1115—1116.

THE area planted with rubber in the Middle East is, according to Lampard, about 730,000 acres, distributed as follows: Malaya, 370,000; Ceylon, 180,000; Java and Sumatra, 130,000; Southern India, Borneo, etc., 50,000 acres. At the rate of 300 lb. per acre this area should be capable of producing, ultimately, 100,000 tons of rubber. In 1910, 8000 tons were produced: for 1911 Lampard estimates 15,000; for 1912, about 25,000; for 1913, about 45,000; for 1914, about 70,000; and for 1915 about 100,000 tons. These figures are perhaps somewhat high, since they are based upon the assumption that the whole area is under rational cultivation, and that a sufficiency of labour exists. Assuming America's consumption of raw rubber to be about equal to that of the rest of the world, the world's consumption for the year 1909—10 works out at about 90,000 tons of natural rubber and 10,000 tons of old rubber and jelutong. Of this about 52,000 tons were provided by South America, 8000 tons by the East, and 52,000 tons by other regions. Assuming that the consumption continues to increase at its present rate, viz., about 10 per cent. per annum, the world's consumption will be as follows: 1912, 110,000 tons; 1913, 121,000 tons; 1914, 133,000 tons; 1915, 146,000 tons. Of this 146,000 tons the East will be able to supply a maximum of 100,000 tons. Lampard does not think that permanently low prices of raw rubber will be brought about by this position of affairs.—E. W. L.

Rubber market report. E. Marckwald. Gummi-Zeit., 1911, 25, 1150.

THE rapid downward tendency in prices was checked in January, 1911, and by the beginning of March the price of fine hard Para was M.5 per kilo. (2s. 3d. per lb.) higher than the lowest January price. There are no grounds for the fear that the extraordinarily high prices of the previous year will reappear. The tendency of prices will remain a generally downward one. High prices of rubber have led to much planting and, even under the worst conditions, 1916 will see the production of 70,000 tons of plantation rubber. Producers will have to reckon, in the next few years, with prices of about M.6 to 8 per kilo. (2s. 9d. to 3s. 7d. per lb.) and under for fine hard Para. It is, therefore, important for the plantations to take care to turn out only a high grade and uniform product. The following figures show the highest and lowest prices paid during 1910, and the prices at the beginning of January and the end of March, 1911, for various sorts of rubber:—

	1910.		1911.	
	Highest. Mid-April.	Lowest End of Dec.	Beginning of Jan.	End of March.
Fine Pará	M27·8	M12·3	M12·5	M14·2
1A African	21·0	13·6	11·0	11·8
Manaos scrappy ..	17·6	9·3	9·5	10·4
Plantation Para ..	28·4	12·1	13·15	14·4
,, Kickxia	16·0	8·0	7·0	8·5
,, Manihot	17·4	9·0	8·0	9·5

—E. W. L.

Rubber [and guttapercha] collection in Siam and Indo-China. Badermann. Gummi-Zeit., 1911, 25, 1082.

SEVEN species of Taban-tree, yielding the Siamese Gettania-gum (guttapercha), are found in Siam, but little attention is paid to their cultivation. The trees grow wild, especially in the maritime provinces of the Malay Peninsula. The gum is mainly exported to Europe. The collection as now carried out is mere robbing of the trees. In Indo-China, on the other hand—Laos and West Annam—where rubber lianas are plentiful, planting of *Hevea brasiliensis* and *Ficus elastica* has been undertaken. These trees flourish more particularly in those parts of the country south of 15° N.—E. W. L.

Kickxia elastica; Tapping experiments with ——. A. Zimmermann. Gummi-Zeit., 1911, 25, 1082—1084.

THE main results of tapping experiments made with 4½ and 5½ year old *Kickxia elastica* trees showed that (1) the herring-bone system of tapping gives considerably higher yields of latex than other systems tried, and, although it is more costly to carry out, it would probably pay to use this method of tapping; (2) the yield of latex increases with the age of the tree, and it would pay to tap 6-year-old trees. Under certain conditions a small yield can be obtained from 5-year-old trees, but in this case tapping should only take place once a year. Repeated tapping of *Kickxia* diminishes the yield somewhat, but when carried out in a rational manner, and so as to allow the tree rest-periods of at least a year, it may be expected that good yields will continue to be obtained.—E. W. L.

Caoutchouc resins. F. W. Hinrichsen, J. Marcusson, and H. Quensell. Z. angew. Chem., 1911, 24, 725—729.

The authors have extended their experiments of last year (this J., 1910, 224), which included 15 samples of rubber of different origin, to 26 additional samples; in the case of 15 of these they obtained for experiment the resins (acetone extract), and in the case of the other 11 they obtained the raw rubber and extracted the resins themselves. The results confirmed in all respects their earlier results; one or two anomalous results were obtained, but are in all probability due to uncertainty as to the real botanical origin of the samples which yielded them. Whilst further work on samples of accurately known origin is desirable, the authors consider it fairly well established that: (1) The resins of rubber show for the most part optical activity. The few exceptions occur in samples derived from species of *Hevea*, such as Para rubber. (2) The optically active resins as a rule contain high percentages (over 50) of unsaponifiable matters: the activity is chiefly concentrated in the unsaponifiable portions. (3) Vulcanised materials exhibit the same characters as the raw rubbers. (4) The optical activity lies in the substances accompanying the rubber; the derivatives of the rubber hydrocarbons themselves are inactive. —J. T. D.

Patents.

Rubber; Process and apparatus for devulcanisation of ——. L. A. M. Banchieri. Milan, Italy. Eng. Pat. 14,251, June 13, 1910.

The disintegrated rubber is mixed with 5 to 14 per cent. by weight of terpinol or a derivative of the terpene group and subjected to the action of steam at about 120°—130° C. in a closed vessel. The water of condensation with traces of terpinol is returned to the steam generator.—H. E. P.

Rubber; Process for the regeneration of ——. G. D. C. D. J. Gabet. Fr. Pat. 423,133, Nov. 29, 1910.

The waste rubber is treated warm, with or without pressure, with a vulcanisable oil and a liquid or solid hydrocarbon. These remain in the rubber, at all events partially, after vulcanisation. Thus 40 parts by weight of linseed oil, 10 parts of petroleum and 100 parts of powdered desulphurised waste rubber may be used. Vulcanisation is carried on for 45 to 50 minutes under a pressure rising to 5 atmospheres (151° C.).—H. E. P.

Rubber; Process for the production of substances resembling ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 422,955, Oct. 29, 1910. Under Int. Conv., Dec. 27, 1909. (See also Fr. Pats. 418,544 and 419,316 of 1910; this J., 1910, 1215).

Homologues of isoprene and erythrene are polymerised under suitable conditions. Thus α-methylbutadiene, βγ-dimethylbutadiene, αα-dimethylbutadiene or a cyclic derivative of erythrene may be employed. These bodies are heated, at various temperatures for various times up to 3 months, with or without agents which accelerate the polymerisation or act as diluents or solvents. By distillation in steam or by other means, followed in some cases by solution in benzene and precipitation by alcohol, a substance resembling rubber is obtained.—H. E. P.

Caoutchouc and other plastic substances; Manufacture of mixtures of ——. H. Dogny and V. Henri, Paris. Eng. Pat. 26,932, Nov. 19, 1910. Under Int. Conv., Nov. 20, 1909.

See Fr. Pat. 420,321 of 1909; this J., 1911, 375.—T. F. B.

Rubber; Process for recovering ——. H. T. G. van der Linde. Fr. Pat. 423,489, Dec. 9, 1910. Under Int. Conv., Jan. 8, 1910.

See U.S. Pat. 979,902 of 1910; this J., 1911, 225.—T.F.B.

XV.—LEATHER; BONE; HORN; GLUE.

Leather; Yield of ——, *and leather analysis.* W. Appelius and L. Manstetten. Collegium, 1911, 133—148.

The "yield-value," according to J. von Schroeder, expresses the weight of air-dry vegetable-tanned leather obtained from 100 parts of hide-substance. The "degree of tanning" shows how much tanning material has been fixed by 100 parts of hide-substance. These values, found by nitrogen determinations, cannot be relied upon as a guide to the yield to be expected in practice, as the actual tanning is not the only determining factor in the case. The amount of water in the raw hides is variable and causes great differences in the amount of leather obtained from a certain amount of raw hide. In practice the highest yield is obtained from the butt, and the lowest from the sides and offal. On the other hand, by analysis the highest "yield-value" is obtained from the offal and the lowest from the butt. A representative sample of leather from a whole tanned hide is difficult to obtain; not only must samples be taken from different parts, but the proportions of each taken must also be carefully regulated. If it is impracticable to take several samples from the tanned hide the average composition of the leather is most nearly represented by a piece either from the neck or from the region between the butt and the sides. More tanning material is fixed by drum-tannage than by pit tanning, although the operation is considerably shorter by the former method. This is accounted for by the stronger liquors used in drum-tanning. The organic matter which can be extracted by water is less in the case of well-scoured drum-tanned leather than in that obtained by the other method. According to analyses made by the authors the full quantity of fixed tannin appears to be taken up by the hide as soon as the tan-liquor has completely penetrated the goods.—D. J. L.

Leather; The weighting of ——. F. Abraham. Chem. Zeit., 1911, 35, 453.

Weighting materials have been used on leather for 50 years, and Eitner drew attention to the practice 25 years ago. The importation of American hemlock-tanned leather and English leather into Germany began about 50 years ago, and the goods were characterised by their cheapness and fine appearance. High duties on the imported goods were demanded, but were found unnecessary, as the leather when put into manufacture was found to be no cheaper than the home-tanned product. The imported leather contained materials added solely for the purpose of weighting, and the consequent lowering of prices forced the home tanners to resort to similar devices, especially with leather for export. Water and tannin are too easily removed to be used as weighting materials, and an excess of the latter causes brittleness. Sugar is used to a great extent; it is found to the extent of 2 per cent. in unweighted vegetable-tanned leather. It is used in the form of grape or starch sugar or syrup, molasses or dextrin, and applied in strong solution to the flesh side of the damp leather. Bad results were first obtained until the English custom of drying the leather quickly at 50° C. was followed, by means of which the leather does not remain damp. Of mineral weighting agents, magnesium sulphate and barium chloride are the most common. In a recent case a belting firm who had obtained their leather for a long time from one leather works suddenly asserted that the leather contained 10 per cent. of sugar, and reduced their payment for it by a corresponding amount. The leather manufacturers complained and took the case to law, when it was decided that the belting makers had no right, on judicial grounds, to reduce their payments. The leather on analysis showed 6 per cent. of sugar, and the leather makers stated that their product was so specifically light that the addition was nece sary to make it saleable, although Paessler showed that other specimens of leather for the same purpose were specifically lighter. The court could find no evidence of fraud, for the seller could assume, as the goods had been accepted for years without any objection, that the buyer was aware of the added weighting material, seeing that the value of the goods was M.185,000, while an analysis would cost M. 8 only. In the evidence it was stated that sugar and barium chloride were harmful to health, owing to their attraction for water, and damaged the leather, but this was denied. Instances were given in which magnesium and aluminium sulphate were introduced into the leather owing to these substances having been used for clarifying the liquors. The chemical analysis was of as much importance to the seller as to the consumer.—D. J. L.

Patents.

De-liming hides ; Process for ——. C. H. Boehringer Sohn, Nieder-Ingelheim, Germany. Eng. Pat. 3140, Feb. 7, 1911. Under Int. Conv., June 23, 1910.

A certain quantity of a salt of an organic acid, *i.e.*, lactic acid, is first dissolved in the de-liming liquid, the de-liming being effected with an inorganic acid the quantity of which at the utmost is equal to the organic acid present in the form of its salt.—H. E. P.

Leather ; Process of tanning ——. J. A. Hamrick, Hot Springs, Ark. U.S. Pat. 989,252, April 11, 1911.

The leather is immersed in a hot solution of gambier until it is thoroughly coloured ; a fluid extract of alder is then added to the solution, in which the leather is allowed to remain for from two to ten days. The leather is now removed, the solution is heated, fluid extracts of persimmon and black-haw are added, and the leather is immersed in the mixture for a further period of from one to five days.—W. P. S.

Glue ; Process for finishing ——. H. Schimmel. Ger. Pat. 232,715, June 1, 1910.

The drying of tablets of glue is effected in a closed vessel by means of a current of air which is caused to flow alternately over receptacles containing the glue and over receptacles containing hygroscopic substances. Means are provided for changing the direction of the air current in order to maintain, as far as possible, uniform conditions in all parts of the system.—A. S.

Gelatin ; Use of quinonesulphonic acid and its salts for rendering —— *insoluble and impermeable.* L. Meunier and A. Seyewetz. Fr. Pat. 423,595, Feb. 19, 1910.

Quinonesulphonic acid and its salts are more soluble than quinone, and have not the same irritating odour. Unlike chromium salts, they can be used in quantity without destroying the fluidity of the gelatin solutions. The use of the sodium salt of quinonesulphonic acid, hitherto not described, is claimed in particular.—H. E. P.

Artificial leather. E. Reidel, Mannheim, Germany. Eng. Pat. 7639 of 1911, date of Appl. Jan. 4, 1910. Addition to Eng. Pat. 225 of 1910, dated Jan. 8, 1909.

See Fr. Pat. 410,369 of 1909 ; this J., 1910, 832.—T. F. B.

Horn substitutes from casein ; Manufacture of ——. A. Bartels, Harburg-on-Elbe, Germany. Eng. Pat. 21,750, Sept. 19, 1910.

See Fr. Pat. 420,543 of 1910 ; this J., 1911, 376.—T. F. B.

Method of extraction in which the material is digested in its own water. Ger. Pat. 232,933. *See* I.

XVI.—SOILS ; FERTILISERS.

Nitrolim ; New observations on the action and properties of ——. A. Stutzer, F. Reis, and J. Söll. Fühling's landwirtsch. Zeit., 1910. 413. Biedermann's Zentr., 1911, **40**, 232—235.

Bacteria, mould fungi, and yeasts are unable to make use of cyanamide as a nutrient. Dicyanodiamide is also without value, but in presence of peptone it has no adverse influence on bacterial growth. Cyanamide is poisonous towards germinating seeds, and dicyanodiamide retards germination but is irregular in its action, having very little influence on mustard but injuring barley. Maize plants, grown in loam in pots, gave only one-tenth of the yield with dicyanodiamide as with nitrate. The addition of dicyanodiamide to strongly growing tomatoes was without influence. Added to barley and oats nitrolim was at first injurious. but the effect gradually disappeared after rain. Garden soil, whether sterilised or not, slowly destroyed cyanamide at 25° C. ; a soil rich in iron was very active in causing decomposition. Under parallel conditions, freshly precipitated iron oxide destroyed 27 per cent., dried and ignited oxides destroyed 63 and 81 per cent. respectively. Aluminium hydroxide had very little action, manganese oxide destroyed 31 per cent. The chief product in the case of iron oxide was urea ; dicyanodiamide was formed in presence of calcium carbonate. The diamide is not present in fresh nitrolim, nor is it formed on storage or in solution until this is boiled. The transformation only takes place in alkaline and not in neutral or faintly acid solution. Small doses of cyanamide have no action on animals, and quite large doses of dicyanodiamide can be given without injury.—E. F. A.

Patents.

Acid phosphates and phosphoric acid ; Manufacture of —— *from bones and the like.* The Weaver Refining Co., Ltd., and J. O. Neill, Acton Bridge, Cheshire. Eng. Pat. 21,268, Sept. 13, 1910.

Bones from which the fat has been removed are covered with water and treated with from 0·5 to 1·5 per cent. of their weight of a mineral acid ; at the end of 2—6 hours, the bones are washed free from acid and subjected for from 15 to 20 hours to the action of steam under a pressure varying from 5 to 30 lb. Bones, phosphates, etc., which have been thus treated are rendered more soluble in acids, and a larger yield of acid phosphate is obtained from them. —W. P. S.

Manure and its process of manufacture. T. Knösel. Fr. Pat. 423,562, Dec. 10, 1910. Under Int. Conv., Dec. 13, 1909.

Calcium cyanamide is intimately mixed with sulphite liquors (from the manufacture of cellulose), which may or may not have been neutralised, say by the addition of calcium carbonate. For example, 60 kilos. of calcium cyanamide are intimately mixed with 150 litres of sulphite liquor of 14·5° B., and then 100 litres of liquor of 38·5° B. are added, little by little, with continued stirring ; after further stirring and allowing to stand, the mass acquires such a consistency that it may be ground, and 400 kilos. of dry manure are obtainable, the product, owing probably to the organic matter and potassium derived from the liquor, being superior to calcium cyanamide and more rapid in its action. Or, 65 kilos. of calcium cyanamide are mixed with 1000 litres of ordinary non-concentrated sulphite liquor (6·5° B.), and the mass is heated, after which the mixture is left to stand for some time until precipitation is complete, and the liquor is then separated and the precipitate washed, or the whole is employed as a manure without separating : the precipitate contains 81·55 per cent. of the organic matter present in the sulphite liquor. —F. Sodn.

Fertilisers. L. R. Coates, Baltimore, U.S.A. Eng. Pat. 22,851, Oct. 3, 1910.

See U.S. Pat. 971,830 of 1910 ; this J., 1910, 1262.—T. F. B.

XVII.—SUGARS ; STARCHES ; GUMS.

Raffinose content of raw beet sugars, and the ratio of ash to organic non-sugar. F. Strohmer. Wochensch. Zentralver. Rübenzuckerind. Oesterr.-Ungar., 1911, **49**, 265—266. (Cf. also this J., 1910, 968.)

At the Raffinose Conference held some months ago in Berlin it was stated by the British chemists that raffinose is probably present in a raw beet sugar when the analysis shows a lower ratio of ash to organic non-sugar than 1·5 (see also this J., 1910, 1219). This view, however, is not held by the author. In the case of 21 first-product raw sugars, which came from different Austro-Hungarian factories, and which contained no measurable amount of raffinose, he found that no fixed relationship could be observed between the ash and organic non-sugars, the ratio in question being in some higher and in others lower than 1·5, with extremes of 1·86 and 1·02. Contrary to the contention of the British chemists that a low ratio indicates the presence of raffinose, the figures obtained appear to point to the fact that the lower the ratio the better is the agreement between the direct polarisation and the sucrose value calculated from the raffinose formula, although a greater number of analyses are required to make this more conclusive. Further, the author has examined over 300 different raw beet sugars, which neither wholly nor partly originated from a molasses desaccharification process, and were not after-products, and found in these that the difference between the direct polarisation and sugar content by Clerget varied between −0·38 and + 0·28 per cent., so that in all raffinose could be assumed to be absent. From these figures it results that the presence of measurable amounts of raffinose is to be confined to sugars originating either wholly or partly from a desaccharification process. For such sugars the author agrees that the contention of the British chemists is valid, since in these he has found that the raffinose content is always the higher the smaller the ratio of ash to organic non-sugar.—J. P. O.

Calcium saccharate; Technically prepared ——, and its behaviour in raw juice. A. T. Höglund. Z. Ver. deut. Zuckerind., 1911, 375—385.

In the calcium saccharate resulting from the Steffen process of recovering sugar from molasses, there is present about 100 parts of lime (calcium oxide) to 100 parts of sugar, whereas theoretically there should be only 49·1, this large excess of lime being principally in the form of oxide with only a small proportion as hydroxide. On investigating the behaviour of this impure saccharate when it is treated in the malaxeur previous to being added to the raw juice for decomposition by carbonatation, the author found that the greatest amount of trisaccharate it is possible to obtain under ordinary conditions of working is produced when the compound is added (*a*) so that the calcium oxide present is not slaked, *i.e.*, either in the solid state or else mixed with a small amount of water or sweet-water, and (*b*) in such amount that the total lime content of the resulting mixture is 2 to 3 per cent. on the weight of roots worked. If, on the contrary, before adding the saccharate to the juice it is mixed with a sufficient amount of water or sweet-water to slake all the lime, then the amount of insoluble saccharate formed is not appreciably more than if milk of lime or lime in pieces had been used. Attention is called to the fact that the presence of a large amount of trisaccharate in raw juice always causes a distinctly troublesome saturation, and that this is due not only to the trisaccharate itself, but also to the double compound of sucrose and calcium carbonate, which is gelatinous, and decomposed by the gas only with difficulty. Calcium trisaccharate can often be entirely decomposed only by over-saturation, but this is undesirable, so that the alternative is to allow the last traces of this compound to pass into the scums.—J. P. O.

Evaporation of sugar solutions; The rational limit of concentration in the ——. O. Claassen. Chem.-Zeit., 1911, 35, 381—382.

That when concentrating the thin-juice of the sugar factory to massecuite it is more economical to utilise the steam in the multiple effect, rather than in the vacuum pan, is shown by the following calculation, in which (1) the evaporation of the thin-juice is continued to 40° Brix, and (2) it is carried to 55° Brix. In both cases it is assumed that 100 kilos. of roots are worked, that 115 kilos. of thin-juice at 13·5° Brix are obtained, and that the evaporative power of the coal used is 8·5 kilos. (1) In order to evaporate the thin-juice from 13·5 to 40° Brix in the quadruple effect, the amount of water to be expelled is 115 $(1-\frac{13·5}{40})$=76·2 kilos., corresponding to 76·2 × 0·26=19·81 kilos. of steam or $\frac{19·81}{8·5}$ = 2·33 kilos. of coal. This thick-juice is now boiled in the vacuum pans to a massecuite containing 95 per cent. of dry substance, and in so doing the amount of water evaporated is 115−76·2 $(1-\frac{40}{95})$=27·46 kilos., corresponding to 27·46 × 1·1=30·21 kilos. of steam, or $\frac{30·21}{8·5}$ = 3·55 kilos. of coal. Hence for the entire evaporation there is necessary in the quadruple 2·33, and in the pans 3·55 kilos., a total of 5·88 kilos. of coal. (2) In evaporating the thin-juice from 13·5 to 55° Brix in the quadruple, the amount of water to be evaporated is 115 $(1-\frac{13·5}{55})$=86·25 kilos., corresponding to 86·25 × 0·26=22·43 kilos. of steam, or $\frac{22·43}{8·5}$=2·64 kilos. of coal. When boiling this thick-juice in the vacuum pans to the massecuite of 95 per cent. dry substance, the water to be expelled is 115−86·5 $(1-\frac{55}{95})$=12·65 kilos., corresponding to 12·65 × 1·1 = 13·92 kilos. of steam, or $\frac{13·92}{8·5}$=1·64 kilos. of coal. In this case there are required in the quadruple 2·64, and in the pans 1·64 kilos., a total of 4·28 kilos. of coal. Therefore, in the example given, there is an economy of 5·88−4·28=1·60 kilos. of coal in favour of utilising the steam in the effect rather than in the pans.—J. P. O.

Waste waters [of the beet sugar factory]; The Hoyermann-Wellensiek process for purifying the ——. H. Thein. Deutsche Zuckerind., 1911, **36**, 286—287.

In the beet sugar factory the waste waters from the washers, the diffusion battery, and the chip-presses are generally purified by simply liming and settling, which procedure is unsatisfactory, owing to the occurrence of putrefaction, hydrogen sulphide being evolved, and the water darkened. It is stated that during the past campaign excellent results as regards the purification of the different waste waters of the factory were obtained by the use of the Hoyermann-Wellensiek process, which consists in the use of a preparation called "Humin," obtained by treating brown coal rich in humic substances with caustic soda. By mixing the "Humin" with warm condenser water, and using a sufficient volume of this to impart a light brown colour to the waste water, and then liming to weak alkalinity, a voluminous precipitate, was obtained, which rapidly subsided, leaving the water clear and practically free from bacteria. For a beet sugar factory having a daily slicing capacity of 9,000 ctr. (443 tons), 2·5 to 3 ctr. (275—330 lb.) of the preparation were found to be necessary. Figures are given indicating that by this treatment the amounts of suspended matter and proteins present were considerably diminished.—J. P. O.

Invertase; Action of —— on polysaccharides [polyoses] derived from laevulose. E. Bourquelot and M. Bridel. Comptes rend., 1911, **152**, 1060—1062.

By the action of invertase on sucrose, raffinose, gentianose or stachyose, lævulose is split off, the rest of the molecule remaining intact. It has been suggested that this uniform action of the enzyme is due to the presence of the sucrose grouping in all these sugars, and the authors have carried out experiments to determine whether lævulose is formed from all of them with the same readiness. Equimolecular solutions containing 1/342 grm.-mol. of sugar per 100 c.c. were treated with invertase prepared from yeast, and were examined after 9 days. The whole of the sucrose was hydrolysed, 31·9 per cent. of the raffinose, 25·5 per cent. of the gentianose and 11·1 per cent. of the stachyose. If the sucrose group is present in all these sugars, the number and nature of the other groups clearly have an important influence on the rate at which the lævulose is split off. The authors consider that the hexose groups are not linked together, end to end, in the sugar molecules; the lævulose complex is probably united not only to dextrose but to the other hexose groups present.—J. H. L.

Sugars; Action of ammonia and of sodium carbonate on various —— in dilute aqueous solution. A. Jolles. Biochem. Zeits., 1911, 32, 97—100.

At 37° C., $N/100$ ammonia, unlike $N/100$ sodium hydroxide (this J., 1910, 1401), has no action on the rotatory powers of dilute solutions (0·2—1·0 per cent. concentration) of arabinose, dextrose, lævulose, galactose, and maltose, in the course of 24 hours, and the action of $N/10$ ammonia is less marked than that of $N/100$ sodium hydroxide. According to Lobry de Bruyn, the reaction between alkalis and dextrose, lævulose, and mannose, is due to OH-ions, and the differences observed by the author are to be ascribed to the difference between the degrees of electrolytic dissociation of ammonium and sodium hydroxides. This view is borne out by the observation that whilst $N/1$ ammonia only decreases the rotatory power of a 1 per cent. solution of dextrose from 2·9° to 2·5° in 24 hours, $N/10$ ammonia which, being more dilute, is more dissociated than $N/1$ ammonia, decreases it to 2·0°. The action of sodium carbonate also is less marked than that of sodium hydroxide, the concentration of OH-ions in the former case being much less than in the latter.—L. E.

Sugar-palm of the East Indies. J. Roy. Soc. Arts, 1911, **59**, 567—569.

The sugar-palm (*Arenga saccharifera*) is found abundantly in the Dutch East Indies, and yields sugar, a fermented beverage, called *sagueiro*, and cordage, caulking material for boats, and brooms. The male inflorescence is bruised with a wooden pestle, and the exuding sap collected in large bark buckets, and is drunk fresh or allowed to ferment. One flower-stalk will often yield sap for 2 to 6 months, and as one fails another comes to maturity; the life of a palm which is tapped regularly is said to be 15 to 20 years. The palm sap is also boiled down in shallow iron pans set on the top of a mud or clay furnace, fired with wood. The syrup is removed to empty cocoanut shells, cut in halves, by means of rough iron ladles, and is allowed to set. The product, resembling toffee in taste, is either broken up like ordinary brown sugar, or melted down with water to a syrup which is eaten with sago. The palm sugar is now being displaced by cane and beet sugar. —W. C. H.

Patents.

Sucrose; Process of extracting ——. C. Rosenow, Peroia, Ill. U.S. Pat. 989,876, April 18, 1911.

After grinding the cane in one or more mills, the bagasse obtained is subjected to maceration, and very light pressure or other suitable means applied, so as to obtain a portion of the juice poorer in sugar content than that remaining in the macerated bagasse. The thin-juice extracted in this way is used and re-used for maceration, and finally the bagasse so treated is ground in another mill, in order to extract from it as much of the remaining juice as possible.—J. P. O.

Glucoses, etc.; Manufacture of commercial —— *from amylaceous residues of any origin.* J. J. Levrat and A. Batiat. Fr. Pat. 423,845, Feb. 25, 1910.

The material (*e.g.*, 100 kilos. of starch manufactory residues containing 50 per cent. of amylaceous matter) is partially saccharified by heating with oxalic acid (100 grms.), carbonic acid (5 litres) and water, under pressure. The product is filtered and completely saccharified by heating with hydrochloric acid (50 grms.) under pressure. If the impurities do not form soluble compounds, the partial saccharification may be dispensed with. The saccharified product is treated, at 30° C., with sufficient milk of lime to render it slightly alkaline, saturated with carbon dioxide, heated to 80° C., filtered and concentrated. In some cases it is necessary to decolourise the raw material; this is effected by means of metallic hydroxides.—L. E.

Sugar; Process of crystallising ——. P. Kestner, Lille, France. U.S. Pat. 989,366, April 11, 1911.

See Fr. Pat. 412,285 of 1910; this J., 1910, 1029.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Hops and yeast; Experiments relating to ——. H. W. Harman. J. Inst. Brewing, 1911, **17**, 357—379.

The determination of the tannin gives little indication of the brewing value of hops. Their preservative value is judged best, but probably imperfectly, by means of their content of soft resins. Experiments are described showing that after cold storage for two years, a sample of East Kent hops suffered no appreciable loss of soft resins when stored for another year in a brewery under ordinary conditions. Other experiments concerned the extraction of resins during hop-boiling. Various kinds of hops were boiled for two hours with wort of gravity 1050. Whilst the quantity of total resins extracted was about the same in all cases (50 per cent. of the amount present), the proportions of the soft and hard resins respectively which were extracted varied with the quantity of each originally present. The extracted hop oils which have from time to time been offered to brewers have not on the whole proved satisfactory substitutes for the actual oil as it is present in the hop.

Experiments have been carried out on the reproduction of yeast, especially in its relation to the assimilation of nitrogen. In the main series yeast was grown in a first wort (tapped at a gravity of 1090 and broken down to 1058) and a third wort (tapped at 1029·4 and boiled down to 1050). The weaker wort after boiling down contained more nitrogenous matter than the first wort at the same gravity, but was much thinner in palate flavour. During fermentation, attenuation proceeded further in the case of the third wort; more yeast, containing a somewhat higher protein-content, was produced, and the resulting beers contained slightly more nitrogen than in the case of the first wort. The yeast produced with the third wort was of much poorer quality than with the first wort. Further experiments in which yeast was grown in sucrose solutions containing peptone gave rise to the following conclusions: When the quantity of nitrogen in the medium is varied, the same proportion of it (30—40 per cent. in the case of ordinary worts) is always utilised by the yeast. Variations in the amount of yeast used for pitching do not alter the total quantity of nitrogen withdrawn from the wort nor the amount of new yeast formed. The proportion of protein in the yeast depends to some extent on the nitrogen-content of the wort, but if afterwards the yeast is grown in an ordinary wort of gravity 1055 the product has the normal content of protein.—J. H. L.

Hops; Determination of the α- and β-bitter acids in ——, *and the application of the results in brewery practice.* G. Feuerstein. Z. ges. Brauw., 1911, **34**, 187—191, 197—200. (Cp. Lintner, this J., 1908, 1170.)

Lintner has described a method for determining the α- and β-bitter acids of hops (Z. ges. Brauw., 1908, 31, 407) which consists in heating a mixture of 10 grms. of the hops and 300 c.c. of petroleum ether (b. pt. 30°—50° C.) under a reflux condenser on the water-bath for about 8 hours; the whole is then cooled, made up to 505 c.c. (5 c.c. corresponding to the volume of the hops), and filtered at once, 100 c.c. of the filtrate being treated with 80 c.c. of 96 (volume) per cent. alcohol, and titrated with $N/10$ alcoholic potassium hydroxide in presence of phenolphthalein. Though the results do not represent absolute values, they are useful as a means of comparison, and are of great importance in judging hops. The author shows, however, that the use of petroleum ethers with such a wide range of boiling-points as 30°—50° C. leads to serious error. Thus, the content of bitter acids in a sample of hops was found to be 7·60 per cent. when petroleum ether boiling at 31°—32° C. was used for extraction, and 10·69 per cent. when petroleum ether boiling at 46°—47° C. was employed. Practically uniform results are obtained with petroleum ethers of boiling-points ranging between 45° and 50° C., and further experiment shows that a mixture of petroleum ether of lower boiling-point with such a quantity of light or heavy petroleum benzine that the boiling-point of the whole lies between 45° and 50° C. may also be used with satisfactory results. The petroleum ether recovered by distilling the liquors obtained in previous determinations contains alcohol, and should not be used again. The author confirms Lintner's statement that the hops should be ground prior to extraction, and Neumann's statement that with ground hops, an extraction period of 6 hours is sufficient. The content of bitter acids in hops varies widely in different years, and according to the district in which the hops are grown. An average content of 10 per cent. of bitter acids in air-dry hops may be taken as a basis in determining the amount of hops to be added to the wort, the amount added being greater or less according as the bitter acid content is below or above this figure. With this precaution, and by using ground hops, considerable economy should be effected.—L. E.

Yeast; Influence of salts on the autofermentation of ——. (*Prelim. note.*) A. Harden and S. G. Paine. Chem. Soc. Proc., 1911, 27, 103.

It has been found by one of the authors, during an investigation of the permeability of the yeast-cell envelope, that the entrance of such salts as sodium chloride and sodium phosphate is imperceptible when dilute solutions are allowed to act for a short time, and comparatively small even after prolonged immersion of the cells. When, however, more concentrated solutions are employed, an appreciable entrance of the salts is indicated. These facts, in view of the recent work of H. E. and E. F. Armstrong (Proc. Roy. Soc., 1910, *B*, 82, 588), therefore suggested the advisability of ascertaining the effect of such salts on the autofermentation of the yeast. For the experiments here given, top yeast obtained from a London brewery was freed from wort by the simple expedient of pressing, which had been found to give practically quantitative removal of the interstitial liquid; washing was avoided in order that osmotic equilibrium of the cell contents might remain undisturbed. Three to five grams of such yeast were accurately weighed out for each experiment, wrapped in tissue paper, and dropped into a flask containing a measured quantity of the liquid under investigation, previously saturated with carbon dioxide at 25°. The gas evolved by autofermentation of the yeast was measured periodically by means of the apparatus described by Harden, Thompson, and Young (Bio-Chem. J., 1910, 5, 230, and this J., 1910, 1324). In experiments with sodium chloride and ammonium sulphate it has been found that when these salts are present in decimolar concentration no effect is produced on the autofermentation, but when molar solutions are employed the rate of fermentation is very considerably enhanced during the first four or five hours, so that the volume of carbon dioxide yielded in presence of the salt is three times as great as that given by a water control. At this point, however, the autofermentation in the former case comes abruptly to an end, and eventually after four or five days the volume of gas given in the two cases is approximately the same. A similar result has also been obtained with a number of other salts, including phosphates, arsenates, acetates, and citrates. In a recent paper by C. Neuberg and A. Hildesheimer (this J., 1911, 379) it is stated that salts of pyruvic acid are fermentable by yeast, and that this property is also exhibited by salts of glyceric and lactic acids. Similar experiments have been carried out with these salts, and these have shown that the two latter exhibit precisely the same phenomenon as that observed in the case of sodium chloride, whilst with potassium pyruvate the rate of fermentation during the first four hours is exactly comparable with that in a sodium chloride control. At this point, however, the fermentation in presence of the latter salt slackens, while the evolution of gas from the pyruvate solution continues and only gradually diminishes. Eventually after four days some 60 c.c. of carbon dioxide are yielded in presence of 2·4 grms. of potassium pyruvate in excess of the volume given by the control. The provisional conclusion of Neuberg and Hildesheimer that these salts undergo fermentation by yeast cannot, therefore, be accepted until experimental proof is forthcoming that the carbon dioxide is actually derived from them, and not from the constituents of the yeast. The increase in the rate of autofermentation produced by the addition of salts to living yeast may be explicable on the lines suggested by H. E. and E. F. Armstrong, or it may be that, as a result of plasmolysis of the cells, the glycogen is thrown into more intimate contact with the glycogenase. The acceleration does not appear to be due to a stimulating influence on the glycogenase, since when added to yeast juice in equivalent concentration sodium chloride tends to inhibit, rather than to enhance, the rate of autofermentation.

Pressed yeast; Modern manufacture of ——. W. Kiby. Chem.-Zeit., 1911, 35. 421—423, 434—436.

The author describes the old Vienna-process of yeast manufacture and the various improvements which have been made since the introduction of the aeration-process. In the Vienna-process the fermentation is carried out in unfiltered mashes made from ground kiln-dried malt and other corn-grist. The yeast is first made to ferment vigorously in a small mash prepared from equal parts of ground malt and rye and rendered acid by the growth of lactic acid bacteria. When fermentation has reached a certain stage in this medium, the whole is added to the main mash. After fermentation of the latter is completed the yeast is skimmed off the wort, allowed to come to rest in cold water, and then pumped to sifting machines which remove the undissolved portions of grain. The yeast is then washed with water several times and pressed. The quantity of yeast obtained by this process is 10—14 per cent. of the grain used, whilst the yield of alcohol is about 30 per cent. In Germany the process is still used by a few factories, the yeast produced by it being employed mainly for carrying out fermentations by the aeration process. It is used more generally in Austria, France, Belgium and Holland. The discovery that strong aeration of the wort during fermentation increases largely the amount of yeast produced, led to the inception of the aeration process, which, even in its earlier forms, gave a yield of yeast of 20—25 per cent., the yield of alcohol falling at the same time to 20—22 per cent. Later modifications of the process have been made with a view, on the one hand, to increasing still further the production of yeast, and on the other to maintaining the quality of the product by supplying the most favourable conditions for the growth and nutrition of the yeast. The fermentation is carried out in filtered worts, to avoid subsequent removal of undissolved grain from the yeast. In order that the proteins and carbohydrates of the grain may be hydrolysed as completely as possible, green malt is employed instead of kilned malt, on account of the greater activity of its enzymes. Rye, instead of being ground, is steeped for 12—15 hours and allowed to germinate until the rootlet appears. As in the Vienna-process lactic acid is allowed to form in the mash. This assists in the decomposition of proteins and also stimulates the yeast. The author considers that dilution of the wort leads to a more rapid assimilation of nourishment by the yeast. He recommends also that the fermentation should be begun at 25° C., the temperature afterwards being allowed to rise to 30° C. Towards the end of the fermentation aeration should be less vigorous and the temperature should be lowered to 24° C. Attempts to increase the production of yeast by greatly increased aeration, combined with low temperatures (*e.g.*, 15° C.) during the early stages of fermentation, have led to yields of yeast as high as 40 per cent. The quality of the yeast in such cases is, however, very poor, and the yield of spirit rarely exceeds 14—15 per cent. Excessive aeration, moreover, favours the growth of Mycoderma yeasts, which have almost no fermenting power, and which, under these conditions grow more rapidly than the yeast, especially if the acidity of the wort is only slight. An acidity corresponding to 2 c.c. of $N/1$ alkali per 100 c.c. of wort is usually sufficient to check their growth. The use of the same yeast in successive fermentations, although allowing an important economy, is attended with certain dangers. The yeast, after a time, is liable to flock together in the wort, and assume a state in which it cannot be pressed well. This evil may be remedied by maintaining in the clarified wort (after removal of carbon dioxide) an acidity corresponding to 2 c.c. of $N/1$ caustic soda per 100 c.c. From time to time it is necessary to introduce fresh yeast into the factory; for this purpose a pure culture, or yeast from the Vienna-process is recommended. A successful application of centrifugal force has been made for the complete removal of suspended yeast from the liquors drawn off from the main deposit of yeast. For the testing of pressed yeast the following methods are described :—Added starch (potato-starch, etc.), may be distinguished from that normally present, by microscopic examination. The grains of the former have an appearance characteristic of their source, whilst those of the latter are eroded by diastatic action. In yeast prepared by the Vienna-process the starch present may amount to 4 per cent., especially if, in order to avoid weakening the yeast, it has been imperfectly washed. For the determination of " strength " the method employed by the Association of German Yeast Manufacturers is recommended. Ten grms. of yeast are well mixed with 160 c.c. of a solution containing 8 grms. sodium of chloride and 2 grms. of sugar, at 30° C. The mixture is kneaded for 10 minutes with 280 grms. of flour (at 30° C.), and the dough is then quickly rolled in the hands and dropped into a baking tin, which is placed in an oven at 33°—35° C. According to the time taken by the dough to rise to a certain point, the yeast is approved, rejected or submitted to a further baking test at 230°—250° C. As a preliminary test for the presence of admixed bottom-fermentation beer yeast the following procedure of Herzfeld may be adopted. Ten c.c. of a 1 per cent. solution of raffinose are mixed with 1 grm. of yeast and kept for 24 hours in an Einhorn fermentation tube at 30°C. A similar tube containing yeast with water, instead of raffinose solution, serves as control. Assuming that the closed limb of the tube holds 5 c.c., if the volume of carbon dioxide evolved is not more than 2·5 c.c. (after subtracting that in the control tube), the pressed yeast may be regarded as free from bottom-fermentation yeast. The latter, however, is certainly present if the volume of carbon dioxide exceeds 4·5 c.c. (allowing for the control). A further test is then carried out by the method of Bau. Three tubes, each containing 10 c.c. of a 1 per cent. solution of raffinose and 0·4 grm. of pressed yeast, are kept at 30°C. for 24, 48 and 72 hours respectively. At the end of 24 hours the contents of the first tube are filtered and 3 c.c. of the filtrate are boiled with 1 c.c. of Fehling solution. If, after the precipitate has settled, the upper liquid remains blue, the yeast contains more than 10 per cent. of bottom-fermentation yeast. Similar results with the contents of the second and third tubes indicate the presence of 5 and 1—5 per cent. in the respective cases. These results should be controlled by an examination of the yeast by Lindner's drop-culture method,which permits of the detection, and even an estimation of the relative numbers of foreign organisms. Top- and bottom-fermentation yeasts, and wild yeasts such as Mycoderma (with no fermenting power), may, in this way, be distinguished by their manner of growth, and dead cells by absence of growth.—J. H. L.

Lead arsenate [*insecticide*] *on grapes ; Elimination of —— during the manufacture of wine.* L. Moreau and E. Vinet. Comptes rend., 1911, **152**, 1057—1060.

GRAPES gathered from vines which had been treated abundantly with lead arsenate insecticide in August (see this J., 1911, 40, 41) were found to contain 46·61 mgrms. of the salt per kilo. After pressing, 85·3 per cent. of this amount was retained in the marc. Of the remaining 14·7 per cent. in the must, more than half was deposited with the yeast-sediments. The marc was fermented for 10 days, during which time only 8·4 per cent. of the lead arsenate contained in it was extracted. On the basis of these results the authors calculate that in the case of vines treated two or three times with lead arsenate before the flowering stage (*loc. cit.*), the wines produced can contain normally only minute traces of lead and arsenic—traces such as may be found in the products from vines which have had no arsenical treatment. If, however, the vine is treated after flowering, larger quantities of the poison may find their way into the wine.—J. H. L.

Tartars ; Destruction of —— by fermentation. C. Ordonneau. Bull. Soc. Chim., 1911, **9**, 398—402.

THE spontaneous fermentation of crude tartars (calcium tartrate and potassium hydrogen tartrate) in the presence of water, may take place under anaerobic or aerobic conditions. Anaerobic fermentation is due to a bacterium and leads to the production principally of acetic acid ; formic, butyric, and traces of higher acids (identified by fractionation of the corresponding ethyl esters) are also formed, but not propionic acid. Aerobic fermentation is brought about by moulds and converts the tartrates into carbonates, the normal tartrate being formed as an intermediate product from the potassium salt.—F. SODN.

Barley grain ; Life-history of a ——. W. G. Smith. J. Inst. Brew., 1911, **17**, 347—355.

Ale brewers ; Points of interest to —— in the vinegar brewer's mash-tun. H. C. A. Vine. J. Inst. Brewing, 1911, **17**, 322—337.

Action of invertase on polysaccharides [*polyoses*] *derived from lævulose.* Bourquelot and Bridel. See XVII.

PATENTS.

Wines ; Clarification of sparkling —— under pressure of an inert gas and in absence of air. A. Marone. First Addition, dated Nov. 22, 1910, to Fr. Pat. 388,256, Mar. 17, 1908 (this J., 1908, 914).

IN the process originally described, the wine was clarified under pressure of carbon dioxide ; this gas is rather costly, however, and its use also involves the danger that the wine may become excessively carbonated. In the process as now modified, these disadvantages are obviated by the use of nitrogen instead of carbon dioxide. The nitrogen is obtained by the complete combustion, in presence of air, of a substance composed exclusively of one or more of the elements : carbon, hydrogen, and oxygen (*e.g.*, carbon, ethyl alcohol, acetylene) ; the quantity of air is so regulated that all the oxygen contained in the combustible material and in the air itself, is converted into carbon dioxide and water. The residual nitrogen is cooled and purified by washing with cold water and a solution of alkali.—L. E.

Asphodel ; Industrial treatment of —— [*Production of alcohol, etc.*]. A. Badoil. Fr. Pat. 423,043, Nov. 23, 1910.

THE tubercles of the plant are first macerated in boiling water in order to remove resins, wax, etc., and then subjected to a current of steam under a pressure of about 3 kilos. for 1—2 hours. The tubercles (with as much of the roots as possible) are now crushed and pressed, the juice obtained, which is very rich in fermentable matter, being slightly acidified and boiled for 1—2 hours in order to convert the fermentable matter into glucose. The juice is then purified with animal charcoal, and either fermented, whereby alcohol of very good quality is obtained, or concentrated to a syrup for the preparation of beverages. The water from the preliminary steep, after serving for two or three operations, is concentrated, and yields a very black paste which may be used as a boot polish, etc. The stalks and leaves of the plant, treated in the same way as the tubercles, also give fatty products and fermentable juice, from which saleable products are obtainable. The stalks are considerably softened by the treatment with steam under pressure, and on grinding, yield fibres suitable for paper-making ; the parts separated from the fibres may be collected on filters, pressed, and used as cattle-fodder. The seeds may be freed from resins by treatment with hot water and then treated in the same way as the tubercles, the product obtained being a valuable adjunct in the manufacture of cattle fodder.—L. E.

Saccharification and fermentation by Mucedinae ; Rapid process of ——. Soc. Française Amylo. Fr. Pat. 423,336, Feb. 12, 1910.

Mucedinae are cultivated in a restricted quantity of nutrient liquid, or in a dilute nutrient liquid, or the culture is very strongly aerated during growth ; under these conditions, the mycelia develop conidia, gemmae, or chlamydospores. The culture is employed in this modified condition in the distillery, its rate of growth in the must, and its enzymic activity being much increased. —L. E.

Fermenting process. D. Forster, Budapest, and P. Finitzer, Batorkeszi, Hungary. Eng. Pat. 8652, April 9, 1910. Under Int. Conv., April 10, 1909.

See Fr. Pat. 415,022 of 1910; this J., 1910, 1266.—T.F.B.

Malt; Process of treating ——. W. Reinhardt Frankfort on Maine, Germany. U.S. Pat. 989,421, April 11, 1911.

See Eng. Pat. 13,108 of 1910; this J., 1910, 1222.—T.F.B.

XIXa.—FOODS.

Milk; Nature of the cellular elements present in ——. *Part III. The milk of animals other than the cow.* R. T. Hewlett, S. Villar, and C. Revis. J. of Hygiene, 1911, **11**, 97—104.

The results of experiments with samples of milk from asses, goats, and from human subjects, confirm the conclusions already arrived at in the case of cows' milk (this J., 1910, 38). A uniform type of life evidently tends to a fairly uniform excretion of tissue cells from the udder; outside causes temporarily increase this excretion, whilst some of the samples of human milk showed plainly that the presence of a very large number of cells is not by any means necessarily connected with any diseased or disordered condition of the mammary gland. When, for any reason, the number of cells is high, the cells themselves are always well-defined, showing little signs of degeneration and stain in a much more characteristic and definite manner, a fact which is difficult to explain if they are considered to be blood elements.—W. P. S.

Milk; The alcohol test and the acidity of ——. G. Fendler and C. Borkel. Z. Unters. Nahr. Genussm., 1911, **21**, 477—480.

The authors have investigated a test proposed for ascertaining the freshness of milk, which consists in mixing the milk with twice its volume of 50 per cent. alcohol (by vol.). Should the milk be fresh, or its acidity be not more than about 8 Soxhlet degrees, curdling does not take place, but when the acidity is higher the milk is curdled by this treatment. As the result of the examination of some hundreds of samples of milk, the authors are of opinion that the test is useful as a preliminary test for ascertaining the quality of milk, although there is no very definite relation between the results obtained and the acidity of the milk samples. The use of 70 per cent. alcohol in the test cannot be recommended.—W. P. S.

Phosphorus in milk; Determination of ——. Bordas and Touplain. Comptes rend., 1911, **152**, 1127—1128.

In reply to criticisms by Fleurent and Levi (this J., 1911, 510), the authors still adhere to their statement that in the incineration of a milk residue with ordinary precautions, there is no loss of phosphorus either by the action of carbon on the phosphates, or the formation of volatile phosphorus compounds from the fats. The addition of foreign basic substances to retain the phosphorus is not considered necessary.—F. Shdn.

Proteins; Studies on the precipitation of ——. A. J. J. Vandevelde. Bull. Soc. Chim. Belg., 1911, **25**, 166—173.

It is shown that the different proteins of milk, colostrum, meat-serum, and eggs, when subjected to various treatments (such as subjecting their solutions to the action of dimethylketone, methyl alcohol, ethyl alcohol, etc.), are to some extent transformed from one kind to another. For instance, in the case of milk, different quantities of the various lacto-proteins are precipitated by the ordinary reagents according to the treatment to which the proteins have been subjected, although the total quantity of the proteins remains the same. These changes resemble those observed by Wolff and Fernbach in the case of soluble starch (this J., 1903, 1302).—W. P. S.

Cocoa powder; Determination of husk in ——. W. L. Dubois and C. I. Lott. J. Ind. Eng. Chem., 1911, **3**, 251—252.

Having found by the examination of 13 varieties of cocoa shells that the percentage of constituents of higher specific gravity than 1·535 ranged from 21·26 to 52·2 (the average being almost 37·0), the authors tested a number of prepared samples, containing known amounts of husk, by Goske's method (this J., 1910, 369), adopting their own average figure as the factor. From the results obtained the authors are of opinion that Goske's method is only approximately accurate when the precise factor for the added shell is known, and consider that for commercial cocoa powders, it is quite unreliable.—W. E. F. P.

Coffee; A new adulterant of ——. C. Griebel and E. Bergmann. Z. Unters. Nahr. Genussm., 1911, **21**, 481—484.

Attention is drawn to the use (in Germany) of the seeds of *Lathyrus sativus* L. as an adulterant of coffee. The roasted seeds are readily detected in admixtures with roasted coffee beans and their presence in ground coffee may be detected by microscopical examination. The cellular tissue of the testa is a characteristic feature, although similar tissue is found in vetches, etc. The starch grains which are present in *Lathyrus sativus* seeds are generally so distorted by the roasting that their identification is difficult.—W. P. S.

Viburnum lentago; Fruit of ——. C. E. Gillette. Chem. News, 1911, **103**, 205—206.

The sweet viburnum, *V. lentago*, is a shrub from 8 to 20 feet high, which is common as an undergrowth in the forests of North America. The fruit is sweet and edible, and may be used as a substitute for raisins. Its average weight is about 0·3 grm. The sample examined lost nearly 50 per cent. in weight when dried, and yielded 56 per cent. of extract to alcohol, and an additional 2·5 per cent. to water. The sugars consisted of lævulose and a small amount of dextrose. The dried residue, extracted with ether, yielded 4·25 per cent. (calculated on the fruit) of a light yellow oil with a sweet taste and a characteristic odour. It became thicker, but did not solidify at −24 C. It had a sp. gr. of 0·8654 at 15° C. and a saponification value of 218. When heated to 70° C. and cooled, it rapidly formed a film upon the surface, whilst after boiling it formed a transparent varnish which dried rapidly, yielding a practically colourless film. After standing for 30 days at 15° C. the sp. gr. of the oil had increased to 0·9039. The unsaponifiable matter (nearly 25 per cent. of the oil) was of a reddish amber colour, and had a rancid odour recalling that of old hickory nuts. Its saponification value was 166. The fatty acids, after removal of the unsaponifiable matter, had an odour of lard. They separated into an upper yellowish-brown layer solidfiying at −12° to −14° C. and a clear acid solidifying at about 0° C. A light-coloured soluble acid solidifying at 25° to 30° C. was also separated from the saponified product. The ash in the fruit amounted to 2·53 per cent. Malic acid was the predominating organic acid, and there was a slight trace of tannin.—C. A. M.

Colza seed-cake; Greening of ——. L. Bussard. Les Matières Grasses, 1911, 4, 2199—2200.

It is a common practice to add to Indian colza seed-cake from 0·75 to 1 per cent. of sodium carbonate with the object of reviving the green colour of the chlorophyll, and thus meeting the demand of the merchants for a green product, such as that produced in Normandy. There are also certain European colza seed-cakes which, owing to their mode of preparation, age, or the presence of impurities, have a brown or blackish-brown tint. Samples of the Indian treated product were of a greenish-yellow colour with a somewhat brownish tint near the surface or in the fractures, and superficially these resembled the fresh green seed-cake sufficiently to be bought by the farmers for feeding stuffs instead of being used as the brown products for fertilisers and thus fetching a much lower price. The microscope affords the best means of distinguishing between Indian colza seed-cakes (from *Brassica juncea, Sinapis dichotoma, S. glauca, Eruca sativa*, etc.) and French colza seed-cake (from *Brassica oleracea*).—C. A. M.

Dyestuffs; Action of artificial organic —— on the peptolysis of proteins. L. Guglialmelli and H. Damianovich. Rev. Gén. Mat. Col., 1911, **15**, 129—131.

THE authors have studied the effect of small quantities of artificial organic dyestuffs on the digestion of albumin by pepsin. The dyestuffs were used in the form of 0·1 per cent. solutions and the pepsin dissolved in 0·3 per cent. hydrochloric acid. In the tests 25 c.c. of the pepsin solution were used, with 5 c.c. of the dyestuff solution, and control tests with 5 c.c. of distilled water instead of the dyestuff solution were also carried out. The results show that the digestion of albumin by pepsin is prevented or considerably retarded by acid dyestuffs, *i.e.*, by those dyestuffs which dye animal textile fibres in an acid solution. Picric acid is especially active in this respect, preventing digestion even at a concentration of 1 in 6000. Basic dyestuffs, on the other hand, have little or no effect. The authors are extending their work with a view of studying the effects of dyestuffs on the pancreatic digestion of proteins and starchy substances in an alkaline medium, and on the digestion of the same substances by papaïn in a neutral medium.—A. S.

Modern manufacture of pressed yeast. Kiby. *See* XVIII.

Colourimetric determination of iron [in milk, etc.]. Lachs and Friedenthal. *See* XXIII.

PATENTS.

Soluble protein or albumin and a process for the production of the same from meat fibre or other insoluble protein matter. S. A. Vasey, Bromley, Kent. Eng. Pats. 14,611, April 11, 1910, and 3766 of 1911, dated June 16, 1910.

THE process described in Eng. Pat. 20,766 of 1909 (this J., 1910, 1224) may be modified as follows: The solution of the meat, obtained by dissolving the meat in sodium hydroxide solution, is neutralised by the addition of phosphoric acid containing calcium phosphate, or calcium acid phosphate, and "an equivalent quantity of ammonium carbonate or ammonia is added." The mixture is then boiled, filtered, and the filtrate evaporated.—W. P. S.

Bread; Process of making diabetic ——. A. Pfeffer, Ulm, Germany. U.S. Pat. 989,189, April 11, 1911.

GLUTEN flour is made into dough, hydrogen peroxide is added, and the dough is baked. It is claimed that the process ensures rising and relatively great aeration of the loaves, and the elimination of the gluten flavour from the latter.—W. P. S.

Baking preparation. W. B. Brown, Chicago, and R. A. Holbrook, Chicago Heights, Ill., Assignors to Victor Chemical Works, Chicago, Ill. U.S. Pat. 990,699, April 25, 1911.

THE baking powder claimed is a mixture of an alkali carbonate or bicarbonate with a non-hygroscopic acid phosphate of calcium of approximately the composition $CaH_2P_2O_7$. The acid phosphate is prepared by the dehydration of acid orthophosphate of calcium, $CaH_4(PO_4)_2.H_2O$, at a temperature between 275° F. and red heat, preferably between 275° and 375° F.—A. S.

Industrial treatment of asphodel. Fr. Pat. 423,043. *See* XVIII.

XIXB.—WATER PURIFICATION; SANITATION.

Oxygen; Determination of dissolved ——. L. W. Winkler. Z. angew. Chem., 1911, **24**, 831—832.

IN determining oxygen dissolved in water, by means of "Adurol" (monochloro- or monobromo-quinol) and ammonia (this J., 1911, 382), it is advantageous to use a 2N-sodium chloride solution, since this absorbs practically (between 10° and 20° C. almost exactly) half the quantity of atmospheric oxygen dissolved by distilled water. Half the pressure of the column of the salt solution is then added to the barometrical pressure reduced to 0° C., and in calculating the amount of dissolved oxygen at the normal pressure the tension of the solution is taken as 10 per cent. less than that of water. When a sodium chloride solution of this strength is employed, the ammoniacal ammonium bromide solution need only be of half the strength of that previously given. A suitable solution is obtained by dissolving 25 grms. of ammonium bromide in 10 per cent. ammonia solution, and diluting the liquid to 100 c.c. This has a sp. gr. of 1·095 at the ordinary temperature, as compared with 1·078 for the sodium chloride solution at 20°/20° C.—C. A. M.

Nitrites [in water]; Simple process for the detection of ——. Dané. Bull. Soc. Chim., 1911, **9**, 354—355.

THE water to be examined is mixed with 2—5 c.c. of a solution containing 0·02 c.c. of synthetic indole in 150 c.c. of 95 per cent. alcohol, and sulphuric acid (1 : 2) is added. In the presence of nitrites (more than 1 part in 2,500,000 of water), a rose-colour or red colouration is produced in less than a minute. The reaction may also be applied to the colourimetric determination of nitrites. —F. SODN.

Water; Sterilisation of water —— by means of chlorine. Plücker. J. Gasbeleucht., 1911, **54**, 385—386.

ALTHOUGH it has been claimed that satisfactory results have been obtained in America in the sterilisation of drinking water by means of chlorine, the author points out that several investigators, particularly Schüder, have shown that chlorine, in the proportion of 40 mgrms. per litre of water, does not invariably destroy cholera and typhoid bacilli. When smaller quantities of chlorine are used, the destruction of the organisms is still less complete. The bacteriological experiments carried out by American workers are open to criticism, as antiquated methods were employed, the action of chlorine on pathogenic organisms was not ascertained, and the excess of chlorine was not removed from the water before the bacteriological investigations were made. The author is of the opinion that the chlorine process cannot be relied upon to sterilise drinking water efficiently.—W. P. S.

Sulphurous acid, sulphites, and some complex compounds of sulphurous acid; Antiseptic and disinfectant properties of free ——. E. Hailer. Arbb. Kais. Gesundh.-Amt, 1911, **36**, 297—340. Chem. Zentr., 1911, **1**, 1309—1311.

TWO methods of investigation were used, *viz.*, a "static" method, in which mould, fungi, yeasts, and bacteria in a suitable nutrient medium were exposed to the antiseptic agent: and a "kinetic" method, in which *Staphylococci* were exposed for definite periods to the antiseptic and then introduced into a suitable nutrient medium. By the static method it was found that in general bacteria were the least resistant, the concentrations of sulphur dioxide necessary for killing bacteria, yeasts, and mould fungi being as 1 : 4 : 5. The antiseptic action of sulphur dioxide was diminished by addition of dextrose to the nutrient medium, and increased by rise of temperature from 22° to 37° C. The disinfecting power of sodium bisulphite was inferior to that of a solution of sulphur dioxide of equivalent concentration, and normal sodium sulphite was quite ineffective in the concentrations employed. Sulphuric acid proved less effective than sulphur dioxide. Mould fungi, yeasts, and bacteria were about equally resistant to phenol, growth being suppressed by a $\frac{1}{35}$ grm.-molecular solution, the corresponding concentrations for sulphurous acid solution being: for mould fungi, $\frac{1}{150}$; for yeasts, $\frac{1}{180}$; and for bacteria, $\frac{1}{520}$ grm.-mol. Of the complex compounds of sulphur dioxide, sodium formaldehyde sulphite and sodium acetaldehyde sulphite had no effect on mould fungi, even at high concentrations: sodium acetone sulphite and sodium dextrose sulphite were more active. Against bacteria, sodium dextrose sulphite was most active, then sodium acetone sulphite, whilst sodium acetaldehyde sulphite was least active. The results obtained by the kinetic method agreed generally with those by the static method. Addition of sodium chloride in the proportion of 2 : 1 and 5 : 1 considerably increased the disinfecting power of sodium dextrose sulphite. Sulphur dioxide is largely used in the preparation of dried fruits and of wine. Experiments showed, however, that on properly dried, unsulphured apricots and plums, no perceptible growth of mould fungi, yeasts, or bacteria occurs, and treatment with sulphur dioxide is therefore unnecessary.—A. S.

Patents.

Filters specially applicable to feed water. H. B. Watson and T. C. Billetop, Newcastle-on-Tyne. Eng. Pat. 8374, April 7, 1910.

The frames for the filtering surfaces employed consist of one or more perforated cylinders of metal, in the latter case concentric. These cylinders are riveted to circular covers with central openings. In building up the unit the cylinder of smallest diameter is placed over a central tube and suitably jointed to the bed-plate, then follow the larger cylinders in order, each being jointed so as to prevent leakage, the whole being held in position by a bolt passing down the central tube and arranged in such a manner that no axial thrust is thrown on the cylinders; a light internal steadying frame may also be fitted. The liquid to be filtered passes inwards through the cylinders leaving by an opening in the bed-plate. Six diagrams are shown giving structural details of modifications of the principle involved in bolting the frames together.
—B. G. McL.

Water purifying systems. A. E. Alexander, London. From J. S. L. Wharton, W. S. Hallowell, and J. C. Jones, Philadelphia, U.S.A. Eng. Pat. 22,923, Oct. 4, 1910.

Water for use in boilers is passed over inclined surfaces situated in a chamber through which the waste steam from a boiler is conducted. The water thus heated is collected in a large tank which is divided into two compartments by means of a movable filter partition; after passing through this filter, the water collects in the second compartment of the tank which is in connection with the pump supplying the boiler. Should the filter become clogged, the water flows into the second compartment through an opening above the filter. The supply of water to the heater is controlled by a valve operated by a ball-float in the second compartment of the tank, this compartment being provided with an overflow. Suitable reagents may be added to the water before it enters the heater, a pump working isochronally with the boiler pump being provided in connection with a reagent tank for this purpose; the supply of reagent is also regulated by the valve and ball-float mentioned above and means are provided for returning to the reagent tank any excess of reagent solution which passes through the reagent pump.—W. P. S.

Water; Process and apparatus for purifying —— by heating. [*Removal of calcium carbonate, etc.*] L. Savary-Carlier, Bapaume, France. Eng. Pat. 30,378, Dec. 31, 1910. Under Int. Conv., Jan. 6, 1910.

The essential feature of the invention consists in subjecting the water in the form of a spray to the action of steam, the mixture of water-spray, steam, and separated impurities being subsequently condensed, collected, and allowed to settle. The water to be heated is sprayed into a vertical pipe where it meets a current of steam (waste-steam from an engine, etc.) which is introduced into the pipe below the water inlet. The steam, water-spray, and separated calcium carbonate, pass upwards into a drum, thence downwards through a pipe surrounded by a condenser, and are collected in a tank divided into two compartments by means of a partition reaching nearly to the top of the tank; the calcium carbonate separates as a sediment in the first compartment, whilst the clear water passes over the partition into the second compartment, whence it is conducted away for use in boilers, etc. The supply of water to the apparatus is controlled by a valve operated by a float in the collecting chamber, and sludge-cocks are provided at the bottom of the tank.—W. P. S.

Water; "Self-contact" column for the sterilisation of —— by ozone. M. P. Otto. Fr. Pat. 423,223, Feb. 9, 1910.

The water, after passing through an injector where it is mixed with a suitable quantity of ozone, flows down a pipe which extends nearly to the bottom of a circular tank or well about 5 metres in depth; the lower end of the pipe is provided with a number of small openings, or several pipes may be employed which deliver the mixture of water and ozone tangentially into the tank, the object being to thoroughly mix the gas with the water. The treated water leaves the tank at the top and flows over a number of weirs in order to expel the excess of dissolved ozone.
—W. P. S.

Water; Process for clarifying —— and for eliminating micro-organisms therefrom. R. Gans. Fr. Pat. 423,388, Dec. 7, 1910. Under Int. Conv., Jan. 6, 1910.

The water is treated with from 0·5 to 5 mgrms. of potassium permanganate per litre and a small quantity of a manganous salt is added if the water does not naturally contain manganese salts. A colloidal precipitate is thus formed and the water is then passed through a filter consisting of manganese oxides; if desired, natural or artificial zeolites may also be used in the filter.—W. P. S.

Sewage [sludge]; Treatment of ——. J. S. Waddlington, Bradford. Eng. Pat. 22,251, Sept. 26, 1910.

Semi-liquid sewage is introduced into an inclined, rotating cylinder which is mounted in an outer casing; the cylinder is constructed of perforated material and is lined with a porous fabric. As the sewage passes through this cylinder it is subjected to the action of jets of steam, supplied through a central shaft. The liquid portion of the sewage, consisting of water, oil, etc., filters through the porous fabric and is collected in the casing of the cylinder, whence it is removed for further treatment. The solid portion of the sewage falls from the end of the cylinder into a double hopper which delivers it on to the surface of travelling bands mounted in a steam-heated chamber: the dry solids are finally collected at the bottom of this chamber and removed as required. Very liquid sewage may be passed through a preliminary cylindrical screen, lined with fabric and into which compressed air is admitted, before the more solid portion is passed into the apparatus described above.—W. P. S.

Sewage; Apparatus and process for the purification and clarification of ——. "Ruwa" Ges. m. b. H. für Rauch- und Wasser-Aufbereitung. Fr. Pat. 423,938, Dec. 21, 1910.

The sewage is passed through two settling tanks and then through a series of clarifying tanks, each of which contains a number of baffle-plates inclined against the current of the liquid. These plates are provided with triangular bars on their faces which are against the current, and are so arranged that the liquid flows over and under the plates alternately. On leaving these tanks the liquid is passed through a series of filter beds. The sludge collecting in the first two tanks is removed by means of a dredge.—W. P. S.

Chlorinated hydrocarbons; Process for making emulsions or solutions of —— for destroying harmful vegetable matter. Crefelder Seifenfabrik Stockhausen und Traiser. Fr. Pat. 422,685, Oct. 4, 1910.

Carbon tetrachloride or other chlorinated hydrocarbon is emulsified by means of compounds of fatty acids or sulphonated fatty acids which do not liberate alkali when dissolved in water; thus their heavy metal (especially copper) salts may be used. For example, carbon tetrachloride is emulsified in the usual manner by means of sodium sulphoricinoleate solution, copper sulphate solution is added until no further precipitation occurs, and ammonia is then added until a clear solution is produced. The ammonium salts of saturated or unsaturated fatty acids or of sulphonated fatty acids may also be used as emulsifying agents.—T. F. B.

Sterilisation of liquids. V. Henri and A. Helbronner, Paris, and M. von Recklinghausen, Bas Meudon, France. Eng. Pat. 14,127, June 10, 1910. Under Int. Conv., June 11, 1909.

See Fr. Pat. 403,945 of 1909; this J., 1910, 107.—T. F. B.

Sterilising liquids by ultra-violet rays; Apparatus for ——. T. Nogier, Lyons, France. Eng. Pat. 26,783, Nov. 17, 1910. Under Int. Conv., Nov. 18, 1909.

See Fr. Pat. 420,281 of 1909; this J., 1911, 382.—T. F. B.

Liquids and ferments; Process for destroying harmful bacteria in ——. V. Henri, A. Helbronner, and M. von Recklinghausen. Fr. Pat. 423,041, Nov. 25, 1910. Under Int. Conv., Nov. 29, 1909.

See Eng. Pat. 27,798 of 1909; this J., 1911, 46.—T. F. B.

Liquids; Apparatus for treating —— *by ultra-violet rays.* V. Henri, A. Helbronner, and M. von Recklinghausen. Fr. Pat. 423,111, Nov. 28, 1910. Under Int. Conv., Dec. 1, 1909.

See Eng. Pat. 28,067 of 1909; this J., 1911, 106.—T. F. B.

[Water] purification; Distilling apparatus for triple ——. J. A. Power. Fr. Pat. 423,300, Dec. 3, 1910. Under Int. Conv., April 21, 1910.

See Eng. Pat. 27,988 of 1910; this J., 1911, 507.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Coca leaves; Valuation of ——. A. W. K. de Jong. Arch. Pharm., 1911, **249**, 209—214. (See this J., 1910, 897.)

The paper is principally taken up with replies to criticisms of the author's previous work on the valuation of coca leaves in an essay on this subject by Bierling and others (*loc. cit.*). The author states that extraction of cocaine by a solvent in a Soxhlet is preferable to adding a known volume of solvent to the drug and withdrawing an aliquot portion after shaking. In the latter case adsorption of the alkaloid takes place, and may lead to variable results. When ether is used for extracting, cooling with ice is necessary to avoid loss by evaporation. In some cases when an ethereal solution of cocaine is shaken with 0·5 per cent. hydrochloric acid, emulsions are formed. Bierling stated that this drawback can be diminished by the use of stronger acid. The author shows that increasing the strength of the acid up to 2·0 per cent. causes no decrease of the emulsion, and as acid of this strength may decompose or alter the alkaloid its use is not advisable.—F. Shdn.

Corydalis alkaloids; protopine and glaucine. J. Gadamer. Arch. Pharm., 1911, **249**, 224—233. (See this J., 1911, 152 and 383.)

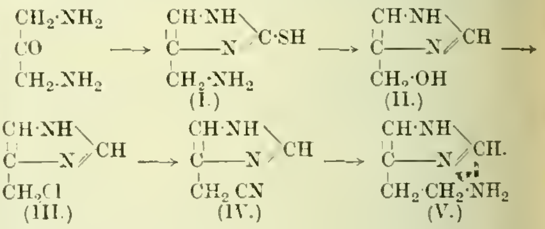
About 21 kilos. of the dried leaves of *Corydalis cava* gave 10 grms. of amorphous dark-coloured hydrochlorides. The bases from these were separated into those of a phenolic character and those without this property. The latter yielded protopine, a base, $C_{21}H_{23}NO_7$, discovered in the same plant by Haars (see this J., 1905, 634), glaucine, a small amount of a non-crystalline base, and a little amorphous alkaloid. The phenolic bases consisted of bulbocapnine, a base giving a *l*-bitartrate with $[\alpha]_D = +20°$, and another base giving a *l*-bitartrate with $[\alpha]_D = +42°$, both rotations being observed in aqueous solution. The pseudocorycavidine of Gaebel (this J., 1910, 715) is shown by the author to be a molecular compound of optically inactive corycavine with dextro-rotatory corycavidine.—F. Shdn.

Oxyberberine; Synthesis of ——. A. Pictet and A. Gams. Comptes rend., 1911, **152**, 1102—1105.

Homopiperonylamine was prepared by the action of nitromethane on piperonal and reduction of the product. The base was treated with formaldehyde or methylal in the presence of hydrochloric acid, when norhydrohydrastinine (methylenedioxytetrahydroisoquinoline) was obtained, boiling at 197°—199° C. at 50 mm. The *o*-nitrobenzoyl derivative of the latter base (m. pt. 103°—105° C.) and methyl opianate were dissolved in concentrated sulphuric acid, and allowed to stand for several days. On pouring into water, a neutral substance, $C_{28}H_{24}N_2O_2$, m. pt. 156°—158° C. separated. On hydrolysing with alcoholic potassium hydroxide, *o*-nitrobenzoic acid and oxyberberine were produced.—F. Shdn.

Synthesis of 4 (or 5)-β-aminoethylglyoxaline, one of the active principles of ergot. F. L. Pyman. Chem. Soc. Proc., 1911, **27**, 91.

The following synthesis of 4(or 5)-β-aminoethylglyoxaline affords a convenient method for its preparation. Diaminoacetone dihydrochloride when heated with potassium thiocyanate yields 2-*thiol*-4(or 5)-*aminomethylglyaxaline* (I) [m. p. 188° (corr.)], which on oxidation with nitric acid gives 4(or 5)-*hydroxymethylglyoxaline* (II) [m. p. 93°—94° (corr.)]. The hydrochloride of the latter is converted by phosphorus pentachloride into the hydrochloride of 4 (or 5)-*chloromethylglyoxaline* (III) [m. p. 144—145° (corr.)], and this, when suitably treated with potassium cyanide, gives rise to 4(or 5)-*cyanamethylglyoxaline* (IV) [m. p. 138°—140° (corr.)]. The latter base, on reduction with sodium and alcohol, yields 4(or 5)-β-aminoethylglyoxaline (V).



A number of salts of these compounds, and several derivatives obtained as by-products in the various stages of the synthesis, were also described.

Gnoscopine (dl-narcotine); Synthesis and resolution of ——. W. H. Perkin, jun., and R. Robinson. Chem. Soc. Proc., 1911, **27**, 101.

A detailed description was given of the synthesis and resolution of gnoscopine, a preliminary account of which has already appeared (this J., 1910, 371, 781).

Rhubarb; Constituents of ——. F. Tutin and H. W. B. Clewer. Chem. Soc. Proc., 1911, **27**, 89—90.

The material employed for this investigation consisted of the best quality of sun-dried "Shensi" rhubarb. An alcoholic extract of the drug, when distilled with steam, yielded small amounts of palmitic and chrysophanic acids, together with a hexoic acid and some essential oil. The portion of the extract which was soluble in water yielded cinnamic and gallic acids, rhein, emodin, aloe-emodin, emodin mono-methyl ether, chrysophanic acid, and a new anthraquinone derivative, $C_{27}H_{10}O_6$ (m. p. 295—297°), which it is proposed to designate *rheinolic acid*. It yielded, furthermore, a crystalline mixture of the glucosides of rhein, emodin, aloe-emodin, emodin monomethyl ether, and chrysophanic acid; dextrose; lævulose; tannin; and an amorphous, non-glucosidic resin. This resin, on hydrolysis, gave small amounts of gallic and cinnamic acids, rhein, emodin, aloe-emodin, emodin monomethyl ether, and chrysophanic acid, together with a new *compound*, $C_{14}H_{12}O_3$ (m.p. 256°), which is probably a *trihydroxydihydroanthracene*. The portion of the extract undissolved by water yielded a trace of a hydrocarbon (m.p. 64°); a phytosterol (verosterol), $C_{27}H_{46}O$; a mixture of fatty acids, consisting of palmitic, stearic, oleic, linolic, and linolenic acids, both free and combined; rhein; rheinolic acid; emodin; aloe-emodin; emodin monomethyl ether; chrysophanic acid; and a trace of a substance which did not fuse at 340°, but yielded an acetyl derivative, melting at 335°. It also gave some amorphous products, and a further quantity of the crystalline mixture of the glucosides of the anthraquinone derivatives. Of the anthraquinone derivatives, only aloe-emodin and chrysophanic acid had any purgative action. the mixture of glucosides being quite inert. The chief purgative principle is the above-mentioned non-glucosidic resin.

Rhamnus cathartica ; The bark of ——. A. Tschirch and H. Bromberger. Arch. Pharm., 1911, **249**, 218—223.

An alcoholic extract of the bark of *Rhamnus cathartica*, when allowed to stand, deposited a phytosterol, rhamnosterol, $C_{13}H_{28}O_2$, m.pt. 83°—85° C. The alcoholic extract was concentrated and poured into water, and dextrose and a tannin-like substance were isolated from the solution. Extraction of the insoluble matter with benzene gave rhamnofluorin, $C_{14}H_{12}O_6$, which carbonised at 220° C., and emodin, identical with that obtained from Frangula. The same solution was also found to contain chrysophanol (chrysophanic acid containing no methoxyl groups), m. pt. 196° C.—F. Shdn.

Liquorice juice ; Analysis of ——. E. J. Parry. Chem. and Drug., April 29, 1911, 133.

Since the publication of the papers of the author (Chem. and Drug., Jan. 1910, p. 21), Eriksson (this J., 1911, 445) and Telle (Ann. Falsif., 1911, 4, 3), a much greater amount of reliable information in regard to the composition and analysis of liquorice juice is available than was the case before, and it should now be possible for a definite opinion to be expressed as to the purity of a given sample. The determinations recommended are:—moisture, mineral matter, glycyrrhizin, invert sugars, uninverted sugars, matter insoluble in water, matter insoluble in dilute ammonia, alcohol precipitate (see below), and microscopic examination of the matter insoluble in water and of that insoluble in ammonia. Adulteration of liquorice-juice is practised to an enormous extent; and in France steps are being taken to establish standards of purity. The author suggests 9 per cent. of glycyrrhizin as a minimum for normally prepared edible liquorice juices; Spanish juices which are much richer in glycyrrhizin have too little "body" to be used alone. With regard to the sugars the methods of Eriksson for the separate determination of invert sugars and sucrose are open to criticism; moreover as liquorice root contains an enzyme, the relative proportions of inverted and uninverted sugars in the juice will vary greatly according to the method of preparation. The figures obtained by the author and by Eriksson indicate that a normal edible juice contains not more than 18 per cent. of total sugars. In order to distinguish between natural and added starch in liquorice juice, the sample should be powdered, extracted with water, and the residue extracted with 3 per cent. ammonia solution. The residue should not exceed 6 per cent. and should be compared microscopically with the starch present naturally in liquorice root. When alcohol is added to an aqueous extract of the juice until the alcohol concentration is 70 per cent., a precipitate is produced; according to Telle this does not exceed 16·5 per cent. in the case of pure juices (except in some doubtful Levant and Spanish juices), whereas it is much higher in the presence of gum, gelatin, and commercial glucose containing dextrin.—A. S.

Seychelles cinnamon bark. J. Meyer. Arbb. Kais. Gesundh.-Amt, 1911, **36**, 372—381. Chem. Zentr., 1911, **1**, 1313—1314.

The specimens of bark examined contained young portions and inner older portions, both of which were rich in aromatic substances, and also outer portions practically useless as a spice. The bark, with the exception of the valueless outer portion, yielded more than 5 per cent. of ash, the prescribed maximum for Ceylon cinnamon and cassia barks. The alcohol extract of the inner bark contained more dissolved matter than the extracts of the total bark and of the outer bark, but was lighter in colour. The amount of matter soluble in alcohol was 10·37 per cent. in an average sample of the bark, 12·1 in the thin bark, and 9·5 in the undivided thick bark (15·5 per cent. in the inner and 7·94 in the outer portion). The inner layer of the bark was rich in cinnamon oil, and the thin bark also contained a not inconsiderable quantity, but the outer bark contained very little oil, the percentages being: average sample of bark, 1·12; thin bark, 1·76; thick bark: undivided, 0·90; inner portion, 2·86; outer portion, 0·36. The oil contained as much cinnamic aldehyde (60—72·6 per cent.) as Ceylon cinnamon oil, and more eugenol than the latter. It is not possible to distinguish Seychelles cinnamon from other kinds of cinnamon by chemical analysis.—A. S.

Adrenaline ; Chemical-toxicological detection of ——. G. Venturoli and G. T. Callerani. Giorn. Farm. Chim., 1911, **60**, 97—105. Chem. Zentr., 1911, **1**, 1383—1384.

The authors make use of the properties of the so-called oxyadrenaline which is produced by the action of air on a neutralised solution of adrenaline. This substance can be isolated by means of its solubility in amyl alcohol in ammoniacal solution; it cannot be extracted by chloroform, ether, or petroleum spirit either from an acid or an alkaline solution. Oxyadrenaline does not give the characteristic reactions of adrenaline, with the exception of those of Brouardel and Boutmny and of Jungmann (bluish green colouration with a very dilute solution of potassium ferricyanide containing ferric chloride, and blue colouration with an ammoniacal solution of phosphomolybdic acid respectively). For the detection of adrenaline, the material is acidified with tartaric acid, extracted with 95 per cent. alcohol, the solution evaporated to dryness, the residue extracted with absolute alcohol, and the solution evaporated. The residue is freed from fat by means of ether, dissolved in water, the solution made alkaline with ammonia, and extracted with amyl alcohol. The solution is evaporated, and the residue tested by means of the colour reactions mentioned above. By the method described, the author was able to detect adrenaline in meat, 100 grms. of which had been treated with 5 c.c. of a 0·1 per cent. solution of adrenaline.—A. S.

Saponin from the leaves of Trevesia sundaica Mig. J. Flieringa. Arch. Pharm., 1911, **249**, 161—173.

A crude saponin was obtained from the leaves of *Trevesia sundaica* Mig. grown in Java. This saponin can be salted out completely with either ammonium or magnesium sulphate and the crude substance possesses hæmolytic properties. It was resolved by means of hydrated magnesium oxide into two portions, a yellow saponin, possessing little hæmolytic action, and a green saponin, which was more active than the original substance. The yellow substance was resolved into several glucosidal fractions by dissolving in alcohol and precipitating with ether. These fractions were resolved into sapogenin and sugar when hydrolysed by acids. The first three fractions yielded hexose as well as pentose and methylpentose. The fourth fraction yielded what appeared to be a mixture of dextrose and arabinose. Under the action of alkalis the sugar was only partially split off and a new saponin substance with strong hæmolytic action was produced. The sugar from this glucoside consisted of methylpentose principally.—F. Shdn.

Essential oils ; Determination of ——. C. D. Howard. J. Ind. Eng. Chem., 1911, **3**, 252.

For the estimation of essential oils in extracts and pharmaceutical preparations, the following process is stated to be rapid and accurate: 20 c.c. of the preparation (or 10 c.c. if containing more than 5 per cent. of oil) are placed in a 4-ounce separating funnel with 50 c.c. of water and 2 drops of strong hydrochloric acid (the latter being omitted in the case of oils of the type of cinnamon and clove) and extracted by successive agitations with 15, 10, and 5 c.c. of ether respectively. After being washed once with 10 c.c. of water saturated with ether to remove the bulk of the alcohol, the combined ether extracts are transferred to a 10 per cent. Babcock milk bottle, to the stem of which a bulb tube, connected with a filter-pump, is attached. The bottle is immersed in nearly boiling water and shaken with a gentle rotary motion; when all danger of spirting has passed, the bottle is shaken violently and is finally immersed in boiling water until—in a few seconds—the ether is completely expelled. After the addition of cold water, the mixture is centrifuged; for oils heavier than water, salt solution is used as the floating agent, except in the case of wintergreen oil, for which cold sulphuric acid (1 : 2) is employed. As stated by the author, and since confirmed by Hortvet and West (J. Ind. Eng., Chem. 1909, **1**, 84), no appreciable loss of oil occurs when the ethereal solution is rapidly evaporated.—W. E. F. P.

Geranium oil; Artificial ester [ethyl oxalate] in Bourbon ——. E. J. Parry. Perfumery and Essent. Oil Rec., 1911, **2**, 83.

Six samples of Bourbon geranium oil have recently been found to have been sophisticated by the addition of ethyl oxalate. Within a few minutes of the commencement of saponification with alcoholic potash (for the quantitative determination of the esters), crystals of potassium oxalate were formed. After completing the determination, and freeing the reaction-liquid from oil, oxalic acid was detected. These adulterated oils had the sp. gr. 0·9093 to 0·9225, n_D^{20}=1·4634 to 14703; apparent ester value, 46 to 74 per cent; α_D = from −10° 45′ to −10° 35′.
—J. O. B.

Guiana "sandalwood"; Essential oil of ——. P. Jeancard and C. Satie. Perfumery and Essent. Oil Rec., 1911, **2**, 79—80.

The so-called Guiana "sandalwood" has, of recent years, been exported in considerable quantity from French Guiana, where it grows in proximity to rosewood. Its botanical source is, as yet, undetermined The oil distilled in France from different parcels of wood shows great variation in characters. The sp. gr. ranges from 0·963 to 1·0122; α_D=+0°30′ to −6°; solubility in 75 per cent. alcohol, 1 : 1·5 to 1 : 12; saponification value, 13 to 65; acetyl value, 65 to 117. Although presenting these marked differences, all samples of the oil contained a common constituent in varying proportions. This has been isolated and found to be an alcohol, *maroniol*, probably a tertiary alcohol. It is a colourless, fragrant, viscous liquid; b. pt., 158°—159° C. under 20 mm.; sp. gr., 1·0378 at 23° C.; α_D= —6°; acetyl value, after acetylation in xylene solution for 5 hours, 189.—J. O. B.

Esterification; Catalytic —— of alcohols and fatty acids: the case of formic acid. P. Sabatier and A. Mailhe. Comptes rend., 1911, **152**, 1044—1047.

The catalytic influence of the oxides of titanium and thorium on the esterification of vapourised mixtures of alcohols and fatty acids (see this J., 1911, 384) diminishes as the temperature is lowered from 280° C. Equimolecular mixtures of ethyl alcohol and formic acid are esterified by titanium oxide to the extent of 65 per cent. at 150° C. (scarcely any decomposition of the acid occurring at this temperature) and 47 per cent. at 120° C. Methyl, ethyl, propyl, butyl, isobutyl, isoamyl, and benzyl formic esters have been readily prepared by passing formic acid, with an excess of the alcohol, over titanium oxide at 150° C. or thorium oxide at 200°—220° C. Experiments with equimolecular mixtures of ethyl alcohol and various acids show that esterification is more complete the lower the molecular weight of the acid. At 230° C., with titanium oxide, acetic acid forms 67 per cent. of ester, but isovaleric acid 36 per cent. At 150° C. formic acid produces 65 per cent. of ethyl ester and acetic acid 20 per cent. With the same acid primary alcohols are esterified to a greater extent than secondary and tertiary alcohols. Titanium oxide is a more active catalyst than thorium oxide, and its activity was not diminished by experiments extending over twenty days.—J. H. L.

Terpenes and essential oils; Contributions to our knowledge of ——. O. Wallach. Parts 105 and 106. Annalen, 1911, **381**, 51—113.

Carbolic acid [phenol] of the fifth German Pharmacopœia, 1910. Schmidt. *See* III.

Patents.

Salts of halogenised fatty acids of high molecular weight; Manufacture of ——. Ges. f. Chem. Industrie in Basel, Basle. Eng. Pat. 28,871, Dec. 12, 1910. Under Int. Conv., Dec. 24, 1909.

Salts of halogenated fatty acids of high molecular weight are readily obtained by the action of halogens on salts of unsaturated higher fatty acids; the attachment of the halogen occurs quantitatively. *Example.*—35 parts of the magnesium salt of erucic acid are dissolved in 250 parts of carbon tetrachloride and 16 parts of bromine are dropped into the solution, cooled to −5° C., during the course of three hours. The liquid is then shaken with a solution of sodium thiosulphate to separate the free bromine, dried by means of calcined sodium sulphate, and the greater part of the carbon tetrachloride distilled off. On adding acetone, alcohol, or ethyl acetate to the oily residue, the magnesium salt of dibromobehenic acid is precipitated; it is washed with alcohol and dried in a vacuum. The magnesium salts of di-iodo fatty acids of high molecular weight are claimed as new products.
—T. F. B.

Di-iodo-fatty acids of high molecular weight; Earth-alkali salts of —— and process of making same. A. Baselli, Assignor to Soc. of Chem. Industry in Basle, Basle. U.S. Pat. 988,066, March 28, 1911.

The alkaline-earth salts of di-iodo-fatty acids of high molecular weight, prepared by the action of iodine on the alkaline-earth salts of the unsaturated higher fatty acids, are of therapeutic value owing to their high content of iodine. They are insoluble in water and alcohol, soluble with difficulty in ether and ethyl acetate, and easily soluble in carbon tetrachloride and toluene. They are stable towards air and light.—T. F. B.

Chlorides of unsaturated dihalogen-fatty acids; Preparation of ——. F. Hoffmann-La Roche und Co. Ger. Pat. 232,459, Feb. 15, 1910.

The chlorides of unsaturated dihalogen-fatty acids of the formula, $C_nH_{2n}Hal_2O_2$, are obtained by treating the acids with thionyl chloride. The ordinary methods (*e.g.*, treatment with phosphorus pentachloride) are inapplicable, since the halogen is very readily eliminated and the molecule destroyed.—T. F. B.

Phenyl esters of iodo-fatty acids; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 233,327, March 30, 1910.

Phenyl esters of iodo-derivatives of fatty acids are obtained (1) by esterifying iodo-fatty acids or their derivatives with phenols; (2) by the addition of iodine to phenyl esters of unsaturated fatty acids; (3) by the action of alkali or alkaline-earth iodides on phenyl esters of chloro- or bromo-fatty acids. The products are of value in medicine, since they exhibit the properties of the iodine and of the phenols.—T. F. B.

Santalol and menthol ethers; Manufacture of ——. A. Zimmermann, London. From Chem. Fabr. auf Actien (vorm. E. Schering), Berlin. Eng. Pat. 2344, Jan. 30. 1911.

Santalol or menthol, or an alkali salt of the same, is treated with chloromethyl ether in the presence of a condensing agent. *Example:* An excess (2 mols.) of chloromethyl ether dissolved in toluene is added to a toluene solution of 220 grms. of santalol in the presence of 121 grms.

of dimethylaniline at 10°—20° C. The addition takes some hours, and then, after 24 hours, the mother liquor is removed by suction. The toluene solution is shaken first with slightly acidified water, then repeatedly with pure water, dried, evaporated in a vacuum, and the residue distilled. The product is methoxymethylsantalol ($C_{15}H_{23}O{\cdot}CH_2{\cdot}O{\cdot}CH_3$), and is a colourless liquid boiling at 152°—158° C. under 4 mm. pressure. Methoxymethylmenthol ($C_{10}H_{19}O{\cdot}CH_2.O.CH_3$) is similarly obtained from sodium menthol, the dimethylaniline being omitted. It boils at 100°—102° C. under 7 mm. pressure.—J. C. C.

Salicylic acid derivatives; Esters of —— and process of making same. N. Sulzberger, Berlin, and L. Spiegel, Charlottenburg, Germany. U.S. Pat. 987,771, March 28, 1911.

An aliphatic acid containing more than twelve carbon atoms (*e.g.*, oleic acid) is heated with a condensing agent and a derivative of salicylic acid in which the hydroxyl group is free, and the hydrogen of the carboxyl group is replaced by a non-acid group (*e.g.*, an alkyl ester of salicylic acid). The esters thus prepared are absorbed by the skin without causing irritation, and are decomposed in the organism with liberation of salicylic acid. The ethyl ester of oleylsalicylic acid melts at about 10° C. and solidifies below 0° C.; it is non-volatile, and is soluble in oils and fats.—T. F. B.

Hydrocinchona alkaloids; Manufacture of ——. H. Thron, Assignor to Verein. Chininfabr. Zimmer und Co., Frankfort-on-Maine, Germany. U.S. Pat. 989,664, April 18, 1911.

Hydro-cinchona alkaloids are prepared by treating cinchona alkaloids with hydrogen in presence of a colloidal solution of a metal of the platinum group.—T. F. B.

Alkaloids of the poppy and plants of the same family; Process for obtaining ——. W. Heinrici. Fr. Pat. 423,194, Oct. 26, 1910. Under Int. Conv., April 9, 1910.

It is possible to increase largely the yields of alkaloid from the poppy or similar plants by submitting the plant juice to fermentation and oxidation. Various agents may be employed for the purpose, *e.g.*, yeast, diastase, pepsin, oxydase, etc., and potassium permanganate or hydrogen peroxide. The expressed plant juice is allowed to stand with a small quantity of the ferment or oxidising agent, until no further increase of alkaloid is evident. For example, after fourteen days it has been found possible to increase the alkaloid content of fresh extracts of *Papaver somniferum* from 1·8—2·5 per cent. up to 8·7—13·2 per cent.—T. F. B.

1-p-Dimethylaminophenyl-2.3.4-trimethyl-5-pyrazolone and process of making same. F. Stolz and G. Körndorfer, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst-on-Maine, Germany. U.S. Pat. 990,310, April 25, 1911.

1-*p*-Dimethylaminophenyl-2.3.4-trimethyl-5-pyrazolone, obtained by methylating 1-*p*-aminophenyl-2.3.4-trimethyl-5-pyrazolone, is a white crystalline powder, of m.pt. about 140° C., readily soluble in dilute acids, alcohol, benzene, and chloroform, and fairly readily soluble in water; it yields a red solution when dissolved in water with ferric chloride.—T. F. B.

Nitro-1-aminophenyl-4-arsinic acid; Process for preparing a ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 231,969, July 15, 1909.

Nitro-1-aminophenyl-4-arsinic acid is prepared by nitrating oxanil-4-arsinic acid,

$$H_2O_3As{\cdot}C_6H_4{\cdot}NH{\cdot}CO{\cdot}COOH,$$

and then eliminating the oxalic acid residue. The product is suitable for use in preparing pharmaceutical compounds.—T. F. B.

Nitro-1-aminophenyl-4-arsinic acid; Process for preparing a ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 232,879, Oct. 8, 1909. Addition to Ger. Pat. 231,969, July 17, 1909 (see preceding abstract).

Urethanes of 1-aminophenyl-4-arsinic acid are treated with nitrating agents, and the carboxyl group eliminated, whereby a nitro-1-aminophenyl-4-arsinic acid is produced.—T. F. B.

Cotarnine with acid amides, imides, or ureides; Process for preparing compounds of ——. Knoll und Co. Ger. Pat. 232,785, July 26, 1910.

Compounds of cotarnine with acid amides, imides, or ureides possess sedative properties; they may be prepared by causing the components to interact, with addition of a suitable solvent if desired.—T. F. B.

Esters of organic acids, excepting formic esters; Process for preparing ——. Administration der Minen von Buchsweiler, A.-G. Ger. Pat. 232,818, Feb. 17, 1909.

Organic acids (other than formic acid) or their anhydrides and alcohols are caused to react in molecular proportion, in presence of anhydrous calcium chloride and a small quantity of mineral acid. The above mixture may be produced by passing hydrochloric acid gas through a mixture of the alcohol and the calcium salt of the organic acid. In this process no excess of alcohol is necessary; the yields are stated to be high and the products pure.
—T. F. B.

Aloïn; Process for preparing a mixed acetic-formic ester of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 233,326, Jan. 27, 1910.

A mixed acetic-formic ester of aloïn, which possesses the aperient properties of aloïn but not its unpleasant taste, is obtained by treating aloïn with a mixture of acetic anhydride and formic acid, or with acetic-formic anhydride, with or without addition of a condensing agent.—T. F. B.

Olefine alcohols; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 233,519, March 22, 1910.

When the ammonium hydroxides of the formula, $CH_3{\cdot}CH(OH){\cdot}CHR{\cdot}CH_2{\cdot}N(CH_3)_3OH$ (where R is hydrogen or alkyl), are decomposed by heating, olefine alcohols of the formula, $CH_3{\cdot}CH(OH){\cdot}CR:CH_2$, are produced. They may be utilised for the preparation of pharmaceutical products.—T F. B.

Alcohol and alcoholic matters from wool fat; Process for obtaining ——. S. Morgenstern, Charlottenburg, Germany. Eng. Pat. 22,605, Sept. 29, 1910.

See Fr. Pat. 421,044 of 1910; this J., 1911, 435.—T. F. B.

Alkaloids from the poppy and related plants; Process for the production of ——. W. Heinrici, Halle-on-Saale, Germany. Eng. Pat. 24,865, Oct. 26, 1910. Under Int. Conv., April 9, 1910.

See Fr. Pat. 423,194 of 1910; preceding.—T. F. B.

Camphor; Process for the manufacture of ——. J. Schmitz and G. Stalmann, Assignors to Dr. Schmitz und Co. G. m. b. H., Düsseldorf, Germany. U.S. Pat. 989,651, April 18, 1911.

See Fr. Pat. 387,053 of 1908; this J., 1908, 832.—T. F. B.

Aloïn ester. W. Hiemenz and E. Rietz, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 989,974, April 18, 1911.

See Ger. Pat. 233,326 of 1910; preceding.—T. F. B.

Ketone alcohols. G. Merling and H. Köhler, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 989,993, April 18, 1911.

See Fr. Pat. 409,403 of 1909; this J., 1910, 719.—T. F. B.

Isoprene; Production of ——. H. C. Woltereck. Fr. Pat. 423,112, Nov. 28, 1910. Under Int. Conv., Nov. 30, 1909.

See Eng. Pat. 27,908 of 1909; this J., 1911, 48.—T. F. B.

Manufacture of polyazo dyestuffs. Eng. Pat. 8967. *See* IV.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Cinematographic films with central coating of emulsion. Comp. Gén. de Phonographes, Cinématographes, et Appareils de Précision, Paris. Eng. Pat. 2500, Jan. 31, 1911. Under Int. Conv., Feb. 24, 1910.

In cinematograph films coated with sensitive emulsion only on the central portion of the support, the width of the emulsion coating is extended so that the natural reduction in thickness of the coating at its edges is produced on the portions of the film occupied by the perforations, the borders of the film being left free from emulsion.—T. F. B.

Photographic images on objects of all kinds; Process for producing ——. A. Hans. Fr. Pat. 423,529, Dec. 10, 1910.

The article on which the photograph is to be reproduced is coated with a sensitive support of gelatin, fish glue, etc., containing a suitable chromium compound; after exposure beneath a negative, the development is commenced by immersion in water, and finished by spraying the surface with a fine jet of water. When development is complete, the image is stained by immersion in a solution of a suitable dyestuff soluble in water, after which it is rinsed, dried, and if possible baked at a temperature of 200°—300° C. Instead of colouring the image after development, the sensitive support may contain a colouring matter, as in the ordinary pigment process; in this case the finished print is coloured further with a transparent colour ground in oil or varnish. If a glass support has been used, the image is covered with a powdered colouring matter of the same colour as that with which the image has been stained, in order to give sufficient depth of colour. —T. F. B.

Colour photography; Manufacture of colour screens for ——. R. Ruth, Charlottenburg, Germany. Eng. Pat. 19,554, Aug. 20, 1910. Under Int. Conv., Feb. 8, 1910. Addition to Eng. Pat. 16,273 of 1910, dated July 10, 1909.

See Fr. Pat. 417,382 of 1910; this J., 1911, 50.—T. F. B.

Photographic plates for half-tone printing. H. W. H. Palmer. Fr. Pat. 423,047, Nov. 26, 1910. Under Int. Conv., Nov. 27, 1909.

See Eng. Pat. 27,665 of 1909; this J., 1911, 50.—T. F. B.

Cinematograph films with central coating of emulsion. Comp. Gén. de Phonographes, Cinématographes, et Appareils de Précision. Fr. Pat. 423,840, Feb. 24, 1910.

See Eng. Pat. 2500 of 1911; preceding.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Patents.

Explosives; Process of making material for ——. G. E. Bailey, Los Angeles, Cal. U.S. Pat. 989,519, April 11, 1911.

The process consists in mixing rosin and a starch-containing material with boiling water to form a pasty mass, adding nitric acid, heating and stirring the mixture until "fumes of nitrous oxide" are no longer evolved, and washing the resulting mass of partially oxidised rosin and nitrated starch in hot water until free from nitric acid. Finely ground wheat may be employed as the starch-containing material.—H. H.

Explosives. G. Cornaro, Turin, Italy. U.S. Pats. 989,947 and 989,948, April 18, 1911.

Mixtures of potassium perchlorate with (1) finely divided aluminium and arsenic, and (2) aluminium and zinc, coated with a varnish of soot, boiled linseed oil, and turpentine. —G. W. McD.

Explosive. Sprengstoffwerke Dr. R. Nahnsen und Co. A.-G. Fr. Pat. 423,296, Dec. 3, 1910.

The following mixtures are claimed: Ammonium nitrate (85 parts), calcium silicide (10), and aluminium (5 parts), Ammonium nitrate (80), carbohydrate (10), calcium silicide (5), and aluminium (5 parts). Potassium chlorate (67·15), nitronaphthalene (0·85), dinitrotoluene (12·75), vegetable oil (4·25), calcium silicide (10), and aluminium (5 parts). —G. W. McD.

Safety explosives containing ammonium nitrate, etc.; Wrappers for ——. Soc. Anon. d'Explosifs et de Prod. Chim. Fr. Pat. 423,583, Feb. 18, 1910.

Thin aluminium foil is used for wrapping the explosive. —G. W. McD.

Nitroglycerin compounds or similar explosives; Machines for packing —— *into cartridge cases.* A. J. Boult, London. From H. A. Stillwell, Woodbury, N.J., U.S.A. Eng. Pat. 22,525, Sept. 28, 1910.

See U.S. Pat. 983,655 of 1911; this J., 1911, 385.—T. F. B.

Explosive. J. Luciani, Paris. U.S. Pat. 989,375, April 11, 1911.

See Fr. Pat. 386,966 of 1907; this J., 1908, 837.—T. F. B.

Explosive. G. Cornaro, Turin, Italy. U.S. Pat. 990,036, April 18, 1911.

See Fr. Pat. 376,607 of 1907; this J., 1907, 991.—T. F. B.

Explosive. W. H. Palmer, Porsgrund, Norway, Assignor to Marpal, Ltd., London. U.S. Pat. 990,585, April 25, 1911.

See Fr. Pat. 394,833 of 1908; this J., 1909, 384.—T. F. B.

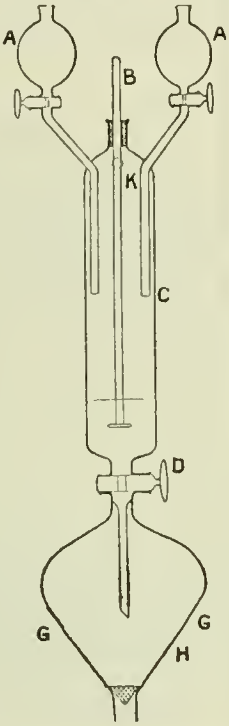
XXIII.—ANALYTICAL PROCESSES.

Manganese; Detection and determination of small quantities of ——, *especially in organic substances.* G. Bertrand. Bull. Soc. Chim., 1911, **9**, 361—370.

The method, which depends on the conversion of the manganese into permanganic acid, preferably by means of potassium persulphate, in the presence of silver nitrate (H. Marshall, Chem. News, 1901, **83**, 76), is carried out on organic matter as follows:—The material is incinerated at a dull red heat until all the carbon has apparently disappeared, and the residue is heated on the water-bath with strong hydrochloric acid for a short time; a little sulphuric acid is then added, the solution is evaporated to dryness, and the residue is again ignited at dull redness. The sulphated ash, which has, in the above manner, been freed from carbon and chlorides and contains all the manganese in a soluble form, is dissolved in nitric acid (sp. gr. 1·33), diluted with three times its volume of water, and the solution, containing not more than 1 mgrm. of manganese, is made up to 10 c.c. with the same acid; 5 drops of 10 per cent. silver nitrate solution are added, and at least 0·1 grm. of powdered potassium persulphate, and the mixture is gently warmed. In the presence of manganese the purple colour soon develops, and in a few minutes, when this has reached its maximum intensity, the solution is boiled, to decompose the excess of persulphate; the colour may then be compared with that of a standard, prepared from a solution of manganese sulphate of known strength.—F. Sodn.

Apparatus for precipitating, filtering, and drying in an inert gas. J. B. Firth and J. E. Myers. Chem. Soc. Proc., 1911, **27**, 96—97.

The apparatus designed for the above purpose is shown in the accompanying sketch. The reacting liquids are placed in the funnels, *A*, *A*, and the remainder of the apparatus is exhausted through a Büchner flask fitted to the filter-funnel, *H*. The apparatus is then filled with the inert gas through a side-tube at *K*. The tap, *D*, being closed, the reacting liquids are run into the precipitating tube, *C*, and are mixed by means of the stirrer, *B*, which slides in a rubber stopper lubricated with rubber grease. When the reaction is complete, the tap, *D*, which has a wide bore, is opened, and the precipitate filtered off in the funnel, *H*. The washing and drying are carried out by drawing suitable liquids through the precipitate, and finally aspirating a stream of the inert gas to remove the liquids used for drying. There is a ground glass joint at *G*, by means of which the funnel is prepared for filtration and the precipitate is removed. This apparatus is being used with satisfactory results in the preparation of copper hydride.



Halogens; Determination of —— by the method of Baubigny and Chavanne. H. Emde. Chem.-Zeit., 1911, **35**, 450—452.

Experience with the method of Baubigny and Chavanne for the determination of iodine (this J., 1903, 761, 1018) and of chlorine and bromine (this J., 1904, 136) has led the author to recommend this method, in preference to that of Carius, in all cases, as being simpler and more rapid, whilst equally accurate. For the determination of chlorine and bromine, however, in the presence of each other, the use of an Allihn's tube is advised for filtering the mixed silver halides, so that, after drying at 140° C. and weighing, the whole may be converted into chloride, by heating (not to fusion) in a current of chlorine, and weighed again.—F. Sodn.

Iron [in milk, etc.]; Colourimetric determination of ——. H. Lachs and H. Friedenthal. Biochem. Zeits., 1911, **32**, 130—136.

If the reaction-mixture, obtained by treating a solution of ferric iron with a thiocyanate, is shaken with ether, the red non-dissociated ferric thiocyanate which is formed most abundantly in presence of a certain quantity of H-ions (that corresponding to about 2*N*-hydrochloric acid) passes into the ethereal layer; further portions of non-dissociated compound are formed in the aqueous solution and are dissolved by the ether, the amount of non-dissociated compound finally contained in the ether being more than that originally present in the aqueous solution, and the reaction is thus rendered more delicate. The authors describe a method, based on these considerations, for determining traces of iron, *e.g.*, in milk. Portions of 1, 0·8, 0·6, 0·5 c.c., etc., of a 0·01 per cent. solution of ferric iron are introduced into a series of test-tubes, the same volumes of a 0·001 per cent. solution being placed in a second set of tubes. The contents of each tube are made up to 1 c.c. with distilled water, and treated with 1 c.c. of 6*N*-hydrochloric acid (free from iron) and with 1 c.c. of a concentrated solution of potassium thiocyanate. The mixtures are then shaken with 1 c.c. of ether; the ethereal layers form a series of colour standards. The red colour disappears in 4 to 6 hours, yellow needles crystallising out. To determine the iron-content of milk, 5 c.c. of the milk are incinerated, the ash is taken up with 1 c.c. of 6*N*-hydrochloric acid and 1 c.c. of water, the solution is treated with 1 c.c. of a concentrated solution of potassium thiocyanate, and shaken with 1 c.c. of ether, the colour of the ethereal layer being compared with the standards. The extraction with ether permits of the determination of iron in turbid or dark liquids, *e.g.*, urine, ink. With this method it is possible to determine iron in solutions containing only 1 part in 50,000,000. Any trace of iron in the reagents may be removed, in the form of ferric thiocyanate, on shaking with successive portions of ether; the vessels employed in the determination should be rinsed, prior to use, with a concentrated solution of potassium thiocyanate containing hydrochloric acid, the slightest contamination with iron being thus indicated. —L. E.

Ferrous oxide; New reaction of ——. Separation of iron and aluminium. Charitschkoff. Chem.-Zeit., 1911, **35**, 463.

A solution of naphthenic acid in petroleum spirit will extract iron in the ferrous condition from a neutral or slightly acid aqueous solution, provided that the reagent is present in excess. Ferric salts do not give this reaction. A rapid method for the quantitative separation of iron from aluminium may be based upon this reaction. The solution containing salts of the two metals is rendered neutral or faintly acid, and, after reduction of the iron to the ferrous condition, is extracted with the petroleum spirit solution of naphthenic acid. The whole of the iron will be found in the upper layer in the form of ferrous naphthenate, whilst the aluminium will be left in the aqueous layer.—C. A. M.

Chromium, iron, and aluminium; Separation of —— by means of ammonium persulphate. R. C. Cowley. Chem. and Drug., April 29, 1911, 133.

For the separation of chromium, aluminium, and iron, treatment of the mixed hydroxides of the metals with sodium peroxide, which converts the chromium into chromate and the aluminium into aluminate, in presence of water, is now largely employed. The author has found that the sodium peroxide may be replaced by ammonium persulphate, which is easier to handle and cheaper than sodium peroxide. The hydroxides are mixed with water and warmed with a small quantity of the persulphate until solution is complete, the chromium hydroxide being converted into a compound of chromic anhydride. On the addition of alkali, ferric hydroxide is precipitated; aluminium and chromium can be detected in the solution in the usual way.—A. S.

Racemic acid as a reagent in analysis. [Detection and determination of calcium and strontium.] A. Kling. Bull. Soc. Chim., 1911, **9**, 355—361.

The very small solubility of the racemates of calcium and strontium allows racemic acid to be used for the detection and determination of these metals. For example, traces of calcium or strontium in barium salts may be detected by neutralising the solution, containing 4—5 per cent. of the salt to be examined, with sodium carbonate and adding an excess of sodium acetate, a few drops of acetic acid, and a 10 per cent. solution of pure racemic acid; a crystalline precipitate is almost at once produced in the presence of calcium or strontium. In certain cases also (as, for instance, in the presence of aluminium, iron, magnesium, phosphoric acid, and citric acid), the separation of calcium as racemate is specially suitable. To 100 c.c. of the solution, containing 0·2—0·3 grm. of calcium, 10 c.c. of a solution containing 10 per cent. of sodium acetate and 10 per cent. of acetic acid and 10—20 c.c. of a 10 per cent. solution of racemic acid are added, and, after half an hour, the precipitate is filtered off and washed with cold water; it is then ignited to calcium oxide or titrated with permanganate. In the presence of iron or aluminium an amount of normal sodium tartrate, 10—15 times that of the iron or aluminium, is added before precipitation, and, if magnesium be present, it is necessary to dissolve the precipitate in hydrochloric acid and reprecipitate by boiling with sodium acetate and acetic acid in presence of a little racemic acid. In the determination of strontium, the racemate is ignited, and then the residue is dissolved in nitric acid and the nitrate ignited to oxide. The precipitation of strontium is incomplete in presence of iron or aluminium.—F. Sodn.

Analysis of creosotes for the preservation of wood. Estor. *See* III.

Determination of the rosin in rosin size. Rouyer and Naville. *See* V.

Acidity of paper. Application of the "Hughes" reaction with potassium iodide. Strachan. *See* V.

Determining nitrites. Rupp and Lehmann. *See* VII.

Volumetric determination of sulphur in iron and steel. Elliot. *See* X.

Detection of graphite in lubricants. Marcusson and Meyerheim. *See* XII.

Determination of fatty acids in soaps. Budde. *See* XII.

Determination of glycerol. Probeck. *See* XII.

Yield of leather and leather analysis. Appelius and Manstetten. *See* XV.

Determination of α- and β-bitter acids in hops and application of results in brewery practice. Feuerstein. *See* XVIII.

The alcohol test and the acidity of milk. Fendler and Borkel. *See* XIXa.

Determination of phosphorus in milk. Bordas and Touplain. *See* XIXa.

Determination of husk in cocoa powder. Dubois and Lott. *See* XIXa.

Determination of dissolved oxygen. Winkler. *See* XIXb.

Detecting nitrites in water. Dané. *See* XIXb.

Valuation of coca leaves. De Jong. *See* XX.

Analysis of liquorice juice. Parry. *See* XX.

Chemical-toxicological detection of adrenaline. Venturoli and Gallerani. *See* XX.

Determination of essential oils. Howard. *See* XX.

Patents.

Gases; Devices for detecting combustible ——. A. Philip and L. J. Steele, Portsmouth. Eng. Pat. 5142, Mar. 1. 1910.

Automatic means are described for preventing overheating of detectors in which catalytic substances are employed. When the combustible gases in the atmosphere to be tested are present in sufficient quantity to cause the catalytic substance, such as platinised asbestos, to become heated to a certain temperature, the mercury thread in the thermometer of the apparatus may be caused to close an electric circuit; this results in the closing of the inlet to the apparatus by means of an electro-magnet, and the current of electricity supplying the initial heat to the catalytic substance is also interrupted. A suitable alarm device is also actuated by the expansion of the mercury in the thermometer. In another form of the apparatus, the action of the combustible gases on the catalytic substance causes a current of electricity to operate a valve which cuts off the supply of gas, and admits pure air to the apparatus; when the apparatus cools, the gases to be tested are readmitted. The action of the apparatus also lights red and white lamps alternately.—W. P. S.

Photometers. J. M. G. Trezise and W. J. Sheppard, London. Eng. Pat. 15,408, June 27, 1910.

In the photometer described, and of which several modifications are given, the exposed surface of the photometer-light is reduced or localised by means of a translucent screen placed between the light and the photometer screen; the distance between the light and the translucent screen is adjustable, so that a large range may be obtained or the instrument calibrated or standardised. The illumination on the photometer screen may also be varied by movement in a curved, straight, transverse, or diagonal path. The observation tube of the photometer may be fitted with mirrors or prisms, the reflecting surfaces of which are darkened, so that the intensity of the light visible to the observer is reduced to a convenient extent. —W. P. S.

Oil; Process for testing —— in respect to its behaviour towards gases or vapours. Oelwerke Stern-Sonneborn A.-G. Ger. Pat. 232,233, July 1, 1910.

The oil, mixed with the gas or vapour, is caused to travel over a long path, which can afterwards be examined along its whole length, so that the amount and character of the deposit produced can be ascertained. An apparatus is described consisting of a cylindrical casing in which any desired number of concentric pipes can be arranged, the surfaces of the pipes being so shaped that helical paths, for the mixture of oil and gas or vapour, are formed between the pipes and between the outermost pipe and the casing. —A. S.

Carbon dioxide in flue gases; Apparatus for indicating and automatically registering the content of ——. E. P. Ward. Fr. Pat. 423,713, Oct. 17, 1910. Under Int. Conv., Oct. 18, 1909, and Sept. 20, 1910.

See Eng. Pats. 23,846 of 1909 and 21,835 of 1910; this J., 1910, 1241, and 1911, 451.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Chemical action induced by cathode rays and canal rays. E. P. Perman. Chem. Soc. Proc., 1911, **27**, 94.

The transmutation of copper, thorium, and uranium by means of cathode rays and canal rays has been attempted, and the chemical effect of canal rays on a number of substances has been studied. The following are the chief conclusions: (*a*) Neither cathode rays nor canal rays produce any transmutation of the elements. (*b*) Canal rays in air or oxygen have a strong oxidising action. (*c*) The oxidising action appears to be mostly direct, but is accompanied by a scattering effect. (*d*) Many substances are decomposed by the action of canal rays independently of the nature of the gas in which the rays are produced.

Decacyclene and its alleged solvent power for graphite. M. Padoa. Atti R. Accad. dei Lincei, Roma, 1911, [5], **20**, I., 345—347. Chem. Zentr., 1911, **1**, 1411.

The author, using the cryoscopic method, found that decacyclene, prepared by a modification of Dziewonski's method (this J., 1903, 487), had no solvent action on samples of Bavarian, Siberian, and Ceylon graphite. (Compare Ostromisslenski, this J., 1908, 980.)—A. S.

Alizarin in rhubarb; Occurrence of ——. H. Müller. Chem. Soc. Proc., 1911, 27, 101.

The author has continued his investigations on rhubarb, and finds that the root contains alizarin as well as emodin and chrysophanic acid.

Books Received.

A Pocket Medical Dictionary. Giving the Pronunciation and Definition of the principal words used in Medicine and the Collateral Sciences, including complete tables of Bacteria, Bacilli, Micrococci, Spirilla, etc., etc. Also new dose-lists of drugs, and their preparations, etc., based upon the new U.S. Pharmacopœia. By George M. Gould, A.M., M.D. Fifth Edition. H. K. Lewis, 136, Gower Street, London, 1909. Price 5s.

Pocket book size, bound in leather, containing 863 pages of subject matter, and ending with a list of symbols and abbreviations. The portions of the work useful for the chemist and analyst are: (I), The complete table of bacilli arranged under the heads "Name" (given in full), "Where Found," and "Characters." It fills 22 pages. (II), Table of bacteria (9½ pages), under "Name," "Where found," and "Primary characters." (III), Table of micrococci (9 pages), arranged as in (II). (IV), Table of spirilla (1½ pages). (V), Table of tests (25 pages). These are given under the names of their authors, and are arranged alphabetically. Among the tables for Weights and Measures, are given some for converting metric weights into troy weights, and *vice versa*, and others for giving the comparative values of apothecaries' and metric liquid measures, and the reverse, also for the comparative values of avoirdupois and metric weights.

Das Radium in der Biologie und Medizin. Von Prof. E.S. London. Akademische Verlagsgesellschaft m. b. H., Leipzig. 1911. Price M. 6; bound, M. 6.80.

8vo volume, containing 173 pages of subject matter, and 22 pages devoted to a bibliographic index of literature relating to the subject. The text is illustrated with twenty photolithographic engravings, and is subdivided according to the following scheme:—I. Physical and chemical properties of radium. II. Physiological properties. (i), Mechanism of the action of radium on the living organism. (ii), Action on:—bacteria; lower fungoids; ferments, toxins and antitoxins; plants and lower animal organisms; processes of embryonal development, etc.; single organs, and tissues. III. General action of radium and its emanation on the higher organisms. IV. Radium-therapeutics. (i), Radio-active agents. (ii), Modes of application. (iii), Therapeutic applications of radio-active substances. (iv), Measuring the radio-activity. (v), Healing results. (vi), Review of the employment of the emanations. Bibliography of the literature of the subject.

Chemistry for Beginners. I. Inorganic. By Edward Hart, Ph.D., Professor of Chemistry, Lafayette College, Easton, Pa., U.S.A. Fifth Edition. The Chemical Publishing Co., Easton, Pa., U.S.A. 1910. Price $1.00.

This book, of small 8vo size, contains 207 pages of subject matter with 78 illustrations, and an alphabetical index.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

Patent Specifications may be purchased at the Sale Branch of the Patent Office, Quality Court, Chancery Lane, London, W.C., fifteen days after the date on which acceptance of the complete specification is advertised. The price is 8d. each.

I.—GENERAL PLANT; MACHINERY.

Applications.

10,575. Crossley. Filter presses. May 2.

10,724. Lane. Synthetical production of compound gases. May 3.

11,163. Podmore and Bailey. Filtration process.* May 9.

11,251. Deacon, Gore, and Palatine Engineering Co., Ltd. Apparatus for adding coagulants or other reagents to liquids. May 9.

11,252. Maschinenbau-Ges. Martini und Hüneke. Apparatus for pumping and conveying inflammable liquids. [Ger. Appl., May 10, 1910.]* May 9.

11,309. Sutcliffe. Kilns.* May 10.

11,527. Humphrey. Methods and apparatus for raising or forcing liquids. May 12.

Complete Specifications Accepted.

10,418 (1910). Franke. Treatment of substances to be dried by pressing. May 10.

11,288 (1910). Scott, and Scott and Co. Combined digesting and drying apparatus. May 10.

11,546 (1910). Martin, and Matthews and Yates, Ltd. Apparatus for treating materials with gases. May 17.

16,977 (1910.) Heys. Apparatus for separating materials. May 10.

21,746 (1910). Hessling. Compressing air and other gases. May 17.

25,560 (1910). Scheinemann. Evaporating apparatus. May 17.

2830 (1911). Soc. Anon. des Manuf. des Glaces et Prod. Chim. de St. Gobain. Classifying powdered or fine material. May 17.

8233 (1911). Passow. Manufacture of filtering plates, etc. May 10.

II.—FUEL; GAS; MINERAL OILS AND WAXES; DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

10,521. Rindfleisch. Treatment of fine coal. [Ger. Appl., Jan. 10, 1911.]* May 1.

10,529. Wilde. Treatment of products of combustion. May 1.

10,651. Stanley (Morris). Manufacture of artificial fuel.* May 2.

10,724. Lane. *See under* I.

10,911. Royston (Rickie). Gas producers or generators.* May 5.

11,091. Spicer. Solidification of petrol and like liquids. May 8.

11,111. Kummerer, and Ges. f. Elektrotechn. Industrie. *See under* XXIII.

11,143. Hird. *See under* III.

11,266. Heenan and Froude, Ltd., and Cleworth. Gas producers. May 10.

11,276. Doherty. Apparatus for coking coal.* May 10.

11,383. Doherty. *See under* VII.

11,517. Burkheiser. *See under* VII.

11,554. Testrup and Rigby. Production of briquettes. May 12.

Complete Specifications Accepted.

7919 (1910). Woodall and Duckham. Continuously-working vertical gas retorts. May 10.

10,832 (1910). Hill. Fuels. May 10.

10,841 (1910). Tavernier. Manufacture of nuts or briquettes of fuel with the refuse of lixiviated cellulose. May 10.

11,444 (1910). Clerk, Bickerton, and Bradley. Gas producers. May 17.

11,521 (1910). Woodroffe. *See under* XXIII.

12,923 (1910). Jones. Coke ovens. May 17.

13,518 (1910). British Thomson-Houston Co. (General Electric Co.). Arc-light electrodes. May 17.

22,469 (1910). Lloyd. Gas scrubbers or the like. May 10.

22,908 (1910). Beilby. Apparatus for the distillation of coal or other carbonaceous materials. May 17.

III.—TAR AND TAR PRODUCTS.

Applications.

11,052. Jones. Manufacture of *m*-cresol from a mixture of cresols. May 8.

11,061. Jones. Partial separation of *m*-cresol from *o*-cresol and *p*-cresol. May 8.

11,143. Hird. Plant for the continuous distillation of coal tar, mineral oils, and the like. May 9.

11,426. Newton (Bayer und Co.). Manufacture of nitrogenous anthraquinone derivatives. May 11.

Complete Specifications Accepted.

11,440 (1910). Imray (Meister, Lucius, und Brüning). Manufacture of anthraquinone derivatives. May 17.

11,804 (1910). Meister, Lucius, und Brüning. Manufacture of pure β-anthraquinonylurea chloride. May 17.

22,862 (1910) Still. Apparatus for distilling hydrocarbons dissolved in tar oils. May 10.

IV.—COLOURING MATTERS AND DYES.

Applications.

10,523. Bloxam (Durand, Huguenin, und Co.). Manufacture of violet to red mordant dyestuffs.* May 1.

10,635 and 10,636. Stange. Manufacture of deep black water-soluble colouring matters from nigrosines and from indulines. [Ger. Appls., May 24 and July 26, 1910.]* May 2.

10,772. Frank. Colouring matters. May 4.

10,835. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of disazo dyestuffs. May 4.

10,905. Newton (Bayer und Co.). Manufacture of mordant dyestuffs of the triphenylmethane series. May 5.

10,907. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of azo dyestuffs for wool. May 5.

11,083. Newton (Bayer und Co.). Manufacture of mordant dyestuffs of the triphenylmethane series. May 8.

11,085. Newton (Bayer und Co.). Manufacture of azo dyestuffs. May 8.

11,421. Allmann. Manufacture of vat dyestuffs of the anthraquinone series containing sulphur. [Ger. Appl., June 30, 1910.]* May 11.

11,422. Soc. Chem. Ind. in Basle, and others. Manufacture of sulphurised vat dyestuffs of the anthracene series.* May 11.

11,427. Newton (Bayer und Co.). Manufacture of trisazo dyes. May 11.

Complete Specifications Accepted.

11,877 (1910). Levinstein, Baddiley, and Levinstein, Ltd. Intermediate products for the manufacture of azo dyestuffs. May 17.

14,735 (1910). Newton (Bayer und Co.). Manufacture of azo dyes. May 10.

20,726 (1910). Tootall. Dyes for domestic purposes. May 17.

20,970 (1910). Meister, Lucius, und Brüning. Manufacture of vat dyestuffs. May 17.

1730 (1911). Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of disazo dyestuffs. May 10.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

10,564. Heide (Knowlton Bros.). Paper making.* May 1.

10,812. Silberrad. Retting of flax straw. May 4.

10,846. Kalbfleisch. Sizing compound and the production thereof.* May 4.

11,489. Pfiel. Manufacture of cellulose from wood, wood chips, straw, reed, etc. [Austrian Appl., June 19, 1910.]* May 12.

Complete Specification Accepted.

19,133 (1910). Horton. Fabrics impregnated with carbon and their manufacture. May 10.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

10,673. Ratignier and Pervilhac. Printing patterns on fabrics or tissues.* May 2.

10,731. Chester. Treatment of textile fabrics and yarn composed of wool or other animal fibre. May 3.

10,760. Henderson. Treatment of skin wools. May 3.

10,836. Ransford (Cassella und Co.). Production of multi-coloured effects in textile goods. May 4.

10,890. Garner. Dyeing machines. May 5.

11,320. Smith. Impregnating compositions for fireproofing and preserving fabrics, wood etc.* May 10

11,360. Garner, Hay, and Cooper. Printing or ornamenting textile and other fabrics. May 11.

11,420. Meister, Lucius, und Brüning. Printing carpet yarns. [Ger. Appl., June 4, 1910.]* May 11.

Complete Specifications Accepted.

11,055 (1910). Landau und Co., and Kreidl. Process for loading silk. May 10.

14,054 (1910). Furneaux. Apparatus for dyeing or scouring fabrics, yarns, wool, etc. May 17.

28,084 (1910). Boult (During). Production of embossings on tissues. May 17.

867 (1911). Dörr. Process for dyeing mixed textile materials. May 17.

1941 (1911). Sumner. Apparatus for bleaching and for preparing bleaching, deodorising, and disinfecting solutions. May 10.

5184 (1911) Imrie (Anilinfarben u Extract-Fabr. vorm. J. R. Geigy). Process for dyeing with a mixed chrome-copper lake. May 17.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

10,522. Meister, Lucius, und Brüning. Manufacture of pure nitric oxide. [Ger. Appl., Oct. 31, 1910.]* May 1.

10,759. Gewerkschaft des Steinkohlenbergwerks Lothriugen, and Uhde. Production of ammonium nitrate.* May 3.

11,103. Boult (Flugger). Manufacture of zinc oxide and zinc sulphide.* May 8.

11,245. Hale. Apparatus for use in recovering corrosive acids from their absorbents.* May 9.

11,306. Aumont. Apparatus for producing oxygen. [Fr. Appl., May 23, 1910.]* May 10.

11,383. Doherty. Recovering as ammonia the volatile nitrogen of coal.* May 11.

11,517. Burkheiser. Recovery of sulphide and sulphate of ammonia in the manufacture of gas. [Addition to No. 20,920 of 1908.]* May 12.

11,539. Ranson. Manufacture of zinc compounds. May 12.

11,640. Consortium f. Elektrochem. Industrie. Generation of hydrogen from silicon and alkali solutions without external heat. [Ger. Appl., May 14, 1910.]* May 13.

Complete Specifications Accepted.

13,097 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia. May 17.

14,187 (1910). Saint-Martin. Apparatus for treating liquids with oxygen or ozone. May 17.

20,127 (1910). Johnson (Badische Anilin und Soda Fabrik). Catalytic manufacture of ammonia. May 17.

28,733 (1910). Chem. Fabr. von Heyden. Manufacture of anhydrous hydrosulphites. May 10.

28,839 (1910). Behrens. Manufacture of concentrated acetic acid. May 10.

319 (1911). Friderich. Manufacture of nitric acid. May 10.

IX.—BUILDING MATERIALS.

Applications.

11,320. Smith. *See under* VI.

11,509. Brand. Artificial stone. [U.S. Appl., May 14, 1910.]* May 12.

11,647. Julians and Hogg. Manufacture of artificial stone. May 13.

Complete Specification Accepted.

13,970 (1910). Heaton. Manufacture of bricks. May 10.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

10,642. Bracq. Ore roasting furnaces.* May 2.

19,643. Vautin. Recovery of metals from slags. May 2.

10,666. Soc. Anon. des Forges et Fonderies de Montataire. Converters for making steel. [Fr. Appl., July 19, 1910.]* May 2.

10,900. Hodson. Manufacture of ferro-alloys for steel making. May 5.

10,939. Winner. Furnaces for smelting metals, etc. [Ger. Appl., May 7, 1910.]* May 5.

11,146. Mason. Plating or depositing metals on aluminium or other oxidisable metals. May 9.

11,205. Boczogo, Hollaki, and Duffek. Hardening iron and steel articles.* May 9.

11,215. Rümpler. Formation of galvanic metallic coatings on aluminium articles. [Ger. Appl., Aug. 5, 1910.]* May 9.

11,432. Lemêtre. Preserving metals from rust.* May 11.

11,515. Helsingborgs Kopparverks Aktiebolag. Method of chlorinating roasting of ores. [Appl. in Sweden, May 25, 1910.]* May 12.

11,644. Cowper-Coles. Production of tin-plate and tin-plate substitutes. May 13.

Complete Specifications Accepted.

10,782 (1910). De Spirlet. Furnaces for roasting ores. May 10.

11,175 (1910). Seward and others. Electrolytic production of light metals, particularly sodium. May 10.

13,934 (1910). Poldihutte Tiegelguszstahlfabrik. Melting or refining furnaces. May 17.

16,177 and 24,873 (1910). Duke. Alloy and its manufacture and treatment. May 17.

19,772 (1910). Ruthenburg. Electrolytic production of antimony. May 17.

25,741 (1910). Kohlhaas. Manufacture of steel. May 10.

27,741 (1910). Gabrielli. Roasting ores to separate the metals contained therein. May 10.

28,746 (1910). Boucher. Manufacture of iron and steel. May 17.

580 (1911). Reid. Apparatus for electro-plating. May 17.

XI.—ELECTRO-CHEMISTRY.

Applications

10,858. Plauson, Zsvetaeff, and Tistchenko. Electric furnaces.* May 4.

11,497. Woltereck. Process of forming Planté plates. May 12.

11,626. Schwerin. Treatment of finely subdivided substances by electric osmose.* May 13.

Complete Specification Accepted.

19,804 (1910). Reid. Electric furnaces. May 17.

XII.—FATS; OILS; WAXES.

Complete Specifications Accepted.

19,150 (1910). Newton (Bayer und Co.). Medicinal soaps and process of making them. May 17.

23,117 (1910). Janousek. Process for scenting soaps. May 17.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Application.

10,682. Walker and Goldie. Colour oil. May 3.

Complete Specifications Accepted.

23,752 (1910). Fabr. de Vernis et Prod. Chimiques Anti-fouling paints. May 17.

27,636 (1910). Meister, Lucius, und Brüning. Manufacture of yellowish-green colour lakes. May 17.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

10,821 and 10,822. Davidson. Extraction or coagulation of india-rubber from latex. May 4.

10,911. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds resembling rubber. May 5.

10,942. Boult (Comp. Gén. d'Extraction de Caoutchouc). Mechanical dry extraction of rubber from plants. May 5.

11,101. Woosnam. Curing and manufacture of india-rubber. May 8.

11,323. Olsson. Manufacture of resilient substances. May 10.

11,482. Terry, Spencer, and Curbishley. Devulcanising old and waste rubber. May 12.

11,544. Soc. Internationale Asia-Caoutchouc. Separation of rubber or similar substances from resin. [Belg. Appl., May 12, 1910.]* May 12.

11,624. Pfleumer. Manufacture of hot vulcanised froth from india-rubber, gutta-percha, and balata. [Ger. Appl., Aug. 6, 1910.]* May 13.

Complete Specification Accepted.

11,576 (1910). Thame. Treatment of raw rubber. May 17.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

10,996. Piggott. Preparation for treating leather. May 6.

11,411. Parks. Preparation for hardening, preserving, and waterproofing leather, etc.* May 11.

Complete Specifications Accepted.

11,345 (1910). Vulcano Tanning and Machine Co. Tanning or like treatment of hides or skins. May 17.

15,798 (1910). Folsch. Process for waterproofing boot leather. May 10.

491 (1911). Thompson (Hide-Ite Leather Co.). Manufacture of artificial leather or leather board. May 17.

XVII.—SUGARS; STARCHES; GUMS.

Complete Specification Accepted.

16,666 (1910). Verity. Manufacture of dextrin. May 17.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

10,937. Lake (Soc. Anon. l' Autolyse). *See under* XIX.

11,419. Durst. Preparation of colouring malt in the form of meal. [Ger. Appl., May 11, 1910.]* May 11.

11,424. Erdman and Schmuck. Purification of yeast.* May 11.

Complete Specifications Accepted.

13,129 (1910). Henri, Helbronner, and von Recklinghausen. Manufacture of wine and other potable liquors. May 17.

27,489 (1910). Reinhardt. Production of malt grist for brewing purposes. May 10.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

10,937. Lake (Soc. Anon. l'Autolyse). Conversion of yeasts into food.* May 5.

11,298. Mackenzie. Purification of sewage effluents and other liquids by air washing under pressure. May 10.

11,549. McKenzie. Food product. May 12.

Complete Specifications Accepted.

14,187 (1910). Saint-Martin. *See under* VII.

23,676 (1910). Birney. Preservative treatment of milk. May 17.

1122 (1911). Pusey and Fleming. Preservation of milk. May 17.

1941 (1911). Sumner. *See under* VI.

9478 (1911). Deuts. Milchwerke Dr. A. Sauer. Manufacture of albumen from Japanese soja. May 17.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

10,826. Johnson (Badische Anilin und Soda Fabrik). Manufacture of diolefines. May 4.

10,915. Johnson (Badische Anilin und Soda Fabrik). Manufacture of hydrocarbons of the terpene series. May 5.

11,029. Weitz. Manufacture of camphene or camphor free from chlorine. [Ger. Appl., May 7, 1910.]* May 6.

11,084. Newton (Bayer und Co.). Manufacture of ethers of a-halogenisovalerianylisourea. May 8.

11,503. Newton (Bayer und Co.). Manufacture of pharmaceutical products. May 12.

11,625. Imray (Meister, Lucius, und Brüning). Manufacture of substituted aromatic arsines. May 13.

Complete Specifications Accepted.

27,898 (1910). Darrasse frères, and Dupont. Apparatus for use in the sublimation of camphor. May 10.

569 (1911). Verein. Chininfabr. Zimmer und Co. Manufacture of hydrocinchona alkaloids. May 10.

5595 (1911). Meister, Lucius, und Brüning. Manufacture of nitro-oxyarylarsinic acids. May 17.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Complete Specifications Accepted.

11,610 (1910). Leighton and Babcock. Photographic paper. May 17.

21,410 (1910). Ives. Coloured photographic print and process of making same. May 10.

XXIII.—ANALYTICAL PROCESSES.

Application.

11,111. Kummerer, and Ges. f. Elektrotechnische Industrie. Photometers.* May 8.

Complete Specification Accepted.

11,521 (1910). Woodroffe. Apparatus for automatically analysing a gas or gaseous mixture volumetrically and recording the same. May 17.

Journal of the Society of Chemical Industry.

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THE SOCIETY OF CHEMICAL INDUSTRY.

INCOME AND EXPENDITURE ACCOUNT FOR YEAR 1910.

EXPENDITURE.

	£	s.	d.	£	s.	d.
To Journal — Editorial and Sundry expenses—						
Editor's Salary	542	16	0			
Do. Expenses	27	14	3			
Do. Assistant	104	0	0			
Abstractors	716	2	11			
Sub-Editor's Salary	150	0	0			
Indexing Journal, &c.	111	11	0			
Foreign Journals	31	16	10			
Sundry Journals	31	8	11			
French and U.S.A. Patents and Specifications	68	12	0			
Insurance of Stock	6	10	0			
	1790	11	11			
Publishing expenses	2681	14	1			
				4472	6	0
,, Sectional expenses—						
Birmingham	40	0	0			
Canada	59	17	6			
Liverpool	31	13	8			
London	113	19	1			
Manchester	48	9	6			
Newcastle-on-Tyne	12	1	1			
New England	45	0	0			
New York	125	0	0			
Nottingham	11	3	0			
Scottish	31	16	8			
Sydney	10	14	2			
Yorkshire	34	4	11			
				563	19	7
,, Annual Meeting expenses				173	11	8
,, Working expenses—						
Secretary's Salary	300	0	0			
Assistant in Office	225	0	0			
Honorarium to Treasurer's Assistant and Clerical Assistant	77	10	0			
Rent, Lighting and Cleaning	193	10	11			
Stationery and Binding	84	4	6			
Postages, Bank Charges, Telephone, and Sundry expenses	179	13	11			
				1059	19	4
,, Excess of Receipts over Expenditure, 1910				773	19	3
				£7043	15	10

INCOME.

£	s.	d.		£	s.	d.	£	s.	d.
			By Entrance Fees	222	12	0			
			,, Life Composition Fees	51	17	6			
							274	9	6
			,, Annual Subscriptions				5174	14	8
			,, Journal—						
			Advertisements	286	4	10			
			Sales	720	13	9			
							1006	18	7
			,, Collective Index—Sales				3	6	0
			,, Decennial Index—Sales				11	0	0
			,, Dividends and Interest on Investments—						
4476	9	2	Metropolitan 3% Consolidated	126	9	4			
1000	0	0	New Zealand 3% (1945)	28	5	0			
1277	4	8	New South Wales 3% (1935)	36	1	8			
1231	0	10	Consols 2½%	28	19	8			
600	0	0	Gas Light and Coke 3% Debentures	16	19	0			
1084	13	4	North British 3% Consolidated	30	12	10			
1696	0	0	Midland Rly. 2½% Perpetual Preference	39	18	6			
1509	0	0	Great Eastern Rly. 4% Irredeemable	56	16	8			
673	0	0	South Eastern Rly. 4½% Preferred	28	10	4			
1000	0	0	Metropolitan Water Board 3% Debentures	28	5	0			
200	0	0	Nottingham Joint Station 3% Debentures	5	13	0			
1250	0	0	Great Western Rly. 5% Guaranteed	58	17	0			
800	0	0	Great Northern Rly. 3% Debentures	22	12	0			
450	0	0	Nottingham and Grantham Canal 4½% Consolidated	17	3	2			
724	8	0	India 3½%	17	18	3			
			Interest on Deposits	30	5	8			
							573	7	1
							£7043	15	10

Manchester Section.

Meeting held at Manchester in May, 1910.

MR. R. H. CLAYTON IN THE CHAIR.

MODIFICATION IN THE SULPHIDE TONING OF BROMIDE PRINTS.

BY W. F. A. ERMEN, M.A., AND CHAS. W. GAMBLE, M.SC.TECH.

A considerable amount of attention has recently been given to modifying the tints of silver bromide prints; one of the most successful methods in this direction has been to convert the black silver deposit to one of a brown colour by what is known as "sulphur toning," which consists in treating the print with a solution of iodine in potassium iodide to convert the image to silver iodide, when it is washed, treated with sodium bisulphite to decompose the starch iodine compound, washed and then immersed in dilute ammonium sulphide. Contrary to what might be anticipated, the image turns brown and not black, and the quality and colour of this brown is largely determined by the physical and chemical condition of the original print.

There are many factors which determine this "condition," and amongst the more important are the original sensitive surface, the negative, the exposure, the developing

THE SOCIETY OF CHEMICAL INDUSTRY.

BALANCE SHEET, 31st DECEMBER, 1910.

	£	s.	d.	£	s.	d.
To Sundry Creditors................				882	5	8
,, Subscriptions received in advance .				135	0	0
,, Accumulated Fund—						
Balance—31st December, 1909	16,707	16	9			
Add—Excess of Receipts over Expenditure, 1910	773	19	3			
				17,481	16	0
				£18,499	1	8

				£	s.	d.	£	s.	d.
			By Sundry Debtors (Publishers, &c.) ..				390	13	0
			,, Arrears of Subscriptions (received 1st January to 14th March, 1911)				50	0	0
			,, Cash at Bank—						
			On Deposit	750	0	0			
			Current Account	383	17	6			
			,, Cash in hand (Secretary)	24	6	2			
							1158	3	8
			,, Investments as last year—						
£	s.	d.							
4476	9	2	Metropolitan 3% Consolidated	4163	2	1			
1000	0	0	New Zealand 3% (1945)	870	0	0			
1277	4	8	New South Wales 3% (1935)	1122	3	1			
1231	0	10	Consols 2½%	1031	15	4			
600	0	0	Gas Light and Coke 3% Debentures ..	507	0	0			
1084	13	4	North British 3% Consolidated	900	5	6			
1696	0	0	Midland Rly. 2½% Perpetual Preference	1187	4	0			
1509	0	0	Great Eastern Rly. 4% Irredeemable	1629	14	5			
673	0	0	South Eastern Rly. 4½% Preference .	747	0	7			
1000	0	0	Metropolitan Water Board 3% Debentures	922	10	0			
200	0	0	Nottingham Joint Station 3%	166	0	0			
1250	0	0	Great Western Rly. 5% Guaranteed ..	1762	10	0			
800	0	0	Great Northern Rly. 3% Debentures ..	696	0	0			
450	0	0	Nottingham and Grantham Canal 4½% Consolidated	495	0	0			
				16,200	5	0			
Add—									
724	8	0	India 3½% purchased in 1910 ..	700	0	0			
							16,900	5	0
							£18,499	1	8

We have examined the above Balance Sheet, dated 31st December, 1910, and have verified the Investments and the balance at the Bankers. In our opinion the Balance Sheet shows correctly the position of the Society at 31st December, 1910.

9, Old Jewry Chambers, London,
15th May, 1911.

NORTON, FEASEY & SLADE,
Chartered Accountants.

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agent used, and the amount of deposit produced by development.

It is by modifications of these methods that we have sought to produce variation in colour.

A number of prints, on the same brand of bromide paper, and developed respectively with ferrous oxalate, metol-quinol, and amidol, were treated with the following reagents to convert the metallic silver image into the silver halide:—(1) Chlorine, bromine, and iodine. (2) Potassium ferricyanide and a soluble bromide. (3) Potassium bichromate and hydrochloric acid. (4) Cupric chloride and bromide. (5) Lead ferricyanide. (6) Mercuric chloride.

The images of silver halide produced by the first two methods of bleaching are probably very similar in their physical state; consequently when treated with solutions either of simple alkali sulphides or hydrogen sulphide, they yield images of silver sulphide, almost identical in tone. If, however, the bleaching agent employed leaves an insoluble residue mixed with the silver halide, we may expect some access of colour in the final sulphided print, due either to the colour of the residue itself, if this is unacted upon by the sulphiding agent, or if this residue can form a coloured sulphide, to the colour of the latter.

When the silver image is attacked by the mixture of bichromate and hydrochloric acid, some green chromium compound is left behind; this is not affected by the soluble sulphide, but the tone of the resulting image is decidedly greenish.

The Welborne-Piper method of applying bichromates as the bleaching agent yields silver sulphide with a purple tinge, due perhaps to a partial hardening of the gelatin, by means of which a certain proportion of metallic silver is retained in the final image. When the silver print is treated with a warm bath of sodium thiosulphate and alum the image is converted into silver sulphide by the nascent sulphur liberated. In a freshly prepared bath the picture is much weakened, and only shows a feeble yellowish tone; but as the bath "ripens," fine tones of a purple cast result.

Cupric chloride and bromide react with metallic silver to give silver chloride or bromide and the corresponding insoluble cuprous salt. On washing with water the latter is rapidly oxidised and removed, but a small portion of the copper is obstinately retained, and is converted into cupric sulphide, so that the final brown is somewhat darker than that given by the pure silver sulphide.

Mercuric chloride acts similarly to the copper salts, but mercurous chloride, being quite stable and insoluble, is not removed on washing the print, so that on sulphiding we get an image consisting of equal numbers of molecules of silver and mercurous sulphides. This latter is intensely black, and quite hides the brown colour of the silver sulphide. The print is much intensified.

Lead ferricyanide yields a white image composed of lead and silver ferrocyanides. On sulphiding we again find that we get an intensely black picture much deeper than the original.

It is well known that a solution of Schlippe's salt (sodium thioantimonate) may be used as a sulphiding agent in place of sodium sulphide, if a warmer tone is desired. This is doubtless due to the fact that some antimony pentasulphide is deposited during the formation of the silver sulphide, owing to the removal of the sodium sulphide which holds it in solution. We have endeavoured to find other processes for effecting such precipitations of coloured sulphides in combination with silver sulphide. We have found that if the sulphides of tin, arsenic, or antimony are dissolved in caustic soda, the bleached image treated with these solutions acquires a colour closely corresponding to that of the particular sulphide taken. Thus the arsenic solution gives a bright yellow image, with antimony the colour is crimson, whilst tin yields a warm brown. Either the "ous" or the "ic" sulphides of arsenic or antimony may be employed, but stannous sulphide is insoluble, so that only stannic sulphide is available for the purpose described. We have also used a solution of ammonium thiomolybdate, as described by H. E. Smith, and a solution of phosphomolybdic acid in ammonium sulphide. We find that both these reagents give warm brown tones, but they rapidly decompose, and deposit molybdenum sulphide on the whole surface of the paper, thus staining the print yellow. If sodium sulphide is added to the solution of the metallic sulphide, browner tones result, approximating to those produced by sodium sulphide alone as the amount of this is increased. The same degradation of tone is shown by solutions which have been kept for a while. It is only freshly prepared solutions that yield clear reds or yellows.

If instead of using a mixture of a ferricyanide and a bromide as the bleaching agent, prints are treated with a solution of cupric bromide, the tones produced are influenced by the presence of the copper left in the image, and to a more marked degree than when sodium sulphide alone is used. The hues are of the same order, but considerably browner. When lead ferricyanide is used as the bleaching agent, our compound sulphides show a curious reversal of the tones formed from the pure silver halide. Arsenic gives a deep brick-red image, antimony a purple and tin a yellowish brown.

Mercuric chloride, on the other hand, leads to tones similar to those shown by the plain silver halides, but they differ as do those which have been bleached with lead ferricyanide, in that they show a very considerable increase in depth. The gradations in the darker portions of the print are lost in the increase in opacity.

The method of preparing the compound sulphides was to take the metallic sulphides, preferably freshly precipitated and in a pasty condition, and to saturate with these a strong solution of caustic soda. For use, the toning solutions were diluted so as to contain the equivalent of 1 per cent. of sodium hydroxide.

Meeting held at the University on Friday, March 10th, 1911.

MR. R. H. CLAYTON IN THE CHAIR.

THE TRANSFORMATION OF RADIUM.

BY PROF. E. RUTHERFORD, F.R.S.

The subject of the transformation of radium is now a very large one, and I cannot hope to give more than a brief survey of the main results; but I shall concentrate my attention as far as possible on the more chemical side. In 1896 Becquerel discovered that the ordinary uranium compounds possessed the property of emitting a penetrating radiation of a type that would pass through matter opaque to ordinary light. This radiation darkens a photographic plate, but the effect due to uranium and its compounds is exceedingly feeble, at least a day's exposure being required to produce a sensible impression. A little later thorium and its compounds were found to possess a similar property and to about an equal degree to that of uranium. Some time later, Madame Curie made a systematic examination of the radiating power of uranium and thorium minerals, and found that the former showed a radiating power of activity between four and five times greater than that to be expected from their content of uranium. Since, in previous experiments, she had found that the radioactivity of uranium was an atomic property, she concluded that there must be a new active substance present in the mineral. Following out this line of reasoning, she was able chemically to separate two very active constituents, radium and polonium. The former in a pure state possesses a radiating power to an intense degree. While the photographic method has proved useful in many investigations on radioactivity, the electric method of measurement is far simpler and more reliable. The rays from active matter, like the Röntgen rays, possess the property of causing a discharge of electricity from a body, whether electrified positively or negatively. The ordinary gold leaf electroscope has proved very useful for such measurements. Under ordinary conditions, the insulated gold leaf system of the electroscope loses its charge very slowly. When a radioactive substance is brought near, the gas becomes a temporary conductor of electricity, and the electrified body loses its charge. This is shown by the increased rate of movement of the gold leaf. Under suitable conditions, the rate of movement of the gold leaf can be used as a relative measure of the activity of substances. The electrical effect due to uranium and thorium and the corresponding minerals, is marked and easily measured. A pure radium compound has an activity several million times greater than that of uranium, so that an insignificant quantity of radium produces a rapid discharge of the electroscope. The time is too short for me to discuss here the methods of separation and concentration of radium from uranium minerals. It suffices to say that radium has chemical properties very similar to those of barium, and is ordinarily separated with it. Finally, by the method of fractional crystallisation of the chloride or bromide, the radium is at last obtained free from barium. Mme. Curie has recently shown that radium can be obtained in the metallic state by methods similar to those employed to isolate metallic barium. The atomic weight of radium is 226·5; it has a characteristic spectrum, and from the chemical point of view is a new element with distinctive chemical and physical properties.

It is now necessary to consider the types of radiation emitted by radium and its compounds. It must be borne in mind that there are a number of active substances which possess very similar radiating properties. There are three distinct types of radiation emitted, which are known as the α, β, and γ rays. These radiations differ widely in their power of penetrating matter, and can also be distinguished by the effect on them of a strong magnetic or electric field. The α rays are of comparatively insignificant penetrating power, for they are completely stopped in passing through a few centimetres of air, or through a thin sheet of metal. They are, however, in many respects, the most important radiations emitted, for, under ordinary conditions, they are responsible for most of the electrical effect and for most of the energy emitted by radioactive substances. They have been shown to consist of a stream of particles carrying a positive charge of electricity projected with velocity of about 10,000 miles per second. I have recently shown that the α rays are material in nature, and consist of charged atoms of the rare gas, helium. The β rays are far more penetrating than the α rays, and are far more easily deflected by a magnetic field. They have been shown to consist of a stream of negatively charged particles projected at a speed between 100,000 and 180,000 miles per second. The apparent mass of these particles is only about 1/1800 of the mass of the hydrogen atom. They are, in fact, identical with the corpuscles or electrons, and their apparent mass is believed to be entirely electrical in origin. The γ rays are exceedingly penetrating, and their electrical effect can be detected through nearly a foot of lead. They are not deflected by a magnetic electric field, and appear to be analogous in their properties to Röntgen rays. The true nature of this type of radiation is at present a matter of much discussion.

The difference in penetrating power of these radiations can be easily illustrated by experiment. The discharging effect due to an uncovered layer of radium is mainly due to the α rays. On placing a sheet of paper over the radium, the α rays are all absorbed and the discharging effect is then due to the β and γ rays, but mainly to the β rays. A sheet of lead, 2 mm. thick, cuts off most of the β rays, and a discharging effect is then due to the γ rays alone. It must be remembered that the electrical effect due to the γ rays is, under ordinary conditions, less than 1/1000 of that due to the α rays.

It is seen that for the most part radiations from radium consist of a stream of charged particles projected with great velocity. The α particle is an atom of helium which is initially projected with a velocity of about 10,000 miles per second. Rutherford and Geiger have devised an electrical method of detecting a single α particle, and of counting the number emitted per second by one gram of radium itself. The α particle can also be detected by its property of producing a visible flash of light, or scintillation, when it falls on a screen of phosphorescent zinc sulphide. When the eye has become accustomed to darkness, the number of α particles falling on a given area of zinc sulphide can be counted by observing with a microscope the number of scintillations. We have thus two distinct methods of detecting a single atom of matter in swift motion, one electrical and the other optical. In addition, Mr. Kinoshita, in this Laboratory, has shown that a single α particle produces a detectable photographic effect on an ordinary plate.*

We shall now consider the interpretation of the effects taking place in radium. The radiations are emitted continuously, and show no sensible diminution over periods measured by years. In addition to the form and energy of characteristic radiations, radium is also continuously evolving heat. One gram of radium emits heat at the rate of 118 gram calories per hour; in other words, the heat is sufficient to melt an equal weight of ice in about 40 minutes. The amount of energy given out in the course of a year is very large, and yet there is no sensible alteration of the radium itself, or in its rate of emission of α and β particles. The radiating power is unaffected by chemical or physical conditions, and in this respect differs notably from any known chemical substance. Simple considerations show that chemical changes of the ordinary type are insufficient to account for the continuous emission of heat energy. At the same time it is necessary to account for the characteristic radiations. In order to account for radioactive phenomena, Rutherford and Soddy put forward some years ago the transformation theory, which is now generally accepted as a reasonable explanation of the effects observed in radium and other radioactive substances. From the chemical point of view, radium is to be regarded as an ordinary element with a definite atomic weight and with specific chemical and physical properties. It differs, however, from an ordinary element, like copper or gold, inasmuch as the atoms of which it is composed are not stable. Each second, a small fraction of the radium atoms present becomes unstable and disintegrates with explosive violence. This atomic explosion is generally marked by the expulsion of part of its mass, the α particle, at a very high speed, and the appearance of a new element with distinctive chemical and physical properties. Since the α particle is an atom of helium, and one α particle is expelled in the explosion of the radium atom, the residue of the atom has an atomic weight about 4 units less than radium. These residual atoms form an entirely new substance called the radium emanation. This exists at ordinary temperatures as a gas of high atomic weight (222·5).

I shall now consider in some detail the properties of this remarkable gas. The name "emanation" was first given to an emission of what appeared to be a radioactive gas from thorium, and when, somewhat later, similar effects were observed in radium and actinium, the name was retained. In order to illustrate the properties of these emanations, a small quantity of actinium preparation wrapped in thin paper is placed in a glass tube; the emanation produced in it diffuses through the paper and mixes through the air. On sending a puff of air through the tube between the plates and the electroscope the gold leaf collapses with great rapidity. On closing up the electroscope the discharging effect of the emanation introduced falls off very rapidly. It can be shown that the actinium emanation is a type of matter which has a radioactive life of less than a minute, for half of it is transformed into another type of matter in about 4 seconds. In this emanation, we have an example of a transition element with very unstable atoms, so that the average life of the atom is very short. The radium emanation will produce similar effects but with a difference, that its atoms are far more stable. It takes 3·85 days before half the atoms are transformed. The emanation from radium can be separated from it either by heating the radium or by dissolving it. The emanation can then be collected, and if necessary purified and contained in a sealed vessel. Under these conditions, the emanation is gradually transformed into other substances, and loses its activity. The law of decay of activity is very simple, and holds universally for all radioactive substances. The radiation from an active substance is proportional at any moment to the number of atoms breaking up per second, and at the same time varies directly as the number of unchanged atoms present. For example, if the activity of a substance falls to half value in a time, T, it follows that half of the initial number of atoms present remain unchanged at that time. In a time, 2T, one-quarter remain unchanged, in a time, 3T, one-eighth, and so on; in other words, the number of unchanged atoms present varies according to an exponential law with the time. The time, T, or half value period of a product, varies for different substances, but has a characteristic value for each substance. Since the emanation has a half value period of 3·85 days, the greater part of it is transformed in one month, and the activity observed after that interval is a very small fraction of the original value. The emanation is produced at a constant rate by a radium compound. Since the emanation is itself a transition substance and continuously changing into other types of matter, its amount reaches an equilibrium or maximum value when the number of new atoms of emanation supplied per second by the radium is on the average equal to the number of the emanation atoms which are transformed per second. The actual amount of emanation produced by radium is exceedingly small, but can be measured. One gram of radium in equilibrium yields 0·6 cubic millimetre of pure emanation at standard pressure and temperature. Notwithstanding its small amount this quantity of emanation emits radiations of enormous intensity. I have in a fine glass tube the emanation derived from about 1/10 of a gram of radium, so that the volume of the gas in a pure state is only 6/100 of a cubic millimetre. The walls of the glass tube are made so thin that the α particles are projected through the glass walls and travel several centimetres through the air before they are stopped. On bringing near a screen of zinc sulphide, it is seen to be brilliantly lighted up. This luminosity is due mainly to the α rays, and if the screen were examined with a microscope, it would be seen to show a multitude of scintillations. A screen of willemite is made brilliantly luminous, while the mineral kunzite gives a marked orange coloured phosphorescence. This emanation tube emits β and γ rays of great intensity. This is seen by the rapid discharge of the electroscope through a thick metal screen. This tube of emanation, if brought close to a photographic plate, would cause a marked photographic effect in a few seconds. An interesting effect produced by this tube is that the α rays passing through the air produce ozone at a rapid rate. The emanation in the tube has practically all the radiating properties of the 100 mgrms. of radium from which it was obtained.

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* Since the delivery of this lecture, Mr. C. T. R. Wilson has devised a method of making visible to the eye the path of a β as well as of an α particle. By a sudden expansion of the air, the ions produced by the β particle in the gas become centres of condensation of water vapour, and the trail of the particle is rendered visible by a fine cloud of water drops. Experiments of this character bring in evidence in a striking way the objective reality of the α and β particles.

The radium emanation can be condensed from the gases with which it is mixed by surrounding the tube containing the emanation with liquid air. The temperature of condensation in the experimental conditions is about —150° C. The emanation contained in the glass tube makes the walls phosphoresce, and the luminosity due to this is easily seen in a dark room. By opening a stop cock, this purified emanation is put in connection with a glass tube containing fragments of the mineral willemite cooled down by liquid air. The emanation is seen to pass from one tube to another, and to condense in the liquid air. This is shown by the luminosity communicated to the fragments of willemite. This condensation property of the emanation has proved of great service in purifying it from other gases, and is regularly employed in the laboratory for this purpose. Although the emanation exists in such minute amount, its physical and chemical properties have been closely examined. It has an atomic weight of 222·5, and gives a characteristic spectrum of bright lines. It behaves as a chemically inert and monatomic gas, and appears to belong to the well known group of inert gases. Its boiling point has been found to be —65° C. At the temperature of liquid air it condenses probably into a solid and emits an orange coloured light. The emanation is the heaviest gas known and is, in many respects, the most remarkable.

The enormous emission of energy from a radioactive substance is well illustrated by the emanation. The heating effect of radium is mainly a consequence of the expulsion of α particles. When the radium is enclosed in a vessel, the α particles are stopped either in the radium itself or in the envelope, and their great mechanical energy is converted into heat. It is known that the heating effect of any radioactive substance is in reality a measure of the kinetic energy of the expelled α particles. The emanation separated from radium emits about 80 per cent. of the heat evolved from the radium from which it is separated. Knowing the volume and density of this gas, it is a simple matter to calculate the rate of emission of heat from a known weight of emanation. Suppose, for example, it was possible to obtain a pound of this gas. Its radiations and heating effect would be so enormous that it would be difficult to construct a vessel to hold it. A short time after its introduction, the pound of emanation would emit energy at the rate of about 10,000 horse-power. The rate of emission of energy would decrease at the same rate as the emanation loses its activity; but in the course of a month it would have emitted an amount of energy corresponding to about 60,000 horse-power-days. This means that the emanation during its life emits about ten million times as much energy as the most violent explosive that can be prepared. The energy is derived from the transformation of the radioactive atoms, and is released as the result of atomic explosions.

The radium emanation is a transition element, *i.e.*, an element which has only a limited life on account of the instability of its atoms. In breaking up, the atom of the emanation expels an α particle or helium atom, and is transformed into a new substance called radium A, which behaves as a metal at ordinary temperatures. The atoms of radium A are very unstable, and break up with a half value period of 3 minutes, emitting an α particle in the process. Radium A is transformed into another metallic substance called radium B, which is half transformed in 26 minutes, accompanied by the expulsion of β particles but no α particles. This in turn changes into radium C, also a metal, which is half transformed in 19 minutes. The explosion of the atoms of radium C are very violent, for not only is an α particle expelled with great velocity but also β particles of great speed accompanied by a very penetrating type of γ rays. Radium itself emits only α rays, and the β and γ rays which arise from it when in equilibrium with its products are mainly due to the presence of radium C. These three substances, radium A, B, and C, are usually included under the name "active deposit" of radium. They can be distinguished from each other not only by the differences in rate of transformation and in types of radiation emitted, but also by the chemical and physical properties. The presence of these substances can easily be shown by experiment. When a platinum plate is placed in a vessel containing a large quantity of radium emanation, the active matter, A, B, and C, is deposited as a solid on the plate. On removing the plate from the emanation, the presence of active matter is seen at once by the luminosity it produces in zinc sulphide, and in the rapid discharge of the electroscope. The presence of this matter on the plate can be shown by rubbing the finger lightly on the plate, when part of the active matter is removed, as shown by the fact that the finger at once causes a rapid discharge of the electroscope. It must be borne in mind that the actual weight of matter on the active plate is exceedingly small, far smaller than could be weighed by the most sensitive balance, or to be detected by a microscope. Notwithstanding this, the properties of this substance can be examined chemically. If the platinum plate is placed in dilute hydrochloric or sulphuric acid, the active matter leaves the plate and passes into solution. On evaporating the solution the active matter again remains behind. On introducing a nickel plate into the solution of the three substances, Radium A+B+C, radium C alone is deposited on the nickel. This is a very convenient and useful method of isolating radium C for experimental purposes. The difference in physical and chemical properties between these three products can also be shown by heating a platinum plate to various temperatures. Radium B volatilises at the lowest temperatures, and radium A and radium C at still higher temperatures.

We have now followed the transformation of radium through four distinct successive stages. The process of disintegration, however, does not stop with radium C; the latter changes into another substance called radium D, which is very slowly transformed with a half value period of about 16 years. This in turn changes into radium E, half value period about 5 days. Radium E changes in turn to radium F, which has a half value period of about 140 days. In its transformation, radium D emits β rays of weak penetrating power, radium E swift β rays, while radium F emits α particles. Radium D has chemical properties very similar to those of lead. For this reason it is sometimes called radio-lead. It has not so far been found possible to isolate it chemically from the lead present in radioactive minerals. Radium F is identical with the substance called polonium, the first of the new radioactive substances separated by Mme. Curie from pitchblende and is derived from the decomposition of radium. Polonium has chemical and physical properties somewhat similar to that of bismuth, and is deposited from a solution on a bismuth, or copper or silver plate. Polonium has not yet been completely isolated, although it has been sufficiently purified to obtain a few of the characteristic lines of its spectrum. It is a matter of great difficulty to obtain sufficient quantity of this active substance for an ordinary chemical examination. The process of disintegration of radium apparently ends with polonium, for after the decay of polonium no residual activity is observed. There is good reason for believing that polonium after expelling an α particle changes into helium and lead. It is very difficult to obtain direct experimental proof that lead is the end product of the transformation of radium; but the indirect evidence strongly supports such a conclusion.

Now that we have traced the descendants of radium, it is necessary to see what evidence we have of its ancestors. We have seen that radium must be regarded as an unstable element which is slowly being transformed into the radium emanation. The rate of transformation is too slow to determine by direct activity measurements over an interval of a few years, but it has been shown by Boltwood by a direct experimental method that radium is half transformed in about 2000 years. Consequently in a gram of radium about 0·3 mgrm. is transformed initially per year. There is every reason to believe that radium is transformed according to the same law as all other radioactive products. Since radium is a changing substance, its presence to-day in old minerals, which have existed unchanged for periods measured by millions of years, can only be explained by supposing that radium is continuously produced by the transformation of another substance. The search for this elusive parent of radium has been of the highest interest. Boltwood finally showed that a new radioactive substance, which he called *ionium*, was the direct parent of radium. Ionium is a substance with chemical properties closely allied to that of thorium, and emits α particles in its transformation. If ionium is completely freed from radium, it is found after a short interval that radium has again appeared in the ionium due to the transformation of the latter. In the same way it is known that ionium in turn is derived from the transformation of uranium. This element is to be regarded as the first ancestor of the radium family. Uranium itself is transformed exceedingly slowly, and it can be calculated with some certainty that it would require about 5000 million years for half of it to be transformed.

The results I have so far discussed are now generally accepted by all workers in radioactivity. The numerous radioactive substances arising from the transformation of uranium must be regarded as new elements which have a limited life and are transformed according to a definite law. Similar series of transformations occur in thorium and actinium, but time is too short to discuss these in detail. Uranium and thorium appear to be distinct radioactive elements which have no genetic connection with each other. On the other hand, there appears to be no doubt that actinium is in some way derived from the uranium family; but so far it has not been found possible to locate its position in the general scheme of transformations. There is some evidence that actinium is to be regarded as a side branch of uranium or the uranium series. The great majority of the radioactive substances break up with the expulsion of α particles; helium is consequently one of the side products of their decomposition. For example, it has been shown experimentally that radium, the radium emanation, polonium and ionium all give rise to helium in their transformation, and in amount to be expected from the number of α particles ejected. In other cases, for example, radium B, radium D and E, the transformation is accompanied by the expulsion only of β particles of comparatively slow velocity. There is reason to believe that the transformations occuring in these cases are accompanied by no sensible change in atomic weight. The atomic weights of the various radioactive elements can be simply deduced by taking into consideration the expulsion of α particles. With the exception of uranium, each member of the uranium series expels one α particle during the transformation of one atom. The experimental evidence shows that uranium must emit two. Since the atomic weight of uranium is 238·5, the atomic weight of the next product, uranium X, is 8 units less, or 230·5. Since uranium X emits only a β particle, it is transformed, without change in atomic weight, into ionium. The latter is transformed into radium with the loss of an α particle, and the atomic weight of the latter should consequently be 226·5. This is very close to the atomic weight found experimentally. In a similar way, the atomic weight of the other members of the series can be calculated, and are included in the table below.

	Radiation.	Atomic weight.
Uranium	2α	238·5
Uranium X	β	230·5
Ionium	1α	230·5
Radium	1α	226·5
Emanation	1α	222·5
Radium A	1α	218·5
Radium B	β	214·5
Radium C	1α	214·5
Radium D	β	210·5
Radium E	β	210·5
Radium F	1α	210·5
End product	—	206·5 (lead ?)

It will be seen that the atomic weight of the end product is very close to that of lead, which we have seen from other evidence is believed to be the final product of the uranium-radium series.

The very small quantity in which most of the radioactive elements can be obtained has not so far made it possible to examine their chemical and physical properties with the same detail as in the case of the ordinary elements. In the case of radium and its emanation, a sufficient quantity of material has been available to examine these properties by direct chemical methods. It appears probable that the substances like ionium, radium D and polonium, which can be obtained in reasonable amount from uranium minerals, will ultimately be chemically isolated. It is obviously not an easy matter to examine the chemical properties of a substance like radium A or radium C, which disappear in an hour or so after separation. At the same time, a considerable amount of information can be obtained as to the chemical properties of such elements by using the radiating power as a method of qualitative and quantitative analysis. There seems to be no reason why the chemical properties of these new substances should not ultimately be determined with tha same certainty as in the case of ordinary elements. A certain amount of work has already been done in this direction, but a systematic examination is much wanted.

In conclusion, I would again point out that the process of transformation occurring in the radioactive bodies cannot be influenced to the slightest degree by any chemical or physical agency. We are only able to watch these atomic processes but cannot control them. As far as we know at present, there does not seem to be much hope that we shall be able eventually to alter the rate of transformation of the radioactive substances. The forces which bind the atoms together are too powerful to be influenced by the weak physical or chemical agencies at our command.

Newcastle Section.

Meeting held at Armstrong College on January 19th, 1911.

MR. E. F. HOOPER IN THE CHAIR.

THE PREPARATION OF COAL FOR THE MARKET.

BY PROF. HENRY LOUIS, M.A., D.SC., ETC.

Coal, as it occurs in a coal seam, contains inorganic impurities, consisting of shale or clayey or sandy matter. which may be either finely divided and disseminated through the masses of coal, in the same way, for instance, as the ash of wood is disseminated through the wood; or, they may occur in some more concentrated form, often in layers, varying in thickness from sheets of the thinness of paper up to dirt bands which may be several feet in thickness. Furthermore, in the act of coal getting, portions of the adjoining strata, and especially of the floor, are apt to be cut up and mixed in with the coal proper. When the inorganic matter is very finely disseminated, its separation is, from a practical point of view, impossible; when it occurs in larger particles, the coal can be freed from it to a greater or lesser extent, the methods to be adopted depending essentially upon the size of the fragments of dirt.

As regards its composition, the inorganic matter is either of the earthy character referred to above, and called by the miner "shale," or more often "dirt"—and I propose to keep to the word "dirt" as a convenient generic term in this lecture—or else it may consist of iron pyrites. The coal, after it has been mined, is wound up the shaft in small wagons or tubs, one or more of which may be contained in the cage in which it is hoisted. These tubs vary greatly in size, and may carry anything from 5 cwt. up to two tons of coal. When the cage has arrived at the shaft top, or bank, the tubs are run out of the cage, this, in modern installations, being often done by mechanical appliances. They then run over the weighing machine where their weight is recorded, and then they pass on to the tippler, which is an automatic appliance for turning the tub over and emptying the coals out gently and evenly. It is at that point I think we may fairly take the preparation for the market to begin. I include everything up to this point as part of the mining operations. The first step the coal has to undergo is screening or separating into suitable sizes. All coal above a certain size—which may be anything from 2 to 4 inches according to the market requirements and the local custom—is looked upon as lump coal or round coal, whilst the undersize from the screen is generally spoken of as small coal, and each group is treated independently. Occasionally there is a screen which makes merely two sizes; sometimes a screen which makes a number of different sizes, which are spoken of as "cobbles," "nuts," "peas," "duff," and so on, both the names and the exact dimensions varying widely in different parts of the country.

In some parts of the country the bad practice prevails of only taking the large coal out of the pit. This is very often done by loading underground with a fork, the tines of which may be anything from 1 inch to 1½ inches apart, anything that goes through these being of course left in the pit and wasted. From the point of view of heat generation, the coal that is left in the pit is quite as good as the coal that is taken out, and there is very little to be said in defence of such waste of a valuable national asset.

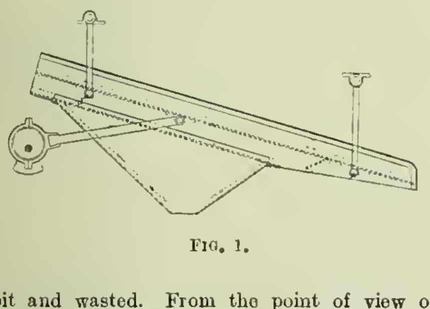


Fig. 1.

The screens used are of various kinds; the most common is the ordinary jigging screen (Figs. 1 and 2). The figures represent two of the best types of ordinary jigging screen, which merely consists of a shallow iron trough, the bottom of which forms the screening surface, suspended from girders by a number of radius rods, and worked by an ordinary eccentric, the revolution of the eccentric swinging the screen to and fro. Care must be taken that the eccentric acts upon the screen at a suitable point near its centre of gravity, otherwise a very objectionable amount of jerk is apt to be developed. The screening surface may consist of iron plates with holes—round holes, diamond shaped, or square according to local practice—or it may consist of woven wire, these being the two methods in most general use. This is a cheap screen, fairly efficient, there is no excessive amount of wear and tear about it, but it requires a considerable amount of room at the heapstead; it makes a great deal of noise, and communicates a large amount of vibration to the structure in which it is placed, in addition to which it is also rough on the coal; it does very well for most of the hard, strong coals of this country, but for some of the more tender coals, especially like some of those met with, for instance, in the north of France, it is much too rough, and other methods of screening have to be used.

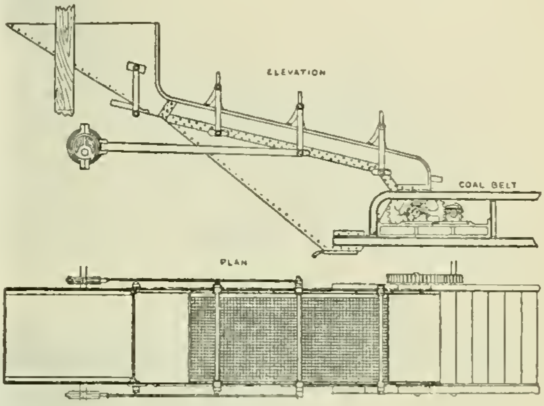


Fig. 2.

A form of screen which has been used to some extent in this country is the "Vibromotor," in which the jigging motion is produced not by an eccentric but by having a vertical shaft which swings from a joint, and to it a weight is attached eccentrically, so that the movement of the weight swings the screen. It is really an appliance which makes use of the fact of the machinery being out of balance. The objectionable results of a wheel running out of balance are well known; in this case the want of balance is utilised, and the injurious effects are absorbed in doing useful work. The result is that the "Vibromotor" runs very smoothly and very easily, and communicates very little jar even to rather a light structure, so that in cases where a screen has to be placed high up in the heapstead it has great advantages. It has not come into very general use in this country, probably for commercial reasons, but it is certainly a very satisfactory type of screen. One form is shown in Fig. 3.

In order to get over the difficulty of dealing with tender coals, a number of screens have been devised in which the screen frame is fixed, but the bars of the screen have independent motions and thus cause the coal to travel over it. There are many of them. Fig. 4 is a modern German form of the Briart screen made by the Maschinenbauanstalt Humboldt; originally used in Belgium, it has come into extensive use in Belgium, Westphalia, and France. It consists of a fixed frame of iron plates, in which rest a number of bars, which are simply channel irons with perforations in the upper plate of the channels, thus producing the screening action. They are hung by radius rods at their bottom ends, and at the top alternate bars are moved alternately by a pair of eccentrics, so that one of the bars is always moving upwards and forwards while the neighbouring bar is moving backwards and downwards. The result is that the coal resting on the bars which are moving upwards and forwards, is gradually moved down the screen by that action, so that, although the screen is fixed, the independent motion of those bars moves the coal along it very smoothly and very gently.

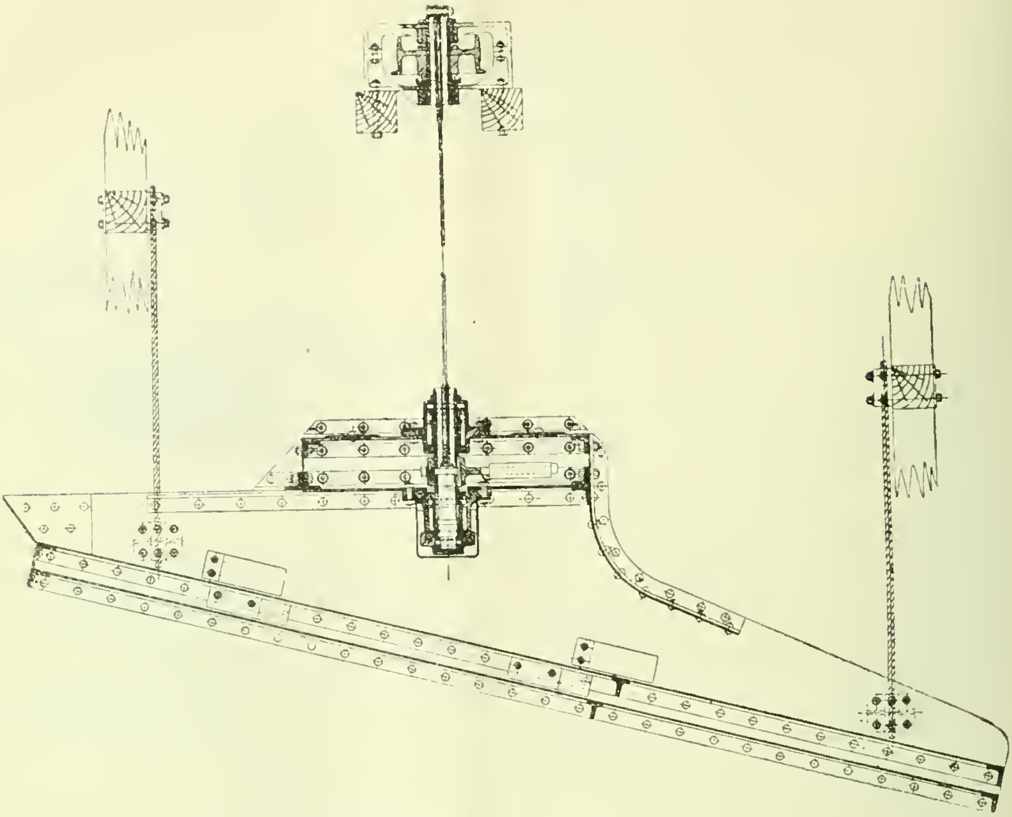


FIG. 3.—Sectional Elevation of Vibromotor Screen.

Fig. 5 shows the "Chambers" screen. Here again are a number of bars supported upon pins; alternate bars are carried on alternate pins, and are attached to a rocking lever, actuated by one or other of two eccentrics. The net result is that alternately a bar is lifted and swung forward whilst the neighbouring bar drops and moves backwards. As in the case of the Briart Screen, the coal resting on these bars is slowly moved along them. This screen has the advantage over the Briart screen that the bar is always horizontal at all times of its travel, and thus there is very little jar or jerk indeed, so that it works very smoothly.

Fig. 6 shows the Borgmann and Emde screen, simple in construction, and made up of longitudinal and transverse bars, the longitudinal bars being made of flat iron bars on edge, with semi-circular notches in the upper surface. The transverse bars which run across them are round iron bars or tubes,and they are all driven by a simple mechanical contrivance, so that the pieces of coal resting on these transverse bars, which really form rollers, are caused to travel along by the revolution of these bars. It works smoothly and quietly, perhaps a little too quietly, and small coal riding on top of a big flat piece does not get sufficient screening.

A multiple screen for making a number of different sizes, the "Coxe screen," is intended for anthracite, which accounts for the large number of different sizes that it makes. The nest of screens is supported upon four double cones and is driven by a vertical shaft which carries an eccentric; the result is that the whole nest gets a motion of gyration about an axis, so that when the coal is charged on at one end it moves over the surface of the screen in a series of circles. Every portion of that screen is in fact revolving in a circle, no two of which are concentric, and a very efficient screening action results. The screen is self-contained and does not jar its foundations. I have seen a screen running, resting on two balks of timber without being bolted down, but of course this is not to be recommended.

Occasionally it happens that a colliery which screens its coal is asked for through-and-through coal, or unscreened coal. That is simply done by rendering the screens "dumb," or "plating" the screens—replacing the perforated plates by plain plates, or laying plain iron plates over the perforated ones.

The products of the main screening are thus round coal and small coal, and entirely different methods of treatment are required in dealing further with each of these. The treatment of round coal is exceedingly simple: The lump coal, the over-size of the first or main screen, is delivered on to a picking belt, this being the appliance which is most generally used in this country. It is made up of a series of iron plates bolted to two or three longitudinal chains driven by a suitable motor, generally by means of a sprocket wheel, the plates themselves resting on a series

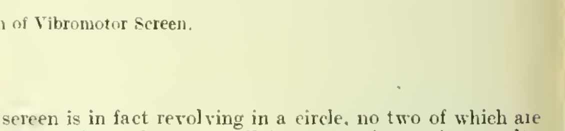


FIG. 5.

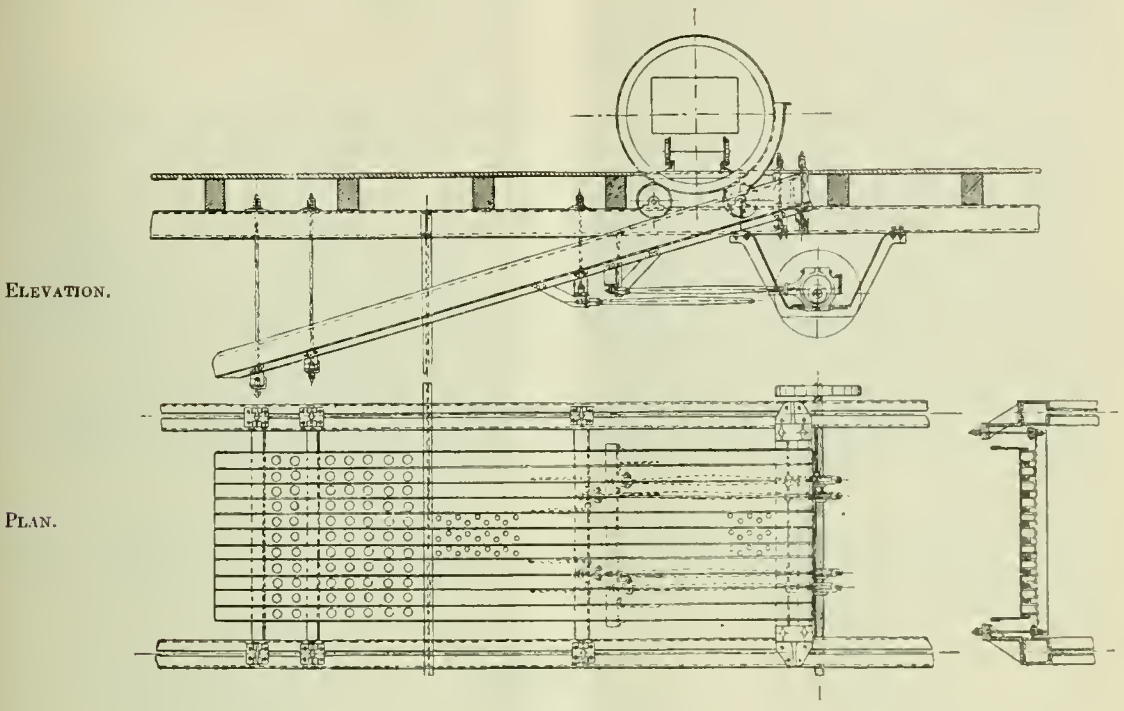


Fig. 4.

of rollers. Such a belt will be from 50 to 100 feet long, and it will travel along at a speed of about 50 feet a minute. Lads standing on either side of the belt pick out the dirt, and throw it on to a travelling belt to take it away or into tubs by means of which it can be removed. The pickers usually stand about 10 feet apart, and a belt of this kind will deal with from 20 to 50 tons of ordinary coal per hour. Instead of a picking belt, a picking table is sometimes used, which consists of an iron table carried on a vertical spindle, or on rollers, revolving at about the same rate as the picking belt would travel, the pickers standing round the outside. In some forms they can stand round both outside and inside. The advantage of the picking table is that when only one is required, it requires very much less space than a corresponding belt would do.

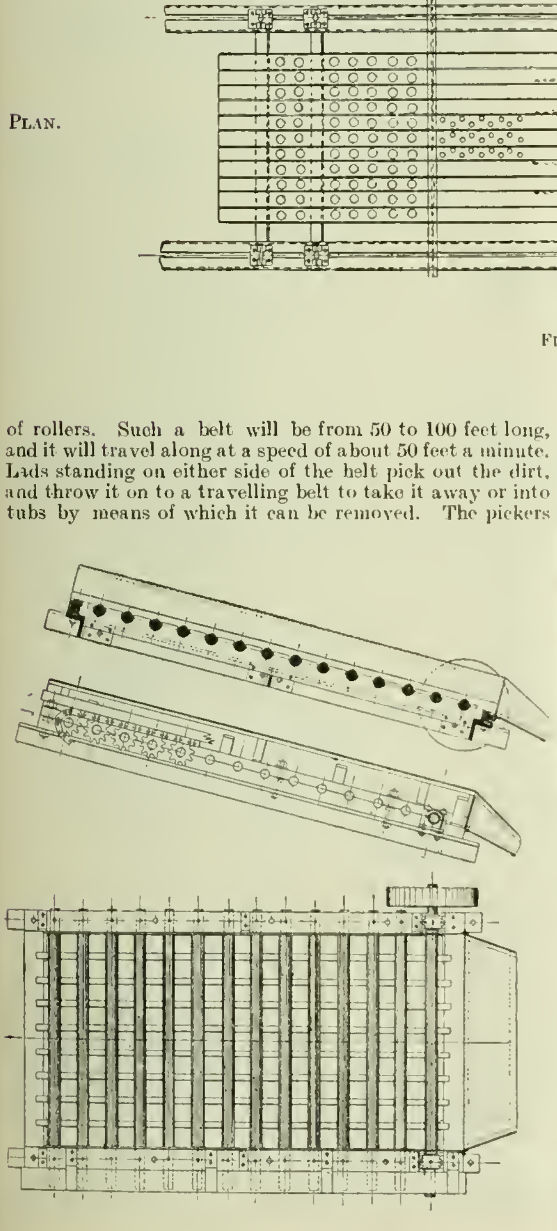


Fig. 6.

Small coal is treated in various ways. Cobbles, say down to 1½ inches or sometimes 2 inches, are sometimes screened out in a second screen below the top one, and run on to another belt where they can be picked, but picking of anything under 1½ inches is practically impossible, and everything under that size has to be treated by the methods which I shall describe somewhat more fully.

Mechanical means have to be resorted to for cleaning this small coal, this being usually spoken of as the process of coal-washing. In practice the difference in the specific gravities of coal and dirt is utilised for their separation. The specific gravity of coal varies from about 1·25 up to about 1·6 for anthracite. Ordinary bituminous coal averages about 1·3. Dirt (namely shale, fireclay, sandstone, and so forth) will probably range from 2 to 2·7 and may be averaged at about 2·5. Iron pyrites ranges from 4·8 to 5·2 and averages about 5 in specific gravity, so that any methods that will separate the ordinary dirt from coal will still more easily separate the pyrites from it, and for that reason I shall only discuss here the methods for removing ordinary dirt.

A very simple laboratory test can be used for showing whether the coal is washable, and to what extent, by crushing the coal and throwing it into a solution of specific gravity intermediate between that of the clean coal and of the ash to be separated from the coal. I found recently that a solution of zinc iodide in water is very useful and convenient for this purpose; it can be obtained up to 1·9 specific gravity, and solutions ranging from 1·4 to

1·7 are very convenient for this method of separation. The ground mass is stirred in the solution, using a separating funnel, when the coal will float up and the dirt sink to the bottom, when each can be drawn off, washed, and examined. Such a method is, of course, impossible in practice on account of the expense and the difficulty of working with heavy solutions, so the power of gravity is utilised by setting either the fluid or the coal in motion and using the momentum set up in the moving particles to effect the separation. The nature of this action is easily intelligible: If a particle is let fall in vacuum, it goes on falling with a uniform accelerated motion, there being no resistance to retard its fall, but if it falls in a resisting medium, it has work to do in displacing the particles of the fluid and in overcoming its own friction against those particles. This work becomes greater the faster it is falling, and, as it increases, it must attain such a velocity that any further increase would so greatly increase the resistance that it cannot fall faster. In other words there is a limiting velocity to which all particles are subject when falling in a resisting medium, so that a particle falling in a resisting medium falls at first with gradually increasing velocity until it reaches this practically constant uniform velocity and continues to fall at that, and this speed of falling is known as the "ultimate falling velocity" of the body.

For spheres it can be proved that a simple formula holds good. If two spheres having diameters D and D^1 and specific gravities S and S^1 respectively fall in a medium of specific gravity F, the relation holds that the ultimate falling velocity of these spheres will be the same when $\frac{D}{D'} = \frac{S' - F}{S - F}$. When the fluid is water, F is practically equal to 1, and then $\frac{D}{D'} = \frac{S' - 1}{S - 1}$. if the particles are to to fall with the same ultimate falling velocity. When the particles are falling in air, F is practically zero, and then $\frac{D}{D'} = \frac{S'}{S}$ for ultimate equal falling velocities. Comparing coal and shale, and taking the specific gravity of shale as 2·5 and of coal as 1·3, the value of $\frac{D}{D'}$ is 5 for spheres falling in water, that is to say a sphere of coal will fall in water at the same ultimate falling velocity as a sphere of shale if the diameter of the sphere of coal is 5 times that of the sphere of shale, and in the same way when falling in air, if the diameter of the sphere of coal is twice that of the sphere of shale they will fall with the same ultimate falling velocity. This result helps very much in designing coal washing machinery. At the same time it is not strictly true, except for the particular case when particles are falling in very large masses of fluid; when, as is usually the case, there are a very large number of particles crowded together, taking up a considerable portion of the fluid, the conditions are usually spoken of as the conditions of hindered falling; the particles get into each other's way and jostle each other, and under the ordinary conditions of working, particles of coal and shale can be separated when the differences between their diameters are considerably greater than given by these equations, so that it is not necessary to screen as closely as these formulæ would indicate. If it is required to separate all the coal from all the shale in a given mass, which has been screened through two screens, of which the mesh of the larger is five times the diameter of the mesh of the smaller, it is obvious that the largest possible particle of coal that can be in the product must fall more slowly than the smallest possible particle of shale that can be in it, and therefore separation is possible. It is by working on such formulas as these, that it is possible to determine the ratio that the successive meshes of screens must have to each other, in order to enable us to separate the particles. Nevertheless, these relations are only true when the particles are of certain definite sizes; when the particles dealt with are so small that another factor comes into play, namely, the internal friction of the particles of the fluid or the viscosity of the fluid, which may be neglected when dealing with particles of any considerable size, then these equations no longer hold; an entirely different set of laws come into play and such very fine particles are no longer capable of being treated by ordinary washing machinery.

The principle of separation by equal falling can be applied in several ways; one of them is to allow fragments of the coal that have to be washed, to be carried along in a stream of water, when, obviously, the slower falling ones will be carried further and those that fall more rapidly will fall nearer the point at which the coal enters the water; this is the simplest of all the principles involved. As the corollary of the above equations, if a particle is placed in an ascending stream of water, it is found that if the velocity of the ascending stream is greater than the ultimate falling velocity of that particle, the particle will be carried upwards, but if the velocity of the ascending stream is less than the ultimate falling velocity of the particle, the particle will fall. Obviously, if a graded mixture of dirt and coal is introduced into a stream ascending with suitable velocity, the coal can be made to ascend whilst the shale falls, and that is an application of the principle of simple equal falling, which I shall speak of as the first principle of coal washing.

If the particles are subjected to a descending instead of an ascending stream, all the particles will move downwards, but the descending water current will accentuate the falling velocity of the faster falling ones, so that if a set of particles is submitted to alternately ascending and descending water currents, the action of these reinforces each other and a sharp separation is obtained between the faster falling and the slower falling ones. Under these conditions a separation takes place a good deal more easily than the equal-falling formula would indicate. This forms what I call the second principle of coal washing, *i.e.*, the principle of submitting dirty coal to a mixture of alternate ascending and descending currents. It is the principle which is perhaps most widely used in coal washing, and forms the principle of the appliances known as jigs or bashes. Yet another set of conditions obtain, when another form of appliance is used, which we meet with again quite frequently. If a stream, carrying particles of coal and particles of dirt mixed together, is allowed to flow down an inclined plane, it is obvious that the larger particles project further from the plane and are therefore exposed to faster water currents, whilst the smaller particles lying immediately upon the surface of the plane are exposed to the slower water currents; therefore a larger particle would be carried down the plane more rapidly than a smaller particle. With particles of the same size, the lighter particle would be moved the faster because it affords less resistance to motion along the plane. Therefore, under these conditions, even a roughly screened mixture of particles of coal and dirt can be washed, and it is possible to so adjust matters that the coal will be washed down the plane while the force of the stream of water will leave the particles of shale upon it; or it can be arranged so that both shall be carried down, one more rapidly and the others more slowly. This may be called the third principle of coal washing.

Finally, yet another principle consists in submitting fragments of dirty coal (mixed coal and dirt), suspended in water, to a series of jerks or shocks whilst under the influence of a stream of water. This jerking motion separates and frees the particles from each other, and helps the stream of water to act in the way already indicated, and at the same time it imparts differential momentum to the particles and thus causes them to move at different rates over the surface of this jerking plane. In fact it is possible to cause the heavy particles to move in an opposite direction to the stream of water whilst the light particles are carried along by the stream. This I will call the fourth principle of coal washing.

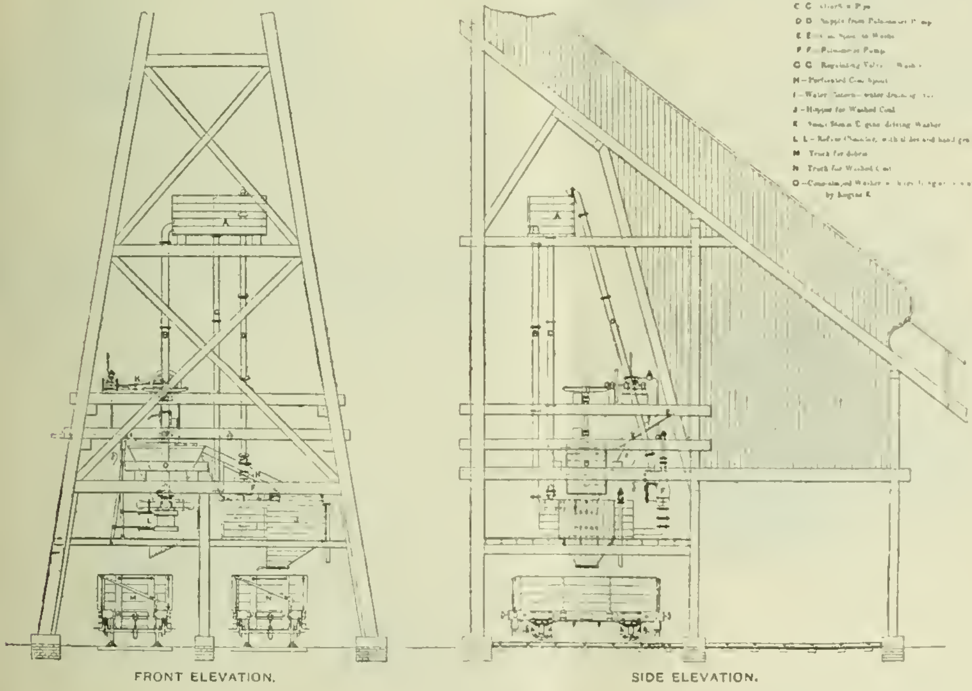
I call the first principle that of "Differential rates of falling in a moving body of water"; the second principle "Exposure to alternately ascending and descending water currents"; the third principle "Streaming particles over an inclined plane," and the fourth principle "Exposing particles to impulses whilst they are also subjected to a water current."

By the application of any one of these principles we can separate a mixture of particles in accordance with their specific gravities, provided that the disparity between the sizes of the largest and smallest particles present be not excessive, in other words provided the particles have been suitably sized by screening. To illustrate these principles, I propose to quote an example or two of well-known coal washing appliances belonging to each class.

A good example of the first type is a machine very well known in the North but not so much used as it was, known as the Robinson Coal Washer (Fig. 7). It consists of an inverted cone in which a number of arms are revolving; the coal is fed in through a shoot at one side; in the lower part of the cone are a number of perforations connected to a water pipe; the water ascends and carries the lighter coal upwards whilst the heavier particles of dirt fall and are collected in the bottom of the cone, and by that means a separation is easily attained. It is usually applied to coal screened to pass about $\frac{3}{4}$-inch mesh or less. The capacity of such a machine is from 15 to 30 tons per hour, and one man and a couple of lads can attend to one of these machines. One of these washers in use at South Derwent Colliery could treat 100 tons of small coal a day and reduce the ash from 11 per cent. to 5 per cent., at the same time also largely reducing the sulphur.

The illustration (Fig. 7) shows the Robinson washer complete. The coal is contained in a bin and passes from a shoot into the washer. The clean coal is carried round in the washer and issues over a screen, to get rid of the water. The washed coal drops into a little hopper and is discharged into the railway waggon below it. The water draining off the coal runs into a tank, whence it is pumped up by a pulsometer into a tank from which a pipe goes down to the washer to supply the annulus from which the perforations open into the body of the machine. The dirt drops down into a box which can be closed by a top or bottom slide at will. In ordinary running the bottom slide is shut and the top slide open. The dirt collects here, and from time to time the top is momentarily closed and the bottom opened, and the dirt drops out into a waggon, when the previous arrangement is restored and so the work goes on.

The second principle, the principle of the jig or "bash," has been in use for a considerable time. I believe its first application was made by Bérard, in 1850, and ever since that time it has been used to a greater or less extent for coal washing. In all cases the coal rests upon a sieve through which the water currents pass. The sieve can either swing up and down in a hutch of water, or it may be fixed and the water caused to pulsate through it by the motion of a piston. Both methods are applied, and, as far as results go, there is nothing to choose between them, but in most instances the fixed sieve arrangement is more convenient, and the majority of machines are built in that form. There is a very important difference between the machines designed for washing very small coal and those for washing nut coal. In washing nut coal the mesh of the screen is always decidedly less than the size of the nuts to be washed. The nuts therefore rest upon the screen; they are fed in at one side and travel across the sieve under the influence of a stream of water; in the course of their travel they are subjected to these alternating water currents, and are thus separated into a lower layer of dirt close to the sieve, and an upper layer of clean coal above it; at the discharge end the coal is discharged at a higher level and the dirt at a lower level immediately over the screen, by means of adjustable gates.

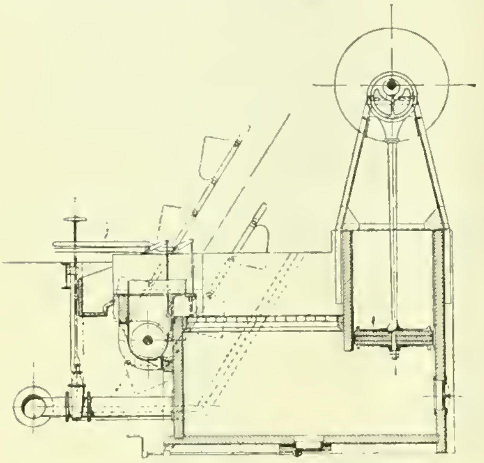


FRONT ELEVATION.

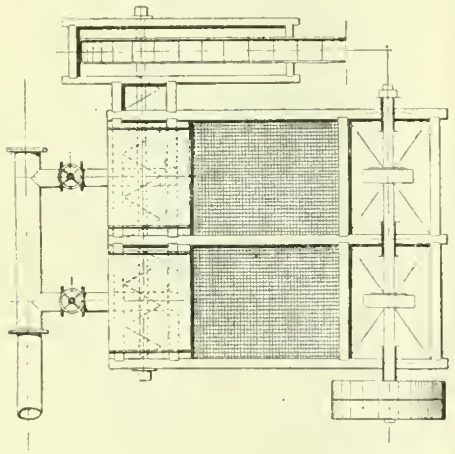
SIDE ELEVATION.

FIG. 7.

For washing fine coal, on the contrary, the mesh of the screen is larger than the largest particles to be washed, and, in order to prevent both coal and dirt passing through the screen, a bed of some material has to be placed upon the screen. In practice a bed of felspar is generally used. Clean Norwegian felspar cleaves into fragments of rhombohedral shape, and when these rest on a screen and are subjected to the action of water currents they tend to revolve about an edge and thus form a sort of valve which helps in the separation that I have been describing. At the same time, Norwegian felspar is a material of convenient specific gravity; it is fairly hard, and will stand tolerably well the wearing action on the screen, and is, therefore, an all-round convenient substance. The fragments of felspar used are usually ½ in. to 1½ in. in size and their area usually about 50 per cent. greater than the mesh on which they rest. In the course of use the edges get rounded, and the pieces are then no longer fully efficient. When that happens, the pieces have to be broken down to the next smaller size and used on a smaller jig, and so on until they are rendered too small to be any longer of use. The average life of such a bed of felspar is six weeks.



Sectional Elevation.



Plan.

Fig. 8.

Fig. 8 shows a German type of nut washer, which consists of a hutch, in a side compartment of which a piston moves up and down. The coal to be washed is fed in through a hopper and drops upon a screen. By the motion of the piston, water is caused to pulsate through the screen and the coal as it travels along from the hopper towards the discharge, is divided into two layers; the lower layer is discharged through the adjustable lower gate, the height of which can be regulated by a little handle. The washed coal forming the upper layer is discharged at an adjustable upper gate and drops on to a little jigging screen which is to drain it. The water drains back into a trough and is brought back to the machine again. The dirt washed out through the lower gates drops into a trough, and is carried away by an elevator. This forms a very neat and complete form of washer.

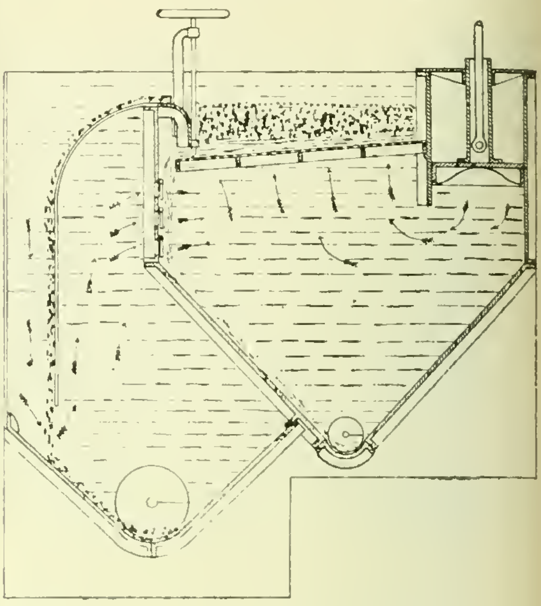


Fig. 9.

Fig. 9 shows a nut washer built by an English firm, Messrs. Sheppard and Sons, the principle of which is very much the same. At one side is the piston moving up and down in a separate compartment. The coal is washed over a gate into a tank whence it is carried away by a screw conveyor; the dirt drops out through an adjustable lower gate into a hutch where there is another screw conveyor for removing it, and by means of valves the water that comes over with the coal is brought back so that the amount of additional water required is very small. This machine is intended for washing nut and pea coal for sizes ranging between 1½ in. and ⅜ in., with a piston making 60 to 70 strokes from 5 to 7 inches per minute. It will wash these coals at the rate of about 5 tons per hour.

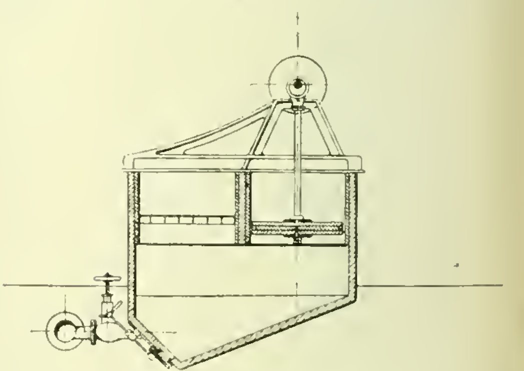
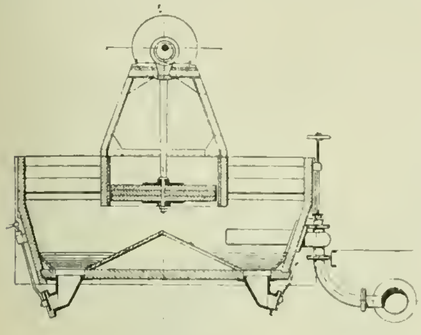
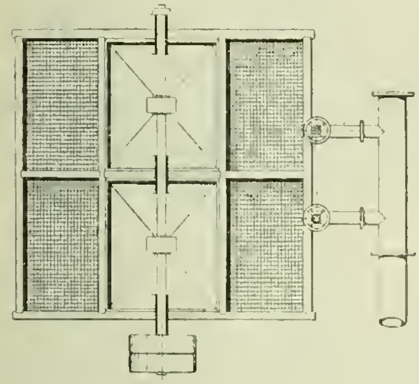


Fig. 10.

Fig. 10 is a single felspar washer for fine coal, built by a well-known German firm. A bed of felspar is laid on the screen, and coal fed on to it. The dirt passes through the bed and the screen and drops into a hutch from which it is removed from time to time by a gate at the bottom, and the fine coal passes over the top and is conveyed away as required after being washed. This is the form used in small washeries. For large washeries double felspar washers of the same type are used (Fig. 11), the principle being exactly the same, only there are two washers, with a large piston working between each pair of washers, thus saving space.



Sectional Elevation.



Plan.

Fig. 11.

A more usual arrangement, instead of having sliding gates, is for the dirt to drop into a hutch from which it is removed by a screw conveyor or a scraper conveyor, and the clean coal from all the washers is usually discharged into a trough along which it is carried by a stream of water or by a conveyor into a storage hopper. In order to illustrate the moving screen jigs, Fig. 12 shows a felspar washer, built by Messrs. Sheppard and Son, in which there are two screens suspended from a rocking lever moving up and down in a hutch. These are intended for successively washing the same coal, when it is required to get a very clean article. The coal enters at one end, is partially washed on the first screen, the partly washed coal passing over a gate on to the next screen, and the dirt dropping through into the hutch. The washing is finished on the second screen, the clean coal is discharged at an overflow, and the dirt drops down into the hutch, whence screw conveyors take it away. This machine is intended for washing coal less than ⅜ in. in size. It works at about 180 quarter-inch strokes per minute with a felspar bed 4 in. to 6 in. in depth, and will deal with something like 2½ or 3 tons per hour. The Baum jig may be built either as a nut or fine coal jig, the difference of this make being the way in which the water pulsations are obtained. Instead of having a moving piston to actuate the water, a stream of compressed air is allowed to act upon the surface of the water being regulated by means of a little valve, so that the air acts in alternate puffs on the surface of the water. Baum, in applying his washers, does not use a felspar bed, and claims to get practically the same result by using a rather deep layer of rough dirt on the surface of the screen.

The best illustration of the third principle is afforded by the "Trough washer," of which there are a number of different types. A simple example of a trough washer consists of an inclined trough across which there are a number of dams or riffles placed. When coal and dirt flow down this trough, the heavier dirt settles down and collects against these dams, whilst the lighter coal is washed over the dams and discharged at the bottom end. The troughs are worked in pairs, and as soon as the dams in one trough are filled up with dirt, the neighbouring trough is brought into play, the dams in the first trough are merely lifted up and the dirt scraped out or washed out from the trough, then the dams put back again and the trough is ready for use again. In order to make the trough continuous acting, when, of course, the troughs need not be in pairs, a number of devices have been employed. One of the simplest is the machine known as the "Elliott" washer (Fig. 13); this consists of a single trough set at an inclination of about 1 in 15; instead of there being fixed dams, there are a number of dams or scrapers as they may be called—reaching down just to the bottom of the trough, and attached to two endless chains, so arranged that the set of dams lying in the troughs are moving upwards. The coal is fed in about half way down the trough, whilst clean water is allowed to run in at the top of the trough, which helps to wash the coal over the tops of the scrapers; it is discharged at the lower end and runs over a screen to get rid of the entangled water and drops into hoppers, whilst the heavier dirt, settling in the bottom of the trough, is dragged up gradually by the scrapers as they travel slowly upwards, and is discharged at the upper end of the trough into a wagon, this being exactly the same principle as that of the plain trough washer, except that the Elliott washer is continuous acting and automatic. The scrapers are usually 3 in. or 4 in. deep and set about 6 feet apart, and such a washer will deal with anything from 5 to 20 tons per hour. The illustration is from a colliery in Cheshire, where a washer is working 10 tons an hour. The dirty coal, *i.e.*, the unwashed slack, contains 25 per cent. of ash, the washed coal 4·2 per cent., and the dirt discharged as much as 68·7 per cent. of ash.

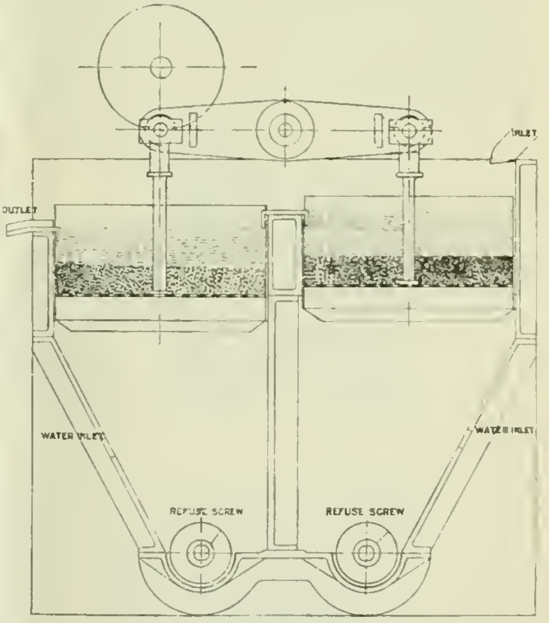


Fig. 12.

These are the principal patterns of washing machines in use. There are one or two, but not many, on the shaking table principle, which I have called the fourth principle. One of these is the Craig table, which was tried for a while in the North here, and met with a fair measure of success, but never seems to have come into general use. It is a V-shaped table with narrow discharge shoots at the bottom and broad shoots at the top, the whole being set on a slight incline; a two-armed cam drives the table sharply downwards against a bumping block, giving a sharp bump, whilst a strong spiral spring pushes it up the incline again to be met by the next stroke of the cam. The coal is fed on about the centre of the table where the two arms of the Y meet, and the coal, as it rests on the table, receives a series of bumps as described, thus jerking the dirt towards the upper ends of the Y-shaped table, whilst the lighter coal flows down to the lower end and is discharged from the small spouts. It was tried at Coanwood Colliery, where it washed 8 tons per hour and reduced the ash from 11·5 to 4·8 per cent., but apparently it was found rather complicated and does not seem to have come into extensive use. A machine on a somewhat similar principle is quite a new machine, the Greaves Washer. So far as I know the first washer on that principle in the North is just now being erected in south-east Durham, but has not yet been tried in this district. It consists essentially of a shaking tray or screen. This screen is so suspended as to be able to swing, and is caused to swing to and fro under the action of a cam. Coal is fed in at one end, and, under the action of these jerks, it is caused to travel along and is discharged at the upper end on to a screen which carries it to a coal conveyor by which it is carried off to the required coal discharging point. The fine dirt settles under the action of the jerks in the lower part of the screen and is discharged there by means of a gate at the side which is kept closed by a spring or counterpoise until a sufficient weight of dirt has accumulated to overcome that counterpoise, when the gate opens and the dirt is discharged, and the washing goes on, so that the appliance works continuously. It is said that the capacity of one of these washers is about 15 tons per hour.

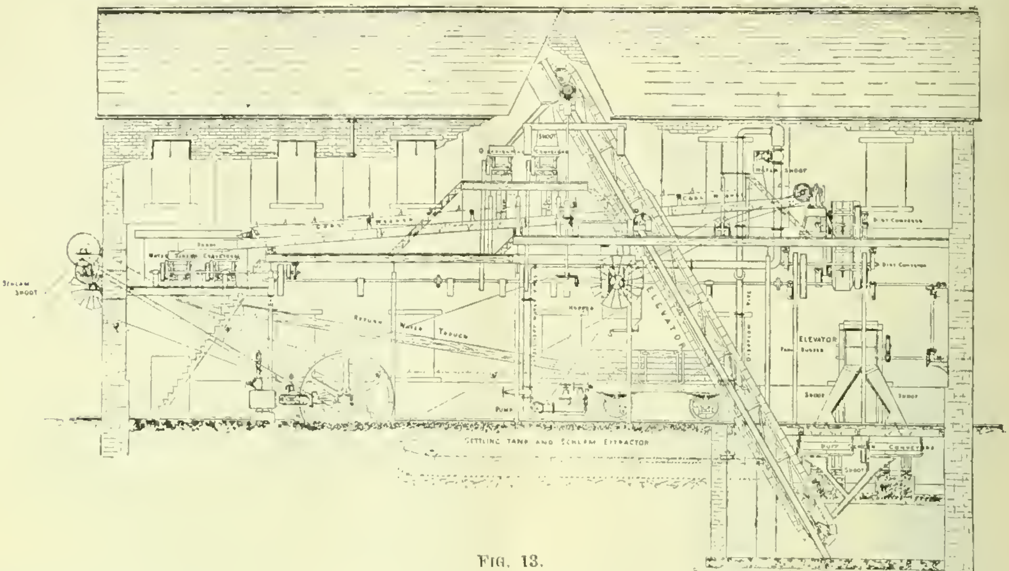


FIG. 13.

The above are examples of individual appliances, but the best results can only be obtained when a certain number of machines is combined into a complete

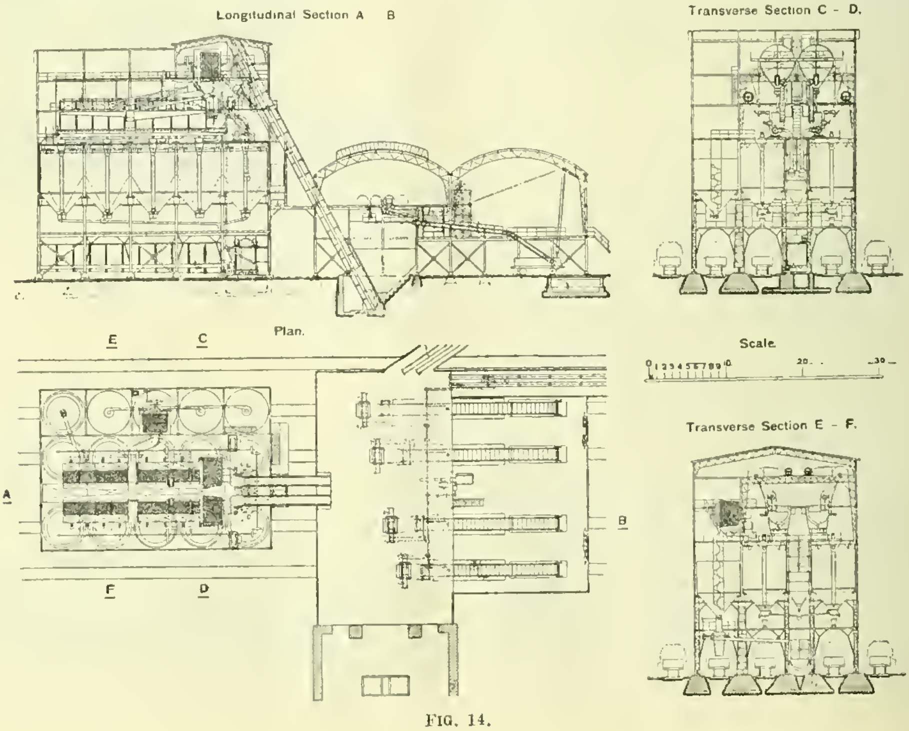
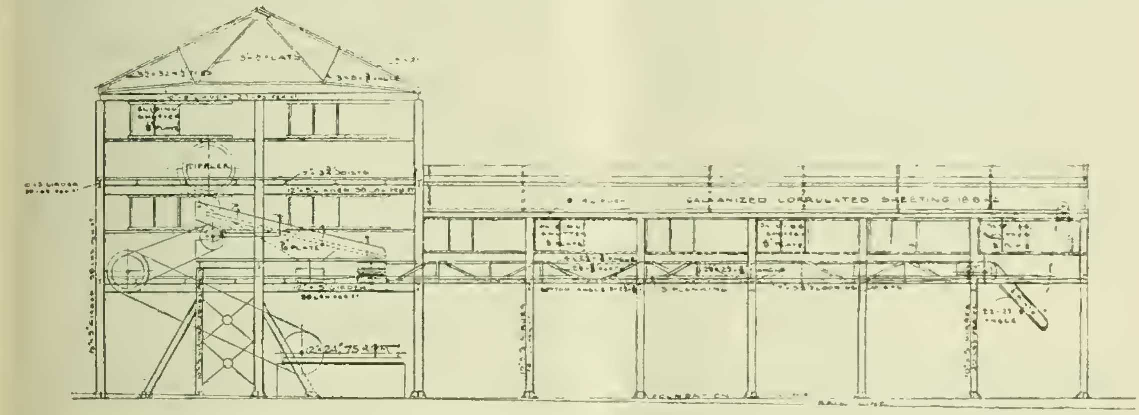


FIG. 14.

installation. In a complete washery all the small coal—anything say under 1½ in.—is usually brought to the washery. It is then usually lifted directly into a screening appliance, the usual form of screen in these washeries being the revolving cylindrical screen or trommel, a number of which arranged successively being often used for screening the coal into a number of different sizes. Where space is an object, a spiral or concentric trommel may be used. Of course all these screens have to be enclosed in iron housings to prevent the dust flying about. By these means a number of separate sizes are made. Usually the coal, as it comes from the colliery, includes everything under 1½ in. or 2 in.; it is sized into various sizes, usually from 1½ in. down to ¾ in. for nut coal, ¾ in. down to about ¼ in. or ½ in. for bean, and peas down to about ⅜ in. These three sizes are mostly washed on nut washers, each size going to its separate nut washer; everything less than ⅜ in. goes to the felspar washers for washing; of this duff usually two or three different sizes are made, each going to its individual felspar washer. The general arrangement then is that the cleaned coal is delivered into hoppers. Sometimes if required for coking, all the sizes may be mixed; if required for market, the different sizes are often kept separate. Often the dirt from the nut washers still contains a large proportion of coaly matter, and in a complete washery it is usually found worth while to take the dirt from the coarser washers to a crusher to be crushed fine, and wash the resulting fine stuff in felspar washers, a separate set of washers being usually dedicated to this purpose. There are several such washeries in this country with capacities ranging from 50 to 200 tons per hour.

For the sizing of the finer small coal, which is rather difficult to do by screens on account of their aptitude to clog, a set of V-boxes is often used. The coal is run in at one end of a set of inverted pyramids or cones, and in each of these cones there is an upward stream of water. In accordance with what I have called the first principle of coal washing, it is evident that the coarser stuff will settle in the first cone, the next fine in the next, and so on up to the finest. The spigots from these different cones are then used to supply the individual felspar washers this being perhaps the best method for sizing the finest sizes of coal.

In a complete washery the coal comes from the mine, and is tippled in tipplers on to several jigging screens. The over-size or the coarse coal, drops on to the picking belts, the fine coal goes through underneath, and is carried by a transverse belt into storage hoppers. From these it is elevated to the washery proper, where it first passes through one of the spiral screens before mentioned. Here it is sized, the nut coals going to a set of nut coal washers, the finer material going to a set of pointed boxes, the spigot of each of which supplies its individual felspar washer. The finer coal is allowed to drop down into a large tank at the bottom of the building, where a scraper moves it along into the boot of an elevator which lifts it in turn to the same hopper as the other clean coal. The capacity of such an entire plant, including the picking belts, is about 1500 tons of coal per day of 10 hours. Such a complete washery, as erected at a German colliery, is shown in Fig. 14. A complete picking belt heap-stead, without washery, built by the Maschinenbauanstalt Humboldt, is shown in Fig. 15.



Elevation of Coal Cleaning Plant Capable of Dealing with 500 Tons Per Day.

Fig. 15.

In any system of coal washing, it is often found that the finest coal will form slimes which will only settle in water with great difficulty, and which are thus very often lost. Now it has been found in many cases, especially in dealing with coals for coking purposes, that this extremely fine coal is the most valuable part as regards its coking qualities, and its presence or absence often makes all the difference in getting good or bad coke. In Germany this difficulty has been got over by the very ingenious method of blowing out the very fine coal first before it gets to the water and has a chance of making slimes, and treating it dry.

A good example of a machine for that purpose is one which has been devised by Hochstrate. The coal is screened in a revolving screen, and the under-size from this is dry-blown before washing, the under-size being about ¼ in. mesh. It drops from the screen housings, and in dropping down it is caught by a blast from a blower through a blast pipe, and the lighter stuff is blown up an inclined shoot, the heavier stuff being able to fall down direct; the lighter material when carried up strikes against an inclined plane, the heavier particles roll down, getting clear of the blast, and drop back into the shoot into which the heavier particles have already fallen. The lighter stuff is blown upwards into a big dust chamber. The stuff that drops through the shoot is met by a second stream of air which again blows out the finer stuff and carries it into the same dust chamber, whilst all the heavier particles drop down together through the shoot into a water trough which carries all the coal of about 0·3 inch mesh to the washeries where it is washed in the ordinary way. The fine coal settles in this dust chamber, and is drawn off at the bottom. Now obviously from the formula for equal-falling, everything that is blown into that dust chamber will consist of very small particles of dirt with relatively larger particles of coal, they being equal-falling particles. By screening this dust, therefore, through a very fine screen, the dirt can be got rid of, and practically clean fine coal can be left behind; the clean coal dust obtained in this way is mixed with the coal washed in the washery before it goes to the coke ovens.

Discussion.

Dr. J. T. Dunn asked if it was a fact that in the washer with the moving sieve the strokes were only

¼ in.: it seemed marvellous that strokes of such shortness should produce such a remarkable effect in the washing of the coal.

Mr. John Pattinson said that 33 years ago he had examined 55 samples of the small coal used on the Tyne: 14 of these were steam coal and 41 were from the Durham Coalfields. The maximum amount of ash in the steam coal was 18 per cent., the other coal 20 per cent. The minimum ash in the steam coal was 10·4 per cent. and the other coal 4·8 per cent.; the average in the steam coal was 13·86 per cent. and the other coal 10·59 per cent. The maximum of sulphur existing as pyrites in the steam coal was 3·29 per cent. and in the other coal 4·27 per cent. and the minimum total sulphur in steam 1·28 per cent. and the other coal 0·71 per cent. It would be seen that by washing this coal in the way that Professor Louis had described, how very much the quality of the coal could be improved. Coal totally unfit for making coke and other manufacturing purposes was, by these processes, made available, and a very great economy effected in the use of coal.

Mr. Hugh Dunford Smith asked for figures as regards the reduction of sulphur by means of the washers, and also for any information about the Blackett washer.

The Chairman asked for a rough idea as to the actual percentage of total coal loss in the washings.

Professor Louis said it was true that the felspar washer had a quarter inch stroke. He did not know any felspar washer that runs with more than a one inch stroke. A short, quick stroke was recognised as the proper way of separating small particles successfully.

With regard to the reduction of sulphur it was impossible to give any averages, as it depended entirely upon the nature of the coal treated with. When the coal contained sulphur as an organic compound, there was no reduction. When dealing with pyrites, if very finely disseminated, reduction was difficult unless the coal was crushed very fine. When dealing with big stuff, the whole of the pyrites could be separated: he had known cases of sulphur being got out in sufficient quantities to make it worth while to sell. The Blackett washer was a modification of the trough washers. It consisted of a hollow cylinder in which the dams that hold back the dirt were represented by a spiral of angle iron on the inside of the hollow cylinder, forming a screw. When the inclined cylinder revolved, the screwing action of the spiral brought the dirt up and discharged it at the top of the cylinder and the coal ran to the bottom. The machine had been erected at one or two collieries with satisfactory results, but he thought it was rather more wasteful of power than the corresponding Elliot washer. The percentage of coal lost in washing depended entirely on the method used. In a complete washery where all the dirt carrying a proportion of carbonaceous matter was crushed fine and washed, the loss of coal was very small indeed. In a simpler form like the trough, or Robinson washer, in which coal was separated on the one side and dirt on the other, and the dirt thrown away, a considerable proportion of carbonaceous matter was lost.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Patents.

Evaporating, cooling, and moistening fluids. W. Tattersall, Accrington. Eng. Pat. 8884, April 13, 1910.

The invention relates to film evaporators in which a film of liquid picked up by the surface of a rotating horizontal drum, partially immersed in the liquid, is evaporated by a current of air. The claim is for forming the film-carrying surface of the drum of sheets of corrugated material. The corrugations are alternately relatively large and small and the sheets are so arranged that the centres of the small corrugations of one sheet abut against the centres of the large corrugations of the next sheet. —W. H. C.

Evaporating apparatus. J. E. Kauffmann, Kansas City, Kans. U.S. Pat. 990,878, May 2, 1911.

The apparatus consists of a number of evaporating pans connected in series. Each pan has two steam-chests connected by tubes. The liquid is supplied to the first pan of the series and enters a perforated vessel at the top, adjacent to the tubes, and is sprayed over the tubes. The other pans are also provided with perforated distributing vessels, but these are spaced away from the tubes. Steam is supplied to one of the steam-chests of the pan at one end of the series, the other steam-chest being connected with the exhaust. The vapour given off in the first pan is conducted back to one of the steam-chests of the pan behind and so on throughout the series. One steam chest of each pan is provided with an exhaust pipe. By means of a circulating pump and a suitable arrangement of pipes and valves, the liquid can be circulated as desired through the series of pans.—W. H. C.

Evaporators; Feed regulating device for ——. R. Meller, Philadelphia, Pa. U.S. Pat. 991,342, May 2, 1911.

The liquid is fed to the evaporator through a balanced valve to which a diaphragm is attached. On one side, the diaphragm is in communication with the feed liquid after it has passed the valve, and on the other side with a column of liquid in communication with the vapour space of a separator, attached to the evaporator. Both sides of the diaphragm are thus in communication with, and subject to the variations of pressure which occur within, the evaporator.—W. H. C.

Dryers. W. B. Ruggles, Bayonne, N.J., U.S.A. Eng. Pat. 10,349, April 27, 1910.

The heating flues of a dryer of the rotary drum type, wherein the material to be dried is kept out of contact with the heating medium, are arranged to enter and leave the drum at the same end at which the material to be dried is introduced. The combustion gases or other heating medium are led from a furnace through a large central flue in the drum to an annular chamber at the far end thereof, from which they return through a number of smaller pipes near the periphery of the drum to a similar chamber at the near end, connected with the outlet flue in which a fan works. The material to be dried is fed in by a screw conveyer at the near end and the dried material passes out through a number of holes in the far end of the drum to a hopper. Air enters through these holes and is drawn out together with the steam by a branch pipe connected with the fan casing.—H. H.

Dryer. C. E. Geiger, Assignor to W. E. Koop and G. W. Fiske, Louisville, Ky. U.S. Pat. 990,433, April 25, 1911.

The material to be dried is caused to pass at a regulated speed through a chamber provided with a tubular heating system. A gaseous heating medium is caused to pass through the pipes of the heater and is withdrawn by a fan and delivered into the lower part of the drying chamber, so that it passes upwards over the material to be dried and escapes, laden with moisture, from the upper part of the chamber.—W. H. C.

Filter presses. G. Irwin, and S. H. Johnson and Co., Ltd., London. Eng. Pat. 10,610, April 29, 1910.

Filter presses for materials which require to be subjected to heat and vacuum after the cakes have been formed, for example, in the recovery of oily ink from the cloths used for wiping engraving plates, are fitted with hollow plates having ducts for the heating fluid and for applying the vacuum respectively. Each duct is formed entirely within the material of a plate and communicates with the corresponding duct in the adjacent plate without any mechanical attachment, so that the plates are completely removable, while the ducts form a continuous conduit throughout the length of the press when the plates are in contact.—H. H.

Liquids; Machine for the centrifugal treatment of ——. C. L. Leune, Paris. Eng. Pat. 12,831, May 26, 1910. Under Int. Conv., Oct. 2, 1909.

The machine is of the type in which the cups or vessels containing the liquid are supported in a rotating head connected with the lower end of a vertical driving shaft. The necessary flexibility between the driving pulley and the rotating head is obtained by making the shaft in two sections connected by a ball-and-socket joint and a driving pin, and connecting the head with the end of the lower shaft section by a similar joint and pin. The lower shaft section rotates in a ball bearing in a spring bearing head. A casing enclosing the cups consists of a base and a cover fitting into one another and attached to the rotating head by screws.—A. T. L.

Centrifugal machines. T. Broadbent and Sons, Ltd., and H. Broadbent, Huddersfield. Eng. Pat. 21,620, Sept. 17, 1910.

In a centrifugal machine of the type having inner and outer concentric cylinders or drums rotating at slightly different speeds, the inner drum is driven directly from the main shaft, while the outer drum is driven by a train of spur-wheels as follows. A pinion keyed on the main shaft drives a countershaft which drives a loose pinion on the main shaft. This latter pinion is compound, having a raw hide portion which engages with three planet wheels mounted in a bracket secured to the main shaft, and at the other ends of the studs or shafts of these planet wheels are spur-wheels driving a toothed wheel connected with the outer drum. The substance to be treated is fed into the space between the drums, and is slowly passed through the apparatus by a screw formed on the outer surface of the inner drum.—H. H.

Fire extinguishing; Compound for ——. R. F. and C. K. Graham, Barnes, Surrey. Eng. Pat. 4574, Feb. 23. 1911.

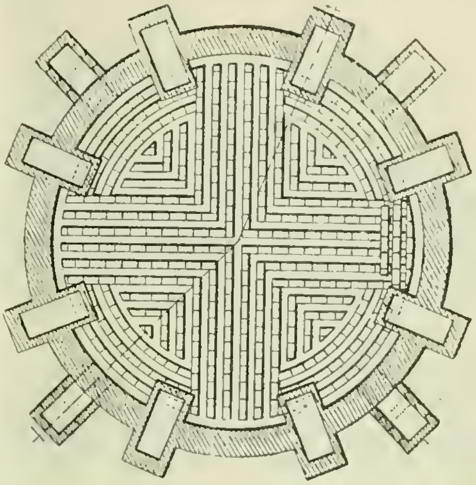
A solution of sodium nitrite and ammonium chloride in molecular proportions.—H. H.

Extinguishing fires; Process of ——. M. Breslauer, Charlottenburg, Germany, Assignor to Minimax Consolidated Ltd., London, and Neuruppin, Germany. U.S. Pat. 990,521, April 25, 1911.

Fires of benzene, petroleum, and other easily inflammable liquids are extinguished by the use of a solution of free bromine or other halogen dissolved in halogen-substituted hydrocarbons.—W. H. C.

Kiln. C. Hook, Vigo, Ohio. U.S. Pat. 990,558, April 25, 1911.

The kiln has solid circular outer walls provided with chimney stacks spaced apart and communicating with the interior of the kiln. In front of the openings short arcs of parallel walls are built within the kiln. The remainder of the space within the kiln is filled with a series of parallel walls extending from the space between the stacks to the centre, so that two parallel rows of walls are formed at right angles (see Fig.). In the lower tiers of bricks in the walls, the bricks are spaced with their ends apart and in the upper tier with their ends together. The walls are covered with a floor of bricks spaced apart laterally.—W. H. C.

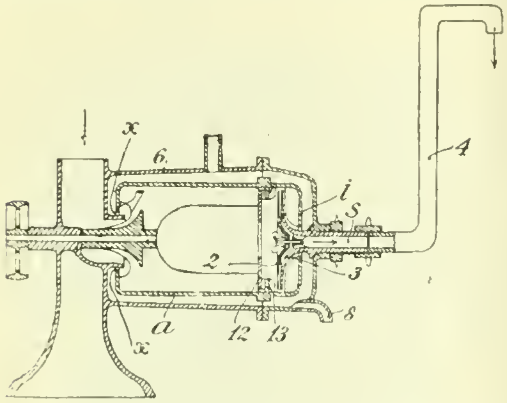


Charging materials into apparatus in which operations are conducted with an inflammable liquid in a protective non-oxidising atmosphere; Process and means for ——. Maschinenbau-Ges. Martini und Hueneke. Ger. Pat. 232,614, Jan. 21, 1910.

In processes such as degreasing by means of volatile solvents (see Fr. Pat. 423,281 of 1910; this J., 1911, 631), it is of importance to charge material into the apparatus without admission of air. According to the present patent the material is embedded in a solid mass, immersed in a liquid, or surrounded with an atmosphere of a non-oxidising gas, and is then introduced into the apparatus by a suitable transporting device. For example the vessel in which the treatment is to be effected may be provided with a side opening closed by a damper. The material to be treated is embedded in a mass of a solid substance contained in a box, the cross-section of which just fits the side opening of the vessel. This box is pushed flush against the damper, the latter is raised, the box is forced into the vessel on suitable supports, and the damper is lowered. When the material is immersed in a liquid, a suitable conveyor, *e.g.*, a bucket conveyor, working in an air-tight casing, is used for charging it into the vessel. In a third modification, the vessel is provided at the side with a cylinder fitted with a piston, and which can be placed in communication with the vessel as desired. The material is placed in the cylinder, and the air in the latter is displaced by a non-oxidising gas; communication between the cylinder and the vessel is then opened, and the material is forced into the latter by means of the piston.—A. S.

Froth; Centrifugal device for dissipating ——. Aktieselskabet K. Hansen und Schröder. Ger. Pat. 233,324, Nov. 3, 1909. Addition to Ger. Pat. 232,039, March 25, 1909.

The apparatus is a modification of that described previously (this J., 1911, 479). Near the end, *i*, of the rotating receptacle, *a*, are two fixed discs or plates, 2, 3, disposed quite close to one another. The liquid, freed from froth, collecting on the inner periphery of *a*, passes into the narrow space between these two plates, and flows away through the outlet pipe, *s*, which is connected by a valve, with the ascending pipe, 4. The rotating receptacle, *a*, is enclosed in a stationary casing, 6, into which the air liberated by the dissipation of the froth, passes by way of openings, x; any liquid carried over by the air collects in the annular space and is run off through the pipe, 8. In front of the plates, 2, 3, is a froth-sealing device, 12, 13, which rotates with the receptacle, a.—A. S.



Distilling and rectifying apparatus. E. Guillaume, Paris. Eng. Pat. 12,736, May 25, 1910. Under Int. Conv., May 26, 1909.

See Fr. Pat. 403,385 of 1909; this J., 1910, 104.—T. F. B.

Gases; Method for purifying and cooling ——. C. Bayer, Friedenshütte, Prussia. Eng. Pat. 20,794, Sept. 6, 1910. Under Int. Conv., Sept. 22, 1909.

See Fr. Pat. 419,697 of 1910; this J., 1911, 120.—T. F. B.

Gases; Process of washing —— for rapidly freeing them from dust or smoke held in suspension therein. P. Kestner, Lille, France. U.S. Pat. 991,157, May 2, 1911.

See Eng. Pat. 9548 of 1905; this J., 1906, 464.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Gas engines; Pathogenic properties of the gases discharged by the exhaust pipe of ——. S. Delépine. Public Health, 1911, 309—314.

The effect of the exhaust gases on guinea pigs and mice was observed with the engine working under varying conditions of load and of air and gas supply. With the engine fully loaded, the exhaust was free from poisonous gases, but was dangerous owing to the large proportion of carbon dioxide and the absence of oxygen. When the air supply was insufficient, the exhaust contained up to 4·5 per cent. of carbon monoxide, and was dangerous when diluted with less than 50 volumes of air. Insufficiency of air supply may arise from trivial causes such as partial blocking of the air pipe. It is recommended that the discharge of exhaust gases into sewers should be forbidden, and the discharge into any confined space to which persons have access should be avoided.—A. T. L.

Transformer oils. Berninger. *See* XI.

Transformer oil. Duckham. *See* XI.

Patents.

Coke ovens. C. Still, Recklinghausen, Germany. Eng. Pat. 23,459, Oct. 10, 1910.

In a horizontal oven having series of vertical heating flues supplied with gas from below, the transverse walls between the heating flues are formed with vertical air-supply passages having lateral branches into each adjacent flue both near the gas inlet and at a higher level. In this way, each heating flue is supplied with air from both sides and at different levels through inlets arranged opposite each other in pairs.—A. T. L.

Coke oven; Horizontal ——. A. Märker. Ger. Pat. 232,187, April 18, 1909.

The oven has separate vertical heating flues, the flues of each heating wall communicating at the bottom with a common, horizontal channel, in which is disposed a gas-supply pipe provided with burner-nozzles. This pipe is supported on a frame below by means of linked rods, which are so connected that by means of a hand lever, the pipe can be raised to the full height of the rods, or lowered on to the frame. When the pipe is in its highest position, the burner-nozzles project into the heating flues, but when it is lowered, the frame, pipe, and burners can be withdrawn laterally from the oven through an opening provided for the purpose.—A. S.

Inclined gas-retorts. E. Hovine. Fr. Pat. 423,383, Dec. 7, 1910.

The retorts are of greater depth than width, in order to facilitate complete filling with coal, whilst in other respects they are of such a section and shape that they can be substituted for inclined retorts of the ordinary shape without altering the other parts of the setting.—W. H. C.

Gas producers. J. Dunlop, Glasgow. Eng. Pat. 16,984, July 16, 1910.

The producer, which is intended for use with bituminous and caking fuels, is of the underfed type. A hollow vertical shaft, rotated by gearing, passes centrally through the producer and carries downwardly inclined stirring arms in the producer chamber and a helical thread at its lower part working within a fuel supply chamber. The top of the producer is covered in by a vaporiser receiving its water supply by way of the hollow shaft.—A. T. L.

Gas producers. H. Främbs and Bender und Främbs, G. m. b. H., Hagen, Westphalia. Eng. Pat. 23,559, Oct. 11, 1910.

The producer is of the type having no grate, the air being admitted above the water-sealed ashpit through a hollow metal ring in the walls. The air is supplied to this ring from an air-chamber arranged above it in the walls of the producer, the air passing into the ring through orifices controlled by slides, so that the supply may be regulated over the entire periphery of the ring. The lower part of the producer shaft is conical, and the poking holes in the top of the producer are arranged in line with the conical walls.—A. T. L.

Gas producers; Means for protecting the operatives of ——. E. Dor-Delattre, Dorplein-Budel, Holland. Eng. Pat. 25,827, Nov. 7, 1910.

The working platform of the producer is supported above the top plate and is separated from it so as to form a chamber, which is in direct communication with the chimney. An annular space is left between the platform and the charging hopper, and the chimney draught draws air through this space into the chamber mentioned, so removing any gas or smoke which escapes during poking. Covers are provided in the platform above each poking hole and these covers have apertures of just sufficient size to allow the passage of the poking tool, the cover being free to follow the lateral movements of the tool.
—A. T. L.

Gas producing apparatus; Process for the regulation of the temperature of the fuel bed in ——. H. L. Doherty, New York. U.S. Pats. 990,713 and 990,714, April 25, 1911.

The claims relate to a method of and apparatus for heating gas retorts. Producer gas is burned in suitable chambers to heat the retorts and the products of combustion pass through regenerators and preheat the air necessary for the combustion. After passing through the regenerators, a portion of the products of combustion is separated and

compressed, and the compressed gas is used in an injector to induce a supply of air and to inject it into the generators, where the carbon dioxide is transformed into carbon monoxide. The quantity of waste gas thus introduced is so proportioned that the temperature of the producer is kept below that at which the ash of the fuel slags.
—W. H. C.

Gas-producer. H. C. Perdue, Hobart, Ind. U.S. Pat. 991,082, May 2, 1911.

A number of hollow agitating shafts are arranged at substantially the same level, horizontally across the lower part of the generator chamber. The hollow shafts are provided with a number of short perforated projections and pass at each end through water-jacketed stuffing-boxes. They are rotated from one end by means of worm wheels and worm gear fixed outside the producer and at the other end communicate with a chamber through which air and steam are supplied to the hollow shafts. The mixture of air and steam issues from the perforated projections into the bed of fuel.—W. H. C.

Gas producers. Farnham's Patents, Ltd. Fr. Pat. 423,670, Dec. 15, 1910.

The generator consists of a vertical cylindrical chamber of refractory material, provided at the lower extremity with a grate which can be moved vertically by suitable mechanism. When it is desired to put a fresh charge of fuel into the generator, a sliding support is forced by a screw mechanism horizontally into the mass of fuel at a slight distance above the grate. The latter is then lowered, cleaned, and a fresh charge of fuel is placed upon it through a lateral charging door. The horizontal slide is then withdrawn and the grate moved vertically upwards, compressing the fuel above. The freshly charged coal rapidly ignites and the hydrocarbons pass upwards through the incandescent fuel above and are decomposed. The gas escapes from the upper part of the generator and passes through a jacketed downtake to the mains. The jacket serves as a vaporiser in which the heat of the gas is used to evaporate water which flows down over the downtake. The steam produced saturates the air which enters the generator through the annular jacket.—W. H. C.

Gas producer for bituminous fuels. L. Soest und Co., Ges. m. b. H. Ger. Pat. 230,318, March 16, 1909.

The producer is of the type in which the gas is drawn off from the lower portion, and the raw fuel is charged into a crater-like enlargement in the upper part of the producer and is coked by the heat supplied by conduction and radiation from the fire beneath. The raw fuel is charged into the "crater" at one side and forms a heap, hollow in the centre; the walls of the "crater" are substantially parallel to the natural slope of the heap of raw fuel. The lower, inner part of the "crater" is open, so that at this part the partly coked fuel rests directly on the glowing fuel beneath.—A. S.

Blast-furnace gases; Treating —— and preparing char-peat. B. Loomis, Hartford, Conn., Assignor to Loomis Utilisation Co., New Jersey. U.S. Pat. 990,891, May 2, 1911.

The hot blast-furnace gas is passed through bodies of moist peat first in one direction and then in the reverse direction. The peat arrests the dust and ashes in the gas and the latter distils off the volatile hydrocarbons from the peat and chars the latter. The cleaned gas, enriched with the hydrocarbons from the peat, is withdrawn for use in the hot-blast stoves or in other ways, and, when the peat is charred, the current of gas is shut off and the peat-charcoal washed with water to cool it and to wash out the dust and ashes, after which it is used as fuel.—W. H. C.

Crude petroleum, fatty substances and the like; Purifying or decolorising ——. G. Taylor, Reigate. Eng. Pat. 20,409, Sept. 1, 1910.

The crude petroleum or the like is mixed and agitated with powdered, dried calcareous sandstone and then allowed to settle and the purified petroleum is decanted. The calcareous sandstone preferably employed for this purpose is that found at Colley Hill Mine, Reigate.
—W. H. C.

Emulsions of asphaltum, pitch, petroleum-tar, mineral-fat, Japanese-wax and other similar substances; Process for the preparation of ——. R. Wallbaum. Fr. Pat. 423,291, Dec. 3, 1910. Under Int. Conv., Dec. 4, 1909.

Emulsions suitable for use as a wall covering for protection against damp, for treating roads, etc., are prepared by melting any of the substances mentioned in the title, or mixtures of them, with saponifiable substances. For this purpose rosin, fatty acids, naphthenic acids or salts of the same are employed. The mixture thus obtained is then mixed and agitated with a solution of free alkali or ammonia, to saponify the rosin, etc., and form an emulsion, which may afterwards be diluted with water.
—W. H. C.

Nuts or briquettes of fuel, smokeless, inodorous, and insoluble; Process for manufacturing —— with the refuse matter of lixiviated cellulose. E. Cavernier, Puteaux, France. Eng. Pat. 10,841, May 3, 1910.

See Fr. Pat. 413,152 of 1910; this J., 1910, 1095.—T. F. B.

Gas producers. R. V. Farnham, Skelmorlie. Eng. Pat. 27,450, Nov. 25, 1910.

See Fr. Pat. 423,670 of 1910; preceding.—T. F. B.

Viscosimeter. Ger. Pat. 233,530. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Coal; Preparation of charges of limed —— for distillation in gas retorts, and apparatus therefor. R. O. Paterson and L. E. Twycross, Cheltenham. Eng. Pat. 26,772, Nov. 17, 1910.

Powdered lime is supplied in regulated quantity through a flexible shoot to the coal passing beneath, and the lime is immediately damped by means of steam. The lime is fed into the shoot from a hopper by means of a rotating roller, the speed being adjusted so as to deliver the required quantity. Regular delivery is ensured by means of a hammer or tapper, worked by a rotating cam, striking the lower part of the hopper.—A. T. L.

Filaments for incandescent electric lamps; Manufacture of ——. F. Harrison, London. Eng. Pat. 10,871, May 3, 1910.

In the process of bending a U- or V-shaped metallic filament to the desired form, a steel rider is hooked on to the filament, which is mounted in a bell-jar in an inert atmosphere and brought to the necessary temperature by the passage of a current. A glass rod is held against the filament at the point where it is to be bent up, and the part to which the rider is attached is drawn in the required direction, by means of a magnet.—A. T. L.

Incandescent electric lamps; Exhaustion of ——. F. Harrison, London. Eng. Pat. 10,872, May 3, 1910.

A lamp bulb in which a metal filament is supported by a central rod, usually of glass, is exhausted in two stages. In the first stage, about half of the air or gas is pumped out while the bulb is cold. In the second stage, the bulb is heated externally, and the relatively large quantity of air left in it conducts the heat to the filament and its support, so that in the final exhaustion all gases are removed from these parts.—A. T. L.

Metallic filaments for electric lamps. I. Kitsee, Philadelphia. Eng. Pat. 11,415, May 9, 1910.

See U.S. Pat. 971,385 of 1910; this J., 1910, 1243.—T.F.B.

Electrodes for arc-lamps; Manufacture of ——. A. Blondel and G. Dobkevitch, Paris, Assignor to General Electric Co., New York. U.S. Pat. 991,475, May 9, 1911.

See Eng. Pat. 23,262 of 1902; this J., 1904, 112.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Tar treatment of roads; General directions and specifications relating to the ——. The Road Board.*

Road Board Specification No. 4. Specification for Tar No. 1.—To be suitable for the surface tarring of roads, the tar shall be derived wholly from the carbonisation of bituminous coal, except that it may contain not more than 10 per cent. of its volume of the tar (or distillates or pitch therefrom) produced in the manufacture of carburetted water gas. The specific gravity of the tar at 15° C. (59° F.) shall be as nearly as possible 1·19; but may be as low as 1·16, or as high as 1·22, provided that in other respects the tar complies with the provisions of the specification. It shall be commercially free from water—*i.e.*, it shall not contain more than 1 per cent. by volume of water or ammoniacal liquor, which water or liquor (if present) shall not contain more ammonia, free or combined, than corresponds to 5 grains of ammonia per gallon (=70 mgrms. per litre) of the tar. On vigorous agitation for a quarter of an hour with 20 times its volume of water at 21° C. (70° F.), the tar shall not impart to the water more than 5 grains of phenoloid bodies, reckoned as phenol, per gallon of water (=70 mgrms. per litre). Tar supplied direct from gas works shall be solely the natural by-product of the manufacture of illuminating gas (coal gas, with or without admixture of carburetted water gas), and shall have been subjected to no other or further treatment than may be necessary for the abstraction of water or ammoniacal liquor and light oils. On distillation, the tar must yield below 170° C. not more than 1 per cent., and between 170° C. and 270° C., not less than 16 per cent. and not more than 26 per cent., of distillate (exclusive of water). The free carbon shall not exceed 16 per cent. of the weight of the tar. Tar supplied from tar distilleries, on distillation, must yield below 170° C. not more than 1 per cent., and between 170° C. and 270° C. not more than 26 per cent., of distillate (exclusive of water). The distillate shall remain clear and free from solid matter (crystals of naphthalene, etc.) when maintained at a temperature of 30° C. for half-an-hour. The distillation shall be continued to 300° C., and the residual pitch thus obtained shall not amount to more than 73 per cent. of the weight of the tar. The free carbon shall not exceed 16 per cent. of the weight of the tar. The temperature during distillation shall be taken by a thermometer of which the bulb shall be opposite the opening to the side tube of the distillation flask, and the quantities of distillates and free carbon shall be stated in percentages by weight. A tar prepared by simple dehydration may be used with satisfactory results in most cases, but tars from which the naphthalene has been extracted are superior for the purposes of surface tarring.

Road Board Specification No. 5. Specification for tar No. 2.—For tar suitable for surface tarring, but specially recommended for re-tarring. The tar shall be derived wholly from the carbonisation of bituminous coal, except that it may contain not more than 10 per cent. of its volume of tar (or distillates or pitch therefrom) produced in the manufacture of carburetted water gas. If pitch be added to the tar in order to secure the specific gravity and proportion of residual pitch referred to below, the pitch so added must also have been derived from tar of the foregoing description. If oil be added to heavy tar or pitch, in order to secure the specific gravity and proportion of residue referred to below, the oil so added must be derived from tar of the foregoing description, and must be practically free from naphthalene and tar acids or phenols. The specific gravity of the tar at 15° C. shall be as nearly as possible 1·21, and in no case shall it be lower than 1·18 or higher than 1·24. On vigorous agitation for a quarter of an hour with twenty times its volume of water at 21° C. (70° F.), the tar shall not impart to the water more than 5 grains of phenoloid bodies, reckoned as phenol, per gallon of water (= 70 mgrms. per litre). The tar shall be free from water, and, on distillation, shall yield no distillate below 140° C., nor more than 3 per cent. of distillate up to 220° C., which distillate shall remain clear and free from solid matter (crystals of naphthalene, &c.) when maintained at a temperature of 30° C. for half-an-hour. Between 140° and 300° C. it shall yield not less than 15 per cent., nor more than 21 per cent., of the weight of the tar. The free carbon shall not exceed 18 per cent. of the weight of the tar.

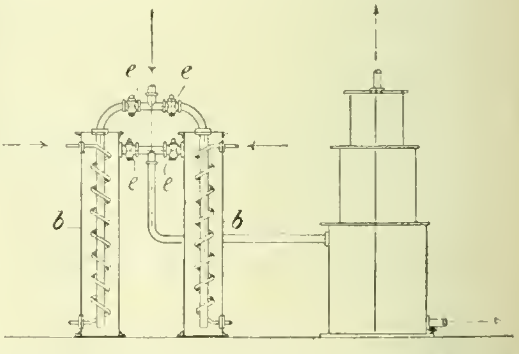
Road Board Specification No. 6. Specification of pitch.—The pitch is obtained by softening commercial soft pitch as specified below, by addition of tar oils, also specified below. *Commercial soft pitch.*—The pitch shall be derived wholly from tar produced in the carbonisation of bituminous coal, except that it may contain not more than 10 per cent. of pitch derived from tar produced in the manufacture of carburetted water gas. On distillation, the pitch shall yield below 270° C. not more than 1 per cent. of distillate, and between 270° C. and 315° C., not less than 2 per cent. and not more than 5 per cent. of distillate. The free carbon should not exceed 22 per cent. of the weight of the pitch; but if it be found difficult or unduly expensive to obtain this quality of pitch, a quality containing as much as 28 per cent. of free carbon may be used with a reduced proportion of sand as filler. *Tar oils.*—The tar oils to be used shall be derived wholly from tar produced in the carbonisation of bituminous coal, or from such tar mixed with not more than 10 per cent. of its volume of tar produced in the manufacture of carburetted water gas. The specific gravity of the tar oil at 20° C. shall lie between 1·065 and 1·075. The tar oils, after standing for half-an-hour at 20° C., shall remain clear and free from solid matter (crystals of naphthalene, etc.). The tar oils shall be commercially free from light oils and water—*i.e.*, on distillation shall yield not more than 1 per cent. of distillate below 140° C. The amount of distillate between 140° C. and 270° C. shall lie between 30 per cent. and 50 per cent. The proportions by weight in which the pitch and tar oils are to be mixed shall be as follows: pitch, 88 per cent. to 90 per cent.; tar oils, 10 per cent. to 12 per cent.

Low temperatures. [Nitration of toluene, naphthalene, and phenol.] Pictet. *See* VII.

Patent.

Distilling hydrocarbons dissolved in tar oils; Apparatus for ——. C. Still, Recklinghausen, Germany. Eng. Pat. 22,862, Oct. 3, 1910.

The steam coils of apparatus used for distilling benzen and other hydrocarbons from the tar oils, by means of which they have been washed out of gas, require to be renewed frequently, especially in case of coke oven gases containing a high percentage of ammonia. In order to enable these repairs to be effected without stopping the



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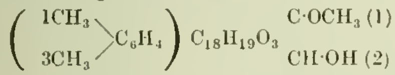
* Messrs. Waterlow and Sons, Ltd., London Wall, E.C. Price 1s. 1½d. including postage.

distilling process, the apparatus is arranged as shown in the figure, the oil heaters, *b*, *b*, being kept apart from the apparatus in which the oils are distilled by direct steam. By making the heaters sufficiently large, one of them may be cut out of the system for repairs by aid of the cocks, *e*, *e*, without disturbing the work. Both the heaters and the steam coils are made in such a way as to permit ready access to and exchange of the latter when necessary.
—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Bixine: Constitution of ——. J. F. B. van Hasselt. Rec. Trav. Chim. Pays.-Bas., 1911, 30, 1—47.

When bixine, the colouring matter of *Bixa orellana*, Lin., is treated with excess of potassium hydroxide, one methyl group is removed, with the formation of a new substance to which the author gives the name "norbixine." The two hydroxyl groups which are contained in norbixine do not form part of a carboxyl group and are very feebly acid. They are probably situated in two different parts of the molecule, as two isomeric methylethylnorbixines exist, as also two methylnorbixines, namely, bixine and isobixine. One of these hydroxyl groups is more strongly acidic than the other, which, in bixine, is methylated. This methyl group can be eliminated by alkali in aqueous solution, but when the more acidic hydroxyl group is once methylated, the product cannot be saponified. Bixine does not contain a carboxyl group. Bixine combines with ten atoms of halogen and it would appear that in this reaction some internal change takes place (*e.g.* rupture of a chain) rather than that five double linkages are present, as the substances formed do not resemble bixine in any way. When reduced with zinc dust in acid or alkaline solution, bixine forms a dihydro-compound which is yellow. The hydrobixines, like the bixines, absorb 10 atoms of halogen. Bixine is reduced very slowly, isobixine fairly quickly, and norbixine very rapidly. It has not been found possible to convert the hydrobixines into the corresponding bixines; the former are very unstable and in their formation it is probable that a rupture of the chain in the molecule takes place. On dry distillation bixine yields *m*-xylene. The author gives the following formula for bixine:—



$$\left(\begin{matrix}1CH_3\\3CH_3\end{matrix}\!\!>C_6H_4\right)C_{18}H_{19}O_3\begin{matrix}C{\cdot}OCH_3\ (1)\\CH{\cdot}OH\ (2)\end{matrix}$$

but the nature of the chromophoric groups is still unexplained. Alkylation does not alter the character of the colouring matter. The hydrobixines are yellow colouring matters, but do not appear to be related to flavone derivatives; the relation of bixine to carotine shows that the former belongs to the chlorophyll group.—J. C. C.

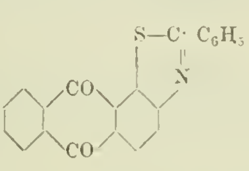
Dialysis of dyestuffs. W. Biltz and F. Pfenning. Van Bemmelen Festschrift, 1910, 108. Chem. Zentr., 1911, 1, 1102—1103.

From the results of their experiments, the authors divide dyestuffs into three groups:—(1) Dyestuffs (non-colloidal), which dialyse rapidly: these pass through the membrane almost completely in the course of a few days; (2) dyestuffs (semi-colloidal) which dialyse tolerably rapidly: the solution in the dialyser is always more strongly coloured than the outer liquid, or the dialysis slackens considerably after 12—24 hours; (3) non-dialysable (colloidal) dyestuffs; the outer liquid remains colourless for a long time. It was found that the colloidal character is influenced strongly by the molecular size (reckoned by the number of atoms) of the dyestuff. In general, dyestuffs with up to 45 atoms in the molecule dialyse rapidly; those with a greater number considerably more slowly. With dyestuffs containing 55—70 atoms in the molecule, dialysis is very slight, and when the number of atoms is greater than 70, no dialysis takes place. Dyestuffs containing sulphonic groups dialyse much more easily than when these are absent. For example the sulphonic acids of the Malachite Green group dialyse readily although their molecules contain from 70 to 95 atoms.—A. S.

Patents.

Dyestuffs of the anthraquinone series containing sulphur, and of parent materials therefor; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. für Anilinfabr., Berlin. Eng. Pat. 12,828, May 26, 1910.

Benzyl- or benzylidene-derivatives of α- or β-aminoanthraquinone are prepared from the aminoanthraquinones by the usual methods; substitution derivatives of both components of the interaction may also be condensed, except that sulphonic acids of aminoanthraquinones and amino-derivatives of α-aminoanthraquinone do not give useful results. There must also be a free ortho-position relative to the benzyl- or benzylidene-amino-group. When these products are heated with sulphur, new dyestuffs giving yellow to brown shades are produced. The following constitution is suggested as typical of the new dyestuffs:—



—J. C. C.

Thioindigo and its derivatives; Manufacture of ——. A. G. Bloxam, London. From Act-Ges. für Anilinfabr., Berlin. Eng. Pat. 16,517, July 11, 1910.

Thioindigo can be obtained from acetophenone or its substitution derivatives by treating the substance with sulphur monochloride, whereby an intermediate compound containing sulphur is produced. When this is now treated with chlorosulphonic acid the thioindigo compound is produced. Acetophenone yields thioindigo and tolyl methyl ketone furnishes dimethylthioindigo. Example: 12 parts of acetophenone are treated at the ordinary temperature with 22 parts of sulphur chloride; the yellow resinous product is powdered and introduced into about seven times its weight of chlorosulphonic acid. After some time the mass is poured on ice and the reddish coloured precipitate collected. This may be purified by means of any method usual for the purification of thioindigo.—J.C.C.

Vat dyestuff of the anthraquinone series; Manufacture of a blue ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst on the Maine, Germany. Eng. Pat. 20,110, Aug. 29, 1910.

A blue vat dyestuff is obtained by melting the product of the action of chloride of lime on β-aminoanthraquinone (60 kilos.) at about 220°—240° C. for about half an hour with potassium hydroxide (250 kilos.). After cooling the mass is dissolved in water with access of air and the separated dyestuff is collected. It is purified by extraction with suitable organic solvents or by reducing it. It forms an indigo-blue powder furnishing a blue vat from which textile fibres are dyed in the same shade.—J. C. C.

Disazo dyestuffs; Manufacture of ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat 1730, Jan. 23, 1911.

Disazo dyestuffs, suitable for use in making colour lakes, are obtained by combining the tetrazo compound of *o*-dichlorobenzidine (NH_2: Cl=1:2) with two mols. of a 1-aryl-3-methyl-5-pyrazolone which does not contain sulphonic or carboxylic groups. The dyestuffs are reddish-yellow to orange-red, and they and the lakes prepared from them are insoluble in water and oil; the lakes are fast to light and have great covering power.—T. F. B.

Monoazo dyestuffs for wool; Process for preparing acid ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 233,367, July 10, 1909. Addition to Ger. Pat. 224,497, April 29, 1909 (see Eng. Pat. 11,356 of 1909; this J., 1910, 685).

Diazo compounds of aromatic amines which contain no nitro or sulpho groups (with the exception of aminodiaryl ethers) are combined in alkaline or neutral solution with 2-arylamino-8-naphthol-6-sulphonic acids or their derivatives substituted in the position. The products have properties similar to those described in the principal patent.—T. F. B.

Nigrosines or indulines soluble in water; Process for preparing deep black ——. L. Stange. Ger. Pat. 233,600, May 25, 1910.

Spirit Nigrosines or Spirit Indulines are condensed with dinitrochlorobenzene, and the products are rendered soluble in water in the usual manner; alternatively, the salts of Nigrosines or Indulines which are soluble in water, may be condensed with dinitrochlorobenzene. The introduction of the dinitrophenyl group changes the shade from violet black to deep yellowish black. The dyeings obtained with these products appear to be fast, as do the lakes prepared from them.—T. F. B.

Azo dyestuffs; Manufacture of substantive ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 9620, April 20, 1910.

See U. S. Pat. 969,450 of 1910; this J., 1910, 1296.—T.F.B.

Azo dyes; Manufacture of —— and intermediate compounds for use therein. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,735, June 18, 1910.

See Ger. Pat. 230,595 of 1910; this J., 1911, 350.—T. F. B.

Azo dyestuffs for chrome-mordanted wool; Manufacture of ——. A. G. Bloxam, London. Eng. Pat. 20,216, Aug. 30, 1910.

See Fr. Pat. 420,330 of 1910; this J., 1911, 351.—T. F. B.

Anthraquinone derivatives; Manufacture of acidylated sulphurised ——. Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 4158, Feb. 18, 1911. Under Int. Conv., April 23, 1910.

See Fr. Pat. 420,530 of 1910; this J., 1911, 351.—T. F. B.

Azo dyes; Mordant-dyeing —— and process of making same. B. Richard, Assignor to the Aniline Color and Extract Works, formerly J. R. Geigy, Basle, Switzerland. U.S. Pat. 991,750, May 9, 1911.

See Ger. Pat. 226,242 of 1909; this J., 1910, 1450.—T.F.B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Silk; Comparative investigations on the composition and structure of different varieties of ——. *XII. The mono-amino acids from the "gum" of Indian tussah.* F. W. Strauch. Z. physiol. Chem., 1911, 71, 365—366.

Abderhalden's researches have shown that the composition of wild silks differs in many respects from that of the cultivated varieties. Comparative investigations on similar lines have now been directed to the question whether differences also exist in the constitution of the "gums" derived from the various silks. The present paper deals with the gum of Indian tussah silk (compare this J., 1909, 1083), which contained on the average, 25 per cent. of ash. Apparently the material had been "weighted" before it came on the market; the ash contained a notable proportion of copper. The following yields of mono-amino acids were obtained, calculated on the ash-free material dried at 120° C.:—glycocol, 1·5; alanine, 9·8; leucine, 4·8; serine, 5·4; aspartic acid, 2·8; glutamic acid, 1·8; phenylalanine, 0·3; tyrosine, 1·0; and proline, 3·0 per cent.—J. F. B.

Paper; Fancy colouring of —— on the paper-machine. E. Heuser. Wochenbl. Papierfab., 1911, 42, 1607—1611.

Recent developments in the decoration of paper on the paper-machine have made great advances from an artistic point of view, the aim being to avoid sharply defined patterns, and to effect the tasteful blending of the different colours in harmony with the structure of the paper. It is this structure which governs the diffusion of the colours, and the different varieties of fibrous materials develop different types of patterns. The effects obtained vary with the process of application of the colouring matter; sometimes this is applied in the form of clear solutions of dyestuffs, sometimes in the form of separately dyed fibres of a different nature from the body of the paper, *e.g.*, mechanical or chemical wood-pulps, sawdust, ramie, or even pieces of dyed paper stamped out, suspended in water, and allowed to flow on the surface of the wet paper on the wire of the machine. When solutions of dyestuff are used, their penetration and diffusion depends on the position on the wire at which they are applied, *i.e.*, on the amount of water present at that particular moment in the body pulp in the course of formation of the web. In the manufacture of "Phidias" or "Marmorella" papers, solutions of different dyestuffs are run on the surface of the liquid pulp between the breast-box and the slices. These diffuse to a certain extent, but still tend to retain the form of straight stripes. These stripes are made wavy and more artistic by the to-and-fro motion of strips of felt suspended in the pulp, and moved sideways by means of an eccentric. The diffusion of the colours is controlled by the condition of beating and the proportion of water carried by the stuff. An extremely attractive form of fancy paper is the "Cirrhus relief" paper. The manufacture of this is based on the fact that the drained surface of a "free-beaten" pulp on the paper-machine wire is naturally irregular, being composed of elevations and hollows. Across this uneven surface are sprayed solutions of dyestuffs from the sides of the wire, the sprays being directed as nearly horizontally as possible. The dye solution is taken up by the sides of the elevations on the surface and misses the hollows, creating a relief effect. When the paper is smoothed out by the couch and press rolls, the actual relief vanishes and the paper becomes flat, but the colour-relief remains. The surface of the pulp may purposely be made irregular by drops of water, forming "craters," or regular relief patterns may be impressed by a coarse dandy roll on the surface of the paper before spraying on the colour, and when this is applied, the pattern of the dandy roll remains on the finished paper in the form of a colour-relief. "Terrazo-paper" is made by first applying a uniform layer of colour by means of a felt roll to the surface of the moist web on the wire, and then spraying water on the coloured surface; the surface layer is thus disturbed and forms pale patches with dark edges. "Syenite paper" is an imitation marbled paper prepared by spraying a dark solution of a dye on the not too moist surface of a web of paper coloured with a pale shade. An extremely ingenious method of marbling consists in allowing a coloured froth, produced from a soap solution containing a dyestuff, to flow upon the surface of the web, then breaking the bubbles of froth by means of a water-spray before the couch-roll is reached. The froth, the spray-water, and the body-pulp may all contain different colours. Lastly the author mentions a method of producing patterns by allowing a differently coloured fibrous pulp to flow on the paper-machine wire through a stencilled wire-sieve, so that the applied pulp reproduces the patterns of the stencil before the body-pulp is applied.—J. F. B.

Patents.

Flax, hemp, cotton, and similar fibres and materials formed therefrom; Treatment of ——. W. Schewelin, Moscow, Russia. Eng. Pat. 17,898, July 27, 1910.

The raw material is heated to 100° C. for six hours, with continual agitation in a caustic soda lye of 1—1·5° B. for flax or hemp or 0·5° B. for cotton. To this lye are also added 1 per cent. on the weight of the raw material of crude ethyl alcohol, and 0·5 per cent. of naphthenic acid. After this boiling, the liquor is run off and the material is washed with hot water and then treated once or twice in the same vessel with hot crude alcohol registering more than 60° on the Tralles alcohol-meter. The cleansing effect of the alcohol is increased if small quantities of naphthenic acid, stearic acid or oleic acid, and light coal-tar oil are added to it. The alcohol is recovered.—P. F. C.

Silk weighted with metal salts; Process of preserving ——. O. Meister, Zurich, Switzerland, Assignor to Weidmann Silk Dyeing Co., Paterson, N.J. U.S. Pat. 991,221, May 2, 1911.

Silk which has been weighted with metallic salts may be preserved by treating it with the compound formed by the interaction of formaldehyde and ammonia (hexamethylenetetramine).—T. F. B.

Textile fabrics [artificial silk]; Manufacture of ——. J. Wilkinson, and The Bradford Dyers' Assoc., Ltd., Bradford. Eng. Pat. 10,186, Apr. 26, 1910.

In the manufacture of fabrics from artificial silk threads whether alone or in combination with cotton threads, difficulty is experienced with the warp owing to the deficient elasticity of the artificial silk. This difficulty is overcome by twisting the artificial silk threads with woollen or other threads of animal fibre, weaving the fabric, and then destroying the animal threads, preferably by treatment with alkali hydroxides.—J. F. B.

Papers sensitive to water; Process for coating —— *with metallic and body colours in a watery binding agent.* F. C. Wickel, Paris. Eng. Pat. 9272, April 16, 1910. Under Int. Conv., Apr. 17, 1909.

Certain types of paper, such as tissue papers and imitation parchment, are too sensitive to water to be satisfactorily coated with the liquid aqueous media usually employed for enamelling papers. As soon as the water touches these papers, cockles and ridges are produced, which prevent the uniform application of the colour. According to this invention the metal powder or body colour is incorporated with an extremely adhesive and viscous binding agent, which is spread as a plastic mass, containing a minimum quantity of water, by means of a multiple roller apparatus similar to that used for applying a varnish printing ink. For preparing the colour-paste, 100 parts of rice or wheat starch and 50 parts of potato starch are heated in a closed vessel, in a water-bath, with 450 parts of a 1 per cent. solution of sodium or potassium hydroxide. The stiff paste thus obtained may be neutralised or left alkaline: it is kneaded by mechanical means, with a little glycerin and water, and about 3000 parts of metallic tin powder, or suitable proportions of other colours. The mixture thus prepared is generally not sufficiently viscous, and as a rule, about 50 parts of molasses are necessary to impart the desired consistence. Wax, soap, glycerin, and any other ingredients are added as required.—J. F. B.

Wool; Apparatus and means for removing and recovering potash from ——. J. F. White. Bradford. Eng. Pats. 9866, April 22, and 10,962, May 3, 1910.

See Fr. Pat. 416,481 of 1910; this J., 1910, 1372.—T. F. B.

Silk; Process for loading ——. Landau und Co., and I. Kriedl, Vienna. Eng. Pat. 11,055, May 4, 1910. Under Int. Conv., June 15, 1909.

See Fr. Pat. 415,657 of 1910; this J., 1910, 1300.—T. F. B.

Silk weighted with metal salts; Process of preserving ——. O. Meister, Zürich, Switzerland. Assignor to Weidmann Silk Dyeing Co., Paterson, N.J. U.S. Pat. 991,220, May 2, 1911.

See Ger. Pat. 223,883 of 1909; this J., 1910, 1154.—T.F.B.

Fabrics impregnated with carbon and methods of and apparatus for producing the same. F. L. Horton, Lynn, Mass., U.S.A. Eng. Pat. 19,133, Aug. 15, 1910. Under Int. Conv., Aug. 18, 1909.

See U.S. Pats. 963,291 and 972,110 of 1910; this J., 1910, 940 and 1245.—T. F. B.

Composition or material and method of making same [from acetylcellulose]. W. G. Lindsay, New York. Eng. Pat. 10,794, May 2, 1910. Under Int. Conv., May 5, 1909.

See Fr. Pat. 415,517 of 1910; this J., 1910, 1299.—T. F. B.

Cellulose films; Apparatus for the continuous manufacture of ——. E. Brandenberger, Thaon-les-Vosges, France. U.S. Pat. 991,267, May 2, 1911.

See Eng. Pat. 15,190 of 1909; this J., 1910, 147.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Bleaching; Electrolytic —— *and the manufacture of hypochlorites by electricity.* E. Reuss. J. Soc. Dyers and Col., 1911, 27, 110—122.

The author summarises the methods employed for electrolytic bleaching, and the manufacture of hypochlorite, the early forms of the Kellner mangle, the Tailfer apparatus. Kellner's hollander for pulp bleaching, Leclanché's apparatus for the external formation of hypochlorite, and the more modern forms by Hermite. Atkins, Kellner, Vogelsang, Schuckert und Co., Mather and Platt, and Oettel, being described. Figures are given showing the relative cost of electrolytic bleach, sodium hypochlorite and bleaching powder, and tables which show the relative details of the working of the Kellner and Haas-Oettel apparatus. The advantages to be derived from the use of electrolytic sodium hypochlorite, and the various uses to which it may be put are fully dealt with.—B. N.

Fading of dyestuffs; The ——. W. Harrison. J. Soc. Dyers and Col., 1911, 27, 129—130.

A criticism of a method suggested by Gebhard (this J., 1910, 876) for a uniform method of testing the fastness of colours to light. The two sources of light suggested may lead to difficulties in obtaining a true comparison with sunlight; the amount of bleaching, represented by unchanged colour, is not reliable where a series of changes occurs; and the photographic plate method may return results very different to visual ones. The moisture conditions proposed by Gebhard are unfair, as they are not met with in practice. A suggestion is made by the author that the "quantity and intensity of the various waves of light constituting sunlight in the various countries" be obtained, so that the conditions at any place may be reproduced, by combinations of different sources of light, for testing purposes.—B. N.

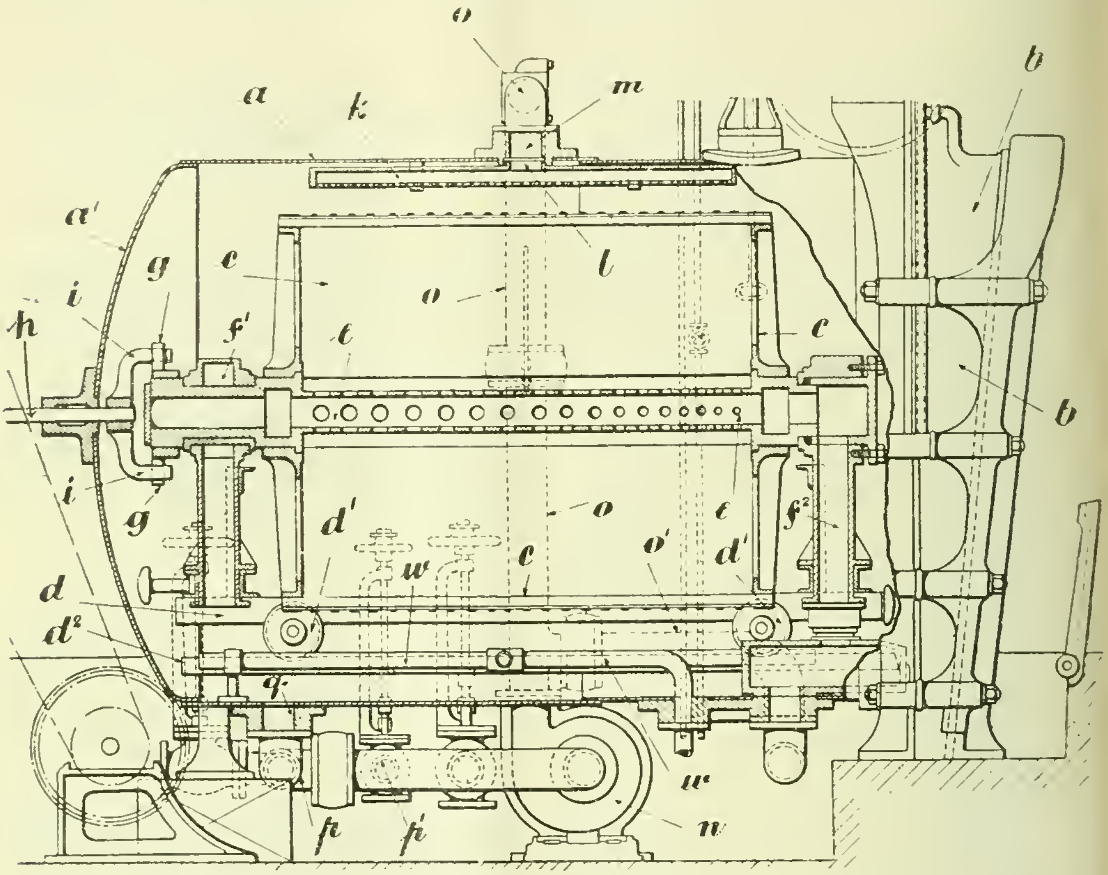
Marking inks. H. Strunk. Veröffentl. a. d. Gebiete d. Militärsanitätswes., Heft. 45; Arbb. hyg.-chem. Unters.-Stellen, 1911, IV. Tl., 42—52. Chem. Zentr., 1911, 1, 1463.

Textile fabrics marked with Aniline Black ink are found to be badly tendered when sterilised by steaming if the excess of ink be not previously washed out, and even when this is done the marked portions of woollen materials are friable after steaming. Without washing, marked fabrics suffer injury merely on long keeping. Silver inks are stated to be without injurious action if the marked fabric be exposed to sunlight for 24 hours, and then to a current of steam for half-an-hour.—A. Sbld.

Patents.

Bleaching textile fabrics and the like; Method of and means for ——. A. E. Roberts, Prestwich, and J. B. Turner, Manchester. Eng. Pat. 10,792, May 2, 1910.

A cage, *c*, made of perforated end plates joined by cross bars and encircled with hoops, is mounted on a truck, *d*, fitted with wheels, d^1, which run on rails, d^2, laid along the floor of a kier-casing, *a*, which is closed by a fixed end, a^1, and at the other end by a movable wedge-shaped block, *b*. The axis of the cage is a perforated pipe, *e*, supported in hollow pedestal bearings, f^1, f^2, which at their lower ends are connected with the truck. This pipe, *e*, and the interior of the bearing, f^2, communicate by a through passage. In order to rotate the cage, *c*, a shaft, *h*, mounted in the casing end, a^1, is provided with spokes, *i*, which engage pegs, *g*, fitted on to the end of the pipe, *e*. Another perforated pipe, *k*, as long as the working length of the cage, is arranged in the upper part of the kier with its inlet, *l*, directly below an opening, *m*, in the casing, *a*.



The liquor is driven by a pump, *n*, through a pipe, *o* and the inlet, *m*, into the casing. It can be withdrawn through an outlet, *q*, and returned to the pump by a pipe, *p*. The pump also communicates on the delivery side, with the perforated pipe, *e*, *via* pipe, o^1, and bearing, f^2. In order to heat the liquor, perforated steam pipes, *w*, are arranged in the bottom of the casing. To work the apparatus the cloth is cuttled down in the cage, *c*, in the open form, with the folds parallel with the pipe, *e*, and the cage is run into the kier. After closing the kier, the necessary liquor is run into the casing through pipes, *p*, p^1, o^1, *e*, or *p*, *o*, and *k*, until it nearly reaches the level of the pipe, *e*. The cage is then set in rotation at about 12 revolution, per hour, and the liquor is raised to the boil. The pump is next started, and draws the boiling liquor out of the casing, and re-delivers it on to the constantly moving material through the spray perforations in the pipes, *k* or *e*. In this way the fabric is alternately and repeatedly subjected to a thorough soaking in the boiling liquor in the lower part of the kier, and to an atmosphere of steam in the upper part.—P. F. C.

Black dyeings on the fibre; Process of producing ——. Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 2232, Jan. 28, 1911. Under Int. Conv., Apr. 14, 1910.

Blue-black shades, which can be discharged to a pure white, are obtained by treating with diazotised *p*-nitraniline, cotton dyed with a dyestuff of the following constitution:

$$\text{p.-p.-diamino-compound}\left\langle\begin{array}{l}\text{1-amino-8-naphthol-2 : 4-}\\ \quad\text{disulphonic acid}\\ \text{m.-diamine.}\end{array}\right.$$

in which the "p.-p.-diamino-compound" is a base of the benzidine or p.-p.-diaminoazobenzene series, and "m-diamine" means m-phenylenediamine, m-toluylene-diamine or some similar substance.—P. F. C.

Non-inflammable fabric and garments made therefrom. T. D. Gimlette, Haslar, and F. A. Capps, Gosport, Hants. Eng. Pat. 2524, Jan. 31, 1911.

The fabric is impregnated with a 10 per cent. solution of tin chloride, then wrung out, dried and dipped in a 10 per cent. solution of sodium tungstate.—P. F. C.

Bleaching process. R. Müller, Eilenburg, Germany. Eng. Pat. 1727, Jan. 23, 1911. Addition to Eng. Pat. 9369, April 18, 1910.

See Addition of Nov. 5, 1910, to Fr. Pat. 414,821 of 1910; this J., 1911, 534.—T. F. B.

Discharge effects; Process for producing ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,998, May 28, 1910.

See Ger. Pats. 228,753 of 1909 and 228,754 of 1910; this J., 1911, 206.—T. F. B.

Substitutes for lithographic stones or metal plates; Process for producing ——. H. Christiansen, Halle, Germany. U.S. Pat. 991,273, May 2, 1911.

See Eng. Pat. 15,417 of 1909; this J., 1910, 27.—T. F. B

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphuric acid; Production of —— by the oxidation of sulphur dioxide by means of nitrogen oxides without lead chambers. H. Petersen. Chem.-Zeit., 1911, **35**, 493—494.

As far back as 1905, the author experimented successfully on the production of sulphuric acid in towers. The principle on which he worked was that the rate of production of sulphuric acid in a given space depends upon, and is practically proportional to, the amount of nitrogen oxides contained in the space, and that for the maximum rate of production the sulphurous acid present must find at once the quantity of nitrogen oxides needed for its complete oxidation. This means that to produce 50,000 kilos. of sulphuric acid of sp. gr. 1·52, nitrogen oxides equivalent to 40,000 kilos. of nitric acid of sp. gr. 1·32 must be employed. The efficiency of Gay-Lussac and Glover towers is discussed, and it is pointed out that recent improvements in the material for packing the towers, and in the mode of distributing the acid, would further increase the efficiency; but better and more economical forms of apparatus can be suggested than towers—three are mentioned by the author, in which the gases from the burners are made to pass directly through the acid. The first system consists of a gas-cooler, and four shallow leaden boxes, connected by pipes, and rising behind one another by steps of 30 cm. Each is provided with a perforated false bottom, and packed above this with quartz or other acid-resisting material. The first two boxes contain nitrous vitriol, the others sulphuric acid of 1·6 to 1·7 sp. gr. A fan draws the gases, cooled to 50° C. in the cooler, through the acid: the formation of sulphuric acid goes on instantaneously in the first box, the second prevents any possible escape of sulphur dioxide, and the evolved nitric oxide is absorbed in the third and fourth. Acid of sp. gr. 1·6 is most suitable for the whole operation, since it easily absorbs nitrogen oxides, and is equally easily denitrated. Water is added in the gas cooler or the first box to maintain the sp. gr. at 1·6. The second system consists of only two boxes, filled completely with quartz, and provided with short lead baffles projecting down from the lid. The acid as it flows through fills these boxes completely, and the gases pass horizontally through, so that less pressure is required than in the former system. The third system has only a single box, and is in effect a development of the second system. —J. T. D.

Acetic acid; Purification of ——. K. J. P. Orton, M. G. Edwards, and H. King. Chem. Soc. Proc., 1911, **27**, 120—121.

Chlorine and bromine do not react with pure acetic acid when light is excluded. Fall in the titre of a solution of bromine in acetic acid, especially if diluted, shows the presence of certain impurities, which are found in the majority of commercial acetic acids. Both fractional distillation and fractional freezing give but small proportions of pure acetic acid. Distillation from phosphoric oxide, on the other hand, yields 85—90 per cent. of the acid free from these impurities. With the proper precautions only traces, 0·009—0·04 per cent., of acetic anhydride are produced in this treatment.

Acetic anhydride in acetic acid; Detection and determination of small quantities of ——. M. G. Edwards and K. J. P. Orton. Chem. Soc. Proc., 1911, **27**, 121.

A method of detecting and estimating small quantities of acetic anhydride in aqueous acetic acid is based on the fact that certain aniline derivatives, notably 2 : 4-dichloroaniline, react with acetic anhydride with great rapidity. The anilide can be separated accurately from the aniline derivatives, and then indirectly estimated in the form of chloroamine.

Formic acid; Catalytic decomposition of ——. P. Sabatier and A. Mailhe. Comptes rend., 1911, **152**, 1212—1215.

The facts already known concerning the decomposition of formic acid indicate that its decomposition by catalysis would take place according to one or more of the following reactions: (1) $HCOOH=CO_2+H_2$, (2) $HCOOH=CO+H_2O$, (3) $2HCOOH=HCOH+CO_2+H_2O$. At the same time the temperature of the decomposition would be lowered. Various metals and oxides were used as catalytic agents, and the vapour of the formic acid was led over a length of half a metre of the catalyst in a horizontal glass tube at the desired temperature. The results could be grouped into three classes according to the catalyst used. The first comprised palladium, platinum, copper, nickel, cadmium, and oxides of zinc and tin, which decomposed the formic acid according to equation (1), at varying temperatures and rates. Palladium sponge and platinum sponge brought about total decomposition at temperatures of 245° and 215° C. respectively. The second class comprised titanic oxide and blue oxide of tungsten which acted according to equation (2) exclusively, and silica, zirconia, alumina, and uranous oxide which gave a proportion of formaldehyde along with reaction (2). The third class are those which produced all three reactions at the same time; for instance, thoria gave 79 per cent. of reaction (2) at 150° C., and 21 per cent. of reactions (1) and (3) together. Also, an empty tube of Jena glass at 340° C. gave 2·6 c.c. of gas per minute chiefly according to reaction (1). Reaction (2) predominated with powdered pumice, magnesia, wood charcoal, and many other substances. Thus the experiments showed that the decomposition took place in quite different ways, even at the same temperature, according to the catalyst used. This result negatives the idea that a catalytic agent simply lowers the temperature of a reaction which is brought about by heat alone. The catalyst acts rather by producing temporary combinations according to its chemical constitution, although it may be difficult to indicate these in all cases.—J. H. J.

Ammonia; Production of —— and recovery of nitrogen from peat. H. Woltereck. Comptes rend., 1911, **152**, 1245—1247.

Further experiments confirm those already recorded (this J., 1908, 158; 1909, 20). The treatment of peat by steam alone at 450° C. produces only about one-third of the quantity of ammonia obtained, under the same conditions, by means of a mixture of steam and air, and results are given which show a recovery of 102·6 per cent. of nitrogen (referred to the nitrogen present in the original peat) by the latter method, no nitrogen being left in the residue. No acetic acid was obtained when peat was treated first with steam and then with a mixture of steam and air, but when the material was heated only with the mixed steam and air, the yield of acetic acid amounted to 2·31 per cent.—F. Sodn.

Ammonium selenate; Preparation of ——. F. C. Mathers and R. S. Bonsib. J. Amer. Chem. Soc., 1911, **33**, 703—708.

Good yields of ammonium selenate can be obtained by the interaction of barium or lead selenate with excess of ammonium carbonate, the barium or lead carbonate being filtered off, the filtrate evaporated, and the ammonium selenate recovered by crystallisation. The best conditions for carrying out the reaction are:—(1) 2·8 grms. of ammonium carbonate (27·8 per cent. of carbon dioxide) and 10 c.c. of water for each 1 grm. of barium selenate, the mixture being allowed to stand for 30 hours with occasional shaking; (2) 0·55 grm. of ammonium carbonate and 5 c.c. of water for each 1 grm. of lead selenate: the best yields are obtained after 1—2 hours, but good yields are obtained in 15—30 mins. Lead selenate gives a better yield of ammonium selenate than the barium salt does.—A. S.

Bush salt. W. Lenz. Ber. deuts. Pharm. Ges., 1911, **21**, 270—272.

The natives of Ssongea obtain "bush salt" by lixiviating the ashes of the sedge, *Cyperus Haspan*, L. It is a light-brown greyish powder, of fine granular appearance, and containing a very small amount of organic matter. It nearly all dissolves in water, and contains 77·77 per cent.

of potassium chloride and 18·48 per cent. of potassium sulphate. Sodium is practically absent.—F. Shdn.

Chlorides, chlorates, and perchlorates; Determination of —— in mixtures of the same. Marqueyrol. Ann. Chim. Analyt., **16**, 167—168.

The method proposed depends on the fact that hot nitric acid completely decomposes chlorides and chlorates, converting them into nitrates, whilst perchlorates, under the same conditions, are not attacked. The chlorine present as chloride is first determined in a portion of the mixture in the usual way; another portion of the mixture is fused in a platinum crucible with ten times its weight of a mixture of equal parts of sodium carbonate and potassium nitrate. After cooling, the fused mass is dissolved in dilute nitric acid, and the chlorine is determined in the solution; this represents the total chlorine present, namely, as chloride, chlorate, and perchlorate. A third portion of the mixture is then evaporated to dryness with nitric acid of 36°—40° B., a further quantity of nitric acid being added and the evaporation repeated if a trace of the residue yields a reaction for chlorides when tested with silver nitrate. The residue is now fused with ten times its weight of a mixture of equal parts of sodium carbonate and potassium nitrate, and the chlorine is determined; this quantity of chlorine represents that present as perchlorate. The chlorate is estimated by difference.
—W. P. S.

Barium sulphate; Plasticity of ——. A. Atterberg. Z. angew. Chem., 1911, **24**, 928—929.

Precipitated barium sulphate (mixed with about 22 per cent. of its weight of water) is found to possess plastic properties, like a clay of the second class of plasticity (see this J., 1910, 629). It lacks, however, the cohesion of the heavier clays. Minerals readily splitting into plates or scales such as heavy spar, kaolinite, potash mica, biotite and talc, are found to be strongly plastic when ground and elutriated so that the particles do not exceed 0·002 mm. in diameter.—A. Sbld.

Cerium; Separation of —— by potassium permanganate. E. J. Roberts. Amer. J. Sci., 1911, **31**, 350—352.

An investigation of the method of separating cerium from accompanying rare earth metals by oxidation with permanganate, has shown that this is best effected by keeping the solution slightly acid during the process, sodium carbonate being the most suitable neutralising agent. A solution containing potassium permanganate and sodium carbonate, in the proportion of 1 mol. to 4 mols., is used for the precipitation, and solutions of pure permanganate and pure sodium carbonate are also required, the process being carried out as follows:—The rare earth solution, which should not contain salts other than nitrates, is heated to boiling and neutralised, if necessary, with the sodium carbonate solution. Then the permanganate solution is added in small quantities, until the red colour just begins to be permanent, and the mixed solution of permanganate and alkali is introduced very slowly, with constant stirring, the liquid being kept nearly boiling and a faint colour of permanganate maintained all the time; a little of the pure permanganate solution is added if at any time the colour entirely disappears. When the precipitation is almost complete, the liquid is tested with litmus paper from time to time, and if acid, a little of the mixed solution or of sodium carbonate is added until it is nearly neutral. The whole is heated and stirred for about ten minutes and is then filtered hot, the precipitate being washed with boiling water, until the washings give no precipitate with ammonia. To ensure complete removal of the cerium, the liquid must be made exactly neutral at the end of the precipitation, and, to obtain a pure cerium preparation, the precipitate of cerium and manganese hydroxides is dissolved in strong hydrochloric acid, the diluted solution is precipitated with oxalic acid, the oxalate reconverted into nitrate, and the process repeated. In this way, even a mixture containing 35—40 per cent. of praseodymium and neodymium has been found to yield pure cerium in two operations.—F. Sodn.

Mercury; Some reducing actions of ——. D. Borar. Chem. Soc. Proc., 1911, **27**, 128.

The action of mercury on solutions of a number of substances has been examined with the following results: (1) Potassium permanganate is reduced to potassium hydroxide and manganese dioxide, the mercury being oxidised to mercuric oxide. (2) Potassium bichromate in neutral solution is not reduced. In the presence of hydrochloric acid, however, chromium chloride and mercurous chloride are formed. (3) Ferric salts in the presence of hydrochloric acid are reduced to the ferrous state. The experiments showed that mercury may be used as reducing agent for ferric compounds in the estimation of iron. (4) Potassium persulphate is reduced to potassium sulphate, the mercury being converted into a basic sulphate. (5) Copper sulphate in the presence of hydrochloric acid is reduced to cuprous chloride. (6) Nitrobenzene in the presence of hydrochloric acid is reduced to aniline to a small extent. (7) Solutions of potassium nitrate, potassium chlorate, and sodium peroxide are not acted on by mercury to any appreciable extent.

Low temperatures. R. Pictet. J. Roy. Soc. Arts, 1911, **59**, 678—702.

Taking for granted that the attraction of matter for the ether increases at a greater rate than that of matter for matter, according to Newton's law, it follows that the particles constituting a body of matter will not touch, but will remain in a state of stable equilibrium at a definite distance apart, which can only be modified by external force. Supposing two heterogeneous atoms to approach one another in the ether, three positions of equilibrium will be reached, the first and third stable, the second unstable. The first position results from the loss of all potential due to gravitation and cohesion, that is, when the attraction of the ether for the atom balances that of atom for atom. If now the two atoms are subjected to a force which can cause them to unite, a period of endothermic reaction will follow, the energy being absorbed in overcoming the attraction of the ether; when this is accomplished, the attraction due to affinity manifests itself, and a period of exothermic reaction ensues. The second (unstable) position of equilibrium is reached when the endothermic reaction ceases, and the third (stable) position when the whole reaction is completed. From this hypothesis the following conclusions are drawn: Heterogeneous substances, however great their mutual affinity, will not interact at absolute zero or at very low temperatures, whatever the pressure. Several heterogeneous bodies, when strongly cooled and then slowly heated, will only combine in one way, so long as the temperature is properly controlled. The series of reactions will follow along the line of the least chemical resistance, *i.e.*, the first reaction will be that in which the total quantity of energy expended during the endothermic period is the minimum. Each atom which enters the zone of chemical attraction of another atom, will at once modify the fundamental properties of that atom. The following experiments were carried out with a view to support these theories.

Sulphuric acid (95 per cent.) cooled to about −125° C., did not react with caustic soda, cooled to the same temperature, even when intimately mixed; a reaction was started by passing electric sparks 30—35 mm. long through the mixture, but it only took place at the points where the sparks touched the mixture: when the mixture was exposed to air at the ordinary temperature, its temperature rose rapidly, and before the acid had completely melted the reaction became very violent. The mass reaction commenced at −80° to −85° C. The interaction of caustic potash with sulphuric acid was similar, excepting that the mass reaction commenced at a slightly lower temperature. The reaction between sulphuric acid and 23 per cent. ammonia solution commenced below −65° C., the temperature then suddenly rising to above 100° C. Fuming (89 per cent.) nitric acid reacted in a similar manner with caustic alkalis; with common salt, no reaction occurred at −74° C., excepting by aid of an electric spark;

the reaction became general at about —20° C. When marble cooled to —89° C. was added to dilute sulphuric acid (corresponding to the formula, $H_2SO_4 7H_2O$, which remains liquid at —115° C.) cooled to —70° C., no reaction occurred: when the temperature was allowed to rise slowly a slight reaction was observed at —52° C., and the evolution of carbon dioxide increased progressively up to —15° C.; from —15° to —7° C. the reaction became very energetic. When cooled sodium carbonate (crystals) was added to the same cooled dilute sulphuric acid, the reaction first took place at —56° C.; at —30° it had increased in vigour, whilst at —23° C. it was violent and general. The reaction between the dilute sulphuric acid and solid barium chloride commenced at —70° C., and that between 33 per cent. hydrochloric acid and silver nitrate at —109° C. When an alcoholic solution of blue litmus, cooled to —140° C., was added to dilute sulphuric acid cooled to the same temperature, it retained its blue colour; at —110° C. it changed to greenish-violet, and at —105° C. to red. Similarly, when the cooled solution of litmus was added to 33 per cent. hydrochloric acid cooled to —140° C. (at which it is still liquid) the colour remained blue, passing to violet at —115° C., and red at —110° C. Solutions of caustic potash and phenolphthalein in absolute alcohol were cooled to —145° C., at which temperature they were viscous: when mixed together no coloration appeared, but at —100° C. a faint pink tint was developed, and at —90° C. the coloration was intense. The reaction between sodium and 84 per cent. (aqueous) alcohol commenced at —48° C., and between potassium and alcohol at about —68° C., this being more violent than with sodium. Finally, the reaction between fuming nitric acid and alcohol only commenced at —70° C., and became vigorous at about —60° C. In each of these reactions the two stages mentioned above (endothermic and exothermic) were apparent; in the first stage the reaction was only local, but in the second it became a mass reaction.

Nitration of toluene, naphthalene, and phenol.—When toluene was treated with a mixture of nitric and sulphuric acids at 30°—35° C. in such a manner as form mononitro derivatives, the product consisted of 60 per cent. of *o*-nitrotoluene and 40 per cent. of *p*-nitrotoluene: when, however, the toluene was cooled to —50° to —55° C., and slowly added to a similarly cooled mixture of nitric and sulphuric acids, 85 per cent. of *o*-nitrotoluene was obtained, and only 15 per cent. of the *p*-compound; the temperature was kept constant during the reaction by external cooling. When cooled naphthalene was slowly mixed with a mixture of sulphuric and nitric acids cooled to —55° C., keeping the temperature at that point during the reaction, the product consisted of 20 per cent. of *a*-nitronaphthalene, 28 per cent. of *a*(1.5)-dinitronaphthalene, 40 per cent. of γ(1.3)-dinitronaphthalene, and 12 per cent. of unaltered naphthalene; under similar conditions, but at the ordinary temperature, the product consists solely of the *a*-mononitro compound. For the experiments on phenol, 160 grms. of nitric acid, of sp. gr. 1·34, diluted with twice its weight of water, was gradually mixed with 80 grms. of phenol, the mixture being kept at 0° C.; in a second experiment, the flask containing the mixture was cooled to —40° C., but even at that temperature the mass reaction commenced, the temperature rising rapidly to —20° C.: in each case the yield of *p*-nitrophenol was the same—about 6 grms. Again, when a solution of phenol in ether was mixed with nitric acid of sp. gr. 1·34 (each being cooled to —45° to —50° C.), no reaction took place for a few seconds, but then a violent explosion occurred. In the last experiment, 80 grms. of nitric acid, of sp. gr. 1·34, was cooled to —50° to —60° C., and 40 grms. of phenol was mixed with it, the low temperature being maintained; no reaction occurred under these conditions, but by passing an electric current uniformly through the mixture, the reaction proceeded progressively, without apparent increase of temperature. The product of this reaction contained 15 grms. of *p*-nitrophenol, *i.e.*, five times as much as under normal temperatures. The reduction of dinitrobenzene to *m*-nitraniline by means of hydrogen sulphide, and diazotisation of the product to produce *m*-nitrophenol, was also studied; when the reactions were carried out at low temperatures, the yields were double those obtainable at normal temperatures.—T. F. B.

Nitrogen; A chemically active modification of——, produced by the electric discharge. R. J. Strutt. Proc. Roy. Soc., 1911, **85**, A, 219—229.

Pure nitrogen, from whatever source, when subjected to the Leyden jar discharge, is found to undergo a modification, which causes it to glow for a short time after it has left the region of the discharge. The glow, which is emitted while the gas is returning to its normal condition, is not affected by the removal of ions by means of an electric field; it is weakened by heating and intensified by cooling, and the view is suggested that it is occasioned by the recombination of dissociated atoms. Copper oxide and manganese dioxide destroy the glow catalytically. The modified nitrogen combines with ordinary phosphorus, much red phosphorus being formed, and the amount of gas absorbed shows the percentage of active nitrogen present to be comparable with that of the oxygen converted in an ozoniser. It combines with sodium and also with mercury at a gentle heat, forming in the latter case an explosive compound, and in each case, the line spectrum of the metal is developed; and line spectra have been observed with other metals, such as cadmium, magnesium, potassium, etc., which probably also combine with the nitrogen. It develops the band spectra of compounds (tin chlorides, mercury salts, etc.), when they are vapourised in it, giving, in many cases, spectra of substances which are too unstable to be examined at the temperature of the Bunsen flame. Nitric oxide reacts with glowing nitrogen forming nitrogen peroxide, possibly in accordance with the equation, $2NO+N=NO_2+N_2$, and acetylene and halogen derivatives of hydrocarbons are decomposed by it, with the liberation of halogen, where present, and the production of cyanogen.—F. Sodn.

Rare gases, hydrogen, and nitrogen; Simple method for the preparation of pure ——. G. Gehlhoff. Verh. Physik. Ges. 1911, **13**, 271—277.

Under the influence of the glow electrical discharge, the vapours of alkali metals absorb hydrogen, carbon monoxide, oxygen, and nitrogen rapidly and completely, the absorptive power being greater the higher the atomic weight of the metal; the compounds formed have very low vapour pressures at the temperatures used. The rare gases—helium, argon, etc.—are not absorbed. The author uses potassium, which has a high absorptive power at 200° C.; it is employed as cathode, the current being led to it by a thin platinum wire, another platinum wire serving as anode. The absorption vessel is heated in an electric furnace, and has suitable connections so that the gas to be purified can be circulated repeatedly through the apparatus by means of a pump, and a sample collected in a tube for spectroscopic examination when desired. It is stated that in this way spectroscopically pure helium was obtained in 6 minutes from a mixture of 10 per cent. of helium, 45 per cent. of air, and 45 per cent. of illuminating gas, the total pressure corresponding 10 mm. of mercury. By subsequently heating and exhausting the vessel, the absorbed gases, with the exception of oxygen, can be expelled again, so that a single charge of potassium will last for a long time. At lower temperatures nitrogen is absorbed more rapidly than hydrogen, so that pure nitrogen or hydrogen can be separated from a mixture of the two gases by a suitable choice of temperature. The absorption tube is kept filled with hydrogen and is then always ready for use. For preparing large quantities of rare gases, the greater portion of the impurities is first removed by means of cheaper reagents before circulating the gas through the apparatus described.—A. S.

Sublimed sulphur; Determination of —— in mixtures of the same with other kinds of sulphur. Taurel and Griffet. Comptes rend., 1911, **152**, 1182—1183.

Sublimed sulphur, or flowers of sulphur, exists in the form of minute globular particles, each one of which consists of a crystalline nucleus surrounded by a layer of amorphous sulphur. The nucleus is soluble in carbon bisulphide whilst the amorphous layer is insoluble; the thickness of this layer, and, consequently, the proportion of insoluble sulphur, varies very greatly (from 12 to 33 per cent.

of the weight of a specimen may be insoluble) and is due to different methods of manufacture and to the fact that the crystalline portion changes gradually into the amorphous form. The method proposed for the determination of sublimed sulphur in mixtures consisting of sublimed sulphur and other forms of sulphur depends upon the fact that, when the mixture is treated with carbon bisulphide, the ground or precipitated sulphur dissolves whilst the amorphous coatings of the sublimed sulphur globules remain insoluble; they retain their form and the apparent volume of the sublimed sulphur is not altered. Fifteen grms. of the sample under examination are weighed into each of two graduated tubes of equal diameter; to one tube is added, previously, 35 c.c. of petroleum spirit and to the other 35 c.c. of carbon bisulphide. The tubes are shaken gently so that the soluble sulphur is dissolved, and both tubes are then submitted to centrifugal action. The volume of the sediment in the carbon bisulphide tube gives the volume of the sublimed sulphur present, the proportion of the latter being obtained by comparison with the volume of the sediment contained in the other tube, this being the total volume of the mixed sulphurs. —W. P. S.

Sulphur and phosphorus; Compounds of ——. J. Mai. Ber., 1911, **44**, 1229—1233.

FUSED naphthalene will dissolve considerable quantities of phosphorus sesquisulphide, P_4S_3 (see this J., 1903, 511) and sulphur, and on heating to 175°—180° C., combination takes place, P_4S_7 or P_4S_{10} being formed according to the relative proportions of the sesquisulphide and sulphur present. The heptasulphide generally separates immediately, but the more easily soluble decasulphide only on cooling. It is best to work in an atmosphere of carbon dioxide, and, after the reaction is finished, to remove the greater part of the naphthalene by means of benzene, and then extract the residue with carbon bisulphide to remove the remainder of the naphthalene and any uncombined sesquisulphide and sulphur. No other compounds besides P_4S_7 and P_4S_{10} could be obtained in this manner. Benzene, xylene, or coal tar cumene (b. pt. 160°—170° C.) may be used in place of naphthalene, but the latter is preferable.—A. S.

Diamond at high temperatures; Electric conductivity and behaviour of ——. C. Doelter. Monatsh. Chem., 1911, **32**, 275—298.

THE electric conductivity of the diamond was determined at various temperatures between 900° and 1300° C. From its behaviour it is classed amongst the metallic conductors, although the conductivity increases with the temperature. The author does not consider the transformation of diamond into graphite to be impossible, but to be certainly very unusual. When protected, the diamond can stand temperatures up to 2500° C., otherwise there is corrosion and formation of charcoal. The diamond is evidently a metastable form, and is produced from carbon in the presence of certain catalysers. Generally charcoal is formed from the diamond first, and then in the presence of oxides passes into graphite. Where the combustion is complete, as in oxygen, no transformation takes place. With incomplete combustion, corrosion and blackening of the surface take place. In the electric arc there is possibly melting and solidification of the charcoal formed, or a fresh formation of charcoal or graphite by reduction of the carbon dioxide. The temporary browning of the diamond in the cathode tube at very high temperatures requires explanation.—F. SHDN.

PATENTS.

Nitric acid; Manufacture of ——. L. Friderich, Geneva, Switzerland. Eng. Pat. 319, Jan. 5, 1911. Under Int. Conv., Jan. 6, 1910.

RED fuming nitric acid is obtained by adding one molecular proportion of water, a little at a time, to one molecular proportion of liquid nitrogen peroxide (N_2O_4), which is contained in an autoclave provided with a stirrer, and then, whilst stirring the mixture, introducing oxygen under pressure (say 3—5 atmos.) until the gas is no longer absorbed.—F. SODN.

Nitric acid; Manufacture of ——. L. Friderich, Geneva, Switzerland. Eng. Pat. 403, Jan. 6, 1911. Under Int. Conv., Sept. 24, 1910. Addition to Eng. Pat. 319 of 1911 (see preceding abstract).

NITROGEN peroxide absorbed in a porous material, such as wood charcoal, is substituted for the liquid peroxide used in the original patent. This material is, for example, stirred in an autoclave whilst water (one gram-molecule for each gram-molecule of the peroxide present) is added, oxygen also being introduced under a pressure of 1·5 to 3·0 kilos. per sq. cm. The modification allows oxygen to be used at a lower pressure than formerly.—F. SODN.

Nitrous gases; Process for the absorption of ——. Badische Anilin und Soda Fabrik. First Addition, dated Nov. 9, 1910, to Fr. Pat. 412,788, Jan. 11, 1910 (this J., 1910, 1010). Under Int. Conv., Nov. 20, 1909 and Jan. 27, 1910.

SOME portion of the atomiser described in the principal patent is made of glass or other transparent material, so that any tendency of the apparatus to become choked may be visible from the outside, the provision of a suitable door at the side of the atomiser enabling the latter to be cleared of obstructions, without stopping the working of the apparatus.—O. R.

Nitrous gases; Absorption of ——, *and production of nitric acid.* C. C. Schlarb. Fr. Pat. 422,751, Nov. 18, 1910.

OXIDES or basic nitrates of iron, aluminium, or chromium, or compounds of these oxides with alkali or alkaline earth oxides or magnesium oxide, are used as absorbents in presence of water, and where necessary in presence of oxygen also. Preferably gases poor in oxides of nitrogen are first passed through the absorbent mixtures, then richer gases, and finally rich gases mixed with oxygen or ozonised air. It is stated that in this way lyes containing from 50 up to 80 per cent. of nitric acid can be obtained, from which nitric acid of 60 per cent. or higher concentration can be recovered directly by distilling, leaving a residue suitable for use again as absorbent. In some cases it is preferable to first distil off water from the liquor, together with a small quantity of nitric acid, in a vacuum, and then distil off the bulk of the nitric acid at atmospheric or diminished pressure. When the lyes, after distilling off the nitric acid, contain alkali or alkaline-earth nitrates, or magnesium nitrate, these are removed by lixiviation before using the liquors again in the absorption apparatus. The nitrates thus recovered are free from nitrites.—A. S.

Sulphuric acid; Process of manufacture of —— *by means of alkali sulphates and bisulphates, of industrial origin or contained in minerals of complex composition (glauberite, alunite, etc.), with the production of alkali hydroxides or salts and of aluminium sulphate or pure alumina.* Soc. Dior Fils. First Addition, dated Feb. 24, 1910, to Fr. Pat. 417,816, Sept. 11, 1909 (this J., 1911, 26).

THE Addition relates to the practical application of the process already described, with special reference to the utilisation of sodium bisulphate. The powdered substance (100 kilos. for example) is intimately mixed with excess of alumina and coke dust (10—18 kilos.), or alumina is added to the molten bisulphate, and the cooled product is powdered and mixed with coke; the mixture is then heated, preferably to 1100°—1250° C., in a muffle furnace, the muffle being heated from above and below and provided with a charging hopper, a working door, openings for the admission of a regulated supply of air and compressed steam (preferably superheated), and a flue through which the heated gases are withdrawn to be utilised. When the mass tends to lose the blackish tint which develops during heating, and white specks appear, it is withdrawn from the furnace, and lixiviated and treated as described in the principal patent. If desired, the coke may be added at any stage during the heating process. It is stated that almost theoretical yields can be obtained.—F. Sodn.

Hydrogen; Process and apparatus for producing —— in the dry way, by auto-combustion. G. F. Jaubert. Fr. Pat. 422,296, Jan. 14, 1910.

Metals such as aluminium or zinc, or their alloys, or metalloids such as silicon or carbon, or their compounds, *e.g.*, ferrosilicon, when mixed with alkali or alkaline-earth hydroxides in the form of dry powders, yield mixtures quite stable at ordinary temperatures. If, however, reaction be induced by local application of heat, hydrogen is evolved and sufficient heat is developed to cause the propagation of the reaction throughout the mass. A suitable apparatus consists of a tube closed at one end by a screw cap and having near this end an opening (with a screw cap) through which a quick-match or piece of hot iron may be introduced to induce the commencement of the reaction. The other end of the tube is formed by a perforated plate, through which the hydrogen evolved passes into a chamber packed with filtering material, and thence into an annular space formed between the tube and a jacket extending nearly the whole length of the latter. The hydrogen accumulates in this annular space under pressure, and is withdrawn as required through a suitable outlet.—A. S.

Hydrogen peroxide; Process of producing —— by means of impure solutions of persulphuric acid. Oesterr. Chem. Werke A.-G. and L. Loewenstein. Fr. Pat. 422,460, Nov. 11, 1910. Under Int. Conv., Nov. 17, 1909.

It has proved difficult hitherto to prepare hydrogen peroxide by the distillation of impure persulphuric acid, as the salts of heavy metals present in the latter become concentrated during the distillation and cause decomposition of the peroxide. According to the present patent, the persulphuric acid is distilled rapidly and continuously by causing it to flow downwards in a thin film over a heated surface. The apparatus consists of an inclined or vertical steam-jacketed pipe provided below with a receptacle for the sulphuric acid produced, and at the upper end with an inlet for the persulphuric acid, which flows downwards as a thin film over the inner surface of the pipe. The hydrogen peroxide escapes through an outlet near the upper end of the pipe.—A. S.

Animal charcoal and a cementing agent [for steel]; Process of manufacture of —— with the obtaining of alkali cyanides as a residue. E. Bué. Fr. Pat. 423,070, Nov. 26, 1910.

Waste leather, preferably of the type used for the soles of soldiers' boots [*semelle de troupier*], is cut into pieces, 15—20 mm. across, and heated to 200°—250° C. in retorts fitted with agitators, and the animal charcoal thus produced is at once collected in sheet-iron extinguishers, as far as possible in the absence of moisture. After cooling, the charcoal is mixed with potassium or sodium carbonate, in the proportion of 3 parts of carbonate to 2 parts of charcoal, and the mixture is then powdered and heated, for 10 hours at 1000°—1100° C., in retorts made of soft steel, which are enclosed in outer retorts of refractory earthenware. The cooled product, which is composed of animal charcoal, "cement," alkali cyanide, and an excess of alkali, is washed systematically with water, the charcoal being filtered off, and the filtrate, the amount of which should be seven times that of the alkali carbonate, is heated with milk of lime, at a temperature between 90° C. and the boiling point, so as to transform the carbonates into hydroxides. The mixture is then filtered and the liquid evaporated *in vacuo* until saturated (in the cold) as regards the alkali hydroxide; on cooling, the alkali cyanides, which are almost insoluble in the strong alkali, separate in small crystals and are removed. The potassium or sodium hydroxide is reconverted into carbonate, which is used again, and finally, the residues of calcium carbonate and the crystallisation mother liquors are mixed with coarsely powdered wood charcoal, in the proportion say of 10 of residues to 80 of charcoal, to give a cementing agent. 100 parts of leather give 40 of alkali cyanide, 80 of animal charcoal, and 1200—1500 parts of "cement," the yield of cyanide corresponding to a utilisation of 70—80 per cent. of the nitrogen present. The animal charcoal is said to be specially active as a decolourising agent, and the cementing material to be both energetic and regular in its action, besides containing no sulphide and producing no needles of cementite.—F. Sodn.

Oxygen and nitrogen; Manufacture of —— by liquefaction of air. Soc. l'Air Liquide (Soc. Anon. pour l'Étude et l'Exploit. des Proc. G. Claude). Fr. Pat. 423.224, Feb. 9, 1910.

Air is liquefied in three or more fractions, less and less rich in oxygen, by passing it through successive systems of reflux tubes, and the fractions are employed as washing liquids in the successive stages of a rectifying column, in a manner which is generally similar to that described in Fr. Pats. 352,856 and 410,967 (this J., 1905, 969, and 1910, 949), but the process is modified in the following particulars: (1) The air is completely liquefied by reflux condensation, downward passage of air from one system of tubes to the next being through tubes of wide section. (2) Oxygen containing more or less nitrogen (perhaps 20 per cent.) is withdrawn from the apparatus at a point near the bottom of the rectifying column (say above the second or third plate), instead of from the upper part of the evaporator; in all cases, almost pure oxygen collects, therefore, in the evaporator, and more regular conditions of evaporation are secured. (3) Condensation of the last portion of the air is effected in a tube immersed in the liquid collecting in the lower part of the column, but above the point at which the oxygen is withdrawn, the rate of condensation being regulated by means of the tap controlling the supply of this liquid to the uppermost stage of the column. (4) Evaporation of the washing liquid at each stage, as it is delivered into the column, is avoided by previous cooling, under pressure, in the stage below. (5) The collectors for the various fractions of the liquefied air are so arranged that heat cannot pass by conduction from one fraction to the next. (6) A screen (of wire gauze, for instance) is arranged above the level of the liquid on each plate of the rectifying column, so that drops of liquid cannot be projected from one plate to another.—F. Sodn.

Carbonic acid; Process for separating —— from gaseous mixtures containing same. E. A. and J. G. Behrens, Bremen, Germany. Eng. Pat. 13,187, May 31, 1910.

See Fr. Pat. 416,489 of 1910; this J., 1910, 1379.—T. F. B.

Nitric oxide; Process of producing —— from mixtures of nitrogen and oxygen, and apparatus therefor. Salpetersäure-Ind.-Ges., and H. Pauling, Gelsenkirchen, Germany. Eng. Pat. 22,319. Sept. 26, 1910.

See Fr. Pat. 420,252 of 1910; this J., 1911, 360.—T. F. B.

Nitric oxide; Process of producing —— from mixtures of nitrogen and oxygen, and apparatus therefor. H. Pauling, Assignor to Salpetersäure-Ind.-Ges., Gelsenkirchen, Germany. U.S. Pat. 991,357, May 2, 1911.

See Fr. Pat. 420,252 of 1910; this J., 1911, 360.—T. F. B.

Nitrites and nitrates; Process of manufacturing ——. H. Pauling, Assignor to Salpetersäure-Ind.-Ges., Gelsenkirchen, Germany. U.S. Pat. 991,356, May 2, 1911.

See Eng. Pat. 9884 of 1910; this J., 1910, 1157.—T. F. B.

Lead; Conversion of metallic —— into lead oxide. Bergmann und Simons, and Lindgens und Söhne, Mülheim on Rhine, Germany. Eng. Pat. 26,835, Nov. 18. 1910. Under Int. Conv., Dec. 11, 1909.

See Fr. Pat. 409,949 and Addition thereto; this J., 1910, 816, and 1911, 85.—T. F. B.

Phosphates; Process of making ——. H. Schröder, Hedwigsburg, Germany. U.S. Pat. 991,096, May 2, 1911.

See Ger. Pat. 192,591 of 1906; this J., 1908, 282.—T. F. B.

VIII.—GLASS; CERAMICS.

Lead glazes; Influence of metallic oxides on ——. F. Kraze and A. Popoff. Sprechsaal, 1911, **44**, 278—280.

As lead glazes have a more brilliant surface than leadless ones, and do not tend so much to crazing, the authors started with the formula (0·8PbO, 0·2 RO) 0·084 Al_2O_3, 0·97 SiO_2, and filled in the 0·2 RO by each of the other basic oxides in turn. The results were examined for effect on fusibility and coefficient of expansion. Copper gives the most fusible glaze, and then follow cobalt, strontium, ferric iron, barium, potassium, manganese, sodium, calcium, magnesium, nickel and chromium. With respect to coefficient of expansion, sodium tends most to crazing, and then potassium, strontium, magnesium, calcium, barium, zinc, iron, manganese, chromium, copper, cobalt. It will be noticed that the five bases last mentioned, which tend least to crazing, are the colouring oxides.—H. H. S.

Plasticity of barium sulphate. Atterberg. *See* VII.

IX.—BUILDING MATERIALS.

Wood impregnating; Value of laboratory experiments in ——. R. Nowotny. Z. angew. Chem., 1911, **24**, 923—928.

A review is given of the literature of mycological and chemical research on the impregnation of wood. The author considers laboratory experiments to be mainly of use in comparing the germicidal action of proposed new impregnating agents with that of the substances usually employed, and thus many useless experiments on the large scale can be avoided. No reliable opinion, however, can be formed as to the "life" of a wood impregnated with any apparently suitable preserving agent, except from actual experience.—A. Sbld.

Alundum [fused alumina] as a refractory material. L. E. Saunders. Amer. Electrochem. Soc., April, 1911. Met. and Chem. Eng., 1911, **9**, 257—258. (See also this J., 1909, 1088.)

The alundum mostly used in the preparation of refractory articles is a white crystalline product containing less than 1 per cent. of impurities (oxides of iron, titanium, and silicon); it melts at 2050° C.—2100° C., and its coefficient of expansion (linear) is 0·0000078. A reddish brown vitreous product containing 6—8 per cent. of impurities is also sometimes used; this melts not more than 50° C. lower than the purer form and its coefficient of expansion is 0·0000085. Alundum does not soften when within 100° of its melting point. It has the sp. gr. 3·93—4·00, hardness, between 9 and 10 on Mohs' scale, and thermal conductivity about twice that of Marquardt porcelain and three to four times that of most fireclays. Alundum is not attacked by aqueous acids and alkalis and only very superficially by fused alkali carbonates. It is dissolved with some difficulty by fused slags, both acid and basic, more readily by the former. For the preparation of shaped articles, it is mixed with a refractory binding agent, moulded, and fired in a ceramic kiln; the articles are usually more refractory than amorphous alumina. When treated with sulphuric or hydrochloric acid they lose up to 0·03 per cent. of their weight, but subsequently are quite unaffected. The articles are porous and cannot be used where gas-tight vessels are required, or as protecting tubes for pyrometers. The melting point of the bonded articles is never below 1950° C. and they possess great strength, both tensile and compressive; their electrical resistance was found to be 476×10^5 ohms at 535° C., 49×10^5 at 721°, 24×10^5 at 908°, and $7{\cdot}5 \times 10^5$ ohms at 1040° C. Alundum muffles last four to five times as long as clay muffles, and are more refractory and have a higher tensile strength than quartz. Crucibles of alundum can be used for melting metals, even platinum. On account of their porosity they cannot be used for melting slags or salts, but this quality makes them specially suitable as a substitute for Gooch crucibles; no asbestos filter-layer is required and the porosity can be so controlled that the finest precipitates, even deflocculated graphite, may be collected in them. Alundum extraction thimbles can be cleaned by simple ignition. An alundum cement is made for lining crucibles and furnaces; it does not melt or combine with carbon below 1950° C. Alundum bricks have been tried with some success in place of silica for the roofs of electric furnaces. In the discussion J. W. Richards pointed out that the high thermal conductivity of alundum would make it an excellent material for zinc retorts. (See also U.S. Pats. 954,766—954,768, 954,808, and 954,809; this J., 1910, 630.)—A. S.

Dinas bricks; Refractoriness of ——. W. Grum-Grzimailo. Tonind.-Zeit., 1911, **35**, 573—575.

In Siemens-Martin furnaces, fine cracks sometimes develop on Dinas bricks, and cause the material to become spongy, to lose its strength, and fall to pieces. The cracks are often caused by the sudden application of a hot flame, and the blocks swell, sometimes by as much as 30 per cent. of their volume. Pieces of Dinas bricks which have been exposed to a temperature of 1200° C. for a month or more, and protected from fuel dust, have a uniform honey yellow colour, and under the microscope are found to consist of well-developed twin crystals of tridymite. Under such temperature conditions, sand and quartz pass into tridymite, the specific gravity of the silica decreases from 2·65 to 2·33, and the change is accompanied by an increase in volume of about 20·7 per cent. Consequently a sudden change from quartz to tridymite caused by a sharp rise of temperature destroys the cohesion between the quartz grains and converts the Dinas material into a loose spongy mass. This result can be avoided by increasing the temperature gradually. Commercial Dinas material consists of quartz chips cemented together by a slag or glass composed of ferrous, calcium, magnesium or aluminium silicates. When the temperature is raised to about 1450° C. the glass begins to convert the quartz into tridymite; the easily soluble quartz is dissolved by the glass, and the slightly soluble tridymite separates out, though the change is generally not complete in commercial varieties of Dinas material, which consist of groups of tridymite crystals and quartz grains bound together by the slag. The change to tridymite is, however, always completed in the furnace, and when the Dinas material has to be subjected to sharp rises of temperature, only material that has been completely transformed in the brick-kiln during manufacture should be employed. Through microscopical investigations, the author finds that good Dinas can be made from any silicious material with more than 94 to 95 per cent. of silica, also that the quartz should be fine grained and the admixtures finely divided in order to provide numerous centres from which the change from quartz to tridymite can start. In this way the quartz can dissolve in the glass more quickly and changes during burning can be hastened. The best material is not milky vein quartz or large-grained quartzite, but a ferrous and aluminous gravel with finely divided admixtures. Such a material gives tridymite bricks at a temperature of 1450° C., whilst Dinas from a pure quartzite must be carefully burned, and the temperature raised to 1500° to 1600° C. in order to ensure the conversion into the mechanically strong tridymite.—W. C. H.

Trass; The water of hydration in ——. A. Hambloch. Tonind.-Zeit., 1911, **35**, 586.

In the earlier (German) specifications for trass, a minimum content of 7 per cent. of water of hydration was provided for, but trass with only 5½ per cent. was allowed to be used if it satisfied the requirements for strength. This ambiguity has now been removed, and a minimum of 7 per cent. fixed, and the strength of normal trass mortar consequently raised. Under the new rules, the edge-runner has been fixed as the most suitable mixer for plastic mortars. The water of hydration may be regarded as basic in character and as linked to the other atoms by a hydroxyl (OH) group; it is water of constitution as distinguished from water of crystallisation. The hydrated silicates in trass owe their origin to the steam disengaged in volcanic action. The strongest and most dense kinds of trass-rock (blue, grey and yellow) supply the best variety of trass, which possesses much more marked hydraulic properties than that derived from the lighter and more porous varieties from trachyte-tuff. In the case of puzzuolanas, the content of water of hydration may be diminished by weathering action, a possibility that is excluded in good sorts of trass on account of their mode of formation. Trass and puzzuolanas which have been deprived of the water of hydration also lack hydraulic properties, and the author has found that hardly any hardening process takes place in mortars compounded from hydrated lime and trass deprived of its water of hydration. Of course after several months a certain amount of strength is developed, but the time required is too long for practical building purposes; such mortars are generally so friable that even with the most careful handling they fall to pieces from lack of binding power. —W. C. H.

Cement; Causes of the changes in velocity of hydration of ——. P. Rohland. Z. Chem. Ind. Kolloide, 1911, 8, 251—253.

The author has shown that electrolytes change the velocity of hydration. The effect is more marked when they are added in the dissolved than in the solid state, and is approximately proportional to the concentration; the process is very sensitive to change of temperature. Sodium carbonate, aluminium chloride, and potassium monosulphide accelerate the velocity, while potassium bichromate, borax, and sulphates (except aluminium sulphate and alum) retard it. Compounds such as these may occur or may be formed in cement. It has been shown that small concentrations materially affect the velocity, hence these constituents may exert an important action. The hardening process essentially consists in a coagulation of the hydrolytically separated hydroxides of silicon, aluminium and iron.—H. E. P.

Cement mortar; Influence of storage of mixed —— *on its hardening power.* H. Burchartz. Mitt. Kgl. Materialprüfungsamt, 1911, 29, 164—169.

The author has investigated the effect on the hardening properties of cement mortar of storing the mixed mortar for various periods (0—24 hours) before use. He draws the following conclusions from his experiments:—(1) The hardening power (strength) of mortar is unfavourably affected by storage after mixing, the loss of strength increasing with the length of storage. (2) The rate of decrease in the strength of the mortar is greatest when the storage time corresponds to the period at which the cement is beginning to set (5—8 hours in the author's experiments). (3) The reduction in strength decreases with an increase in the amount of water used in gauging. (4) The difference between the strength of the stored mortar and that of the freshly worked mortar is greater when tested at 7 days than at 28 days.—F. Sodn.

Portland cement; Action of alkali salts upon ——. E. Burke and R. M. Pinckney. J. Ind. Eng. Chem., 1911, 3, 317—326.

With the object of discovering the cause of the frequent disruption of cement work by "alkali-water," samples of "Portland," "natural" and "slag" cement were subjected to the action of solutions of sodium sulphate, sodium carbonate and magnesium sulphate, considerable quantities of these salts usually occurring in such water. The cements, previously set with water and allowed to harden for several weeks, were ground to pass a sieve of 100 meshes per linear inch and leached with the solutions for periods varying from 5 to 11 weeks, according to the rate of percolation. With the sulphate solutions, phenomena similar to those occurring when cement work is immersed in "alkali-water" were noted; but the action of the sodium carbonate solution was much less marked. There was no appreciable difference in behaviour between the three types of cement employed. The authors conclude that the disruption (due to internal expansion) is caused by the interaction of the alkali sulphates and magnesium salts in the water with the calcium hydroxide present in the set cement. The calcium sulphate produced (in the form of gypsum, $CaSO_4,2H_2O$) has a greater weight and volume than the calcium hydroxide it replaces. The relative volumes of molecular equivalents of calcium hydroxide and gypsum are as 1·0 : 2·08, and the increased space required by the latter compound can only be obtained by forcing the cement particles so far asunder as to break their hold upon each other. This disruption of the cement was most marked with waters containing magnesium sulphate, the interaction in this case resulting in the formation of two practically insoluble products, gypsum and magnesium hydroxide, both of which remain in the cement where they are formed. The relative volumes of molecular equivalents of calcium hydroxide and the products (gypsum + magnesium hydroxide) are as 1·0 : 2·78, and the authors' results confirm the opinion commonly held that magnesium sulphate is mainly responsible for the destruction of cement work by sea-water. In the case of water containing only sodium carbonate, practically no destructive action was found to occur, the explanation being that although the calcium hydroxide of the cement is converted into calcium carbonate, the relative volumes of molecular equivalents of these materials are as 1·0 : 1·03, and the small additional space thus required is probably supplied by the removal of small quantities of silica and alumina from the cement by solution in the alkaline water.—W. E. F. P.

General directions and specifications relating to the tar treatment of roads. See 111.

Patents.

Wood; Art of waterproofing ——. H. W. Lake, London. From Welin Davit and Lane and De Groot Co., New York. Eng. Pat. 9608, April 20, 1910.

In waterproofing blocks of wood in which the cells run parallel through the length and are open at the ends of the block, these ends are first dipped in a hot asphaltum composition so as to seal the cells, and the blocks are then covered with a suitable waterproof coating. The asphaltum compound preferably consists of paraffin (m. pt. 105° F.), 50; gilsonite (natural bitumen), 40; and asphaltum, 10 per cent.—A. T. L.

Artificial stone; Process for the manufacture of ——. O. Kesler, Altona, Germany. Eng. Pat. 27,142, Nov. 22, 1910.

A solution of glue, to which glycerin has been added, is incorporated, together with asbestos, with a mixture of cement and manganese dioxide. For example, a solution of 4—5 kilos. of glue in 20—25 litres of water, mixed when cold with 40—50 grms. of glycerin, is added to a mixture of 50 kilos. of cement and 3·5 kilos. of finely divided manganese dioxide, about 0·5 kilo. of asbestos made into a thin paste with water is added to the mixture, and the whole is thoroughly mixed and cast into moulds; after about a day, the material is taken out of the moulds and pressed, and the slabs thus obtained are then preferably impregnated with linseed oil, in order to render them resistant to moisture. The product, being a non-conductor and very resistant to electrical influences, is well adapted for the making of switch-boards; it can be polished without previous treatment.—F. Sodn.

Lime-kiln; Continuous —— *with automatic charging.* N. Mathon. Fr. Pat. 422,683, Oct. 3, 1910. Under Int. Conv., Oct. 4, 1909.

The shaft of the kiln is supported on four pillars between which are passages through which an abundant supply of air has access to the kiln. The fire-grate has the form of a pyramid with a square base, from which the burnt lime falls on to inclined planes, and thence on to pivoted plates, which direct it into a central funnel or hopper in the space enclosed by the inner faces of the four pillars. The lime falls from the hopper on to a suitable transporting device.—A. S.

Cement; Manufacture of white hydraulic ——. J. G. A. Rhodin, Muswell Hill, Middlesex. Eng. Pat. 18,338, Aug. 3, 1910.

A finely divided mixture of felspar (orthoclase or oligoclase, or other substance rich in aluminium silicate, such as albite, kaolin, etc.), lime, a suitable aluminium compound, such as potassium alum, and common salt, together, preferably, with magnesium sulphate (for example, 150 parts of felspar, 198 of slaked lime, 6 of potassium alum, 3 of common salt, and 3 of crystallised magnesium sulphate, or 240, 238, 8, 4, and 4 parts respectively) is prepared by grinding the ingredients together, preferably in a tube mill, and the mixture is heated for about an hour, in a muffle or other suitable furnace, at a temperature above 900° C. but below such as would render necessary regrinding of the product or cause its discolouration. A perfectly white hydraulic cement, with good storing qualities, is thus produced in two operations. The larger the proportion of lime present, the higher is the temperature necessary in burning; thus, with the examples given, the temperatures should not exceed 1100° C. and 1000° C. respectively, 1050° C. and 950° C. being suitable average temperatures.—F. Sodn.

Slag cement or similar products; Apparatus for regulating the supply of the different materials in the manufacture of ——. J. L. Gautier. Fr. Pat. 422,514, Nov. 14, 1910.

The different materials are contained in separate hoppers and the transporting devices which convey them from the hoppers to the mixing chamber are all operated from the same driving shaft, so that the relative proportions are kept constant even when the output of the apparatus is varied. The whole of the parts of the apparatus are mounted in a single framework so as to be easily moved. In the example described, the lime is conveyed from its hopper to the mixing chamber by means of a screw conveyor, the dry granulated slag is carried by a band conveyor, and the other materials are fed into the mixing chamber by oscillating distributors from hoppers placed between the lime and slag hoppers; the screw conveyor, the band conveyor, and the distributors are all driven from the same shaft.—A. S.

Cement, concrete, or similar materials; Manufacture of products of ——. J. M. Rauhoff. Fr. Pat. 422,857, Nov. 22, 1910.

The cement or concrete is mixed with an oxidisable substance, preferably finely divided metallic iron, and with a fire-resistant material such as asbestos. It is claimed that on oxidation, the iron swells and closes the pores of the concrete, thus rendering it waterproof.—A. S.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Electrolytic iron refining. C. F. Burgess. Amer. Electrochem. Soc., April, 1911. Met. and Chem. Eng., 1911, **9**, 267.

With an electrolyte containing 40 grms. of iron in the form of ferrous sulphate and 40 grms. of ammonium chloride per litre, the electrolytic refining of iron can be conducted continuously for many months under the conditions previously described (this J., 1904, 667). With anodes of the best commercial grades of pure iron, electrolytic iron of 99·97 per cent. purity can be prepared; with mild steel or other less pure materials as anodes, the purity of the deposited metal is less by a few hundredths of 1 per cent. It is estimated that 1 kilowatt-hour is required for refining 2 lb. of iron, or a cost for power of ½ cent. (¼d.) per lb. The costs for labour, solution, maintenance, and fixed charges are estimated to be not greater than the cost of power, so that the cost of refining would be about 20 dols. (£4 3s. 4d.) per ton. With anodes of mild steel (35 dols. or £7 5s. 10d. per ton.), electrolytic iron would therefore cost about 55 dols. (about £11 9s.) per ton, and would thus be able to compete with high-grade Swedish iron.—A. S.

Steels; Gases contained in ——. G. Charpy and S. Bonnerot. Comptes rend., 1911, **152**, 1247—1250.

From the results of experiments on the heating of steel *in vacuo* at 950° C., the authors conclude that the gases thus evolved are formed, partly at any rate, by a reaction between the carbon of the steel and, possibly, traces of water vapour in the apparatus and are not exclusively those previously dissolved or occluded. Results with different steels are given, and it has, in each case, been found that 26—32 per cent. of the gases obtained are carbon monoxide. A determination of the critical points of a hard and a soft steel in a vacuum showed no variation either in the temperatures or in the amounts of heat evolved, whether the experiments were made before or after extracting the gases.—F. Sodn.

Iron, chromium, and carbon; Chemical and mechanical relations of ——. J. O. Arnold and A. A. Read. Iron and Steel Inst., May, 1911. [Advance proof.]

A set of alloys containing about 0·8 per cent. of carbon, and from 0·6 to 23·7 per cent. of chromium was studied in the same way as the corresponding set of manganese alloys (this J., 1910, 633). The results show that the carbides always contain chromium as well as iron. The amount of chromium thus replacing iron increases to a maximum when the steel contains about 10 per cent. of chromium: both Cr_3C_2 and Cr_4C are then present. As the chromium content of the steel increases, the hard carbide, Cr_3C_2, disappears, and only Cr_4C is found. It is not certain whether the carbides found are true double carbides of chromium and iron, or whether they are mixtures; but the carbide, $2Fe_3C, 3Cr_4C$, obtained from steels containing 15—24 per cent. of chromium, is probably a double carbide. Practically all the carbon in the steel was obtained in these carbides. All the steels tested were tough in the lathe, those containing 20 and 24 per cent. of chromium being slightly hard. The greatest tensile strength (yield point 48·7, breaking stress 56·8 tons per sq. in.) was shown by the steel containing 19·5 per cent. of chromium. On the other hand the maximum resistance to alternating stresses was shown by those containing 1 to 5 per cent. of chromium. Plates are given in the paper, showing the micrographic structure of the steels.—J. T. D.

Carbon; Rapid determination of the total —— *in iron, steel and iron alloys.* H. De Nolly. Rev. Mét., 1911, **8**, 391—395.

An apparatus is figured consisting of a conical flask fitted with a rubber stopper perforated by three holes, fitted with copper tubes. By means of a glass gas-holder oxygen in which the steel is burnt is supplied by one of the tubes, to which is also clamped a support for the cup containing the metal. The necessary heat is generated by an electric current through electrodes fitted to the other tubes. 40 to 50 c.c. of a solution of four grams of sodium hydroxide dissolved in one litre of water are placed in the flask with a few drops of phenolphthalein solution. After the combustion of the metal, the flask is shaken to ensure complete absorption of the carbon dioxide and the excess of sodium hydroxide is estimated by titration with a solution containing 4·083 grms. of sulphuric acid per litre, and of which 1 c.c. corresponds to 0·001 grm. of carbon. The process occupies from 5 to 7 min. and is applicable to all steels. For white cast-iron 2 grms. of lead peroxide are added to the metal, and owing to the difficulty in burning graphite the results are not very accurate for grey cast-iron.—A. H. C.

Metallography; Notes on ——. H. Le Chatelier. Rev. Mét., 1911, **8**, 367—376.

Metals prepared in the electric furnace by Moissan. Titanium.—Microphotographs of the polished state and also after etching with hydrofluoric acid are given of a specimen of nearly pure titanium and of one in a less pure cast condition. It is shown that they both contain the carbides of titanium and iron as cell walls surrounding pure titanium. *Titanium carbide* is also illustrated as a very friable material consisting of small isolated crystals. *Aluminium carbide* is shown to consist of compact masses of the carbide having large crystalline facets and embedded in a eutectic of aluminium and carbide. *Chilled castings.*—The specimens of iron used by Moissan in the preparation of artificial diamonds did not show the presence of graphite as was expected, but after annealing the specimen cementite, pearlite, and some phosphide of iron.

Steels from M. Charpy crystallised by annealing after crushing.—Microphotographs are given (see Fig. 1) of a steel annealed after receiving the imprint of a Brinell ball. They show a greatly increased crystallisation at the circumference of the indent where the greatest deformation had occurred and the necessity is indicated of annealing deformed steel at the temperature of critical transformation in order to obtain the best crystallisation and neutralise the effects of crushing.

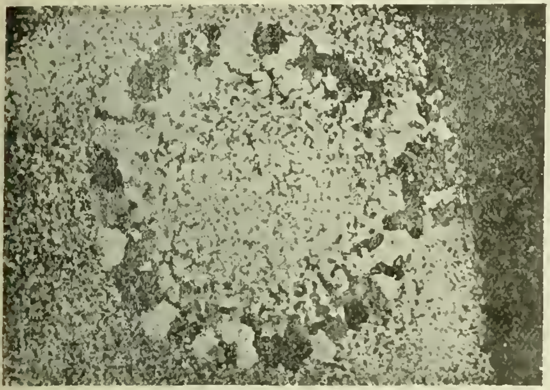


Fig. 1.

Spontaneous disintegration of aluminium.—The specimens examined were those of Ducru, who has made a large number of unpublished observations. By polishing alone (see Fig. 2) and also by feeble electrolytic attack after embedding in gum lac. it is shown that the disintegrated metal consists of a large number of grains formed from the metal by the gradual growth of small fissures. These develop from the original cellular structure of the metal, feeble chemical or mechanical action serving to open the joints between the cells and thus convert a compact mass into a granular one.—A. H. C.

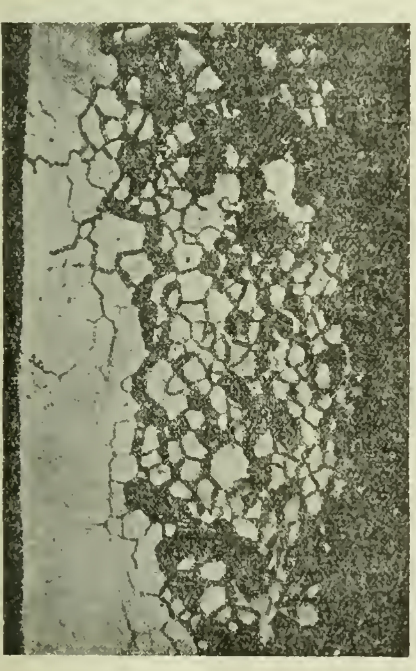


Fig. 2.

Manganese; Rapid and accurate volumetric method for the determination of ——, *and its application to the analysis of iron and steel.* F. J. Metzger and L. E. Marrs. J. Ind. Eng. Chem., 1911, **3**, 333—335.

The process is based upon the conversion of manganese from the divalent to the trivalent condition by potassium permanganate in the presence of sulphuric and hydrofluoric acids. A solution of potassium permanganate of approximately $N/30$ strength is employed, and the iron-value of the permanganate solution is multiplied by 0·78682 (according to the atomic weights for 1911) to obtain the value in terms of manganese. The titrations are performed in wax beakers made by cutting off the tops of the white ceresin bottles usually employed for the storage of hydrofluoric acid. For the determination of manganese in steel or pig-iron, 1 grm. of the sample is dissolved in 10 c.c. of nitric acid (1 : 1) and 1 grm. of ammonium persulphate is added to the slightly cooled solution. When quiescent the solution is boiled briskly for a few seconds and then evaporated to dryness, "baking" being avoided. The residue is boiled with 20 c.c. of sulphuric acid (1 : 2) and 30 c.c. of water until the solution is clear, when it is cooled and transferred to a wax beaker. 5 grms. of ammonium fluoride and 25 c.c. of hydrofluoric acid are then added and, after dilution with water to 100—150 c.c., the liquid is titrated with the standard permanganate until a distinct pink colour persists for several minutes. Since the presence of as much as 2 c.c. of strong nitric acid is without effect upon the titration, 1 or 2 c.c. of dilute nitric acid may be employed to facilitate the solution of the evaporated residue if the latter has been inadvertently over-heated. The ammonium persulphate effects the oxidation of the combined carbon; in the case of pig-iron the graphitic carbon remains suspended in the solution and need not be removed before titration unless present in sufficient quantity to obscure the end-point. In the latter case it is filtered off before the addition of the ammonium fluoride and hydrofluoric acid. In the examination of a number of steels obtained from the U.S. Bureau of Standards, the results afforded by the above process were in all cases slightly higher than the averages obtained by the Bureau methods; the maximum variation in duplicate determinations was, however, much lower, being only 0·025 per cent. in the former, as against 0·14 per cent. in the latter case.

—W. E. F. P.

Manganese in the presence of chromium and tungsten [*e.g. in alloy steels*]; *Determination of* ——. T. C. Watters. Met. and Chem. Eng., 1911, **9**, 244—245.

The following combination of the Volhard and bismuthate methods has given good results in the determination of manganese in alloy steels containing chromium. Two grams of drillings are dissolved in 20 c.c. of sulphuric acid of sp. gr. 1·2, enough water being added to keep the iron sulphate in solution. After adding 5 c.c. of nitric acid of sp. gr. 1·42, the solution is evaporated until white fumes are evolved, and the carbonaceous matter is destroyed. 100 c.c. of water are then added, and after boiling to dissolve ferric sulphate, the whole is washed into a 500 c.c. flask, and sodium carbonate solution added until the liquid becomes dark-coloured and the precipitate produced dissolves with difficulty. An emulsion of zinc oxide and water is now added gradually, with agitation, until the whole of the iron and chromium is precipitated. The mixture is diluted to 500 c.c. with water, allowed to stand, and 250 c.c. of the supernatant liquid filtered through a dry filter, acidified with 25 c.c. of nitric acid of sp. gr. 1·42, and treated with 1 grm. of sodium bismuthate. After shaking and allowing to settle, the solution is filtered through asbestos, and the residue washed with water containing a little nitric acid. The solution of permanganic acid thus obtained is treated with a measured excess of a standardised solution of ferrous sulphate, and the excess titrated back with permanganate. —A. S.

Electric furnace; Fusion and reduction of oxide ores in the ——. [*Reduction of titanic iron ores.*] W. Borchers. Metallurgie, 1911, **8**, 246—248.

A difficulty in reducing ores in the electric furnace is that the high temperature causes fusion before reaction is complete, and the dense ore and metal then sink to the bottom, and are separated from the carbonaceous reducing material which floats on the top by an intermediate layer of slag. One method of overcoming this would be to find a sufficiently dense reducing material. In the case of certain titaniferous iron ores the author has succeeded in doing this. These are first heated with a quantity of coke insufficient to reduce the iron completely, when a titanate slag results (titanium oxide, 40—47; silica, 20—5; ferrous oxide, 34—30 per cent.): this, smelted with coke in a separate furnace, gives an alloy (carbide and silicide), containing: 42—48 per cent. of titanium; 1—5 of silicon; 6—20 of carbon; and 7—30 per cent. of iron, which has very powerful and rapid reducing properties. Into the furnace in which this alloy has been prepared from 1000—1100 kilos. of slag and 400—450 kilos. of coke, is introduced the result of melting in another furnace 1600—1700 kilos. of the original ore. Reaction is very rapid, and there are produced about 1000 kilos. of iron containing very little titanium and about 1500 kilos. of slag, of which 1000—1100 kilos. go back into the furnace to be reduced with coke, and the other 400 can be used to produce ferrotitanium or other titanium compounds.—J. T. D.

Corrosion of metals. P. Longmuir. Iron and Steel Inst., May, 1911. [Advance proof.]

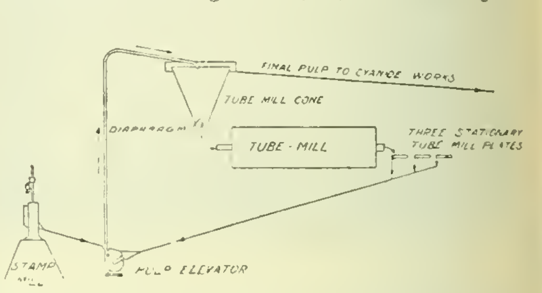
The author has investigated cases of corrosion occurring at widely varying times and places, and finds that a common feature is a distinct sulphur content in the residue. Rust from rails contained up to 0·574 per cent., while the rails themselves do not contain over 0·06 per cent. of sulphur. In one example of brass corrosion the remaining deposit contained 28·65 per cent. of sulphuric anhydride. Analyses of the atmosphere and rain clearly show the higher sulphur content of the air near large towns. Particles of soot ejected into the atmosphere appear to be very high in sulphur. The air, wall deposits, and water from tunnels were also examined; also the products of corrosion of the adjacent rails. These latter corrosion products contained up to 3·68 per cent. of sulphur. Corrosion appears to depend on local conditions to at least an equal extent as on the composition of the material itself. The real problem of corrosion lies in the influence exerted on the metal apparently unaffected, as exemplified by the brittleness of rails which have been corroded through service in moist tunnels. All the results obtained by the author on such rails show the reality of this brittleness, though its intensity is erratic. The acid-cleaning of steel wire to remove scale, renders it brittle. In some cases annealing removes this brittleness, in others it does not. A short immersion in strong acid gives similar results to several years' exposure to a moist and slightly acidulated atmosphere.—R. W. N.

Iron at high temperatures; Action of steam on ——. J. A. N. Friend, T. E. Hull, and J. H. Brown. Chem. Soc. Proc., 1911, **27**, 124.

The authors have studied the action of steam on iron at various temperatures up to and including 950° C. At 500° the reaction was found to be too slow to admit of being carried to completion. The most favourable temperatures for study were found to lie between 650° and 820° C. After five hours' heating at 820°, pieces of iron, 0·05 mm. in thickness, were completely converted into ferroso-ferric oxide. At lower temperatures equilibrium appeared to be obtained between the steam and mixtures of ferrous and ferroso-ferric oxide in varying proportions. The explanation that naturally suggests itself is that the outer layers of the metal have been converted into ferroso-ferric oxide, and the rate of diffusion is so slow at the temperatures under consideration that a practically infinite time is required for the oxidation of the interior portions. It was pointed out, however, that this is not the only explanation. It may be that definite mixtures of ferrous oxide and ferroso-ferric oxide are produced, having a lower dissociation pressure than ferroso-ferric oxide, but higher than ferrous oxide, the mixtures being in equilibrium with the steam at the various temperatures corresponding therewith.

Amalgamation of gold in banket ore. W. R. Dowling. J. Chem., Met., and Min. Soc., S.A., 1911, **11**, 414—422.

Detailed accounts are given of the considerations affecting the methods of recovery of the gold in a group of South African mines accounting for £20,000,000 worth of gold per annum, or about two-thirds of the total Rand output. The large scale of work at the present time necessitates simplification of plant and operations. From time to time the relative importance of amalgamation recovery has varied considerably. In early days most of the gold was recovered by amalgamation, both inside and beyond the stamp battery. On the introduction of the cyanide process ensued coarser crushing, and the amalgamation recovery decreased. The development of slime treatment brought finer crushing, and more gold was again recovered on the plates. At the present time the tendency is to amalgamate only the tube-mill pulp. Inside amalgamation and stamp-mill plates are being abandoned, an additional advantage of this being the large amount of gold thus set free, as well-set mill-plates hold up about one ounce of gold per square foot. In the future probably only that gold which is too coarse for cyanidation will be caught on plates. Formerly about 12 square feet of plate surface was provided per stamp, but in the most recent mills this has been successfully reduced to about 2 square feet per stamp. Stationary plates set with a slope of 18 per cent. admit of a pulp containing only 55 per cent. of moisture flowing over them, and being satisfactorily amalgamated. The water ratio can thus be reduced. The consumption of mercury is also much diminished.—R. W. N.


FINAL PULP TO CYANIDE WORKS
TUBE MILL CONE
DIAPHRAGM
TUBE - MILL
THREE STATIONARY TUBE MILL PLATES
STAMP MILL
PULP ELEVATOR

[*Silver*] *Cyanidation; Use of lead acetate in ——.* E. M. Hamilton. The Pacific Miner, Sept., 1910, 340. J. Chem., Met., and Min. Soc., S.A., 1911, **11**, 452.

The use of lead acetate in the cyanidation of silver ores is not as generally advantageous as it was thought to be. The author has found many cases where it has not assisted the solution of silver, and even has had a deleterious effect on the gold extraction, though no explanation of the latter fact is offered. On starting a new plant the addition of lead acetate may be distinctly beneficial, while later on it may with advantage be dispensed with, probably because after a certain time the zinc accumulated in the solution acts as a protective agent, and the action of the lead salt is no longer apparent. In one case, where soluble sulphides caused the disappearance of zinc from the solutions, the extraction diminished seriously, and lead acetate failed to restore it to a normal figure. This was, however, immediately effected by the addition of a slight excess of zinc cyanide. Lead acetate should only be used where tests show that it is really effective.—R. W. N.

Agitation; Air-lift —— of slime pulp. R. Allen. J. Chem., Met., and Min. Soc., S.A., 1911, **11**, 422—430.

THE construction and application of the successive types of air-lift agitators is discussed, both historically and in regard to present application. The "Brown-McMiken" or "Pachuca" vat is dealt with at length, and also the recent shortening of the central tube in this type (see Fig. 1). A continuous system with Brown vats, evolved by Mennell, Grothe, and Carter, is described (see Fig. 2), in which the pulp flows continuously through a series of tanks. This represents a great advance on the "charge" system, in which each tank is filled, agitated, and discharged separately. The Just method of introducing air into a vat through a special porous brick floor is mentioned. A list of published articles bearing on the cyanide treatment of pulp is given.—R. W. N.

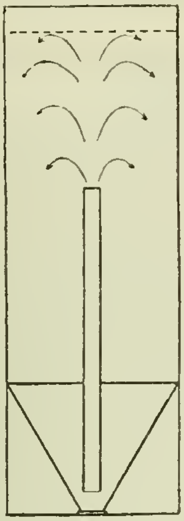


FIG. 1.

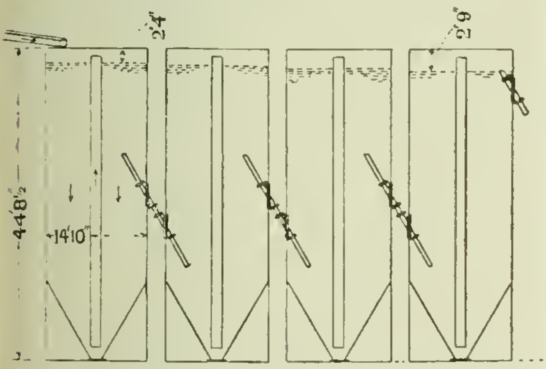


FIG. 2.

Silver; Touchstone tests for ——. A. Steinmann. Ann. Chim. Analyt., 1911, **16**, 165—167.

THE following reagent is recommended for testing the metallic streaks which are obtained when silver and its alloys are rubbed across the surface of touchstone (basanite, Lydian stone); it consists of a mixture of nitric acid (sp. gr. 1·27), 40 c.c., glacial acetic acid, 50 c.c., and water, 50 c.c. The use of this reagent enables one to distinguish between pure silver and alloys of the same containing small quantities of copper, etc. The amount of silver in an alloy may be determined approximately by comparing the behaviour of the alloy towards the reagent with that of alloys of known composition.—W. P. S.

Platinum and allied metals Output of ——, in 1909. J. Ind. Eng. Chem., 1911, **3**, 354—355.

THE following information is taken from advance chapters of U.S. Geological Survey publications. *Platinum.*—The actual production of crude platinum in the Urals in 1909 is estimated at 190,087 troy ounces. In the same year, New South Wales produced 440 ounces, Sumatra and Borneo are believed to have yielded about 500 ounces, 2392 ounces were exported to the United States from Colombia and a small amount was produced in British Columbia. The output of crude platinum in the United States was 672 ounces (valued at 12,803 dollars) not including the considerable quantity of secondary metal annually recovered from scrap material of various kinds. 118,853 ounces of crude platinum, including unmanufactured products, ingots, bars, sheets and wire, and valued at 2,557,596 dollars, were imported into the United States in 1909, chiefly from Russia; the value of the manufactured products imported was 416,352 dollars, the average price of the metal in 1909 being 24·98 dollars per ounce.

Iridium.—341 pounds of iridium, valued at 135,878 dollars, were imported into the United States in 1909. The metal is chiefly obtained from crude platinum in which it generally exists alloyed with osmium as iridosmine. Most of the iridium produced is probably employed for hardening platinum, the iridium content of the alloys ranging from 5 to 20 per cent. Such alloys are hard and difficult to work when containing from 10 to 20 per cent. of iridium and are not attacked by *aqua regia* when the proportion of iridium reaches 30 per cent. Iridium is also used for other scientific and technical purposes, but owing to its brittleness the pure metal is very difficult to work. The metal has been increasing rapidly in value; the average price in 1909 was about 35 dollars per ounce, whereas in Oct., 1910, the metal was quoted at 60 dollars per ounce.

Osmium.—Four pounds of osmium, valued at 1569 dollars, were imported into the United States in 1909. Except in the manufacture of certain kinds of incandescent lamps, the metal is but little employed.

Palladium.—The imports of palladium into the United States in 1909 amounted to 33 pounds, valued at 13,416 dollars. This metal occurs in small quantity in crude platinum and in certain copper deposits; the demand is considerably greater than the supply, the most extensive use being probably in the manufacture of certain alloys employed in dental work. The metal is also used in watchmaking, for the circles of astronomical instruments an for soldering platinum metals.

Rhodium.—The price of pure rhodium is stated to about 155 dollars per ounce. The metal occurs in crude platinum in amounts up to 4 per cent., and is chiefly used for the thermo-elements employed in high temperature determinations.—W. E. F. P.

Radium; Available deposits of ——, and the future of the radium market. P. Krusch. Z. prakt. Geol., 1911, **19**, 83—90. Chem. Zentr., 1911, 1, 1318—1319.

THE author enumerates the following sources of radium: (*a*) German East Africa, where pitchblende occurs in pegmatites. The pegmatites are worked for mica, along with which are found masses of pitchblende, weighing as much as 30 to 35 kilos. and containing up to 89·5 per cent. of U_3O_8. Fergusonite containing 13·6 per cent. of uranous oxide is also found in this district. Norway also has two corresponding deposits, one at Evje (north of Christiansand) and another at Stavanger. The Norwegian deposits though rich in uranium appear to be only weakly radioactive. (*b*) Cornwall and South Devon, where uranium minerals are found with tin ores and metallic sulphides. The distribution is very irregular and the radioactivity weak. (*c*) Joachimsthal, where pitchblende accompanies cobalt, nickel and the rare metals. These deposits are very rich, and the separation of radium from uranium is so complete that all the radium passes to the residues from the manufacture of uranium colours. One kilo. of pitchblende with 60 per cent. of U_3O_8 has an activity equal to that of 0·333 mgrm. of radium bromide. It is estimated that the mines can produce 16 to 20 tons of ore annually containing on an average 55 per cent. of U_3O_8. A similar but irregular deposit is found in Gibson County (Colorado). Radium is also found in small quantities in Swedish "Kolm" (see this J., 1910, 1452). A comparison of the sources shows that radium is an acid element (like uranium), and that uranium ores are associated to a remarkable extent with sulphide ores of the rare metals, copper, cobalt and nickel, particularly when the latter are found in the neighbourhood of tin-bearing granite. Since the same mineral is sometimes radioactive and sometimes free from radium, it appears probable that radium can be found in nature without uranium. The production of radium at Joachimsthal is about 1·8 grms. of the most active salt per annum. This is valued at £28,800, from which must be deducted £720 for expenses. A steady radium market will only be attained by an amalgamation of mining interests, with a view to minimising uncertainties and risks. It would also be advisable to increase the consumption of uranium colours, as well as of radium salts.—W. H. P.

Radioactive Caucasian mineral; Composition of a ——. N. Sokolow. J. Russ. Phys. Chem. Soc., 1911, **43**, 439—440.

A mineral, occurring in the Caucasus in solid, black masses, sp. gr. 6·4 at 15° C., and exhibiting marked radioactive properties, was found to contain 76·01 per cent. of uranium oxide (U_3O_8), 1·70 of sulphur and 20·00 per cent. of a residue insoluble in nitric acid and in sodium hydroxide solution. The composition of this residue was : silica, 5·17 ; lead, 4·50 ; ferric oxide and alumina, 4·30 ; manganese oxide, 0·155 ; zinc oxide, 0·166 ; lime, 4·100 ; and magnesia, 0·203 per cent.—T. H. P.

Copper in pyrites and burnt pyrites ; New method for the determination of ——. W. N. Iwanow. Chem.-Zeit., 1911, **35**, 531.

The method is based on the fact that pyrites and burnt pyrites when heated with metallic iron are converted into products easily soluble in hydrochloric acid. 3 grms. of the finely-powdered material are mixed with an equal weight of finely-divided iron (*Ferrum hydrogenio reductum*) and placed in a glass tube, 7 cm. long and 1 cm. diam., open at one end. The mixture is covered with a thin layer of the iron powder, and the tube is then heated for a few minutes to dull redness. The hot tube is placed in a flask, broken by dropping water on to it, and after cooling, 50 c.c. of hydrochloric acid are added, and the mixture heated until the iron is completely dissolved, precipitation of the copper taking place owing to the production of hydrogen sulphide. After diluting to 200 c.c., a strong current of hydrogen sulphide is passed through, the copper sulphide and insoluble impurities are filtered off, and after gentle ignition, dissolved in nitric acid. From the solution, iron, etc., is precipitated by ammonia, and the copper is then determined by electrolysis.—A. S.

Barium and calcium sulphates ; Behaviour of —— *towards the more important metallic sulphides in presence of silica.* W. Schütz. Metallurgie, 1910, **8**, 228—246.

The results of numerous experiments are summarised in the following conclusions :—In presence of silica and metallic (lead—zinc—copper) sulphides both barium and calcium sulphates begin to decompose below 800° C., and the decomposition is practically complete at 1100°—1200° for barium, 1000°—1100° C. for calcium sulphate. The decomposition of calcium sulphate can hence be made use of in the roasting of galena, the excess of oxygen (from the dissociation of sulphur trioxide) going to burn the sulphur of the galena. The heat of combustion of this excess galena is not itself sufficient to carry the reaction through, but a little addition of pyrites renders it sufficient. The temperature required is not high enough to cause any sensible volatilisation of galena. The materials for the operation must be intimately mixed ; if finely ground, they can be agglomerated and thus brought into suitable condition for the furnace either by a preliminary heating or by moistening with water. The proportion of gypsum, whilst sufficient to prevent the too early fusion of the mixture, must not be too great : the equivalent of 10 to 13 per cent. of lime (CaO) in the mixture may be taken as normally suitable. Barium sulphate cannot usefully be substituted for calcium sulphate, as the volatilisation of galena is too considerable at the then necessary temperature.—J. T. D.

Aluminium magnesium alloys [" *duralumin* "] ; *Physico-metallurgical investigation of* ——. A. Wilm. Metallurgie, 1911, **8**, 225—227.

The author has already shown that the addition of small proportions of magnesium to alloys of aluminium confers on them the property of being hardened by a heating process. Micrographic investigation has as yet given no clue to the mechanism of this hardening, but certain of its peculiarities and their practical bearings have been investigated. Such an alloy, heated to the requisite temperature (usually about 400° C.) and quenched, does not at once harden, like steel, but shows practically no alteration ; its hardness now gradually increases, however, and after perhaps 24 hours reaches its limit. Aluminium with ½ per cent. of magnesium is still a soft metal even after this treatment, but the presence in addition of copper very greatly increases the hardness. These alloys can be cold-worked after hardening, with the effect of still further increasing their hardness. Moreover, an alloy which has been cold-rolled, with the effect of increasing its hardness and lowering its ductility, if it be now hardened by heating and quenching, not only gains further in hardness, but has its ductility greatly raised. The gain in hardness due to heating and quenching increases as the temperature of heating rises from 400° to 450° C., but further rise up to 540° C. causes no further increase in hardness. If the alloys after heating to the desired temperature be allowed to cool slowly, they will be much harder when cold than the quenched alloys ; but the slowly cooled alloys gain very little in hardness after cooling, and the ultimate hardness of the quenched alloy is always greater than that of the same alloy slowly cooled. If the quenched alloy be immersed in boiling water immediately after quenching, the rate of increase of hardness is enormously increased, but the ultimate hardness is not so great as that reached slowly in the cold. If, however, an alloy that has been hardened by quenching and standing, and has afterwards been cold-worked, be immersed in boiling water the reduction of hardness is inconsiderable, but the increase of ductility is very marked. All of these aluminium magnesium alloys may be kept or used at temperatures up to 150° C. without any deterioration ; but at 200° C. and upwards they lose hardness very considerably. Other metals introduced into these alloys affect their properties in various ways ; nickel confers toughness, manganese increases the hardness, and has also the curious effect of preventing the wetting of the metal by mercury, and, of course, the resulting atmospheric oxidation of the aluminium. But great caution is needed in alloying aluminium with these other metals, on account of the great tendency to segregation which they cause.—J. T. D.

Metal mist ; The nature of —— *in molten salts.* R. Lorenz, G. von Hevesy, and E. Wolff. Z. physik. Chem., 1911, **76**, 733—742.

The Lorenz " metal mist " (see this J., 1907, 1016) is the cloud of metal which can be produced by maintaining the metal beneath the surface of its molten halogen salt, or by direct electrolysis of the salt. It is generally of a pronounced colour. In the case of lead in lead chloride the concentration of the metal in the melt may be determined by gradual addition of powdered lead peroxide, diluted by mixing with powdered lead chloride. The reaction $PbO_2+Pb=2PbO$ takes place and the end-point is given by the disappearance of the colour, since the lead monoxide dissolves without colouration. In this way results accurate to 0·001 mgrm. can be obtained. At 550° C. the concentration of lead in a saturated melt is $1{\cdot}54\times10^{-4}$ per cent. by weight. This value increases with rise of temperature, but diminishes in the presence of potassium chloride, until when the melt has the composition, $KCl,2PbCl_2$, it is reduced almost to zero. The system, $Pb,PbCl_2$, is very similar to the system iodine-potassium iodide, and the system, $Pb,PbCl_2$–KCl, is very similar to the system, $Hg,HgCl_2$-pyridine (studied by Werner), so that the authors are led to the conclusion that in the system, $Pb,PbCl_2$, there is some equilibrium of the form, $(Pb)_n.PbCl_2=PbCl_2+(Pb)_n$.—W. H. P.

Alloys; Notes on lead-tin-antimony ——. W. Campbell and F. C. Elder. School of Mines Quart., 1911, 32, 244—255.

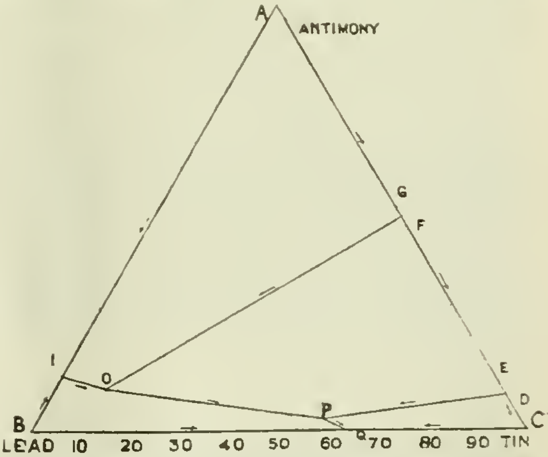
Table I.

Name.	Pb.	Sn.	Sb.	Authority.
Electrotype	93	3	4	Private notes.
Bearing	86	1	13	Private notes.
Linotype	85	3	12	Private notes.
Stereotype	82	6	12	Private notes.
Bearing	82	2	16	Private notes.
Stereotype	82	3·2	14·8	Roberts-Austen.
Bearing	80	12	8	Guillet. Compagnie de l'Est. Charpy.
Bearing	80	5	15	Guillet (Guillemin).
Bearing	80·5	4·5	14·5	As 0·5. Glyco very similar.
Bearing	78	6	16	Magnolia.
Bearing	77·7	5·9	16·8	Law. Thurston. Magnolia and Tandem metals.
Type	77·5	6·5	16	Private notes.
Bearing	77	10	12·5	Cu 0·5. Antifriction.
Bearing	77	8	14	Cu 1·0. Coleco very similar.
Bearing	76	14	10	Law. Guillet. Compagnie d'Orleans. Metallic packing.
Bearing	73·5	8	18·5	Babbitt. American R. R.
Bearing	73	12	15	Law. Guillet. Compagnie du Nord. Piston packing.
Bearing	70	20	10	Law. Metallic packing. French R. R. (Charpy).
Stereotype	70	13	17	Thurston. Mackensie Metal.
Bearing	70	10	20	Guillet. Paris-Lyon-Mediterranée R. R.
Type	70	10	18	Cu 2·0. Roberts-Austen.
Bearing	68	21	11	Babbitt. American R. R.
Bearing	68	15	17	Law. Guillet. (Dudley. Graphite metal.)
Stereotype	67	17	16	Thurston.
Type	63·2	12	24	Cu 0·8. Private notes.
Bearing	62·5	26·2	10	Cu 1·25. Private notes.
Bearing	62	27	11	Babbitt metal.
Type	60·5	4·5	24·2	Cu 0·75.
——	60	35	5	Private notes.
Bearing	60	20	20	Brannt. Roberts-Austen.
Solder	60	39	1	Private notes.
——	55·5	40	14·5	Private notes.
Bearing	48	40	10	Cu 2. Private notes.
Bearing	46	36·5	16·5	Cu 1. Babbitt "No. 2." American R. R.
——	42	46	12	Hiorns. Guillet. Hoyle's metal.
Bearing	42	42	16	Guillet. Chemins de fer de l'Etat Français.
Bearing	40	45	15	Guillet (Ledebur).
Bearing	40	42	16	Cu 2. German.
Bearing	37	38	25	Guillet. Italian R. R. (Thurston).
Stereotype	35	60	5	Thurston (Berthier).
——	33	53	10·6	Cu 2·4. Zn 1. Roberts-Austen, White metal.
Bearing	10	75	15	Private notes.
Bearing	10	75	12	Cu 3. Private notes.
——	5	75	20	Used for small castings.

Table II.

Pb.	Sn.	Sb.	Load corresponding to a compression of 0·2 mm.	Load corresponding to a compression of 7·5 mm.
80	10	10	800 kilos.	1775 kilos.
60	20	20	1050 ,,	1700 ,,
40	40	20	1150 ,,	1825 ,,
20	60	20	1350 ,,	2200 ,,
10	80	10	1100 ,,	2700 ,,

Table I. gives the most important of the alloys of these metals in use. In these alloys the antimony never exceeds 25 per cent. The results obtained by Charpy on certain antifriction alloys with regard to crushing strength are given in Table II. The tests were carried out on specimens 15 mm. high and 10 mm. square. The lead-antimony eutectic contains 13 per cent. of antimony and freezes at 245° C. Lead-antimony alloys are used as bearing-metal, type-metal, etc. The lead-tin eutectic contains 63 per cent. of tin, and freezes at 182·5° C. The thermal diagram is similar to that of lead-antimony. These alloys are used as solders, pewters, etc. There is no true tin-antimony eutectic; pure tin freezes at a lower temperature than any of the alloys. The addition of tin to antimony lowers the freezing-point progressively, although various compounds are denoted by inflections of the curve. Such alloys are used for antifriction metal, Britannia metal, engraving processes, etc. Examination of the ternary alloys shows that the structure follows four main types: 1. Excess of antimony or SbSn in a laminated ground-mass. 2. Excess of soft lead dendrites in a laminated ground-mass. 3. Excess of Snα in a laminated ground-mass. 4. Excess of hard SbSn in Snα and ground-mass. The ternary diagram is given (see Fig.). The arrows show fall of temperature. About one hundred alloys were examined, and the data used to determine the point O, with 80 per cent. of lead, 10 of tin, and 10 of antimony, at 245° C., and point P, with 40 per cent. of lead, 57·5 of tin, and 2·5 of antimony, at 189° C. R. Loebe (this J., 1911, 218), has found the point P to be nearer to the tin side of the diagram.—R. W. N.



Zinc dust and commercial zinc; Presence of nitride in ——. C. Matignon. Comptes rend., 1911, **152**, 1309—1312.

ALL the samples of zinc dust examined were found to contain small proportions of nitride, the nitrogen content varying from about 0·02 to 0·05 per cent. In the case of metallic zinc, the presence of nitrogen could not be proved in all cases, and in general the nitrogen content was very low (30—40 mgrms. per kilo.); one sample, however, contained 0·012 per cent. of nitrogen. Zinc white was found to be free from nitride. The nitride-content was ascertained by heating with fused sodium hydroxide or boiling with sodium hydroxide solution, and determining the ammonia evolved.—A. S.

Arsenic and tin; Compounds of ——. P. Jolibois and E. L. Dupuy. Comptes rend., 1911, **152**, 1312—1314.

MICROSCOPIC examination of alloys prepared by heating together, in sealed tubes, known weights of arsenic and tin, and then polishing, and etching with ferric chloride solution, indicated the existence of two compounds, As_3Sn_4 and AsSn, respectively. The alloys containing from 5 to 31·4 per cent. of arsenic consisted of crystals of As_3Sn_4 in a ground mass of tin. There was evidence of an eutectic at 50 per cent. of arsenic. The compound, As_3Sn_4, forms large needles of sp. gr. 6·31 at 0° C.; it is attacked by hydrochloric, nitric, and sulphuric acids, and dissolved by hot, concentrated alkali solutions. The compound, AsSn, has similar properties.—A. S.

Passivity; Contribution to the knowledge of ——. F. Flade. Z. physik. Chem., 1911, **76**, 513—559.

THE author distinguishes between the "primary state" of passivity produced by ordinary passivifying processes, and the "stationary state" which results from prolonged anodic polarisation under constant conditions. The stationary state readjusts itself if the conditions of polarisation are slightly changed, but it is not reproducible in different experiments. If the polarisation potential is changed by altering the resistance of the circuit, nickel and chromium electrodes behave in the normal manner, showing a larger current with a higher potential. Iron under the same conditions shows irregularities, the current strength being nearly, if not entirely, independent of the potential. If the temperature is raised, the potential at a "stationary" passive electrode decreases and the current strength increases, but the temperature coefficient varies in the different experiments. If the circuit is opened and the electrode is allowed to become active in dilute sulphuric acid, the process for nickel is not quite smooth, although the discontinuity is not very well marked. In the case of iron there is first a rather rapid fall of potential, which is followed by a slower and less continuous fall, although the points of discontinuity are again different in different experiments. There is however a sharply defined point at which the electrode becomes suddenly active, corresponding to the disappearance of the "primary state." This point is the same in different experiments and for different electrodes, and is independent of the presence of ferrous or ferric ions. It varies however with temperature, and with acid concentration. A rise in temperature or an increase in the concentration of the acid assists the activifying, displacing the transition point to a higher potential. The author considers that the phenomena of the stationary state depend on the existence of oxide films of varying composition, and possibly also on the mechanical properties of the metal. The primary state is probably due to a solid solution of oxygen in the iron, which decomposes or loses its effect in dilute sulphuric acid as soon as the oxygen concentration falls below a critical value.—W. H. P.

Metals; Electrolytic furnace process for the production of pure ——. J. W. Beckman. Amer. Electrochem. Soc., April, 1911. Met. and Chem. Eng., 1911, **9**, 274—275.

THE method proposed by the author consists in using as electrolytes fused salts prepared by heating together lime and an oxide of a metal more electro-positive than calcium (see U.S. Pat. 973,336 of 1910; this J., 1910, 1315). In the case of iron, for example, the salt, CaO,Fe_2O_3, is prepared by fusing together lime and ferric oxide. On passing a current through the fused salt, no noticeable action takes place, but if iron oxide be added, iron is deposited on the cathode and oxygen liberated at the anode, and the electrolysis can be carried on continuously by adding iron oxide from time to time. It is stated that manganese, iron, chromium, and a 50 per cent. alloy of vanadium have been prepared by the process. In the discussion it was pointed out that on the small scale employed in the author's experiments, the production of the metals may have been due to high-temperature reduction by the graphite crucible and not to electrolysis.—A. S.

Ferrous oxide in silicates; Titration of —— by the Pebal-Dölter method. M. Dittrich. Ber., 1911, **44**, 990—991. (See also this J., 1910, 1054.)

IN dissolving silicates for the subsequent determination of iron, it frequently happens that after the material has been heated with hydrofluoric acid and sulphuric acid, part of the silicate remains undissolved and firmly attached to the bottom of the crucible. This is particularly the case with minerals and rocks, poor in silica and rich in magnesia. It is recommended that the powdered mineral be mixed with quartz which has not been too finely powdered and therefore resists solution by the hydrofluoric acid long enough for the mixture of acids to attack the mineral. The addition of the quartz also exposes a larger surface of the mineral to the action.—E. F. A.

Sulphides; Action of carbonyl chloride on artificial and natural ——. E. Chauvenet. Comptes rend., 1911, **152**, 1250—1252. (Compare this J., 1911, 127.)

CARBONYL chloride readily transforms metallic sulphides into anhydrous chlorides at comparatively low temperatures, according to the equation, $MS + COCl_2 = MCl_2 + COS$, and natural sulphides are conveniently decomposed for analysis in this manner. The following approximate reaction temperatures have been determined for certain artificial sulphides:—Antimony, 300° C., bismuth, ferric, mercuric, and lead, 350°, barium, cadmium, and zinc, 400°, and copper, manganese, and nickel sulphides, 450° C. For mineral analysis, the apparatus previously described (*loc. cit.*) may be used, the tube terminating in a small two-necked receiver, in which the volatile chlorides are condensed and collected; in the case of a blende, for example, containing, besides zinc sulphide, sulphides of iron and copper and traces of arsenic and antimony sulphides, the tube was heated to about 500° C.; the volatile chlorides of iron, arsenic, and antimony then collected together in the cool part of the apparatus, whilst copper and zinc chlorides remained in the boat. The method has given satisfactory results also with galena, bournonite, cinnabar, and other minerals.—F. SODN.

Eutectics; Uniformity in the composition of ——. K. Losew. J. Russ. Phys. Chem. Soc., 1911, 43, 375—392.

AMONG the different exceptions to the uniformity in the composition of eutectics indicated by the work of Gorbow (this J., 1910, 634), a special place is occupied by those cases in which there exist, in the alloys, eutectics differing but slightly from one or other of the pure metals; in such cases, it is almost impossible to determine the composition of the eutectics by means of thermal analysis. In such instances study of the microstructure of the eutectics is of use and the author has applied this method to alloys of (1) cobalt and antimony and (2) nickel and antimony. The results show that it is highly improbable that, for these alloys, eutectics exist which approximate to pure antimony. The alloys of nickel and antimony show one noteworthy peculiarity; when they contain between 57 and 92·5 per cent. by weight of nickel, they exhibit on solidification a second temperature-halt, caused by the formation of crystals of the compound, Ni_4Sb, from two kinds of solid saturated mixed crystals.—T. H. P.

Patents.

Pig-iron ; Method of refining molten——. J. B. Nau, New York. U.S. Pat. 991,633, May 9, 1911.

The refining chamber is composed of a covered receptacle divided unequally by means of a vertical partition into a large chamber provided with a vertical shaft, and a smaller chamber communicating with the first through an aperture at the bottom of the partition. The first chamber having been partly filled with a granular refining material containing iron oxide and extending up the shaft, a stream of molten pig-iron is directed through the mass so that it forms a pool at the bottom in which the lower part of the column is immersed. The whole receptacle is then oscillated intermittently, whilst an electric current is passed through the pool. In this way, the separation of the slag products and the partly refined iron from the reducing material is facilitated ; the liquid mass flows into the second chamber, whilst the column of granular matter is caused to descend slowly into the pool.—C. A. W.

Brazing, soldering, and like methods of uniting metallic surfaces. A. C. Hyde, Ealing, Middlesex. Eng. Pat. 5232, March 2, 1910.

The pieces to be united are placed in contact, and the brazing or soldering metal is applied to the joint, which is then heated in an atmosphere of hydrogen, carbonic oxide or other reducing gas. In this way, two metals, both oxidisable at the temperature of working, may be united by means of an alloy having a lower melting point than either ; thus iron or steel articles may be brazed together with copper, brass or bronze.—C. A. W.

Metals [refractory] ; Reduction of —— from their oxides or other compounds. J. Härdén, Purley, Surrey. Eng. Pat. 7303, Mar. 23, 1910.

The reduction of the oxide or other compound of the refractory metal (tungsten, uranium, etc.), is effected in an electric arc furnace by means of calcium carbide, with or without the addition of a metallic silicide.—W. E. F. P.

Light metals and particularly sodium ; Electrolytic production of ——. G. O. Seward, East Orange, N.J., F. von Kugelgen, Holcomb Rock, Va., U.S.A., and F. von Bidder, Geneva, Switzerland. Eng. Pat. 11,175, May 5, 1910. Under Int. Conv., May 10, 1909.

The apparatus, intended primarily for the production of the alkali metals, can however be employed in any case where the metal obtained is of lower specific gravity than the electrolyte. The cell is composed of a steel casing, which surrounds an annular anode of carbon or graphite in one or several pieces, the intervening space being filled with a lining of asbestos, fireclay and cement. The current is brought to the anode by means of a series of carbon pencils extending through the walls. The cathode is composed of a cast iron tube, enlarged at the top, which passes vertically through the bottom of the cell and projects slightly above the surface of the electrolyte, its upper end being contracted to a small aperture in which a nipple is fixed. The top of the cathode is separated from the surrounding anode by means of a water-cooled curtain, composed of separately insulated sections, which dips below the electrolyte and soon becomes coated with an incrustation of solidified salt. The thickness of this incrustation is limited, and the ascent of the separated metal within the cathodic compartment is facilitated, by means of local heating. To this end, the cathode is enlarged at the upper end so that it closely approaches the curtain, the activity at the bottom of the vessel being further diminished by means of artificial cooling. The separated metal rising in the inner chamber floats on the electrolyte and overflows through the small aperture in the top of the cathode into a receptacle beneath, from which it may be tapped at intervals. In order to maintain the same atmospheric pressure in the different parts, the cathode chamber is connected through a tube with the discharge passage, and the latter, through a liquid seal, with the outer air. In practice, an electrolyte melting at about 600° C. is employed, the operation being conducted at a temperature between 630° and 670° C. ; it may therefore be necessary to add suitable fluxes to the alkali chloride of the electrolyte. The fusion of the latter is effected, at the commencement, by the passage of an alternating current, the change to direct current being deferred until the molten mass rises within the curtain. It is preferable to subject the salt to a preliminary refining by melting it in an electric furnace, when the insoluble impurities will be precipitated and the mass dehydrated.
—C. A. W.

Gold leaf substitute ; Manufacture of ——. F. Demel, London. Eng. Pat. 11,803, May 12, 1910.

As a substitute for gold leaf, it is proposed to employ a thin film composed of a copper foundation upon which coatings of silver and gold of nearly equal thickness are deposited electrolytically in succession. To this end, a short cylinder of highly polished aluminium is coated with guttapercha, and copper powder is dusted over the surface—which is then polished. The cylinder is now revolved with its lower face immersed in an electrolytic bath of silver, the thin film of metal is washed and polished and then coated in a similar manner with a film of gold (0·0045 to 0·008 mgrm. per 85·5 sq. mm.). The deposited layer having been again washed and polished, the cylinder is finally revolved with its lower face immersed in benzene, the metallic film being cut and allowed to fall, as the guttapercha dissolves, on to a paper band travelling at identical speed through the solution. A certain amount of guttapercha is left undissolved, and this serves as an adhesive when the foil is required for gold stamping.—C. A. W.

Aluminium ; Process for coating iron sheets, plates and the like with ——. C. Woud. Krommenie, North Holland. Eng. Pat. 20.669, Sept. 5. 1910.

The iron sheets, etc., are passed between the pressing rolls of a varnishing machine to which a mixture of aluminium powder and varnish has been previously applied.
—W. E. F. P.

Copper ; Process and apparatus for purifying acid electrolyte used in refining ——. C. H. Aldrich and J. K. Bryan, Perth Amboy, N.J. U.S. Pat. 991,685, May 9, 1911.

The greater portion of the copper having been removed by concentration and crystallisation, the residual solution is passed in successive stages through a series of pans arranged at different levels above the furnace. In this way, it is concentrated to about 70° B., and nearly the whole of the copper, nickel, iron and zinc is precipitated. Finally the mother liquor is electrolysed at a temperature of 170° to 180° F. for the separation of the arsenic and antimony.—C. A. W.

Ores ; Apparatus for electrochemical treatment of ——. T. Bubola. Luipaardsvlei, Transvaal. U.S. Pat. 991.695. May 9, 1911.

The apparatus comprises a circular vat in which the ore is lixiviated electrolytically with the treating liquid, the latter being passed in at the bottom of the vessel so that it spreads over the floor and rises through a filter into contact with the material. The filter floor is incorporated with metallic netting, which forms the anode for the electrolysis, the cathodes being composed of a number of rod-like electrodes suspended vertically in pairs at the top of the vat. These cathodes are supported at the extremities of horizontal arms to which is imparted a planetary motion about the axis of the vessel. The liquid is withdrawn from the upper part of the apparatus and passed into a precipitation vat, where it is electrolysed, the current for this purpose being diverted from the main supply.—C. A. W.

Converter processes. O. Thiel. Landstuhl, Germany. Eng. Pat. 10,199, April 26, 1910.

See Fr. Pat. 415,042 of 1910 ; this J., 1910, 1314.—T. F. B.

Air [for metallurgical processes]; Art of treating ——. J. B. Miles, Philadelphia, U.S.A. Eng. Pat. 21,754, Sept. 19, 1910.

See U.S. Pat. 971,297 of 1910; this J., 1910, 1210.—T.F.B.

Steel; Manufacture of ——. F. Kohlhaas, Düsseldorf, Germany. Eng. Pat. 25,741, Nov. 5, 1910. Under Int. Conv., Nov. 12, 1909.

See U.S. Pat. 981,575 of 1911; this J., 1911, 135.—T. F. B.

Armour-plates and other articles of steel or alloys of steel; Manufacture of cemented ——. F. Giolitti, Rome, Assignor to Soc. Anon. Ital. Gio. Ansaldo Armstrong & Co., Genoa, Italy. U.S. Pat. 991,972, May 9, 1911.

See Fr. Pat. 392,355 of 1908; this J., 1909, 145.—T. F. B.

Furnaces for roasting ores. X. de Spirlet, Brussels. Eng. Pat. 10,782, May 2, 1910. Under Int. Conv., May 5, 1909.

See Fr. Pat. 415,338 of 1910; this J., 1910, 1392.—T.F.B.

Ores; Process for the roasting of [sulphide] —— to separate the metals contained therein. C. Gabrielli, Paris. Eng. Pat. 27,741, Nov. 29, 1910. Under Int. Conv., Nov. 30, 1909.

See Fr. Pat. 422,928 of 1910; this J., 1911, 553.—T. F. B.

Treating blast-furnace gases, and preparing char-peat. U.S. Pat. 990,891. *See* IIa.

Manufacture of animal charcoal and a cementing agent. Fr. Pat. 423,070. *See* VII.

XI.—ELECTRO-CHEMISTRY.

Hydro-electric plants in Norway and their application to electro-chemical industry. A. Scott-Hansen. Faraday Soc., May 2, 1911. [Advance proof.]

The waterfalls of Norway are a plentiful source of energy particularly from May to July, when the snows melt on the mountains. By means of storage, for which the country is specially suited, the natural water power can be greatly increased. In the Skien watershed, the natural power has been raised from 50,000 to 375,000 available horsepower, while the Mösvand reservoir has increased the power of the Rjukan factories from 30,000 to 250,000 horsepower, with an outlay of only some £85,000. The total water power of Norway is from 5 to 7 million horsepower, probably even more. The power stations can supply power at 22 to 44 shillings per horsepower year, so that conditions are excellent for the development of electrochemical and electrometallurgical industries. Nearly 180,000 horsepower will be used this year for the manufacture of nitrates from the air by the Birkeland-Eyde and Badische processes, about 60,000 in the manufacture of calcium carbide, and some 20,000 in other electrochemical industries. Electrical steel smelting also seems likely to develop, and three plants of 16,000 horsepower (which can increase to 60,000) are being erected at Hardanger, Arendal, and Tinfoss. Other ores will probably be smelted in the near future. On the Glommen River are three falls. The uppermost, Kykkelsrud yields about 40,000 horsepower, of which 10,000 kilowatts is transmitted at 60,000 volts (3 phase, 50 periods) to Christiania (31 miles) and the rest to Sarpsborg. At Sarpsborg is the lowest fall with two power stations, Hafslund (24,000 horsepower, for calcium carbide and zinc smelting) and Borregaard (26,000 horsepower). The middle fall of the Glommen at Vamma will shortly have a dam 90 feet high, and a power station giving 70,000—80,000 horsepower. Minor power stations are at Arendal (electro-iron and steel), Christiansand (nitrate works, and nickel and aluminium factories) Gjossingfjord (experimental steel works), Vadheim (sodium factory), and Trondhjem (carbide, ferrochrome, and ferrosilicon). Another great power centre is in the Telemarken district (S.E. Norway). The Svaelgoss station supplies 40,000 horsepower to Notodden (nitrate factory) at 10,000 volts without transformation. A new station at Lienfoss will give Notodden a further 20,000 horsepower. The third great fall is the Rjukanfoss on the Maaneely River. The Mösvand dam gives a reservoir of 840 million cb. m. and five miles below is another dam forming the intake for the power station. There is a lower fall of 1000 feet with a second station. The two stations give 140,000 horsepower in ten units. The turbines, on account of the great height of the falls, are Pelton wheels. The engineering difficulties in the construction of these stations were very considerable and are fully described in the paper. The power from these stations is transmitted through 60 copper and aluminium cables to Saaheim, where 2000—3000 persons will be employed in factories for the fixation of nitrogen. At Tysse is a power plant of 7 units, each of 4500 horsepower, from which electric energy is transmitted at 12,000 volts to Odda where it is used to make calcium carbide and cyanamide. The station will eventually yield some 100,000 horsepower. Replying to discussion the author stated that the relative economy of the Badische and Birkeland-Eyde furnaces could not be decided at present. The latter, however, could be built in larger units, up to 4000 kilowatts as against 800 in the case of the Badische furnace.—W. H. P.

Mercurous perchlorate electrolytic meter. F. C. Mathers and A. F. O. Germann. Amer. Electrochem. Soc., April, 1911. Met. and Chem. Eng., 1911, **9**, 269—270.

The authors recommend a solution of mercurous perchlorate containing free perchloric acid as an electrolyte for electrolytic meters. The solution has a high conductivity so that very high current densities can be used. Mercurous perchlorate is very soluble in water, and the ClO_4 radical is exceptionally stable. Mercury possesses the advantage over silver and copper of a very high electrochemical equivalent, and the amount deposited may be rapidly determined by measurement instead of by weighing. —A. S.

Transformer oils. A. Berninger. Mitt. K. K. Techn. Gewerbe-Museums in Wien, 1911, 21, 21—27.

Oils for use in transformers should be pure petroleum oils with a flash-point above 100° C. and an ignition temperature above 200° C. They should be completely free from acid and moisture, and contain no alkali or sulphur compounds. Their dielectric strength (*Durchschlagfestigkeit*) and electrical resistance at different temperatures between 15° and 100° C., should also be determined. The resistance of an oil may be measured with the aid of a very sensitive mirror galvanometer at a constant tension of 440 volts, care being taken to expel all traces of moisture by boiling the oil before applying the test, since the presence of only 0·06 per cent. of water will depress the result by about 50 per cent. The hot oil is placed in the testing vessel, and the test made after 10 minutes. An accurate measurement (expressed in megohms per c.c.) may be made with the mirror galvanometer at as low a temperature as 28° C., and by prolonging the curves, plotted from the results obtained at different temperatures, the value for 20° C. may be calculated. The difference between the calculated and determined values at different temperatures is at most about 9 per cent. The resistance varies considerably with the temperature, especially between 0° and 30°C. Hence it is important to determine the resistance at the normal working temperature of the transformer. For measuring the dielectric potential (*Durchschlagspannung*) at definite temperatures the author uses a cylindrical glass vessel resting upon a tripod of hard rubber. The electrodes are formed of two polished steel balls, 11 mm. in diameter, screwed on to thin stems, one of which passes through the bottom of the vessel, whilst the other passes through the hard rubber cover, and is provided with a millimetre scale by the aid of which the distance between the electrodes can be accurately adjusted. A thermometer, the bulb of which should be at the level of the electrodes, and a stirring rod, to prevent the accumulation of particles of carbon between the electrodes, also pass through openings in the cover. For each determination the same quantity of oil is taken, and, after being heated to 105° C., it is introduced into the vessel, and the electrodes fixed at a distance from one another of 5 mm. The oil is now stirred, the temperature taken, and the tension of an alternating current of 44·5 periods, taken from an 8 kilowatt transformer for 100,000 volts (effective) gradually raised by regulation on the primary side until sparking is produced between the electrodes. The dielectric potential may be read upon a Grau's high tension voltmeter. The results quoted show that no conclusion as to the dielectric strength can be drawn from a determination of the electrical resistance, and that the former must therefore be experimentally determined at the working temperature as described.—C. A. M.

Transformer oil. A. Duckham. Electrician, 1911, **67**, 212—214.

The author describes generally the properties required in transformer oils. In dealing with the formation of a deposit or sludge and the thickening of the oil when in use, the following causes are enumerated: (1), deposition of atmospheric dust; (2), thickening due to evaporation of lighter constituents of oil; (3), action of oil on insulating materials and varnishes of transformer; (4), chemical change in the oil. The effects due to the first three causes are usually only slight, the greater part of the sludge, etc., being produced by chemical change in the oil, experiments having shown that under the conditions existing in a transformer, oxidation of mineral oils with formation of saponifiable products and other oxygen compounds therefrom takes place. There is usually a space above the oil, where the cables are attached to the terminals, in which air can circulate, and the presence of ozone and oxides of nitrogen in this space has frequently been detected. Experiments have shown that mineral oils when heated in contact with oxygen, and especially with ozone, rapidly darken and thicken, whilst an amorphous brown powder is deposited. Some oils are affected much more than others. The author is investigating the composition of the brown deposit and of the saponifiable oil which is simultaneously formed.

—A. S.

Patent.

Reactions in gases [by means of electric arcs]; Process for the production of ——. O. Schönherr and J. Hessberger, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 991,174, May 2, 1911.

See Eng. Pat. 26,602 of 1904; this J., 1905, 1178.—T. F. B.

XII.—FATS; OILS; WAXES.

Cocoanut oil; Examination of Shrewsbury and Knapp's method of determining ——. R. Ross, J. Race and F. Maudsley. Analyst, 1911, **36**, 195—198.

The results obtained in the examination of a large number of samples of English and foreign butter by the method of Shrewsbury and Knapp (this J., 1910, 1128) pointed to the maximum value being 35·5 instead of 32, as suggested by the authors of the process. The highest value obtained for the residual fats was 23·0. In the case of cocoanut stearine the Shrewsbury and Knapp figure was 138·5 and that of the residual fats 136·8, whilst four samples of cocoanut oil of different origin gave values of 166·5 to 170·5 for the fats, and of 163·4 to 168·6 for the residual fats. A sample of cacao butter gave values of 16·5 and 6·4 respectively. With triolein very variable results were obtained, but in the case of different specimens of oleic acid the results were fairly uniform (25 to 29·5). In the authors' opinion the value obtained for oleic acid is probably approximately correct, and the value of 65 and higher for triolein is excessive. A rise in the iodine value is not necessarily accompanied by a rise in the Shrewsbury and Knapp figure. The constitution of the residual fatty acids separated from the alcohol-water solution indicated that proportional quantities of all the constituents were dissolved. Useful data as to the nature of a butter may be obtained by calculating the iodine value of the fatty acids into oleic acid, and then the molecular weight of the residual fatty acids by means of the formula

$$x = \frac{100M-(282 \times O),}{100-O}$$

where M represents the molecular weight of the fatty acids and O the percentage of oleic acid. This value for pure butter fat is usually about 235, and is materially lower when cocoanut oil is present. In determining the Shrewsbury and Knapp figure it is essential to follow exactly the prescribed directions (*loc. cit.*). Without the use of glycerin in the saponification process very high results are obtained (*e.g.*, 112 with a Swedish butter and 77 with a Danish butter). The method also enables a conclusion to be drawn as to the composition of margarine, the presence of cocoanut oil being indicated by a high value.—C. A. M.

Chicken and turkey fats; Constants of ——. R. Ross and J. Race. Analyst, 1911, **36**, 213.

The following results were obtained with specimens of chicken fat and turkey fat:—

Fats.

Fat.	Sp. gr. at 100° F.	Saponification value.	Iodine value. (Wijs.)	Reichert-Meissl value.	Polenske value.	Hehner value.	M. pt. ° C.	Refractometer (Zeiss) at 50° C.
Chicken	0·9065	204·6	71·5	1·8	2·1	94·6	23—27	47·5
Turkey	0·9090	191·6	66·4	3·8	1·6	95·1	31—32	46·0

Fatty Acids.

	Sp. gr. at 100° F.	Neutralisation value.	Iodine value.	Acetyl value.	Ricinoleic acid. calculated.	Refractometer reading 50° C.	M. pt. ° C.	Mol. weight.
Chicken	0·8866	208·3	73·6	25·4	per cent. 13·7	36·5°	27—30	270·0
Turkey	0·8990	195·0	70·7	18·4	9·9	32·5°	37—38	287·0

Both fats were optically inactive. The fat of fowls that had been overfed gave higher refractometer readings and iodine values than the normal figures given above.
—C. A. M.

Colloidal copper soap as a fungicide. Vermorel and Dantony. *See* XIXb.

Patents.

Glycerin; Method of treating ——. S. H. Fleming, Camden, N.J., Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. Reissue No. 13,234, dated May 9, 1911, of U.S. Pat. 969,159, Sept. 6, 1910.

See this J., 1910, 1168.—T. F. B.

Purifying or decolourising crude petroleum, fatty substances, and the like. Eng. Pat. 20,409. *See* IIa.

Viscosimeter. Ger. Pat. 233,530. *See* XXIII.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Thenard's blue; Production of ——. L. Vanino. Chem.-Zeit., 1911, **35**, 497.

McEachern (this J., 1911, 223) has pointed out that alumina and cobalt oxide alone do not produce a satisfactory colour, but that additions of sodium or magnesium salts greatly improve it; and he quotes as suitable two mixtures: alumina 8, cobalt phosphate 12, sodium phosphate 2 parts, and alumina 11, cobalt phosphate 1½, ammonium-magnesium phosphate 1 part. Wagner and the author some years ago found that good results were not obtained from alumina and cobalt oxide, but that additions of zinc sulphate or magnesium sulphate gave bright and stable blues. Moreover, they found that cobalt sulphate could be used instead of phosphate, and that the alumina was most suitably introduced as ammonium-alum. To 25 parts of alum, 2·5, 3·0 or 5·0 of cobalt sulphate, and 0·3 of either magnesium or zinc sulphate (or 0·15 of each of them) were added. The salts were melted in their water of crystallisation, and the whole well stirred during evaporation to dryness, to ensure intimate mixture and homogeneity; then the residue was heated to the requisite temperature. Wagner and the author found at the same time (and McEachern has independently confirmed it) that Rinmann's green is easily obtained by direct heating together of zinc oxide (9 parts) and cobalt oxide (1 part).—J. T. D.

Turpentine substitutes; Nature of ——. J. H. Coste and L. M. Nash. Analyst, 1911, 36, 207—212.

In reply to the communication of Richardson and Whitaker (this J., 1911, 115) it is asserted that the chief adulterant of oil of turpentine in this country, is Roumanian spirit, although some American and Borneo spirit is also employed for the purpose. It is true that no Borneo crude petroleum oil is now imported, as it is distilled locally. Owing to the fact that the wells are now sunk to a greater depth and give a lighter oil, the nature of both oil and spirit from Borneo is very different from that of the products of a few years ago. Petroleum spirit suitable for turpentine substitutes yields 90 per cent. of distillate at 210° C., whilst an ordinary good turpentine substitute yields 95 per cent. at 210° C., or at a lower temperature in the case of Borneo spirit. In the authors' experience benzene is not used as an adulterant, and the low flash-point of "gasolene" renders its use equally improbable. Where adulteration is suspected a determination should be made of the close-flash (Abel), and should there be any great deviation from the usual value of 70° to 94° C., a further examination must be made. The production of froth on shaking a sample of turpentine oil at once suggests the presence of petroleum products. On distilling turpentine substitutes there is generally a considerable rise of temperature towards the end of the distillation. A similar rise of temperature may be observed in the case of old or oxidised turpentine oil, but an examination of the residue will show to which cause the rise was due. The following results were recently obtained with samples of turpentine substitutes typical of those now upon the market :—

	Borneo spirit.		Roumanian spirit.	
Sp. gr. at 15·5°/15·5° C....	0·8116	0·8190	0·8000	0·8060
n_D 20° C.	1·4548	1·4538	1·4432	1·4448
Flash-point (Abel)	81° F.	95° F.	96° F.	97° F.
Volume of oily layer (aromatic hydrocarbons) on nitration, per cent.....	60	52	30	28
Distillation (in Wurtz flask)	° C.	° C.	° C.	° C.
10 per cent. distilled at ...	148·5	159·0	159·0	165·5
20 ,, ,, ..	150·0	160·5	161·0	167·0
30 ,, ,, ..	151·0	162·5	163·0	172·0
40 ,, ,, ..	152·5	164·5	165·5	175·0
50 ,, ,, ..	154·0	167·5	168·0	179·0
60 ,, ,, ..	156·0	170·0	171·0	183·0
70 ,, ,, ..	158·5	174·5	174·5	188·0
80 ,, ,, ..	162·0	180·5	180·0	193·0
90 ,, ,, ..	168·5	190·0	190·5	202·5
95 ,, ,, ..	174·5	200·0	203·0	212·0

The results show that these substitutes consist of mixtures of aromatic and aliphatic hydrocarbons. They were but slightly affected by sulphuric acid of a strength sufficient to polymerise the normal constituents of American turpentine oil (this J., 1910, 241) and a method of determining them when present in turpentine oil may be based upon this fact (see also this J., 1910, 438).
—C. A. M.

Patents.

Varnish; Process for preparing —— by dissolving linoxyn in volatile solvents. J. Berlaimont. Ger. Pat. 233,335, Dec. 24, 1909.

Linoxyn may be dissolved to form varnishes, by means of amyl alcohol or amyl acetate at the ordinary temperature; the mass at first swells up, and absorbs the solvent, but after some time a clear, transparent solution is obtained.—T. F. B.

Lead pigment and method of making. A. S. Ramage, Assignor to The Chemical Development Co., Buffalo, N.Y. U.S. Pat. 991,088, May 2, 1911.

See Fr. Pat. 419,470 of 1910; this J., 1911, 224.—T. F. B.

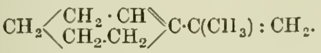
Disazo dyestuffs [*for lakes*]. Eng. Pat. 1730. *See* IV.

Regulating the changes in organic bodies [*rubber, linoleum etc.*] *due to autoxidation or polymerisation.* Eng. Pat. 10,361. *See* XIV.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

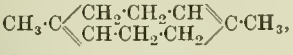
Indiarubber; Synthesis of ——. J. Ind. Eng. Chem., 1911, 3, 279—284.

The early work of Tilden (see this J., 1892, 536) is described and also the views of Harries (see this J., 1910, 502), who has been unable to repeat Tilden's results. Isoprene has been proved by Euler (this J., 1898, 474) to be β-methyl-divinyl, $CH_2:C(CH_3)\cdot CH:CH_2$, and as its polymerisation to caoutchouc must be assumed to take place at the double linkages, other hydrocarbons with the chain, $C:C\cdot C:C$, should also be capable of yielding rubber-like substances by polymerisation. Since isoprene yields caoutchouc, which is a methyl-derivative, 1·3-butadiëne, $CH_2:CH\cdot CH:CH_2$, should yield the mother substance of caoutchouc (nor-caoutchouc), and homologues of isoprene should yield homologues of caoutchouc. Excerpts are given from a number of recent patent specifications one the synthesis of rubber and rubber-like substances. for of the most interesting relating to the production of a cyclohexene-caoutchouc by the polymerisation of isopropenylcyclohexene,



$$\mathrm{CH_2}\left\langle\begin{matrix}\mathrm{CH_2\cdot CH}\\ \mathrm{CH_2\cdot CH_2}\end{matrix}\right\rangle\mathrm{C\cdot C(CH_3):CH_2}.$$

According to Harries isoprene yields first dimethylcyclooctadiëne,



$$\mathrm{CH_3\cdot C}\left\langle\begin{matrix}\mathrm{CH_2\cdot CH_2\cdot CH}\\ \mathrm{CH\cdot CH_2\cdot CH_2}\end{matrix}\right\rangle\mathrm{C\cdot CH_3},$$

which then polymerises to caoutchouc (compare Pickles, this J., 1910, 707).—A. S.

Ficus elastica; Acclimatisation of —— in Sicily. Caoutchouc et Guttapercha, 1911, 8, 5144.

Several species of Ficus succeed on the shores of the Mediterranean, in particular in Sicily. The *F. magnololida* yields a mass containing 7·60 per cent. of rubber, with 91 per cent. of a viscous resin without value. The *F. elastica* Roxb. yields a rubber of the composition: loss on washing and drying, 6·85; resin, 17·47; ash, 1·25; caoutchouc, 74·43 per cent. The product was considered of second quality, and was valued at 11½ fr. per kilo. (3s. 5½d. per lb.). It is considered at Palermo that the rubber would improve in time under cultivation.—H. E. P.

Rubber; Theory of the vulcanisation of ——. F. W. Hinrichsen. Z. Chem. Ind. Kolloide, 1911, 8, 245—250.

In discussing the adsorption theory of vulcanisation (see this J., 1910, 890, 891) the author contends that chemical combination must come into play, otherwise the irreversibility cannot be explained. The case of adsorption of methyl violet by charcoal is not a real parallel, since in this case the substance suffers change to another modification. Experiments are given which show that a semi-vulcanised mixing containing rubber and sulphur alone contains more combined sulphur after being kept for six months at about 70° C., either dry or moist. A sample kept on the roof showed similar results. A more marked effect was observed by keeping the rubber (dry and in the dark) at 80°—90° C. The combined sulphur was initially 1·7 per cent. (total 6·4). After 10 days the combined sulphur had increased to 3·2 per cent., and after 20 days to 4·5 per cent. Thus vulcanisation clearly occurs at these temperatures. It is suggested that the influence of various filling materials on the velocity of vulcanisation can be ascertained by working at suitable temperatures which allow the velocity to be regulated to a convenient extent.—H. E. P.

Rubber solutions; Viscosity of ——. M. Pontio. Caoutchouc et Guttapercha, 1911, 8, 5108.

The author has made many attempts to use the viscosity as a measure of the value of samples of raw rubber, but has found that the results do not appear to afford such a criterion. Experiments with purified Para rubber in cumene solution did not give concordant results.—H. E. P.

Patent.

Changes in organic bodies [rubber, linoleum, etc.] due to auto-oxidation and polymerisation; Process for the regulation of ——. Wo. Ostwald, Leipsic, and Wa. Ostwald, Wilmersdorf, Germany. Eng. Pat. 10,361, April 27, 1910.

It is claimed that by means of neutral or basic aromatic nitrogen compounds, neutral or basic heterocyclic compounds, or alkaloids, the autoxidation and polymerisation of such substances as rubber, gums, resins, linoleum, etc., can be so regulated that deleterious changes are prevented. The nitrogenous compounds may be applied to the raw materials or to the finished products, or at any stage of the manufacture, and they may be added directly or used in the form of vapour or in solution. The following examples are given:—(1). 10 kilos. of raw rubber are mixed with 450 grms. of aniline, and after 24 hours, treated further in the usual manner. (2). A pneumatic tyre is painted inside and outside with a 10 per cent. solution of dimethylaniline in benzol. (3). An inner air tube of a pneumatic tyre is immersed in a 3 per cent. solution of quinoline. (4). 100 kilos. of thickened linseed oil for the manufacture of linoleum are mixed with 1 kilo. of aniline, or the finished linoleum is painted with a solution of one of the nitrogenous compounds. (5). A spirit sandarac varnish is mixed with 1 per cent. of quinoline. (6). Linseed oil mixed with 5 per cent. of pyridine dries slowly and uniformly, without cracks. (7). Motor car tyres are treated with a 10 per cent. solution of nicotine. (See also Ger. Pat. 221,310 of 1908; this J., 1910, 832.)—A. S.

XV.—LEATHER; BONE; HORN; GLUE.

Tanning materials; Comparative efficiency of certain ——. R. W. Griffith. J. Amer. Leather Chem. Assoc., 1911, 6, 211—219.

The analysis of a tanning material offers some indication of its tanning merits, but its real efficiency in the production of leather must be tested practically. Some materials, particularly myrobalans and valonia, show a considerable difference between the amount of tannin as obtained by analysis and that available for producing leather. This is due to the decomposition of the tanning matter as the liquors are allowed to stand. A valonia liquor showed a loss of 23 per cent. of the original tannin, after standing for 90 days, whilst a myrobalans liquor showed a loss of 21·7 per cent. In practice, therefore, these materials should not be leached in the ordinary way but should be used as "dusting-down" material between the hides. The rate of penetration, and the total amount of tannin absorbed are also factors to be considered in judging of the efficiency of a material, and the author reviews work done on this point by himself and J. Youl (this J., 1901, 428). With regard to the comparative absorption of the respective tannins from the different materials, the following figures were obtained. For every 100 parts of quebracho tannin absorbed, there are absorbed: 100·4 parts of oak bark, 94·6 parts of oakwood extract, 94 parts of valonia, 93·2 parts of hemlock, 92·5 parts of chestnut, and 78·8 parts of myrobalans. These figures indicate the actual combining value of the tannins as they are absorbed to form leather.—J. R. B.

Tanning extracts; Testing of ——. A. Gansser. Collegium, 1911, 177—180.

In continuation of his work (this J., 1911, 500) on the weight-giving properties of tanning extracts, the author gives a table showing the increase in weight produced by various extracts on animalised cotton, hide powder and on silk, and he concludes from the figures obtained that the increase in weight does not depend only on the tannin content. The solubility of the extract is of influence, easily soluble extracts being fixed to a smaller extent than the more difficultly soluble ones. The nature of the resinous substances influences the increase of weight; if they are very finely divided so that they are deposited as a thin coating on the fibres, the yield is high. Against the effect of the solubility must be placed the resulting colour; difficultly soluble extracts, whilst giving high yields, also produce somewhat dark colours. The effect of the addition of certain non-tanning matters was also measured. Gallic acid, glucose, dextrin, and molasses all lowered the weight-giving property.—J. R. B.

Leather; Extraction of —— with 95 per cent. alcohol. J. S. Rogers. J. Amer. Leather Chem. Assoc., 1911, 6, 209—211.

Riker (this J., 1911, 39) described a method for extracting the soluble matter from leather by means of 95 per cent. alcohol, and claimed that by this method neither sugars nor magnesium sulphate were extracted. The author refutes this statement, pointing out that absolute alcohol dissolves 1·42 per cent. of dextrose and that 95 per cent. alcohol dissolves 1·95 per cent. In the case of a leather, which, by water extraction, gave 10·19 per cent. of sugar, extraction with 95 per cent. alcohol gave 4·32 per cent., or 40 per cent. of the total sugar was extracted by alcohol, Similarly magnesium sulphate is soluble to the extent of

1·3 per cent., and therefore it is evident that the alcohol method of extraction is unreliable.—J. R. B.

Coagulum from gelatin-gum sols ond its analogy with casein. F. W. Tiebackx. Z. Chem. Ind. Kolloide, 1911, **8.** 238—239. (See this J., 1911, 561.)

THE coagulum can be rapidly prepared by adding sulphuric acid to a sol containing 0·5 per cent. of gelatin and 0·7 per cent. of gum till the liquid is = 0·003*N*. The coagulum is collected in a dish and warmed on the water bath. Two layers are formed, the lower of which can be cut easily when cold. It is best preserved under water. It is very similar to globulin or casein in its behaviour to electrolytes. The view is expressed that casein and other proteins may be adsorption-compounds, in which the components resemble one another closely in composition and properties.—H. E. P.

PATENT.

Waterproofing boot leather; Process for ——. F. Fölsch, Wernigerode a. H., Germany. Eng. Pat. 15,798, July 1, 1910.

SEE Fr. Pat. 417,811 of 1910; this J., 1911, 39.—T. F. B.

XVI.—SOILS; FERTILISERS.

Soils: Biochemical circulation of phosphate ion in ——. J. Stoklasa. Zentr. Bakt. u. Parasitenk., 1911, II. Abt., **29**, 385—519. Chem. Zentr., 1911, **1**, 1314—1317.

THE author deals first with the condition of inorganic phosphates in soils, with special reference to the circumstances under which they become soluble in water. A great deal of phosphorus, however, in fertile soils is in organic combination as phosphatides, phytins and nucleoproteins. The insoluble phosphates are attacked by carbon dioxide and organic acids secreted by micro-organisms, the resulting organic salts and soluble phosphates being then available as foodstuffs. The following figures are given for the amounts of carbon dioxide secreted in 24 hours by various organisms. Anaerobic: *Clostrydium butyricum* 0·511 grm. and *B. hartlebii* 0·27 grm. Aerobic: *Azotobacter chroococcum* 1·273 grm. and *B. mycoides* 0·213 grm. Fungi: *Aspergillus niger* 0·18 grm. and *Penicillium glaucum* 0·13 grm. Algae: *Nostoc commune* 0·055 grm. The co-operation which exists between autotrophic (self-feeding) and heterotrophic (saprophytic) organisms in the soil is not entirely explained by the death of the former providing the latter with assimilable carbohydrates. The autotrophic organisms always contain phosphatides, in which the heterotrophic ones find a suitable source of phosphorus. Lecithin for instance is attacked and part of the phosphorus is used by the heterotrophic organism itself, the rest being liberated as phosphoric acid and used by other organisms. The action of moisture and carbon dioxide ("weathering") on the mineral grains in the soil provides food for the algæ of the air, which produce humus and new organic matter. The algæ living in symbiosis with bacteria produce lichens, which after death increase the amount of cellulose and furfuroids, and provide a suitable medium for further bacterial growth. The bacterial action has an important effect in rendering the phosphates soluble, and the solution thus produced is quickly assimilated, particularly by nitrogen-fixing bacteria to which phosphoric acid is absolutely essential. In the action of other bacteria phosphorus also plays an important part. From the author's conclusions it appears that one of the principal functions of phosphorus in a soil, is its part in the production of new bacterial growth.—W. H. P.

Phosphoric acid; Fixation of —— by the organic matter of the soil. A. Petit. Comptes rend., 1911, **152**, 1317—1319.

EXPERIMENTS with a solution of monocalcium phosphate (0·141 grm. of phosphoric anhydride per 50 c.c.) showed that whilst a specimen of garden soil containing 54·6 per cent. of organic matter removed a considerable quantity of phosphoric acid from the solution, a forest soil equally rich in organic matter removed practically none. The humus substances extracted from the garden soil also removed practically no phosphoric acid from the solution, and the action of the soil was therefore probably due to the inorganic substances (calcium, aluminium, and iron compounds) present therein. In agreement with this view, it was found that the residue left after igniting the soil, so as to destroy organic matter, removed a much larger proportion of phosphoric acid from the solution than the unignited soil.—A. S.

Soil phosphates; Effect of ignition on solubility of ——. G. S. Fraps. J. Ind. Eng. Chem., 1911, **3**, 335.

THE method devised by Stewart (Bull. 145, Illinois Experiment Station) for the determination of organic phosphoric acid in soil is based upon the fact that a larger amount of this constituent can be extracted from the ignited than from the original soil by treatment with acid; Stewart assumes that the increase is due to organic phosphates which are rendered soluble by the ignition. In experiments upon soil phosphates the author has shown that, by ignition, wavellite, dufrenite and variscite are rendered almost completely soluble in 12 per cent. hydrochloric acid, while the amount of phosphoric acid extractable from these substances by $N/5$ nitric acid is increased tenfold. The author therefore concludes that methods based upon ignition are useless for the determination of organic phosphoric acid in soils.—W. E. F. P.

Nitrate and nitrite assimilation. O. Baudisch. Ber., 1911, **44**, 1009—1013.

PREVIOUS workers have left it undecided whether nitrate assimilation in plants is dependent on light. It is shown that a solution of potassium nitrate is slowly converted into nitrite in diffused daylight and that the latter in turn yields nitrosyl $>N{<}^{O}_{H}$, which may be compared to the aldehyde group in activity. When an aqueous solution of potassium nitrite containing excess of methyl alcohol is exposed to light, oxygen is first liberated, which oxidises the alcohol to formaldehyde, and this reacts with the nascent nitrosyl group giving formhydroxamic acid, HO·CH : N·OK. This was identified by means of the typical iron and copper acetate reactions. The illuminated solutions react alkaline and reduce Fehling solution and gold chloride. When exposure to light is prolonged, further reduction to ammonia and amines takes place. In the dark there is no reaction either in cold or hot solutions. Ethyl alcohol behaves similarly to methyl alcohol. Nitrates and nitrites are also directly reduced by aldehydes when illuminated, the action rapidly going beyond the hydroxamic acid stage. Carbohydrates behave similarly; carbon dioxide is eliminated in presence of lævulose. Phenols and naphthols also accelerate the reduction. It is considered that the assimilation of nitrate and nitrite in plants is dependent upon light.—E. F. A.

Ammonia and citric acid; Physical properties of aqueous solutions containing ——. R. A. Hall and J. M. Bell. J. Amer. Chem. Soc., 1911, **33**, 711—718.

IN determining the citrate-soluble phosphoric acid in fertilisers, the use of an "exactly neutral" solution of ammonium citrate is prescribed, but the official (Amer. Assoc. of Official Agric. Chemists) methods of determining the neutral point by means of colour indicators have given rise to many disputes, owing to the difficulty of obtaining a sharp colour change. The authors have made experiments with solutions of citric acid to which varying quantities of ammonia were added, and show that the neutral point can be ascertained by determinations of electrical conductivity or of density, the neutral solution exhibiting the maximum conductivity and maximum density. Also the presence of free ammonia in ammonium citrate solutions can be detected by shaking with chloroform, which dissolves a portion of the free base but not citric acid or ammonium citrate.—A. S.

Manganese and aluminium; Physiological importance of —— in the vegetable cell. J. Stoklasa. Comptes rend., 1911, **152**, 1340—1342.

Plants containing manganese, the importance of which in the vegetable cell has been demonstrated by Bertrand, always contain aluminium also. Experiments (water cultures and pot cultures) with soluble salts of the two metals on wheat, barley, rye, maize, etc., showed that growth was impeded by 0·1099 grm. of manganese or 0·0542 grm. of aluminium per litre of nutritive solution, but with 0·05493 grm. of manganese or 0·0271 grm. of aluminium, there was a considerable increase of yield. Still better yields were obtained in presence of 0·02747 grm. of manganese or 0·0136 grm. of aluminium, whilst when compounds of the two metals were applied together in these proportions, the increase of yield was remarkable. Larger quantities of both manganese and aluminium are fixed by the plants when they are used together than when either of them is used separately. The leaves of the plant contain a larger proportion of the metals than any other parts. The author states that good varieties of hops always contain more manganese and aluminium than inferior varieties, and that in Bohemia a mangano-superphosphate is used for improving the quality of hops. —A. S.

Patents.

Superphosphate chambers with mechanical discharging devices. H. P. C. Freudenthal. Fr. Pat. 422,875, Nov. 22, 1910.

In order to make the manufacture of superphosphate a continuous process, several superphosphate chambers, *e.g.*, four, are mounted on a turn-table, so that whilst the reaction is proceeding in two of the chambers, a fresh charge is being introduced into the third from above, and the finished product in the fourth is being broken and discharged by a suitable mechanical device operating from below.—A. S.

[Calcium] cyanamide; Process of manufacture of granular and inoffensive ——. L. Devaucelle. Fr. Pat. 423,072, Feb. 4, 1910.

Calcium cyanamide is mixed with a small quantity of an alkali or alkaline-earth silicate, aluminate, or silico-aluminate or with puzzuolana, cement (for instance, 5 parts to 100 parts of anhydrous calcium cyanamide), very hydraulic lime, or other material capable of rendering "hydraulic" the free lime present in the cyanamide, and the mixture is then hardened by slight hydration or by complete immersion in water, and ground so as to give a granular product. Or, calcium cyanamide is made from calcium carbide which has been prepared from limestone containing silica and alumina, or from limestone mixed with clay, and is hydrated and ground as before. The product, not being an impalpable powder, may be applied as a manure without annoyance to the operator. —F. Sodn.

XVII.—SUGARS; STARCHES; GUMS.

Sugar beet; Determination of "objectionable nitrogen" in the ——. G. Friedl. Österr.-Ungar. Zeits. Zuckerind. Landw., 1911, **40**, 274—284; Deutsche Zuckerind., 1911, **36**, 387. (See also this J., 1905, 808; 1906, 673.)

The author has previously (this J., 1910, 1122) confirmed Andrlik's opinion that there is a close relationship between the quotient of purity and the content in "objectionable nitrogen," and has further shown that the quality of the beet may be judged on the ground of its "objectionable nitrogen" content. Continuing his experiments on the colourimetric determination of this nitrogen value (see this J., 1910, 1123), it was found that Fehling's solution as the standard liquid is not reliable, and that organic dyestuffs give much more satisfactory results. These, however, are not used in the form of a solution, but incorporated with gelatin and painted on glass, thus forming a series of standard glasses, which are used in a Stammer colourimeter. In discussing the meaning of the term "objectionable nitrogen," it is pointed out that according to Andrlik the ammonia and amide nitrogen should be deducted, since neither reach the molasses stage of manufacture. This amount of ammonia and amide nitrogen, calculated on the beet, is, however, practically negligible according to the author; and he prefers to class as "objectionable" the nitrogen not precipitated by cupric hydroxide. It was observed that this method cannot be used in the case of siloed roots, since these often undergo decomposition, as the result of which other compounds capable of influencing the colour of the blue filtrate, and therefore the accuracy of the determination, are formed.—J. P. O.

Gum content; Abnormally high —— of cane juices, syrups, and molasses. J. J. Hazewinkel. Archief Suikerind., Nederl.-Ind., 1910, **18**, 44—45.

During a recent campaign in Java it was observed that false grain persistently formed whilst boiling both first and after-products, in spite of efforts in various directions to rectify matters. This irregularity was found to be due to the presence of an abnormally high gum content in the juices, the amount being so great that on heating some of the evaporated juice with a little acetic acid it immediately thickened, and on cooling, set to a solid mass. This gum had not been eliminated by clarification, but had passed into the syrups, and finally accumulated in the molasses. The amount of gum found in the molasses was nearly 8 per cent., and a high reducing sugar content, with a purity value as low as 24, were also observed. As to the cause of the trouble, it was established that *Leuconostoc* had in all probability not been concerned; but various facts, such as the unfavourable operation of the milling process, seemed to point to the working of more or less unripe cane. That this is the correct explanation seems to find confirmation in the observation that the irregularity in question, when it has occurred in previous campaigns, has always been more marked in wet than in dry seasons.—J. P. O.

Sugar-cane gum; Investigations on ——. J. J. Hazewinkel and L. G. L. Steuerwald. Archief Suikerind., Nederl.-Ind., 1911, **19**, 313—321. Intern. Sugar J., 1911, **13**, 284—285.

Recent experience has shown that the gums contained in cane juice are capable of exerting considerable influence upon the irregularities that may occur during the process of boiling (compare preceding abstract). As regards the determination of the gums, Hazewinkel has previously shown that the most convenient method for the sugar factory, that of precipitation with a mixture of acid and alcohol, is not reliable, the results varying considerably according to the relative amounts of sample, alcohol and especially of acid employed. It is now found that the greater the concentration of acid in the mixture, the less precipitate is formed, and that on treating the precipitate with acid a portion of it is dissolved, the composition of which varies with the concentration of the acid. This method of precipitation having proved unsatisfactory, the authors used the pentosan determination as a means of studying the behaviour of the gums throughout the process of manufacture. It was found that the pentosan content of the raw juice increases with the time lapsing between cutting and milling, an observation that would appear to bear out the assumption of a correlation between the freshness of the cane and the nature of the mill work. An examination of the methods of imbibition showed that hot water gives the same results as cold, so far as the pentosan content is concerned. Almost all the pentosans contained in the raw juice come from the second and third mill juices, practically none being present in the first; while all the pentosans in the syrups pass undecomposed into the molasses resulting from such syrup.—J. P. O.

Sulphurous acid in cane juice; Influence of non-sugar substances on the titration of —— by iodine. P. de Sornay. Intern. Sugar J., 1911, 13, 276—281. Bull Assoc. Chim. Sucr., 1911, 28, 624—629.

Although in beetroot juices the sulphurous acid content cannot be determined by direct titration with standard iodine, in cane juices this method gives reliable results. A number of experiments are described indicating that neither the organic non-sugars nor sucrose nor invert sugar have any appreciable influence on iodine under the conditions of the volumetric method. Distillation of the sulphited product, whether an atmosphere of carbon dioxide be used or if no precaution be taken to eliminate the air, gives very accurate results when the determination is completed by oxidising the sulphurous acid and precipitating as barium sulphate; but the author considers that the volumetric method is sufficiently exact for the routine work of the sugar factory. Sometimes sulphitation is controlled by alkalimetric titration; but whilst this method may be of use for comparative purposes, it cannot give an absolute indication of the amount of sulphur utilised, since it does not take into account the sulphur combined as sulphites. It is also shown that the percentage of the sulphur burnt that is utilised varies somewhat according to the sulphitation plant as follows: in the Quarez, 87·8 to 89·6 per cent.; using a sulphur box, 83·6 to 84·3 per cent.; and using the Giffard injector, 66·6 to 73·2 per cent.—J. P. O.

Sulphurous acid; Use of —— in the sugar factory. R. Bouchon. Bull Assoc. Chim. Sucr., 1911, 28, 705—718. (See also this J., 1911, 229.)

Continuous sulphitation, using liquid sulphur dioxide, can now be applied in the raw sugar factory with satisfactory results, both practically and economically. At the Nassandres factory, with a capacity of 700 to 800 tons of roots per day, the liquefied gas is stored in 2 reservoirs each holding 4 cb. m. After leaving the cylinders, the gas passes into a steam-jacketed expansion chamber, and from thence into the sulphitation tank, where, by means of suitably placed perforated discs, it is made to pass uniformly through the juice. Besides its convenience of use, liquid sulphur dioxide has the advantages that it contains no sulphuric acid and hence inversion of sucrose is avoided, and that it is utilised almost completely, none escaping into the atmosphere. Comparing costs, it is found that 50 kilos. of refined sulphur cost 10 fr. (8s.), and produce 100 kilos. of sulphur dioxide by the sulphur oven, whereas 100 kilos. of the liquid product cost about 24 fr. (19s.) It is, however, claimed that for 100 kilos. of sulphur dioxide produced by the combustion of 50 kilos. of sulphur in the oven, only 68·5 are utilised in the juice, giving a loss of 32 per cent., but that with the liquefied gas this loss is only 0·5 per cent. Taking this into account, the relative cost becomes 14·6 fr. (11s. 6d.) for sulphur oven gas, against 24 fr. (19s.) for the liquid product, while according to Claassen, who has used liquid sulphur dioxide for some years past at the Dormagen factory in Germany, the cost of sulphur dioxide in this form is M. 12 per 100 kilos. (6s. per cwt.) in 190 kilos. (37 cwt.) lots.—J. P. O.

Pauly apparatus; Further experiments with the ——. J. J. Hazewinkel. Mededeel. Proefstation Suikerind., Nederl.-Ind., No. 50. Intern. Sugar J., 1911, 13, 282.

In a previous contribution (this J., 1911, 564), the author has shown that the suspicion that decomposition, either of sucrose or of invert sugar, may occur while passing cane juice through the Pauly preheater is groundless, so far as steam pressures between 1·2 and 1·4 atmospheres are concerned. He has now found that this statement is true, also for pressures up to 2 atmospheres, and he concludes that "there need be no apprehension as to the general introduction of the Pauly apparatus into the Javan sugar industry, provided it be worked within the limits of temperature and pressure indicated."—J. P. O.

Carbonatation scums; Determination of sugar and of lime in ——. L. Lindet. Bull. Assoc. Chim. Sucr., 1911, 28, 776—778.

In the sugar factory it is important to know the amount of lime and especially of sugar present in the carbonatation scums. For the determination of the lime, a solution of sugar gives too low results, while for the sugar, if acetic acid be used to decompose the calcium sucrate, coloured solutions, which must be defecated before polarisation, are obtained. For carrying out the determination of both the sucrose and the lime in one operation, ammonium nitrate is generally used; but this, according to the author, is open to the objection that it does not liberate all the combined sugar that may be present in the scums. These errors, it is stated, may be obviated by the use of phenol, which rapidly decomposes all the calcium sucrate, and dissolves all the lime, giving a light-coloured solution, in which the sucrose may be determined by polarisation, and the lime by titration. Some figures are given indicating that this method yields more accurate results than when either a solution of sugar, acetic acid, or ammonium nitrate, are used.—J. P. O.

d-Glucose and d-galactose; Action of N/1 barium hydroxide on ——. F. W. Upson. Amer. Chem. J., 1911, 45, 458—479.

Contrary to Kiliani's view, it has been shown that the formation of saccharinic acids from hexoses can be effected by all alkaline hydroxides (cp. Nef, this J., 1908, 31; 1910, 1264); the ratio of the various saccharinic acids formed, however, varies greatly with the concentration of the alkali. By the action of 8 *N*-sodium hydroxide solution, Nef obtained considerable amounts of α- and β-*d*-dextrometasaccharinic acids (or their lactones) from *d*-glucose, and of α- and β-*d*-galactometasaccharinic acids from *d*-galactose, and he obtained α-and β-isosaccharins from both sugars by this treatment. The author has now investigated the action of *N*/1 barium hydroxide solution on *d*-galactose and *d*-glucose. The product obtained from *d*-galactose was found to contain α- and β-*d*-galactometasaccharins, though only in very small quantities; α-*d*-isosaccharin was also isolated, and the product doubtless contained the β-isomeride as well. The product from *d*-glucose was found to contain a small quantity of β-dextrometasaccharin, but no α-isomeride, or α- or β-*d*-isosaccharin was isolated though these compounds were certainly present. The author ascribes the difficulty of isolating the optically active C_6-saccharinic acids to the presence of relatively large amounts of optically inactive C_5- and C_6- saccharinic acids. The products, both from *d*-galactose and *d*-glucose, yielded relatively large quantities of *d*,*l*-lactic acid and *d*, *l*-1.3-dihydroxybutyric acid.
—L. E.

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—— Acidity of honey. Z. Nahr.- u. Genussm., **20**, 44.—A. S.

Sugars; Decomposition of —— by bacteria. J. Mendel. *See* XVIII.

Collodion membrane filter: Practical realisation of the —— for the sterilisation and purification of liquids. E. Fouard. *See* XIXB.

Fehling's solution. Rosenkranz. *See* XXIII.

Patent.

Starch; Process of preparing ——. F. Thörl. Harburg on Elbe, Germany. U.S. Pat. 990,929, May 2, 1911.

See Eng. Pat. 9931 of 1907; this J., 1907, 980.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Malt embryos; Composition of ——. K. Yoshimura. Biochem. Zeits., 1911, 31, 221—226.

The author has investigated the amino-compounds in malt embryos, and has isolated histidine, choline, and betaïne (the two latter compounds in quantities corresponding to about 0·02 and 0·06 per cent. respectively of the air-dry material), but has not found arginine, vernine, or asparagin. He has also examined malt embryos for sucrose, since, according to Grüss, the maltose formed in the germination of barley is taken up from the endosperm by the aleurone layer and there converted into sucrose which is taken up by the embryo. To this end, 200 grms. of air-dry malt embryos were extracted with 95 per cent. alcohol, the extract, after removal of the alcohol, was dissolved in water, purified with basic lead acetate, and filtered; the filtrate was freed from lead and evaporated to a syrup. The reducing sugar content of the syrup was determined before and after inversion, and the syrup was tested for sucrose by Jolles' method (this J., 1910, 1467). Maltose and invert sugar, but no sucrose, were found to be present. The author points out that the sucrose formed from the maltose may have undergone hydrolysis by a secondary reaction. Attempts to isolate inositol were unsuccessful.—L. E.

Yeast-juice; Beer ——. E. Kayser. Comptes rend., 1911, 152, 1279—1280.

It has previously been shown that manganese salts exert a favourable influence on alcoholic fermentation (cp. Kayser and Marchand, this J., 1907, 427, 479). The author now finds that manganese salts (phosphate and nitrate at concentrations of 0·1 and 0·09 per cent. respectively) exert a favourable action, comparable to that of monopotassium phosphate, on the fermenting power of the yeast liquor obtained by Lebedeff's process (this J., 1911, 147). The favourable effect is more pronounced when the manganese salt is added to the liquid used for maceration than when it is added to the filtrate subsequently obtained. With regard to the activity of the liquor obtained by Lebedeff's process, the state of the yeast just prior to drying, and the temperature of maceration, are of great importance. The author has obtained the most active liquors from beer yeast that had been allowed to stand for 35—40 hours at 25° C. prior to being dried.—L. E.

Yeast-juice; Alcoholic ferments of ——. *VI. Influence of arsenates and arsenites on the fermentation of the sugars by yeast-juice.* A. Harden and W. J. Young. Proc. Roy. Soc., 1911, B, 83, 451—475 (cp. this J., 1906, 490, 1111; 1908, 824; 1909, 1157; 1910, 711).

As with phosphate, addition of arsenate (sodium arsenate) accelerates the fermentation of sugars by yeast-juice. The action of the arsenate, however, differs from that of phosphate in that the enhanced rate of fermentation continues long after an equivalent quantity of carbon dioxide has been evolved, and the arsenic does not form an organic compound (*e.g.*, an analogue of a hexosephosphate), the arsenate remaining free throughout the fermentation. In presence of arsenate, the amounts of alcohol and carbon dioxide produced by the fermentation of dextrose with yeast-juice were found to be in the ratio 0·92, a value which agrees well with that previously found by similar methods for the normal fermentation of dextrose by yeast-juice. With addition of increasing quantities of arsenate, the acceleration in the rate of fermentation increases rapidly to a maximum and then decreases, at first rapidly and then more slowly; the total fermentation, which is very considerably increased by a suitable quantity of arsenate, depends on the concentration of arsenate employed, and may be more or less than that obtained in absence of arsenate. Addition of arsenate accelerates the fermentation of mannose by yeast-juice to about the same extent as that of dextrose, but, as in presence of phosphate (this J., 1909, 1157), lævulose is fermented much more rapidly, and the optimum concentration of arsenate is greater than with dextrose or mannose. The action of arsenate differs from that of phosphate, in that the former accelerates the action of the hexosephosphatase of the yeast-juice, and thus increases the supply of phosphate; and arsenate cannot replace phosphate in the fundamental reaction of alcoholic fermentation. Arsenate also accelerates the auto-fermentation of yeast-juice and the fermentation of glycogen; this is mainly due to an acceleration of the action of the diastatic enzyme of yeast-juice (glycogenase). The action of arsenites on the fermentation of sugar by yeast-juice is similar to, but less marked than that of arsenates, and both arsenate and arsenite inhibit fermentation completely when they are present in a high concentration. With a view to discovering if any other salts produce results in any way comparable with those produced by arsenates and arsenites, experiments have been made with the sulphate, orthovanadate, antimonate, tungstate, chromate, stannate, phosphite, and citrate of sodium, and with tartar emetic and zinc sulphate, but all the results were negative.—L. E.

Hexose phosphoric acid produced by expressed yeast juice; Composition of the ——. *I.* A. Harden and W. J. Young. Biochem. Zeits., 1911, 32, 173—176.

This paper summarises the points at issue between the authors, Iwanoff and Lebedeff.—J. H. L.

Hexose phosphoric acid produced by expressed yeast juice; Composition of the ——. *II.* W. J. Young. Biochem. Zeits., 1911, 32, 177—188 (compare Harden and Young, this J., 1910, 711).

In view of the statement of v. Lebedeff (this J., 1910, 1264), that the hexose phosphoric acid formed when zymase acts upon dextrose contains only one phosphoric acid residue, the author has re-investigated the matter and confirmed his earlier results. The barium salt has the formula, $C_6H_{10}O_4(PO_4Ba)_2$. When the acid is heated with phenylhydrazine in presence of acetic acid, one of the phosphoric acid residues is split off and a substance melting at 150°—153° C. is produced, which has the empirical formula assigned to it by v. Lebedeff, viz., $C_{24}H_{31}O_7N_8P$. It is the phenylhydrazine salt of the osazone, $H_2PO_4{\cdot}C_4H_5(OH)_3{\cdot}C(N_2H{\cdot}C_6H_5){\cdot}CH(N_2H{\cdot}C_6H_5)$, and is identical whether the hexose phosphoric acid is produced from dextrose, lævulose or mannose. No evidence could be found for the formation of the triosazone described by Iwanoff. The sodium and aniline salts of the hexosazone figured above were prepared by the author and analysed. When phenylhydrazine acts upon the hexose phosphoric acid in the cold, an unstable substance is produced, which is the salt of the base with a hydrazone of the acid, viz., $(C_6H_5N_2H_3{\cdot}H_2PO_4)_2C_6H_7(OH)_3{\cdot}N_2HC_6H_5$. On warming this compound with more phenylhydrazine, it is converted into the osazone salt mentioned above, one phosphoric acid residue being split off. The corresponding *p*-bromophenylhydrazone salt was also prepared and analysed. It is probable that in the hexose phosphoric acid one of the phosphoric acid groups is attached to a carbon atom adjacent to the carbonyl group. Since, moreover, lævulose is produced by the hydrolysis of the hexose phosphoric acid, the latter probably has the constitution represented by $H_2PO_4{\cdot}CH_2{\cdot}CO{\cdot}C_4H_8O_3(PO_4H_2)$.—J. H. L.

Yeast-fermentation without sugar. II. C. Neuberg and L. Tir. Biochem. Zeits., 1911, 32, 323—331 (compare Neuberg and Hildesheimer, this J., 1911, 379).

It has already been shown (*loc. cit.*) that solutions of the salts of pyruvic acid are fermented by yeast in the absence of sugar. The investigation has now been extended to a large number of other organic compounds, with positive results. The tests were carried out at 30°—34° C. in Schrötter tubes. One grm. of the yeast was shaken with 15 c.c. of a 1—3 per cent. solution of the substance under examination, and the suspension was transferred to the tube, which held 10—11 c.c. The volume of carbon dioxide evolved was measured at the end of 24 and 36 hours. Top-fermentation yeasts A, B, M, H. and XII., and bottom yeast D from the *Institut für Gärungsgewerbe* were used with each substance, and also the yeast preparations "Zymin" and "Hefanol." From the potassium salt of pyruvic acid 10—11 c.c. of gas were produced in 36 hours by each of the culture yeasts. In the case of the other substances, however, the volume rarely exceeded 5 c.c. and often varied considerably with the different yeasts. The following substances fermented with one or more of the yeast races:—salts of formic, acetic, butyric, glyoxylic, lactic, pyruvic, *l*,β-hydroxybutyric, malic, *d*,*l*-glyceric, *d*-gluconic, pyrotartaric, oxalic, maleic, fumaric, succinic, *d*-tartaric, *d*-saccharic, tricarballylic, aconitic, citric, aspartic, and glycerophosphoric acids; ethylene-glycol, glycerol, *d*,*l*-alanine, silk fibroin peptone and lecithin. Oxalacetic acid fermented as readily as sugar with yeast or "Hefanol." In all cases the gas evolved consisted of carbon dioxide. The process is not inseparable from the life of the yeast for it is effected by "Zymin" and "Hefanol" in presence of toluene. It is probably closely connected with the phenomena of respiration, of which alcoholic fermentation is perhaps a special case. It is noteworthy that the compounds found capable of fermentation either occur tolerably abundantly in natural fermentation media, such as fruit juices, or stand closely related to substances present in yeast or produced by it. The readiness with which pyruvic and oxalacetic acids are attacked by yeast indicates that they probably play an important part in alcoholic fermentation.—J. H. L.

Sugars; Decomposition of —— by bacteria. J. Mendel. Zentr. Bakt. u. Parasit., 1911, II. Abt. **29**, 290—330. Chem. Zentr., 1911, **1**, 1371.

The author has investigated the action of the following organisms on solutions of dextrose, maltose, sucrose and lactose:—*Bact. vulgare* (*Proteus vulgaris*), *B. cloacae* (Jordan), *B. lactis aerogenes* (Escherich), *B. Fitzianus* and *B. coli commune.* Fermentation was found to proceed best in sugar solutions of 6—10 per cent.; the maximum concentration at which it occurred ranged in the different cases from 30 to 50 per cent. The duration of fermentation varied, according to the organism used and the concentration of the sugar, from 5 days with dilute solutions to 16 days with strong solutions. In no case was the whole of the sugar fermented. The fermentation stops, not in consequence of the death of the organism, but probably owing to the inhibitive action of the acids produced. The products of fermentation included in all cases alcohol, acetone, and lactic and acetic acids. The nature and amount of the acids, the ratio of volatile to non-volatile acids, and the quantity and composition of the gas produced during fermentation were all found to vary with the nature of the organism and the nature and concentration of the sugar. *B. coli*, *B. Fitzianus* and *B. lactis aerogenes* produced, as compared with *B. vulgare* and *B. cloacae*, a relatively large amount of acid. In the case of lactose solutions, the quantity of volatile acid increased and that of fixed acid diminished as the concentration of the sugar was increased. The proportion of hydrogen to carbon dioxide in the gaseous products varied with the conditions. In no case was methane detected. The decomposing action of bacteria on sugars is to be attributed to enzymes which may be characterised in a similar manner to those of yeast. Among the decomposition-products of peptone, when acted upon by the bacteria named, hydrogen sulphide and indole were detected. The former is produced only by *B. vulgare*, but indole is formed by most of the other organisms, especially in maltose-peptone solutions. When the concentration of the sugar is high the activity of the bacteria seems to be directed towards the destruction of the nitrogenous matter present rather than towards that of the sugar.—J. H. L.

Sulphurous acid in vinification; Use of ——. J. Ogier and Richaud. Ann. Falsif., 1911, **4**, 197—214.

Having considered the results of many investigations on the physiological action of sulphurous acid, the Superior Council of Hygiene (France) is of the opinion that the maximum quantity of free sulphurous acid permissible in wine may be raised to 100 mgrms. per litre, and the maximum for the combined sulphurous acid to 350 mgrms. per litre, or a total of 450 mgrms. of sulphurous acid per litre, with an allowance of 10 per cent.—W. P. S.

Tartaric acid; Determination of —— in ciders, perrys, vinegars, etc. A. Kling and L. Gobert. Bull. Assoc. Chim. Sucr., 1911, **28**, 760—767.

With slightly acid products, containing a relatively large amount of tartaric acid, such as wine, Kling has previously shown (this J., 1910, 451) that reliable results are obtained by precipitating the acid as calcium racemate, and titrating a solution of this with potassium permanganate. On now applying this method to substances which are strongly acid, but contain tartaric acid in small amount, such as vinegar, cider, and perry, fully satisfactory results were again obtained, whereas those found by methods generally used were frequently much too low. It is emphasised that in using the racemate method it is very necessary to use only *l*-tartrate, and for purifying the commercial product from the *d*-compound the following procedure has been found convenient: 20 grms. of ammonium *l*-bitartrate are dissolved in 900 c.c. of water; 20 c.c. of this are diluted to 200 c.c. with water, and to this liquid 10 c.c. of the solution A of calcium acetate (*loc. cit.*) added. After half an hour, the precipitate is filtered off, washed, dried, and calcined, and from the weight of residue the amount of calcium acetate, which should be added to the remaining 880 c.c. to separate all the *d*-tartaric acid, is calculated. This addition having been made, the liquid is allowed to stand for 12 hours, filtered and diluted to a litre, a little formaldehyde being added as preservative. This constitutes the solution A (*loc. cit.*).—J. P. O.

Collodion membrane filter for the sterilisation and purification of liquids. Fouard. *See* XIXb.

Patents.

Brewers' wort; Preparation of —— [Sparging apparatus]. R. Hoffmann, Ortelsburg, Germany. Eng. Pat. 3245, Feb. 8, 1911.

A dish or plate is suspended by means of floats in the wort so that the edge of the dish is about 5 mm. below the surface of the liquid. The sparging water is conducted through a pipe to the centre of the dish and overflows from the latter into the wort, a number of concentric rings or the like being provided on the surface of the dish in order to ensure a uniform distribution of the water.
—W. P. S.

Alcohol and nourishing food for animals from potatoes; Manufacture of ——. C. Steffen, jun., Vienna. Eng. Pat. 9980, April 23, 1910. Under Int. Conv., April 26, 1909.

See Fr. Pat. 415,160 of 1910; this J., 1910, 1267.—T.F.B.

Malt grist for brewing purposes; Process and apparatus for producing ——. W. Reinhardt, Bochum, Germany. Eng. Pat. 27,489, Nov. 25, 1910. Under Int. Conv., Dec. 3, 1909. Addition to Eng. Pat. 13,108 of 1910, dated May 29, 1909.

See Addition of Nov. 16, 1910, to Fr. Pat. 416,512 of 1910; this J., 1911, 567.—T. F. B.

XIXa.—FOODS.

Milk; Original acidity of ——. Bordas and Touplain. Comptes rend., 1911, **152**, 1274—1276.

Milk is alkaline to methyl orange, amphoteric towards litmus, and acid to phenolphthalein; the authors have used phenolphthalein as being the most suitable indicator for studying the reaction of milk. It is shown that the original acidity of a milk is due exclusively to the free casein that it contains: the discordant results obtained by other workers have been due to the use of unsuitable indicators. When lactic fermentation sets in, the increase in the acidity of the milk is due, in the first place, to liberation of casein from calcium caseinate and to conversion of dicalcium phosphate into the monocalcium salt; it is only after acting on these salts, that the lactic acid affects methyl orange.—L. E.

Rice as food. Investigation of the nitrogen- and phosphoric acid-metabolism consequent on diets of rice with other foods. H. Aron and F. Hocson. Biochem. Zeits., 1911, **32**. 189—203.

In preparing rice for human consumption the husk is always removed, and the grain usually undergoes a further milling which removes the pericarp and subcortical layers more or less completely. As carried out in the hand-mills of the natives of rice-growing countries, this milling is imperfect and the product is generally brownish in colour, whereas the rice from modern machine-mills is quite white. The portions removed during milling contain a higher proportion of cellulose, fat and ash, than the remainder of the grain, and indeed the extent to which this process has been carried can be ascertained from the phosphoric acid-content of the product. Thus rice from which only the husk has been removed contains 0·7—0·8 per cent. of phosphoric acid (P_2O_5): undermilled rice contains 0·4—0·6, and overmilled rice 0·15—0·4 per cent. The nitrogen content of the grain is small (1—1·6 per cent.) and only slightly diminished by milling. Experiments described by the author indicate that rice alone provides insufficient nitrogen for the needs of the human body. A mixed diet of rice and fish (or flesh) is satisfactory provided the rice has not been rendered too poor in phosphorus by excessive milling.—J. H. L.

Shrewsbury and Knapp's method of determining cocoanut oil. Ross and others. *See* XII.

Patents.

Sugared cakes for feeding cattle, and process for manufacturing them. J. E. B. Fabre, Rang-du-Fliers, France. Eng. Pat. 9987, April 25, 1910.

Molasses or sugar residues are concentrated to a density of 95°—98° Brix, and then mixed thoroughly with dried beetroot slices, grains, distillery refuse, or the like. The pulp obtained is pressed into moulds, and the resulting cakes are further dried. (Reference is directed to Eng. Pats. 14,662 of 1905, 23,346 of 1906, 4850 of 1907, and 18,773 of 1909; this J., 1909, 1268).—W. P. S.

Centrifugal emulsors. E. W. Richmond and R. A. Lister and Co., Ltd., Dursley. Eng. Pat. 13,328, June 1, 1910.

A centrifugal emulsifier for mixing fats with separated milk comprises a double-chambered supply tank for milk and fat adapted to be fitted into the top of a cream separator, and a turbine device for effecting the emulsion interchangeable with the cream separator bowl. The milk enters the smaller of the supply tanks through a valve controlled by a float therein and flows freely into the turbine, while the supply of fat is regulated by a hand-operated valve. The rotor of the turbine has a number of circular ribs with slots cut alternately so that the liquid is churned as much as possible.—H. H.

Flour; Milling of ——. A. Rollason, Long Eaton, Derbyshire. Eng. Pat. 19,149, Aug. 15, 1910.

Air, in which the quantity of moisture has been reduced to less than 3·5 grains per cb. ft., is circulated through the mill so that it may be brought into intimate contact with the grain, the milling machinery, and other appliances, during the whole of the milling process. It is claimed that the quantity of flour milled is thus considerably increased.—W. P. S.

Milk; Drying ——. J. R. Hatmaker, Paris. Reissue No. 13,232, dated May 2, 1911, of U.S. Pat. 920,952, May 11, 1909.

See Fr. Pat. 366,751 of 1906; this J., 1906, 1113.—T. F. B.

XIXb—WATER PURIFICATION; SANITATION.

Vitiation of the atmosphere of enclosed spaces: Method for measuring the degree of ——. H. Henriet and M. Bouyssy. Comptes rend., 1911. **152**. 1180—1181.

A determination of the quantity of reducing substances in the atmosphere of a room or other enclosed space gives a measure of the extent to which the air has been vitiated. In the method proposed for this purpose, these reducing substances are condensed together with the water present in the air by means of a cylindro-conical vessel having a capacity of 3 litres; this vessel contains a freezing mixture and the moisture in the atmosphere is condensed and frozen on the outer surface of the cylinder. On removing the freezing-mixture, the ice on the outer surface of the cylinder melts and the resulting water is collected. The volume of air from which a given weight of water is condensed, may be calculated from the formula: $v=\frac{m(1+at)}{ad}\cdot\frac{76}{f}$ or, corrected to 0° C. and 760 mm. pressure, $v=\frac{1}{ad}\cdot\frac{mH}{f}=1{\cdot}243\frac{mH}{f}$, where v is the volume of moist air at t° under a pressure H, m the weight of the moisture, a the weight of 1 c.c. of air, d the density of the moisture and f its pressure. Five grms. of the condensed water are boiled for 5 minutes with 10 c.c. of a solution containing 0·316 grm. of potassium permanganate and 0·425 grm. of chromic acid (CrO_3) per litre. After cooling, 10 c.c. of a solution of ferrous ammonium sulphate and 10 c.c. of 66 per cent. sulphuric acid are added, and the mixture is titrated with a $N/500$ solution of permanganate. The difference between the amounts of permanganate consumed in this experiment and in a control experiment is a measure of the reducing substances present in the condensed water. The results may be expressed in mgrms. of oxygen per 100 cb. metres of air. The following results were obtained on the examination of the atmosphere at different places:—Open air (park), 1; open air (street), 10; printing office, 13; badly ventilated office, 14; badly ventilated lobby, 17; dressmakers' room, 21. The latter room had a capacity of 104 cb. metres, 20 people were at work, and, in order to render the vitiation as great as possible for the purpose of the experiment, the windows had not been opened for 24 hours.—W. P. S.

Sewage; Purification of —— *by the soil and by bacteria beds.* A. Müntz and E. Lainé. Comptes rend., 1911, **152**, 1204—1208.

The two modes of purification of sewage by irrigation over land and by bacteria beds are generally regarded as being identical, except that the action is more intense in the latter, a small area of beds producing the same result as a large area of land. In a recent paper (this J., 1911, 505), the authors showed that in bacteria beds it is the direct combustion of the organic matter by organisms which plays the chief part in the purification, and nitrification holds only a secondary place. The present paper contains the results of a similar investigation with respect to the purification by irrigation over land. The investigation was confined to the transformation of the compounds of nitrogen. A large galvanised tank, one metre deep, placed in the open air, was filled with a known weight of suitable permeable soil. The sewage was applied at the same rate as it would be in agricultural practice for six and a half months. The sewage and the effluent were analysed continuously, as also the soil before and after the experiment. The balance of the nitrogen was found to result in a loss of 1·5 per cent. of the total applied and present in the soil; whereas, in another sample of the same soil to which sewage was not applied, there was neither loss nor gain, including the natural drainage. This shows that it is not the soil which parts with its nitrogen in the state of gas, but the sewage applied thereto. If the loss is calculated on the nitrogen in the sewage applied, it amounts to 16 per cent., as compared with 60 per cent. in the case of bacteria beds, as previously found. There is thus considerable difference in the two methods of purification.

In the bacteria bed, the action of the organisms which liberate gaseous nitrogen predominates, whereas in the land, the action of the nitrifying organisms predominates. —J. H. J.

Diphenylamine test for nitrous and nitric acids; A modification of the ——. W. A. Withers and B. J. Ray. J. Amer. Chem. Soc., 1911. 33. 708—711.

After pointing out that the manner of carrying out the diphenylamine test is of considerable importance, the authors recommend the following mode of procedure, in which some of the features of modifications proposed previously are combined. The reagent is prepared by dissolving 700 mgrms. of diphenylamine in a mixture of 60 c.c. of concentrated sulphuric acid and 28·8 c.c. of distilled water, cooling the solution, and then adding slowly 11·3 c.c. of hydrochloric acid of sp. gr. 1·19. After standing overnight some of the diphenylamine should separate, showing that the solution is saturated. In making a test, 1 c.c. of the liquid under examination is mixed thoroughly with 1 drop of the diphenylamine reagent, and then 2 c.c. of concentrated sulphuric acid are added from a pipette, so that two layers are formed. The whole is agitated gently so as to cause a slight mixing of the liquids at the plane of contact, and then kept at 40° C. for 15 or 20 minutes. It is stated that in this way 1 part of nitrite nitrogen in 25 millions or 1 part of nitrate nitrogen in 35 millions can be detected, whilst, by heating at 40° C. for 1 hour, the delicacy is increased to 1 part in 32 millions or 1 part in 44 millions respectively.—A. S.

Collodion membrane filter; Practical realisation of the —— for the sterilisation and purification of liquids. E. Fouard. Bull. Assoc. Chim. Sucr., 1911, 28, 756—759.

Hitherto the fragility of the collodion membrane filter, first introduced into bacteriological technique by Roux and Salembeni in 1907, has somewhat restricted its use, since the rate of filtration is very low, and the membrane is incapable of resisting a greater pressure than 40 or 50 cm. of water. Now, however, by dipping wire gauze, preferably in the form of a cylinder, into collodion solution the author has obtained a filter of great strength, with which he has carried out a number of experiments. Using a filter of 150 sq. cm. surface, made from collodion solution containing 5 per cent. of nitrocellulose, and a pressure of 3 atmos., it was found possible from Seine water to obtain 12 litres of absolutely sterile liquid in 24 hours. Diffusion juice, which had been tempered with 1 per cent. of lime, and afterwards neutralised, when passed through the collodion filter at the rate of 225 c.c. per hour, with a pressure of 2 atmos., yielded a completely decolourised solution. On analysing this filtered diffusion juice, it was found that the protein and pectic matters had been entirely separated, and it is suggested that in this way it would be possible to prepare samples of juice for polarimetric examination, without employing the chemical methods of defecation now in use. As regards the technical application of the collodion filter in the sugar house, it is pointed out that if practical it would obviate the processes of liming and carbonatation, the greater part of the mineral matter being precipitated by the addition of the suitable amount of calcium carbonate. In other industries, such as in the preparation of fine wines, particularly champagne, it might be possible to replace the long and delicate operation of clarification by filtration through collodion, a sterile liquid being thus obtained, suitable for inoculation with any desired yeast.—J. P. O.

Fungicide; Colloidal copper soap as a ——. V. Vermorel and E. Dantony. Comptes rend., 1911, 152, 1263—1265.

A solution of 500 grms. of copper sulphate in 50 litres of water is poured into a solution of 2000 grms. of soap (free from alkali) in 50 litres of water. A greenish-blue opaque liquid is thus obtained which has a surface tension as low as that of solutions of alkali soaps, and which moistens the surface of grapes like alcohol. After dialysis, the colloidal copper soaps obtained by the authors are precipitated by the salts of polyvalent metals, and especially by aluminium salts; addition of a stable colloid of the same electrical sign (*e.g.*, 0·1 per cent. of gelatin) renders the soap sufficiently stable to resist this precipitating action within the limits of practical conditions. The prescription given above applies to rain-water; in the case of water charged with calcium salts, a larger quantity of soap should be used. If hot solutions are used in the preparation, a more concentrated copper soap may be obtained; on cooling, the particles of copper soap enveloped in alkali soap are precipitated; this precipitate, dried and ground, dissolves again in hot water, with the production of a fresh colloidal solution; hence, should experiments on the large scale prove that colloidal copper soaps are efficacious fungicides, the preparation can be supplied in a convenient form. White soaps are suitable for making the copper soap; they should be as rich as possible in sodium oleate and should not contain any excess of sodium carbonate or of alkaline hydroxides and should be free from stearate. —L. E.

Pathogenic properties of the gases discharged by the exhaust pipe of gas engines. Delépine. *See* 11a.

Patents.

Water purification apparatus. C. Schmidt, Munich, Germany. Eng. Pat. 850, Jan. 12, 1910. Under Int. Conv., Jan. 12, 1909.

Powdered reagents are placed in a tank or trough, provided with a central horizontal shaft bearing arms and blades set at a suitable angle. This shaft is rotated by means of a water-wheel actuated by the water to be treated, and the blades cause the powder to be conveyed towards one end of the tank where it is discharged through an opening into a suitable mixing device, and thence on to an inclined plate where it mixes with the water. Arrangements are provided for regulating the quantity of powder discharged from the reagent tank.—W. P. S.

Liquids; Apparatus for the treatment of —— by means of ultra-violet rays. V. Henri and A. Helbronner, Paris, and M. von Recklinghausen, Bas Meudon, France. Eng. Pat. 12,947, May 27, 1910.

The liquid is subjected in the form of a thin layer on the surface of a rotating cylinder to the action of rays emitted by a mercury vapour lamp situated close to a window in the outer casing which encloses the cylinder, or the lamp may be placed inside the cylinder if the latter be constructed of material which is permeable by ultra-violet rays. In another form of the apparatus, the lamp is situated near an open end of the cylinder and reflecting surfaces are arranged so as to direct the rays to the periphery of the cylinder. An endless belt moving across the periphery of the cylinder, or a siphon arrangement, may be employed for removing or periodically washing secondary products from the cylinder, the liquid being removed by a scraper and secondary roller, or by means of a jet of air.—W. P. S.

Bacteria in water supply systems; Apparatus for destroying ——. V. Henri, A. Helbronner, and M. von Recklinghausen, Paris. Eng. Pat. 25,882, May 5, 1910.

In sterilising water by means of ultra-violet rays it is essential, in order to avoid waste of energy, to regulate the duration of exposure of each part of the current of water according to its distance from the source of the rays. The devices described in Eng. Pat. 1805 of 1910 (this J., 1911, 305) may be employed for this purpose; the current of water flowing through a channel and under a lamp emitting ultra-violet rays may thus be regulated so that the liquid immediately under the lamp flows more quickly than that at the sides of the channel.—W. P. S.

Sterilisation of liquids, gases, and other bodies; Process and apparatus for the integral ——. A. L. Billon-Daguerre, Asnières, France. Eng. Pat. 2735 of 1911, date of appl., July 7, 1910.

A lamp capable of emitting ultra-violet rays, or other rays which are destructive to life, is arranged in a tank containing the liquid to be sterilised; the outlet of the tank consists of a thick-walled tube the end of which is placed close to the wall of the tank, so that the liquid, as it is withdrawn from the tank, passes in the form of a thin layer between the lamp and the end of the tube.—W. P. S.

Formaldehyde; Process for the evolution of —— together with water vapour. K. A. Lingner. Ger. Pat. 223,651, Nov. 25, 1909.

Oxidising agents, which, without the application of heat, have no action on formaldehyde, are caused to act, in presence of water and formaldehyde, or compounds capable of yielding formaldehyde, on easily oxidisable substances, especially finely powdered metals or mixtures of metals. —A. S.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Quinidine; Transformation of —— by sulphuric acid. M. Pfannl. Monatsh. Chem., 1911, **32**, 241—255.

When quinidine (conquinine) is heated to 100° C. with 66 per cent. sulphuric acid for two hours, about 16·5 per cent. is sulphonated, 26 per cent. remains unchanged, and 54 per cent. is converted into isoquinidine (isoconquinine). No other substances appear to be formed and the action is not reversible. Isoquinidine, $C_{20}H_{24}N_2O_2$, melts at 142° C., and has $[\alpha]_D=-9^\circ$ in 97 per cent. alcohol. The hydriodide is 4·6 times more soluble in water at 30° C. than quinidine hydriodide.—F. Shdn.

Quinidine and cinchonidine; Transformation of —— by sulphuric acid. F. Paneth. Monatsh. Chem., 1911, **32**, 257—274.

Quinidine was heated for 9 hours at 100° C. with 66 per cent. sulphuric acid (see preceding abstract). The amount of isoquinidine produced was about the same, but there was rather more sulphonation. When concentrated sulphuric acid was used, at either the ordinary temperature or at 75° C., there was no formation of isoquinidine, but the principal products were sulphonic acids. Cinchonidine was heated with 66 per cent. sulphuric acid to 100° C. for two hours. There was some sulphonation, but the chief product was isocinchonidine, $C_{19}H_{22}N_2O$, crystallising from alcohol in colourless rhombic leaflets with truncated corners. It melts at 235·5° C. (corr.), and has $[\alpha]_D=-128^\circ$ in a mixture of chloroform and alcohol. The hydriodide melts at 225° C., and has $[\alpha]_D=-58^\circ$ in a mixture of alcohol and chloroform.—F. Shdn.

Hydrastine content of fluid extract of hydrastis; Determination of the real ——. A. W. van der Haar. Pharm. Weekblad, 1911, 329. Z. Allgem. österr. Apoth.-Ver. 1911, **49**, 211.

The method for the determination of hydrastine in fluid extracts described in the Dutch Pharmacopœia, 4th Ed., is inaccurate in some respects. The following method as used by the author gives consistently good results. 10 grms. of the extract are boiled in a large flask with 20 c.c. of water till the weight is 10—11 grms.; 1·5 c.c. of hydrochloric acid are added, and, after cooling, water is added till the total weight is 20 grms., and the whole filtered after shaking with 1 grm. of powdered talc. 10 c.c. of the filtrate are shaken for a minute in a 100 c.c. flask with 4 c.c. of ammonia and 25 c.c. of ether, 25 c.c. of light petroleum and 1·5 grm. of powdered tragacanth are then added, and the whole is vigorously shaken till the liquid becomes clear. 40 c.c. of the liquid are evaporated and the residue dried till of constant weight; it should weigh at least 80 mgrms. The porportion of hydrastine in this residue is very nearly and constantly one-tenth.—F. Shdn.

Digitalis leaves; Glucosides of ——. F. Kraft. Schweiz. Woch. Chem. Pharm., 1911, **49**, 161—165, 173—176.

Although a physiologically active glucoside, soluble in water, "digitalein," has long been known, and a number of other glucosidal substances have been described as belonging to the "digitalein group," no precise data concerning any of these are available. The author has, therefore, reinvestigated the subject. A glucoside of definite composition and crystalline in the hydrated state, has been isolated, and named gitalin. It was obtained from the cold aqueous extract of digitalis leaves, previously purified by means of lead acetate, freed from excess of lead, and concentrated, by shaking out with chloroform. The chloroform extract was shaken with anhydrous sodium carbonate and anhydrous sodium sulphate to remove acids and water, and the glucoside precipitated, in the anhydrous condition, by adding light petroleum spirit to the chloroform solution. In this condition it forms a white neutral powder, permanent in the air; m. pt., 150°—155° C.; soluble in 600 parts of cold water, and in all proportions in chloroform. The solutions in water and in ether soon undergo decomposition, on standing, and at once on warming, with the formation of a substance insoluble in water. When the amorphous anhydrous glucoside is dissolved in 1·5 parts of alcohol at the ordinary temperature, and the solution is treated with 0·75 part of water, and shaken, when the whole assumes the form of a crystalline magma. The crystalline hydrate thus formed is much less soluble, 1 : 3000 in water. It melts, at 175° C. in a fine capillary tube; and at 150° C. when dehydrated. When alcoholic or acetone solutions of gitalin are allowed to stand for some hours, an insoluble gelatinous precipitate of anhydrogitalin is formed. When this is freed from gitalin, it forms crystals, m.pt. 255° C. Gitalin itself is not hydrolysed on boiling with alcohol, or with water. Anhydrogitalin, on the other hand, is readily hydrolysed, forming anhydrogitaligenin, crystallising in flat plates, m. pt. 119° C., and two sugars. One of the latter is Kiliani's crystalline digitoxose; the other is amorphous. The various so-called digitoxins of trade are largely composed of gitalin, either in the amorphous or in the less soluble crystalline condition. The nature of these digitoxins, of "*digitalinum verum*," of digetonin, and of digitalis saponins are also briefly discussed.—J. O. B.

Cantharidin; Determination of —— in tincture, oil, and plaster of cantharides. R. Gaze. Apoth.-Zeit., 1911, **26**, 332.

Tincture.—Fifty grms. of the tincture, 25 grms. of water, and 1 c.c. of sodium carbonate solution (1 : 2), are evaporated together to dryness on the water bath. The residue is taken up with 10 c.c. of water, treated with 2 c.c. of hydrochloric acid (1 : 4), and shaken out with 10 c.c. of chloroform, which has been used previously to rinse out the flask. After separation, the chloroform is drawn off, and the acid aqueous liquid is again shaken out with 5, 5, and 5 c.c. of chloroform in succession. The chloroform extract is evaporated by a gentle warmth, the last traces of solvent being blown off with a bellows. After standing for 12 hours, the air-dry residue is treated once with 10 c.c., then four times successively with 5 c.c. of light petroleum spirit. These petroleum spirit washings are passed through a small filter. The air-dry residue and this filter are then washed, first with 10 c.c. of water containing a drop of ammonium carbonate solution, then with pure water, and dried at 50° C. The dry residue is dissolved in a little acetone, and passed through the dry filter, into a small tared flask. The solvent is evaporated off at a gentle heat by the aid of a current of air, and the brownish-yellow residue is dried, first at 50° C. and finally in the water oven, till of constant weight. The average yield is 0·0684 grm. of cantharidin from 100 grms. of tincture, representing 10 grms. of cantharides. The cantharides contain, as an average, 0·1079 grm. of cantharidin in 10 grms. The marc left, after making the tincture, was found to contain 0·041 grms. of cantharidin in 10 grms. The tincture therefore contains only about three-fifths of the total cantharidin present in the drug.

Oil.—Twenty grms. of the oil, 40 grms. of benzene, 1 c.c. of 25 per cent. hydrochloric acid, and 10 c.c. of water, are shaken together frequently in the course of half an hour. Then 20 c.c. more of water and 5 c.c. of sodium carbonate solution (1 : 2), are added, and the mixture is thoroughly shaken for 2 minutes, and then gently warmed to facilitate separation. When this occurs, the alkaline aqueous liquid is drawn off and the benzene residue is again shaken out with another 5 c.c. of the sodium carbonate solution and 20 c.c. of water. When this has separated and been drawn off, a further washing with 25 c.c. of water is performed. The aqueous portion is evaporated to dryness, the dry residue is taken up with 20 c.c. of water and filtered through a small filter, containing a little dry sand. After washing the filter with a little water, the filtrate is rendered acid with hydrochloric acid and shaken out with four successive quantities of 5 c.c. of chloroform. The process is then completed as above. About one-third of the total cantharidin present in the drug appears to be taken into solution by the oil. The above quantity of oil yielded 0·0194 grm. of cantharidin.

Plaster.—The determination of cantharidin in the plaster is not yet satisfactorily worked out. The final product which should be cantharidin is accompanied by so much waxy impurity as to render the results worthless quantitatively.—J. O. B.

Bryony root ; Constituents of ——. F. B. Power and C. W. Moore. Chem. Soc. Proc., 1911, **27**, 118—119.

The freshly collected roots of *Bryonia dioica*, Linné, were found to contain an enzyme, which was obtained in the form of a light brown powder. This product slowly hydrolysed the glucosidic constituent of the root, and also effected the hydrolysis of amygdalin and salicin. An alcoholic extract of the root, when distilled in steam, yielded a small amount of a pale yellow essential oil. From the portion of the extract which was soluble in water, and contained a quantity of sugar, there were isolated : (1) a colourless, neutral substance (m. p. 220°—222° C.), which appears to possess the formula, $C_{20}H_{30}O_5$, and has $[a]_D=+58·6°$; (2) an amorphous glucosidic product, having a bitter taste, which, on hydrolysis, yielded a brown resin and a sugar, from which *d*-phenylglucosazone (m. p. 208°—210° C.) was prepared ; (3) an amorphous alkaloidal principle, possessing an intensely bitter taste, which was apparently incapable of forming any crystalline salt. The portion of extract which was insoluble in water consisted of a dark brown, viscid resin, amounting to about 2 per cent. of the weight of dried root employed. From this material the following compounds were isolated : (1) a phytosterol, $C_{27}H_{46}O$ (m. p. 137° C.), which was optically inactive ; (2) a new dihydric alcohol, *bryonol*, $C_{22}H_{34}O_2(OH)_2$, melting at 210°—212° C., and yielding a diacetyl derivative, melting at 152° C. Bryonol belongs to a group of dihydric alcohols, possessing the general formula $C_nH_{2n-8}O_4$, which comprises the following additional compounds : ipurganol, $C_{21}H_{32}O_2(OH)_2$: grindelol, $C_{23}H_{36}O_2(OH)_2$; and cucurbitol, $C_{24}H_{38}O_2(OH)_2$; (3) oleic, linolic, palmitic, and stearic acids. The activity of the root appears to reside chiefly in its resinous and alkaloidal constituents, and the so-called "bryonin" of previous investigators has been shown to consist of a complex mixture, which was not entirely glucosidic.

Scopoletin ; Constitution of ——. C. W. Moore. Chem. Soc. Proc., 1911, **27**, 119—120.

Scopoletin, a fluorescent substance obtained from *Scopolia japonica* and several other plants, has been shown to be 4-hydroxy-5-methoxycoumarin, since by prolonged boiling with aqueous potassium hydroxide it is converted into 2 : 4-dihydroxyanisole. When, however, the alkali hydroxide is allowed to act for a few minutes only on scopoletin, 2 : 4-dihydroxy-5-methoxycinnamic acid is formed.

Fagara xanthoxyloides, Lam. [*Kelenmau*] ; *Constituents of* ——. H. Priess. Ber. deuts. Pharm. Ges., 1911, **21**, 227—267.

The bark of the root of *Fagara xanthoxyloides*, Lam. is used medicinally in Togo by the natives, to whom it is known as "Kelenmau." The fruit consists of reddish-brown cleft shells, containing black, shining, round seeds. The latter contain 31·9 per cent. of a fatty oil, of a light yellow colour and sharp rancid taste. The shells on distillation with steam give 2·4 per cent. of essential oil, containing methyl-*n*-nonyl ketone, and yielding, after hydrolysis, a little acetic acid, dipentene, linalool, and a sesquiterpene. The original oil has the sp. gr. 0·9229 at 15° C., and $[a]_D = -1·20°$ at 15° C., and is easily soluble in alcohol, ether, and chloroform. When cooled to $-5°$ C. a crystalline solid separates, which contains no nitrogen and melts at 144°—145° C. after crystallising from alcohol. This same substance, $C_{12}H_8O_4$, can also be extracted from the shells by alcohol after the steam-distillation. It gives a nitroproduct, $C_{12}H_7O_4NO_2$, m. pt. 250° C. and a dibromo addition product, m. pt. 164° C. It contains one methoxyl grouping, and has the properties of a lactone. On account of its physiological properties it has been termed *xanthotoxin*. When the bark of the root is extracted with benzene, a white crystalline substance is obtained, which melts at 127°—128° C. after crystallisation. It contains no methoxyl-grouping and shows reactions characteristic of the phytosterols. It has the composition, $C_{20}H_{18}O_6$. The remainder of the paper is taken up with a complete summary of the constituents and applications of the various species of *Fagara* and *Xanthoxylum* as far as known at present.—F. Shdn.

Essential oils ; Constituents of ——. *Enolisation of citral. Preparation of isogeraniol* $C_{10}H_{18}O$. F. W. Semmler and E. Schossberger. Ber., 1911, **44**, 991—995.

When aldehydes containing one or more labile hydrogen atoms near to the CHO grouping are boiled with acetic anhydride, an *enol*-acetate is produced (this J., 1910, 839). This reaction has been applied to citral, in the hope of producing a substance containing two double linkages attached to the same carbon atom. Citral was boiled with acetic anhydride and the products fractionated by distillation, when a mono- and a di-acetate were produced. The *enol*-citral acetate, $C_{12}H_{18}O_2$, boils at 118°—126° C. at 10 mm., has the sp. gr. 0·9420 at 20° C., and $n_D=1·5010$. When reduced with sodium amalgam in the presence of methyl alcohol and dilute acetic acid, isogeraniol, $C_{10}H_{18}O$, is produced. This alcohol, which has a pleasant smell, boils at 102°—103° C. at 9 mm., has the sp. gr. 0·8787 at 20° C., and $n_D= 1·47325$. The diphenylurethane derived from it melts at 73° C. after repeated crystallisation from light petroleum, and its properties show it to be distinct from either nerol or geraniol.—F. Shdn.

Southern cypress ; A sesquiterpene and an olefinic camphor occurring in ——. A. F. Odell. J. Amer. Chem. Soc., 1911, **33**, 755—758.

By fractional distillation, *in vacuo*, of a red viscous resin obtained by extracting cypress (*Taxodium distichum*) sawdust with 95 per cent. alcohol, the author isolated the following compounds : (1) A tricyclic sesquiterpene, *cypressene*, $C_{15}H_{24}$, a yellowish-green, viscous, and almost odourless oil, b. pt. 218°—220° C. at 35 mm., 295°—300° C at 778 mm., sp. gr. 0·9647 at 18°/4° C., $n_D^{22}=1·5240$, $[a]_D^{20}=+6·53$. (2) An olefinic camphor, *cypral*, $C_{12}H_{20}O$, a light yellow, mobile, very fragrant oil, b. pt. 182°—185° C. at 35 mm., sp. gr. 0·9469 at 20°/4° C., $n_D^{20}=1·5040$, dextrorotatory. Cypressene dissolved in either chloroform or acetic acid, gives immediately an intense red colouration on addition of concentrated sulphuric acid. Two mols. of bromine are absorbed by it in carbon tetrachloride solution, and a variable amount of substitution also occurs. Cypral reduces ammoniacal silver solution and restores the colour to decolourised fuchsine solution ; it does not reduce Fehling's solution. It absorbs four mols. of bromine in carbon tetrachloride solution.—A. S.

Stovaine and its homologues ; Certain physical and physiological properties of ——. V. H. Veley and W. L. Symes. Proc. Roy. Soc., 1911, B. **83**, 413—420. (Cp. E. Fourneau, this J., 1904, 835.)

The following values have been found for the sp. gr. at 15°/15° C. of ethyl-stovaine (or stovaine, $O·COC_6H_5.C(CH_3)(C_2H_5)CH_2.N(CH_3)_2HCl$) and some of its homologues :—Methyl-stovaine, 1·213 ; ethyl-stovaine, 1·207 ; amyl-stovaine, 1·106 ; phenyl-stovaine, 1·191 ;

and benzyl-stovaine, 1·178. The propyl ester of a dimethyl-amino-oxybenzoyl-isobutyric acid,

$O{\cdot}COC_6H_5{\cdot}C(CH_3)COOC_3H_7.CH_2N(CH_3)_2HCl$,

which the authors refer to as Fourneau's salt, was found to have the affinity value $7{\cdot}9.10^{-8}$. Experiments on the action of the above compounds on the contractility of isolated muscle indicated that the replacement of the ethyl group in stovaine by the amyl, phenyl, benzyl and ($COOC_3H_7$) groups, produces a decrease of rate of action; the effect of the substitution of methyl is less marked, the differences observed being within the limit of experimental error. As on muscle and on nerve, stovaine and methyl-stovaine have similar and approximately equal effects on the circulation and on the respiration, methyl-stovaine being, if anything, slightly less active. Amyl-, phenyl-, and benzyl-stovaine, and Fourneau's salt are powerful local anæsthetics. Methyl and amyl-stovaine and Fourneau's salt will be further investigated with a view to ascertaining whether their anæsthetic properties are of practical value.
—L. E.

Ultra-violet rays; Action of —— upon green vanilla pods. J. Pougnet. Comptes rend., 1911, **152**, 1184—1186.

After exposure to the action of ultra-violet rays, green vanilla pods yielded a distinct odour of vanillin, whilst similar pods protected from the rays gave no odour. The odour was perceptible after 2 hours' exposure at a temperature of 68° C., or after 6 hours at 37° C., and the development of the odour was accelerated by first immersing the pods in a very dilute solution of manganous chloride (see also this J., 1910, 1226).—W. P. S.

Ultra-violet light; Condensation by ——. R. Pribram and A. Franke. Ber., 1911, **44**, 1035—1039.

On exposure of a redistilled 30 per cent. solution of formaldehyde, in a quartz vessel to light of short wave length from a mercury vapour lamp for some time, no external change can be noticed. If the resulting liquid is then distilled, a white residue is left, and the distillate possesses enhanced reducing properties, acting rapidly on Fehling's solution in the cold. The residue when freed from formaldehyde is also strongly reducing, and gives an osazone which melts at 168° C. This seems to indicate the formation of glycollic aldehyde, which would pass into the distillate in small quantities. The identification is not quite complete, however, since the melting point of the *p*-nitrophenylosazone is rather lower than that of the corresponding derivative of glycollic aldehyde. Control experiments with formaldehyde which has not been exposed to the ultra-violet light, show no evidence of condensation.—W. H. P.

Esterification of alcohols by hydracids; New method of ——. G. Darzens. Comptes rend., 1911, **152**, 1314—1317.

The method is based on the action of thionyl chloride (or bromide) on the alcohol in presence of a tertiary base: $ROH+SOCl_2+B=RCl+SO_2+B,HCl$. A mixture of 1 grm.-mol. of the alcohol and 1 grm.-mol. of a tertiary base is placed in a flask, and then whilst shaking and cooling in water, 125 grms. of thionyl chloride are added from a tap-funnel. After 20—30 minutes, the flask is fitted with a reflux condenser, the sulphur dioxide expelled by heating, and then the hydrochloride of the base removed by extraction with water. From the residue the ester is extracted by means of ether. In many cases the reaction product may be treated directly with water, without driving off the sulphur dioxide. Dimethyl- and diethylaniline are suitable bases, but when they are not solvents of the alcohol, pyridine is used. The author has prepared by this method, isoamyl chloride from commercial isoamyl alcohol, trichlorhydrin from dichlorhydrin, *a*-chloroethylbenzene from phenyl-ethyl alcohol (yield 95 per cent.), and cinnamyl chloride from cinnamyl alcohol (nearly quantitative yield). Phenols (phenol and *β*-naphthol) cannot be converted into esters by this method. With hexahydrophenol, using excess of the tertiary base, a good yield of cyclohexene can be obtained, the chloro-derivative being unstable.—A. S.

Bismuth salicylate; Analysis of —— [Detection and determination of nitrate]. H. Caron and D. Raquet. Ann. Chim. Analyt., 1911, **16**, 177—179.

The diphenylamine test for nitrates is not trustworthy in the case of bismuth salicylate owing to the fact that the salicylic acid either prevents the development of the blue colouration due to the presence of nitrate or renders the test very insensitive. If, however, the bismuth salicylate be dissolved in hot water and decomposed by the addition of hydrochloric or sulphuric acid, the salicylic acid crystallises out as the solution cools, and can be removed by filtration. The filtrate may then be tested for nitrates by means of the diphenylamine reaction. The following process is recommended for the determination of nitrate in bismuth salicylate; it depends on the action of the nitric acid on the salicylic acid in the presence of sulphuric acid, the compound formed giving a yellow colouration when treated with ammonia. A quantity of 0·5 grm. of the bismuth salicylate is boiled for 10 minutes with 50 c.c. of $N/10$ sodium hydroxide solution, the mixture is diluted to 100 c.c., and filtered. An aliquot portion of the filtrate is then evaporated, the residue is treated with 1 c.c. of concentrated sulphuric acid, 10 c.c. of water are next added, and the solution is rendered ammoniacal. The yellow colouration obtained is then compared with those yielded by quantities of 1 per cent. sodium salicylate solution containing known amounts of nitrate when these are treated as described.—W. P. S.

Hypophosphorous acid in pharmaceutical preparations; Determination of ——. K. Feist. Apoth.-Zeit., 1911, **23**, 253. Pharm. J., 1911, **86**, 672.

The method given by Treadwell for the determination of hypophosphites consists in adding excess of mercuric chloride to a solution of the salt made slightly acid with hydrochloric acid, collecting the precipitate of mercurous chloride in a Gooch crucible after standing for twenty-four hours in the dark with slight warming, washing, drying, and weighing. The reduction takes place in accordance with the equation:

$$H_3PO_2+2H_2O+4HgCl_2=2Hg_2Cl_2+4HCl+H_3PO_4.$$

The author finds that this process gives accurate results with calcium hypophosphite, provided that four times the theoretical quantity of mercuric chloride is used, and the reaction mixture is digested for twenty-four hours at 65° C. It, is, however, not applicable to compound syrup of hypophosphites, as under these conditions the sugar exerts a reducing action on mercuric chloride. For the assay of such preparations the liquid is evaporated to dryness with ammonium vanadate, and nitric acid, and the phosphate in the residue determined by the usual molybdate method. (See also C. T. Tyrer, this J., 1897, 764.)

Patents.

Yohimbine; Manufacture of products from ——. F. Müller, Charlottenburg, Germany. Eng. Pat. 877 of 1911; date of appl., June 16, 1910. Addition to Eng. Pat. 14,576, Mar. 12, 1910 (this J., 1911, 307).

Soluble products are obtained by the direct interaction of yohimbine with the following substances:—*a*-amino-hydroxy-iso-butyric acid, acetamide, salicylic acid amide, urea, succinic acid amide, caffeine, and ethyl-urethane.
—F. Shdn.

Therapeutic substance [finely divided antimony]; Manufacture of ——. R. H. A. Plimmer, London. Eng. Pat. 13,756, June 7, 1910.

Finely divided pure antimony can be obtained by the reducing action of an electric current upon antimony trichloride or other salts of antimony, dissolved in water containing an acid.—F. Shdn.

New products for combating illness, etc. [glycerophosphates of proteins with eugenol]. H. Belart, Huddersfield. Eng. Pat. 13,842, June 8, 1910.

Products for medicinal use are made by combining glycerophosphates of proteins, such as casein, with eugeno
—F. Shdn.

Mercurised compounds of carboxylic acid esters and of their products of saponification; Manufacture of ——. W. Schranth, Berlin-Halensee, and W. Schoeller, Berlin. Eng. Pat. 27,049, Nov. 21, 1910. Under Int. Conv., Dec. 2, 1909.

See Ger. Pat. 228,877 of 1909; this J., 1911, 48.—T.F.B.

Camphor; Apparatus for use in the sublimation of ——. Darrasse frères, and L. Dupont, Paris. Eng. Pat. 27,868, Nov. 30, 1910. Under Int. Conv., Dec. 21, 1909.

See Fr. Pat. 410,489 of 1909; this J., 1910, 840.—T.F.B.

Hydro-cinchona alkaloids; Manufacture of ——. G. W. Johnson, London. From Verein. Chininfabr. Zimmer und Co., Frankfort-on-Maine, Germany. Eng. Pat. 569, Jan. 9, 1911.

See U.S. Pat. 989,664 of 1911; this J., 1911, 649.—T.F.B.

Pharmaceutical preparation. F. R. von Arlt, Vienna, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 991,261, May 2, 1911.

See Eng. Pat. 24,240 of 1910; this J., 1911, 508.—T.F.B.

β-Methyladipic acid; Process of producing ——. F. Hofmann and C. Coutelle, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 991,719 and 991,720, May 9, 1911.

See Ger. Pat. 221,849 of 1908; this J., 1910, 719.—T.F.B.

β-Methyltetramethylenediamine; Process of producing ——. F. Hofmann and C. Coutelle, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 991,721, May 9, 1911.

See Ger. Pat. 216,808 of 1908; this J., 1910, 234.—T.F.B.

Octadionols. Octenediones. G. Merling and H. Köhler, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 991,734 and 991,735, May 9, 1911.

See Ger. Pats. 227,176 and 227,177 of 1909; this J., 1910, 1332.—T.F.B.

Alcohols or alcoholic matters from wool-fat; Process for obtaining ——. S. Morgenstern, Charlottenburg, Germany. U.S. Pat. 991,874, May 9, 1911.

See Fr. Pat. 421,044 of 1910; this J., 1911, 435.—T.F.B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

The relationship between the size of the particle and the colour of the image. Chapman Jones. Phot. J., 1911, **51**, 159—174.

Particles of silver suspended in a gelatin film were enlarged by successive treatments with mercuric chloride and ferrous oxalate until they were of such a size as to be measurable with the aid of a microscope: by calculation the size of the particles at any stage of the enlargement could then be calculated. On examining the colour and size of the particles and tabulating the results obtained, it was found that a well-defined relationship existed. In one series, the particles after one treatment had a diameter of 0·085 microns; no light was transmitted, and a very little bright blue light was scattered; a second treatment increased their size to 0·113 micron; the transmitted light was yellow and the scattered light blue; after the third treatment the diameter was 0·15 micron, the transmitted light brownish yellow, and the scattered light bluish. The fourth treatment gave a diameter of 0·19 micron, and the transmitted and scattered light was grey. A similar progressive change was observed in other series of experiments. No relationship could be established between the colour of the particles and their distance apart, as suggested by Zsigmondy.—T.F.B.

Patents.

Photographic images; Process of intensifying or toning silver salt ——. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils, Lyon-Monplaisir, France. Eng. Pat. 25,751, Nov. 5, 1910. Under Int. Conv., July 16, 1910.

Silver photographic images may be intensified by means of quinones or their sulphonic acids, in presence of alkali bromides or chlorides. For example, a solution consisting of benzoquinone, 0·5 grm.; potassium bromide, 2·5 grms.; water, 100 grms., increases the contrasts of the image, and at the same time tones it to a brown shade; the image is cleared after the treatment by means of a dilute solution of ammonia. The colour of the image may be somewhat modified by varying the amounts of quinone and bromide.—T. F. B.

Colour photography. E. N. White, Banes, Cuba. Eng. Pat. 10,892, May 3, 1910.

See Fr. Pat. 417,003 of 1910; this J., 1910, 1410.—T. F. B.

Colour photography on paper from one plate. J. Sury, Wyneghem, Belgium. Eng. Pat. 12,252, May 18, 1910.

See Fr. Pat. 416,135 of 1910; this J., 1910, 1410.—T. F. B.

Photographic print; Coloured —— *and process of making the same.* F. E. Ives, Woodcliffe on Hudson, N.J., U.S.A. Eng. Pat. 21,410, Sept. 14, 1910. Under Int. Conv., Sept. 14, 1909.

See U.S. Pat. 960,939 of 1910; this J., 1910, 841.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Patents.

Explosive. C. E. Griffing, Los Angeles, Cal. U.S. Pat. 991,057, May 2, 1911.

A granulated mixture of sugar (25 parts), potassium chlorate (30), charcoal (15), manganese dioxide (15), milk sugar (5) and zinc flue dust (10 parts).—G. W. McD.

Explosive. G. M. Peters, Cincinnati, and M. F. Lindsley, Kings Mills, Ohio, Assignors to The King Powder Co., Cincinnati, Ohio. U.S. Pat. 991,232, May 2, 1911.

Ammonium nitrate (50 parts), potassium chlorate (30), nitrobenzene (10), and woodmeal (10 parts).—G. W. McD.

Explosives; Manufacture of safety ——. M. A. G. Himalaya, Lisbon. Eng. Pat. 22,030, Sept 22, 1910. Under Int. Conv., Sept. 29, 1909.

See Fr. Pat. 421,202 of 1910; this J., 1911, 448.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Distillation and desiccation under reduced pressure. F. Bordas and F. Touplain. Ann. Falsif., 1911, **4**, 182—185.

The following process is recommended for rapidly evaporating liquids and drying substances under very low pressure. The material is placed in a suitable vessel, such as a desiccator, from which the greater part of the air is exhausted by means of a water-pump or other pump which works rapidly. The moisture given off by the material is condensed in a vessel fitted between the desiccator and the pump, this vessel being surrounded by a receptacle containing solid carbon dioxide dissolved in acetone. Instead of an ordinary manometer, a vacuum tube is used as a gauge, the character of the electric discharge through this tube indicating the pressure in the apparatus. When most of the air has been exhausted, the removal of the remaining gases and vapours is completed by means of a rotating mercury pump, the arrangement of the connections being so devised that the action of one pump may be readily exchanged for that of the other. The use of the freezing mixture round the condensing vessel enables a very low pressure to be obtained in the desiccator, and such liquids as wine, beer, etc., may be evaporated and the residue dried completely within 3 hours; flour, sugar, and other solids may be dried in a few minutes.—W. P. S.

Barium; Factors influencing the systematic qualitative determination of ——. L. J. Curtman and E. Frankel. J. Amer. Chem. Soc., 1911, **33**, 724—733.

Quantitative experiments have shown that in ordinary systematic qualitative analysis, the test for barium with ammonium carbonate is unreliable, owing mainly to loss of barium in the precipitates produced in earlier groups and to the increased solubility of barium carbonate in presence of ammonium salts. In a series of test analyses, the presence of as much as 25 mgrms. and in some cases, 50 mgrms., of barium could not be detected.—A. S.

Platinum metals; Application of the "glow reaction" to the qualitative detection of the ——. L. J. Curtman and P. Rothberg. J. Amer. Chem. Soc., 1911, **33**, 718—724.

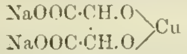
The characteristic glow produced when the constituents of illuminating gas, especially hydrogen, are oxidised in presence of finely divided platinum, palladium, rhodium, or iridium, may be used as a qualitative test for these metals, being capable of indicating the presence of 0·002 mgrm. of platinum, 0·0005 mgrm. of palladium, 0·0009 mgrm. of rhodium, or 0·005 mgrm. of iridium. For practical purposes other substances do not interfere with the test, which may be applied directly to a solution without any preliminary separation process. The method of making the test is as follows:—About 0·2 c.c. of the solution (containing at least the quantity mentioned above of the respective metal, *e.g.*, 0·002 mgrm. in the case of platinum) is absorbed in a piece of very thin asbestos paper by alternately dipping the paper into the solution and heating it. The moist paper, held by one end in a pair of tongs, is then heated to redness in the Bunsen flame, removed, and when the redness has disappeared, but while the paper is still hot, it is held in a stream of a mixture of illuminating gas and air from a Bunsen burner. The burner must be arranged to supply a correctly proportioned mixture of gas and air, and the pressure must not be too great.—A. S.

Indicators; Behaviour of the uranyl salts of dibasic phosphoric acids towards ——. E. Starkenstein. Biochem. Zeits., 1911, **32**, 235—242.

In the titration of orthophosphates with uranium acetate the same results are obtained whether potassium ferrocyanide or cochineal is employed as indicator, but when the latter is used, an excess of free acetic acid should be avoided. Glycerophosphoric acid, although it forms a soluble uranyl salt, can be similarly titrated with the help of cochineal, one atom of uranium corresponding to one atom of phosphorus; with ferrocyanide, however, a colouration is produced after addition of only a few drops of the uranium solution. Inositol phosphoric acid, like pyrophosphoric acid, behaves normally with cochineal, but in both cases ferrocyanide gives a colour when only half the quantity of uranium solution has been added (*i.e.*, one atom of uranium corresponds to two atoms of phosphorus). Metaphosphoric acid forms the soluble salt, $UO_2(PO_3)_2$, and can be titrated if cochineal is used, one atom of uranium corresponding to two atoms of phosphorus. Potassium ferrocyanide cannot be used in this case, as it gives a colour from the commencement.
—J. H. J.

Fehling's solution. W. Rosenkranz. Z. Ver. deut. Zuckerind., 1911, 426—434.

According to the work of Grossmann and Loeb and others, a certain concentration of hydroxyl ions in Fehling's solution is necessary for the existence of the complex salt:



$$\begin{matrix} NaOOC{\cdot}CH.O \\ \dot{} \\ NaOOC{\cdot}CH.O \end{matrix} \!\!>\! Cu$$

No definite hydroxide concentration has, however, been agreed upon, and the alkali content in the two formulæ in general use varies appreciably. That a difference of only 2 grms. of sodium hydroxide per litre of the mixed solutions exerts a considerable influence upon the amount of cuprous oxide precipitated is shown from experiments made with solutions of pure dextrose, which were treated with the reagent for 20 minutes in a boiling water-bath. It is further pointed out that the amount of hydroxide should be diminished to the lowest possible limit sufficing for the formation of the complex salt, since the higher the alkali content the greater the action upon any sucrose that may be present with the invert sugar. By the following series of experiments the author shows that the influence exerted by the temperature and the pressure of the solution undergoing reduction may be appreciable, and should be taken into account, as well as the relative proportions of sucrose and invert sugar present: (1) 25 c.c. of a 0·5 per cent. solution of invert sugar, with 25 c.c. of water, and 50 c.c. of Fehling's solution, gave at 775 mm. pressure and 103°—105° C., 236·5 mgrms. of copper; (2) 25 c.c. of a 0·5 per cent. solution of invert sugar, with 25 c.c. of water, and 50 c.c. of Fehling's solution, gave, at 600 mm. pressure and 90°—96° C., 232·5 mgrms. of copper; (3) 25 c.c. of a 0·5 per cent. solution of invert sugar, with 25 c.c. of a 10 per cent. solution of sucrose, and 50 c.c. of Fehling's solution gave at 775 mm. pressure and 103°—105° C., 260·4 mgrms. of copper; (4) 25 c.c. of a 0·5 per cent. solution of invert sugar, with 25 c.c. of a 10 per cent. sucrose solution, and 50 c.c. of Fehling's solution, gave at 600 mm. pressure and 90°—96° C., 244·9 mgrms. of copper. Experiments were also made upon the stability of Fehling's solution, when boiled for half-an-hour with an equal volume of water alone, at varying pressure and temperature. At pressures of 760 to 988 mm., and corresponding temperatures of 100° to 107·5° C. there was no decomposition, but with a pressure of 1064 mm., and a temperature of 109·6° C., precipitation of cuprous oxide occurred.
—J. P. O.

Detection and determination of small quantities of acetic anhydride in acetic acid. Edwards and Orton. *See* VII.

Determination of chlorides, chlorates and perchlorates in mixtures. Marqueyrol. *See* VII.

Determination of sublimed sulphur in mixtures of the same with other kinds of sulphur. Taurel and Griffet. *See* VII.

Determination of total carbon in iron, steel, and iron alloys. De Nolly. *See* X.

Volumetric determination of manganese and its application to iron and steel analysis. Metzger and Marrs. *See* X.

Determination of manganese in the presence of chromium and tungsten. Watters. *See* X.

Touchstone tests for silver. Steinmann. *See* X.

Determination of copper in pyrites and burnt pyrites. Iwanow. *See* X.

Titration of ferrous oxide in silicates by the Pebal-Dölter method. Dittrich. *See* X.

Action of carbonyl chloride on artificial and natural sulphides. Chauvenet. *See* X.

Shrewsbury and Knapp's method of determining cocoanut oil. Ross and others. *See* XII.

Extraction of leather with 95 per cent. alcohol. Rogers. *See* XV.

Effect of ignition on solubility of soil phosphates. Fraps. *See* XVI.

Physical properties of aqueous solutions containing ammonia and citric acid. Hall and Bell. *See* XVI.

Determination of the "objectionable nitrogen" in the sugar beet. Friedl. *See* XVII.

Non-influence of non-sugar substances of the cane on iodine in presence of sulphurous acid. De Sornay. *See* XVII.

Determination of sugar and lime in carbonatation scums. Lindet. *See* XVII.

Determination of tartaric acid in ciders, perries, vinegars, etc. Kling and Gobert. *See* XVIII.

Measuring the degree of vitiation of the atmosphere of enclosed spaces. Henriet and Bouyssy. *See* XIXB.

A modification of the diphenylamine test for nitrous and nitric acids. Withers and Ray. *See* XIXB.

Determining hydrastine in fluid extract of hydrastine. Van der Haar. *See* XX.

Determination of cantharidin in tincture, oil, and plaster of cantharides. Gaze. *See* XX.

Analysis ot bismuth salicylate. Caron and Raquet. *See* XX.

Determining hypophosphorous acid in pharmaceutical preparations. Feist. *See* XX.

PATENTS.

Hardness; Apparatus for testing——. Norma-Compagnie G. m. b. H. and J. Kirner, Stuttgart, Germany. Eng. Pat. 28,283, Dec. 5, 1910. Under Int. Conv., Apr. 21, 1910.

A drop-weight, forming a heavy pendulum, is allowed to swing from a given height so as to strike the end of a bar of the material to be tested. The weight moves over a graduated arc, and the height of the rebound, as shown on the scale, is a measure of the hardness.—A. T. L.

Air or other gases; Apparatus for testing —— by means of the change of colour of a liquid reagent. M. Arndt. Fr. Pat. 422,883, Nov. 23, 1910.

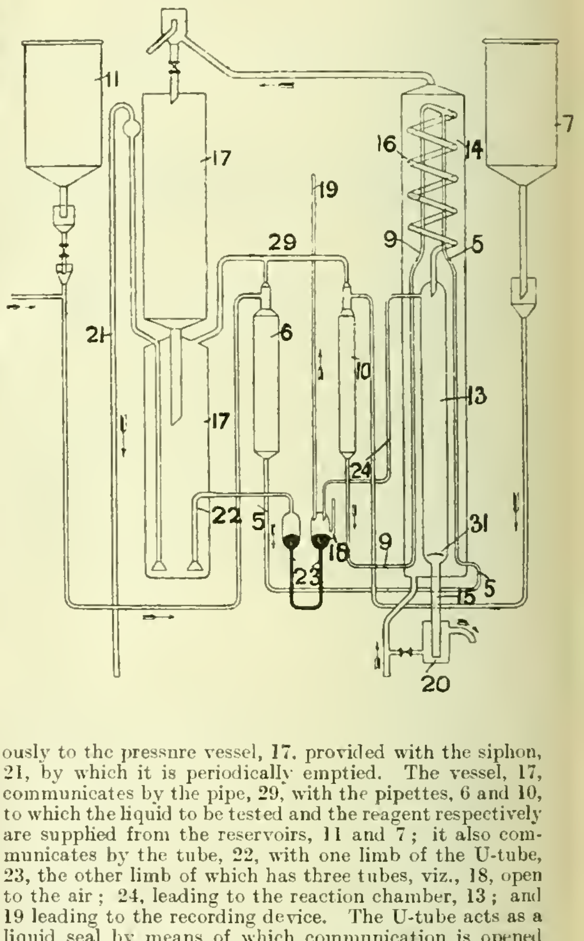
The apparatus is of the type in which the reagent is supplied to a test-material (ribbon, thread, surface, etc.), and the latter is then exposed to the air or gas to be tested. The object of the invention is to prevent as far as possible contact of the air with the test-material, after it has received the reagent, and to supply the reagent to the test-material in a uniform manner. This may be effected by (1) making the supply of the reagent dependent upon the absorptive power of the test-material (ribbon, thread, etc.); (2) using suitable devices for transferring approximately equal quantities of the reagent to the test material (see Ger. Pats. 231,117 and 231,118; this J., 1911, 511); or (3), providing valves for regulating the size and number of drops of the reagent supplied to the test-material. Ten different forms of apparatus are described, as examples. They are all provided with means for keeping the level of the liquid reagent in its receptacle practically constant. —A. S.

Gases or gas mixtures; Device for the analysis of ——. Keiser und Schmidt. Ger. Pat. 233,463, May 18, 1909.

The gas to be tested and a suitable reagent are brought into contact, and the thermal effect of the reaction determined by measuring the alteration of temperature. The gas to be tested is supplied continuously, under uniform pressure, to the absorption vessel, into which also a continuous stream of the absorbing liquid is led, and the alteration of temperature is measured. The thermometer, thermocouple, or the like used for measuring the change of temperature may be wound with wire gauze, and the gas to be tested, and the absorbing liquid caused to flow from below upwards and *vice versa* respectively, over the gauze, in order to increase the absorbent surface.—A. S.

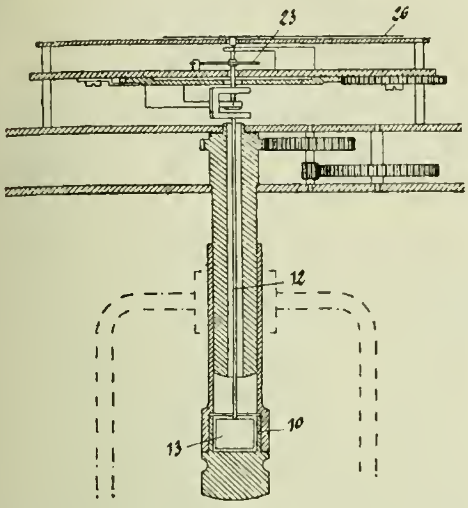
Gas-analytical examination of liquids; Apparatus for the continuous ——. F. Graafen and O. Friese. Ger. Pat. 233,529, Jan. 15, 1910.

Measured quantities of the liquid to be tested and of the reagent are brought together in a reaction chamber; and the volume of gas evolved is indicated by a suitable recording device. A working liquid is supplied continuously to the pressure vessel, 17, provided with the siphon, 21, by which it is periodically emptied. The vessel, 17, communicates by the pipe, 29, with the pipettes, 6 and 10, to which the liquid to be tested and the reagent respectively are supplied from the reservoirs, 11 and 7; it also communicates by the tube, 22, with one limb of the U-tube, 23, the other limb of which has three tubes, viz., 18, open to the air; 24, leading to the reaction chamber, 13; and 19 leading to the recording device. The U-tube acts as a liquid seal by means of which communication is opened alternately between the reaction chamber and the air and between the reaction chamber and the recording device. When the vessel, 17, is filling, the liquids in the pipettes, 6 and 10, are forced through the pipes, 5 and 9, which unite to form the coil, 16; the mixed liquids fall from the lower end of the coil on to the plate, 31, in the lower part of the reaction chamber, and the gas evolved produces a pressure in the reaction chamber and in the tubes, 24 and 19, which pressure is indicated on the recording device; the liquid flows out of the reaction chamber into the vessel, 20, provided with an overflow. The coil and the reaction chamber are enclosed in a cooling jacket, 14. —A. S.



Viscosimeter. K. Kottmann. Ger. Pat. 233,530, Aug. 28, 1910.

The liquid to be tested is placed in the rotating vessel, 10, in which is a friction-member, 13, connected by a spindle, 12, with a pointer, 26. A spring, 23, bears against the spindle, 12. According to the viscosity of the liquid in 10, the motion of the latter is communicated to the friction-member, 13, which is caused to revolve against the action of the spring, 23, and to move the pointer, 26, over a suitable scale.—A. S.



XXIV.—MISCELLANEOUS ABSTRACTS.

Flames containing ammonia and nitric oxide. A. Reis. Z. physik. Chem., 1911, **76**, 560—568.

The author has studied the ammonia-oxygen and the coal gas-oxygen-nitric oxide flames both in the normal condition, and with the cones separated by the Teclu-Smithells separator. Spectroscopic examination of the luminous portions of both flames leads to the conclusion that the α-band of the so-called ammonia spectrum, does not belong to the system nitrogen plus oxygen, as has been suggested, but is really an ammonia band. In the inner cone of a coal gas-oxygen-nitric oxide flame with an excess of coal gas, considerable quantities of ammonia and of cyanogen or cyanogen compounds are formed. If the same flame containing a considerable quantity of nitric oxide be separated, a halo is formed round the inner cone which can be detached by increasing the velocity of the gases. This is probably due to the slowness of reaction of nitric oxide, so that the interconal gases may contain nitric oxide and coal gas in considerable quantities, and therefore may under suitable conditions form a second explosion cone.—W. H. P.

Catalysts ; The influence of foreign substances on the activity of ——. C. Paal. Ber., 1911, **44**, 1013—1018.

The author has investigated the effect of the following metals on the catalysis by palladium of the reaction between gaseous hydrogen and liquid unsaturated esters : magnesium, aluminium, iron, nickel, cobalt, copper, zinc, silver, tin, and lead. All except magnesium, nickel, and cobalt show a decided anti-catalytic effect. When the unsaturated substance was dissolved in benzene and palladium-nickel used as catalyst, the benzene showed a pronounced preventive effect which persisted even after thorough washing with ether and after gentle heating in a current of hydrogen. A similar effect was produced by acetone, while alcohol and ether had no passivifying effect. The palladium probably adsorbs benzene and acetone in preference to hydrogen, while any ether or alcohol adsorbed would be displaced by hydrogen.—W. H. P.

Books Received.

A Systematic Handbook of Volumetric Analysis ; or, The Quantitative Determination of Chemical Substances by Measure, applied to Liquids, Solids, and Gases. By Francis Sutton, F.I.C., F.C.S., Tenth Edition, revised throughout, with numerous additions, by W. Lincolne Sutton, F.I.C., and A. E. Johnson, B.Sc.Lond., F.I.C., A.R.C.Sc.I. J. and A. Churchill, 7, Great Marlborough Street, London. 1911. Price 21s. net.

The tenth edition of this well-known book is an octavo volume containing 613 pages of subject matter, with 121 illustrations, and an alphabetical index. The general scope and characteristic features of previous editions are retained. After a page of memoranda and the table of atomic weights for 1911, there follow :—Part I. General principles. Part II. Alkalimetry and Acidimetry. Part III. Analysis by oxidation or reduction. Part IV. Analysis by precipitation. Part V. Determination of the different elements, salts, ores, etc., and many organic substances such as acetone, aniline, azo dyes, glycerol, etc. Part VI. Urine analysis ; water and sewage analysis ; special index to processes of water and sewage analysis. Part VII. Volumetric analysis of gases. The work closes with a number of tables giving factors for calculating results of analyses, a classification of indicators, results of analyses of water and sewage, saponification values of oils and fats, etc., etc.

Chemisch-technische Untersuchungsmethoden. Herausgegeben von Dr. G. Lunge und Dr. E. Berl. Sechste, vollständig umgearbeitete und vermehrte Auflage. Dritter Band. Verlag von J. Springer, Berlin. 1911. Price M. 22 ; bound M. 24.50.

The present octavo volume contains 1005 pages of subject matter with 150 illustrations, and alphabetical indexes of authors' names and of subjects. It contains the following sections, the names of the authors responsible being given in brackets :—Artificial manures (O. Böttcher). Feeding stuffs or fodders (F. Barnstein). Explosives (O. Guttmann, with additions by E. Berl). Matches and fireworks (A. Bujard), with an appendix on the examination of glue. Gas manufacture, ammonia (O. Pfeiffer). Coal tar industry (Dr. H. Köhler). Mineral oils (D. Holde and G. Meyerheim). Lubricants (G. Holde and G. Meyerheim). Oils, fats, and waxes (J. Lewkowitsch). Special methods of the oil and fat industry (J. Lewkowitsch). Resins, balsams, and gum-resins (K. Dieterich). Drugs and galenical preparations (K. Dieterich). Rubber and rubber goods (F. Frank and E. Marckwald). Essential oils (E. Gildemeister). Organic preparations (J. Messner).

Modern Industrial Chemistry. From the German of H. Blücher. Translated by J. P. Millington, M.A. (Cantab), B.Sc. (Wales). The Gresham Publishing Co., 34 and 35, Southampton Street, London. 1911. Price 30s. net.

Royal 8vo volume bound in leather, treating of all the important substances of chemical industry and the chemical laboratory, of the raw materials, and of the apparatus and instruments employed, the subject matter being classified under headings arranged in alphabetical order, and numerous cross references being given. The subject matter (nearly 2000 entries) occupies 766 pages and there are 12 full-page plates. A number of tables are given, in an appendix, in addition to those embodied in the text.

Themen der physikalischen Chemie. Von Dr. E. Baur. Akademische Verlagsges. m. b. H., Leipzig. 1910. Price M. 4.

The subject matter of this octavo volume, containing 113 pages and 52 illustrations, is arranged under the following headings : (1). Physical chemistry. (2). Voltaic cells. (3). The blast furnace. (4). Problems from the industry of heavy chemicals (5). Catalysis. (6). Gas explosions. (7). Explosives. (8). Metallography. (9). Colloids and adsorption.

DIE CITRONENSÄURE UND IHRE DERIVATE. Von W. HALLERBACH. Verlag von J. Springer, Berlin. 1911. Price M. 3.60; bound M. 4.40.

8vo volume containing 99 pages of subject matter and an alphabetical index, and divided into the following sections: (1.) Introduction. (2). Occurrence. (3). Preparation. (4). Properties. (5). Analysis. (6). Uses. (7). Derivatives. In an appendix the fluctuations in the price of citric acid during the fifteen years, 1896—1910, are given.

DIE OFFIZINELLEN ÄTHERISCHEN OELE UND BALSAME. Zusammenstellung der Anforderungen der 14 wichtigsten Pharmakopoeen in wortgetreuer Uebersetzung. Im Auftrage der Firma E. Sachsse und Co., Leipzig, bearbeitet von C. ROHDEN. Verlag von J. Springer, Berlin, 1911. Price M. 7; bound M. 8.

IN this 8vo volume of 175 pages the officinal essential oils and constituents of essential oils are arranged in alphabetical order, and under each heading the requirements of the 14 Pharmacopœias of the following 14 countries are given: Austria (8th edition, 1906), Belgium (3rd edition, 1906), Denmark (7th edition, 1907), England (1898 edition), France (1908 edition), Germany (5th edition, 1910), Holland (4th edition, 1905), Italy (3rd edition, 1909), Japan (3rd edition, 1907), Russia (6th edition, 1910), Spain (7th edition, 1905), Sweden (9th edition, 1908), Switzerland (4th edition, 1907), United States (8th edition, 1905).

*New Books.

Adressbuch der gesamten Mineralwasserindustrie, der Mineralwasser-Fabriken u. -Niederlagen, der Fabriken alkoholfreier Getränke, der Mineralquellen u. der m. diesen Branchen in Verbindung stehenden Geschäfte Deutschlands, nebst Bezugsquellen-Nachweiser. Nach amtl. Quellen u. auf Grund direkter Angaben zusammengestellt. 3. verm. u. verb. Aufl. 1911/12. (XV, 116 S.) 8° Leipzig, Schulze & Co. Cloth M. 10.

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*Dissertations.

[Prices vary, ranging from two to three shillings.]

Ammann. K.: Ueber die Verwendung von Natriumcarbid zur Synthese organischer Verbindungen. Heidelberg. 1910. 42 S. 8°.

Boie, H.: Ueber *p*-Nitro- und *p*-Amidoverbindungen des Anti-, Thio-, und Anilopyrins. Rostock. 1910. 85 S. 8°.

Flade, F.: Ueber die Passivität bei Eisen, Nickel, und Chrom. Marburg. 1910. 84 S. 8°.

Gokun, T.: Ueber den Einfluss einiger Salze auf die zeitlichen Veränderungen der Viscosität von Kolloiden. Zürich. 1910. 16 S. m. 4 Fig. 4°.

Groskurth, O.: Ueber heterochrome Photometrie. Marburg. 1910. 90 S. u. 3 Taf. 8°.

Grund, G.: Organanalytische Untersuchungen ueber den Stickstoff- und Phosphorstoffwechsel und ihre gegenseitigen Beziehungen. Halle. 1910. 83 S. 8°.

Gurswitsch, M.: Ueber einige Amidoderivate der Schwefelsäure. Bern. 1910. 32 S. 8°.

Hirschberg, E.: Abbauversuche in der Kohlenhydratreihe ueber die *a*-Naphthylisocyanatverbindungen einiger physiologisch wichtiger Substanzen. Berlin. 1910. 23 S. 8°.

Iliovici, G.: I. Ueber die Darstellung von Rohargon aus Luft mit Calciumcarbid. II. Ueber die Produkte der Lichtbogen- und Funkenentladungen in flüssigen Rohargon. Berlin. 1910. 52 S. 8°.

Johlin, J. M.: Ueber Versuche zur synthetischen Gewinnung einiger einfacherer Ketosen. Berlin. 1910. 29 S. 8°.

Krantz, L. P.: Ueber die Konstitution des Isochinolinrots. Jena. 1910. 31 S. 8°.

Kurzer, A.: Zur Kenntnis des Verteilungssatzes in Lösungsmittelgemengen. Breslau. 1911. 43 S. u. 1 Taf. 8°.

Lange, F.: Das ätherische Oel der Meisterwurz. Erlangen. 1910. 46 S. 8°.

Lapinsky, J.: Die Beeinflussung der Zersetzung des Zuckers durch die Hefe mittelst des Solenoids. Zürich. 1910. 21 S. m. Fig. 8°.

Leitreiter, P.: Studien ueber das Verhalten des Mangans im Boden zu einigen landwirtschaftlichen Kulturpflanzen (Hafer, Pferdebohne, Senf, Kartoffeln. Zucker- und Runkelrüben). Rostock. 1910. 65 S. u. 6 Abb. 4°.

Levy. H.: Thermodynamische Behandlung einiger Eigenschaften des Wassers und des Wasserdampfes. Berlin. 1910. 28 S. 8°.

Marschalk, C.: Zur Kenntnis des Catechins. Bern. 1910. 48 S. 8°.

Morzahn, W.: Beiträge zur Kenntnis der Ceriterden. Königsberg. 1910. 57 S. 8°.

Meinecke, F.: Das Liegende des Kupferschiefers. Halle. 1910. 47 S. u. 4 Taf. 8°.

Michel, F.: Ueber die Reaktion zwischen Sulfurylchlorid und Ammoniak. Bern. 1910. 87 S. 8°.

Milde, W.: Beiträge zur Theorie der Aluminiumelektrolytzellen insbesondere des Wirkungsgrades. Jena. 1910. 36 S. m. Fig. 8°.

Neber, P.: Zur Kenntnis der *o*- und *m*-Halogenaniline. Erlangen. 1910. 37 S. 8°.

Pansky, A.: Beitrag zur Chemie der Nitro-Zimmtsäuren. Zürich. 1910. 51 S. 8°.

Paschke, A.: Ueber das 1-Phenyl-4-benzyl-5-methyl-3-pyrazolon. Rostock. 1910. 52 S. 8°.

Paulsen, E.: Beitrag zur Kenntnis der Harze. Kiel. 1910. 62 S. 8°.

Raabe, F.: Ueber Pseudoapokodein und seine Beziehungen zum Apomorphin. Jena. 1910. 36 S. 8°.

Riat, G.: Zur Kenntnis des Aloïns und seiner Abbau-Produkte. Bern. 1910. 57 S. 8°.

Russell, W. F.: I. Beiträge zur Stereochemie der Chinaalkaloide. II. Zur Kenntnis der Amidoxime. Jena. 1910. 47 S. 8°.

Salfeld, L.: Ueber die Metallverbindungen des Thiopyrins. Rostock. 1910. 102 S. und 5 Taf. 8°.

Schneider, W.: Ueber Cheirolin, das Senföl des Goldlachsamens. Sein Abbau und Aufbau. Jena. 1910. 54 S. 8°.

Stahlschmidt, A.: Synthese von Polypeptiden der d.L-Glutaminsäure und der d-Aminovaleriansäure. Berlin. 1910. 46 S. 8°.

Stauffer, H.: Zur Kenntnis des Brasilins. Bern. 1910. 40 S. 8°.

Stockly, J.: Zur Kenntnis des hochgespannten Wechselstrom-Lichtbogens. Freiburg i. Schw. 1910. 70 S. m. 13 Fig. 8°.

Tast, A.: Untersuchungen ueber Kreso-Sapo-formal auf seine Brauchbarkeit als Desinfiziens, Desodorans, Antiparasitikum und Wundheilmittel. Bern. 1910. 28 S. 8°.

Tuchler, J.: Der Einfluss des Antiformins auf Milzbrandbazillen- und Sporen. Bern. 1910. 29 S. 8°.

Viereck, C.: Ueber die Radioaktivität einiger Gesteinarten und derer Verwitterungsprodukte. Halle. 1910. 37 S. m. 4 Fig. 8°.

Wigdorow, S.: Zur Kenntnis der Doppelsalze der Elemente der Ceriterden. Zürich. 1910. 59 S. 8°.

Wurcker, K.: Ueber Anaerobiose, zwei Fäulniserreger und Bacillus botulinus. Erlangen. 1910. 50 S. u. 21 Abb. 8°.

Wuppermann, G.: Ueber Verdampfungsgeschwindigkeit. Leipzig. 1910. 34 S. 8°.

Zamkow, Z.: Ueber die asymmetrische und symmetrische Einwirkung der Hefe auf racemische Aminosäuren. Breslau. 1911. 47 S. 8°.

Zimmermann, R.: Methode zur quantitativen Bestimmung des Phenols und Parakresols im Gemischen derselben und ihre Anwendung auf den Harn. Leipzig. 1910. 96 S. 8°.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding lists can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

Patent Specifications may be purchased at the Sale Branch of the Patent Office, Quality Court, Chancery Lane, London, W.C., fifteen days after the date on which acceptance of the complete specification is advertised. The price is 8d. each.

I.—GENERAL PLANT; MACHINERY.

Applications.

11,653. Hutchins. Centrifugal machines for separating tar, dust, and other solid bodies from gases. May 15.

11,817 and 11,818. Humphrey. Methods and apparatus for raising or forcing liquids. May 16.

11,979, 11,980, and 11,981. Kunick. Process and apparatus for drying liquids. May 18.

12,037. Arledter. Production of mixtures, emulsions, or dispersions of substances.* May 18.

12,055. Humphrey. Methods and apparatus for raising or forcing liquids. May 18.

12,318. Touya. Centrifugal mills.* May 22.

12,406. Crossley and Atkinson. Apparatus for extracting fluids from semi-fluid materials. May 23.

12,449. Humphrey. Raising or forcing liquids. May 23.

12,462. Soderlund and Testrup. Evaporation, distillation, and similar operations. May 23.

12,500. Silberrad. Lixiviating and evaporating plant. May 24.

12,649. Merlini. Processes for drying solid materials and concentrating liquids.* May 25.

12,736. Guignard and Watrigant. Drying apparatus. [Fr. Appl., May 28, 1910.]* May 26.

12,737. Guignard and Watrigant. Extractive process. [Fr. Appl., May 30, 1910.]* May 26.

Complete Specifications Accepted.

8793 (1910). Hoofnagle. Method of disassociating and removing vapour from aqueous liquids. May 24.

8883 (1910). Tattersall. Apparatus for cooling, evaporating, and moistening fluids. May 24.

12,424 (1910). Hewitt. Separation of the constituents of gaseous mixtures. May 31.

13,121 (1910). Hoeking. Evaporating or distilling apparatus. May 31.

13,591 (1910). Hardingham (Metallurgische Ges.). Means for purifying gases and precipitating flue dust. May 24.

21,191 (1910). Reyscher. Drying by air circulation in dryers of the passage type. May 31.

26,954 (1910). Soc. Anon. d'Ougrée-Marihaye. *See under* X.

27,166 (1910). Pasehka. Apparatus for impregnating liquids with gases. May 24.

4410 (1911). Fasting. Separation of granular or pulverised substances. May 31.

5281. (1911). Electrochemische Werke. *See under* VII.

II.—FUEL; GAS; MINERAL OILS AND WAXES; DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

11,653. Hutchins. *See under* I.

11,834. Heinemann. Solidification of petroleum and like hydrocarbon liquids. May 16.

11,904. Müller. Manufacture of incandescent mantles. [Ger. Appl., Nov. 12, 1910.]* May 17.

11,940. Vickers, Ltd., and Imrie. Treatment of producer and other gases. May 17.

11,964. Lüdecke, and Imperial Lamp Works, Ltd. Preparation of tungsten and like metal filaments.

12,144. Noad. Treatment of hydrocarbon oils, etc. May 19.

12,154. Board. Manufacture of fuel briquettes, blocks, etc. May 19.

12,158. Gerard. Solidification of petroleum and other hydrocarbons. May 18.

12,196. Thomas. Manufacture of compressed fuel. May 20.

12,237. Nicholls and Blucker. Incandescent gas mantles. May 20.

12,251. Koppers. Separating and regenerating washing oils used for separating benzol from gases.* May 20.

12,282. Burney, Scruby, and Young. Incandescent gas mantles. May 22.

12,291. Blackler. Process for solidifying petroleum or petrol. May 22.

12,599. Holmes and Co., Ltd., and Howell. Process and apparatus for distilling bituminous materials. May 25.

12,738. Wengler. Furnaces for carbonising peat, wood, or the like.* May 26.

Complete Specifications Accepted.

6899 (1910). Huessener, Schaefer, and Henss. Extraction of tar from hot distillation gases. May 24.

12,613 (1910). Trainer. Manufacture of block fuel briquettes. May 31.

17,076 (1910). Winterstein and Nitsch. Apparatus for separating the liquid from the solid constituents of paraffin, fats, or fatty substances. May 24.

19,095 (1910). A. E. G. Union Elek. Ges. Manufacture of tungsten filaments. May 31.

22,313 (1910). Pyzel. Process and apparatus for sweating crude paraffin or like mixtures of substances which melt at different temperatures. May 31.

22,335 (1910). Burkheiser. Separation of sulphuretted hydrogen from gases. May 24.

III.—TAR AND TAR PRODUCTS.

Complete Specification Accepted.

20,109 (1910). Imray (Meister, Lucius, und Brüning). Manufacture of an oxidation product of β-aminoanthraquinone. May 31.

IV.—COLOURING MATTERS AND DYES.

Applications.

11,700. Newton (Bayer und Co.). Manufacture of vat dyestuffs of the anthracene series. May 15.

12,009. Meister, Lucius, und Brüning. Manufacture of a monoazo dyestuff adapted for the preparation of violet colour lakes. [Ger. Appl., Dec. 2, 1910.]* May 18.

12,010. Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of anthraquinone derivatives and their use in dyeing and printing.* May 18.

12,126. Bayer und Co. Production of brown tertiary trisazo-dyestuffs. [Ger. Appl., May 21, 1910.]* May 19.

12,281. Levinstein, Baddiley, and Levinstein, Ltd. Azo dyestuffs and their production. May 22.

Complete Specifications Accepted.

16,271 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of benzanthrone compounds. May 31.

16,440 (1910). Ullmann. Manufacture of vat-dyeing dyestuffs of the anthracene series. May 24.

23,052 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. May 24.

9003 (1911). Act.-Ges. f. Anilinfabr. Manufacture of a monoazo dyestuff. May 31.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

11,714. Lake (Cie. Franç. des Applications de la Cellulose). Manufacture of cellulosic products. May 15.

11,750. Debourg. Converting vegetable fibres into threads of silky appearance. [Fr. Appl., May 19, 1910.]* May 15.

11,814. Boult (Dist. of Columbia Paper Manuf. Co.). Manufacture of paper.* May 16.

11,969. Hazlewood and Sons, Ltd., and Hazlewood. *See under* VI.

12,259. Dreaper. Manufacture of artificial silk, films, etc. May 22.

12,351. McNaught. Machinery for washing and scouring wool and other fibrous materials. May 22.

12,353. Remmer and Wolsky. Treatment of peat moss for the manufacture of paper, etc.* May 22.

12,746. Labbé. Celluloid or like substitutes and process for manufacturing the same.* May 26.

Complete Specifications Accepted.

12,422 (1910). Weertz. Cellulose solutions and process of making same. May 24.

332 (1911). Lamort. Refining-drums for paper pulp. May 24.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

11,969. Hazlewood and Sons, Ltd., and Hazlewood. Manufacture of filling or loading material for fabrics, paper, etc.* May 18.

12,010. Bloxam (Chem. Fabr. Griesheim-Elektron). *See under* IV.

12,157. Johnson (Badische Anilin und Soda Fabrik). *See under* VII.

12,253. Grass and Grass. Process of printing on fabrics. May 20.

12,283. Bentz. Decolorising or bleaching woven cotton fabrics used as back greys in calico printing. May 22.

12,399. Mycock. Kiers for bleaching, dyeing, and like processes. May 23.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

11,701. Newton (Bayer und Co.). Manufacture of manganates. May 15.

11,839. Müller, and Hydorion Washing Machinery Co. Apparatus for making hydrogen peroxide.* May 16.

12,008. Klages, Sommer, and Saccharin-Fabr. A.-G. Product for yielding hydrogen peroxide.* May 18.

12,157. Johnson (Badische Anilin und Soda Fabrik). Manufacture of zinc formaldehyde sulphoxylate. May 19.

12,227. Burkheiser. Conversion of ammonium sulphide into ammonium sulphate. [Ger. Appl., May 21, 1910.]* May 20.

12,307. Kassner. Process for obtaining and separating oxygen and nitrogen from the atmosphere. [Ger. Appl., May 28, 1910.]* May 22.

12,308. Kassner. Process for obtaining oxygen and nitrogen. [Ger. Appl., May 28, 1910.]* May 22.

12,314. Sinding-Larsen. Binding and utilising atmospheric nitrogen. [Appl. in Norway, May 26, 1910.]* May 22.

12,373. Percy. Manufacture of plaster of Paris and apparatus therefor. May 23.

12,555. Schick, and Act.-Ges. f. Stickstoffdünger. Process for producing nitrogen compounds. [Ger. Appl., Nov. 9, 1910.]* May 24.

12,657. Bollo and Cadenaccio. Reduction of sulphates of alkalis or alkaline earths to the corresponding sulphides. [Addition to No. 27,477 of 1910. Ital. Appl., May 27, 1910.]* May 25.

12,662. Johnson (Badische Anilin und Soda Fabrik). Manufacture of nitrogen compounds of molybdenum and of metallic molybdenum. May 25.

Complete Specifications Accepted.

19,336 (1910). Hildebrand. Liquefaction of carbonic acid. May 24.

23,418 (1910). Gerhartz. Production of hydrogen by decomposing steam with melted iron. May 24.

26,646 (1910). Oesterreich. Chem. Werke, and Lowenstein. Manufacture of hydrogen peroxide from impure solutions of persulphuric acid. May 24.

5281 (1911). Electrochemische Werke. Method of producing endothermic compounds from gases. May 31.

VIII.—GLASS; CERAMICS.

Applications.

11,846. Werlein. Manufacture of a refractory and abrasive product. [Fr. Appl., Aug. 26, 1910.]* May 16.

11,870. Andina and Bottomley. *See under* IX.

12,119. Lessing. Treatment of porous refractory materials to render them gas tight. May 19.

Complete Specification Accepted.

29,521 (1910). Tidy. Kilns for use in burning pottery, earthenware, glazed or enamelled bricks, tiles, etc. May 31.

IX.—BUILDING MATERIALS.

Applications.

11,870. Andina and Bottomley. Continuous kilns for burning or firing bricks, tiles, or other earthenware or fireclay goods. May 17.

12,773. Edgeworth. Machines for grinding cement. May 26.

Complete Specifications Accepted.

12,525 (1910). Ernst and Trachsler. Furnace for burning cement and the like. May 31.

21,560 (1910). Mahler. Manufacture of porous artificial stones. May 24.

30,091 (1910). Deuts. Rekord Cement Werke J. Krumpelmann und Co., and Krumpelmann. Manufacture of a substance for rendering cement waterproof. May 31.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

11,671. Percival. Extraction of metals from ores. May 15.

11,813. Boult (Gallo). Extraction of zinc from its ores. May 16.

11,964. Lüdecke, and Imperial Lamp Works, Ltd. *See under* II.

12,012. Allgem. Deutsches Metallwerke. Copper-zinc alloys having a high percentage of zinc. [Ger. Appl., Jan. 26, 1911.]* May 18.

12,214. Beskow and Ramén. Mechanical roasting furnaces. [U.S. Appl., Aug. 18, 1910.]* May 20.

12,304. Bradley. Treatment of copper bearing substances. [U.S. Appl., June 23, 1910.]* May 22.

12,305. Mills (Bradley Copper Process Co.). Method and apparatus for treating ores.* May 22.

12,429. Schwahn. Production of aluminium and its alloys. May 23.

12,457. Bayliss and Clark. Alloys of zinc. May 23.

12,662. Johnson (Badische Anilin und Soda Fabrik). *See under* VII.

Complete Specifications Accepted.

11,807 (1910). Sieurin. Reduction of metals from their ores. May 24.

12,138 (1910). Newton (Channing). Method of smelting pyritic ores. May 24.

12,343 (1910). Eveland. Carburisation of iron and steel. May 24.

12,440 (1910). Rockwell. Process and apparatus for carburising. May 31.

12,724 (1910). Siemund. Fusing metals electrically for welding and repairing. May 31.

12,757 (1910). British Thomson-Houston Co. (General Electric Co.). Alloys useful as electric-resistance conductors. May 24.

25,031 (1910). Weintraub. Purifying and casting copper, silver, and copper alloys. May 31.

26,954 (1910). Soc. Anon. d'Ougrée-Marihaye and Soc. pour l'Utilisation de l'Air et de ses Dérivés. Supply of superoxygenated air to blast and other furnaces. May 24.

4159 (1911). Hyde. Preparation of ductile molybdenum and articles therefrom. May 31.

XI.—ELECTRO-CHEMISTRY.

Applications.

11,906. Chem. Fabr. Griesheim-Elektron. Depolarisers for galvanic cells or batteries. [Ger. Appl., Oct 10, 1910.]* May 17.

11,932. Marks (Gebr. Siemens und Co.). Electric radiation furnaces.* May 17.

12,040. Chem. Fabr. Griesheim-Elektron. Regeneration of the waste products of galvanic cells or batteries. [Ger. Appl., June 3, 1910.]* May 18.

Complete Specifications Accepted.

20,180 (1910). Beach. Anodes for electrolytic purposes. May 31.

26,546 (1910). Johnson (Deuts. Gold- u. Silber-Scheide Anstalt). *See under* XX.

3533 (1911). Schatzl. Electric furnaces. May 31.

XII.—FATS; OILS; WAXES.

Application.

12,398. Bonsor. Fat and oil extractor. May 23.

Complete Specifications Accepted.

4661 (1910). Simpson. Extraction of vegetable and other oils and fats or essences. May 31.

15,829 (1910). Boult (Fleming). Production of polyglycerins. May 31.

17,076 (1910). Winterstein and Nitsch. *See under* II.

3880 (1911). Haddan (Thorne). Detergent compound. May 31.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

11,726. Legg. Production of chrome pigments.* May 15.

12,345. Wülfing, Dahl, und Co., and Ulrichs. Manufacture of lakes.* May 22.

Complete Specifications Accepted.

12,633 (1910). Hesse. Production of solutions of resins and certain other organic substances. May 31.

13,128 (1910). Ljubarski. Extraction of resin oil from wood. May 31.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

11,892. Sutton. Apparatus for smoking and coagulating the latex of rubber. May 17.

12,477. Wildman and Christy. Process for desulphurising and devulcanising rubber.* May 23.

Complete Specifications Accepted.

4189, 4572, and 4620 (1910). Matthews and Strange. Manufacture of caoutchouc and an intermediate product. May 31.

18,497 (1910). Clarkson. Process for vulcanising indiarubber. May 24.

6858 (1911). Derry. Curing of indiarubber. May 31.

7735 (1911). Caldwell, and Pfleumatic (1910). Ltd. Manufacture of elastic cellular, foamy, or spongy material. May 31.

XV.—LEATHER; BONE; HORN; GLUE.

Application.

12,566. Conway, Baron von Girsewald. Manufacture of glue and the like. [Ger. Appl., Jan. 17, 1911.]* May 24.

XVII.—SUGARS; STARCHES; GUMS.

Application.

12,642. Wiese. Process for refining sugar.* May 25.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

12,207. Meunier. Treatment of distillery wash. [Australian Appl., May 21, 1910.]* May 20.

12,350. Wallerstein. Treatment of beer or ale.* May 22.

12,723. Lebbe. Fermenting process.* May 26.

Complete Specifications Accepted.

16,857 (1910). Zwergel. Manufacture of concentrated non-alcoholic extracts for making liqueurs. May 31.

18,925 (1910). Heron and Heron. Preparation for priming malt liquors. May 24.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

11,736. Scheitlin. Production of compounds from blood or constituents of blood. [Ger. Appl., May 14, 1910.]* May 15.

11,789. Li. Non-fermented products made of soja grains. [Divided Appl. on No. 30,351, Dec. 31, 1910.]* May 16.

11,961. Stacey. Manufacture or treatment of flour. May 18.

12,552. Imray (Maddock). Treatment of wheat products or flour.* May 24.

12,668. Dietrich. Baking powder. [Ger. Appl., Dec. 14, 1910.]* May 25.

Complete Specifications Accepted.

12,949 (1910). Henri, Helbronner, and von Recklinghausen. Sterilising water and other liquids. May 24.

14,605 (1910). Henri, Helbronner, and von Recklinghausen. Apparatus for destroying bacteria in water supply systems. May 24.

29,965 (1910). Smith. Purifying and aërating water. May 24.

30,247 (1910). Pearson. Apparatus for producing pure water by distillation and combining it with oxygen. May 31.

842 (1911). Oetker. Manufacture of baking powder. May 24.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

11,709. Imray (Meister, Lucius, und Brüning). Manufacture of asymmetrical aromatic arseno-compounds. May 15.

11,728. Doerflinger. Manufacture of organic compounds. May 15.

11,736. Scheitlin. *See under* XIX.

11,798. Wolffenstein. Preparation of organic compounds containing arsenic. May 16.

11,901. Imray (Meister, Lucius, und Brüning). Manufacture of arseno-compounds. May 17.

12,550. Newton (Bayer und Co.). Manufacture of homopiperonalamine. May 24.

Complete Specification Accepted.

26,546 (1910). Johnson (Deuts. Gold- u. Silber-Scheide Anstalt). Electrolytic manufacture of glycollic acid. May 31.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Complete Specification Accepted.

25,646 (1910). Manners. Colour photography. May 31.

XXII.—EXPLOSIVES; MATCHES.

Applications.

11,941. Chandelon. Making guncotton more soluble in its various solvents. [Belg. Appl., May 17, 1910.]* May 17.

12,246. Louis. Explosive. [Belg. Appl., May 20, 1910.]* May 20.

12,400. Silberrad. Explosives of the chlorate class. May 23.

12,401. Silberrad. Explosives of the perchlorate class. May 23.

Complete Specifications Accepted.

23,871 (1910). Wharton, Shacklady, and Curtis's and Harvey, Ltd. Apparatus for purifying nitroglycerine. May 24.

4099 (1911). Fairweather (Du Pont de Nemours Powder Co.). Explosives. May 31.

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Official Notices.

EIGHTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY.

WASHINGTON AND NEW YORK, U.S.A., SEPTEMBER, 1912.

The Eighth International Congress of Applied Chemistry will be held in Washington and New York, U.S.A., from September 4th to September 13th, 1912, under the patronage of His Excellency the President of the United States. The Hon. President of the Congress is Prof. Edward W. Morley, Sc.D., Ph.D., LL.D., the President Mr. Wm. H. Nichols, Sc.D., LL.D., and the Secretary Dr. Bernhard C. Hesse, 25, Broad Street, New York City.

The Congress is divided into the following Sections and Sub-sections:—

I. Analytical Chemistry.
II. Inorganic Chemistry.
IIIA. Metallurgy and Mining.
IIIB. Explosives.
IIIC. Silicate Industries.
IV. Organic Chemistry.
IVA. Coal Tar Colours and Dyestuffs.
VA. Industry and Chemistry of Sugar.
VB. India-rubber and other Plastics.
VC. Fuels and Asphalt.
VD. Fats, Fatty Oils, and Soap.
VE. Paints, Drying Oils, Varnishes.
VIA. Starch, Cellulose, and Paper.
VIB. Fermentation.
VII. Agricultural Chemistry.
VIIIA. Hygiene.
VIIIB. Pharmaceutical Chemistry.
VIIIC. Bromatology and Pharmacology
VIIID. Physiological Chemistry.
IX. Photo-chemistry.
XA. Electro-chemistry.
XB. Physical Chemistry.
XIA. Law and Legislation affecting Chemical Industry.
XIB. Political Economy and Conservation of Natural Resources.

Papers will be accepted for reading and discussion in all the above Sections, preference being given to those specially adapted for international discussion. They must be sent in not later than July 1st, 1912.

A preliminary pamphlet has been issued and may be obtained from the Hon. Secretary of the British Organising Committee, Charles G. Cresswell, Society of Chemical Industry Palace Chambers, Westminster, S.W.

INDUSTRIAL BURSARIES.

The Council of the Society has been invited by the Royal Commission for the Exhibition of 1851 to express its views on the following draft scheme of "Industrial Bursaries." As this scheme may form the subject of discussion at some of the Local Sections, the Council takes this earliest opportunity of giving the full text, as follows:—

1. The Commissioners propose to establish a scheme of Industrial Bursaries for young men who, after a course of training in a University or approved Technical College, desire to enter Engineering, Chemical, or other manufacturing works.

2. The Bursaries are intended to enable suitable applicants to tide over the period between their leaving College and obtaining remunerative employment in industry.

3. The value of the Bursary will depend on the circumstances of the Candidate, but will as a rule not exceed £100 a year.

4. A Bursar will be elected in the first instance for one year, but the tenure of his Bursary will ordinarily be prolonged for a second year provided that the Commissioners are satisfied with the work done by the Bursar during his first year.

5. In special circumstances a Bursary may be renewed for a third year.

6. The appointments to the Bursaries will be made by the Commissioners from among Candidates recommended by the Authorities of certain selected Universities and Technical Schools.

N.B.—In dealing with these recommendations great weight will be given to evidence that a Candidate has the practical abilities likely to lead to his advancement in manufacturing work, academic success alone being an insufficient recommendation.

7. The Candidate must be a British subject, under the age of 25.

8. The Candidate must have been a *boná fide* student of Science for a term of three years.

9. The Candidate must further satisfy the Commissioners:—

(*a*) That he has obtained, or can, within one month of election, obtain a post in some Engineering or other manufacturing works approved by them.
(*b*) That he is in need of pecuniary assistance to enable him to accept such a post.

10. A Bursar may, if the Commissioners approve, spend part of the tenure of his Bursary in studying a special industrial process or processes in works either at home or abroad.

11. No Bursar shall enter a firm as a premium pupil without the special consent of the Commissioners.

12. A Bursar must submit a report of his work to the Commissioners on the expiration of each year of his Bursary.

List of Institutions invited to nominate in 1911:—

1. University of Edinburgh.
2. Heriot Watt College, Edinburgh.
3. University of Glasgow.
4. Glasgow and West of Scotland Technical College.
5. University of St. Andrews.
6. University of Aberdeen.
7. University of Birmingham.
8. University of Bristol.
9. University of Leeds.
10. University of Liverpool.
11. University of Manchester.
12. Armstrong College, Newcastle-upon-Tyne.
13. University College, Nottingham.
14. University of Sheffield.
15. University of Oxford.
16. University of Cambridge.
17. University of London.
18. Imperial College of Science and Technology.
19. University College of Wales, Aberystwyth.
20. University College of North Wales, Bangor.
21. University College of South Wales and Monmouthshire, Cardiff.
22. Royal College of Science for Ireland.
23. Queen's University of Belfast.
24. University College, Cork.
25. University College, Galway.

London Section.

Meeting held at Burlington House on Monday, April 3rd, 1911.

MR. E. GRANT HOOPER IN THE CHAIR.

MEASUREMENT OF HIGH TEMPERATURES.

BY C. T. HEYCOCK, F.R.S.

The importance of the accurate determination of high temperatures for industrial purposes is obvious.

I may refer to the early experiments of Wedgwood on the shrinkage of clay plugs when exposed to high temperatures and to the attempts of Deville and Troost, based on the assumption that iodine obeyed the ordinary law of expansion of gases. The subsequent researches of Meyer and others, however, showed that this was not an accurate determination, because of the dissociation of the diatomic molecule of iodine into monatomic iodine.

Those who have tried to measure high temperatures by means of a gas thermometer have found that it is a most difficult instrument to use. First of all, there is extreme difficulty in getting a bulb of which the co-efficient of expansion is known; and a knowledge of this is essential. Again great difficulties are connected with the deformation of the bulb under the influence of high temperature; and with obtaining gases in a pure state, avoiding diffusion and the consequent introduction of other gases whose coefficients of expansion are not so clearly understood. There is also the difficulty that bulb-thermometers condense on them a large quantity of moisture, and other vapours or gases, which are slowly given off during the heating up of the bulb, leading to uncertainty as to the initial volume of the gas in the bulb. So that a gas thermometer is a most difficult instrument to work, though, after all, it is the final Court of Appeal to which we have to refer all our temperature measurements, and undoubtedly, in the hands of the very best workers of late years such as Professor Callendar, Dr. Griffiths, and Dr. Harker, gas thermometers have been brought to a very high pitch of perfection. Other methods have been proposed for the purpose of measuring high temperatures, such, for example, as calorimetric methods, based on the assumption that the specific heat of a substance, or at any rate the law which governs the relation of the change of specific heat to the change of temperature, is known. That was only a rough and ready method, but is still a method I have seen in quite recent years employed in many works—I have no doubt it is still employed—for ascertaining the temperature of furnaces. There again the difficulties are very great, especially the practical difficulties of the loss of heat due to transference of the hot body from the furnace to the calorimeter, and of protecting the calorimeter from the influence of radiation. From time to time, many bodies have been employed besides platinum. I know one set of determinations which were made with quicklime—it does not sound a very hopeful thing—but attempts were made to measure extremely high temperatures by assuming a specific heat of quicklime which was heated up to such an extremely high temperature that it practically fused or glazed on its surface, so that when it was dropped into the calorimeter it did not hydrate at all, and there was no trouble in connection with the heat due to that chemical action.

Of the modern ways of measuring high temperatures, which we must consider anything above that which you can normally measure by means of mercury thermometers, we have (1) the resistance methods, where a change in resistance of a wire, usually of platinum, is employed to determine changes of temperature; (2) methods based upon a change in the e.m.f. of two metals in contact with one another, due to change of temperature; and (3) radiation methods based on the radiation from the heated surface; and it is those methods particularly that I wish to refer.

(1) The earliest work on the measurement of temperature by the change in resistance was probably carried out by Siemens, who gave the Bakerian Lecture to the Royal Society in 1871. He had a comparatively very simple form of pyrometer, although the electrical arrangements attached to it were somewhat complicated. It consisted essentially of a platinum wire joined on to a stouter platinum wire, and then also on to a stout lead; the upper part constituted the pyrometer. Of course a difficulty at once arose with such an arrangement that when the resistance was measured one was not only measuring the change of resistance of the heated portion of the wire, but the unexposed portion of the stem became heated up and the change of resistance of that was measured as well. In order to allow for this, Siemens took a supplemental lead off, so that he could measure either the whole resistance right round from A to B, or that from A to C; and then, if he knew the resistance from A to C, he had only to double it to get the total change in resistance of the unexposed portion of the stem. That pyrometer was investigated afterwards by a Committee of the British Association, who reported on it in 1874. They had a large number of these pyrometers constructed, and they found that made in this way they underwent very considerable changes; the report of the Committee was not favourable to the appliance as it then was—and of course at that time the method of measuring electrical resistance was not a very good one. There the matter remained for a long time, until it was taken up again by Professor Callendar, who published a paper on the determination of high temperatures by means of platinum resistance thermometers in the Transactions of the Royal Society for 1887. For this purpose, he took a fine platinum wire and wound it on a crossed mica frame which was serrated at the edge; it was wound double to get over as far as might be the self-induction in the coils. The ends of the fine platinum wires were connected with stout platinum wires; an arrangement such as this would suffer from exactly the defects of Siemens' original pyrometer; but he got over that in an extremely ingenious way by having another set of leads exactly the same dimensions, the same quality of wire, and precisely the same length, as the main leads which were going to the two ends of the coil. These two leads he called "the Compensator." Since these compensator leads are in the opposite arm of the Wheatstone Bridge to the other pair, they will be heated up similarly since they are both placed symmetrically inside the tube. In other words, all the effects of the unimmersed part of the stem are immediately cut out, because the two pairs of leads are in opposite arms. That was the great advance that was made at that time—a sort of automatic correction for the unimmersed part of the stem which, as we all know, is the great difficulty in measuring high temperatures. These thermometers were constructed in that way and they proved of enormous value. A Griffiths key is generally used in connection with this apparatus, the object being to get over the induction effects which are inseparable from apparatus of this sort. In order to determine a temperature by means of change in resistance, as good a sample of platinum as possible must be obtained. Certain fixed points have to be determined: the resistance at 0° and 100° C. (the fundamental interval), and at the boiling point of sulphur: these values may be called $R_1{}^\circ$, $R_{100}{}^\circ$, and R_s. It is convenient when making one of these pyrometers to adjust it so that the change in resistance for the fundamental interval (F. I.) is exactly 1 ohm.; it depends on the units employed; in the particular box we employed we tried to make it 100 box units. The resistance in sulphur is fairly easily taken provided you screen the thermometer very carefully from the radiation effects: it is generally done by an arrangement something like a Victor-Meyer tube. This is the way in which Griffiths, Callendar, and most of us have done it: the vessel containing the boiling sulphur is carefully lagged, usually in asbestos. The resistance has a second shell of asbestos (generally called the umbrella) to protect it as far as possible from superheating of the glass vessel. Taking suitable precautions and knowing the change of boiling point with

the change of temperature, a fair determination of the point R_s is obtained. Now, Callendar found that a simple formula connected the change in resistance with the change in temperature, namely, $t - pt = \delta\left(\frac{t}{100}\right)^2 - \frac{t}{100}$ (δ is a constant depending on the sample of platinum employed). What is called the pt. in this formula is the uncorrected temperature calculated from the resistance $pt. = \frac{(R_t - R_o) \times 100.}{F.I.}$ To determine δ, the resistance of the pyrometer in sulphur vapour is determined; and knowing its resistance in ice and for the F. I., then pt. is found. We have now pt. δ; we know t because that has been already determined for us by the experiments of Callendar, Harker, and S. Griffiths, who have determined by means of an air thermometer the boiling point of sulphur. We can thus obtain the value of δ, which is the constant for the particular sample of platinum, and is usually about 1·5. That this is a correct treatment of the matter has been comparatively recently proved by the determination of these high temperatures by means of an air thermometer. A few numbers will show what is the difference between T and pt.

pt.	t—pt.	t.
100	2·9	97·1
200	3·1	203·1
1000	197	1097
1300	416	1716

Thus there is a very increasing divergence between platinum temperature and centigrade temperature; but it is a very remarkable thing, and it is unlike what happens with so many of these formulæ, that this formula, although involving such enormous exterpolation, is comparatively true for a change of temperature very nearly up to the melting point of platinum. As it is necessary to know the R_{100}°, pt_{100}°, and R_s with very great accuracy, very accurate barometric readings are necessary. Professor Callendar invented a compensated air barometer in which the expansion of sulphuric acid confined the air, producing an effect which is equal to the effect produced by the increasing volume of air due to the change of temperature. The one we have in Cambridge can be put into a bucket of moderately warm water (about 25° to 30° C.) without any change in the level of the sulphuric acid, although the inner bulb holds something like from 200 to 250 c.c. of air. In that way one can obtain very rapid barometric readings of great value and importance for such purposes as we are considering.

There have been certain divergences of opinion about the boiling point of sulphur: it has been under revision by various workers since Regnault. Callendar and Griffiths made it 444·5°, and in the work on high temperatures Mr. Neville and I have undertaken, we have always assumed this number; but other determinations have been made in which it has been got up to 445°. Of course, this is a very vital point, because the question of δ is intimately wrapped up with knowing the exact boiling point of sulphur. But the final value which has been arrived at now is 444·7°, so that it has come down to only 0·2° higher than the value that Callendar and Griffiths originally assigned.

Having calibrated the machine—and that is a task including the resistance box and the whole thing—one is then in a position to determine any moderately high temperatures; but the apparatus is rather too delicate to place in the hands of ordinary work-people, although it is being used in some cases for industrial purposes; I have seen it used in connection with blast furnaces and hot and cold blast, and I know works where it is used and where several are installed, recording regularly the temperatures. I should like to point out a few of the temperatures which have been determined almost entirely by this method, because they form the starting point from which the other unknown temperatures can with extreme readiness be determined.

	M. pt.	Heycock and Neville (1895).
Tin	231·9° C.	231·7
Lead	327·4° C.	327·7
Antimony	630·7° C.	629·5
Silver	960·9° C.	960·7
Copper	1083·0° C.	1080·5
Nickel	1452·0° C.	—
Platinum	1755·0° C.	—

Those in the first column are regarded to-day as the most accurate numbers available, and they differ but very little from the original numbers which Mr. Neville and I published in 1895; and that little difference is due almost entirely to the difference in δ, due to a slight change now recognised in the boiling point of sulphur.

Now with regard to the other methods of determining high temperatures. Nowadays thermo-junctions are very convenient, but I cannot think that they have the accuracy of the ordinary resistance pyrometer. The thermo-junctions are made of a great variety of materials, depending upon the temperature employed; the common one is platinum, platinum-rhodium; with about 90 per cent. of platinum and 10 per cent. of rhodium (it is very convenient to have different quantities of rhodium). The use of couples with iridium should be avoided for temperatures over 1000° because iridium volatilises almost constantly. For lower temperatures, it is very convenient to use constantan and copper; when using a copper and copper-nickel alloy it should be 60 per cent. copper and 40 per cent. nickel, or other metals may be used, such as iron and constantan; but whilst very convenient for giving a rapid determination of temperatures, accurate enough for most practical purposes, they are not machines of anything like the accuracy of the resistance pyrometers. Difficulties of course arise from a variety of causes; first of all, it is not so easy to measure extremely slight differences of e.m.f. as possibly it is to measure very slight differences of electrical resistance. Again, these couples are liable to injury from a great number of causes, and notably such things as furnace gases, or in the case of platinum couples they are extremely easily injured by bringing them near iron surfaces—whether it is that the carbon in the iron burning off slowly gives off a little carbon monoxide and thence iron carbonyl, or what it is, it is certain that they then undergo extremely rapid deterioration. Again, there is a difficulty in getting for this purpose wires which are perfectly homogenous. The only way, it seems to me, to work satisfactorily with a platinum pyrometer with the e.m.f. method is to standardize the pyrometer directly with pure metals whose melting points have been carefully determined before, and then plot them out on a curve and get the difference curve in that way, so that the true values can be arrived at. They are not such simple things to work with as one might imagine.

To come now to radiation methods, we have the enormous advantage of not having to introduce in any way platinum into the furnace or other thing whose temperature is to be measured. These radiation pyrometers are quite outside the furnace. First of all, there is the Féry radiation pyrometer; there are two forms of it, but it consists essentially of a concave mirror which is exposed to the source of radiation and forms a real image of the source of radiant heat at a certain point just beyond the principal focus. If a delicate thermo-junction is placed at this point, by standardizing it with known temperatures, the difference in e.m.f. between the two wires can be measured, and a measure of the temperature obtained. And further, provided it be a fair sized opening, it will be independent of the law of inverse squares, because, supposing the thermo-junction to be represented practically by a point, the image of the hot object will overlap it; if the apparatus is removed to twice the distance, the image will become half as long and half as wide as it was before, but it will still overlap the thermo elements; so that all the radiant energy which was before on the larger surface will, at twice the distance, be concentrated on a surface of one-fourth the size. This is now being used on a large scale for measuring very high temperatures, such as the temperature of large crucibles containing steel. This arrangement is fixed at the end of a long plumbago tube, and the tube is dipped into the molten steel of which the temperature is required; none of the working parts of the apparatus are in contact with the actual molten steel; and even if it breaks, it is only necessary to put a fresh tube on, and to measure the radiation to get at once the measure of the temperature. Nowadays remarkably concordant results are being obtained for the measurement of temperature by means of direct radiation. Another form of Féry's pyrometer has, instead of an iron constantan couple, a sort of Breguet metallic thermometer, a compound spiral of metals, one end of which carries a needle moving over a scale, and the temperature is read off directly.

I cannot conclude without just referring to a very remarkable paper,* which has comparatively recently appeared on the measurement of the boiling points of these metals by means of an optical pyrometer, in which the author found the boiling point of:—

Aluminium	1800° C.
Antimony	1440° C.
Bismuth	1420° C.
Chromium	2200° C.
Copper	2310° C.

That seems to me really carrying these higher temperature measurements just as far as it is possible to carry them.

DISCUSSION.

Mr. DARLING said he used to think himself that Siemens had abandoned his platinum resistance pyrometer, and that nothing was done until Callendar and Griffiths took it up again, but he found that they never gave up manufacturing the apparatus, but the difficulty described was overcome in a different way, *viz.*, by surrounding the platinum wire by magnesia, instead of winding it on mica. With regard to the relative merits of resistance pyrometers and thermo-electric pyrometers that entirely depended on what you were engaged in. In carrying out an elaborate determination of boiling points or melting points, no doubt a closer result could be obtained by using a platinum resistance pyrometer; but when the two were tested side by side, in a furnace and the instruments kept at a high temperature for a considerable time, those who had experience of both would undoubtedly declare that for workshop purposes the thermo-electric were far better. Platinum wires, kept a little over 1000° C. for any prolonged period altered materially in their resistance, and then, of course all the calibration was wrong. When taking a reading, even with indicators, such as the Whipple indicator, it was a troublesome process. It was necessary to perform an experiment; you had to go through the Wheatstone Bridge method of balancing, which was all very well in skilled hands, but in unskilled hands it was very different: by the time a balance was obtained the temperature might be different from that which was required. The thermo-electric method was better in this respect; all that was necessary was to read the temperature so that from the workshop point of view it had the superiority. The remarks as to the deterioration affecting thermo-junctions again applied equally to platinum; it could not be said that the thermo-electric method was inferior on those lines. With regard to accuracy, under workshop conditions, with large furnaces, it was an impossibility, either with a gas or coal fired furnace, to keep the temperature constant to within 10° C.; and therefore it was no use having a method which would read to a fraction of a degree; to get within the limits of fluctuation of the furnace that was all that was required, and he thought the thermo-electric method was quite accurate enough for workshop purposes generally. He knew many cases, and might instance one—the Royal Arsenal, Woolwich—where they used resistance pyrometers, but abandoned them after a thorough trial, in favour of the thermo-electric method; largely for this reason, that with the latter an installation of pyrometers could all be worked from a common centre, so that the responsibility could be transferred from the man at the furnace to the metallurgist in his office. They did that by having a special melt of wires, a special melt of platinum, and of platinum-iridium, or rhodium, and the wires from such melts were sufficiently homogeneous to give the same thermo-electric effect whichever piece of wire you took. Pyrometers made from those metals were all wired up to the central office, and all the pyrometers were standardised from the office. Then in the process of quenching a gun tube, the temperature having been previously decided upon, the man at the furnace telephoned to the metallurgist when the temperature was what he thought right on his own indicator; he then switched on to the indicator at the office, and if that gave the right reading he could proceed. That could not be done with resistance pyrometers, and that was one great point in favour of the thermo-electric method. It was only fair to say with regard to these resistance pyrometers that lately some had been made which were quite automatic. Paul recently brought out an indicator for resistance pyrometers which did not require any adjustment, whether turning handles or working indirectly, but gave a reading directly on the scale. The difficulty was in adapting it to an installation, say of 50 pyrometers (and they had at least 50 at the Royal Gun Factory). That was not possible by the resistance method. Another point of practical importance about the thermo-junction pyrometer was that it was more easily repaired. If anything went wrong with the resistance pyrometer it was better to send it back to the maker at once; but if anything went wrong with the thermo-junction the pyrometer was stripped, a new junction made, and the whole fixed together. All he had said referred to the workshop use of a pyrometer, rather than to the laboratory use; if a result was wanted with great precision, no doubt the resistance method was better. He might add a word with regard to the form of the Féry pyrometer in which a spiral was used. There was a curious effect produced with that spiral which had baffled him in using it. When the heat was concentrated on the spiral the pointer moved over the scale, remained at a certain point for a moment or two, and then started going on further; and the question was which reading to take. They recommended you to take the first reading when it came to rest, but that was not always right; there was something about it which had not been thoroughly made out. There was no doubt that for accuracy the form with the spiral was not nearly so good as the form with the thermo-junction and galvanometer. In conclusion he might give a practical example of the great accuracy now attained in reading even very high temperatures. Some time ago, in conjunction with some friends, he was taking some temperatures in the neighbourhood of 1500° C., and they used one of Féry's pyrometers and also an Holborn-Kurlbaum, an optical instrument made by Siemens, as a check, and they could not really discriminate between the two. The fluctuations of temperature would be about 10° on either side, and both instruments responded clearly to those fluctuations, and they were unable to detect any differences in the readings. The Féry instrument was standardised at the National Physical Laboratory and the other pyrometer at the Reichsanstalt. They were now getting with very great accuracy at these high temperatures, and those engaged in industry need not be afraid that pyrometers could only be used in the laboratory, for they could be used with confidence even in the workshop.

Dr. PHILIP said with regard to the validity of the formula which involved the constant δ; obviously, everything depended on that, and the accuracy with which it could be determined. As far as his memory served him, the actual value of δ varied somewhat markedly with the quality of the platinum; and he should like to ask whether it was possible to get platinum which had an invariable δ, and if not, how far the results were affected by slight impurities in the metal.

Dr. R. LESSING asked what influence glass or mica windows had on the readings of the Féry pyrometer. It was frequently necessary to take observations through sight boxes protected by glass or mica. He always found it best to adjust the correct distance with the glass on, and only to remove the glass before the actual reading was taken, which was, of course, higher than the reading through the window.

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* Greenwood, "The Approximate Boiling Points of Metals," Proc. Roy. Soc., 1909, vol. 82, A.

There was one other point he would have liked to have seen touched upon, namely, that of testing by Seger cones. It was not, perhaps, the most exact method nowadays, but, on the other hand, their importance was very great because they were used to a very large extent in all ceramic industries, and lately had been revised and standardized to a very much higher pitch of perfection. As long as one knew how they were used and the rate at which they were heated up, they were almost indispensable in certain work, especially in the determination of the melting points of refractory materials, where thermo-couples or resistance pyrometers were out of question on account of the melting point of platinum being reached and surpassed at those temperatures, and where the employment of optical pyrometers was frequently inconvenient in closed crucible furnaces.

Professor W. R. **HODOKINSON** said he though Mr. Heycock had somewhat neglected the thermo couple; and he might have said almost everything Mr. Darling had said about it. He (the speaker) thought it was the pyrometer of the present day; it was so simple and a recorder could be used in connection with it. He did not know whether a recorder could be used with the Siemens; but, unfortunately, they had not a recorder of a practical nature in connection with the Féry instrument. A recorder was wanted because in most metallurgical works it was necessary to keep the pyrometer going day and night, and to be able to turn back at any time and see what had been going on. It would be most valuable if they could combine the two. In a large steelworks which was going on all night and day they did not want a man watching it all the time, and it would be an advantage to be able to go in at any time, turn on the optical pyrometer, and see what had been done so as to corroborate the other one. The only thing he thought which militated against the thermo-junction was that the rhodium was attacked by carbon compounds, carbon monoxide, and so on; and so it must be protected. Undoubtedly, as had been said, some vapour came away from the iron—probably some carbon compound—and affected it; but when enclosed in a silica tube that difficulty was got over. He had had them working for some years now, and they acted perfectly well; they broke occasionally, but they were easily mended and put together again in a few minutes, and re-calibration was no difficulty.

Mr. W. **MACNAB** said that he had worked a good deal with thermo couples, but he had no experience of resistance pyrometers; for furnace work, he thought the thermo couple a most excellent means of measuring temperature; and it had the great advantage, which Mr. Darling and Professor Hodgkinson had referred to, of being so easily repaired when it was either broken or damaged; he certainly thought the thermo couple pyrometer was one of the most convenient instruments for the practical determination of high temperatures in a works.

Mr. **GARDNER** asked if it was quite certain that iridium volatilised?

Professor **HODGKINSON** said there was not the slightest doubt about that.

Mr. W. J. A. **BUTTERFIELD** said with regard to the nitrogen-fille glass thermometers, Mr. Heycock stated that the range of their employment was below 400°; but they were made now of special glass with the scale extended to from 550° to 600° C. He had used them very largely, and he found they agreed fairly well with the thermo-couple. It was very convenient to be able to use a simple thermometer like that. The glass of which they were made was "boro-silicate glass."

Mr. **HEYCOCK**, in reply, said with regard to the question raised by the first speaker and others, what he wanted to point out was, that for really exact determinations of an elevation of temperature there were few things, if any, which were equal to the resistance pyrometer. He agreed that for practical purposes the resistance pyrometer could not be used in workshops. There were lots of things which he did not think he could do with a platinum resistance pyrometer which one did manage to do very rapidly with a thermo-couple. For experimental work, or getting within 10°, ordinary work—and you could get much closer than that with a thermo-couple—by all means use it. Dr. Philip raised the question about the effect of different values of δ; that was first shown by the actual determination of temperatures by the resistance method with thermometers having very different δs: in one case, taking 783 grms. of gold, δ was 1·514, and the temperature 1061·5°. With 1·5δ, it was 1061·8°. With δ 1·538, it was 1062·3°. Then, taking 12 grms. of gold, with a 2·4 δ, he got 1061·2°. With 1·55 δ, he got 1061·9°; and with 1·615 δ (these were all different pyrometers) he got 1062°. The mean of all the values was 1061·7° which showed that even with values for δ which differed from one another enormously one arrived at the same result. He had not much experience with glass and mica windows, but he could well believe that they cut off an enormous amount of radiation. He should hesitate very much to use either a glass or a mica window. If he used anything at all, he should use a bit of rock salt; but that was not a practical thing to use every day. He was interested in what was said about the Seger cones; he had seen them and had some correspondence about them, and he gathered that by making suitable mixtures of metals they had now got—thanks, he believed, to resistance pyrometry—to a much higher pitch of perfection than they had before. With regard to the volatilisation of iridium, if one took an alloy of iridium and platinum, and determined its resistance at a high temperature it would be found, after having been kept hot for a few hours, to undergo a very much greater change than ordinary platinum underwent. He quite agreed that platinum pyrometers suffered considerable change and should be constantly standardized. As a matter of fact, his practice had been always to standardize them at the finish of each day, and sometimes in the course of the day as well. With regard to the question about mercury thermometers, he had never had the advantage of employing a mercury thermometer up to 550°. He did know the effect of using some of those which were made with a sort of Jena glass; they had a great many troubles with them, and he was very much interested to hear that they could now be obtained with glass which was practically silica.

A MODIFICATION OF RASCHIG'S THEORY OF THE LEAD-CHAMBER PROCESS.

BY EDWARD DIVERS.

(This J., May 31, 1911, 594—603.)

ERRATA.

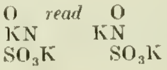
Page 594, col. 2, l. 8, *delete comma between* "might" *and* "he."

Page 594, col. 2, l. 36, *for* "—(N_2O_2)." *read* "—(N_2O_2)—."

Page 596, col. 2, l. 2, *for* "ates ubst" *read* "ate subst."

Page 596, col. 2, l. 40, *for* "dioxides" *read* "dioxide."

Page 597, col. 1, middle, *for* *read*



$$\begin{array}{l}H\\O\\KN\\SO_3K\end{array}\quad \textit{read}\quad \begin{array}{c}H\\O\\KN\\SO_3K\end{array}$$

Page 597, col. 1, line 32, *delete commas after* "intermediate" *and after* "$KN(OH)_2$."

Page 597, col. 2, l. 14, for "sofution" *read* "solution."

Page 599, col. 2, l. 5, *for* "intermediately" *read* "intermediate."

Page 599, col. 2, l. 25 from bottom, *for* "sul honate" *read* "sulphonate."

Page 600, col. 1, l. 30 from bottom, *for* "$HO)_2$" *read* "$(HO)_2$."

Page 600, col. 2, l. 20, *for* "salt" *read* "salts."

Page 602, col. 1, l. 20, *insert a comma after* "atom."

Page 602, col. 1, l. 23 from bottom, *for* "amined sulphon" *read* "aminedisulphon."

New York Section.

Meeting held at 52, East 41st Street (Chemists' Building), on April 21st, 1911.

DR. CHARLES F. MCKENNA IN THE CHAIR.

UTILISING WASTE WOOD BY DESTRUCTIVE DISTILLATION.[*]

BY JAMES LAWRENCE AND JAMES C. LAWRENCE.

Although the wood that is annually wasted by the logging and lumber industries of the United States is commonly thought to be a great amount, it is doubtful if the real figures are familiar to everyone. According to the statistics of the U.S. Forest Service and based on a figure of 65·16 per cent. waste given by Frankforter,[†] there were, in 1907, 150,000,000 tons of wood wasted. By intensive utilisation the greater part of this could have been saved. We will take up only one phase of the question, however, that of utilisation by destructive distillation, and will limit ourselves further by dealing only with those products obtainable from hardwoods, principally oak.

Table of yields.

Parts per 100 parts of wood used.

No.	Parts of wood.	Condition of wood.	Acid liquor obtained.	Tars obtained.	Charcoal residue.	Crude alcohol from acid liquor.	Acetate of lime from acid liquor.	Gas.	Remarks.
1	100	Green, bark on	42·50	3·10	29·90	0·95	4·55	24·50	Heated slowly.
2	100	Green, bark off	44·25	3·58	30·20	1·00	4·75	21·97	,, slower than 1.
3	100	Green, bark off	36·50	2·80	29·20	0·85	4·05	31·50	,, rapidly.
* 5	100	Air dry, clean	40·05	3·50	35·20	1·30	5·15	21·25	,, slowly.
6	100	,,	44·50	3·70	31·60	1·20	5·05	20·20	Slightly dryer than No. 5. Heated slowly.
7	100	,,	40·65	5·75	31·25	1·20	5·15	24·35	Heated a little more rapidly than No. 6.
8	100	,,	42·75	3·55	30·00	1·15	5·00	23·70	Heated a little more rapidly than No. 6.
9	100	,,	44·25	3·63	31·56	0·95	4·95	20·56	Heated slowly.
10	100	,,	43·75	3·45	31·12	1·15	5·05	21·68	,, ,,
	Averages		—	3·45	31·11	1 08	4·86	—	
† 1	100	Air dry, bark on.	44·45	3·70	34·68	—	4·55	17·17	Heated slowly.
† 2	100	,,	42·04	3·20	27·73	—	3·84	27·03	,, rapidly.

* No. 4 was run with sawdust and burned up on heating too rapidly. † Senff—*Loc. cit.*

The immediate products obtained by destructively distilling oak are well-known, viz.: Pyroligneous acid liquor containing acetic acid and methyl alcohol; tars and oils; charcoal; and uncondensed gases. Some of these yield other substances of commercial importance on further treatment. The acid liquor may be neutralised by milk of lime after freeing from tarry matter, and the alcohol or crude wood spirit then distilled off. At present there are processes of carrying out this procedure in one continuous operation.[*] The wood spirit may then be rectified further if deemed necessary, although there is one apparatus manufacturer at least who claims to be able to produce 99 per cent. methyl alcohol in one step. The tars can also be redistilled and the more valuable creosote oils obtained. The gas is (or may be) used for heating the retorts or ovens during a part of the distillation. The charcoal after cooling is ready for market without further treatment.

Until recently it was thought that wood less than four to six inches in diameter could not be advantageously used for destructive distillation because of the tendency toward burning away too rapidly when the exothermic reaction commenced. This reaction starts at about 275° C.[†] and if external heat is applied causes the formation of decomposition products from the acetic acid and methyl alcohol. This burning up is especially true of sawdust, which fact is readily understood when the finely divided condition and large exposed surface is considered. However, a patent has recently been granted in England[‡] for a retort which uses sawdust. It is essentially an endless screw which feeds the sawdust over the heated portion of the retort slowly and a little at a time. We are unable to state what results have been obtained in practice with this apparatus, but a moment's consideration will reveal the great saving to lumbermen if it is practicable.

If the destructive distillation industry is to use only five or six inch cordwood there will be very little chance of utilising any lumber waste, hence it occurred to the authors that some data might be obtained on the effects of using only mill waste for this purpose, and some statistics compiled from actual observation are appended.

The experimental data were obtained from oak lumber slabs and "off fall," the slabs measuring 1 in. to 2 ins.

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[*] Some of the experimental data in this paper were presented at the winter meeting of the Amer. Chem. Soc., Dec., 1910, in a paper read before the Division of Ind. Chem. and Ch. E.

[†] J. Ind. and Eng. Chem., 1911, **3**, 6.

[*] Campbell, Met. and Chem. Eng., 1910, **8**, 3.

[†] Fawsitt, this J., 1885, 5. Klason *et al.*, Z. angew. Chemie, **23**, 1252.

[‡] Halliday, Salford.

thick, 2 ins. to 4 ins. wide, and were cut into lengths of two feet. The charges were of 200 lb. each, and both green and air-dried woods were used. The green wood gave a greater yield of acid liquor, but the yield of acetate obtained from this was lower in proportion than that from dry wood. This was doubtless due to the moisture present causing decomposition of the acetic acid and methyl alcohol, and also to the increasing of the volume of the distillate by water.

Since it has been shown that such finely divided wood as sawdust may be destructively distilled with suitable apparatus by heating carefully a small quantity at a time, it was decided to attempt distillation on the same principle, using slabs. It is also known that when wood is distilled a reaction which generates heat sets in at about 275° C., and it was assumed that if the retort were allowed to cool at this point the internal heat would not increase to such an extent as to decompose the alcohol and acetic acid formed. Therefore, when the yield of distillate reached a maximum the external heat was withdrawn and the distillation was allowed to proceed alone. Theoretically the wood should char itself completely after this point is reached, but on allowing it to cool and then heating some of the charcoal in a glass retort afterwards, it was found that a small percentage of distillate came off, and the charcoal was dark brown, and became black on heating. Our procedure was therefore modified so that the retort was heated very slowly up to 100° C., then a little more rapidly to 280°, and then the external heat was withdrawn until the temperature reached a maximum, when the heat was again applied, and the distillation finished as rapidly as possible, up to a little over 400° C. These operations gave the maximum amount of distillate obtainable, and the decomposition of the alcohol and acid was avoided as far as possible. The table will show the yields of products obtained from the distillations—the difference between the results from green and dry wood and the results of comparative rapidity of heating being noted.* Appended to the table are given the products obtained in the distillation of the same species of wood (red oak) by Senff.† He used only 5 lb. of wood in his charges, and it was cut into very small sticks. He did not attempt to separate the alcohol from the pyroligneous liquor, and reported the yield of acid as acetic acid. In the table we have calculated this to acetate of lime for the sake of comparison.

As to statistics, we will take as an example of commercial utilisation the wood wasted in a small lumber mill over a period of a few months for which we have accurate figures from personal observation. The mill cut 125,000 feet BM. of hardwood lumber. Using Frankforter's‡ figures we find that there was wasted in stumps, slabs, limbs, etc., wood to the amount of 883,700 lb., or 196·4 cords. Almost all of this could have been used for distillation. Taking the figures given as averages in the table of data, we find that this would have yielded products as follows :—

Tar	30,488 lb.
Charcoal	274,919 ,,
Alcohol	9,544 ,,
Acetate of lime	42,948 ,,

From statistics furnished by the U.S. Census Bureau for 1909 these would have the following values :—

	$
Tar at 8 cents per gal.	250.00
Charcoal at 6 cents per bus.	825.00
Alcohol at 24 cents per gal.	1865.00
Acetate at 1.5 cents per lb.	644.00
Total	$3,584.00

In a small commercial plant of about ten cords capacity per day this would have taken less than three weeks to work up. These small figures were taken, contrary to the usual custom of speaking in sums far above ordinary comprehension, to indicate approximately the great field of saving in natural resources which the chemist and chemical engineer can effect.

As a matter of interest we submit below an analysis of a sample of the gas taken from one of the distillations, and would call attention to the high calorific value of this gas for a "wood gas."

	Per cent. vol.
Heavy hydrocarbons	8·16
Marsh gas	12·32
Carbon dioxide	31·45
Carbon monoxide	35·08
Hydrogen	10·94
Nitrogen	2·05
	100·00

Calorific value .... 11,493 B.Th.U. per lb.

Discussion.

Dr. J. E. **Teeple** said that waste from saw mills or stump wood was of such irregular shape and quality that no method of distilling it destructively could ever be a commercial success, unless the wood were first reduced to very fine chips. The destructive distillation of chips and sawdust had been the subject of repeated patents and experiment. Many of the systems tried appeared very promising, but so far as he knew, none had ever been developed into a continuously operating plant, and there was no immediate prospect of one. He had himself had to do with installations on a small factory scale where chips were destructively distilled with apparent success for periods of several weeks, but in every case difficulties were met rendering the system impracticable. If the chips were placed in a stationary retort, they acted as heat insulators and prevented the heat from penetrating to the interior of the mass. If they were kept in motion either by rotary retorts or by screws or conveyors, the high temperature reached usually caused difficulty with the machinery in the course of a few weeks. Another disadvantage was that the charcoal obtained by this method could hardly be used in blast furnaces, and so would be entirely dependent for sale on the local fuel market.

Saw-mill waste was being dealt with quite extensively in the south by other methods. A plant in Georgia, for example, was converting it into producer gas with apparent success. A plant in Texas was recovering some turpentine from shavings obtained from a planing mill and converting residue into paper pulp. A plant in Florida was recovering the turpentine and pine oil by steam distillation, and then using the residue for fuel. A plant in South Carolina was converting part of the lignocellulose of saw-mill waste into glucose and then fermenting this for the production of ethyl or grain alcohol. All these plants were on a commercial scale and apparently working successfully. All of them, however, dealt with soft woods. The soft woods did not yield either methyl alcohol or acetate of lime in paying quantities, and so in any case utilisation of these woods by destructive distillation presented an entirely different problem from hard wood utilisation.

To his own knowledge some of the largest paint and varnish manufacturers had been buying spirit of turpentine recovered from waste wood in tank car lots for several years.

Mr. **George Walker** stated that he had distilled many tons of waste wood in the shape of sawdust from Canadian pine, and that the apparatus used consisted of a cast iron cylinder about twelve inches in diameter and ten to twelve feet long, furnished with an archimedian screw in the interior and discharging the carbonised sawdust into air tight vessels. As the principal object of the operation was the production of illuminating gas, not much attention was paid to the by-products of the carbonisation of the sawdust. In reply to questions, about 500,000 barrels of pine tar were produced annually. It was used principally for fuel, but could be bought for two cents per gallon and was a good material for the manufacture of artificial fuel.

Dr. C. A. **Doremus** said that the last speaker had pointed out a most important point to be considered in regard to the processes in question, viz. : the object of the distillation. In his own case sawdust was treated for the production of illuminating gas. The management of the heat, and the type of retort were such as to yield gas. So in Wilkinson's process for the production of gas from cord wood (J. Amer. Chem. Soc., 1880. 449), the wood after carbonisation was pushed to the rear of the retort, and when a fresh charge was put in the steam, acid, alcohol, etc., set free had to escape through a bed of red-hot charcoal, where water gas was formed. Analyses of the resulting gas and of the gas after enrichment with cracked petroleum naphtha showed the advantages of this system. Those were instances where the destructive distillation was directed to the formation of fixed gases.

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* Berichte, 1885, **18**, 60.
† Figured to parts per 100 parts wood.
‡ *Loc. cit.*

The authors of the paper recognised the importance of paying due attention to the exothermic reaction which took place when wood or cellulose was heated to 275° C., especially if the object of the process was to obtain acid and wood alcohol. As some of their results referred to slow *vs.* rapid heating it might be well to call attention to an error which had crept into the literature on this point. Senff (Ber., 1885, **18**, 60), described the results he obtained by slow and rapid heating. Unfortunately, the two series of experiments which he made were not comparable. In the first series he applied low heat, in the second he introduced the wood, in bundles, into a red-hot retort, which he maintained at red heat during the distillation. Not only were the products such as acid and alcohol decomposed in contact with the red-hot surfaces of the retort and charcoal produced on the exterior of the pieces of wood being distilled, but the exothermic reaction was utterly uncontrolled. These results of Senff had been copied, even into the most recent works on destructive distillation, no reference being made to the manner of the heating. Even Frankforter (J. Ind. and Eng. Chemistry, 1911, **3**, 4) compared slow and cautious heating with rapid heating at red heat, and thus confused the question, though in a less degree than Senff. It thus would seem advisable to clarify this subject by recognising the difference on the one hand between slow and rapid distillation methods of securing a definite class of products, as acid and alcohol, and on the other hand slow distillation for acid and alcohol *vs.* rapid distillation, at much higher temperatures, for a yield of gas chiefly.

Mr. **John W. Hornsey** said that he was particularly interested in what had been said as to the comparative yields by rapid and slow distillation, as he believed that it it was wrong to attribute all the difference in results to the time consumed in the distillation. The difference was due primarily to the method of distillation and to the exothermic nature of the reaction. J. C. Chorley and Sir William Ramsay (this Journal, 1892, 395) showed that if the heat were kept under control, the material itself not over-heated, and the size of the particles such that the outgoing volatile matter was not decomposed through contact with incandescent carbon, the yield from hard woods both in methyl alcohol and acetic acid was fully as great by rapid as by slow distillation. In other words, it was a question of temperature rather than of time. That paper gave valuable data in the form of temperature charts, showing that the temperature of the material began to rise very rapidly at about 275° C. and in a short time materially exceeded that of the heating medium. From this, it would be seen that control of the heat generated by exothermic reaction was most important in preventing over-heating of the material and decomposition of the products of distillation.

A considerable amount of accurate scientific work had been done in determining the exact amount of heat set free in the destructive distillation of bituminous coal for the manufacture of illuminating gas, and it had been shown that the amount varied with the percentage of volatile matter in the coal. He found that confirmed, as when the external heat was withdrawn, the temperature of the material in the retort rose about 11° C. with bituminous coal, 28° C. with lignite, 56° C. with peat, 83° C. with chestnut, and 136° C. with pine. The possible influence upon the results of the exothermic nature of the reaction had not been given the emphasis which it merited, for, if it were possible to construct an apparatus so designed as to fully utilise the heat set free in this manner, the cost of the destructive distillation of wood would be materially reduced. One authority stated that this heat amounted to 6 per cent. of the total heat of the combustion of the wood. He had drawn one heat balance, based upon definite calorimetric determinations of the heating values of the wood and of the products, which showed that 1000 B.T.U. or approximately 12 per cent. of the heat of combustion of that particular wood was set free during the distillation. Judging from the amount of heat theoretically required to effect the reaction, including the amount of heat rendered latent by change of state, it should be possible in a continuously operated machine, after the work was started, to derive all the thermal energy required from that set free during the distillation. That theory was at variance with established practice, but he was inclined to think it might be possible to accomplish this result.

Much valuable work might be done in determining new uses for the many wood distillates and their derivatives. Some seven or eight years ago he had spent a great deal of time at hard wood distillation plants in Northern Michigan and became pretty thoroughly familiar with the practice employed at that time. In order to ascertain what, if any changes had been made in the interim, he had just made a trip through Southern New York State and Northern Pennsylvania, and found that most of the plants now partially distilled their tar so as to take off the lighter oils which were sold and known as "chemical oil." That, however, was only a step which he hoped and expected to see carried much farther. He had spent some time in 1904 at the Marquette plant mentioned by Mr. Miller, and had kept in touch with Mr. Max Klar, the author of the well-known work "Technologie der Holzverkohlung," who had recently remodelled the large chemical plant built by the Cleveland Cliffs Iron Co. at Marquette in 1903. The new apparatus had been in use for a month or two and showed a very marked saving, the cost of some of the steps having been reduced to one-third of what it was by the old methods.

This company started with iron mines and gradually added railroads, blast-furnaces, charcoal kilns and chemical plants. Recently, they had installed plants for the manufacture of formaldehyde, acetic acid, sulphuric acid, acetone, etc., and they now stated unhesitatingly, "We are in the chemical business; iron is our by-product and we manufacture it to use up our charcoal." While all that indicated that marked progress had been made in the past few years in the industry, the field was a very fertile one and much remained to be done. One important feature which seemed to have been given less attention than it deserved was the question of the yield per cord or other unit. What was the theoretical yield and how might it be determined? He found no definite or positive data on that subject in any of the authorities. There were many statements as to actual and average yields, but he could find none as to what might theoretically be obtained under ideal conditions and as to what might constitute ideal conditions. His own work, however, indicated that the present commercial yields were very much less than should be possible. If the yield could be materially improved, the number of products increased, and the cost of operation reduced, the industry might be placed upon a firm and solid foundation.

Mr. **Jas. Lawrence** said, in reply, that the apparatus consisted of a wrought-iron retort and a horizontal cylinder, one end of which was fitted with a door which fastened by bolts to a flange; the other end had a tube inserted into the retort which was closed inside so that the temperature could be taken by pyrometer readings. The gas outlet was placed at the top of the end opposite the door and was of flexible iron tubing 1 in. in diameter. The retort was 5 ft. long by 2 ft. 6 in. in diameter, and was supported on brick base with asbestos side and top shields entirely covering it. The heat was applied by gas burners, thus giving good control of the temperature. The condenser was of copper piping and was a simple coil condenser in a wooden box.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Filter-presses. Free importation of —— into Australasia. Board of Trade J., May 25, 1911. [T.R.]

An Australasian By-Law (No. 159) dated 27th March, 1911, amends By-Law No. 116, and provides, under item No. 166 of the Customs tariff, for the free importation into the Commonwealth of the following machine tools:—

Filter presses (but not including a pump when not an integral part of the press) for use in the manufacture of arsenate of lead and arsenate of lime or Bordeaux paste, provided that security be given by the owner that they will be permanently erected for use for that purpose only, and that evidence of such permanent erection and use be given to the satisfaction of the Collector within twelve months after delivery by the Customs.

Patents.

Digesting and drying apparatus; Combined ——. E. G. Scott and Ernest Scott and Co., Ltd., London. Eng. Pat. 11,288, May 6, 1910.

A steam-jacketed cylindrical vessel is supported on standards by trunnions fixed mid-way along the cylindrical walls and on which the vessel may be brought into a vertical or horizontal position by means of a hand-wheel and worm. During the digestion the vessel is caused to assume a vertical position, and the material, which is introduced through a manhole at the top and is supported on a perforated plate at the lower end, is treated with steam introduced below this plate. For subsequent drying the vessel is turned to a horizontal position, the material being agitated by a stirrer on an axial shaft driven by an external pulley. Suitable glands are provided for steam admission and eduction independent of the position of the vessel. —B. G. McL.

Drying barrels. T. R. Canning, Birmingham. Eng. Pat. 18,387, Aug. 3, 1910.

An apparatus for drying metal or other articles in sawdust comprises a water-jacketed barrel mounted on an inclined shaft, means for rotating the barrel, and a gas burner for heating the barrel externally. In mounting the barrel, the inventor provides a strong cast iron base having an inclined bearing for the spindle carrying the barrel, and a horizontal bearing for the driving spindle, which latter carries driving pulleys, and a bevel pinion engaging a bevel-wheel on the lower end of the inclined spindle on which the double-walled barrel is mounted.—H. H.

Drying apparatus. K. Weiss, Meissen, Germany. U.S. Pat. 991,679, May 9, 1911.

A horizontal perforated cylinder, having a large hollow trunnion for introduction of the drying medium, is caused to rotate in the lower trough-shaped part of a casing; the cylinder has mounted on it a number of broad blades which scrape the material from the trough, and raise it on to the cylinder, whence it is removed by arms fixed on a horizontal shaft placed in the upper part of the casing and revolving at a speed greater than that of the cylinder; these arms pass between the blades of the cylinder, and are placed in such a manner as to cause the material to move along towards the outlet end of the casing. The drying medium leaves the apparatus at the top.—B. G. McL.

Centrifugal dryer. J. M. White, Mapleton Depot, Pa. U.S. Pat. 992,621, May 16, 1911.

A horizontal perforated drum open at both ends and having a lining of "fabric material" is attached to a rotating central shaft, supported on standards by radial arms which are fixed to the drum at the centre. Below the shaft, from both standards, stationary supports extend to the middle of the cylinder, and from these supports angular conveyor plates are arranged for moving the material towards the outlet end of the cylinder. The introduction of the material takes place through a shoot at the other end.—B. G. McL.

Treating materials with gases and the like; Apparatus for ——. H. W. S. Martin, and Matthews and Yates, Ltd., Manchester. Eng. Pat. 11,546, May 10, 1910.

A series of drying chambers are disposed in such a manner relatively to a hot air supply duct and hot air outlet duct that hot air can be supplied direct from the supply duct to any of the chambers, or it may be supplied to one of the chambers and then flow through the remaining chambers of the series. Openings, the size of which can be regulated, are provided between the chambers as well as the inlet and outlet doors communicating with the supply and outlet ducts.—H. H.

Generation of steam and like purposes; Apparatus for ——. W. A. Bone and J. W. Wilson, Leeds, and C. D. McCourt, London. Eng. Pat. 11,865, May 13, 1910.

A boiler of the type described in Eng. Pat. 4362 of 1910 (this J., 1911, 406), in which the heating tubes are packed with granules and the combustion takes place within the tubes, is modified in that hot gases from a furnace or combustion space external to the tubes are passed through the tubes, the function of the granular material being to transfer the heat from the gases to the tubes by radiation and baffling or churning action. The inlet ends of the tubes, which project into a firebrick feeding chamber, are protected by fireclay ferrules, and the outlet ends, which project into an off-take box having means of access, are provided with grids to hold the granules. A feed-water heater having tubes similarly packed with granular refractory material, through which the waste gases pass, is used in conjunction with the boiler.—H. H.

Spraying or atomising liquids; Apparatus for ——. Heenan and Froude, Ltd., and W. Wheal, Manchester. Eng. Pats. 14,702, June 18, 1910, and 29,422, Dec. 19, 1910.

A spraying nozzle is made of conical, elliptical or spherical shape, with a small orifice at the apex or summit thereof, and is filled with slag wool or other fibrous or porous material, with or without a diaphragm of wire gauze. Separate supplies of water and air are forced into the nozzle at high and equal pressures.—H. H.

Compressing air and other gases; Method of —— and apparatus therefor. W. Hessling, London. Eng. Pat. 21,746, Sept. 19, 1910. Under Int. Conv., Sept. 18, 1909.

In a method of compressing air by stages in which the first compression is effected by a rotary or constantly acting compressor and the further compression by a piston or intermittently acting compressor, a very large air vessel is provided between the two compressors whereby the effects of the fluctuations of pressure caused by the intermittently acting compressor upon the constantly rotating one are minimised.—H. H.

Fume, flue dust, and other matter suspended in gas; Collection of ——. R. F. Pearce, Liverpool. Eng. Pat. 24,509, Oct. 21, 1910.

THE gas to be purified is introduced into the lower part of a vessel of water containing a submerged filtering medium, so that the gas rises first through the water and then through the filter into the water above the filter where it is collected. The filtering medium may consist of cocoanut matting, asbestos cloth, or wooden balls. —H. H.

Classifying powdered or fine material; Method of ——. Soc. Anon. des Manufactures des Glaces et Prod. Chim. de St. Gobain, Chauny et Cirey, France. Eng. Pat. 2830, Feb. 3, 1911. Under Int. Conv., Feb. 10, 1910.

POWDERED or fine substances are classified by suspending them in a liquid which is made to flow through a number of successive vertical cylinders of increasing diameter from the first to the last, the liquid passing vertically upwards in each case. Means may be provided for withdrawing the deposited particles from the cylinders either intermittently or continuously.—H. H.

Filtering-plates, bougies and the like: Process for manufacturing ——. H. Passow, Blankenese-on-the-Elbe, Germany. Eng. Pat. 8233, April 1, 1911. Under Int. Conv., April 2, 1910.

WHEN a mixture of kieselguhr and clay or similar material is burnt with a suitable flux, such as salt or fluorspar, at a temperature sufficient to cause partial fusion of the kieselguhr, whereby its internal structure is altered, a material is produced which is of great strength and of high filtering speed but is incapable of retaining bacteria; burning at a lower temperature yields a material which will retain bacteria but which is extremely brittle. The invention consists in preparing a strong filtering material at the higher temperature and subsequently incorporating this with a further quantity of the initial mixture and again burning at the lower temperature; or the same result may be obtained by varying the proportions and the flux used so that the partial fusion of the kieselguhr does not extend entirely through the mass.—B. G. McL.

Distilling; Method of ——. A. G. Waterhouse, New York, Assignor to T. F. Bourne, Montclair, N.J. U.S. Pat. 991,570, May 9, 1911.

IN a continuous distilling apparatus the liquid to be distilled is caused to pass upwards through a cylindrical vessel, in which heating tubes are placed, at such a speed that on arrival at the top it has attained a definite predetermined temperature; the liquid is then caused to pass into another vessel where it is heated to a still higher temperature and where the vapours distilled in the first vessel are brought over the surface of the liquid, the pressure thus produced being utilised to regulate the flow of fresh liquid to the still and to regulate the flow of this heated liquid through the inner tubes of the still, by which means the distillation is effected.—B. G. McL.

Acid or alkali resisting articles; Process of making ——. I. L. Roberts, Lockport, N.Y. U.S. Pat. 992,256, May 6, 1911. (See also this J., 1909, 602.)

ARTICLES of woody material are rendered porous by gradual heating till partial carbonisation takes place throughout the mass; the pores are then filled up with a liquefied resistant material which on cooling hardens in the pores.—B. G. McL.

Crucible-lid. W. and T. Ross, Glasgow. U.S. Pat. 992,599, May 16, 1911.

IN order to prevent the emission of fumes, the circular lid is fitted with a carrying ring and has arms which embrace the outside of the crucible. The rear arm, which is made of resilient metal, engages with a ring which surrounds the crucible at a point below its greatest diameter, so securing the lid in position during pouring. Over the lip of the crucible the lid is suitably cut away and is provided with a lip extending into the crucible.—B. G. McL.

Elastic fluids; Process and apparatus for the purification of ——. G. M. Spencer. Fr. Pat. 424,059, Dec. 23, 1910.

AIR for working pneumatic brakes, etc., is drawn into the compressor through a dust separator comprising a flat chamber standing on one of its narrow sides and having an inlet pipe for air running along near the bottom and an outlet pipe for air at the top. The air issues from a slot in the lower surface of the inlet pipe and impinges on the surface of water or other purifying liquid contained in the chamber.—H. H.

Cooling and drying gases; Process and apparatus for ——. C. H. Leinert. Fr. Pat. 424,233, Oct. 18, 1910.

THE "Gayley" process of drying air for furnaces, in which the air is passed over tubes containing a cold solution of calcium chloride, and the ice depositing thereon periodically removed, is modified by bringing the air into contact with water which has been cooled by flowing over such tubes, and the partially dried and cooled air is then passed through a final drying chamber in which it comes in contact with cooling tubes containing liquid ammonia Ice is prevented from congealing on these tubes by means of a saline solution which is slowly run over them. The air is driven by a fan into a tower down which the cold water drips, and the flow of air is assisted by siphon action in that the dense cooled air is drawn away at a point lower than that at which the air to be cooled enters. The final drying chambers are arranged upon the walls of the preliminary drying chamber in such a manner that reheating of the gas by radiation is prevented.—H. H.

Fractionating ethers, alcohols, and other liquids; Process for ——. C. Crépelle-Fontaine. Fr. Pat. 424,476, Dec. 28, 1910. Under Int. Conv., Dec. 28, 1909.

IN order to reduce the height of fractionating or rectifying columns, it is proposed to provide them, at suitable intervals, with coils or other means for applying water, air, or other cooling medium to the vapours; by this means, the condensation of a particular constituent of the vapours can be localised over a very few plates. It is advantageous to have thermometers attached to the parts of the apparatus provided with the cooling coils, to facilitate the regulation of the temperature in those parts.—T. F. B.

Compressed or liquefied gases; Mass containing wood charcoal for the absorption of ——. M. Schmidt. Ger. Pat. 234,216, July 11, 1908.

WOOD charcoal is sometimes used for filling cylinders for compressed or liquefied gases in order to prevent danger of explosion. In order that the charcoal may be used in the form of pieces, without the possibility of these breaking and yielding dust, porous inorganic substances are added to the charcoal, and the whole is treated with a binding agent which solidifies gradually.—A. S.

Liquids; Process for the mixing or extraction of ——. Chem. Fabr. Flörsheim. Dr. H. Noerdlinger. Ger. Pat. 234,258, April 1, 1909.

THE process consists broadly in causing the liquids to flow through separate conduits into a common conduit of larger cross-section, through which the mixture flows for a relatively long time, and is then led through separate branch conduits to a second common conduit, and so on. The direction of flow is changed both at the places where the streams unite and where they separate. For instance, a number of chambers are arranged stepwise and are connected by branch pipes. The liquids to be separated are led to the upper chamber by separate pipes, and the connecting pipes between the chambers are so disposed that the liquid from the upper part of one chamber is led to the lower part of the next chamber, so that in flowing through the system the liquids take abrupt changes of direction. The whole system may be enclosed in a water- or steam-jacket. It is stated that a system of eight chambers is sufficient for nearly all technical purposes, and that for an installation capable of dealing with 2000 litres per hour, the necessary dimensions are: height, 1·7 m.; length, 1·2 m.; width, 0·7 m.—A. S.

Dis-associating and removing vapour from aqueous liquids; Method of ——. W. T. Hoofnagle, Bloomfield, N.J., U.S.A. Eng. Pat. 8793, April 12, 1910.

See U.S. Pat. 956,097 of 1910; this J., 1910, 680.—T. F. B.

Evaporating apparatus. F. Scheinemann, Treptow, Germany. Eng. Pat. 25,560, Nov. 3, 1910. Under Int. Conv., Nov. 9, 1909.

See Fr. Pat. 421,848 of 1910; this J., 1911, 407.—T. F. B.

Concentrating liquids; Apparatus for ——. J. F. P. Kestner. Fr. Pat. 423,969, March 1, 1910.

See Eng. Pat. 5020 of 1910; this J., 1910, 1190.—T. F. B.

Impregnating liquids with gases; Apparatus for ——. M. Paschka, Vienna. Eng. Pat. 27,166, Nov. 22, 1910.

See Fr. Pat. 410,640 of 1909; this J., 1910, 805.—T. F. B.

Drying of non-pulverulent materials. F. Tiemann, Berlin. U.S. Pat. 992,295, May 16, 1911.

See Fr. Pat. 395,863 of 1908; this J., 1909, 486.—T. F. B.

Separator; Centrifugal ——. G. E. Sanford, E. W. Kopke, and H. E. Procunier, Assignors to International Clarifying Co., Chicago. U.S. Pat. 992,809, May 23, 1911.

See Fr. Pat. 414,841 of 1910; this J., 1910, 1191.—T. F. B.

Liquid-separator; Centrifugal ——. E. A. Forsberg, Assignor to Aktiebolaget Separator, Stockholm. U.S. Pat. 993,048, May 23, 1911.

See Eng. Pat. 21,820 of 1910; this J., 1911, 120.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Furnace problems [in gasworks]. R. Terhaerst and H. Trautwein. J. Gasbeleucht., 1911, **54**, 517—522.

The authors have attempted to estimate the efficiency of the following gasworks installations: (1) Vertical furnace with 18 retorts, (2) chamber furnace, (3) horizontal furnace with mechanical charging, (4) inclined retort furnace. From a comparison of the previously published data they first conclude that for the same coal and the same temperature of carbonisation, there will be practically the same yield of heat units in the gas from all the different systems. The financial comparison is based on the production of mixed gas which is prepared in the vertical furnace directly, and is produced in the other cases by adding a suitable amount of water-gas to the coal-gas (see this J., 1910, 1240). It may be assumed that the coke and tar yields will probably not differ greatly in the four systems and that the cyanogen compounds may be neglected. It is necessary therefore to consider the cost (depreciation and repairs) of the plant, the cost of heating and labour, and the difference in the yield of ammonia, which is smaller by about 0·02 per cent. (of the weight of the coal) with horizontal and inclined retorts than in the other two cases. In the vertical retorts it is assumed that 160,000 cb. m. of mixed gas per day are to be produced for 230 days. In the others 125,000 cb. m. of coal-gas are to be produced and mixed with 35,000 cb. m. of water-gas from a separate generator. The initial outlay on vertical and chamber systems will be much greater than on the others but the difference is partly recovered by reduction in cost of labour, etc. Consideration of all the factors leads to the conclusion that the horizontal furnace has probably some advantage in efficiency. The differences are not considerable, however, and in practice it is largely a question of deciding the relations between the cost of the installation and the cost of labour. The authors conclude with a discussion of the special conveniences of working (space occupied, ease of control, etc.) in each case.—W. H. P.

Washing oils for removal of naphthalene [from coal gas]. A. Bayer. J. Gasbeleucht., 1911, **54**, 496—499.

For the removal of naphthalene from coal gas a light oil of the following composition has been used by the author:—Benzene, 0·4; light oil (100°—180° C.), 67·6; middle oil 180°—230° C.), 25·0; naphthalene, 3·9; and heavy oil, 3·1 per cent. Such an oil is found to remove naphthalene very thoroughly from the gas and to give up to it some light and middle oil. These latter seem to assist in the removal of naphthalene which may already have found its way into the mains. The naphthalene is found dissolved in the condensed hydrocarbons at various points in the system. The results obtained by the use of the light oil are much better than those obtained with a heavy oil or even with a heavy oil mixed with middle oil.—W. H. P.

Petroleum resources of the world and their distribution. J. Mendel. Petroleum, 1911, **6**, 962—971.

After discussing the future of the petroleum industry, the author gives statistics of the petroleum production of the world in the years 1890 to 1910, and data as to the production, consumption, exports, and deposits of petroleum in the United States, Russia, Roumania, Austria-Hungary, Dutch Indies, British India, Japan, Mexico, Peru, Germany, Canada, Australia and New Zealand, Nigeria, British South Africa, Great Britain, Italy, Spain, Portugal, France, Egypt, Turkey, Persia, China, Trinidad, Barbados, Colombia, Venezuela, Ecuador, Argentine, Bolivia, and Chile.—A. S.

Tampico oilfield, Mexico; The ——. S. H. Ball. Eng. and Min. J., 1911, **91**, 959—961.

The oilfield is situated on the border of the states of Vera Cruz and Tamaulipas, on the coast of the Gulf of Mexico. Development started ten years ago, but the most important discoveries have been made within the last few years. The known productive area extends from the city of Tampico about 35 miles westward, and about 120 miles southward. Tertiary limestone covers most of the district. Below this is bluish-grey shale of the Cretaceous period. The structures of these two series are nearly similar. Still lower is a blue shale, with layers of interbedded limestone, containing the oil. These strata also belong to the Cretaceous period. The dip is generally easterly. Asphaltum seeps with escaping gas are found near these basaltic dikes or along fractures, and most of the producing wells are also in these localities. The wells are generally from 1700 to 2000 feet deep. A normal well appears to yield from 500 to 1000 barrels of oil daily, though many large gushers have occurred, among which the Dos Bocas, and the new No. 4 well, Potrero del Llano may be cited. The grade of oil is not high, and a small proportion only is being refined, at Minatitlan, Vera Cruz, and Tampico, most being used as fuel; 50 cents per barrel is now considered a fair price. The present production is about 3700 barrels per day. There are several pipe-lines in the district, and more are projected. Storage tanks exist at Tampico, and the construction of large concrete reservoirs at various points is contemplated. Although the average life of the wells has not yet been determined, the field, from its proved large extent, ought to be long-lived and to produce much oil. Its proximity to the Panama Canal lends it additional importance.—R. W. N.

Ceresin and paraffin wax; Analysis of mixtures of ——. N. Chercheffsky. Les Matières Grasses, 1911, 4, 2235—2239.

THE following table summarises the differences in solubility of paraffin wax (m. pt. 52°—54° C.) and pure Galician ozokerite (m. pt. 68·7° C.) in different solvents :—

Solvent.	Solubility in grms. per 100 c.c. at 15° C.	
	Ceresin.	Paraffin wax.
Alcohol (96·5 per cent.)	0·056	0·108
Methyl alcohol (99·25 per cent.)	0·016	0·004
Amyl alcohol (b. pt. 129°—131° C.)	0·100	0·496
Carbon bisulphide	1·9716	19·072
Carbon tetrachloride	1·948	11·784
Chloroform	1·276	5·332
Acetone (b. pt. 54°—58° C.)	0·028	0·120
Ether	0·592	1·920
Petroleum spirit (sp. gr. 0·710)	1·416	5·940

The critical temperature of solution, preferably determined with alcohol (96·5 per cent.) as the solvent, is nearly constant for pure ceresin, but varies considerably with the melting point in the case of paraffin wax. But since, as a rule, paraffin wax of m. pt. 50° C. to 54° C. is used for admixture with ceresin, 146° C. may be taken as the mean value for paraffin wax and 172° C. as that for ceresin. In each case the determination should be made upon the unsaponifiable portion of a sample. The results quoted show that the critical temperatures of solution of mixtures of the two products agree closely with the calculated figures. Other useful data are afforded by a determination of the temperature of turbidity, preferably in benzine (petroleum spirit), and the refractive index. The general values obtained with typical samples were as follows :—

	Origin.	M. pt.	Refractive index.		Critical temperature of solution with 96·5% alcohol.	Turbidity temperature with benzine.	Solubility in carbon bisulphide at 15° C. grms. per 100 c.c.
			78° C.	100° C.			
		° C.					
Paraffin wax 3RB	America	53·7	1·4280	1·4185	148	24·7	19·07
,, from shale, 3R	Autun	42·1	1·4238	1·4152	136·5	—	38·68
,, ,, ,, 4R	Autun	46·5	1·4246	1·4161	141	—	34·65
Ceresin	Gal	68·7	1·4352	1·4268	172·5	47·4	1·97

—C. A. M.

Petroleum deposit in the Bavarian Tyrol. Board of Trade J., June 1, 1911. [T.R.]

EXTENSIVE borings for petroleum have been in progress for over 25 years on the western shore of the Tegernsee, a lake situated about 35 miles to the south of Munich at the foot of the mountains of the Bavarian Tyrol. Since 1906 a depth of 1,500 feet has been reached, resulting in a progressively increasing flow of oil; 304 metric tons were obtained in 1909, as compared with 168 tons in 1908, and 130 in 1907. The crude oil, which commands a price of about £4 15s. per metric ton, is stated upon analysis to be quite equal to the best Pennsylvania oil in the amount of naphtha and of paraffin it contains. The oil-bearing strata have been traced for several miles along the northern flank of the mountains of the Bavarian Tyrol. A spring strongly impregnated with iodine has also been struck in the course of the explorations. Trial borings for petroleum have also been made from time to time in the Bavarian Palatinate. These, however, have so far proved unsuccessful.

PATENTS.

[Peat or other] substances to be dried by pressing; Treatment of ——. T. Franke, Wiesbaden-Biebrich, Germany. Eng. Pat. 10,418, April 28, 1910. Under Int. Conv., Dec. 27, 1909.

BRIQUETTES are made from wet peat or other substances by mixing them with one-sixth to one-tenth the quantity of small hard material, such as pebbles, porcelain balls, stones, slag, or iron filings, and then pressing out the moisture. The added substance distributes the pressure through the mass. The briquettes, when glazed, are ready for use. (Reference is directed to Eng. Pats. 3554 of 1893, and 20,839 of 1902; this J., 1894, 242.)—A. T. L.

Fuels. A. B. Hill, Chicago, U.S.A. Eng. Pat. 10,832, May 2, 1910.

BRIQUETTES are made from anthracite slack, bituminous coal, or lignite, by means of a binder consisting of 20 lb. of "maix oil," 12 lb. of black rosin, and 2 lb. of lime water to 1 ton of coal. The "maix oil" is the residue obtained from crude petroleum after distilling off the light oils, burning oils, and lubricating oils.—A. T. L.

Coal, coke, and other materials; Separation of water from washed ——. The Hardy Patent Pick Co., Ltd., and G. Smith, Sheffield. Eng. Pat. 14,160, June 11, 1910.

THE coal or other material from the washing apparatus is delivered on to an inclined perforated plate or screen, whence it falls into a rotating bucket-drum, most of the water falling through the screen into a trough, from which it is supplied again to the washing apparatus. The bucket-drum rotates in a casing the lower part of which is perforated to allow of the escape of the water which separates. From the bucket-drum the material falls into an inclined shoot, which delivers it to a final separating screen or to a conveyor.—A. S.

Coke ovens. A. O. Jones, Whitley Bay. Eng. Pat. 12,923, May 27, 1910.

THE patent relates to vertical coke ovens provided with independent, superposed, horizontal heating flues. In order that the ovens may be heated from the sides only, the common vertical inlet and outlet flues, with which all the horizontal flues communicate, are constructed in the walls dividing adjacent ovens. Each heating flue then extends from the common air-inlet flue along the side of one oven, and communicates by a cross-passage in the dividing wall with a flue extending along the side of the next oven. The flues may be so arranged that the branches connecting the heating flues with the common inlet and outlet flues respectively are disposed alternately when considered as a vertical series. At the base of the oven, the gas and air are supplied to a horizontal flue level with or just above the sole plate, and this flue communicates by a vertical passage with a return flue at a lower level. The heating flues may be divided by a transverse partition into two series communicating with common inlet and outlet flues at the front and at the rear of the ovens respectively. —A. S.

Coking oven and coking furnace. L. L. Summers, Assignor to Continuous Process Coke Co., Chicago, Ill. U.S. Pats. 992,078 and 992,079, May 9, 1911.

(1.) IN a coking oven having horizontal retorts which are preferably of greater width than height, the heating flues, which are arranged above and below the retorts and pass from end to end thereof, are formed of refractory material at the discharge ends of the retorts and of a material of relatively high heat conductivity at the receiving ends. The flues may be built up of hollow tiles which also form the roofs of the retorts, a protective roof supported independently being arranged above. A second set of hollow tiles may be arranged above the first to form air heating flues. (2.) The heating ducts of a coking retort, which run lengthwise from end to end of the retort, may be formed in or supported by an overhead arch spanning the retort transversely.—H. H.

Regenerator oven for the production of gas and coke. H. Koppers. Fr. Pat. 424,747, Jan. 9, 1911. Under Int. Conv., April 15, 1910.

To enable a gas-heated kiln to be run economically, whether it be used as a coke oven or as a gas retort, separate regenerator chambers are provided by means of which the air supply to the burners is always heated, while the gas supply is only heated when the kiln is to be used for gas production and heated by producer gas. When used as a coke oven the gas produced by the distillation is used as fuel for heating the oven and cannot be passed through a heat-regenerating chamber as it would decompose. Four regenerator chambers are arranged beneath each oven, or retort, and suitable pipe connections are provided so that while two of the chambers are being heated, the other two are serving to heat air, or air and gas respectively, as the case may be.—H. H.

Vertical gas retorts; Continuously working ——. H. W. Woodall, Lytchett Matravers, Dorset, and A. M. Duckham, Little Brookham, Surrey. Eng. Pat. 7919, April 1, 1910.

In order to obtain a denser coke which can be readily discharged, the dimensions of the retort are such as to reduce the support given to the coal by friction against the side walls, and at the same time to permit access of heat to the whole of the charge. The cross-section at the mouth of the retort is made more than five times as long as it is wide, *e.g.*, the section may be 54 × 9 ins. (Eng. Pats. 972 of 1863, and 3579 of 1875 are referred to.)—A. T. L.

Vertical retorts; Means for charging ——. C. Bolz, Budapest, Hungary. Eng. Pat. 28,941, July 28, 1910.

A travelling hopper is arranged on rails so that it can be brought over the mouth of each retort, and a special connection is provided beneath the hopper so that the retorts are sealed during charging. This connection consists of a funnel tube, and a mouthpiece, the funnel tube carrying a water seal at its lower end so that the mouthpiece can be raised or lowered without permitting escape of gas. The mouthpiece has a spherical end, which fits a spherical seating in the neck of the retort. The hopper is provided with two funnel tubes extending to the right and left, so that two rows of retorts may be charged from one hopper.—A. T. L.

Gas producers. D. Clerk, H. N. Bickerton, and H. W. Bradley, Ashton-under-Lyne. Eng. Pat. 11,444, May 9, 1910.

In a down-draught suction gas producer for use with bituminous fuel, or with sawdust, wood, spent tan, etc., the raw fuel is charged on to a hearth at the side and near the top of the producer. A limited amount of air is supplied to the hearth, and when the fuel thereon is coked, it is broken up and discharged into the main portion of the producer, in which gas is produced by the action of steam and a further supply of air admitted at the top of the producer.—A. S.

Gas mixture; Process of making a ——. G. A. Bronder, Brooklyn, N.Y. U.S. Pat. 992,106, May 9, 1911.

A definite quantity of coal is distilled in a retort and the gas is purified and collected in a holder. The residue of coke is then heated to incandescence and superheated steam and air are alternately forced through, the alternate charges of water gas and semi-water gas thereby obtained being respectively added to the coal gas and utilised as fuel for heating the retorts.—H. H.

Gas scrubbers or the like. E. F. Lloyd, Detroit, U.S.A. Eng. Pat. 22,469, Sept. 28, 1910.

In a wet scrubber of the kind in which the gas takes a sinuous path between spaced vertical partitions in each of a series of compartments, adjacent compartments are separated by a pair of vertical walls of which one is sealed in liquor and the other extends from the top of the scrubber, the space between the two walls forming a downtake for the gas from one compartment to the next. These walls carry horizontal ledges on which separate tiers of the spaced vertical partitions are supported. These tiers are removable endways through doors in the casing. The liquor is pumped from the bottom of the scrubber to sprayers in the top of each compartment.—A. T. L.

Scrubber and method of mingling gas and liquid and creating pressure in the gas. G. M. S. Tait, Montclair, N.J., Assignor to Gas Power Co., New York. U.S. Pat. 992,081, May 9, 1911.

Gas and liquid are introduced into the uppermost of a series of chambers having ejector nozzles formed in the partitions separating contiguous chambers, these nozzles being arranged immediately above one another in the various partitions. The force of the liquid carries the gas down from chamber to chamber by ejector action, the pressure being progressively increased thereby. The liquid and gas are drawn off separately from the lowermost chamber.—H. H.

Gas-washer. W. B. Chapman, New York. U.S. Pat. 992,706, May 16, 1911.

The apparatus consists of an inverted truncated conical casing surmounted by a part which is approximately cylindrical. The conical part is divided into two compartments by a horizontal metal ring, while a similar partition separates the conical and cylindrical portions. A vertical axial shaft, driven from above by a pulley, operates an exhauster for drawing the gas through the apparatus. Fans are disposed in each of the other compartments and baffle plates attached to them which, operating in conjunction with inclined baffle ribs, attached to the wall of the casing, create in addition to the swirling motion an up and down motion of the gas in a direction contrary to the water flow. The gas enters centrally from below and passes from one compartment to the other by openings in the partitions round the shaft.—B. G. McL.

Burning powdered fuel; Methods of and apparatus for ——. H. R. Barnhurst, Allentown, and H. G. Barnhurst, Catasauqua, Pa., U.S.A. Eng. Pat. 12,721, May 25, 1910.

See U.S. Pats. 961,671 and 961,672 of 1910; this J., 1910, 870.—T. F. B.

Gas producer. F. Fielden, New Ferry. U.S. Pat. 992,491. May 16, 1911.

See Eng. Pat. 1500 of 1910; this J., 1911, 122.—T. F. B.

Gas producer. J. Stewart, Codnor Park. U.S. Pat. 992,615, May 16, 1911,

See Eng. Pat. 6204 of 1908; this J., 1909, 466.—T. F. B.

Gas-producer. R. V. Farnham, Skelmorlie. U.S. Pat. 993,160, May 23, 1911.

See Eng. Pats. 26,199 of 1908 and 11,675 of 1909; this J., 1910, 203.—T. F. B.

Gas producers. M. and J. H. White and H. Arnold. Fr. Pat. 424,147, Dec. 27, 1910.

See Eng. Pat. 10,357 of 1910; this J., 1911, 481.—T. F. B.

Sulphuretted hydrogen from gases; Process for separating ——. K. Burkheiser, Hamburg. Eng. Pat. 22,335, Sept. 27, 1910. Under Int. Conv., Sept. 27, 1909.

See Fr. Pat. 420,806 of 1910; this J., 1911, 348.—T. F. B.

Paraffin, fats, or fatty substances; Apparatus for the separation of the liquid from the solid constituents of ——. F. Winterstein and S. Nitsch, Pressburg, Hungary. Eng. Pat. 17,076, July 18, 1910.

See Ger. Pat. 226,137 of 1909; this J., 1911, 36.—T. F. B.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Daylight; Subtractive production of artificial ——. H. E. Ives and M. Luckiesh. Electrician, 1911, **67**, 297—298.

The common illuminants as compared with daylight are deficient in blue light and have an excess of red light; and one method of producing artificial daylight consists in the use of absorbing media over the source of light. The requisite characters of the absorbing medium are discussed (compare also Bull. Bureau of Standards, U.S.A., June, 1909), and it is stated that with a combination of "cobalt blue" and "signal green" glasses, one of which has been coated with a film of gelatin coloured by "rozazein," a light can be obtained by the aid of a tungsten electric lamp suitable for colour matching and similar purposes. The two glasses, one coated with the gelatin film, and the other roughened so as to act as a diffuser, form the bottom of a tin box, 16in. by 12in., by 20in., holding six 60-watt frosted-tip tungsten lamps. The box rests upon legs 15in. high, and the surface to be illuminated is placed beneath, an illumination of about 30 ft.-candles being obtained. The specific consumption is high—10—12 watts per candle—but the first cost of the device is low.—A. S.

Neon incandescence tubes. G. Claude. Comptes rend., 1911, **152**, 1377—1379. (Cp. this J., 1911, 13).

The author has devised a method for increasing the duration of incandescence of neon tubes without recourse to an electromagnetic valve for the continuous supply of gas to the tube. In the case of tubes provided with very small electrodes, the latter volatilise rapidly and the incandescence soon disappears. Tubes, 5 m. in length and 30 mm. in diameter, provided with hollow cylindrical copper electrodes 60 mm. in length and 25 mm. in diameter, and traversed by alternating currents of 0·4 ampère, incandesced brightly for 6—8 hours; even these electrodes, however, became heated nearly to bright redness, and a scaly deposit, resembling copper in appearance, though more brittle, formed on the glass in the neighbourhood of the electrodes. This deposit, on treatment with nitric acid, yielded a gaseous residue which exhibited, besides the spectrum of hydrogen, the spectrum of neon very distinctly and that of helium very intensely, although the neon used in charging the tube was almost free from helium; this, and other experiments, show that the rare gases obtained from the deposit are absorbed by the vapourised metal. Since the disappearance of the rare gases is due to vapourisation of the electrodes, a diminution of this vapourisation will render the incandescence of the tube more lasting, and for this, it is sufficient to use electrodes of very large dimensions. Using a tube of 6 m. in length, fitted with electrodes presenting a surface corresponding to 5 sq. dcm. per ampère, a period of incandescence of 400 hours was attained.—L. E.

Electric lamp for miners; Prize for new ——. Times, May 27, 1911. [T.R.]

The Secretary of State for the Home Department announces that, in order to encourage the production of safe and efficient types of electric lamps for miners, a colliery proprietor has placed at his disposal the sum of £1,000 to be offered as a prize for the best lamp or lamps fulfilling the requirements specified below.

Mr. Charles Rhodes (a former President of the Institute of Mining Engineers) and Mr. Charles H. Merz (a member of the Departmental Committee on the Use of Electricity in Mines) have consented to act as judges.

The conditions of the competition are as follows:—(1) The competition will be open to persons of any nationality; (2) It will be in the discretion of the judges to award the whole of the prize for the lamp which they consider to be the best; or to divide the prize; or to make no award if no lamp appears to them to be of sufficient merit; (3) Lamps must be addressed care of C. Rhodes, Esq., at the Home Office Testing Station, Rotherham, and must reach the testing station not later than December 31st next; a spare globe should accompany each lamp.

The requirements which should be fulfilled by any lamps submitted for competition are as follows:—(1) The lamp should be of sound mechanical construction so as to withstand rough usage; (2) The lamp should be of simple construction and easy to maintain in good order and repair; (3) The lamp should be so constructed as to render impossible the ignition of inflammable gas either within or without the lamp; (4) The lamp battery should be so constructed that any liquid which it may contain cannot be spilled when the lamp is in use, and means should be provided for dealing with any gas which may be generated by the battery; (5) The materials used and the construction should be such that metals and other parts will not be liable to deterioration by corrosion as a result of the action of the electrolyte, etc., used in the battery; (6) The lamp should be effectively locked so that it cannot be opened without detection; (7) The lamp should be capable of giving an amount of light not less than 2-candle power continuously for a period of not less than 10 hours; (8) The light should be well distributed outside the lamp. A movable reflector to concentrate or to shield the light may be provided.

In addition to the above requirements regard will be paid to (*a*) the first cost of the lamp; (*b*) the cost of maintenance; (*c*) convenience in handling; and (*d*) the weight of the lamp when charged and ready for use.

Patents.

Distillation of coal or other carbonaceous materials; Apparatus for the ——. H. N. Beilby, Glasgow. Eng. Pat. 22,908, Oct. 4, 1910.

The apparatus consists essentially of an iron or steel casing enclosed in brickwork, and provided inside with a series of plates pivoted at one end and inclined alternately in opposite directions. By means of a lifting rod or similar device, jerks or vibrations are imparted to the inclined plates, to cause the coal, which is fed in at the top, to pass gradually down through the casing over the plates. Outlet pipes for the distillation products are also provided. —A. S.

Arc light electrodes. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 13,518, June 3, 1910.

The addition of a small proportion of chromium carbide is stated to increase the life of electrodes composed mainly of titanium carbide. An electrode may consist, for example, of an iron tube filled with a mixture of 4·5 per cent. of chromium carbide and 95·5 per cent. of titanium carbide mixture (titanium carbide, 99; sodium fluoride, 1 per cent.; or titanium carbide, 96; sulphur, 3; and sodium fluoride, 1 per cent.).—A. S.

Illumination; Process of correcting rays of short wave length from sources of —— by uranium or cerium. A. Lancien, L. Thomas, and L. Torvier. Fr. Pat. 424,362, Dec. 10, 1910.

Uranium or cerium or both, either in the metallic state or as salts, are mixed with the material acting as the source of light, or with glass or other translucent substance surrounding the source of light, for the purpose of converting the rays of short wave length into rays of longer wave length.—H. H.

Metallic filaments for electric lamps; Manufacture of ——. E. Goossens, Pope and Co. Fr. Pat. 424,777, Jan. 11, 1911.

A large number of tungsten filaments are prepared simultaneously in an electric furnace by heating the raw filaments formed from tungsten oxides and an organic agglutinant in an atmosphere of hydrogen or ammonia, with or without nitrogen, first to a temperature not exceeding 800° C. until the amount of carbon contained in the filament is reduced to 0·1 per cent., and finally to a temperature of 1500° C. to effect the complete elimination of the carbon.—H. H.

Filaments and mantles for incandescence lighting ; Process for impregnating ——. G. Bagrachow. Fr. Pat. 423,989, Nov. 25, 1910.

See Eng. Pat. 18,084 of 1910 ; this J., 1911, 530.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Aniline ; Compounds which cause the red colouration of ——. *II. Effect of sunlight in the absence of oxygen and oxidising influences, and a comparison with the behaviour of mono- and dimethylaniline.* H. D. Gibbs. Philippine J. Sci., 1910, **5**, 419—435. (See also this J., 1910, 871.)

When aniline purified in different ways, is sealed up in an atmosphere of an indifferent gas or *in vacuo*, it colours in the sunlight, and it is possible to detect in the product azophenine, benzene and ammonia. The first of these is the cause of the red colouration, and can be separated in the crystalline form. The pressure of the indifferent gas in the tube seems to have some effect on the reaction, which progresses less rapidly at low pressures. Carbon dioxide retards the rate of colouration somewhat, and is therefore probably not an indifferent gas. Methylaniline undergoes a change similar to that of aniline, and methylamine can be identified as a product. Dimethylaniline shows very little change, 60 days exposure producing only a pale yellow colour in a sample which is not specially freed from monomethylaniline. This confirms the conclusion that the fixation of the labile hydrogen atom destroys the sensitiveness to photo-catalysis. The tropical sunlight of the Philippines is more intense, or more active, than the light of temperate regions or higher latitudes.
—W. H. P.

Chlorination ; A method of ——. *Chlorination of anilines and phenols.* K. J. P. Orton and H. King. Chem. Soc. Proc., 1911, **27**, 139.

The method of chlorination, which was described, is based on the reversible interaction between chloroamine and hydrochloric acid, studied by Orton and Jones (Chem. Soc. Trans., 1909, **95**, 1456). By proper choice of the quantities of hydrochloric acid, any given concentration of chlorine can be obtained. This concentration will remain constant during the chlorination, since a molecule of chlorine used in substitution is replaced by a molecule of hydrogen chloride, which in its turn reacts with a further amount of chloroamine : $Ar{\cdot}NCl{\cdot}Ac + HCl = Ar{\cdot}NH{\cdot}Ac + Cl_2$. In this way, oxidation and other side reactions can be avoided, and the operation most effectively controlled. A few chloro-derivatives of anilines, hitherto unrecorded, were described.

a-Naphthol ; Chlorination of ——. H. Kast. Ber., 1911, **44**, 1337.

1 : 4-Chloronaphthol is obtained in a 20—60 per cent. yield when *a*-naphthol (144 grms.) is dissolved in hot chloroform (600 c.c.) and sulphuryl chloride (132 grms.) diluted with chloroform (200 c.c.) slowly dropped in. On the next day long needles of 1 : 4-chloronaphthol will have separated out and may be obtained pure by crystallisation from chloroform.—J. C. C.

Patents.

Benzene and homologous compounds ; Process of recovering ——. A. Soly and E. Davier. Fr. Pat. 424,242, Nov. 24, 1910.

The benzene or other vapours are aspirated by means of a pump through a series of columns of water from below upwards in such a way that the benzene remains condensed upon the surface, whence it can subsequently be drawn off into a receiver.—C. A. M.

Anthraquinone dicarboxylic acid and its derivatives ; Process for making ——. Badische Anilin und Soda Fabrik. Fr. Pat. 423,986, Nov. 23, 1910. Under Int. Conv., Oct. 14, 1910.

Anthraquinone-1·2-dicarboxylic acid is readily obtained by the oxidation of naphthanthraquinone ; if a naphthanthraquinone substituted in the anthraquinone nucleus be used, the corresponding substituted dicarboxylic acid is formed. Chromic acid, potassium permanganate, nitric acid, potassium chlorate, or other oxidising agent may be used for the purpose. *Example :* A solution of 25 kilos. of naphthanthraquinone in 400 kilos. of sulphuric acid is slowly added to 1000 litres of water ; the mixture is boiled, and 100 kilos. of potassium permanganate are gradually added. When the colour of the permanganate has disappeared, oxalic acid or sulphur dioxide is introduced to dissolve the manganese dioxide, and the hot solution is then filtered. Part of the anthraquinone, dicarboxylic acid crystallises out on cooling, whilst the residue yields a further quantity on extraction with dilute ammonia and precipitation with acid.—T. F. B.

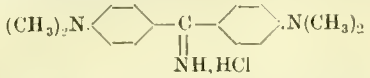
IV.—COLOURING MATTERS AND DYES.

Dyes and colouring matters ; Natural —— *of the Philippines.* B. T. Brooks. Philippine J. Sci., 1910, **5**, 439—452.

The author gives brief notes on the local occurrence of dyes which are already well known, such as indigo, berberine, carthamine, turmeric, annatto, morin, Indian Yellow, bancudo (the brownish red dye from the *morinda* species), tannin, sappan wood (containing brazilin), etc. The black colour of ebony is shown to have no connection with the iron-tannin series, or with the presence of humus acids. Its production is probably due to oxidation in the presence of an enzyme, which is destroyed at 100° C., and rendered inactive by dilute hydrochloric acid. The well-known narra wood yields an extract which contains, among other constituents, a red dyestuff which is closely related to but not identical with santalin, and which the author calls narrin. When fused with caustic potash it yields phloroglucinol and resorcinol, and when slowly oxidised by alkaline permanganate it gives a small quantity of vanillin. Narrin is not a glucoside. Two colourless crystalline substances, pterocarpin and homopterocarpin, were also extracted from narra wood. The former when carefully purified melts at 163° C. and the analysis and molecular weight determinations lead to the formula, $C_{14}H_{12}O_4$. Homopterocarpin melts at 86° C. and has the probable formula, $C_{17}H_{16}O_4$. When heated with caustic potash it yields resorcinol, and with zinc dust resorcinol dimethyl ether. There is probably a close relationship between narrin and homopterocarpin.—W. H. P.

Auramine ; Constitution of ——. L. Semper. Annalen, 1911, **381**, 234—264.

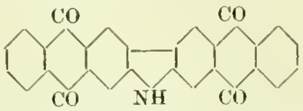
It has not yet been possible to decide which of the two formulæ proposed for Auramine really represents its constitution. The author has studied especially the acyl derivatives of Auramine and finds that these are bright yellow (pure Auramine base being colourless) and give deep blue violet or blue green salts with acids and metallic or alkyl haloids. In the case of acetylauramine this colour change is so sharp that the substance may be used as an indicator. The author shows that these deeply coloured salts of acylauramines are in every respect different from those of Auramine itself or of its known derivatives (methyl, phenyl, etc.) and from their analogy to the quinonoid diphenylmethane dyestuffs there can be no doubt that they possess a quinonoid constitution. This being so the quinonoid formulation of Auramine becomes practically excluded and the formula



must be accepted for it. The various arguments that have been advanced in favour of both formulæ are fully discussed.—J. C. C.

Aromatic compounds ; Introduction of several phthalic acid nuclei into ——. IV. Experiments with carbazole. R. Scholl and W. Neovius. Ber., 1911, **44**, 1249—1252.

When carbazole is condensed with phthalic anhydride in the presence of aluminium chloride, it forms carbazole-3 : 6-diphthaloylic acid which when heated to 90° C. with sulphuric acid condenses to 2 : 3 : 6 : 7-diphthaloylcarbazole,



This crystallises in golden yellow needles and with alkaline hydrosulphite gives a dark brown vat which dyes unmordanted cotton. When treated with water or acids the dyeings are yellow but with alkali hydroxide they are again turned brown.—J. C. C.

Patents.

Azo dyestuffs ; New intermediate products for the manufacture of —— and the production thereof. H. Levinstein, J. Baddiley, and Levinstein, Ltd., Blackley. Eng. Pat. 11,877, May 13, 1910.

Products of the general formula,

$$C_{10}H_{6-n}(OH)(SO_3H)_nNH.CH_2.COOR,$$

valuable as intermediate substances for the preparation of azo dyestuffs, are obtained by condensing aminonaphtholsulphonic acids, containing the amino and hydroxyl groups in different nuclei, with monochloroacetic esters. The preparation of the condensation products of ethyl monochloro-acetate with 1·8-aminonaphthol-3·6-disulphonic acid, 2·5-aminonaphthol-7-sulphonic acid, and 2·8-aminonaphthol-6-sulphonic acid, is described : these products are soluble in hot water, and when treated with nitrous acid yield soluble nitroso derivatives.—T. F. B.

Dyes for domestic purposes. V. Tootall, Southport. Eng. Pat. 20,726, Sept. 6, 1910.

Sufficient quantities of the solid dye for use at one operation are introduced into separate casings or capsules of gelatin, casein, or other material soluble in hot or cold water.—T. F. B.

Anthracene derivatives ; Production of new ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Dec. 16, 1910 (under Int. Conv., Jan. 10, 1910) to Fr. Pat. 403.205, May 21, 1909 (this J., 1909, 1309).

Dyestuffs similar to those described in the chief patent are obtained by using ethylene oxide or its homologues or derivatives such as glycide or propylene oxide instead of epichlorohydrin.—J. C. C.

Azo dyestuffs and their intermediate products ; Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 424,070, Dec. 23, 1910. Under Int. Conv., Jan. 5 and Mar. 21, 1910.

Alkylated azimino-*o*-toluidines (prepared as shown below) are diazotised and combined with 2-arylamino-8-naphthol-6-sulphonic acids. The monoazo dyestuffs obtained dye wool in brown shades which after chroming are fast to fulling. Example : 100 parts of 2 : 4-diacetylamino-5-nitrotoluene are reduced with 150 parts of iron and 10 parts of glacial acetic acid, the aqueous extract is acidified with 50 parts of hydrochloric acid, cooled and diazotised. The acetyl derivative of aziminoacetyl-*o*-toluidine is collected, washed with water until neutral and the paste is treated with 102 parts of sodium hydroxide (30 per cent.) in the cold. On acidifying, the sodium salt of azimino-2-acetylamino-1-toluidine is obtained which is dissolved in water and treated at 40°—50° C. with benzyl chloride. The benzylated compound is then treated with sulphuric acid to eliminate the acetyl group. The compound prepared in this way is diazotised and combined with an alkaline solution of 2-phenylamino-8-naphthol-6-sulphonic acid.—J. C. C.

Azo dyestuffs ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Aug. 20, 1910, to Fr. Pat. 424,405, Aug. 8, 1910. Under Int. Conv., Sept. 3, 1909.

See U.S. Pat. 969,450 of 1910 ; this J., 1910, 1296. In place of the sulphonic acids of 1·8-aminonaphthol, 2.5.7-aminonaphtholsulphonic acid is used.—T. F. B.

Triphenylmethane dyestuffs capable of being chromed ; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 424,723, Jan. 9, 1911. Under Int. Conv., Jan. 29, 1910.

m-Aminobenzaldehyde or one of its nuclear substitution products is condensed with two mols. of an aromatic hydroxycarboxylic acid and the resulting leuco-compound is mono- or di-benzylated in the amino-group of the benzaldehyde molecule. The new leuco-compounds are oxidised either as such, or after sulphonation, to the respective colouring matters. These, which are typical mordant dyestuffs, dye wool from an acid bath in red shades which on chroming are changed to a fast blue Examples are given illustrating the process of condensation of *o*-chloro-*m*-aminobenzaldehyde with *o*-cresotinic acid and subsequent benzylation, as also the condensation of *m*-aminobenzaldehyde-*o*-sulphonic acid with the same carboxylic acid and subsequent treatment as above.—J. C. C.

Vat dyestuffs ; Production of new ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 424,036, Dec. 22, 1910. Under Int. Conv., Feb. 9, 1910.

Blue to blue green vat dyestuffs of the indigo series are obtained by condensing the product of mild reduction of α-hydroxyanthraquinone (α-oxanthranol) with α-isatin-anilide or methylisatin chloride.—J. C. C.

Vat dyestuffs ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 234,058, Feb. 5, 1910. Addition to Ger. Pat. 198,644, Feb. 14, 1907.

The condensation products from 6- or 5-amino-3-oxy-(1) thionaphthene or 4- or 5-acetaminophenyl-2-thioglycol-1-carboxylic acid with isatin or its substitution products, homologues, or α-anilides, are treated with a mixture of bromine and sulphur chloride (see Fr. Pat. 390,484 of 1907 and Addition thereto ; this J., 1908, 1148, and 1910, 687).—T. F. B.

[*Azo*] *dyestuffs ; Process for preparing brown, chrome ——.* Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 233,938, June 5, 1910.

Fast brown chrome dyestuffs are obtained by combining the diazo compounds of *peri*-aminonaphthol or its sulphonic acids with pyrazolones or their sulphonic or carboxylic acids; they may also be prepared by combining the diazotised sulphurous ester of the aminonaphthol with the pyrazolone, and finally saponifying.—T. F. B.

Triphenyl- or diphenylnaphthylmethane dyestuffs ; Process for preparing acid chrome ——. Farbwerke vorm. Meister. Lucius, und Brüning. Ger. Pat. 234,027, March 25, 1910.

The dyestuffs are obtained : (1) by condensing formaurine-dicarboxylic acid with halogen or sulpho derivatives of aromatic hydrocarbons, and oxidising the leuco compounds, or (2) by the simultaneous oxidation of methylenedisalicylic acid or its homologues with halogen or sulpho derivatives of aromatic hydrocarbons.—T. F. B.

Indigo; Manufacture of halogen derivatives of ——. R. Vaniček. Fr. Pat. 424,391, Dec. 3, 1910.

Tetrabromoindigo is prepared by condensing dibromophenylglycine (obtained by brominating phenylglycine) by means of fuming sulphuric acid (60—80 per cent. of anhydride) in the cold. No sulphonation takes place and the use of sodium amide (as in the ordinary process of condensing phenylglycine) is thus avoided.—J. C. C.

Dyestuffs of the anthracene series; Condensation products and ——. Badische Anilin und Soda Fabrik. Fr. Pat. 424,814, Jan. 12, 1911. Under Int. Conv., May 30, 1910.

Negatively substituted dianthraquinonyls can be condensed with salts of aminoarylcarboxylic acids and the products, when treated with condensing agents, furnish new dyestuffs. For example: 4 : 4′-dichloro-2 : 2′-dimethyl-1 : 1′-dianthraquinonyl (prepared from 4-chloro-1-amino-2-methylanthraquinone) is condensed in nitrobenzene solution with potassium anthranilate with the addition of copper oxide. The resulting 4 : 4′dianilino-2 : 2′-dimethyl-1 : 1′-dianthraquinonyldicarboxylic acid, when warmed on the water-bath with 8—10 times its weight of sulphuric acid, furnishes a violet powder which with alkaline hydrosulphite gives a vat dyeing cotton in violet shades. Other examples are cited in the specification.—J. C. C.

Azo dyestuffs; Process for preparing basic ——. Badische Anilin und Soda Fabrik. Ger. Pat. 234,025, April 21, 1910.

The diazo compounds of amines or acyldiamines are combined with 2·4·4′-triaminodiphenyl, the resulting dyestuffs are then tetrazotised (or hexazotised after removing the acyl group), and combined with two (or three) mols. of amines, diamines, naphthylenediamines, or aminonaphthols or their alkyl derivatives, separately or in mixture. By this means, a new series of basic dyestuffs is obtained, which will dye fast shades directly on artificial silks. —T. F. B.

Anthraquinone derivatives; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 11,440, May 9, 1910.

See Fr. Pat. 415,683 of 1910; this J., 1910, 1297.—T.F.B.

β-Anthraquinonyl-urea chloride; Manufacture of pure ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 11,804, May 12, 1910. Under Int. Conv., May 12, 1909.

See Fr. Pat. 415,789 of 1910; this J., 1910, 1294.—T. F. B.

Vat [*anthracene*] *dyestuffs; Manufacture of* ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 20,970, Sept. 8, 1910. Under Int. Conv., Sept. 28, 1909.

See Fr. Pat. 418,843 of 1910; this J., 1911, 78.—T. F. B.

Dyestuffs of the anthracene series; Manufacture of vat-dyeing ——. F. Ullmann, Charlottenburg, Germany. Eng. Pat. 16,440, July 9, 1910.

See Fr. Pat. 418,201 of 1910; this J., 1911, 17.—T. F. B.

Colouring matters of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 23,052, Oct. 5, 1910.

See Addition of Oct. 12, 1910, to Fr. Pat. 349,531 of 1904; this J., 1911, 412.—T. F. B.

Anthracene dye. M. A. Kunz, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 992,567, May 16, 1911.

See Fr. Pat. 417,332 of 1910; this J., 1911, 17.—T. F. B.

Monoazo dyestuffs specially suited for the preparation of pigment colours; Manufacture of ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 27,639, Nov. 28, 1910.

See Fr. Pat. 423,117 of 1910; this J., 1911, 612.—T. F. B.

Disazo dyestuffs; Manufacture of substantive ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 28,680, Dec. 9, 1910.

See U.S. Pat. 988,000 of 1911; this J., 1911, 612.—T.F.B.

Azo colouring matter; Manufacture of ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 28,681, Dec. 9, 1910.

See U.S. Pat. 987,999 of 1911; this J., 1911, 612.—T.F.B.

Azo dyestuffs; Manufacture of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 73, Jan. 2, 1911. Under Int. Conv., Aug. 18, 1910.

See Fr. Pat. 423,809 of 1910; this J., 1911, 611.—T. F. B.

Monoazo dyestuff for lakes and its applications. Act.-Ges. f. Anilinfabr. Fr. Pat. 424,415, Dec. 2, 1910. Under Int. Conv., Sept. 9, 1910.

See U.S. Pat. 988,870 of 1911; this J., 1911, 611.—T.F.B.

Thioindigo and its derivatives; Process for producing ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 418,353, July 18, 1910. Under Int. Conv., Feb. 14, 1910.

See Eng. Pat. 16,517 of 1910; this J., 1911, 677.—T. F. B.

Colouring-matters derived from gallocyanine; Process for the manufacture of ——. A. Steiner, Assignor to Chem. Fabr. vorm. Sandoz, Basle, Switzerland. U.S. Pat. 992,613, May 16, 1911.

See Eng. Pat. 11,736 of 1909; this J., 1910, 554.—T. F. B.

Azo dye. K. Brenzinger, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 993,020, May 23, 1911.

See Fr. Pat. 424,070 of 1910; preceding.—T. F. B.

Azo dye. H. Jordan and W. Neelmeier, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co. Elberfeld, Germany. U.S. Pat. 993,073, May 23, 1911.

See Ger. Pat. 230,595 of 1910; this J., 1911, 350.—T.F.B.

Azo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 424,405, Aug. 8, 1910. Under Int. Conv., Aug. 13, 1909.

See U.S. Pat. 969,450 of 1910; this J., 1910, 1296.—T.F.B.

[*Azo*] *dyestuffs for wool from substituted aminonaphthols; Process for preparing mordant* ——. L. Cassella und Co. Fr. Pat. 424,568, March 16, 1910.

See Eng. Pat. 7060 of 1910; this J., 1911, 16.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cellulose; Experiment to demonstrate the reducing properties of ——. R. Scholl. Ber., 1911, **44**, 1312—1314.

The reducing properties of modified cellulose, which are observed in its action towards Fehling's solution, may likewise be shown by its behaviour with certain "vat" dyestuffs. Flavanthrene, a yellow dyestuff, which gives a blue "vat" on reduction, is particularly suitable for this experiment. A reduced flavanthrene "vat" is prepared by boiling 0·03 grm. of flavanthrene with a little dilute sodium hydroxide and solid sodium hydrosulphite. The cellulose to be tested is treated for a few seconds in the dark blue liquid thus prepared, whilst still hot. The sample is washed out, and "developed" by exposure for a short time to the air, or immediately by means of hypochlorite. The washed cellulose, which is now dyed yellow, is heated to boiling with a little 2*N*-sodium hydroxide, whereby the colouring matter is again reduced to the blue derivative, at a rate which is proportional to the reducing power of the modified cellulose. Oxycellulose becomes blue almost instantaneously, whilst Swedish filter paper and not very carefully bleached cotton turn blue within a minute. A flavanthrene "vat" may be prepared direct by means of over-bleached cellulose, by boiling the latter for half a minute with 2*N*-sodium hydroxide and a trace of the precipitated dyestuff. The latter is prepared by dissolving flavanthrene in a drop of concentrated sulphuric acid, and re-precipitating by the addition of 2*N*-sodium hydroxide. Modified cellulose which has previously been boiled with sodium hydroxide reacts more slowly, owing to the decomposition of the oxycellulose groups, but the yellow coloured extract thus obtained is capable of reducing a "vat" dyestuff.—J. F. B.

PATENTS.

[*Flax*]; *Artificial retting of* ——. A. Callens. Fr. Pat. 424,480, Dec. 19, 1910.

THE flax is retted in two graduated operations with warm water, the water drained off from the second steep being utilised for the first steep. Water is pumped up from the brook, and is heated by means of a steam injector, placed in the discharge pipe from the pump, to a temperature of 29°—33° C. This warm water is collected in a reservoir at a high level, and used for charging the retting vats. These are constructed of concrete, the flax being packed on grids, and kept immersed by means of other grids laid on the top. The water from the reservoir enters a pipe which passes all round the top of the vat and is pierced with oblique openings, thus causing the water to fill up the vat with a swirling motion. The liquor discharged from the vats of the second steep enters the vats of the first steep in a similar manner, these vats being placed at a lower level.—J. F. B.

Cellulose-cuprammonium and its derivatives; Manufacture of ——. J. Wetzel. Fr. Pat. 424,293, March 9, 1910.

A SOLUTION of cellulose in a cuprammonium solution containing at least 6 per cent. of ammonia remains stable if the content of ammonia be subsequently reduced to 3 per cent. (see Fr. Pat. 423,510 of 1910; this J., 1911, 615). Such a solution, containing 3 per cent. of ammonia as a maximum, is coagulated by free exposure to the air.—J. F. B.

Cellulose threads; Continuous or nearly continuous manufacture of ——. Ver. Glanzstoff Fabriken. Fr. Pat. 424,419, Dec. 14, 1910. Under Int. Conv., Oct. 20, 1910.

THREADS issuing from the precipitating bath, containing alkali and cupric compounds, are wound up on iron drums, instead of on glass drums as heretofore. The charged drums are transferred by mechanical means to baths, in which the threads are washed with hot water, the copper compounds extracted in the first washing being recovered by suitable treatment of the baths. The final washing is effected by imparting to the drums a rotation in the inverse direction by means of friction wheels, the drums being immersed in water heated to 50° C. The threads are thereby detached from the drums, and are wound off through the water; they then pass over drying cylinders on to suitable bobbins or skein machines. In the case of monofils the skeins are wound direct, but in the case of multiple threads, which have to be twisted, they are preferably re-damped with a soap solution after drying, on their way to the twisting machine. The residual traces of copper are eliminated by treating the loose skeins with a solution of acid.—J. F. B.

Hair; Artificial ——. B. Borzykowski. Fr. Pat. 424,428, Dec. 28, 1910.

CELLULOSE in the form of ramie-fibre, wood-pulp, waste parts of the cotton plant, cotton, flax, hemp, jute, etc., or the pods and bark of various plants, is dissolved in acids at a temperature depending upon its character. Any acid may be employed, such as sulphuric, acetic, or nitric acid, which, alone or mixed with other acids, has a solvent action on cellulose. A viscous mass is obtained which is almost colourless, but which may be given any desired colour. The mass is forced under pressure through openings into liquids such as water, alcohol, benzene, etc., which will solidify the emerging threads. The cellulose may also be precipitated by pouring into suitable media and redissolved in appropriate solvents such as chloroform, acetone, alcohol, etc., after drying, and formed into threads in the usual manner. Solid or semi-solid blocks or plates may also be obtained by evaporating and pressing the plastic mass. Gelatinous matter of animal origin such as gelatin or albumin may afterwards be added to the product and the fibres have all the characteristics of those of animal origin.—D. J. L.

Artificial threads; Process and apparatus for removing air bubbles from solutions used for the manufacture of ——. A. Bernstein. Fr. Pat. 424,796, Jan. 12, 1911.

FOR the removal of air bubbles from viscous solutions intended for the manufacture of artificial filaments, the solution is subjected to centrifugal action. Two types of machine are described: an intermittent and a continuous type. The viscous solution is treated in a closed centrifugal box for a certain length of time, and is then discharged by means of compressed air into a closed storage vessel. In the continuous type of machine, the solution is introduced into the centrifugal box from below through a hollow spindle. It is thrown to the periphery, around which it forms a vertical layer. The fluid, freed from air, is continuously withdrawn by means of suction through two pipes situated at the top of the centrifugal box at its circumference, and joined together above by a stuffing-box in the vertical axis of the machine. Heavy impurities may be collected in a channel at the bottom of the box. —J. F. B.

Paper; Method of making ——, *and paper-making machine.* D. A. Smith, Drummond, Md., and J. P. Mann, Washington, D.C., Assignors to District of Columbia Paper Manufacturing Co., Washington, D.C. U.S. Pats. 992,694 and 992,695, May 16, 1911.

WHILST on the carrying wire of a Fourdrinier machine the surface of the wet layer of pulp is subjected to the action of spaced dragging members which displace and aggregate some of the fibres of the pulp, forming groupings which result in markings on the paper. The drag is effected by means of a strip of some suitable fabric or other material which is fastened by its upper edge to a supporting bar arranged above the machine, and has its lower edge, which rests on the web of pulp, cut out in places so as to form a number of separated dragging devices. By discharging colour on to these devices, colour effects can be obtained on the finished paper.—P. F. C.

Fancy effects on paper; Process for producing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 424,328, Dec. 30, 1910. Under Int. Conv., Feb. 25, 1910.

DURING the process of manufacture, colour is applied to one side of the sheet of paper by means of rollers, aerographs, etc., and this colour is then displaced in parts by suitable agents such as dropping water, compressed air, or rotating brushes so as to lay bare and make visible the original ground colour of the paper. A modification of this process consists in superposing two sheets of different coloured pulps as in the "duplex" and "marmorite" processes so as to produce a paper having different back and face colours. Or, in the place of the second layer of pulp, some other substance can be used, which will adhere to a wet sheet of paper. Mica, bronze powder and colour lakes are suitable for this purpose.—P. F. C.

Paper, boards, and other plastic materials; Manufacture of ——. Bakelite Ges. m.b.H. Fr. Pat. 424,459, Dec. 15, 1910.

The intermediate products of the condensation of phenols with formaldehyde are mixed with fibrous materials, organic or mineral, such as paper pulp in presence of water; the water is drained off in any suitable manner and the objects or sheets so formed are moulded and then fixed by heat and pressure. Mineral loading matters or agglutinating materials may be incorporated with the mass. According to alternative methods, the phenol and formaldehyde may be incorporated with the fibrous material at first, with the addition of a condensing agent, or sheets of paper or board may be treated with the condensation products with the initial soluble product resulting from the condensation..—J. F. B.

Cellulose solutions; Process for preparing viscous, stable ——. Verein. Glanzstoff-Fabriken A.-G. Fr. Pat. 424,621, Jan. 5, 1911. Under Int. Conv., Sept. 13, 1910.

See Eng. Pat. 309 of 1910; this J., 1911, 484.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Indigo dyeings; Theory of ——. A. Binz and K. Mandowsky. Ber., 1911, **44**, 1 25—1229.

Indigo in substance, or when fixed on the fibre without first being converted into a vat, combines readily with sodium alcoholate, but no action can be observed with vat indigo. The combination between the fibre and the dyestuff in the latter case appears therefore to be of a more intimate nature than a mere mechanical fixing on the fibre. The fact that indigo dyeings after steaming become less fast to rubbing cannot be ascribed to sublimation as the dyestuff does not sublime until about 290° C., and also is not volatile with steam. Here also the explanation seems to be that there is a special combination between dyestuff and fibre which is loosened by steam. On exhaustive treatment with steam the dyestuff is actually liberated and then reacts with sodium alcoholate.—J. C. C.

Indanthrene Blue S; Process for rendering —— *faster to chlorine.* A. Brylinski. Sealed note No. 1402, dated July 8, 1908, and Report thereon by C. Favre. Bull. Soc. Ind. Mulhouse., 1911, **81**, 50—52.

It has been previously shown that the colour of fabrics dyed or printed with Indanthrene Blue is rendered faster to chlorine by steaming with or without pressure (this J., 1902, 545; 1907, 870); the author found steaming under pressure to give the better result. A decidedly increased fastness is, however, obtained with the Blues S (or RS) and G.C.D., and Indanthrene Grey B, by padding the coloured fabrics in a sulphoricinoleate solution, drying and then steaming under pressure. The shades are hardly affected by the process excepting that Blue G.C.D. is rendered a little more violet. In cases where the fabric requires treatment with chlorine during manufacture, the oiling and chlorinating can be combined. The following process is given: The oiled fabrics are printed with addition of ferrous sulphate or stannous chloride to the thickened blue, passed through soda lye, then through an acid bath and washed thoroughly. After drying, the goods are padded in a bath containing 2—3 per cent. of sulphoricinoleic acid, the required quantity of sodium hypochlorite and an excess of sodium carbonate. After drying on the cylinder, they are steamed for 1½ hours, and finished with a slight soaping. It is stated that treatment with a sulphoricinoleate and steaming for an hour without pressure has been applied on the large scale, a few years ago.—A. Sbld.

Olive shades; Fast —— *obtained from Paramine and Fuscamine.* H. Schmid. Bull. Soc. Ind. Mulhouse, 1911, **81**, 47—49.

The author has already shown that new olive and bronze shades are obtained by the oxidation on the fibre of mixtures of Fuscamine G. (*m*-aminophenol) and Paramine in which the former predominates. A specimen is now shown of a fast olive-bronze shade (with white reserve) thus obtained from a mixture of 2 parts of the former base to 1 of the latter, the white effects being obtained with a reserve containing Rongalite C, and potassium sulphite. (See this J., 1909, 88, 519; 1910, 18, 19, 875, 942).—A. Sbld.

Oxyphenol Browns. M. Puaux. Sealed note No. 1158, dated Jan. 23, 1900, and Report thereon by M. Battegay. Bull. Soc. Ind. Mulhouse, 1911, **81**, 53—55.

The following recipe is given for a brown on cotton:—5 grms. of hydroxynaphthol (or 20 grms. of resorcinol) are added to 100 c.c. of the following mixture:—British gum thickening (1 : 1), 600 grms, sodium chromate, 280 grms., ammonia (0·91 sp. gr.), 60 c.c., and warm water, 200 c.c. After printing the colour is developed and fixed by two passages through a Mather and Platt ageing machine. For a complete fixation of the colour, albumin is required, and the following proportions are given:—Starch and British gum thickening, 1000 grms., hydroxynaphthol, 75 grms., and glycerin, 50 c.c., are boiled together, and after cooling, 300 c.c. of the following mixture are added:—Tragacanth thickening, 10 litres, potassium bichromate, 8 kilos. ammonia (0·91 sp. gr.), 4 litres, blood albumin, 10 litres. After printing, the cloth is passed twice through the ageing machine and then into a sulphuric or oxalic acid bath.—A. Sbld.

Subtractive production of artificial daylight. Ives and Luckiesh. *See* IIb.

Working costs of electrolysis of alkali chlorides. Engelhardt. *See* VII.

Patents.

Bleaching, deodourising and disinfecting solutions; Apparatus for bleaching and for preparing ——. O. Sumner, London. Eng. Pat. 1941, Jan. 25, 1911.

An impervious partition is arranged between the two poles of an electrolysing apparatus so that the gases evolved during the electrolysis of a solution of a chloride are kept separate and polarisation is avoided. Means are provided for quickly leading the hydrogen out of the apparatus as it is liberated and for compelling the chlorine gas to pass through the solution.—P. F. C.

Bleaching cloth; Method of ——. E. D. Jefferson, Lowell, Mass. U.S. Pat. 992,133, May 9, 1911.

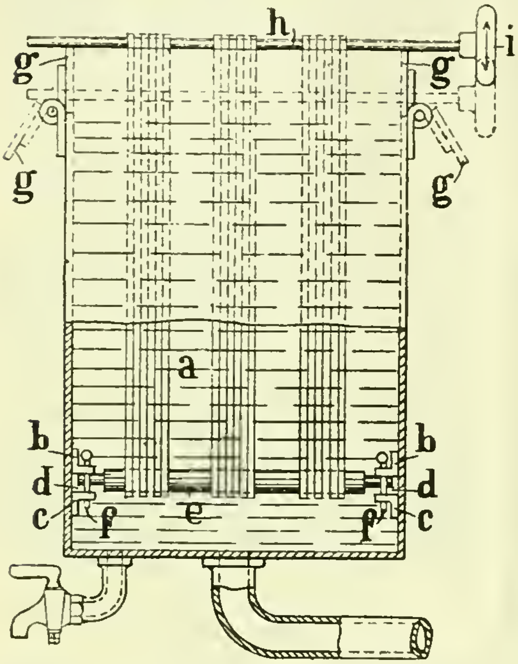
The cloth is arranged inside a closed cylindrical kier and the level of the bleaching liquor in the kier is intermittently raised and lowered by withdrawing the liquor from the bottom of the kier and re-delivering it on to the goods from above. The air pressure which effects this circulation also serves to keep the bleaching liquor thoroughly aerated. —P. F. C.

Bleaching of all sorts of "varech" and recuperation of the liquors; Process of ——. G. Garfounkel and V. Quemere. Fr. Pat. 424,264, Dec. 12, 1910.

The "varech" is first treated at 30° C. with a bath containing 2·5 parts of nitric acid and 2·5 parts of sulphuric acid to 500 parts of water. It is then transferred to a bath containing 10 parts of a solution of bleaching powder of 0·4° B. and 1 part of sodium hydroxide in enough water to work 100 parts of the material. As soon as the bleaching is complete, the product is taken out of the liquor, washed and dried, preferably at a low temperature. The bleaching liquor can be recuperated by adding more bleaching powder and sodium hydroxide to it.—P. F. C.

Mercerising yarn in the hank; Process of ——. M. Friedrich. Fr. Pat. 424,247, Nov. 30, 1910.

Along opposite walls and near to the bottom of a rectangular tank, *a* (into which mercerising liquor can be led from a reservoir), are arranged horizontal grooves, *d*, formed by rods, *b*, *c*, placed one above the other, the upper rods being shorter than the lower ones so as to permit the ends of the tension rollers, *e*, to be easily introduced into the grooves. These rollers are prevented from moving laterally by pegs, *f*. By means of hinged devices, *g*, the height of the walls which support the grooves can be increased so as to subject the yarn hung over the rollers, *h* and *e*, to the required tension during the mercerising process. When the hinges, *g*, are turned down, the distance between the rollers, *h* and *e*, is such that the hanks can easily be placed on or withdrawn from them. The upper tension rollers, *h*, are provided with means, *i*, for turning them and thus keeping the stretched yarn in continuous and reversible motion during the mercerising process.—P. F. C.

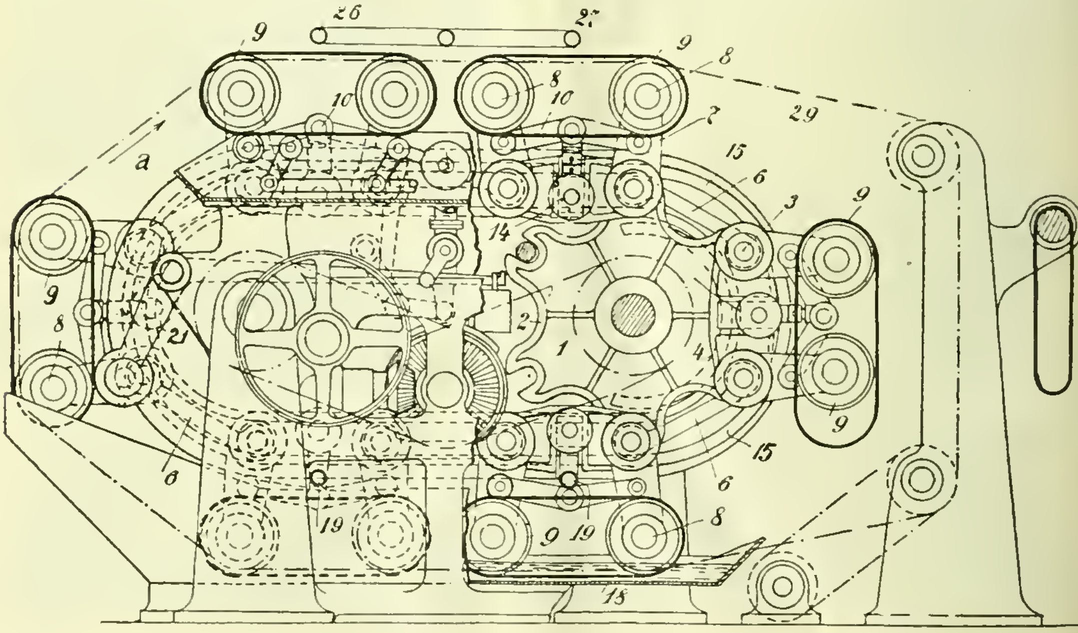


Bleaching yarns, fabrics, embroideries, etc., of cotton and linen; Process of ——. E. Steiger. Fr. Pat. 424,451, Dec. 1, 1910.

The material is first treated in a siphon Soxhlet apparatus with a suitable solvent such as petroleum ether for removing fats, waxes or mineral oils and is then subjected to a diastase treatment at 60°—65° C. to remove starchy substances. The cleansed goods are next bleached by working them for about 2 minutes at the ordinary temperature in a dilute solution of permanganate acidified with acetic acid, then washing and treating them with sulphurous acid to remove precipitated manganese dioxide and afterwards immersing them in a hot sodium carbonate solution of 1° B. These bleaching operations are repeated until a sufficiently good result is obtained. To prevent the white from yellowing subsequently, the goods are after-treated with a dilute alkaline solution of a copper salt, then washed with a liquor which removes all traces of copper and are finally treated with a dilute bleaching liquor.—P. F. C.

Mercerising yarns in the hank; Machine for ——. E. Schelling. Fr. Pat. 424,434, Dec. 29, 1910. Under Int. Conv., Dec. 29, 1909.

Around each of two axles, 1 (see Fig.), can turn a starred wheel, 2, provided with recesses in its periphery for holding the axles, 3, of carriages, 4, which are connected with one another by rods, 6. On each axle, 3, is mounted two movable arms, 7, connected by a cross piece, 8, which serves as the axis of a roller, 9. Each carriage, 4, is provided with two of these rollers and around each pair are hung the hanks of yarn to be mercerised. In order to stretch the yarn during mercerisation, the distance between the members of each pair of rollers, 9, can be increased by adjusting jointed levers, 10, connecting



the arms, 7. When the machine is working, an intermittent rotation imparted to the wheels, 2, causes the carriages to move at intervals around a fixed track, 15, in the direction of the arrow, *a*. At the same time the individual rollers, 9, are made to rotate in the opposite direction by means of an endless chain, 29. The whole of this apparatus is so arranged above a shallow mercerising vat, 18, that two pairs of rollers, 9, and the hanks they carry are always partly immersed in the mercerising liquor. Pipes, 19, are also arranged above the path of the rollers, 9, to discharge mercerising liquor on to them. After leaving the vat, 18, the hanks have the excess of mercerising liquor expressed from them by a squeezing roller, 21. They are finally washed by water sprayed on to them from pipes, 26 and 27.—P. F. C.

Dyeing or scouring fabrics, yarns, wool or other fibrous substances; Apparatus for ——. J. Furneaux, Buckfastleigh, Devon. Eng. Pat. 14,054, June 10, 1910.

The material to be dyed or scoured is packed into a number of wire cages removably mounted as sliding drawers or in any other desired form on a framework which can be readily lowered into an open vat containing the necessary liquor. By means of a crank movement the framework can be made to reciprocate vertically in the vat, thus forcing the liquor through the packed material. In order to facilitate even penetration, conical cavities having perforated walls are formed within the cages, so that the liquor can rise in them and then travel laterally through the adjacent material.—P. F. C.

Dyeing with a mixed chrome-copper lake; Process for ——. H. Imrie, London. From Anilinfarben und Extract-Fabr. vorm. J. R. Geigy, Basel, Switzerland. Eng. Pat. 5184, March. 1, 1911.

Dyeings of Eriochrome Blue-black (the hydroxyazo dyestuff from 1-diazo-2-naphthol-4-sulphonic acid and a-naphthol) upon chromed wool or upon wool which is after-chromed, can be shaded towards red by adding a small quantity of a soluble copper salt such as copper sulphate to the dyestuff or to the dye-bath. The addition must be made before the chromate treatment and the quantity must be so calculated that only a small proportion of the dyestuff is converted into the red copper lake. Example: Wool, mordanted with bichromate or with chromium fluoride, is introduced at the ordinary temperature into a dye-bath containing 3—5 per cent. of Eriochrome Blue-black B, 0·25—0·5 per cent. of copper sulphate, and 1—4 per cent. of oxalic or tartaric acid. The bath is raised to the boil in half an hour, and boiled for the same period. Then 1—3 per cent. of acetic acid is added and boiling continued for a further half hour. Dark shades may be after-treated at the boil in the exhausted bath with 0·5 per cent. of bichromate.—P. F. C.

Dyeing machine. A. Ligget, Philadelphia, Pa. U.S. Pat. 992,365, May 16, 1911.

Inside a closed dye-vat is mounted a rotatable circular frame carrying inside it removable wire-screen cages holding the material to be dyed. In order to assist the circulation of the dye-liquor, centrifugal blades which can be rapidly revolved are fixed to an axis arranged in the centre of the frame.—P. F. C.

Silk weighted with tin; Process for preserving ——. O. Berg and M. Imhoff. Fr. Pat. 424,679, March 18, 1910.

See Eng. Pat. 6538 of 1910; this J., 1910, 1007.—T. F. B.

Dyeing mixed textile materials; Process for ——. G. C. Dörr, Frankfort on Maine, Germany. Eng. Pat. 867, Jan. 12, 1911.

See Ger. Pat. 232,696 of 1910; this J., 1911, 617.—T. F. B.

Dyeing mixed goods (half-wool, half-silk, etc.) in a single bath; Process for ——. G. C. Dörr. Fr. Pat. 424,761, Jan. 10, 1911. Under Int. Conv., Jan. 11, 1910.

See Ger. Pat. 232,696 of 1910; this J., 1911, 617.—T.F.B.

Dyeing hairs, furs, and the like; Process of ——. A. Erlenbach, Dessau, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 992,947, May 23, 1911.

See Eng. Pat. 5134 of 1910; this J., 1910, 1103.—T. F. B.

Dyeing, bleaching, etc., textile fibres; Machine for ——. A. Schiffers. Fr. Pat. 424,346, Nov. 22, 1910.

See Eng. Pat. 28,126 of 1909; this J., 1911, 81.—T. F. B.

Embossings on tissues; Process for the production of ——. A. J. Boult, London. From F. Düring, Berlin. Eng. Pat. 28,084, Dec. 2, 1910.

See Fr. Pat. 423,748 of 1910; this J., 1911, 618.—T. F. B.

Printing; Process of ——. M. Schwarz, Hilden, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 992,270, May 16, 1911.

See Fr. Pat. 389,590 of 1908; this J., 1908, 978.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Chamber-process of sulphuric acid manufacture; Intensive working of the ——. H. Petersen. Z. angew. Chem., 1911, 24, 877—881.

A reply to Nemes (this J., 1911, 417). Nemes' references to literature are altogether incomplete, and his figures untrustworthy. He makes no reference to Falding's system (this J., 1909, 1032), with which excellent results have been obtained, and quite misrepresents the results of the working of the author's double ring system (this J., 1907, 870), which has been most highly spoken of in the English alkali-inspector's reports. The whole of Nemes' figures are estimates, not records of actual work, and are calculated on a basis that cannot be maintained. His conclusions are therefore altogether faulty. The author points out that productions of 8—10 kilos. per cub. m. of acid of sp. gr. 1·52 have been attained with a nitre-consumption of not more than 0·6 per cent. of nitric acid of sp. gr. 1·33, and that a Falding's set has worked to a production of 11 kilos. with 0·8 per cent. The Falding system compares favourably with Meyer's tangential system in that, whilst its production is greater for equal nitre-consumption, it requires less ground space, the attack of the walls by the gases is less, and the initial cost for lead is also less.—J. T. D.

Alkali chlorides; Working costs of the electrolysis of ——. V. Engelhardt. Chem.-Zeit., 1911, 35, 573—574, 582—584.

The direct production of a hypochlorite solution by electrolysis of alkali chlorides is attractive to small consumers, such as laundries and cotton bleach works, and may be expected to show a reduction of the consumption of active chlorine of 30 per cent. as compared with bleaching powder. Larger consumers, *e.g.* linen bleach works, pulp and paper mills are better equipped for the use of bleaching powder than small ones, so that in such cases the reduced consumption is only about 10 per cent. The separate production of chlorine and alkali appeals to those consumers who have a separate use for the caustic alkali, whilst absorbing the chlorine in milk of lime to produce a bleaching liquor. Three types of plant are available: the diaphragm, the gravity or "bell" apparatus, and the mercury cathode plant. Except the last, no plant can be worked so as to yield a product which is free from undecomposed salt, and this circumstance must be taken into account in the utilisation of the alkali produced. For consumption on the spot, the only type of plant which is of any interest is the diaphragm type, notably the Billiter plant made by Siemens und Halske. In all these processes, the cost of power is the main item of working, and the author, in comparing the working costs of the various types among themselves and with bleaching powder, has calculated the cost at which 1 kilowatt-hour must be produced in order to show an economy. In the author's statements full details of capital costs, consumption of salt and current, economy of chlorine, value of caustic alkali, etc., are given, and the cost per ton of bleaching powder equivalent is worked out for the extreme limits of cost of power. These limits are taken as 2 Pfennige (0·24d.) per kilowatt-hour for water power and 5 Pf. (0·59d.) for steam power. In this way it is calculated that for a small consumer, the direct production of electrolytic bleach liquor would show an advantage over bleaching powder, if power cost less than 3·5 Pf. (0·41d.) per kilowatt-hour. For a large consumer, the advantage begins when the cost of power can be reduced below 3·0 Pf. (0·35d.) per kilowatt-hour. With separate production of chlorine and caustic alkali and their subsequent re-combination as hypochlorite, working the Billiter process, the advantage over bleaching powder begins when power costs less than 3·4 (0·4d.) per kilowatt-hour. When the caustic alkali can be utilised and its value credited whilst the chlorine is absorbed in milk of lime, this process shows an advantage when power costs less than 4·7 Pf. (0·55d.), a portion of the undecomposed salt being recovered by evaporation. In the chemical industry, with the production of solid bleaching powder and solid caustic soda for sale, the corresponding figures for cost of power are 4·3 Pf. (0·51d.) for the diaphragm process and 3·9 Pf. (0·46d.) for the mercury-cathode process, the latter being less economical but yielding an alkali which is free from chlorides.—J. F. B.

Electrolytic chlorate manufacture; Influence of current concentrotion in ——. E. Müller and P. Koppe. Z. Elektrochem., 1911, **17**, 421—430. (See Foerster and Müller, this J., 1902, 1235; 1903, 417, and 1905, 930.)

The theory of Foerster and Müller (*loc. cit.*) for chlorate formation is expressed by the equations:

$$\mathrm{2Cl'+2\oplus=Cl_2}$$

$$\underline{\mathrm{Cl_2+2OH'=Cl'+ClO'+H_2O}}$$

$$i.e.\ \mathrm{2Cl'+2OH'+2\oplus=Cl'+ClO'+H_2O};$$

followed by the anodic process:

$$\mathrm{6ClO'+3H_2O+6\oplus=2HClO_3+4HCl+3O},$$

or the purely chemical reaction:

$$\mathrm{2HClO+ClO'=ClO_3'+2HCl}.$$

It is clear that in the anodic process the evolution of oxygen is accompanied by a loss in the current yield of chlorate which may amount to 33·3 per cent. If the purely chemical reaction can be made to preponderate greater efficiency will result. This can be done by acidifying the electrolyte so as to keep the ratio, $\mathrm{HClO:NaClO}$ sufficiently high. It will also result from a reduction of the current concentration (the ratio of current to the volume of the electrolyte). The authors' experiments show the correctness of these deductions, and also that it is more profitable to work with a considerable volume and relatively small acidity, than *vice verso*, since with the former conditions the evolution of free chlorine is largely avoided.—W. H. P.

Alkali carbonates; Titration of —— *in presence of bicarbonates or hydroxides.* J. Tillmans and O. Heublein. Z. angew. Chem., 1911, **24**, 874—876.

In the customary method of determining hydroxide and carbonate, or carbonate and bicarbonate, by titrating with acid and phenolphthalein, which should turn at the point of complete conversion of the whole of the alkali into bicarbonate, then adding methyl orange, and titrating further to obtain a measure of the total bicarbonate formed, there is always a difficulty in ascertaining the end-point of the phenolphthalein titration. The authors have traced the cause of this to the escape of carbon dioxide from the solution, which occurs to a very considerable extent without visible effervescence. A sharp indication and accurate results are obtained by working in a flask which, after each addition of acid, is stoppered and thoroughly shaken. The best way of working is to titrate a portion in the first place to the end with methyl orange alone, then to add to a second portion in a flask phenolphthalein and the quantity of acid ascertained in the first titration, to stopper and shake well, and to titrate back with sodium hydroxide the carbonic acid set free, shaking the stoppered flask after each addition of alkali. This back-titration can of course only be carried out with $N/10$ acid and alkali in dilute solutions.—J. T. D.

Ammonia by heat; Synthesis of ——. I. S. Cardell and F. Thomas. Chem. Soc. Proc., 1911, **27**, 138.

The authors find that ammonia cannot be produced from pure hydrogen and nitrogen, but combination takes place in the presence of oxides of nitrogen. With nitric oxide the amount of ammonia formed decreases with the increased rate of passage of the gases through the experimental tube, but the reverse holds good in the case of nitrous oxide. This is explained by the relative stability of the two oxides.

Ammonia from peat; Production of ——. N. Caro. Chem.-Zeit., 1911, **35**, 505—507, 515—516.

The author gives an account of experiments which have led up to the commercial utilisation of peat in the Mond gas producer (see this J., 1908, 796; 1910, 796). By passing a current of steam over peat, heated to 350°—550° C., almost the whole of the nitrogen is obtained as ammonia, but, at the same temperature, the yield of ammonia is higher with wet peat (containing 50—60 per cent. of water) than with dry peat, and the decomposition is more rapid. Dry peat gives the better results when treated by the Mond process in the ordinary way, because, with wet peat, the drying zone is relatively deep and the zone at the desired temperature (350°—550° C.) is too shallow, but this drawback is overcome by increasing the temperature of the drying zone to about 250° C. by introducing air at this zone, so as to secure local combustion, or by superheating the mixture of air and steam (to 450° C.), before its entry into the generator; this effects some decomposition in the drying zone. Woltereck's experiments, showing that, when steam and air are passed over heated peat, atmospheric nitrogen is converted into ammonia (see this J., 1908, 158,978; 1909, 20), have been repeated, as also his experiments with sugar charcoal, and in no case was a larger yield of ammonia obtained than corresponded to the nitrogen present in the material used.—F. Sodn.

Chlorides; Detection of —— *in bromides and iodides.* A. Testa. L'Ind. Chim., 1911, **11**, 123—124.

Whilst silver chloride is slightly soluble in boiling ammonium oxalate solution, silver bromide is almost and silver iodide quite insoluble. For the detection of chloride, therefore, the solution of the substance is treated with silver nitrate, and the precipitate after washing is boiled for about 1 minute with $N/2$ ammonium oxalate solution. After filtering, a few drops of potassium bromide are added to the solution, when a yellowish turbidity is produced if chloride be present.—A. S.

Sodium hypophosphite; Action of —— *on copper sulphote in aqueous solution.* J. B. Firth and E. Myers. Chem. Soc. Proc., 1911, **27**, 139—140.

The authors have examined the above reaction in acid solution, and find that the composition of the product depends on the conditions under which the reaction is carried out. The reaction proceeds through a series of stages, and finally yields a black substance containing hydride, oxide, and phosphate of copper. This substance, when quite dry, is unstable, and frequently decomposes spontaneously on exposure to air, with the production of water, hydrogen, copper, copper oxide, and copper phosphate.

Gases; Separation of the constituents of mixtures of —— *by liquefaction.* F. Linde. Verh. des Ver. zur Beförd. des Gewerbefleisses, 1911, 9—24.

The "cascade" method of successively liquefying gases, by cooling each compressed gas in a bath of the evaporating liquid formed from a more easily condensable gas, was the first means by which the gases of the atmosphere were liquefied, but is far too cumbrous and costly ever to become of industrial interest. Siemens proposed to expand a compressed gas, making it do outside work, and to apply the "regenerative" principle, by allowing the cooled expanded gas to cool a further quantity of compressed gas before expansion; and Solvay constructed an apparatus for effecting this, but could not reach a temperature below —95° C., because of the rapid inflow of external heat. Quite lately Claude has applied this principle with success. Linde's method differs from Siemens', in that the air expands without doing external work, and the relatively small cooling effect due to internal molecular work is utilised, by making the process continuous, to liquefy the air. The compressed air is cooled after compression to the atmospheric temperature, then passes down the central tube of a double spiral to a valve, passing through which it expands from 200 to 16 atmospheres, and then returns, cooled by expansion, through the annulus of the double spiral to the compressor, cooling, as it passes, the oncoming compressed air in the inner tube. Each successive quantity of compressed air is thus cooled further than the preceding one before expansion, and consequently reaches a lower temperature after expansion, till finally a portion liquefies, and thereafter liquefaction goes on continuously, air being supplied from outside to compensate for the quantity liquefied. The cooling effect depends on the difference between the two pressures, whilst the work of compression depends on their ratio; in practice, therefore, the circulating and cooling system is made to work between 200 and 16 atmospheres, with a ratio of only 12·5 : 1, whilst a portion only, after passing the first valve, passes through a second, reducing its pressure from 16 atmospheres to 1, and partly liquefies. The non-liquefied part of this passes out into the atmosphere. For the separation, from liquid air, of pure oxygen, a rectification is practised, similar to the rectification of spirit. The compressed air is passed into the inmost tube of a triple spiral, which surrounds a closed column packed or built like a rectifying column. At the bottom of the triple spiral, the inmost tube is prolonged alone, passes through the wall of the column near the bottom, thence spirally to the bottom, out, up by the side of the column, and in through the wall again near the top, ending, open, in the axis of the column. In the ascending portion is a reducing valve. When the air begins to liquefy, the liquid is forced up through the valve, falls down the column, and ultimately accumulates around the spiral at the bottom. Evaporation goes on continuously from this, and as the vapour passes up the column it is continuously exchanging with the liquid coming down, the less volatile oxygen condensing, the more volatile nitrogen becoming gaseous, so that the liquid at the bottom steadily grows richer in oxygen, and in the final stationary state consists of oxygen of a purity of 99 per cent. or more, whilst the gas leaving the top of the column has the composition of gas evaporating freely from a 21 : 79 oxygen-nitrogen mixture, or contains about 7 per cent. of oxygen and 93 per cent. of nitrogen (Baly, Phil. Mag., 1900, **49**, 517). The oxygen, as it accumulates, passes out through the middle tube of the triple spiral, and the impure nitrogen through the outermost tube. To obtain pure nitrogen, a modification must be made in the method. The rectifying column is lengthened, so that the liquid air enters not much above its middle. Part of the condensed oxygen is passed through a valve and reduced to very low pressure, so that its temperature is brought below the boiling point of nitrogen, and is carried in a spiral through the head of the column, before being taken to the compound spiral. The escaping gas is by this condensed to a liquid; from this liquid, containing 7 per cent. of oxygen, gas escapes containing about 2 per cent; this in turn is condensed, and gives off gas containing 0·5 per cent., and so on, till ultimately pure, or almost pure nitrogen leaves the top of the column, which is washed by a liquid gradually changing in composition from pure nitrogen at the top to pure oxygen at the bottom.

Claude has effected improvements in the processes both of liquefaction and separation. He uses the continuous cooling process, but compresses only to 40—50 atmospheres; the compressed air is then divided, one part expanded, in a cylinder doing external work, to 4—5 atmospheres, then used to cool the other part, which it is sufficient to liquefy, and finally passed back to cool the on-coming compressed air. The liquefied compressed air passes out through a valve to atmospheric pressure. By this system only three-fifths of the power is needed which the Linde process requires. For rectification, the air at 4—5 atmospheres pressure is introduced into a vessel from the upper part of which long narrow vertical tubes spring, opening into a head, from which other parallel tubes descend, ending in a second vessel similar to the first. The whole of this arrangement is surrounded by liquid oxygen boiling at atmospheric pressure, in a vessel forming the bottom of a rectifying column like that previously described. In the narrow tubes the oxygen is completely condensed, and there collects in the vessel below the 46 : 54 liquid oxygen-nitrogen mixture which corresponds to the 21 : 79 gaseous mixture. Pure nitrogen escapes into the head, and descends the other tubes into the second vessel, becoming liquefied in its passage. The nitrogen passes through a valve to the top of the column, and the liquid mixture through another valve to an appropriate height in the column, where the same rectifying effect goes on as before, supplying pure nitrogen at the top and pure oxygen at the bottom. In 1910, Germany consumed about 3,000,000 cubic metres of compressed oxygen, France about 1,200,000,

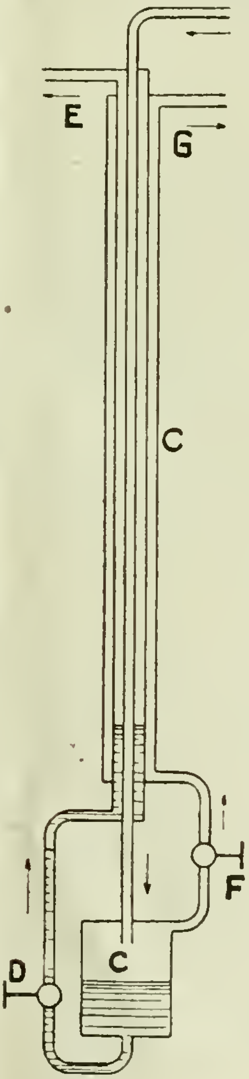


Fig. I.

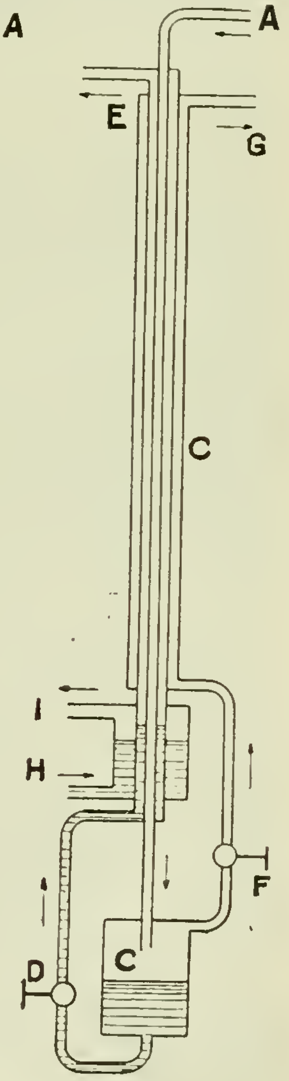


Fig. II.

the United Kingdom about 500,000; the British consumption, however, is rapidly increasing. The output of compressed nitrogen in cylinders is comparatively small, but large installations are being erected for its production for the calcium cyanamide industry. Lately, Frank and Caro, with the aid of the Linde firm, have succeeded in the production of hydrogen of a high degree of purity from water gas. The accompanying figures show the apparatus diagramatically. The compressed water gas enters by the innermost tube, and is cooled by expansion through the valves and return of the cooled gases by the middle and outermost tubes till liquefaction of the carbon monoxide occurs; separation then takes place, the gaseous hydrogen escaping through the valve F, and the outermost tube, the liquid carbon monoxide passing through the valve, D, and evaporating in the middle tube. It was found impossible to liquefy the carbon monoxide, however, by the small amount of cooling by internal work of a gas containing so much hydrogen, and the cooling was therefore aided, as indicated in Fig. II., by cold-jacketing the lower portion of the apparatus by means of a similar apparatus producing liquid air; in this way the industrial success of the apparatus was secured, and a gas produced, containing hydrogen, 97; carbon monoxide, 2; nitrogen, 1 per cent. Removal of the carbon monoxide by calcium carbide or soda-lime then yields a 99 per cent. hydrogen. The gas formed from the liquid contains 85—90 per cent. of carbon monoxide, the rest being chiefly hydrogen, and is an excellent power-gas.

Dr. Frank, in discussion, pointed out that cheap hydrogen was of great importance for ballooning purposes, and that none of the methods hitherto in use for its production yielded it nearly cheaply enough. He had at first been endeavouring to produce diamond carbon by the reaction of carbon monoxide on calcium carbide, and used producer gas as a source of carbon monoxide. The attempt to produce carbon was given up, but he found that carbide absorbed not only the monoxide, but the nitrogen and oxygen (if any) in producer gas, leaving almost pure hydrogen. The expense, however, of carbide, or of cuprous compounds or other means of absorbing carbon monoxide was too great, and ultimately removal by liquefaction as described by Linde was adopted. The hydrogen obtained, after final purification by carbide, was pure enough to satisfy the requirements of the German military authorities, who demand a lifting power of 1180 grms. per cub. metre, which corresponds to an amount of impurity (of gas of density about 14) of less than 2 per cent. He suggested that gas-works, nearly all of which now manufacture water-gas, should install liquefying apparatus, and supply on the large scale hydrogen, and possibly nitrogen and other gases. Carbon monoxide would find use not only as a power-gas for internal combustion engines, but also in many chemical processes, the preparation of formic acid for instance. The more or less complete removal of poisonous carbon monoxide from the water-gas used for general lighting and heating would be an advantage, and the gas so removed would be available for power purposes. Nitrogen could be employed not only in the calcium cyanamide industry, and in the manufacture of synthetic ammonia by Haber's process, but in the metallic-filament glow lamp industry, the inflating of motor tyres, etc. The use of oxygen, moreover, is sure to extend. In the near future the autogenous soldering or welding of the plates of ships, of boilers and similar vessels will replace riveting. The larger engineering and shipbuilding works will establish liquefying plants, whilst the smaller works will obtain their gases in cylinders, and possibly tend to be established near to the gasworks where oxygen and hydrogen are obtainable. The use of oxygen for the melting and refining of refractory metals is also likely to increase; the melting of steel, for example, by the oxyhydrogen flame, would have the advantage that no carbon would be introduced, and that an excess of hydrogen would protect the metal from any oxidation. The use of oxygen to raise the temperature, and hence the illuminating efficiency, of incandescent mantles, and of hydrogen in the preparation of organic compounds, are also directions in which future progress is indicated. —J. T. D.

Ozone; Determination of —— by alkaline potassium iodide. G. Lechner. Z. Elektrochem., 1911, **17**, 412—414.

In the estimation of ozone in a current of gas by neutral potassium iodide, there is always a possibility that some of the iodine separated will be carried over by the current, and that two or three absorption vessels will be necessary. To avoid this the author proposes to use alkaline potassium iodide, in which the iodine does not separate until the solution is acidified, just before titration. On testing the method and checking the results by the observed changes in the volume of the air or oxygen on ozonising, it is found that very satisfactory results are obtained, and that efficient absorption is achieved in a single washing flask containing fragments of porcelain.—W. H. P.

Russian chemical industry. Chem. and Drug., May 27, 1911. [T.R.]

According to the particulars which recently appeared in the "Gazette du Commerce et de l'Industrie," there have been a few notable changes in this industry last year. Soda and sulphuric acid with allied products have been in constant demand, and fairly steady prices have ruled. Ammonium sulphate, obtained as a by-product by the more up-to-date manufacturers of soda, has been offered in such large quantities as to cause a notable set-back in the price and the elimination of all competition by the coke-ovens in the Donetz district. The importations of pyrites used for the manufacture of sulphuric acid have shown a rapid increase, and amounted for the eleven months to the end of November last to 106,470 tons, against 70,000 tons and 80,000 tons for the corresponding periods in 1909 and 1908 respectively. The Russian output of pyrites had decreased until 1908; in 1909 it reached about 34,000 tons, and rose again in 1910 to 50,000 tons. The manufacturers of sulphuric acid are situated near the frontier in the west, whereas the producing mines are so remotely situated that there can be no question for the present of transporting mineral to places where it can be utilised for the making of sulphuric acid. Thus chalcopyrites are almost exclusively used for copper-making, and their sulphur contents are lost. Another feature in the Russian industry is the extraordinary growth of the imports of phosphates, amounting to 118,000 tons for the first two months of 1910, compared with 70,000 tons and 30,000 tons for the same period in 1909 and 1908 respectively. This movement is not so much the result of the demand for agricultural purposes as of the fact that the product is subject to a much lower duty than sulphuric acid, which is used as a basis for its manufacture. Among the Russian chemical products exported abroad, glycerin deserves first to be mentioned, and then potash (3400 tons in 1910, against 2600 tons in 1909). The exports of crude turpentine reached 7300 tons for the first eleven months of 1910, about the same as in the corresponding period of 1909, whereas the figures for the refined spirit show a slight falling off at 4400 tons.

Ammonium sulphate production in 1910. Mining World (Chicago), May 13, 1911. [T.R.]

The ammonium sulphate production in 1910, according to the figures of the Deutsche Ammoniak Verkaufsvereinigung, was as follows (in metric tons of 2200 lb.):—

	Tons.
Germany	373,000
Great Britain	369,000
United States	116,000
France	56,000
Belgium-Holland	43,000
Austria-Hungary, Spain, miscl.	100,000
Total	1,057,000

Patents.

Acetic acid; Process for manufacturing concentrated ——. J. Behrens, Brême, Germany. Eng. Pat. 28,839, Dec. 12, 1910.

Alcohol is converted into acetic acid in two stages, thus: (1) a mixture of aldehyde and alcohol is produced by the catalytic action of zinc oxide or other suitable metallic oxide, and aldehyde is isolated from the mixture, and (2) the aldehyde is oxidised by means of molecular oxygen. The process may be carried out by passing alcohol vapour, superheated to about 350° C., through externally heated cylinders, filled with coarsely granulated zinc oxide, also at 350° C., the condensed reaction product being separated into aldehyde and alcohol by rectification in a fractionating column. The pure aldehyde is then brought into contact with oxygen in an absorbing tower, and the acetic acid and excess of aldehyde are subsequently separated by means of a second fractionating column, very pure and highly concentrated acetic acid being obtained.—F. Sodn.

Ammonia; Catalytic manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 20,127, Aug. 29, 1910.

A mixture of nitrogen and hydrogen is passed, under pressure, over a heated catalytic agent contained in a metallic vessel, of which the wall sustaining the pressure is maintained at a temperature approaching that at which the reaction is taking place, as described in Eng. Pat. 15,973 of 1910; but, in order to prevent deterioration of the vessel, the wall referred to above is not allowed to come into contact with gases containing more ammonia than the quantity corresponding to the state of equilibrium for the pressure and temperature obtaining. For instance, the catalytic agent may be contained in an inner tube or vessel, within that which is heated and sustains the pressure, the gases entering the apparatus through the space between the walls of the two tubes and then passing over the hot catalytic agent in the inner tube.—F. Sodn.

Hydrosulphites; Manufacture of anhydrous ——. Chem. Fabr. von Heyden, Akt.-Ges., Radebeul, Saxony. Eng. Pat. 28,773, Dec. 10, 1910. Under Int. Conv., July 27, 1910.

The process is similar to that described in Eng. Pat. 16,540 of 1910 (this J., 1910, 1204), except that the foreign salts may be omitted and a smaller proportion of bisulphite, or other substance, such as acetone sodium bisulphite, from which bisulphite is easily split off (less than 2 mols. to each molecule of sulphoxylate), is used, the reaction between the acetone sulphoxylate and the bisulphite resulting partly in the splitting off of acetone which is recovered. As an example, 60 parts of acetone and 100 parts of water are added to 250 parts of sodium bisulphite solution of 40° B., and the mixture is heated to 70° C.; 180 parts of sodium acetone sulphoxylate are then added, whilst stirring, the temperature being maintained at 60°—70° C., and the acetone, thus liberated, is distilled off, preferably *in vacuo* ("nearly to boiling of the water at 60°—70° C."), the precipitated sodium hydrosulphite being separated from the mother liquor in the known manner.—F. Sodn.

Hydrogen peroxide solution; Process of preserving ——. M. Schlaugk, Hanover, Germany. U.S. Pat. 992,265, May 16, 1911.

A small proportion of *p*-acetylaminophenol is added: for example, about 1 grm. per litre of "10 per cent. volume" hydrogen peroxide solution.—F. Sodn.

Hydrogen peroxide; [*Aluminium*] *vessels for the preparation and storage of* ——. A. Pietzsch and G. Adolph. Ger. Pat. 233,856, June 4, 1910.

The use of vessels of aluminium or its alloys is claimed, and it is stated that even when the hydrogen peroxide undergoes some slight decomposition in contact with the walls of the vessel, none of the metal is dissolved. A 30 per cent. solution of hydrogen peroxide, for example, prepared in an apparatus of aluminium, proved quite stable when kept subsequently in a paraffin wax vessel.—A. S.

Alkali and alkaline-earth sulphates; Process for reducing —— *to their respective sulphides by means of the catalytic action of iron.* V. Bollo and E. Cadenaccio. First Addition, dated Dec. 29, 1910, to Fr. Pat. 423,228, Nov. 26, 1910 (this J., 1911, 620). Under Int. Conv., May 27, 1910.

Claim is made for the use, not only of iron, but in general of one or several catalysts, whether as oxides or metals or catalysing compounds of the metals. Manganese, nickel, cobalt, copper, chromium, and other catalysing metals which may be utilised industrially, and their respective compounds having a catalytic action, are mentioned by way of example, and steam also may be applied as the catalyst. Claim is further made for carrying out the process in an electric resistance furnace, the mass being submitted to the action of such reducing substances as are indicated in the principal patent, with exclusion of air. —F. Sodn.

Alkali or alkaline-earth sulphides; Process of manufacture of ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 424,417, Dec. 3, 1910.

A mixture of sulphate or bisulphate and carbon (in slight excess) is continuously introduced into a water-jacketed wind furnace, provided with tuyères which supply air at such a rate as to maintain a reducing atmosphere. The product may be utilised without further treatment or may be run directly from the furnace into water and the solution crystallised, after filtration, in a cooling apparatus provided with a stirrer, preferably in absence of air. —F. Sodn.

Zinc oxide; Manufacture of ——. A. Blum. Fr. Pat. 424,380, Dec. 19, 1910.

Alternate layers of fuel and of fuel mixed with a mineral or other material containing zinc (preferably six layers in all, each 10 cm. in thickness) are arranged in a converter of the conical type having a perforated false bottom, or in other suitable furnace, and the charge is heated by combustion to a temperature below that at which reduction of any iron oxide would take place, so as to give a porous ash instead of a slag; air is admitted, at a relatively low pressure (*e.g.*, 2 ins.) at first, and the pressure is gradually increased (but not above 12 ins.) and then diminished; the alternation of reaction zones with zones of auxiliary heating ensures uniform reduction, and the zinc vapours produced are converted into white zinc oxide (containing 75—80 per cent. of zinc) which is collected and filtered in an appropriate chamber. The amount of fuel employed is about 40—50 per cent. of the weight of the charge, the quantity in the mixed layers being less than that in the other layers. The blowing of a charge lasts for about 7 hours, and 1—3 tons of material can be treated in a single operation.—F. Sodn.

Bauxites; Process for the mechanical treatment of ——. N. Leeesne. Fr. Pat. 424,514, Dec. 31, 1910.

Bauxite, after being air-dried or dried by heating, is disintegrated in any form of apparatus in which it is subjected to shock (as opposed to grinding or crushing), and the dust, which contains most of the ingredients other than alumina, is eliminated, as produced or subsequently (by means of a fan, for instance), leaving a granular concentrate rich in alumina. In order to get rid of iron more completely, the bauxite may be dried by heating in a reducing atmosphere at 350°—400° C., and the magnetic iron oxide thus produced separated electro-magnetically. As an example, it is stated that bauxite containing 3 per cent. of silica and 60 of alumina may be made to yield a concentrate containing less than 1 per cent. of silica and as much as 86 per cent. of alumina.—F. Sodn.

Nitrous gases; Process for dissipating the mist which forms in ——. Badische Anilin und Soda Fabrik. Ger. Pat. 233,729, April 27, 1910.

A great difficulty in the treatment of nitrous gases is the formation of mist or fog. This takes place, for instance, when the gases contain a certain proportion of moisture, and when they come in contact with ammonia; large quantities of mist are also evolved from absorbing apparatus in which the gases are treated with alkaline solutions, and mist is also produced when the gases are strongly cooled. According to the present patent, the mist is dissipated by passing the mixture of gas and mist between a pair of electrodes, one of which is emitting sparks whilst the other is not, or between a series of such pairs of electrodes.—A. S.

Ammonium nitrate; Process for the electrolytic preparation of —— from aqueous nitric acid. Elektrochem. Werke Ges. m. b. H. Ger. Pat. 233,895, July 17, 1910.

The process consists in electrolysing aqueous nitric acid of less than 30 per cent. concentration, at the ordinary temperature, using an aluminium cathode, and a solution of nitric peroxide or nitrous acid in dilute nitric acid as anode liquid. The current density may vary within wide limits, but it is essential to work at the ordinary temperature and with acid of the concentration mentioned; otherwise loss of nitrogen occurs. The oxygen formed at the anode serves to oxidise the lower oxides of nitrogen to nitric acid, and in order that it may not interfere with the reduction process at the cathode, a diaphragm is used to separate the anode and cathode compartments.—A. S.

Sulphuric acid; Kessler apparatus for concentrating ——. J. Teisset and J. Prat, Paris. U.S. Pat. 993,125, May 23, 1911.

See Fr. Pat. 398,212 of 1908; this J., 1909, 937.—T. F. B.

Nitric acid; Process for the preparation of concentrated —— starting with nitrogen peroxide. Le Nitrogène, Soc. Anon. Fr. Pat. 424,598, Jan. 4, 1911. Under Int. Conv., Jan. 6 and Sept. 24, 1910.

See Eng. Pats. 319 and 403 of 1911; this J., 1911, 684. —F. Sodn.

Oxalic acid; Process for precipitating ——. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 424,524, March 15, 1910.

See Eng. Pat. 7092 of 1910; this J., 1910, 878.—T. F. B.

Ammonia; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 13,097, May 30, 1910.

See Fr. Pat. 418,434 of 1910; this J., 1911, 85.—T. F. B.

Ammonia; Process of producing ——. C. Bosch and A. Mittasch, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 993,144, May 23, 1911.

See Fr. Pat. 405,712 of 1909; this J., 1910, 424.—T. F. B.

Peroxide of hydrogen; Manufacture of —— from impure solutions of persulphuric acid. Oesterreichische Chem. Werke, A.-G., and L. Löwenstein, Vienna. Eng. Pat. 26,646, Nov. 16, 1910. Under Int. Conv., Nov. 17, 1909.

See Fr. Pat. 422,460 of 1910; this J., 1911, 685.—T. F. B.

Zinc oxide; Manufacture of ——. A. Blum, Monterey, Mexico. U.S. Pat. 993,019, May 23, 1911.

See Fr. Pat. 424,380 of 1910; preceding.—T. F. B.

Formates; Process for the manufacture of ——. A. Wiens, Bitterfeld, Germany. U.S. Pat. 993,331, May 23. 1911.

See Fr. Pat. 362,417 of 1906; this J., 1906, 714.—T. F. B.

Hydrogen; Method of gaining —— by the decomposition of water steam with the aid of melted iron. W. Gerhartz, Rheinbach, Germany. Eng. Pat. 23,418, Oct. 10, 1910.

See Ger. Pat. 226,453 of 1909; this J., 1910, 1250.—T. F. B.

VIII.—GLASS; CERAMICS.

Fused silica; Behaviour. of —— at high temperatures. A. Blackie. Faraday Soc., May 23, 1911. [Advance proof.]

The author has determined the effect of heating to high temperatures for definite periods on the strength of four varieties of vitreous silica: Silica U, unglazed, showing long parallel-sided bubbles; Silica G, glazed on both sides, with spherical surface bubbles, and an intermediate layer with irregular bubbles, the inner portion having elliptical bubbles; Silica S, satin-like, with one smooth surface with a satin-like sheen and flat elliptical bubbles, the other surface being rough with a few grains of sand; Silica T, transparent, with a few long parallel-sided bubbles. The structures of the specimens are illustrated by microphotographs. Silica T is much stronger at all stages than the other varieties. Silica G has a slight advantage over U and S in the virgin condition, but loses this on heating. Silica S is slightly the weakest. Silica U shows a distinct increase in strength after heating to 1188° C. for four hours, but the process of devitrification subsequently overcomes this. Generally loss of strength has hardly commenced at 1120° C.; at 1188° C. it is not very serious after eight hours, but four hours at 1350° C. causes a reduction of 40—60 per cent. The criterion of strength chosen is the modulus of transverse fracture. After fracture the heated specimens were microscopically examined. Except for a few grains of quartz and an occasional grain of carborundum (from grinding) no foreign nuclei were observed, and the former were only occasionally starting points for crystallisation. At the lower temperatures of heating, crystal growth was limited to the outer surface and the walls of bubbles. At 1275° C. sometimes, and at 1353° C. nearly always, crystals were formed in the ground mass and a microcrystalline structure developed in some areas. This may be due to small traces of impurity held in solid solution. Silica T did not show this except near bubbles. The crystals formed were tridymite, and starting from a very minute size increased slightly up to 1118° C., being subsequently shattered at high temperatures. The changes in mechanical strength follow very closely the crystalline changes. The formation of crystals seems to be accelerated by contact with the air. Above the transition point of vitreous silica to tridymite the change can probably not be prevented entirely. A comparison of the coefficients of expansion of the material T with the materials U and S shows a very small difference indeed. (The greatest difference in length up to 800° C. which was observed was about 25 parts per million.) Up to 500° C. the opaque materials seem to have a slightly greater expansion. Above that temperature the transparent silica expands most. There is a distinct tendency for the expansion of both materials to lag behind the temperature. (See also Kaye, this J., 1910, 1201.)—W. H. P.

Patent.

Clay ware; Process for preventing the cracking of ——. L. Schmelzer and E. Schoepke. Ger. Pat. 233,675, June 2, 1910.

There are some clays, which, even after treatment in the ordinary way with steam, still crack on drying. It is claimed that this defect is remedied if the clay be first mixed to a thick paste with water and then heated to boiling by means of steam.—A. S.

IX.—BUILDING MATERIALS.

Portland cement; Physical and chemical properties of ——. W. C. Reibling and F. D. Reyes. Philippine J. Sci., 1910, 5, 367—417.

I. *Free lime in Portland cement.*—The authors have adopted White's calcium phenolate test (this J., 1909, 23) for free lime in cement. They have further developed it so that it is possible to make a distinction between quicklime, slaked lime and sintered lime, each of which produces the same substance, in a different crystalline habit. This involves a close and experienced study "of the behaviour on the microscope slide of calcium oxide and hydroxide in the presence of phenol containing varying quantities of water." "However, only an experienced operator, who thoroughly understands the conditions of the reaction can do this successfully." A series of investigations on the connection between free lime and soundness leads to the following conclusions. Slaked lime will not cause unsoundness in the soundness test. Non-sintered lime (quicklime) must be present in quantity to cause unsoundness, and if it is so present the disruption is likely to occur in pats exposed to water and in air as well as in those exposed to steam. If both sintered and non-sintered lime are present, the pat may be sound in air and in water, but it is very liable to disintegrate during the hot tests. Fused or sintered lime, in the absence of non-sintered lime, indicates a hard-burned cement which probably contains abundance of material with strong cohesive properties. Unless present in large amounts it will not cause disruption in pats exposed to air and to water, but even a fair amount is liable to cause unsoundness in accelerated tests. The effect of a small amount is not liable to become apparent to the eye. Fineness of grinding assists the soundness. It may generally be assumed that the presence of non-sintered lime is positive evidence of under-burned, mixed or adulterated material.

II. *The seasoning of Portland cement.*—The paper contains data of observations on the progress of aeration of cement, tending to show that seasoning does not always exert a satisfactory influence on the properties of a cement. The progress of seasoning is very different in clinker and in the powdered cement. Free lime and unsoundness in a hard-burned cement clinker are invariably caused by coarseness of the raw material or by insufficient mixing. The hard-burning causes the free lime to become surrounded with a protective coating of sintered slag which delays seasoning in the clinker to a remarkable extent. Free lime in an under-burned clinker on the contrary is much more active, and the clinker consequently seasons more rapidly. Exactly the reverse may be the case in the powdered form. It is pointed out that in so far as aeration converts slaked lime to carbonate in unset cement, it reduces its efficiency, since slaked lime possesses a cementing value of its own, while the carbonate is inert.
—W. H. P.

Cement ; Michaëlis' boiling test for ——. G. Hentschel. Chem.-Zeit., 1911, **35**, 558.

Sound cements are said often to fail when tested by Michaëlis' method (immersion in boiling water, for 3 hours, of a pat which has been allowed to set, generally for 24 hours), on account of slowness of setting and, consequently, of hardening ; the following preliminary treatment is therefore recommended :—A pat gauged in the usual way is placed on a highly absorbent surface, such as plaster, and is transferred after about 15 minutes to a 2 mm. iron plate, on which it is heated over a naked flame until the water has completely evaporated ; it is next cooled and placed in cold water for 10 minutes, after which it is left for 3 hours in the air. The pat is then subjected to the boiling test.—F. Sodn.

Patents.

Silicon carbide [*carborundum*] *; Method for the production of dense compacted* ——. F. J. Tone, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 992,698, May 16, 1911.

A mixture of silicon carbide and carbon, which may be mixed with a suitable binding agent, is formed into pieces of the desired shape, and, after baking, if necessary, to remove moisture and other volatile substances, is heated in proximity to a substance containing silicon (by embedding, for instance, in a mixture containing silicon carbide and silica, so as to secure an atmosphere containing silica and silicon vapours), the temperature being sufficiently high to cause the silicon to combine with the carbon *in situ*, but below that at which the resulting compound would be destroyed.—F. Sodn.

Artificial stones ; Process for manufacturing porous ——. F. Mahler, Lucerne, Switzerland. Eng. Pat. 21,560, Sept. 16, 1910.

See Fr. Pat. 417,441 of 1910 ; this J., 1911, 29.—T. F. B.

Wood ; Process for drying ——. Grand Rapids Veneer Works. Fr. Pat. 423,972, Sept. 24, 1910.

See Eng. Pat. 24,193 of 1909 ; this J., 1910, 1384.—T. F. B.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Blast furnace ; Fuel efficiency of the iron ——. J. J. Porter. Trans. Amer. Inst. Min. Eng., 373—403.

The following table is given of the approximate percentage of the items entering into the cost of making pig-iron :—

	Alabama.	Virginia.	Pittsburg.	Chicago.
Ore	35	38	70	54
Flux	1	7	2	2
Fuel	47	39	18	34
Labour	10	11	6	6
Repairs	7	5	4	4

The cost of labour has been reduced to a minimum by use of mechanical means, and is only a small percentage of the total cost. In order to reduce the percentage cost of the fuel, the question of fuel efficiency has been studied, and a formula is given which shows quantitatively, the relation between the various factors affecting fuel economy, and affords a means of comparing the fuel consumption of various blast furnaces at various times and under various conditions. The formula is based on the calorific values of the factors entering into the heat balance of the furnace. After discussing each factor and the limitations of the formula the method of using it is described, and complete details of its application in forty-three cases are tabulated. The importance of the use of dry blast, and high blast heat is indicated.—A. H. C.

Furnace ; The electric —— *with special reference to the manufacture of high-class steel.* J. Härdén. Electrician, 1911, **67**, 287—289.

In the Rœchling-Rodenhauser furnace two or three limbs of the core pass vertically through the hearth with the energising coils placed on them similarly to the Kjellin furnace. In addition a special secondary winding of heavy copper bars is placed outside and around the primary coils, the combined power in these secondary windings being about 35 per cent. of the total power of the furnace, the remainder being transmitted directly to the charge. The current induced in the secondary is conveyed to a set of steel plates inserted in the walls of the lining which are covered with a material forming a conductor of the second class and acting as a Nernst glower on the large scale. A hot basic Bessemer steel containing 0·30 per cent. of carbon, 0·07 of sulphur, 0·06 of phosphorus can be refined to only traces of sulphur and phosphorus with the consumption of 100—300 kilowatt hours per ton, and a cost of 9s. 2½d. per 1000 kilos. A combination of this type of electric furnace and a 25 ton Wellman gas-heated rolling furnace is in use. The latter is used to reduce the carbon and phosphorus and takes the place of a mixer, charges of 3½ tons at a time are withdrawn and run into the electric furnace where the phosphorus is eliminated and then into a second electric furnace where the sulphur is extracted and the carbon content corrected. The whole of the electric power being derived from blast furnace engines the cost of refining is very low, a special feature of these furnaces being their steady load. The Paragon furnace which is a combination of the arc and a resistance furnace is next described. In this the slag is superheated by the arcs playing over the surface, the remainder of the heating power being transmitted to the bath by the terminal plates as in the above furnace, and the gradient of heat is capable of being controlled at will. The advantages of this combination are: (1) The size of the electrodes for a given furnace capacity is only one-half that of an arc furnace. (2) The roof lasts longer and the maintenance of the furnace costs less. (3) The control of the load factor is better, no special machinery being required for compensating the lower power factor of the true induction furnace. A furnace is also described which is designed like an ordinary basic Siemens open-hearth furnace with terminal plates built into the sides, the charge being melted and pre-refined in the ordinary way and then de-gasified by electric heating only.—A. H. C.

Carbon in iron alloys of all kinds; Single method for the determination of total ——. A. Stadeler. Metallurgie, 1911, **8**, 268—270.

The author has compared Wüst's process (this J., 1910, 821) with the tedious chlorine process in the case of alloys such as ferrochromium, ferrosilicon, etc., which are insoluble or soluble with difficulty in a mixture of chromic and sulphuric acids. The new process gives results sufficiently accurate for technical purposes, and hence is applicable to iron alloys of all kinds. The best conditions for the different classes of alloys are given in the following table:—

Material.	Weight of iron alloy.	Weight of mixture of 3 parts of antimony and 1 of tin.	Temp.	Time required for the whole determination
	grm.	grms.	°C.	hours.
Spiegeleisen	0·5	2·5	800	1½
Tungsten-, chrome-tungsten-, nickel-, chrome-nickel-, manganese-, and other special steels	0·3-0·5	1·5-2·5	900	1½
Ferrochromium, ferro-vanadium, ferrotungsten................	0·3-0·5	1·5-2·5	900	1½
Ferrosilicon	0·3-0·5	1·5-2·5	900	2
Ferromanganese	0·2-0·3	1·4-2·4	900	2

The special steels should be used in the form of very fine cuttings, and the other alloys should be powdered and passed through a 100-mesh sieve.—A. S.

Iron-titanium alloys; Analysis of high-silicon ——. W. Trautmann. Z. angew. Chem., 1911, **24**, 877.

These alloys are only imperfectly attacked by potassium bisulphate. By the following methods they may be got completely into solution. 1. The alloy is roasted in a platinum crucible; the cooled oxides are moistened with hydrofluoric acid and then fused with potassium bisulphate. The melt is dissolved on the water-bath in not too dilute hydrochloric acid. 2. The roasted oxides are fused in platinum with sodium carbonate and nitrate, and dissolved out of the crucible by nitric acid; after removing the crucible, hydrochloric acid is added, and very quickly everything, except silica, goes into solution. To render the silica filterable, sulphuric acid is added, the liquid evaporated to fuming, then hydrochloric acid and water are added, and the solution obtained is made up to a known volume, of which an aliquot part is filtered and used for the titanium determination after removal of any dissolved platinum. The titanium is best determined by Bornemann and Schirmeister's method (this J., 1911, 51). The carbon in these alloys cannot be determined by direct combustion, even when the metal is mixed with lead peroxide.—J. T. D.

Titanium; Metallic ——. M. A. Hunter and E. C. Jones. Rensselaer Polyt. Inst., Eng. and Science Series, No. 1, Feb. 1, 1911.

Many attempts to prepare pure titanium are described in detail, with an account of the properties of the metal finally obtained. The reduction of sodium titanifluoride by potassium yielded material containing up to 73·2 per cent. of titanium. With potassium and barium titanifluoride a still poorer product resulted. The reduction of titanium dioxide by carbon yielded a material containing in no case less than 4·6 per cent. of carbon. It is doubtful whether metallic titanium can be thus prepared; the product contains varying quantities of carbide and monoxide of titanium. Nilson and Petersson (Z. physik. Chem., 1887, **1**, 25), by reducing tetrachloride of titanium with sodium, produced a material containing about 95 per cent. of titanium. The author has obtained pure titanium by this method, having taken extreme care to exclude air from the apparatus, which consists of a steel bomb with a clamped-down lid. The reaction takes place almost instantaneously on heating the bomb to dull redness. The product is partially melted by the heat of the reaction. Analysis of the product by two methods gave respectively 99·9, and 100·2 per cent. of titanium, while no trace of sodium or iron could be found. In appearance the metal resembles polished steel. It is hard and brittle when cold, but at a red heat it can be easily forged. The melting-point of the pure metal was found to be between 1800° and 1850° C., the specific gravity 4·50, and its specific heat to be as follows:—0°—100°, 0·1462; 0°—187·5°, 0·1503; 0°—254°, 0·1516; and 0°—333° C., 0·1563.—R. W. N.

Gold; Roasting of complex ores in the assaying of ——. A. C. Hoare. Inst. Min. and Met., May 31, 1911. [Advance proof.]

Zinc blende, stibnite, cinnabar, and mispickel were added in varying proportions to gold ores containing only iron pyrites and of known gold values. After roasting, the material was assayed to determine the influence of the sulphide of the base metal. Roasting was carried out at 700°—800°C. for about 45 minutes, and then, after cooling and mixing in 1 grm. of charcoal, at about 900° C. for 15 minutes. The charcoal was to decompose any sulphates formed during the roasting. The roasted material was fused with a red lead, soda, borax, and charcoal mixture, a strip of iron being added in each case. Cupellation was carried out on Morganite cupels, at a temperature of 1080°C. Control determinations were made on all materials used, and the slags were assayed. It was found that with zinc blende there was no loss in the case of low-grade gold ores, but a loss occurred with an increase in the amount of gold. Stibnite did not cause a loss in roasting; mispickel and cinnabar always caused a loss. To ascertain if any loss occurred in the vapours, charges were roasted in a combustion tube in such a manner that the resulting gases could be drawn through glass-wool filters and through a wash-bottle containing water. With charges containing mispickel and rich in gold, the wash water in several cases contained gold, though none was found on the filters. With charges containing cinnabar and rich in gold, the solid deposits in the filters contained gold, but no trace of it could be found in the wash waters. There is therefore some evidence that gold may be carried away in a gaseous form when ores containing arsenic are roasted. When ores containing cinnabar are roasted, gold is carried over and deposited in the solid form. An examination of the cupels showed no sign of absorbed gold.—R. W. N.

Gold assay; Method of ——. G. M. Austin. Inst. Min. and Met., May 31, 1911. [Advance proof.]

The method, introduced by De Luce, which consists in the extraction of the gold from an ore by a solution of iodine, then adding mercury to precipitate and collect the gold, and finally dissolving the mercury in nitric acid and weighing the gold residue, has been tested as to its applicability to various ores. With silicious, hæmatite, and telluride ores the results are good. Pyritic ores, and those containing manganese, stibnite, mispickel, or zinc blende, give low results.—R. W. N.

Copper; Basic converting of ——. C. B. Neel. Eng. and Min. J., 1911, **91**, 964—965. (See also this J., 1911, 549.)

It is found that improvement is effected by moving the mouth of the converter from the end to near the centre. Increasing the number of tuyères from 32 to 37 has caused the converter to work faster. Further changes are the use of removable pipe tuyères, and the introduction of silicious flux through the tuyères. Acid converters have been changed to basic by simply changing the lining. At Anaconda, where the entire plant has been changed from acid to basic, the converters are lined with magnesite brick, except for a narrow belt at the tuyères, which is tamped with a mixture of 5 parts of sodium silicate to 100 parts of magnesia dust. A converter, 12 ft. 6 in. by 8 ft., treating a 40 per cent. matte, has produced over 2000 tons of copper with one lining. A complete tabulated statement of converter operations during one month is given, from which it appears that the large Peirce-Smith converters produce about 32·3 tons of copper per charge. The average time taken up by blowing and skimming a charge averages 14 hours 20 miuntes, and pouring the copper 1 hour 23 minutes. About 107·5 HP.-hours are required to produce one ton of copper.—R. W. N.

Copper and nitric acid; The interaction of —— *in the presence of metallic nitrates. Part II.* E. H. Rennie and W. T Cooke. Chem. Soc. Proc., 1911, **27**, 42—43, Trans., **99**, 1035—1042.

The authors find that whereas in previous experiments at 59° C. and with $2N$-acid, potassium nitrate had apparently no effect, and rubidium and cæsium nitrates a retarding effect on the solution of copper in dilute nitric acid, all these nitrates have either an accelerating or retarding effect according to the conditions of temperature and concentration. With the same concentration of acid, and with potassium nitrate, the lower the temperature the less is the acceleration (it often becomes retardation), whereas the higher the temperature, the greater is the acceleration. With the same temperature, increase of concentration of acid tends to lessen acceleration. These statements seem also to hold good with rubidium and cæsium nitrates. The authors also find that the effect of the increase of volume of acid due to the solution in it of considerable quantities of nitrates and is a factor not to be overlooked, inasmuch as it obviously diminishes the concentration of the acid, and of nitrous acid or other products formed during the reaction. They conclude that these fresh results tend to confirm the opinions expressed by them in their previous paper (this J., 1908, 746).

Lead smelting in the ore hearth. J. J. Brown. Trans. Amer. Inst. Min. Eng., 1911, 405—411.

The Granley Smelting Co., using water-backed Scotch hearths, 2 ft. wide, and smelting 1000 lb. of charge per hour, paid the smelters in proportion to the number of pounds of lead they produced and were required to convert 70 per cent. of the galena, 50 of the white fume, and 40 of the blue fume in the charge, and a high extraction of 85 per cent. of the lead content of the charge was obtained. These furnaces have now been replaced by 5 ft. Jumbo hearths which are more profitable to the company and enable the men to earn a third more wages with a third less work in hours. The percentages required were altered to 65 per cent. of the galena, 60 of the white, and 50 of the blue fume in the charge. A saving was effected of £240 per hearth per year. Since the charge is smelted in less time there is economy in labour, water, blast, and in the bag house. The works balance sheet for a period of six months of three Jumbo and two Scotch hearths is given, with a very marked advantage in the former. The total lead content of the products was 84·3 per cent. as pig lead, 10·35 as white fume, 2·69 as blue fume, and only 2·65 per cent. was lost as blue slag, which was sold to other smelters, the company having no blast furnace.—A. H. C.

Molybdenum with nickel, manganese with thallium, and calcium with magnesium, thallium, lead, copper, and silver; Alloys of ——. N. Baar. Z. anorg. Chem., 1911, **70**, 352—394.

Molybdenum and nickel are miscible in all proportions in the molten state, and mixed crystals are formed containing 0—33 per cent. of molybdenum; the metals combine to form the compound, MoNi. Manganese and thallium are miscible, as liquids, at about 1200° C., only between the limits 94·6 and 100 per cent. of manganese; mixed crystals are formed containing about 98—100 per cent. of manganese. The readiness with which calcium reacts with other metals increases with increasing atomic weight; it is miscible in the molten state with all the metals studied; and the following series of mixed crystals were obtained:—With thallium, containing 0—3, 50—59, and 91—100 atoms per cent. of calcium; with lead, containing 66·6—77·5 atoms per cent. of calcium; with copper, containing 5·7—13·5 and 56—100 weight per cent. of calcium; and with silver, containing 50—70·5 atoms per cent. of calcium; reactions in the solid state were observed with the alloys containing thallium, copper, and silver respectively. The existence of the following compounds has been ascertained (compare Donski; this J., 1908, 1066):—Cu_4Ca, $CuCa_4$, Ag_4Ca, Ag_3Ca, Ag_2Ca, AgCa, $AgCa_2$, Mg_4Ca_3, Tl_3Ca, Tl_4Ca_3, TlCa, Pb_3Ca, PbCa, $PbCa_2$, the corresponding melting points being 935° C, 480°, 683°, 725°, 595°, 665°, 555°, 715°, 625°, 655°, 970°, 649°, 949°, and 1112° C. The calcium alloys were, as a rule, prepared by rapidly heating the metals in an electric furnace, in an atmosphere of hydrogen, and the results obtained by the method of thermal analysis were, as with the other alloys, confirmed, wherever possible, by micrographic investigation. Most of the calcium alloys studied are brittle; they fall to powder on exposure to air, and react with water; those of copper containing 0—8 per cent. of calcium are not affected by water; the silver alloys containing up to 40 per cent. of calcium are stable in the air and those containing 0—25 per cent. of calcium are not affected by water. Equilibrium diagrams are given for each pair of metals studied.—F. Sodn.

Alloys; Composition of the common ——. E. W. Kaiser. Metallurgie, 1911, **8**, 257—267, 296—308.

The author gives first a short table showing the general. properties of bronzes containing different relative proportions of copper and tin, and then a long table, extending over 21 pages, showing the chemical composition of practically all the alloys known, arranged in alphabetical order.—A. S.

British pig iron statistics for 1910. Times, May 20, 1911. [T.R.]

The total production of pig iron in the United Kingdom in 1910 was 10,216,745 tons. The year's output was 552,458 tons more than in 1909 and 926,905 tons more than in 1908; thus 1910 constitutes a record in British pig iron production. The more notable increases in 1910 compared with 1909 are recorded in Cleveland, Lincolnshire, South Wales, Derbyshire, Northamptonshire, Scotland, Lancashire, and Durham, ranging from some 120,000 tons in the first-named district to 49,000 tons and 39,000 tons for the two last-named districts respectively, while there were increases of 21,000 both in South Staffordshire and Yorkshire. The output for the first half of the year 1910 was 4,993,745 and of the second half of the year 5,223,000 tons. In spite of an increase in the total production of pig iron since the year 1907, there has been a decline of some 415,000 tons in the output of forge and foundry iron; while, notwithstanding that the total output of pig increased by 552,000 tons in 1910 as compared with 1909, the quantity of forge and foundry diminished by 225,000 tons. There has been an increase of 426,000 tons in the make of basic iron, while the Bessemer hematite total is better by 333,000 tons. The figures in 1910 for spiegeleisen, ferro, and other sorts show an improvement of 12,000 tons over 1909, while the increased production since 1907 amounts to 93,000 tons. Under the heading of "Molten iron for steelmaking" there were 1,697,161 tons recorded, or 316,045 tons more than in 1909. The average number of blast furnaces in operation during 1910 was 335 out of a total erected of 506, which compares with 320 and 508 respectively for 1909. The average annual output per furnace in 1910 was 30,475 tons, as against 30,224 tons in 1909 and 27,598 in 1906. The output of pig iron in seven iron-producing countries in the year 1910, in English tons, was as follows:—United States, 27,298,545; Germany, 14,559,590; Great Britain, 10,216,745; France, 3,968,746; Belgium, 1,775,004; Canada, 740,210; Sweden, 594,752.

Nova Scotia steel production. Times, June 1, 1911. [T.R.]

With the bounties at an end there will no longer be any Government returns from which the output of the primary iron and steel plants of Nova Scotia, Quebec, and Ontario can be ascertained from year to year. Henceforward statistics of production will have to be compiled locally. The production of pig iron at the Sydneys for 1910—four furnaces at Sydney and one at North Sydney—was 321,000 tons. There is a sixth furnace in Nova Scotia, that of the Canada Iron Corporation at Londonderry, but this furnace was not working during 1910. Details of production at Sydney, North Sydney, and New Glasgow are as follows:—

	Dominion steel.	Nova Scotia steel.
	Tons.	Tons.
Coke	410,000	90,000
Pig iron	255,000	66,000
Steel ingots	304,000	75,000
Steel billets	88,000	59,000
Steel blooms	268,000	—
Steel rails	140,000	—
Bars and plates rolled	—	49,000
Axles forged	—	34,000
Steel wire rods	79,000	—

The fact that bounties were to expire at the end of 1910 had no effect on extensions at these Nova Scotia plants. At Sydney 120 new by-product coke ovens were recently added to the 500 already in service, and work is proceeding on two new open-hearth furnaces of a larger capacity than any now at work in the Dominion. At New Glasgow the Nova Scotia Company is adding hydraulic machinery that will enable it to make heavy steel forgings, such as will be called for as soon as the successful tenderers for the building of the four cruisers and six destroyers for the Dominion Navy have settled on the sites for the shipbuilding plants and are ready to proceed with the work.

Copper production in Japan. Board of Trade J., June 8, 1911. [T.R.]

In 1908 Japan was the third largest producer of copper in the world, with a production of 5·5 per cent. of the world's output. The following figures show the annual production in Japan during the years 1905—1909:—1905, 35,495 tons; 1906, 38,515; 1907, 40,230; 1908, 41,723; 1909, 45,135 tons. The number of mines producing over 60 tons of blister copper per annum is 48. The principal ores are chalcopyrite and bornite, iron pyrites and zinc blende being almost always present, often with galena. A complex sulphide ore called Kuroko (black ore), consisting of an intimate mixture of barytes, zinc blende and galena, and often containing pyrites and chalcopyrites, is found more widely distributed in Japan than in any other country. The gold and silver found in this ore add considerably to its value. Some 39 mines in which this black ore is found are known to exist in Japan, but of these the only important ones are Kosaka and Kano. The exports of copper (slab and ingot) from Japan during the years 1906—1910 were as follows:—

	Tons.	£
1906	33,733	2,563,000
1907	31,816	2,987,000
1908	35,761	2,170.000
1909	35,787	2,151,000
1910	35,347	2,124,000

The exports are sent chiefly to the United Kingdom, the United States, and Hong-Kong. The amount exported to China has rapidly diminished since 1905, owing to the decrease in the requirements of the copper mints.

Patents.

Iron and steel; Manufacture of ——. A. Boucher, Prilly, Switzerland. Eng. Pat. 28,746, Dec. 10, 1910. Under Int. Conv., Oct. 15, 1910.

The patent relates to the direct conversion, by electrolysis, of cast iron into pure iron for the manufacture of steel. A solution of ferrous sulphate or chloride is employed as the electrolyte, and the cast iron forms the anode while the cathode consists of a conductor preferably mounted to rotate about its own axis. A current of relatively high density (1000 ampères per sq. m. of electrode surface) is employed; and, for the purpose of maintaining the electrolyte in the ferrous condition and thus ensuring a compact and homogeneous deposit of metallic iron, the cell is provided with a branched pipe by means of which the electrolyte continuously circulates through a mass of iron turnings and returns to the vat free from suspended particles.—W. E. F. P.

Alloy [*substitute for German silver*], *and the method of manufacturing and treating the same.* J. F. Duke, Manchester. Eng. Pats. 16,177, July 6, 1910, and 24,873, Oct. 26, 1910.

The alloy is composed of 24 parts by volume of copper, 6 of iron, 4 of nickel and 1 of aluminium. It is prepared in a covered crucible, the aluminium being stirred into the molten or pasty mixture of the other ingredients. The heat generated by the deoxidising action of the aluminium ensures the complete fusion of the charge and the aluminium remaining in the alloy prevents the oxidation of the other constituents in the subsequent working of the material. The alloy is stated to be extremely ductile and malleable, and to possess all the merits and none of the undesirable qualities of German silver and similar alloys. By the addition of from 0·5 to 1 per cent. of tin the tenacity is increased and the alloy assumes a much whiter colour. The alloy as described, or with an increased quantity of iron, may be used as a substitute for tin-plate. —W. E. F. P.

Low-carbon metals and alloys, and titanium alloys; Process of producing ——. J. B. Huffard, W. Va., Assignor to Electro Metallurgical Co., New York. U.S. Pats. 992,422 and 992,423, May 16, 1911.

(1) The reduction of refractory metallic oxides is effected by heating an excess of the latter with a "titanium reducing agent low in carbon," the unreduced oxide being subsequently recovered from the slag. In the production of alloys the alloying metal is contained in, or combined with, the "titanium reducing agent." (2) The oxide of the alloying metal is heated with an excess of "a titanium reducing agent."—W. E. F. P.

Alloys; Manufacture of ——. L. Weiss. Fr. Pat. 424,056, Dec. 23, 1910. Under Int. Conv., Dec. 23, 1909.

One of the component metals in the form of turnings or large grains is mixed intimately in a cold and dry state with the other component, the latter being employed as a fine powder. The mixture is then agglomerated with a suitable binding agent which has a melting point at least as high as either of the components; for this purpose a mixture of sodium silicate with the oxides of the respective metals may be employed. The mass so obtained is compressed into a briquette, dried, and finally smelted in a cupola furnace. For the production of cast iron, in this way, from steel turnings, the latter are crushed, dried, mixed with a fine powder of wood charcoal, ferro-silicon and sand, and agglomerated with a mixture of sodium silicate and manganese peroxide or magnesia. The briquette is dried and smelted either alone or together with pig iron scraps. The presence of free alkali in the silicate is necessary where rusty scraps are employed;

whilst, in order to effect the desulphurisation of the pig iron, it is sometimes advantageous to add ferromanganese.
—C. A. W.

Antimony; Electrolytic production of——. M. Ruthenburg, London. Eng. Pat. 19,772, Aug. 24, 1910.

In a cyclic process for the production of antimony a solution of ferrous and antimonious chlorides, obtained by treating stibnite (antimony sulphide) with ferric chloride, and containing about 1 lb. of antimony per gallon is electrolysed between soluble iron anodes and insoluble cathodes until about one-half of the antimony is deposited. The remaining liquid is then oxidised—by a hot air blast or otherwise—the resulting solution of ferric and antimonic chlorides being employed for the treatment of a further quantity of stibnite.—W. E. F. P.

[*Acid*] *Acidulous gases; Apparatus for treating——, produced in the smelting or treatment of ores.* C. B. Sprague, Salt Lake City, Utah, Assignor to United States Smelting, Refining and Mining Co., Portland, Me. U.S. Pat. 992,391, May 16, 1911.

The flue conveying the acid gases from the furnace is provided with a fan into the suction side of which regulated quantities of a powdered neutralising agent are periodically fed. When available, the fume from a furnace producing zinc oxide may wholly or partly replace the powdered neutralising agent; in either case the resulting solid product is recovered from the gaseous mixture by filtration through bags. (See also this J., 1909, 1139.)—W. E. F. P.

Roasting-furnace. C. E. Dewey, Denver, Colo. U.S. Pat. 992,407, May 16, 1911.

A vertical, rotatable, hollow shaft is disposed centrally within a cylindrical chamber comprising a number of superposed communicating compartments. The hollow shaft is provided with a series of exterior hubs (one for each compartment) having grooved sockets into which rabble arms are fitted, the method of attachment being such that the arms are kept locked in position by the friction of the rabble-teeth against the ore during the rotation of the shaft.—W. E. F. P.

Aluminium articles; Process of treating——, for the formation of galvanic metallic coatings. C. Rümpler, Schöneberg, Germany. U.S. Pat. 992,600, May 16, 1911.

To facilitate the subsequent electro-deposition of metals upon aluminium articles, the latter are electrolytically treated in an alkaline bath containing two or more metallic double cyanides (for example alkali-copper and alkali-zinc cyanides), an alkali sulphite, and an alkali haloid. The current employed varies from 2 to 3·6 ampères per sq. dcm. at from 1·6 to 1·8 volts.—W. E. F. P.

Electric furnace. G. Massip. Fr. Pat. 424,337, Sept. 23, 1910.

The furnace is provided with an upper movable electrode, the second electrode being formed by the hearth itself. Since it is not permissible, in the manufacture of ferro-alloys of low carbon content, to employ a carbonaceous material in the construction of the hearth, it is proposed to render the latter electrically conducting by heating it at the commencement, whilst the upper electrode is raised, the current for this purpose being derived from the main supply and passed through resistances buried in the hearth of the furnace. These resistances may be composed of metallic bars folded on themselves, with a packing of magnesia between the folds, or alternatively of metal plates separated by a mixture of magnesia and carbonaceous matter, the upper lining being, of course, quite free from carbon. The hearth having been heated in this way, the shunt circuit is broken and the upper electrode is lowered, when the heat produced in the bath itself should be sufficient to preserve the conductivity of the refractory material.—C. A. W.

Metals from their ores; Method of reducing——. S. E. Sieurin, Höganäs, Sweden. Eng. Pat. 11,807, May 12, 1910.

See Fr. Pat. 415,894 of 1910; this J., 1910, 1316.—T.F.B.

Pyritic ores; Method of smelting——. P. A. Newton, London. From J. P. Channing, New York. Eng. Pat. 12,138, May 17, 1910.

See U.S. Pat. 963,020 of 1910; this J., 1910, 960.—T.F.B.

Melting or refining furnaces. Poldihütte Tiegelgusz-stahlfabrik, Vienna. Eng. Pat. 13,934, June 8, 1910. Under Int. Conv., June 11, 1909.

See Fr. Pat. 416,585 of 1910; this J., 1910, 1460.—T.F.B.

Furnaces; Electric——. J. H. Reid, Newark, N.J., U.S.A. Eng. Pat. 19,804, Aug. 24, 1910.

See U. S. Pat. 968,079 of 1910; this J., 1910, 1113.—T.F.B.

Super-oxygenated air; Supply of —— to blast or other furnaces. Soc. Anon. d'Ougrée-Marihaye, Ougrée, Belgium, and Soc. pour l'Utilisation de l'Air et de ses Dérivés, Paris. Eng. Pat. 26,954, Nov. 19, 1910. Under Int. Conv., Nov. 25, 1909.

See Fr. Pat. 420,537 of 1909; this J. 1911, 370.—T.F.B.

Electrolytic iron; Process for the manufacture of ductile——. F. Fischer, Berlin. U.S. Pats. 992,951 and 992,952, May 23, 1911.

See Fr. Pat. 407,889 of 1909 and Addition thereto; this J., 1910, 636, and 1911, 629.—T. F. B.

Iron; Manufacture of electrolytic—— in thin, detachable sheets. Langbein-Pfanhauser Werke A.-G. Fr. Pat. 421,966, Oct. 28, 1910. Under Int. Conv., Nov. 12, 1909.

See U.S. Pat. 987,318 of 1911; this J., 1911, 492.—T.F.B.

Iron and other metals; Process for making——. A. E. Bourcoud. Fr. Pat. 424,583, Jan. 4, 1911. Under Int. Conv., Jan. 10, 1910.

See Eng. Pat. 676 of 1910; this J., 1911, 629.—T.F.B.

Metal [*tantalum*] *tubes; Process of manufacturing——.* O. A. Simpson, Charlottenburg, Assignor to Siemens und Halske A.-G., Berlin. U.S. Pat. 993,116, May 23, 1911.

See Eng. Pat. 19,962 of 1910; this J., 1911, 369.—T.F.B.

Metals and alloys; Production of ——. A. Nieske, Dresden, and E. Müller, Stuttgart, Germany. U.S. Pat. 993,270, May 23, 1911.

See Fr. Pat. 420,954 of 1910; this J., 1911, 431.—T.F.B.

Platinum alloy for making scientific or technical utensils and apparatus; Hard, elastic——. W. C. Heraeus Ges. m.b. H. Fr. Pat. 424,030, Dec. 21, 1910.

See Eng. Pat. 29,723 of 1910; this J., 1911, 631.—T. F. B.

Distillation furnace for obtaining zinc and other metals which are volatile at the temperature of reduction. Rheinisch Nassauische Bergwerks u. Hütten A.G. Fr. Pat. 424,409, Nov. 24, 1910.

See Eng. Pat. 27,467 of 1910; this J., 1911, 630.—T. F. B.

Cooling and drying gases [*e.g., air for blast furnaces*]. Fr. Pat. 424,233. *See* I.

[*Aluminium*]. *Vessels for the preparation and storage of hydrogen peroxide.* Ger. Pat. 233,856. *See* VII.

XI.—ELECTRO-CHEMISTRY.

Ozone formation; Influence of the frequency of interruption and the current form on ——. G. Lechner. Z. Elektrochem., 1911, **17**, 414—420.

The author has conducted experiments on the effect of the interruption coefficient in the formation of ozone, when direct current is used with an induction coil to produce the silent discharge in the ozoniser. The yield is apparently increased by increasing the rapidity of interruption. Probably each current impulse with a given maximum potential produces the same amount of ozone. This behaviour is veiled, however, by (1) the fact that owing to self-induction in the primary circuit, the current does not reach its full value at once, so that the current impulses are not quite equal for different interruption frequencies, and (2) the deozonising influence of the discharge when an appreciable quantity of ozone is already present. The first effect can be minimised by increased E.M.F. and resistance in the primary circuit. The second effect can be equalised in all cases by making the velocity of the oxygen supply proportional to the number of interruptions per second. In this way a practically constant concentration of ozone is maintained. It then becomes apparent that, with the same ozone concentration, and the same interval during which the circuit is closed, the yield of ozone is proportional to the frequency of interruption. Experiments have also been made in comparison of an alternating current of frequency 42, and direct current with corresponding interruption. For the same energy consumption the yield is much greater in the case of the direct current. If the yields are compared with the same effective current in the secondary circuit, the alternating current shows a considerably greater yield than the direct current. The ozone yield is probably proportional to the mean current strength, and is therefore for the same effective current greater when the current curve is flat than when it is steep.—W. H. P.

Determination of ozone by alkaline potassium iodide. Lechner. *See* VII.

Working costs of electrolysis of alkali chlorides. Engelhardt. *See* VII.

Influence of current concentration in electrolytic chlorate manufacture. Müller and Koppe. *See* VII.

Patents.

[Electrical] Ozonising apparatus. M. Fuss. Berlin. Eng. Pat. 2618, Feb. 1, 1911. Under Int. Conv.. May 17, 1910.

The apparatus comprises a transformer, around the high-tension coil of which is arranged an ozonising condenser, the outer metal plate of the latter being perforated so that the air passing the apparatus may be charged with ozone. —B. N.

Ozone; [Electrical] Apparatus for producing ——. C. D. Meeker, East Orange, N.J.. Assignor to Gerard Ozone Process Co., New York. U.S. Pat. 987,902, March 28, 1911.

The apparatus comprises a tank containing oil as an insulating liquid, and provided with a cover of insulating material, such as slate. Several ozonising elements are supported in the tank from the cover, and a casing of insulating material, fixed to the slate cover, encloses the upper ends of the elements. Each ozonising element is supported at its upper end in a separate conduit box, the boxes being joined in series, and connected finally with an outlet passing through the wall of the casing. Each element comprises a pair of concentric tubes, the inner one being partially lined and the outer one partially covered with tin foil. By means of suitable mechanical arrangements, the tin foils are connected to the respective electrical terminals of the circuit, so that a pair of the tubes may be removed without disturbing the others. The air to be ozonised passes into the casing, downwards through each inner tube and up through the annular space of each element into the respective conduit boxes, and finally makes its exit through the outlet.—B. N.

Furnace; Electric ——. J. W. Brown. Lakewood, Ohio, Assignor to National Carbon Co., New Jersey. U.S. Pat. 987,953, March 28, 1911.

The electric furnace, of the "ring type," consists of a series of sections or units, each of which is provided with an independent electrical heating means, and arranged to form a ring or endless circuit. Each section consists of a heating chamber, at least partially enveloped by conduits, which may contain chequer-work. The walls between adjacent sections are provided with flues, a separate set communicating with each of the adjacent heating chambers, and a similar set with each of the surrounding conduits. The two sets of flues in each case merge into a common gas chamber, so that by means of valves the gas may be passed to either or both of the heating chambers or the conduits. In each case the common chamber is connected with an air main and a gas main, the supply of air and gas from these being controlled by means of valves.—B. N.

Electric furnace. E. C. Speiden, Assignor to International Acheson Graphite Co., Niagara Falls, N.Y. U.S. Pat. 992,281, May 16, 1911.

The furnace has overlapping electrodes inclined in opposite directions above a zone of maximum temperature development, so as to shield the upper portion of the furnace structure. The working ends of the electrodes are at the lower corners of an approximately equilateral triangle. —W. E. F. P.

Liquids; Apparatus for treating —— electrolytically. A. O. Tate, Toronto, Canada. U.S. Pat. 991,760, May 9, 1911.

An electrode, for use in an electrolytic cell, comprises vertical anodes and cathodes, disposed alternately, in the form of interleaved strips. The latter are separated from each other by insulating strips, the edges of which project beyond the edges of the anodes and cathodes, thus forming vertical gas-conducting channels for conveying the gases upwards, and minimising the intermixture of the acid and alkaline solutions after they have been separated from the electrolyte. At the same time, the channels maintain a more constant and a maximum rate of precipitation of the solids held in solution in the electrolyte.—B. N.

Alloys useful as electric resistance conductors. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 12,757, May 25, 1910.

See U.S. Pat. 963,123 of 1910; this J., 1910, 959.—T. F. B.

Electrolytic preparation of ammonium nitrate from aqueous nitric acid. Ger. Pat. 233,895. *See* VII.

XII.—FATS; OILS; WAXES.

Castor seed; Cultivation, production, preparation, and utilisation of ——. Bull. Imp. Inst., 1911, **9**, 17—35.

A general article giving a brief description of the cultivation of the castor plant and the preparation of the seeds and of castor oil. During the past few years samples of castor seeds from Uganda, Anglo-Egyptian Sudan (this J., 1909, 1318), East Africa Protectorate, Rhodesia, Ceylon, and Fiji (this J., 1909, 1258) have been examined and in nearly all cases, the samples were worth at least as much as Bombay seed, and in several cases were of superior quality to the latter. It is stated that very large quantities of castor seeds are available in the East Africa Protectorate. Mention is made of a process (see Indian Trade J., 1908, **9**, 309; 1909, **11**, 273) for destroying the toxic principle of castor seeds. The decorticated seeds are ground with water to a cream and poured into boiling water, whereby the protein matter is coagulated. The solid matter is strained off, dried, and freed from oil by pressing and by extraction. A sample of the residual meal prepared by this process is stated to have had the following composition: moisture, 9·2; ash, 7·3; oil, 2·6; protein, 71·7; crude fibre, 5·0; and carbohydrates, 4·2 per cent.—A. S.

Para rubber seed; Utilisation of —— [*as a source of oil*]. Bull. Imp. Inst., 1911, **9**, 35—38.

With the rapid increase in the area of productive Para rubber plantations, the use of the seeds of the plant as a source of oil (see this J., 1905, 1117; 1910, 35) is likely to become of importance. After a discussion of the questions of the cost of collecting the seeds and the preparation of the kernels for export, it is pointed out that precautions must be taken in the extraction of the oil to minimise the action of the lipolytic enzyme present in the seeds. Moreover as the seeds contain a cyanogenetic glucoside and an enzyme capable of decomposing it (see this J., 1907, 769), extensive feeding trials will be necessary to ascertain if the residual seed cake is of value as a cattle food.—A. S.

Wool-fat; Examination of the stearine of ——. E. Coen. Soc. chim. ital., Feb. 22, 1911. Chem.-Zeit., 1911, **35**, 508.

Wool-fat contains 18—28 per cent. of unsaponifiable matter, corresponding to 82—72 per cent. of fat. Its saponification value varies between 118 and 136, the mean value (163) for the fat itself being lower than the corresponding values for the stearine of other fatty substances. The acetyl value of the unsaponifiable portion is 25—37 per cent., the content of higher alcohols, reckoned as cholesterol, being 18·4—27·3 per cent. The hydrocarbons are solid; they have the sp. gr. 0·924—0·936 at 15° C., iodine value 26—34, and optical rotation, at 20°—25° C., +11·7° to +15·2°.—F. Sodn.

Acid value of fats; Determination of ——. E. Bödtker. Chem.-Zeit., 1911, **35**, 548.

The results given by Loebell's method of determining the acid value of fats (this J., 1911, 409) cannot be due to the dissociating action of the benzene, as suggested, since that solvent rather has an associating influence. This conclusion is confirmed by the fact that correct values may be obtained by titrating the fatty acids in aqueous or dilute alcoholic solution, the addition of the alkali causing solution to take place. From 5 to 15 grms. of the fat are shaken in a stoppered flask with 25 c.c. of alcohol, the flask being heated on the water bath to melt the fat when necessary. About 50 c.c. of water and 2 to 3 drops of phenolphthalein solution are then added, and the liquid titrated with $N/10$ sodium hydroxide solution until strongly pink, and then with $N/10$ hydrochloric acid until colourless. In the case of strongly coloured fats the colouring matter does not pass into the aqueous layer and the change of colouration in the latter is therefore sharp. —C. A. M.

Fats and ethyl alcohol; Reciprocal solubility in the systems ——. A. J. J. Vandevelde. Bull. Soc. Chim. Belg., 1911, **25**, 210—216.

The author has mixed ethyl alcohol of 94 per cent. by volume strength, in various proportions with different quantities of butter fat, cocoline (a neutral cocoanut oil), a mixture in equal weights of butter fat and cocoline, and olive oil, the mixtures being kept for 8 days constantly at 37° C. The volumes of the two phases in each case are fairly constant for the different fats, particularly where the original mixture is made from equal volumes of the fat and alcohol. The composition of the phases, however, is strikingly different. Since the composition of the natural fats is not quantitatively known it is not possible to establish a law of equilibrium for two such phases, but in the cases examined it may be said that the content of fat in the alcohol phase increases with increase of the initial concentration of the fat, whilst in the fat phase the quantity of dissolved alcohol diminishes with decrease of the initial concentration of the alcohol. Under the conditions of these experiments, using a mixture of 20 vols. of alcohol and 10 vols. of the fats, the alcohol dissolves 3·5 per cent. of butter fat and 5·6 per cent. of cocoline, thus confirming the observations of Cesaro (Bull. Acad. Sci. Belg., 1907, 1018). It would seem, therefore, that with ethyl alcohol it is possible to make a qualitative separation of the constituent glycerides of fats but that, from a quantitative point of view, the difference in volume and weight is not great enough to serve as a basis of distinction.—J. A.

Palm oil mills in the Congo. Chem. and Drug., May 13, 1911. [T.R.]

Two special Belgian Parliamentary Papers have been published dealing with the agreement between Lever Bros., Ltd., Port Sunlight, and the Belgian Government regarding the acquirement of interests in the Congo. The agreement provides that Lever Bros. will create a Belgian company with a capital of £1,000,000, whose chief object will be the manufacture of vegetable oils. This company will within a year set up an oil-mill capable of treating (in each of five districts) 6,000 tons of fresh fruit gathered from the palm-oil tree, subject to a yearly increase, until at the end of ten years 15,000 tons of fruit per annum may be treated. The agreement sets forth the terms of the leases of thirty-three years and other conditions, including a minimum wage of 25c. (2½d.) per day to adult workmen, exclusive of daily rations.

Patents.

Grease and oils; Apparatus for extracting ——. C. Edgerton, Philadelphia, Pa. U.S. Pat. 991,491, May 9, 1911.

The material is extracted in a vertical chamber provided with a detachable bottom and with a perforated strainer round its inner walls. This strainer may be made in vertical sections provided with ribs on the outer side and with adjusting devices for forcing the sections inwards.—C. A. M.

Synthetical soap. R. van der Capellen. Fr. Pat. 424,599, Jan. 4, 1911.

A hydrocarbon of the series, C_nH_{2n+2} or C_nH_{2n}, such as vaseline, is incorporated with a mixture in variable proportions of water, soap, sodium carbonate, and antiseptic, aromatic or tinctorial substances, etc., so as to obtain a paste of the required consistence.—C. A. M.

Medicinal soaps and process of making them. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co. Elberfeld, Germany. Eng. Pat. 19,150. Aug. 15, 1910. Addition to Eng. Pat. 10,075, April 28, 1909.

See Addition of Aug. 23, 1910, to Fr. Pat. 402,740 of 1909; this J., 1911, 222.—T. F. B.

Soaps; Process for scenting ——. A. Janousek. Prag-Karolinenthal, Austria. Eng. Pat. 23,117, Oct. 6, 1910.

See Fr. Pat. 422,752 of 1910; this J., 1911, 559.—T. F. B.

Treatment of liquids with ozone. Eng. Pat. 14,187. *See* XVIII.

Preparing stable iodine or bromine compounds of fats almost free from sulphur. Ger. Pat. 233,857. *See* XX.

Preparing tri-iodo derivatives of stearic acid. Ger. Pat. 233,893. *See* XX.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Turpentine oils; New method of examining ——. P. Klason. Chem.-Zeit., 1911, **35**, 537—539.

The author determines the degree of peroxidation of a turpentine oil by treating it with an alcoholic solution of a mercaptan (preferably cymenesulphydrate, which is practically odourless). The amount of mercaptan used can be determined by titrating with iodine ($2RSH + 2I = R_2S_2 + 2HI$) in the presence of sufficient alcohol to keep the resulting disulphide dissolved. The reaction between the turpentine and the mercaptan should take place in the dark, in a closed vessel, and requires twenty-four hours. The results are conveniently expressed in c.c. of $N/10$ iodine, representing the fall in titre of the original mercaptan solution for a given volume of turpentine. For the investigation of commercial oils of turpentine this reaction is applied to show the difference in their degrees of peroxidation under similar conditions: 10 c.c. of freshly distilled French turpentine oil after 16 days' exposure in an uncovered beaker had a peroxide value of 16 c.c. of $N/10$ iodine, this being the maximum value. Turpentine oil ("*Fichtenöl*") gave a corresponding value of 12·05, and pine wood oil ("*Kienöl*") 11·45. The last two oils had thickened considerably. After one day's exposure 10 c.c. of the finest French turpentine oil gave a value of 5 c.c., the oil obtained as a by-product in the manufacture of sulphate cellulose from fir and pine trees gave about 3 c.c., and pine wood oil, 1·5 c.c. These numbers probably give a good idea of the siccative values of the oils. The differences between the various specimens are probably due to the different velocities of the peroxidation, and the subsequent reactions which cause the thickening change of peroxide into ketone followed by polymerisation. In the case of the French turpentine oil, containing mainly pinene, the peroxidation is relatively much more rapid, and the thickening process slower than in the other cases.—W. H. P.

Turpentine oil from India. Bull. Imp. Inst., 1911, **9**, 8—10.

Two samples of turpentine oil prepared from the oleo-resin of the "chir" pine (*Pinus longifolia*) yielded practically no distillate below 165° C. and 54—55 per cent. between 165° and 170° C. They resembled most nearly Russian turpentine oil and could be used in place of the latter for cheaper grades of varnishes, for black lacquers, and for making certain disinfectants. They were valued at £30—£40 per ton in London (Oct. 1910) by a firm of importers and about £28 per ton (Nov. 1910) by a firm of varnish manufacturers.—A. S.

Rosin from India. Bull. Imp. Inst., 1911, **9**, 10—11.

A sample of colophony stated to have been prepared by using alum for its clarification proved of satisfactory quality on analysis, and was valued at from £13 to £15 per ton, with American colophony at £14 9s. per ton. It is stated that Indian rosin of this quality would sell readily in the United Kingdom at good prices.—A. S.

Patents.

Acetylene; Process of dissociating ——. [*Production of lampblack*]. J. M. Morehead, Assignor to Union Carbide Co., Chicago, Ill. U.S. Pat. 986,489, Mar. 14, 1911.

Lampblack is produced by decomposing acetylene at a temperature corresponding to dull redness at atmospheric pressure. The acetylene is introduced at a temperature below its decomposition point into a retort heated to dull redness, and as soon as the retort has become filled with lampblack the flow of acetylene is stopped and an inert gas blown into the retort to carry the lampblack into a settling or collecting chamber from which it is removed. The hydrogen, which is the other product of the dissociation, may also be collected.—H. H.

Oil and compound thereof [*paint*]. W. N. Blakeman, jun., New York. U.S. Pats. 989,225 and 989,226, April 11, 1911.

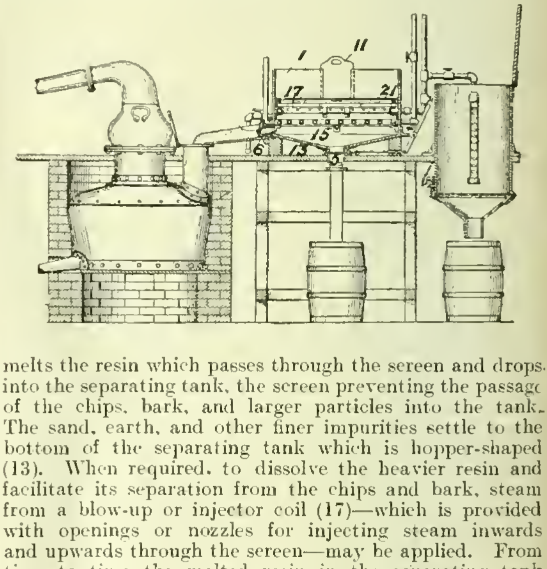
A drying or semi-drying oil (*e.g.* linseed, tung, rosin cotton-seed or maize oil) is chlorinated, and the product incorporated with a pigment, preferably deficient in covering power (*e.g.* zinc oxide, zinc sulphide, lead carbonate, barium sulphate). Or the washed chlorinated oil may be mixed with an excess of an oxidised oil or a non-drying oil to obtain a suitable vehicle for a paint. When a non-drying oil is used, better results are obtained by oxidising as well as chlorinating the oil. Paints thus prepared yield tough durable films. An addition of tung oil improves the drying capacity of the paint and the durability of the film.—C. A. M.

Oil and compound thereof. W. N. Blakeman, jun., New York. U.S. Pat. 989,227, April 11, 1911.

Oils, fats or their derivatives (*e.g.* chlorides) are incorporated with a hydrocarbon chloride, with or without the addition of amorphous or finely divided matter (*e.g.* silica, calcium silicate, obsidian, etc.) to obtain stable agglutinant substances suitable for glacé films, linoleum, roofing, etc. Thus, *e.g.* hard transparent films are obtained by drying a mixture of 84 parts of menhaden oil, 6 parts of naphthalene chloride, and 10 parts of tung oil, whilst a mixture of 80 parts of menhaden oil, 15 parts of "petrolatum chloride," 5 parts of tung oil, and 100 parts of zinc oxide yield an opaque film.—C. A. M.

Gum [*crude turpentine*] *filter.* C. O. Erikson, Assignor to L. L. Hall, F. M. Appleby and C. T. Roan, Douglas, Ga. U.S. Pat. 984,364, Feb. 14, 1911.

Crude turpentine, mixed with the chips, bark, sand, earth, and other impurities which usually accompany it, is placed on the removable screen, 21, in the rectangular separating tank, 1. The heat from the steam coil, 15 melts the resin which passes through the screen and drops into the separating tank, the screen preventing the passage of the chips, bark, and larger particles into the tank. The sand, earth, and other finer impurities settle to the bottom of the separating tank which is hopper-shaped (13). When required, to dissolve the heavier resin and facilitate its separation from the chips and bark, steam from a blow-up or injector coil (17)—which is provided with openings or nozzles for injecting steam inwards and upwards through the screen—may be applied. From time to time the melted resin in the separating tank is drawn off through the spout, 6, and fed into the still. The chips and bark are removed from the screen by opening the gate, 11, and the resin adhering to them may be recovered by steaming them in the recovering tank, 33; the drippings from this tank are collected in the receptacle below. The sand and other impurities which have settled in the bottom of the separating tank are discharged, after the resin has been run off, through the slide or valve, 5.—E. W. L.



Lac; Treatment of ——. J. Johannes. Fr. Pat. 424,261, Dec. 8, 1910.

The crude lac is broken up and mechanically agitated with water to remove impurities, after which it is repeatedly crushed, washed and sifted until the granules are completely cleansed. They may then be submitted to the action of two surfaces, one hot and the other cold, so arranged as successively to approach and separate from each other. Under these conditions a "flocculent lac" is produced, which being in a fibrous state, may be packed without risk of agglomerating, and is also in a condition particularly suitable for subsequent treatment in manufacturing processes. Special apparatus for this treatment is claimed.—C. A. M.

Paints; Anti-fouling ——. Fabrique de Vernis et Produits Chimiques Soc. Anon., Vernier, Switzerland. Eng. Pat. 23,752, Oct. 13, 1910. Under Int. Conv., Oct. 14, 1909.

See Fr. Pat. 419,005 of 1909; this J., 1911, 96.—T. F. B.

Colour lakes; Manufacture of yellowish-green ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 27,636, Nov. 28, 1910. Under Int. Conv., Dec. 11, 1909.

See Fr. Pat. 422,843 of 1910; this J., 1911, 636.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Palay [Cryptostegia grandiflora R.Br.] rubber; Occurrence of —— *in Mexico.* C. S. Dolley. India Rubber J., 1911, **41**, 1155—1158.

The species, *C. grandiflora*, which is commonly known as *Clavel Aleman* or *Clavel d'Espana*, and which produces the rubber known as Palay rubber, appears to have been imported into Mexico within recent years. It is extremely hardy and flourishes in the neighbourhood of Rosario to such an extent as to become a plague to farmers. The author supports the view that the origin of the plant is in India. Three samples of the rubber have been examined at the Imperial Institute (see this J., 1908, 290). Samples from the State of Sinaloa, Mexico, examined by the author, gave the following results:—Dry leaves: Caoutchouc, 3·4; resins, 1·5 per cent.; dry stems: caoutchouc, 4·0; wet spongy coagulum, 59·0 per cent.; latex: caoutchouc, 37·0; mother liquor, 41 per cent.; crude rubber from coagulum: caoutchouc, 85; resins, 8·8 per cent. The plant yields a beautiful strong flax-like fibre, capable of being spun into the finest yarns.—E. W. L.

Ceará rubber. Bull. Imp. Inst., 1911, **9**, 1—8.

The results of the chemical examination of a number of samples of Ceará rubber from British Colonies and Protectorates are given in the following table, the figures relating to the dry rubber (in the case of Nos. 6 and 9 to the dry washed rubber):—

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Per cent.	Per cent.	Per cent.	Per cent	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Caoutchouc	92·1	76·5	89·3	67·2	66·4	78·6	81·9	67·2	84·1
Resin	3·1	8·0	5·9	12·0	9·7	10·8	5·9	3·6	7·8
Protein	3·5	12·5	3·7	13·8	15·5	8·4	10·0	23·9	6·5
Insoluble matter	—	—	—	7·0	8·4	—	—	5·3	—
Ash	1·3	3·0	1·1	2·8	4·5	2·2	2·2	2·7	1·6

Sample No. 1, from Ceylon, consisted of three square sheets, containing 0·9 per cent. of moisture, and was valued at 8s. per lb., with fine hard Para at 10s. per lb. No. 2 from Uganda, was coagulated by means of lime juice and preserved with a weak solution of formaldehyde; it contained 4·8 per cent. of moisture and was valued at 8s. 2d. to 8s. 4d. per lb., with fine hard Para at 10s. 1d. per lb. In order to ascertain whether the high content of protein was due to the method of coagulation, another sample (No. 3) was prepared by diluting the latex and allowing it to stand: this sample contained 3·5 per cent. of moisture and was much purer than No. 2; it was valued at 4s. 3d. per lb. with fine hard Para at 5s. 2d. per lb. Nos. 4 (12·4 per cent. of moisture) and 5 (10 per cent. of moisture), from the East Africa Protectorate were both valued at 3s. per lb., with fine hard Para at 4s. 3½d. and 5s. per lb. respectively. No. 6, from Nyasaland, was prepared from 2-year-old trees by pricking. The rubber, which lost 4·9 per cent on washing, was valued at 5s. per lb., with fine hard Para at 10s. 6d. per lb. If pricking does not damage the young trees, the method might be adopted, as the rubber, though not of very good quality, would be saleable. No. 7, from 2-year-old trees in a Sudan plantation, was of very good quality; it contained 2·2 per cent. of moisture and was valued at 4s. 10d. per lb., with fine hard Para at 5s. 10d. per lb. No. 8, from Southern Nigeria, was of poor quality: it contained 6·4 per cent. of moisture and was valued at 2s. 9d. per lb., with fine hard Para at 5s. 7d. per lb. No. 9, also from S. Nigeria, was rather deficient in strength and the loss on washing was 21·7 per cent.; it was valued at 4s. to 4s. 6d. per lb., with fine hard Para at 6s. 11d. per lb.—A. S.

Rubbers; Acidity of raw ——. C. Beadle and H. P. Stevens. India Rubber J., 1911, **41**, 1257.

The amount of acid (expressed as acetic acid) in various raw rubbers was found to be:—Fine Hard Para, 0·120 to 0·156 per cent.; Fine Soft Para, 0·132 and 0·168; Plantation Dark Sheet, 0·197 and 0·228; Pale Sheet, 0·150 and 0·292; Pale Crepe, 0·017 to 0·120 (mean of five samples, 0·064 per cent.). Thus all samples of Brazilian rubber are acid. The least acidity is found in washed plantation crepe.—H. E. P.

Rubber and balloon fabrics; Technical testing of —— *in the Königliches Materialprüfungsamt zu Gross-Lichterfelde (West).* A. Martens. Sitzungsber. Kgl. Preuss. Akad. der Wiss., 1911, **14**, 346—366. (Cf. this J., 1910, 99.)

Loss on washing (of raw rubber samples) is determined by washing on small rollers. Tensile strength and elasticity tests are made on the Schopper-Dalén machine, preferably with a ring-shaped test-piece. Many experiments were made with strips, both uniform in width throughout their length, and also with enlarged ends, but the results showed that breaking nearly always occurred between the jaws of the grips, in the case of very soft samples. The rings used had a cross-section of 6·6 sq. mm. and an internal diameter of 44·6 mm. and were punched from sheet with a circular punch. As in the case of metals the final extension under a given load can only be read off after the lapse of a certain time, and a further test is therefore applied in which strips or rings are suspended under a given load and the extension observed when it has attained a constant value. The load is then removed and the contraction of the test-piece followed and recorded. The behaviour of the sample under this test depends largely on the degree of vulcanisation. Further valuable information as to the durability of the sample is obtained by exposing it, in a stretched condition, to various external influences such as an elevated temperature. To this end rings are stretched side by side on sheets of glass, this arrangement being a suitable one for observation whether visual or with the aid of the camera. The behaviour of the test-piece when repeatedly stretched is ascertained with the aid of a machine by Schopper capable of testing four rings at a time. A bending or folding test is also applied by means of an apparatus similar to that used for paper testing. For abrasion or wear tests, balls of rubber 30 mm. in diameter are caused to run round a V-groove under a heavy load. The nature and extent of the abrasion is very characteristic for a given mixing. In a second apparatus rubber rings are caused to run between two rollers. For testing rubber rollers for typewriters a small electromagnetic hammer is employed.

In the case of balloon-fabrics the following tests are applied :—(1) *Bursting pressure.* A piece of the fabric is clamped between iron rings, the following diameters being recommended : 113, 160, 196, 252, 357, 505 and 618 mm., corresponding to areas of 0·01, 0·02, 0·03, 0·05, 0·1, and 0·3 square metre. Air pressure is then applied from a bottle, or direct from an air-pump until the fabric gives way. The bursting pressure is dependent upon the size of the ring employed. (2) *Tensile strength.* Strips 50 mm. wide, cut in two or four principal directions are tested. (3) *Gas tightness.* (a) Air is forced under a definite pressure through a circular disc of the fabric, the quantity being measured by means of a gas-meter. (b) For measuring the diffusion of hydrogen through the material, a sample is stretched between two funnel-shaped vessels into one of which a mixture of air and hydrogen is passed, whilst air passing through the second vessel carries away the diffused hydrogen, which is estimated by combustion in presence of palladiumised-asbestos. Tests made after exposure to wind and weather for a long time give an indication of the durability of the material. (4) *Heat-conductivity* is determined by means of Bauer's apparatus, consisting of four opaque cylindrical vessels across which samples of four materials to be compared may be stretched, and the radiation passing through them from various sources measured by means of thermo-couples placed behind the samples.—E. W. L.

Colloidal substances [*caoutchouc*]; *Solution of*——. P. Bary. Comptes rend, 1911, **152**, 1386—1387.

If caoutchouc is treated with benzene, the latter diffuses into the caoutchouc, causes it to swell, and then to break into fragments which subsequently decrease in size until they are invisible to the naked eye. As the size of the solid-liquid particles suspended in the benzene diminishes, their surface-tension increases until finally the sum of the surface-tension of the particles and the elastic tension of the caoutchouc balances the attraction between the caoutchouc and the benzene, so that when the solid liquid particles have diminished to a certain size, a state of equilibrium is attained. These observations may be applied to colloidal solutions in general. The suspended solid-liquid particles may be regarded as spongy cells into which the liquid has penetrated by osmosis, and from which it can escape in the same way if the nature of the external liquid alters.—L. E.

Utilisation of Para rubber seed [*as a source of oil*]. *See* XII.

PATENTS.

Rubber waste; Process of recovering ——. E. E. A. G. Meyer, New Brunswick, N.J. U.S. Pat. 986,931, Mar. 14, 1911.

Ground vulcanised waste is mixed with heated Chinese wood oil which has a very rapid solvent action upon vulcanised rubber. When solution is complete a rubber solvent, preferably of comparatively high boiling point, is added in order to facilitate filtration, and to render the subsequent precipitation of the rubber, by means of a rubber precipitant, such as acetone, easier. The precipitated rubber is allowed to settle, the liquid is drawn off to be employed again after separation into its components, and the rubber particles are then pressed, dried and sheeted in any convenient manner.—E. W. L.

Rubber and vulcanite; Reclamation of waste ——. W. H. Hyatt, Cookham, Assignor to P. D. Penn, Croydon. U.S. Pat. 992,425, May 16, 1911.

See Eng. Pat. 13,599 of 1908; this J., 1908, 1163.—T.F.B.

Rubber or similar substances; Process and apparatus for extracting —— *from vegetables containing them.* Intercontinental Rubber Co. Fr. Pat. 424,795, Jan. 12, 1911.

See U.S. Pat. 982,373 of 1911; this J., 1911, 296.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Skins attacked by the larvæ of Hypoderma bovis in the Lyonnaise district; Percentages and qualities of ——. N. Lehmann and C. Vaney. Comptes rend., 1911, **152**, 1343—1345.

Note has been taken at the Lyonnaise slaughter-house of the damage occasioned to raw skins, since 1896, by the larvæ of *Hypoderma bovis* or warbles. For the three years 1908—1910, the monthly percentage of warbled hides has been observed, all the hides having been derived from country animals. The average percentages of warbled hides were as follows :—

	Per cent.		Per cent.		Per cent.
January	0·27	May ...	7·67	September ..	3·34
February ...	0·91	June ...	11·98	October	0·73
March	2·82	July ...	14·53	November...	0·36
April	7·81	August .	7·94	December ..	0·23

Thus it is seen that warbled hides are met with during the whole year but in the periods from September to December and from January to March the warbles observed are either late larvæ beginning to degenerate or the remains of larvæ. The living and stationary larvæ, capable of changing to adult *Hypodermæ*, make their appearance beneath the skins of the country animals from April to May. During June and July the greatest damage is caused by warbles, amounting each month to more than 200 kilos. of green hide per 100 skins. From March to June, when no adult *Hypodermæ* are in existence, an increase of the monthly percentage of warbled hides and of damage caused in this way, was noticed. This fact can only be explained on the assumption of a migration of larvæ from the interior organs of the host towards the sub-cutaneous tissue. An examination of the fresh skins received from the slaughter-houses of Lyons during the early part of 1911 showed that the migrating larvæ reach the inner side of the skin at the end of March, in April, or even in May. There is possibly a connection between this time of appearance and the period of warm spring days. When they reach the inner surface of the skin the larvæ are very transparent and hence are often unnoticed. Some of them are nearly 20 mm. in length and are identical with the large forms of larvæ found by one of the authors in the gullet and in the meninges of the spinal marrow. One of these transparent larvæ has been found at the surface of the sub-cutaneous tissue before it had penetrated the derma. These facts prove that the larvæ come from the deep internal regions of the body of the host. The following facts prove the penetration of the *Hypoderma* through the digestive tract. (1) The invariable localisation, in winter, of very young larval forms in the sub-mucous tissue of the anterior part of the digestive duct. (2) The growth of these larvæ in the region of the œsophagus. (3) The discovery in February and March of more highly developed larvæ in the coat of the spinal marrow and in the sub-cutaneous tissue of unpunctured skins. (4) The larger number of stationary larvæ found in the skin from May to July. It is often stated, by upholders of the theory of penetration inwards from the exterior of the skin that the larvæ are found mostly on thin skins and the statistics obtained permitted of the examination of this statement. It was found that, in the case of oxen, the thin skins were more warbled than the thick. With cows, on the other hand, the thicker skins were found to contain the more warbles. There appears to be no relation between the thickness of skins and the number of warbles contained in them. In the case of cows there is a great preponderance of thick skins. The greater number of thick skins are provided by heifers, while the cows, the flanks of which have been distended during gestation, furnish the greater part of the thin skins. The frequency of warbles appears rather to vary with the age of cattle.—D. J. L.

Disinfection of hides. Becker. Collegium, 1911, 197.

The author points out that mercuric chloride gives an insoluble compound with albumin, and that the use of carbolic acid and of sulphur dioxide is out of the question because they injure the hides. He has found too that the following substances diminish the activity of the anthrax bacteria without prohibiting their growth altogether, viz., lime, sodium sulphide, arsenic and lime solution and red arsenic. The use of mustard and mustard oil for sterilising against anthrax is recommended. A 0·05 per cent. solution of mustard oil will kill anthrax spores in five minutes. It may be applied either by painting or sprinkling a solution on the hides, or by adding it to the soak water. By this means the hides are sterilised without any injurious effects. In using mustard oil strong solutions must be avoided and rubber gloves should be worn.—J. R. B.

Tannins; Behaviour of —— in presence of albumin and metallic salts. G. Grasser. Collegium, 1911, 185—192, 199—200.

Tannin is precipitated both by albumin and by certain metallic salts, and moreover, insoluble compounds result from the interaction of certain metallic salts and albumin. The author describes the results of qualitative and quantitative experiments on the interaction of all three classes of substances together. The reagents employed were: (1) a 20 per cent. solution of pure dry egg albumin; (2) a 20 per cent. solution of pure gallotannic acid, and (3) 20 per cent. solutions of various metallic salts. In each case, an insoluble precipitate of characteristic colour was thrown down as follows:—Silver nitrate, yellowish; bismuth nitrate, yellow; mercuric chloride, bright yellow; zinc sulphate, white; copper sulphate, brownish yellow; lead nitrate, white; bromine, yellowish; iodine, brown; iron chloride, dirty brown. For the quantitative estimation of the precipitates very dilute solutions were used and the resulting precipitates washed, dried very thoroughly, and analysed, the metallic portion and the albumin being directly estimated and the tannin content obtained by difference. The quantities of the substances taken correspond to their molecular weights, tannin being reckoned as a dibasic acid. The results are shown in the following table:—

	Metal.	Albumin.	Tannin.
	Per cent.	Per cent.	Per cent.
Silver salt	18	32	50
Bismuth ,,	14	40	46
Mercuric ,,	15	50	35
Zinc ,,	10	48	42
Copper ,,	9	50	41
Lead ,,	16	45	39
Iron ,,	5	60	35
Bromine	15	21	64
Iodine	23	21	56

The effect of the above reagents on tannins from different materials was tried and a table is given showing the nature of the resulting precipitates. Each precipitating agent produces fairly similar results with different materials so that the use of the reagents for qualitative detection of the tannin materials is somewhat limited, although the results promise a fruitful field of work for research in this direction.—J. R. B.

Patents.

Tanning skins; New controlling apparatus for revolving drums for tumbling and ——. G. B. M. Spigno. Fr. Pat. 424,632, Jan. 5, 1911. Under Int. Conv., Jan. 10, 1910.

Drums are mounted on pinions with a shaft fixed beneath them and movement is transmitted to them by means of a chain engaging in cog-wheels on the shaft, and at the side of each drum. A reversing gear placed between the motor and the main shaft permits the movement of all the drums connected with the shaft to be reversed in one operation.—D. J. L.

Stoving skins, hair, and other materials; Method and apparatus for ——. A. E. Jumel, sen. Fr. Pat. 424,807, Jan. 12, 1911.

The materials are carried forward mechanically through a stove in which they are met by a current of air or hot gas travelling in the reverse direction. The longitudinal compartments communicate with each other, either directly, or through suitable channels, the lower compartment receiving directly the hot gases from the furnace which are caused to circulate successively through the other compartments. The system is particularly adapted for materials which have been treated with mercurial solutions which, through the elevated temperature, produce vapours harmful to the workers, when the materials are introduced, as formerly, by hand.—D. J. L.

Artificial leather or leather board; Processes of making ——. W. P. Thompson, Liverpool. From Hide-Ite Leather Co., Boston, U.S.A. Eng. Pat. 491, Jan. 7, 1911.

See U.S. Pat. 981,591 of 1911; this J., 1911, 143. An aluminium salt is used to precipitate the mass, and a chromium salt to render it waterproof.—T. F. B.

Tanning or like treatment of hides or skins and apparatus therefor; Method of ——. The Vulcano Tanning and Machine Co., Washington, U.S.A. Eng. Pat. 11,345, May 7, 1910. Under Int. Conv., May 7, 1909.

See Fr. Pat. 415,661 of 1910; this J., 1910, 1322.—T. F. B.

Elastic masses; Process for producing —— from glutinous substances, such as gelatin, and suitable solvents. W. Plinatus. Fr. Pat. 424,228, Aug. 22, 1910. Under Int. Conv., Sept. 6, 1909.

See Eng. Pat. 9616 of 1910; this J., 1911, 501.—T. F. B.

XVI.—SOILS; FERTILISERS.

Soil physics; Studies on ——. I. The flow of air and water through soils. W. H. Green and G. A. Ampt. J. Agric. Sci., 1911, 4, 1—24.

The permeability and capillarity constants of a soil may be defined as follows: *The specific pore or interstitial space.* (S) is the free space per unit volume of soil. The *permeability to water* (P_w) may be measured by the quantity of water which will pass per second, through a soil column of unit length and unit area, when under 1 cm. head of water pressure. The *permeability to air* (P_a) may be similarly defined. The *capillarity coefficient* (K) is the tension due to capillary forces per unit area of cross-section of the pore spaces, which tends to draw water from the saturated to the dry portion of the soil. From these constants it is possible to construct equations which shall represent the rate of motion of air and water through the soil. The authors have studied movements in the three soils, (1) a friable loam from the grounds of the University of Melbourne, (2) a clay soil from Werribee, Victoria, and (3) a surface sand from Canterbury, near Melbourne, sufficiently free from colloidal clay to serve as an example of a highly permeable soil. The results obtained show that the rates of motion agree with the deduced equations. It is therefore suggested that the determination of S, P_a, P_w, and K, would be of more value than the determination of the average size of the particles in a mechanical analysis. To have their full value, the determinations should be made on the natural soil *in situ*, but the information is very valuable, even when it is obtained from disturbed samples.
—W. H. P.

Ammonia; Absorption of —— from the atmosphere [by soils]. A. D. Hall and N. H. J. Miller. J. Agric. Sci., 1911, 4, 56—68.

The authors have attempted to solve the problem as to whether the small quantity of ammonia normally present in air, is reduced or increased by the soil. Pairs of glazed earthenware dishes, containing sulphuric acid, with a surface of 550 sq. cm., were exposed to the air with suitable protection from rain and dust, the lower being 5 cm., the upper 115 cm. from the ground. This was done in four different places on the Rothamsted farm and monthly determinations of absorbed ammonia were made. Generally speaking the upper dish shows greater absorption than the lower, which might suggest that the ammonia is supplied from above and that near the soil its percentage reaches its minimum value. Against this, it might be suggested that the difference is due to better circulation of the air at the higher level. The effect of free circulation is probably very considerable, as even a gauze cover for the dish had a considerable effect on the absorption figure. The results also show that after the application of ammonium salts as manures the soil undoubtedly gives off ammonia in appreciable quantities. The variation due to the difference in position of the pairs of basins hardly supports the theory that the soil absorbs ammonia, since the basins exposed over an arable soil showed no great differences from those over grass, even during the months of cultivation, when the increase in effective surface would be expected to show its results. Although the main question cannot be settled till more information is obtained with regard to the distribution of ammonia in the air, it is clear that if ammonia is absorbed, the quantity must be very small. Assuming the soil to be as effective an absorbent as sulphuric acid, the maximum absorption would be less than a pound of nitrogen per acre per annum.—W. H. P.

Agar as a source of energy for the assimilation of atmospheric nitrogen. H. and E. Pringsheim. Centralbl. f. Bakt., 1910, **26**, 227. Biedermann's Zentr., 1911, **40**, 289—291.

It is suggested that in sea plants soluble substances which reduce Fehling's solution are formed by the action of *Bacillus gelaticus* and similar organisms and that these serve as a source of carbon for other bacteria which elaborate nitrogen derived from the air. *Bacillus gelaticus* was accordingly grown together with *Azotobacter chroococcum* or *Clostridium Americanum* on a very thin agar jelly containing traces of salts. After some time the agar became entirely fluid and the bacteria were found to have developed greatly. The quantity of nitrogen now fixed in the solution was relatively large, amounting in the case of *Clostridium* with 0·4 grm. of agar to 15·4 mgrms. and in the case of *Azotobacter* with 1 grm. of agar and 0·2 grm. of mannitol to 14 mgrms. of nitrogen. These values are as great as those obtained with cellulose instead of agar.—E. F. A.

Guano deposits of Assumption Island, Seychelles. Bull. Imp. Inst., 1911, **9**, 39—44.

In a report to the Governor of the Seychelles by Mr. R. Dupont, it is estimated that there are available on Assumption Island about 106,000 tons of pit guano and 270,000 tons of surface guano. The pit guano is of better and more uniform quality than the surface guano. Samples with 19·57 per cent. of moisture contained 61 per cent. of calcium phosphate. The average content of iron oxide and alumina is about 3·5 per cent., but, in many pits the guano contains less than 1 per cent. of these substances; the proportion of calcium carbonate is generally no more than 4 per cent. The surface guano is much more variable in composition and frequently contains an excessive proportion of calcium carbonate. It is recommended that the pit guano only should be utilised at present, except at a few points where the surface deposits could be worked satisfactorily. It is estimated that 46,000 tons of high-grade material containing not more than 3 per cent. of iron oxide and alumina could be obtained, and 50,000 tons of lower-grade material, which could not be exported to Europe at a profit under present conditions. Up to Aug. 1, 1910, about 7500 tons of high-grade guano, not included in the above estimate, had already been exported. (See also this J., 1902, 1422).—A. S.

Bordeaux mixtures; Action of carbon dioxide on ——. C. T. Gimingham. J. Agric. Sci., 1911, **4**, 69—75.

Pickering (this J, 1907, 1291 and 1909, 1220) attributes the fungicidal action of Bordeaux mixtures to the action of carbon dioxide on the basic sulphate of copper, producing soluble copper sulphate. The present author has found, however, that the whole of the copper brought into solution by the action of carbon dioxide for a short time is reprecipitated on removal of the carbon dioxide. When the dioxide acts for a long time the reprecipitation is not so easy, but these conditions are not those of actual practice, so that discussion must centre round the action of small quantities. When a thin layer of the basic sulphate, $10CuO,SO_3$ (the compound present in the Woburn Bordeaux paste) is exposed to moist carbon dioxide, copper is dissolved, but on exposing the product to air for two days all but the slightest trace is reprecipitated. In the case of ordinary Bordeaux mixtures containing excess of lime, the action is the same, except that the lime must first be carbonated and therefore the solvent action of the carbon dioxide is delayed. It is therefore improbable that the fungicidal action is due to copper sulphate liberated by atmospheric carbon dioxide.—W.H.P.

Bordeaux mixtures; Fungicidal action of ——. B. T. P. Barker and C. T. Gimingham. J. Agric. Sci., 1911, **4**, 76—94.

In view of the work summarised in the preceding abstract it is necessary to investigate other causes of the activity of Bordeaux mixture than the action of atmospheric carbon dioxide. It is probable that the direct toxic influence on fungi which have already attacked the host plant is comparatively slight and that the action is largely preventive. The possibility of the production of soluble copper by the action of the host plant itself is very slight, except in cases where the leaf structure has been injured, in which case the plant is likely to suffer from "Bordeaux injury." It is customary to spray as early as possible in the season before the leaves are damaged, when such action will be at a minimum. It is therefore probable that in ordinary practice the solubility of the copper is due to the action of the fungus itself, an action which must be highly localised, so as to require contact between the fungus and the solid particles of the paste. This is in agreement with prevalent opinion as to the necessity for thorough spraying to get as complete a coating of the leaves as is possible, and the advisability for the same reason of a second treatment within a month or so. Attention is also called by these considerations to the fine division of the precipitate and the adhesive properties of the mixture.—W. H. P.

XVII.—SUGARS; STARCHES; GUMS.

Cane sugar; Effect of high temperatures on —— in solution. N. Deerr. Agric. and Chem. Series, Expt. Station, Hawaiian Sugar Planters' Assoc., Bull. No. 36, 1911. (Compare also Deerr, this J., 1911, 145; and Hazewinkel, 1911, 564.)

In European beet sugar factories it has been found that considerable economy can be effected by the use of high-pressure steam in the evaporating plant; but before advising the introduction of this system into cane sugar factories it is necessary to examine the behaviour of cane juices and syrups at such higher temperatures. In carrying out investigations in this direction, the author has amplified the work of Herzfeld (Z. Rübenzuckerind., **43**, 735) and Douschsky (Int. Sugar J., 1911, **13**, 46—47) on the decomposition of sucrose at high temperatures, but used solutions polarising 78° V. He found that in neutral solutions inversion does not occur below 110° C., but that above this temperature inversion sets in, and is very rapid at 125° C. At all temperatures inversion is greatly inhibited by alkalis up to a certain limit, beyond which a further increase in the amount added, has no effect. In the presence of chlorides, bromides, iodides, nitrates and sulphates of alkalis and alkaline earths, at temperatures above 105° C., in neutral or alkaline solution, the rate of inversion is materially increased; but the normal salts of the weak acids, such as acetic, tartaric and oxalic acids, have a retarding effect. Other experiments corroborated the observations that the dominant factor in determining the rate of inversion at temperatures above 100° C., is the amount of free alkali present, and also that the amount of inversion caused by varying quantities of normal salt is proportional to the amount of salt present. On extending these results to cane juices, it was found that conditions differ considerably, owing to the variable amounts of salts of both strong and weak acids, and of free alkali, *i.e.*, of the lime used in defecation, present, so that a temperature safe with one juice may cause serious inversion in the case of another. In general, however, it may be stated that under the average conditions prevailing in Hawaiian factories juice may be heated to 120° C. for half-an-hour with no measurable loss of sucrose, provided sufficient lime be present. Experiments dealing with the effect of high temperatures on clarification are next described, more especially in reference to the custom in some factories of heating the juices to 115°—120° C., in closed tubular heaters, for the purpose of facilitating rapidity of settling and filtration. It was found that between 100° and 130° C. the temperature of clarification has no appreciable effect. Finally the author deals with the important question of the sterilisation of sugars. It is pointed out that under the ordinary system of evaporation the temperature of 100° C. used is not sufficient to destroy the micro-organisms entering either with the juice or with the remelted sugars taken into the pans as "seed" to induce graining. Laboratory experiments demonstrated that, provided sufficient alkali be present, sugar solutions containing "*Bac. C.*" (*cf.* Lewton-Brain and Deerr, this J., 1909, 845) on being heated momentarily to 125° C. are rendered sterile without any appreciable inversion of sucrose occuring. Summarising the result of the investigation, the author concludes that, under a rational system of control, the use of high temperature evaporation, with the pre-heater system, and the sterilisation of all cane sugar house products, is feasible.—J. P. O.

Sugars; Polarimetric determination of —— by Jolles' method. B. Bardach and S. Silberstein. Z. Unters. Nahr. Genussm., 1911, **21**, 540—543.

The method of Jolles (this J., 1910, 1467) is based on the fact that when solutions of sugars in $N/10$ alkali are heated under certain conditions, the rotatory power of dextrose and most other sugars vanishes whilst that of sucrose is not affected. The present investigation concerns the application of this to the analysis of solutions containing sucrose and dextrose. Of the three methods of heating suggested by Jolles (*loc. cit.*) the authors prefer that in which the solution is maintained for 24 hours at 37° C., the darkening being least in this case. Darkening of the solution is further lessened, and reduction of the rotatory power accelerated, by access of air during the heating. The procedure described by the authors is as follows:—A known quantity of the solution is treated with $N/1$ caustic soda solution until its alkalinity is $N/10$. It is then polarised and a portion transferred to a small beaker (8—10 cm. by 5 cm.) which is maintained, uncovered, at 36°—39° C. for 20 hours. After cooling, the liquid is made up to its original volume and polarised. Solutions of dextrose containing 0·5—5·0 per cent., and polarising 0·51—5·12 angular degrees on the Wild polarimeter employed, gave readings ranging from — 0·09° to — 0·36° after heating as above. Taking — 0·25° as the average of these residual readings, the polarisation value of dextrose, in a solution containing this sugar and sucrose, is given in angular degrees by the formula "$D=A-B-0{\cdot}25°$," in which A and B are the angular readings before and after heating with alkali. The angular reading of the sucrose is "$S=B+0{\cdot}25°$." These formulæ are most accurate when the concentration of the dextrose is 3—4 per cent., and solutions containing more than 5 per cent. should be correspondingly diluted. The accuracy of the results is not appreciably affected by the presence of small quantities (less than 1 per cent.) of salts such as calcium chloride and sodium sulphate and carbonate.
—J. H. L.

Sucrose; Hydrolysis of —— by ultra-violet rays. H. Euler and H. Ohlsén. J. Chim. Phys., 1911, **9**, 416—422.

Neutral solutions of sucrose were exposed to the rays from a Heraeus quartz mercury vapour lamp, the rotatory power, amount of invert sugar, and acidity of the solutions being determined at intervals. The experiments showed that under these conditions, the sucrose is hydrolysed and the solution becomes slightly acid. A control experiment showed that the speed of the hydrolysis due to the temperature (79° C.) to which the solutions were heated by the lamp, is very slow compared with that due to the action of the ultra-violet rays. The quantity of sucrose hydrolysed is nearly as great in a 10 per cent. solution as in one of double this concentration. The rate of hydrolysis increases with the duration of the exposure, this being accounted for by the acid formed in the reaction; the formation of this acid depends on a catalyst which is present, in traces, in the solutions.—L. E.

Patents.

Sugar; Process of manufacturing ——. W. Henning, Lahaina, Hawaii, Assignor to Henning Process Sugar Extraction Co., San Francisco, Cal. U.S. Pat. 991,505, May 9, 1911.

The juices are converted into dry sugar and residual molasses; the latter is divided into two parts of which one is diluted with water to a syrup whilst the second part is converted into dry sugar and residual molasses, the latter also being diluted to a syrup. Both syrups are added to a succeeding "strike" of juices at a time when the sugar of the "strike" is almost finished and its grains are well developed; the dry sugar from the second part of the residual molasses is melted, and added, at the same time as the syrups, to the "strike." The whole mass is converted into dry sugar and residual molasses and the cycle is repeated.—L. E.

Sugar; Process of refining ——. H. Wiese, Wallaceburg, Ontario. U.S. Pat. 991,580, May 9, 1911.

In this process, which is effected without the use of bone black [animal charcoal], raw cane sugar is melted, filtered and boiled to a massecuite, the syrup being extracted and the crystals washed. The crystals are re-melted, neutralised, and again boiled to a massecuite, the syrup being extracted and the crystals washed as before. The low-grade syrup of the first extraction is diluted and boiled to a massecuite, the syrup extracted therefrom being treated in the same way. The sugars of the further extraction are distributed to the grades of equal purity in the main process, and the intermediate syrups are used as washes, and as "caps" in the boiling process, the final products consisting of refined white sugar and low-grade molasses.—L.E.

Dextrin; Manufacture of ——. J. Verity, Stretford, Lancs. Eng. Pat. 16,666, July 13, 1910.

The farinaceous material is treated with acid as usual, and then heated in shallow or narrow closed vessels in a bath of boiling water or other liquid or in superheated steam. The shape of the vessels allows of the rapid and uniform heating of the contents without the necessity of stirring, and the process is complete in 6—12 hours, whilst the ordinary method of heating on open trays occupies 1—2 weeks.—J. H. L.

Dextrin; Process of manufacturing ——. H. Wulkan, Budapest, Austria-Hungary. U.S. Pat. 993,011, May 23, 1911.

See Eng. Pat. 7032 of 1910; this J., 1911, 565.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Yeast; Influence on the extent of multiplication, of variation in the amount of —— added to wort. F. Hayduck and G. Anders. Woch. Brau., 1911, **28**, 233—236.

The percentage increase in the number of cells produced when bottom-fermentation yeast (D) is grown in 15 per cent. wort at 25° C., was found by the authors to diminish as the quantity of the pressed yeast added was increased from 0·5 to 100 grms. per litre of wort, no multiplication occurring at the latter limit under ordinary conditions. When the fermentation was carried out under diminished pressure (0·5 atm.) to remove carbon dioxide, growth occurred even with 100 grms. of yeast per litre (of 12·5 per cent. wort), but none with 200 grms. Aeration, and also addition of sucrose to the wort, had a similar effect to that of diminished pressure; in no case, however, did multiplication occur when 200 grms. of yeast were used. From further experiments the authors conclude that the absence of growth when large quantities of yeast are seeded, is not to be attributed to accumulation of alcohol or disappearance of sugar but is rather due to lack of the space necessary for multiplication. In such cases the individual cells increase in size without budding.—J. H. L.

Enzymic actions; Influence of the viscosity of the medium on ——. P. Achalme and M. Bresson. Comptes rend., 1911, **152**, 1328—1330.

The authors subjected solutions of sucrose, containing varying proportions of glycerol or mannitol, to the action of extract of dried yeast which had been treated with acetone. Curves were plotted showing the relation between the concentration of glycerol or mannitol and, on the one hand, the time required for the inversion of a given proportion of the sucrose, and on the other, the viscosity of the solution. These curves were found to be almost parallel, especially in the experiments with mannitol. Similar results were obtained in experiments with emulsin, amylase, trypsin, organic oxydases, and even with "inorganic oxydases." and using glycerol, mannitol, or sucrose for increasing the viscosity of the medium. In all cases the action of the enzyme was retarded in direct proportion to the viscosity of the medium. In a future communication, the authors intend showing how this influence of the viscosity of the medium will afford an explanation of the contradictory results obtained by different workers with regard to the action of invertase on sucrose (see following abstract). Moreover, by taking the factor of viscosity into consideration, it will be found possible to bring enzymic actions in accordance with a simple law, conforming with the logarithmic law governing the action of acids.—A. S.

Invertase; Rôle of viscosity in the variations in the action of —— according to the concentration of sucrose. P. Achalme and M. Bresson. Comptes rend., 1911, **152**, 1420—1422. (See preceding abstract.)

Conflicting views have been held by various workers concerning the influence of concentration of the sucrose solution on the rate of action of invertase. The authors show that, with increasing concentration of sucrose, the time required for the hydrolysis of a certain proportion (*e.g.*, 25 per cent.) by a given quantity of invertase, increases slowly at first and then more and more rapidly. The curve showing this relation between time and sucrose-concentration presents a striking parallelism to the viscosity curve. If the absolute quantity of sucrose hydrolysed in a given time is considered, it is seen that, with low, increasing concentrations of sucrose, the retardation of invertase-action due to increasing viscosity is small in comparison with the acceleration due to the influence of mass; with medium, increasing concentrations of sucrose, the retardation and acceleration balance each other and the quantity of sucrose hydrolysed remains constant, whilst with high concentrations, the retardation becomes dominant.—L. E.

Emulsin; Action of heat on ——. G. Bertrand and A. Compton. Comptes rend., 1911, **152**, 1518—1521.

Amygdalin is completely hydrolysed by emulsin; but, as E. Fischer has shown (this J., 1895, 877), it is only partially hydrolysed by an aqueous extract of yeast, one molecule of dextrose, and mandelonitrile glucoside being formed. Hence, the yeast extract contains amygdalase which acts only on the disaccharide (amygdalose) of amygdalin, whilst emulsin contains both this enzyme and amygdalinase, which effects the separation of mandelonitrile from the sugar molecule. The authors have examined the influence of heat on the action of emulsin on amygdalin, the amounts of hydrocyanic acid and reducing sugar produced, being taken as measures of the activities of the amygdalinase and amygdalase respectively. It is found that when emulsin is allowed to act on amygdalin for 15 hours, the temperature-optima of the amygdalinase and the amygdalase are the same, viz., about 40° C., whereas, if interaction is limited to 2 hours, the temperature-optima of the two enzymes differ, that of amygdalinase being 58° C., and that of amygdalase, 56° C. The authors point out that the destructive action of heat on enzymes is progressive, and that the temperature-optimum is not a characteristic constant, but varies with the duration of the experiment. The above results show how the temperature-optima of two enzymes from the same source may vary in experiments of different durations, and show the necessity of stating all the conditions under which this determination has been made. The results also support the view that amygdalinase and amygdalase are distinct enzymes, and furnish further proof of the difference between these enzymes and cellase (this J., 1911, 53).—L. E.

Original gravity; Balling formula for the calculation of ——. F. Schönfeld. Woch. f. Brau., 1911, **28**, 209—212, 221—224. (See also this J., 1910, 292.)

A further modification of the Balling formula for the calculation of the original gravity of worts is suggested by the author. The yeast factor for bottom fermentation has been again determined, and the formula now put forward is $p=\left(\frac{2{\cdot}0195A+n}{1{\cdot}0195A+100}\right)100$, in which p = original gravity, A = alcohol per cent., and n = residual extract per cent. In the case of top fermentation the results obtained by the well-known Balling formula: $p=\left(\frac{2{\cdot}0665A+n}{1{\cdot}0665A+100}\right)100$ are not high (as with bottom fermentation beers), but rather tend to be low. This is probably due to loss of alcohol by evaporation during the warmer top fermentation, and to greater yeast production.—J. H. L.

Ciders; The "graisse" sickness of ——. E. Kayser. Comptes rend., 1911, **152**, 1422—1424.

The author has isolated from ciders infected with the "graisse" sickness, four organisms which he distinguishes as *a*, *b*, *c*, and *d*. Their dimensions are as follows:—*a*, 3 to 16 μ by 1·5 to 2 μ; *b*, 1·5 to 4·5 μ by 0·75 to 1 μ; *c*, 1·5 μ by 0·75 μ; *d*, 1·5 to 4 μ by 1 to 1·5 μ. The organisms generally form chains, which are straight in the case of *a*, curved in the case of *b* and *d*, whilst those formed by *c* are convoluted. They are somewhat anaërobic and have a temperature-optimum of about 30° C. They grow readily in solutions of sugar in bean-decoction, yeast water, extract of malt combs, or peptonised meat extract; the organism, *a*, has no visible effect on milk but produces a pleasant odour of apple essence; *b* coagulates milk partially; *c* renders it ropy and coagulates it, and *d* renders it ropy but does not coagulate it. Of the sugars, sucrose, dextrose and lævulose, the organism, *b*, exhibits a preference for lævulose whilst *c* prefers dextrose. A concentration of 15—20 per cent. of sucrose does not prevent the production of ropiness and all the organisms can produce ropiness in presence of 4—5 per cent. of alcohol. Addition of dead yeast, humus, or tannin (even to the extent of 0·1 per cent.) to the culture medium, produces very vigorous and ropy growths, especially in the case of the organisms *a* and *c*. The production of ropiness in ciders depends, not merely on the presence of one of these organisms, but is influenced by other factors as well; ciders which have been completely fermented do not become ropy.—L. E.

Humulene from oil of hop flowers. Deussen. *See* XX.

Patents.

Oxygen or ozone; Apparatus for the treatment of liquids with ——. W. Saint-Martin, Nice, France. Eng. Pat. 14,187, June 11, 1910.

The oxygen, ozonised if necessary, is admitted into the oxidising chamber under pressure. The liquid to be treated enters under a high pressure, by a tube bifurcated at its end, the forks being bent round so that the terminal holes, which are very small, are directed towards each other. In the space between the forks is fixed a solid body in the form of a double cone on a common base, the sloping sides of which are concave, and scored with fine grooves radiating from apex to base. This body is fixed axially between the two nozzles of the forked pipe, the apices being very close to the respective holes. By this device the liquid, as it enters, is atomised and distributed uniformly throughout the chamber. The apparatus may be used for a variety of purposes, such as the artificial ageing of alcoholic liquors, the treatment of spirits from grains, potatoes, beetroot, etc., to render them palatable, the preservation of milk and the removal of obnoxious flavours or odours from oils.—J. H. L.

Enzyme (1), *and amylolytic enzyme* (2); [*Preparation of* ——]. J. Takamine, New York. U.S. Pats. 991,560 and 991,561, May 9, 1911.

(1) A fungus is developed upon a suitable nutrient medium under proper conditions of humidity and temperature. The soluble constituents are then extracted with water, and the extract is treated with phosphoric acid and calcium hydroxide in quantities to form calcium diphosphate; the solid matter is then precipitated from the solution with alcohol, washed, and dried. (2) A starch liquefying and saccharifying agent is prepared by acidifying bran with phosphoric acid to render the pro-ferment active, developing a fungus on the acidified mass, and finally extracting the soluble constituents of the acidified mass with water.—L. E.

Spirit; Process for the purification of crude ——. I. Traube. Ger. Pat. 233,209, Jan. 16, 1910.

In Ger. Pats. 41,207 and 53,486 (see Eng. Pats. 8387 of 1887 and 17,972 of 1888; this J., 1888, 449; 1889, 995), a process for purifying crude spirit was described, consisting in the addition of concentrated solutions of certain salts (potassium and sodium carbonates, sodium phosphate, etc.), in order to cause the formation of different strata in the liquid. Of the salts mentioned in the specifications, only potassium carbonate has proved of technical importance. It is now claimed that the process may be carried out with the cheaper salts, sodium chloride or potassium chloride, if certain quantities of alkali and alkaline earth salts of di- or polybasic acids be also added.—A. S.

Hops; Process of extracting ——. G. G. Smith, St. Albans, Vt. U.S. Pat. 992,275, May 16, 1911.

See Eng. Pat. 24,300 of 1909; this J., 1910, 104.—T. F. B.

Wine and other potable liquors; Manufacture of ——. V. Henri and A. Helbronner, Paris, and M. von Recklinghausen, Bas-Meudon, France. Eng. Pat. 13,129, May 30, 1910. Under Int. Conv., June 4, 1909.

See Fr. Pat. 403,674 of 1909; this J., 1910, 104.—T. F. B.

Alcohol and similar liquids; Process for the purification of ——. E. Guillaume, Blida, Algeria. U.S. Pat. 992,498, May 16, 1911.

See Fr. Pat. 365,417 of 1906; this J., 1906, 947.—T. F. B.

Fractionating ethers, alcohols, and other liquids. Fr. Pat. 424,476. *See* I.

XIXa.—FOODS.

Milk; Investigation of the surface tension relations in ——, *and nature of the membranes surrounding the globules of milk fat.* H. Bauer. Biochem. Zeits., 1911, **32**, 362—379.

Burri and Nussbaumer (Biochem. Zeits., 1909, 20, 90) found that the surface tension of milk, measured by means of Traube's stalagmometer (see this J., 1911, 448), is considerably diminished by cooling, and that by determining the surface tension of a sample of milk before and after cooling for 1 hour below 10° C., it can be readily ascertained whether the milk has been previously cooled or not; in the former case the two determinations will give approximately the same value, whilst in the latter case, the two values will be different. The author has obtained similar results and confirms the view that the depression of the surface tension is due to the solidification of the fat globules, for the amount of the depression varies according to the fat-content of the milk, and the surface tension can be restored nearly to its original value by heating the milk above the melting point of the fat, *e.g.*, for ¾ of an hour at 50° C. In the latter part of the paper the author discusses the nature of the membranes surrounding the globules of fat in milk, and describes experiments with butter fat and with emulsions of paraffin and tripalmitin in separated milk, from the results of which he concludes that these membranes are solid as maintained by Storch and Völtz (Arch. ges. Physiol., 1904, 102), and that they probably contain some fat. During the souring of milk, the membranes suffer profound chemical changes, and become less resistant to mechanical and thermal influences.—A. S.

Casein; Hydrolysis of ——. T. B. Osborne and H. H. Guest. J. Biol. Chem., 1911, **9**, 333—353.

From a quantitative standpoint much uncertainty attaches to the analysis of proteins so long as only a portion of their products of hydrolysis has been identified. In the case of casein Abderhalden has identified but little more than 50 per cent. and attempts have now been made to increase this figure. The total nitrogen in casein is 15·6 per cent. divided as follows: Ammonia nitrogen 1·61, two-thirds histidine nitrogen 0·46, three-quarters arginine nitrogen 0·92, one-half tryptophane nitrogen 0·10, proline nitrogen 0·82, oxyproline nitrogen 0·03, amino-nitrogen 11·19, making in all 15·13 per cent.; much of the small deficit is probably to be assigned to tryptophane and oxyproline. It is now possible to account for 67·85 per cent. of the products of hydrolysis viz., alanine 1·5, valine 7·2, leucine 9·35, proline 6·7, phenylalanine 3·2, glutamic acid 15·55, aspartic acid 1·39, serine 0·5, tyrosine 4·5, oxyproline 0·23, histidine 2·5, arginine 3·81, lysine 5·95, tryptophane 1·5, diaminotrihydroxydodecanic acid 0·75, ammonia 1·61, sulphur 0·76, phosphorus 0·85. On the assumption that the amino acids are in polypeptide union the total of the casein accounted for is only 57·7 per cent. The undetermined residue has a mean nitrogen content of 13·1 per cent., which is much the same as that of the undetermined residues of some other proteins.
—E. F. A.

Gliadin [*in flour*]; *Some factors influencing the quantitative determination of* ——. J. E. Greaves. J. Biol. Chem., 1911, **9**, 271—293.

The possibility of the determination of gliadin in flours by means of the polarimeter has been systematically investigated. Fairly accurate results can be rapidly obtained, but they are less reliable than those obtained by the Kjeldahl method. Filtering through animal charcoal or clarifying with this substance decreases the concentration of solutions of the proteins of flour soluble in alcohol, but such solutions can be filtered satisfactorily through asbestos. Only 0·05 per cent. more protein nitrogen, soluble in alcohol, was extracted when 7·985 grms. of flour were shaken with 100 c.c. of alcohol than when twice as much flour was used; and the extraction of protein does not seem to be complete when more than 2 grms. of flour are used to 100 c.c. of 70 per cent. alcohol. The greatest amount of protein nitrogen is extracted from flour by 65 per cent. (by vol.) alcohol, the amount decreasing as the strength of the alcohol increases. However, 74 per cent. (by vol.) alcohol extracts more nearly pure gliadin than does alcohol of other strengths. Using 7·985 grms. of flour to 100 c.c. of alcohol it appears that 74 per cent. alcohol extracts as much gliadin as 70 per cent. alcohol. Hot extraction yields more protein nitrogen than cold but a good deal of non-gliadin protein is present. Heating the flour before extraction decreases the amount of protein extractable by alcohol, and the ratio of the percentage of nitrogen extracted to the polarimeter reading varies with the strength of the alcohol. In some flours the amount of nitrogen soluble in ether present, is sufficient to affect the accuracy of the direct determination of the gliadin by extraction. Temperature has but little influence on the rotation of alcoholic extracts of flour. A correction for the sugar present in the alcoholic extract is usually necessary.—E. F. A.

Sugars; Determination of —— in grain and cattle foods; a comparison of the alcohol and sodium carbonate digestion methods. A. H. Bryan, A. Given, and M. N. Straughn. U.S. Dept. Agric., Bur. Chem., Circular No. 71. April 19, 1911.

FOR the determination of the sugars in grain, plants (fresh and dried) and cattle foods, the aqueous extraction method, as applied to beetroot and similar products, cannot be used, on account of the presence of comparatively large amounts of starch, pentosans, gums, etc. From a long series of experiments on different methods of extraction, the authors have come to the conclusion that 50 per cent. alcohol, used hot, is the best solvent, and that the following is the most suitable procedure: 12 grms. of material are placed in a 300 c.c. flask, neutralised by calcium carbonate if acid, 150 c.c. of carefully neutralised 50 per cent. alcohol (by vol.) added, the flask shaken, and placed on a water-bath, a small funnel being inserted in the neck of the flask to condense the alcohol vapour. At the end of an hour the liquid is cooled, made up 300 c.c. with neutral 95 per cent. alcohol, mixed, and allowed to settle. 200 c.c. of the solution are transferred to a beaker, evaporated to 20—30 c.c. and washed into a 100 c.c. flask. Sufficient normal lead acetate is then added to produce a flocculent precipitate, the solution made up to the mark with distilled water, and passed through a folded filter. To the filtrate anhydrous sodium carbonate is added to precipitate all the lead, and after standing for 15 minutes, the mixture is again filtered. For the reducing sugars, 25 c.c. of the filtrate are diluted with an equal volume of water, and the Munson and Walker method (U.S. Dept. Agric., Bureau of Chem., Bull. 107 revised, p. 241; see also this J., 1906, 656) used. To obtain the total sugars, 50 c.c. of the same filtrate are placed in a 100 c.c. flask, neutralised with acetic acid, 5 c.c. of concentrated hydrochloric acid added, and the mixture allowed to stand overnight at the ordinary temperature. After neutralising with anhydrous sodium carbonate, it is made up to 100 c.c., filtered, and 50 c.c. used for the total sugars by the Munson and Walker method. So as to control the hydrolysis by acid, and determine whether the hydrolysis is confined only to the sugars, the invertase method recommended by Hudson (this J., 1910, 443) should be occasionally used. As to the volume of insoluble matter of the sample, a large number of determinations showed that 12 grms. of material occupy 9 c.c., so that the correction factor for 12 grms. in 300 c.c. is 0·97, and the percentage figures for the reducing sugars and the sucrose should be multiplied by this figure. Experiments were also made with an improvement of the cold aqueous method, using a small amount of sodium carbonate to inhibit enzyme action, and clarifying with alum or normal lead acetate solution. On comparing these two methods, using different grains (maize, wheat, and milo), mixed cattle foods (containing maize, cotton-seed meal and alfalfa), and also molasses cattle food, it was found that the cold aqueous method was subject to the following limitations: (1) trouble is often experienced on filtering the extract quickly after clarifying with alum, and during this time the enzymes again became active, too high results thus being obtained; (2) the acidity of the sample must always be determined, so as to regulate the amount of sodium carbonate to be added; and (3) alum does not completely clarify, and some mineral matter is occluded in the cuprous oxide precipitate. In consideration of these sources of error, the authors give preference to the hot alcoholic extraction method, which should always be used, except perhaps when a series of comparative results are to be obtained on a number of samples of the same material, and then the figures found should be controlled from time to time by those obtained by hot extraction with alcohol.—J. P. O.

Determination of aliphatic amino-groups. Application to study of proteolysis and proteolytic products. Van Slyke. *See* XXIII.

PATENTS.

Japanese soja [soya]; Preparation of albumin from ——. Deutsche Milchwerke (A. Sauer), Zwingenberg, Germany. Eng. Pat., 9478, April 18, 1911. Under Int. Conv., April 18, 1910.

THE finely ground soya is lixiviated several times with warm water and the milky extract, after separation by filtration and pressure, is coagulated by addition of suitable acids (lactic acid, etc.), or salts, or spontaneously by the action of enzymes extracted from the soya. The coagulated precipitate is dried and freed from fat or oil by extraction with a suitable solvent, the albumin being left as a white powder. When the product is to be administered to women to promote lactation, it is important that the enzymes present in the soya should not be destroyed, and no part of the process is carried out above 65°—70° C. Higher temperatures may be employed when the product is to serve only as a normal food.—J.H.L.

Milk; Manufacture of condensed ——. C. H. Campbell, New York. U.S. Pat. 992,705, May 16, 1911 (see also this J., 1907, 709).

THE milk is heated to a temperature below that at which the albumin coagulates and is concentrated at this temperature by contact with large volumes of air sufficiently rapidly to prevent souring; thereafter the mass is heated, with or without an addition of a small quantity of water, to a coagulating temperature and then rapidly cooled, with agitation. The cream may be removed from the milk and replaced before the material undergoes the second heating operation.—B. G. McL.

Treatment of liquids with ozone. Eng. Pat. 14,187. *See* XVIII.

XIXB.—WATER PURIFICATION; SANITATION.

Oxygen in air; A method for the accurate volumetric determination of the ——. H. E. Watson. Chem. Soc. Proc., 1911. 27, 135.

AN apparatus was described, in which about 50 c.c. of air are first measured at constant volume. The gas is then passed into a vessel containing phosphorus, which is warmed, and the residual gas finally reintroduced into the measuring vessel without removal from the apparatus. The accuracy of the method was discussed, and some preliminary results were given. These show that different analyses of the same sample usually agree to 2 parts in 10,000. A complete analysis can readily be performed in an hour and a half.

Action of carbon dioxide on Bordeaux mixtures. Gimingham. *See* XVI. *Fungicidal action of Bordeaux mixtures.* Barker and Gimingham. *See* XVI.

PATENTS.

Water and other liquids; Sterilisation of ——. V. Henri and A. Helbronner, Paris, and M. von. Recklinghausen, Bas Meudon, France. Eng. Pat. 12,949, May 27, 1910.

IN apparatus for the sterilisation of water by means of vapour electric lamps, in which the flow of water turns on the lamp, it takes some time before the full quantity of ultra-violet rays is emitted by the lamp; so that the water is not fully sterilised during this time. This invention consists in providing an electro-magnetic valve in circuit with the lamp for reducing the flow of water at the start until the lamp is in full operation. When the lamp is started, the electro-magnet is energised by the strong current, and the armature, which contains the valve, is attracted into such a position that the valve is slightly open. This has the effect of allowing the water to flow through the valve from a by-pass in the rubber seating which closes the main inlet pipe. As the current intensity falls, the armature is turned by a spring so that the valve is fully open. This has the effect of reducing the pressure outside the by-pass, so that the rubber seating closing the main inlet pipe is raised by the pressure in the main, and the water flows from the main to the pipe leading to the sterilising apparatus.—J. H. J.

Water supply systems; Destroying bacteria in ——. V. Henri and A. Helbronner, Paris, and M. von Recklinghausen, Bas Meudon, France. Eng. Pat. 14,605, June 16, 1910. Addition to Eng. Pat. 2424 of 1910.

In the principal patent the lamp, in a quartz container, was supported inside the chamber through which the water passed, but difficulty was found in working the lamp under pressures greater than that of the atmosphere. According to the present patent this difficulty is removed by having a quartz channel let into the side of the water chamber, the lamp being placed in the channel so that its rays pass through the quartz sides of the channel into the water passing through the chamber. Several forms of chamber suitable for the purpose are shown.—J. H. J.

Water; Purification and aeration of ——. D. Smith, Leeds. Eng. Pat. 29,965, Dec. 24, 1910.

A movable supply trough into which the impure water is fed, is fitted with a screen and an outlet meter and tap, together with vessels for holding sulphuric acid and lime water. As the screened water passes into a movable filter trough, measured amounts of the chemicals are added, and the mixture passes through several screens of straw, some of which contain "aerating material." Near the end of the trough and over it, a brush revolves under the perforated bottom of a box containing magnesia and a little sodium carbonate, and continuously adds these "aerating reagents" to the filtered water as it passes to the storage cistern.—J. H. J.

Water; Process for freeing —— from its contained iron. Deseniss und Jacobi Akt.-Ges. Ger. Pat. 234,253, March 23, 1910.

The process is similar in principle to that described in Eng. Pat. 12,246 of 1909 (this J., 1910, 107), but the air which separates in the closed chamber below the filter, instead of being returned to the latter, is used to operate the pump which delivers water and fresh air to the filter.—A. S.

Pasteurisation; Process and apparatus for ——. J. Wojik, Oberglogau, Germany. Eng. Pat. 26,064, Nov. 9, 1910.

The heating is effected by a mixture of compressed air and steam, so adjusted as to maintain a counter-pressure corresponding to that in the bottles or other vessels. Cooling and reduction of pressure are produced by compressed air carrying water-spray. The apparatus claimed for carrying out the process is characterised by the fact that the perforated inlet pipes in the heating vessel are disposed like ribs round the walls, and all supply channels are fitted with recoil valves.—J. H. L.

Cleansing fluid and sheep-dip. W. G. Little, East Grinstead. U.S. Pat. 992,220, May 16, 1911.

See Eng. Pat. 27,006 of 1909; this J., 1910, 780.—T. F. B.

Waste water; Apparatus for clearing and filtering ——. F. Schneider, Schwarzenberg, Germany. U.S. Pat. 992,811, May 23, 1911.

See Eng. Pat. 25,587 of 1909; this J., 1910, 689.—T. F. B.

Sterilisation of liquids by ultra-violet rays; Process and apparatus for the ——. V. Henri, A. Helbronner, and M. von Recklinghausen. Fr. Pat. 424,402, Dec. 28, 1910. Under Int. Conv., Dec. 29, 1909.

See Eng. Pat. 30,397 of 1909; this J., 1911, 151.—T. F. B.

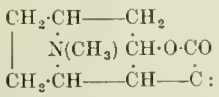
XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Morphine; Determination of small quantities of ——. R. Gottlieb and O. Steppuhn. Apoth.-Zeit., 1910, 1054, Pharm. J., 1911, 86, 711.

It has been pointed out by Rübsamen that morphine may be extracted from solutions of its salts by making just alkaline to phenolphthalein, and shaking repeatedly with large volumes of chloroform, afterwards distilling off the chloroform and determining the morphine in the residue by Gordin's method. Objections have been raised to the method, but good results can be obtained by proceeding as follows: The solution must be only just alkaline to phenolphthalein, and since the alkalinity is diminished by the extraction, more $N/10$ alkali is to be dropped in as required; instead of shaking with the chloroform, it is better to mix the two liquids in a beaker with a stirrer for ten minutes at a time, adding alkali as required; the chloroform should have been well stirred with pure water first, and about 600 c.c. should be used each time for extracting 200 c.c. of the aqueous liquid. After the ten minutes' stirring, the whole is transferred to a separator, the chloroform run off, and the operation repeated three or four times. The united chloroform solution is distilled, the last portion evaporated in a dish, and the morphine dried; a known excess of $N/10$ sulphuric acid is then added, and enough absolute alcohol to take all into solution, and the determination concluded by Gordin's method (this J., 1900, 784). A number of control determinations showed that about 90 per cent. of the morphine is obtained.

Dioscorine; Constitution of ——. K. Gorter. Rec. Trav. Chim. Pays-Bas, 1911, 30, 161—176. (See this J., 1910, 1329.)

Dioscorine methiodide (m. pt. 213° C.), was treated with silver hydroxide and the product distilled in a vacuum. Carbon dioxide was evolved towards 160° C., and *des*-methyldioscoridine, $C_{13}H_{21}N$, resulted. This substance is a liquid boiling at 116°—120° C. at 8 mm., with the sp. gr. 0·8987 at 26°/4° C., and $n_D = 1{\cdot}50525$ at 26° C., indicating the presence of three double linkages. When again methylated, treated with silver hydroxide, and the quarternary base distilled, trimethylamine and a hydrocarbon, $C_{11}H_{14}$, were formed. The latter was condensed with hydrobromic acid, then boiled with quinoline and oxidised with permanganate, when *o*-toluic acid was produced. From this it was concluded that the hydrocarbon was butenylcycloheptatriene. The constitution of dioscorine is therefore:—



When reduced by means of sodium amalgam, dioscorine yields a saturated base, $(C_{13}H_{20}NO_2)_2$, melting at 266°—267° C.—F. Shdn.

Belladonna and hyoscyamus extracts. P. W. Danckwortt. Arch. Pharm., 1911, 249, 247—253.

Comparisons have been made of alcoholic extracts of fresh and air-dried belladonna plants and leaves. Extracts of the air-dried material were made containing chlorophyll and also free from it. It has been found that the leaves contain less alkaloid than the whole plant. Percolation of the dry drug gives an extract stronger as to alkaloid than that prepared from the fresh plant according to the German Pharmacopœia (4th edition). The extract from the dried plant contains more alkaloid than that from the dried leaves, but the yield of extract from the latter is greater. The International Convention at Brussels in 1902, which dealt with potent medicaments prescribed 10 per cent. as the amount of water to be present in belladonna extract. This should be increased to 15 per cent. A stronger alkaloidal extract was obtained from hyoscyamus leaves when dry than from the fresh plant.—F. Shdn.

Indian hemp; Standardisation of preparations of ——. The value of the "iodine number." C. R. Marshall and J. H. Wigner. Report by the Therapeutic Committee of the British Medical Assoc. British Medical J.; through Pharm. J., 1911, **86**, 739—740.

In view of the disadvantages attaching to the usual physiological method of standardising preparations of Indian hemp (*Cannabis indica*), the authors examined the method recently suggested by Hooper (this J., 1908, 874, 1038). They found, however, (1) that a very active specimen of pure cannabinol gave a lower iodine number than similar but almost inert samples prepared from old charas; (2) that whilst the physiological activity of cannabinol is diminished considerably by oxidation, the iodine number is not affected to nearly so great an extent; and (3), that the higher-boiling terpenes from charas, which exhibit no characteristic cannabis effect physiologically, have approximately the same iodine number as that of active cannabinol. The determination of the iodine number cannot therefore be used as a substitute for physiological standardisation.—A. S.

Gentian tinctures prepared from unfermented gentian root with hot and cold alcohol; Composition of ——. M. Bridel. J. Pharm. Chim., 1911, **3**, 534—539.

In conjunction with Bourquelot, the author has shown that gentian root may be dried in the air, under cover, without any great loss of its hydrolysable constituents. Dried root containing 5·16 per cent. of gentiopicrin was thus obtained; had no loss of glucoside whatever taken place, it would have contained 6·447 per cent. The almost total disappearance of gentiopicrin from the commercial drug is due to the fermentation to which it is submitted previous to drying. It is now found that hydrolysis of the glucosides also occurs on macerating this unfermented dry root in cold 60 per cent. alcohol. Consequently, the tincture of gentian of the French Codex is practically devoid of gentiopicrin, even when made from unfermented root. Instead of macerating 1 part of the drug in 5 parts of 60 per cent. alcohol in the cold, for 10 days, as prescribed in the French Codex, the alcohol should be heated to boiling, and the powdered gentian added to it. The whole should be boiled under a reflux condenser for 20 minutes, then cooled and macerated according to the official directions. The tincture thus prepared will contain 1 per cent. of gentiopicrin, and will be stable. The optical deviation of the two tinctures alone is sufficient to indicate the profound change which has taken place in that prepared by cold maceration; this is —43′, in the official tincture of the French Codex, compared with −4° 7′ of the preparation made, from the same root, with boiling alcohol. This is due to the practically total hydrolysis of the gentiopicrin in the former tincture. In this, the original gentiopicrin is replaced by gentiogenin produced by hydrolysis. This crystallises out on the sides of the vessels containing the tincture, and may be identified by Tanret's reaction, viz., a particle when treated with 3 or 4 drops of pure sulphuric acid gives a brown colouration, which changes to blue on adding water, drop by drop.—J. O. B.

Mountain pine oil. E. Böcker and A. Hahn. J. prakt. Chem., 1911, **83**, 489—498.

The chief constituent of the oil of the mountain pine (*Pinus pumilio*), after the removal of the hydrocarbons is *l*-bornyl acetate. A quantity of the oil previously freed from terpenes and sesquiterpenes was fractionated and treated with sodium bisulphite. There was obtained from the fraction boiling at 148°—160° C. at 13 mm., an unsaturated aldehyde, $C_{15}H_{26}O$. The fraction boiling between 128° and 135° C. at 15 mm. yielded an unsaturated ketone, $C_{15}H_{24}O$. The two lowest fractions boiling between 85° and 105° C. at 13 mm. reacted readily with the bisulphite. An unsaturated, cyclic ketone, $C_8H_{14}O$, styled pumilone, was isolated from these two fractions, and amounted to 1—2 per cent. of the natural oil. It had the sp. gr. 0·9314 at 15° C., and 0·9288 at 20° C., $\alpha_D =$ —15°, $n_D = 1{\cdot}46459$, b. pt. 216°—217° C. at 754 mm. The odour was strong but not unpleasant, and probably gives the original oil its characteristic odour. The semicarbazone melts at 116°—117° C.—F. Shdn.

Camphor; Assay of ——. W. Lenz. Arch. Pharm., 1911, **249**, 286—298.

Comparison was made between four specimens of camphor, the official Japanese variety, synthetic camphor, raw camphor from German East Africa, and a sample prepared from the latter by distillation with steam. A determination of the melting-point is an excellent criterion of the purity of a sample. The optical rotation is not suitable for the valuation of camphor owing to the high optical activity of some of the impurities. Determination of the non-volatile matter is useful. Conversion into the oxime gives satisfactory results, the yield being 93 per cent. of the theoretical by using the following process: 5 grms. of camphor are dissolved in 50 c.c. of absolute alcohol in a flask fitted with a ground-in air-condenser. 5 grms. of hydroxylamine hydrochloride in 10 grms. of water, are added, then 8 grms. of sodium hydroxide (pure by alcohol) in 20 grms. of water, and the whole heated in a vigorously boiling water-bath for an hour. Next day 75 grms. of water are added, the mixture is heated and then acidified with hydrochloric acid. Afterwards the whole is made exactly neutral to litmus by sodium carbonate solution, and left for a night in an ice-chest. The crystals are filtered off, washed and dried. The filtrate and washings are shaken out with light petroleum to recover the dissolved oxime. The reaction with vanillin-hydrochloric acid can only be used to identify natural camphor. The solubility of camphor in 38 per cent. hydrochloric acid is very useful for determining the presence of impurities of commercial camphor. Natural camphor dissolved in ten times its weight of hydrochloric acid below 20° C. forms a clear cherry-red solution, the other varieties giving more or less turbid liquids.—F. Shdn.

Humulene from the oil of hop flowers. E. Deussen. J. prakt. Chem., 1911, **83**, 483—489.

The principal constituent of the humulene of the oil of hop flowers is practically pure α-caryophyllene. It is shown that humulene nitrosochloride and humulene nitrosite are identical with the corresponding derivatives of α-caryophyllene. Humulene nitrosite was obtained with a yield of about 10 per cent. from the oil, and after several crystallisations from light petroleum melted at 131° C. When crystallised from alcohol and chloroform it formed bluish quadratic tablets, melting at 113° C. As it is optically inactive, it cannot be identical with β-caryophyllene nitrosite, but is possibly a derivative of inactive α-caryophyllene.—F. Shdn.

Amidopyrine [pyramidone, dimethylaminoantipyrine]; Detection of impurities in ——. C. Kollo. Pharm. Post., 1911, 173. Pharm. J., 1911, **86**, 711.

Amidopyrine is prepared by reducing nitroso-antipyrine to amino-antipyrine, and alkylating this with methyl chloride or iodide; it is liable to contain alkali halides and unchanged antipyrine as impurities. Small quantities of the former cannot be detected satisfactorily by testing in the ordinary way with silver nitrate, since no precipitate nor turbidity may form at once if the amount of halide is small, and an opalescence, or more, forms after a few minutes even in the absence of halide. Very small quantities, however, can be detected with certainty by aid of Günzburg's reagent, consisting of a solution of one part each of phloroglucinol and vanillin in 500 parts by measure of ether. 15 to 20 drops of this solution are put into a porcelain dish, and the ether evaporated off; a small quantity of the amidopyrine is then ignited on a platinum wire, and the products of combustion brought into contact with the film of phloroglucinol and vanillin; a red ring or a red area appears on this if even a trace of halide be present. An alternative test which will also detect a trace, is to mix about 0·1 grm. of the amidopyrine with 0·2 grm. each of silver nitrate and pure copper nitrate, and heat the mixture to redness in a tube closed at one end; after cooling, 3 or 4 c.c. of dilute sulphuric acid are added, and a fragment or two of zinc. When all the silver is reduced —this requiring five to ten minutes—the liquid is filtered, and nitric acid and silver nitrate added to it; if halide be present, the silver salt is precipitated. The most delicate test for antipyrine is by means of *p*-dimethylaminobenzaldehyde; 1 grm. of this is dissolved in 5 c.c. of strong hydrochloric acid (sp. gr. 1·126), and 94 c.c. of absolute alcohol, and about 0·1 grm. of the amidopyrine is added to ten drops of this reagent and the solution evaporated on a water-bath in a porcelain capsule; a ring or patch of a fiery red colour shows antipyrine.

Arsanilic acid and its derivatives; Reduction of ——. *p, p′-Diaminoarsenobenzene.* P. Ehrlich and A. Bertheim. Ber., 1911, **44**, 1260—1269.

The formation of diaminoarsenobenzene can take place by the reduction of the corresponding arsenic oxide compounds by means of sodium amalgam or stannous chloride. It can also be produced by the reduction of the substituted arsinic acid by sodium hydrosulphite or stannous chloride in the presence of hydriodic acid as a catalyser. *p,p′*-Diaminoarsenobenzene, or *p*-arsenoaniline, $NH_2{\cdot}C_6H_4{\cdot}As:As{\cdot}C_6H_4{\cdot}NH_2$, melts at 260° C., and is a light-yellow microcrystalline powder. It is insoluble in water and aqueous alkalis, but soluble in cold acetic acid or pyridine. When treated with excess of dilute hydrochloric acid it dissolves, but addition of hydrochloric acid to this solution precipitates the hydrochloride. Dilute sulphuric acid added to any of its solutions causes a precipitate of the insoluble sulphate. Sodium hydrosulphite owing to its energetic reducing properties and also to the fact that the reduction products are insoluble, can be used as a reagent to detect substituted arsinic acids and arsenic oxides. It was found that the toxicity of *p*-aminophenylarsinic acid is very greatly increased by reduction, and it is mentioned that recognition of the much greater effect of trivalent arsenic against trypanosomata, etc., compared with quinquevalent arsenic, has led to the synthesis of dihydroxydiamino-arsenobenzene, $C_{12}H_{12}N_2O_2As_2$, which has proved of value in the treatment of a number of diseases (see next abstract.)—F. Shdn.

Salvarsan [dihydroxydiaminoarsenobenzene] with iodine solution; Titration of ——. G. O. Gaebel. Arch. Pharm., 1911, **249**, 241—247.

Theoretically, one equivalent of salvarsan ($C_{12}H_{12}N_2O_2As_2.2HCl+2H_2O$) in aqueous solution requires eight equivalents of iodine. The reaction between these two substances is reversible, and it has been found by trial that one equivalent of salvarsan requires 7·509 equivalents of iodine, or 1 c.c. of $N/10$ iodine is equivalent to 0·006326 grm. of salvarsan. In order to carry out the titration, a solution of salvarsan is made of about 0·2 to 0·8 per cent. strength. Such an amount of this is measured off as will contain 0·1 grm. of substance. This is titrated with $N/10$ iodine till there is a permanent colouration indicating excess of the latter. The amount of salvarsan present can be calculated, using the above factor, if the concentration of the substance is kept within these limits. Addition of excess of acid alters the conditions of equilibrium.—F. Shdn.

Diethylbarbituric acid (veronal); Identification of ——. A. Jorissen. J. Pharm. Chim., 1911, **3**. 478—481.

In order to identify veronal, about 3 grms. of potassium hydroxide are fused in a nickel crucible over a small flame. Whilst still melted, 0·3 grm. of veronal is added in small portions and the heating continued for two minutes. When cold, the mass is taken up with 10 c.c. of water. Half of this should give the Prussian blue reaction with ferrous sulphate. The remaining liquid is acidified with sulphuric acid, shaken with ether and the ethereal liquid evaporated. Oily drops are left, smelling of rancid butter, which when taken up with one c.c. of water and tested with dilute ferric chloride solution should give a wine-red colouration. When veronal is mixed with lime and ignited on platinum foil, it takes fire. If the flame be extinguished rapidly, a red mass is left behind.—F. Shdn.

Creosote and guaiacol carbonates; Identification of ——. A. Fernau. Z. Allgem. österr. Apoth.-Ver., 1911, **49**, 165.

For the isolation of creosote from creosote carbonate 10 grms. of the latter are dissolved in about 30 grms. of a $N/1$ solution of potassium hydroxide in absolute alcohol in a porcelain dish. The solution is evaporated till the weight is 15 grms., when the whole is acidified by the careful addition of dilute hydrochloric acid. The mixture is transferred to a graduated cylinder, diluted to 60 c.c., 5—10 grms. of salt are added, and the whole is shaken. The creosote floats to the top as an oil and its volume, which should be about 9 c.c., is read off. Guaiacol carbonate can be treated in the same way.—F. Shdn.

Ether; Accurate estimation of traces of water in ——. D. Tyrer. Chem. Soc. Proc., 1911, **27**, 142—143.

It is occasionally of importance to determine with accuracy the amount of water contained in a sample of "wet" ether. A method susceptible of a great degree of accuracy can be based on the fact that the addition of a little water to ether greatly increases its solvent power for some solutes. The most suitable substance which can be used as a solute is cadmium iodide. According to Eder (Dingl. Polytech. J., 1876, **221**, 189), cadmium iodide is soluble in "absolute" ether to the extent of 28 per cent. Using a very dry sample of ether, it was found by the author, however, that cadmium iodide is practically insoluble in ether. It is to be presumed that the high value obtained by Eder was due to the ether he used containing water and alcohol. In the following table is given the solubility of cadmium iodide at 12° C. in pure ether and in ether containing various quantities of water. The ether used was Kahlbaum's pure material, prepared from ethyl alcohol, and thoroughly dried by twice distilling over phosphoric oxide. The above results were read from a smoothed curve of experimental values. On inspecting the table it will be seen that an addition of 0·1 per cent. of water to dry ether increases the solubility of the cadmium iodide by about 0·64 unit. Now as the solubility can be determined with ease to within an error less than 0·01 unit, the percentage amount of water in the ether can be found to less than 0·001 unit. This method of analysis might be extended to the determination of traces of water in the alcohols, it being only necessary to find a suitable solute and to obtain a perfectly anhydrous alcohol.

Grams of water in 100 of ether.	Grams of CdI_2 per 100 of solvent.
0·0	0·143
0·10	0·78
0·30	2·07
0·50	3·36
0·70	4·77
0·90	6·46
1·00	7·30
1·10	8·27
1·14 (saturated)	8·68

Formic acid; Delicate reaction for ——. G. Denigès. Bull. Soc. Pharm. Bord., April, 1911, 151. Pharm. J., 1911, **86**, 773.

To 5 c.c. of a formic acid solution (1 or 2 drops of the acid in 5 c.c. of water), are added as many drops of a 1 : 5000 aqueous solution of Methylene Blue as c.c. of the formic acid solution taken; twice, or thrice this amount of blue liquid should be used with formic acid concentrations above 1 per cent. The mixture is boiled, and immediately afterwards as many drops of a solution of sodium bisulphite of 36° to 40° B. as c.c. were used of the formic acid solution (5 drops in this case), are added. On shaking, the blue colour rapidly disappears; the more formic acid present the quicker the disappearance of the colour. One milligram of formic acid per c.c. of solution may easily be detected in this way. One may, however, increase the delicacy of the test in the following way:—Into a test-tube, pour 5 c.c. of the liquid to be examined; into a second tube, 5 c.c. of distilled water; then into each tube introduce 5 drops of 1 : 10,000 Methylene Blue solution. The two tubes are placed in a boiling water-bath, and after two or three minutes, there is added to each tube, at the same moment, 5 drops of the sodium bisulphite solution. The tubes are again placed in the boiling water-bath for not longer than twenty to thirty seconds, and then examined. If the decolourisation is equal, the absence of formic acid may be assumed, or at least that the liquid examined contains less than 0·20 grm. of this acid per litre. On the other hand, if the liquid under examination contain formic acid, it will be completely decolourised. It is understood that the formic solution should be acid. By combining distillation in presence of phosphoric acid, and evaporation, formic acid may be identified in a liquid containing originally only a few milligrams per litre. The author proposes to adapt the reaction to the rapid estimation of formic acid.

Light; Chemical action of ——. G. Ciamician and P. Silber. Ber., 1911, 44, 1280—1289.

When a mixture of acetone and methyl alcohol is exposed to the light for 12 months or more, isopropyl alcohol is produced and, probably at the same time, formaldehyde. The latter must then condense with a further amount of the alcohol to form the ethyleneglycol, which is found in the mixture. Acetone and ethyl alcohol under similar conditions form trimethylethyleneglycol, isopropyl alcohol, a little diacetyl, and dimethylethyleneglycol. Acetone and isopropyl alcohol under the same circumstances condense to form the pinacone, $C_6H_{14}O_2$. Benzophenone in ethyl alcohol forms benzopinacone.—F. Shdn.

Export of peppermint oil and camphor oil from Japan in 1910. Perf. and Ess. Oil Rec., 1911, 2, 119. [T.R.]

According to the official trade returns of Japan, there was a decrease in the exports of peppermint oil from that country during 1910. Last year the total exports thereof amounted to 141,127 kin, valued at 464,485 yen, compared with 151,801 kin, valued at 466,657 yen in the preceding year. The Japanese exports of camphor oil last year were greatly in excess of those of the year 1909. In the latter year they amounted to 1,272,765 kin, and in 1910 to 1,686,861 kin, valued respectively at 220,319 yen and 309,990 yen.

Volumetric determinations with mercury compounds. Rosenthaler. *See* XXIII.

Patents.

Nitro-oxyarylarsinic acids; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 5595, March 6, 1911. Under Int. Conv., May 24, 1910.

3-Nitro-4-hydroxyaryl-1-arsinic acids are obtained by heating 3-nitro-4-aminoaryl-1-arsinic acids with caustic soda solution. For example, 10 kilos. of 3-nitro-4-aminophenyl-1-arsinic acid (obtained by nitrating the requisite oxalylaminophenylarsinic acid and eliminating the oxalic acid residue) are heated with 60 litres of caustic potash solution of 36° B., at 80° C., until the amino compound is entirely decomposed, as shown by diazotising a portion and combining with R-salt. When the solution thus obtained is diluted with water and saturated with hydrochloric acid, the nitrophenolarsinic acid separates as a yellowish-white powder, soluble in hot water and alcohol.
—T. F. B.

Medicinal composition; Method of producing a ——. H. Rieck, Irvington, N.J. U.S. Pat. 992,254, May 16, 1911.

A preparation for the treatment of diabetes is obtained by adding powdered charcoal to liquid zymase from yeast, which has been evaporated to a syrupy consistence, allowing the charcoal to take up the co-enzyme, adding "yeast containing healthy cells capable of development in the system," and evaporating the mixture to dryness and granulating the product.—T. F. B.

Carbon tetrachloride; Process of producing ——. W. F. Doerflinger, New York. U.S. Pat. 992,551, May 16, 1911.

A mixture of carbon tetrachloride and sulphur chloride is saturated with chlorine, carbon bisulphide is added in amount approximately equivalent to the amount of chlorine absorbed, and the mixture is passed over an extended surface of a suitable catalytic agent at a temperature below 45° C., to produce carbon tetrachloride; the product is then cooled, saturated with chlorine, and again caused to react with carbon bisulphide.—T. F. B.

Anhydrides of fatty acids, especially acetic anhydride; Process for preparing —— *from salts of fatty acids.* T. Goldschmidt. Second Addition, dated Dec. 29, 1910, to Fr. Pat. 407,046, Sept. 16, 1909. Under Int. Conv., Dec. 10, 1910.

The interaction of chlorine with an acetate and sulphur or a sulphide, as described in the principal patent (see Eng. Pat. 25,430 of 1908; this J., 1910, 112) and the first addition (this J., 1910, 592), can be carried out at temperatures up to 40° or 50° C., thus dispensing with artificial cooling.—T. F. B.

Fats; Process for preparing stable iodine or bromine compounds of —— *almost free from sulphur.* A. Voswinkel. Ger. Pat. 233,857, Sept. 5, 1909.

Oils or fats are converted into bromine or iodine derivatives by treating them with the halogen in presence of the sulphydrate of a chlorinated aldehyde. For example, chloral sulphydrate and iodine react according to the equation, $(C_2HCl_3O)_2H_2S+I_2=2HI+S+2C_2HCl_3O$. In this case it is well to use a solvent (such as alcohol) which will rapidly combine with the chloral.—T. F. B.

Tri-iodo derivatives of stearic acid; Process for preparing ——. E. Erdmann. Ger. Pat. 233,893, Jan. 18, 1910.

By treating linolenic acid, or the mixed fatty acids obtained by saponifying linseed oil, with three mols. of iodine monochloride, iodine monobromide, or hydriodic acid, tri-iodo derivatives of stearic acid are formed, which can be employed in medicine as the free acid or in the form of salts. The calcium salts contain from 41·5 to 55·9 per cent. of iodine.—T. F. B.

Copper salt [borocitrate]; Double ——. F. R. von Arlt. Fr. Pat. 423,974, Oct. 24, 1910. Under Int. Conv., Nov. 10, 1909.

See Eng. Pat. 24,240 of 1910; this J., 1911, 508.—T. F. B.

Fractionating ethers, alcohols, and other liquids. Fr. Pat. 424,476. *See* I.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Photographic paper. G. W. Leighton and C. S. Babcock, Chicago, U.S.A. Eng. Pat. 11,610, May 10, 1910. Under Int. Conv., May 10, 1909.

See Fr. Pat. 418,906 of 1910; this J., 1911, 109.—T. F. B.

Photo-engraving or photo-etching; Preparation of surfaces suitable for ——. A. Payne, Whitley Bay. U.S. Pat. 992,898, May 23, 1911.

See Eng. Pat. 28,415 of 1907; this J., 1909, 383.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Erosion of tubes by explosives; Experiments on —— in the United States. H. E. Yarnell. J. Amer. Soc. Naval Eng., May, 1910. Z. ges. Schiess- und Sprengstoffw., 1911, **6**, 193—194.

The nitrocellulose powders experimented with had nitrogen contents varying from 12·29 to 12·80 per cent. The amount of erosion of the metals is stated in grms. per kilo. of powder charge, and with gun steel the highest figure for erosion (41·23 grms.) was obtained when using a powder containing 12·8 per cent. of nitrogen, which developed a pressure of 18·76 tons per sq. inch. The lowest figure was 29·83 grms. when using a powder containing 12·34 per cent. of nitrogen, which developed a pressure of 19·85 tons per sq. inch. With nickel steel the highest figure for erosion was 41·53 grms., when a pressure of 18·8 tons per sq. inch was developed, using a powder containing 12·8 per cent. of nitrogen. The lowest figure was 28·43 grms. with a powder containing 12·34 per cent. of nitrogen, which developed a pressure of 19·12 tons per sq. inch. The author concludes that the lower the nitrogen content of the nitrocellulose the less the erosion, and that whilst the higher nitrogen content allows a lower weight of charge to be used, the erosion is so much greater that it counteracts the value of the improved ballistics. A gun-steel should be selected with the highest possible melting-point, and consequently it should have as low a carbon content as possible, and should not be alloyed with either nickel, manganese, or tungsten. The explosive used should give the lowest possible temperature of explosion consistent with good ballistics. Although cordite has a low charge weight and requires a lesser chamber capacity than a nitrocellulose powder, the increased temperature of explosion causes a very considerable increase in erosion. Suggestions are made as to the possibility of improving the gas-checks (*Liderungen*) in projectiles. As the author's experiments showed that the addition of water to the charge, in his experimental apparatus, very considerably reduced the erosion, he considers it might be possible to introduce into the chamber some arrangement for holding a liquid which would, on the explosion of the charge, very considerably reduce the erosion. The holder might in some way also be made to act as a gas-check. A slower burning powder might be employed so that a lower temperature is developed in the chamber, and maintained to a certain extent along the barrel. (See also this J., 1903, 920.)—G. W. McD.

Picric acid; The action of molten —— on different metals. J. Saposchnikow. Z. ges. Schiess- und Sprengstoffw., 1911, **6**, 183—185.

The author has investigated the action of molten picric acid (2 grms.) at 125° C., during a period of eight to nine hours on 1 grm. of various metals, in the form of filings or shavings. The percentage amounts of the metals dissolved by the picric acid were as follows: tin (nil), aluminium (4·88), iron (15·3), copper (17·54), nickel (18·62), zinc (20·46), lead (27·98). An alloy of copper (75 parts) and zinc (25 parts) lost 3·3 per cent. of copper and 2·7 per cent. of zinc, whilst an alloy of copper (80 parts) and nickel (20 parts) lost 1·6 per cent. of copper and 5·8 per cent. of nickel.—G. W. McD.

Explosives in coal mines.

The Home Secretary has had published "for official use" the text of the Explosives in Coal Mines Order of April 22 last, and which provides, among other things, that the explosive "fortex" shall be used only when contained in a case of paper thoroughly waterproofed with paraffin wax, and shall be used only with a detonator or electric detonator of not less strength than that known as No. 6 (*i.e.*, the detonator or electric detonator to be used shall possess an effective detonator strength as great as, or greater than, that of one containing 15 grains of a composition consisting in every 100 parts by weight of 80 parts of fulminate of mercury and 20 parts of chlorate of potassium). In the case of the explosive "kentite" it is provided that the strength of the detonator shall be not less than that known as No. 7 (*i.e.*, the detonator or electric detonator to be used shall possess an effective detonative strength as great as, or greater than, that of one containing 23 grains of a composition consisting in every 100 parts by weight of 80 parts of fulminate of mercury and 20 parts of chlorate of potassium).

Patents.

Explosive; Method of manufacture of a new ——. S. Salerno. Fr. Pat. 424,189, March 7, 1910.

A mixture of ammonium nitrate (30 parts), trinitrotoluene (10), trinitronaphthalene (2), strontium carbonate (3), potassium nitrate (12), manganese dioxide (4 parts), and traces of iron oxide. The salts are intimately mixed together, then added to a mixture of the organic compounds, and the whole heated in a vessel at about 150° C.; after cooling, the mass is broken up.—G. W. McD.

Phosphides of sulphur, rich in sulphur; Method of manufacture of —— suitable for the preparation of innocuous inflammable materials. Stahl und Nölke A.-G. für Zündwaarenfabrikation. Fr. Pat. 424.522, Dec. 30, 1910.

When red phosphorus (124 parts) is mixed with sulphur (98—100 parts) and heated to 330° C., in a current of carbon dioxide, a phosphorus sulphide, P_4S_3, is formed. On mixing this compound (220 parts) with sulphur (224 parts), and heating to the melting point, a compound, P_4S_{10}, is formed, which separates from its solution, in carbon bisulphide, in the form of yellowish-coloured plates. The crystals melt at 52° C., and at 128°—130° C., decompose into P_2S_5, which is insoluble in carbon bisulphide. A suitable match composition, containing this compound, is as follows:—gelatin (20 parts), zinc oxide (12), whiting (12), powdered glass (12), phosphorus polysulphide (16), and potassium chlorate (50 parts).
—G. W. McD.

Explosive. C. Wester, Helsingborg, Sweden. U.S. Pat. 993,211, May 23, 1911.

See Eng. Pat. 18,622 of 1909; this J., 1910, 721.—T. F. B.

Explosives. C. F. G. van Pittius. Fr. Pat. 424,555, Jan. 3, 1911. Under Int. Conv., Jan. 8, 1910.

See Eng. Pat. 555 of 1910; this J., 1911, 156.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Apparatus for maintenance of constant pressures above and below the atmospheric pressure. Application to fractional distillation. J. Wade and R. W. Merriman. Chem. Soc. Trans., 1911, **99**, 984—997.

The fundamental manostatic arrangement (see Fig. 1) consists of an air inlet passage, a', which is automatically left uncovered by the mercury of a manometer when the pressure falls below a certain limit. For pressures below that of the atmosphere, the apparatus is attached to V, F being left open. When the apparatus has been exhausted to a suitable extent, mercury is introduced at F till the negative pressure read in N′ (10 mm. bore) has the required value. The tube, a (2·5 mm. bore) is attached to one of the side tubes, n (the one next above the manometer reading required), the others being closed with suitable plugs. The tube, a, is drawn out at its lower end into a slender cone, a' (less than 1 mm. bore), with its apex truncated at an acute angle with the axis, which projects into the funnel-shaped enlargement of the tube, M (2 mm. bore). T is a tap for the removal of mercury. If the pressure in the attached apparatus becomes too low, the mercury will rise in N′ and therefore fall in M and if the opening, a' is exposed, air will rise in bubbles through a and increase the pressure, in the apparatus, causing the mercury in N′ to fall to the required value. For high pressures the working is the same except that the vessel is attached to F and V left open. The manometer reading is then a positive pressure to be added to that of the atmosphere. In applying the apparatus to fractional distillation, two large reservoirs (10 litres and 20 litres respectively) are placed in train, to increase the volume of the whole system so that local fluctuations due to irregular boiling, change of receiver, etc., shall not have an appreciable effect. For the production of pressures above atmospheric the authors have devised a mercurial air compressor (see Fig. 2) on the principle of the automatic Sprengel pump. Mercury flows from M through *m* (2 mm. bore) carrying with it air from A in the usual manner. The flow is controlled by the screw clamp, R. The air is driven out from C and the mercury passes by S and T′ to G, from which it is raised by the elevator, E (bore 2·8 ± 0·2 mm.), which acts like an inverted Sprengel pump worked by a water pump at M. The two pairs of forked tubes, F, are capable of slight oscillation so that the ascent of a cylinder of mercury from one pair is immediately followed by the rise of a bubble of air in the other. The rubber connections at various points of the apparatus greatly diminish the risk of fracture. The instrument is filled and adjusted by means of the reservoir, P, while the pressure at which the discharged air is delivered from C exceeds that of the atmosphere by the difference in level of the mercury columns, T and T′. The necessary apparatus for fractional distillation is shown in Fig. 3. The special flask, D, is required to support the fractionating column (which must not be clamped) and to provide for the necessary capillary air tube. To protect the sensitive thermometer from the effects of varying pressure it is placed in a closely fitting jacket (J) containing a little mercury, and held down by fairly stout platinum wire. The separating funnel for reduced pressures is shown at B and is comparatively simple, but for increased pressures the stop-cock, P, is useless. In this case the modification, S, is used in which the stopper is mounted on a stout glass rod passing through the sleeve, V, to which it is secured by a short length of caoutchouc tubing. The tubing acts as a spring and keeps the stopper normally withdrawn, but when it is pressed home at high pressures the compressed air keeps it in position. Thus any leakage is downwards and internal and therefore negligible.—W. H. P.

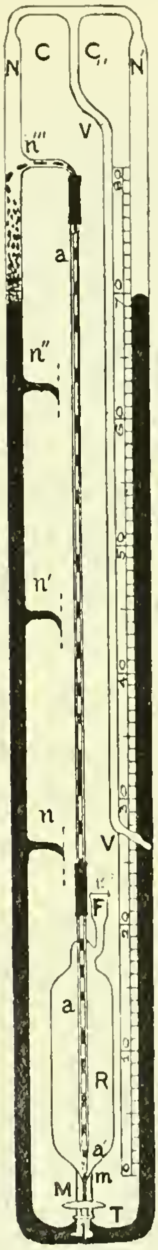


FIG. 1.

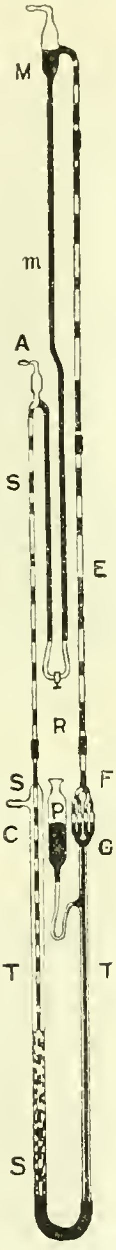


FIG. 2.

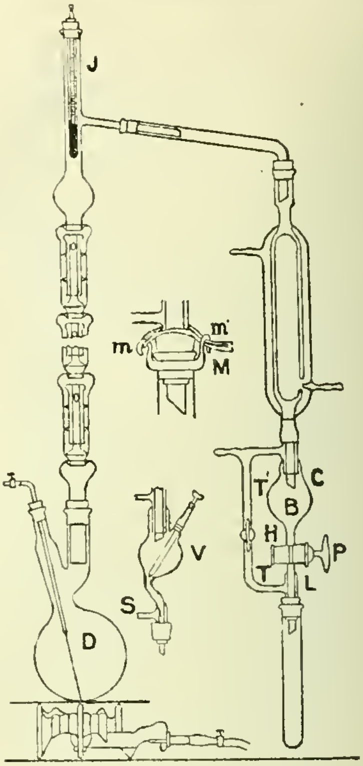


FIG. 3.

Interferometer; Some applications of the ——. R. L. von Klemperer. Chem.-Zeit., 1911, **35**, 557—558.

A SERIES of test experiments have been made by the author with Löwe's portable interferometer which is described. In this instrument, the passage of light from a collimator through two parallel slits gives rise to a series of interference bands; displacement of these bands is produced by interposing, in the path of the rays, two similar tubes, containing respectively air and the gas to be examined, and the amount of a given constituent (such as carbon dioxide), present in the latter, is indicated by the angle through which a plate of glass, acting as compensator in the path of one ray, must be turned in order to restore

the bands to their normal position. Experiments on the determination of carbon dioxide (0—20 per cent.) and of small quantities of hydrogen and methane in air (as in mines) showed the instrument to be suitable for these purposes, but it is pointed out that, in all cases, the standard gas for comparison should differ from the gas under examination only in the absence of the constituent to be determined; otherwise serious errors may be introduced. Chimney gases must not, for instance, be compared with air, and, moreover, in this case, the author places a tube containing lead peroxide between the flue and the instrument, so that any sulphur dioxide may be retained. The instrument, although accurate and portable, is not regarded as suitable for use in the permanent control of stoking operations, because it lacks any registering device. The presence of 1—2 per cent. of oxyhydrogen gas (*Knallgas*) in air is detected with ease by means of the interferometer, but, since the refractive index of such a mixture is less than that of air, the gas to be tested must in such case be introduced into the air tube, and *vice versa*.
—F. Sodn.

Mercury; Volumetric determination of —— by processes involving reduction to the metal. F. Reinthaler. Chem.-Zeit., 1911, **35**, 593—595.

The author points out that in the method of Rupp (this J., 1905, 752) it is necessary to avoid carefully any large excess of formaldehyde, which would affect the starch-iodine colouration in the final titration. An attempt to estimate the mercury by measuring the amount of formaldehyde used in the reduction of the mercury salt to the metal in alkaline solution was unsuccessful. Apparently metallic mercury has a catalytic effect on the reaction, $2CH_2O+NaOH=H{\cdot}COONa+CH_3OH$, which only goes very slowly in ordinary dilute solution. Müller's modification (this J., 1908, 77) of Rupp's method has the disadvantage that on long standing the mercury globules increase in size so considerably that it becomes difficult to dissolve them in the standard iodine solution. If this process is hastened by warming, the oxidation of potassium iodide by the oxygen of the air introduces an error of considerable magnitude. The method of Feit (this J., 1889, 571) in which the amount of arsenious oxide required for the reduction of the mercury is determined, is also open to some objection. On warming to effect the reduction, the sodium arsenite solution is oxidised slightly by the oxygen of the air. The author gives experimental results which show that a considerable error can thus be introduced. The method can be made exact by working in an indifferent atmosphere of carbon dioxide as follows. The mercuric chloride or nitrate solution is nearly neutralised by sodium hydroxide, and then treated with an excess of $N/10$ or $N/15$ sodium arsenite solution. Carbon dioxide is then passed while the flask is warmed on the water-bath and shaken. In 1—1½ hours the reduction is complete. After cooling the solution may be titrated, in the presence of the mercury (which being in large globules reacts very slowly indeed), with $N/10$ or $N/15$ iodine solution. By this method very accurate results are obtained, but if the directions are carefully followed, the method of Rupp is sufficiently accurate and much simpler and more rapid.—W. H. P.

Mercury compounds; Volumetric determinations with ——. L. Rosenthaler. Arch. Pharm., 1911, **249**, 253—259.

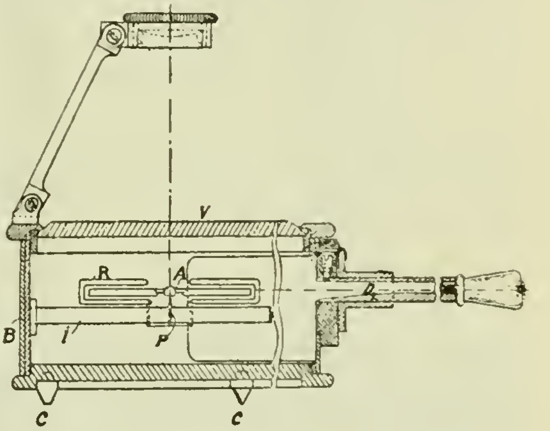
In order to make use of mercury solutions in volumetric work, $N/10$ mercuric nitrate solution is prepared either from the nitrate by adding sufficient nitric acid to prevent turbidity, or by dissolving the pure oxide in nitric acid. Excess of this solution is added to the liquid to be titrated, followed, after shaking, by 2 c.c. of a saturated solution of ferric ammonium sulphate. The mixture is decolourised by the addition of nitric acid (free from nitrous acid) and the excess of mercury titrated back by $N/10$ ammonium thiocyanate. The end-reaction can be made sharper by the addition of an alkali nitrate. The method can be applied to hydrocyanic acid (with or without benzaldehydecyanhydrin being present), cyanides, bromides and iodides (*e.g.*, ferrous iodide in *Sir. Ferri iodati*). It is not suitable for determining chlorides and the hydrocyanic acid in benzaldehydecyanhydrin.—F. Shdn.

Phosphoric acid; Determination of —— by Neumann's method. I. Bang. Biochem. Zeits., 1911, **32**, 443—444.

The following modification is recommended. The phosphoric acid is precipitated in the usual way as ammonium phosphomolybdate, and the precipitate, after washing, is treated with water and a measured quantity of $N/2$ potassium hydroxide until it is dissolved. 50 c.c. of formaldehyde solution which has been treated with 5 or 6 drops of phenolphthalein indicator and titrated until a faint red colouration is produced, are now added in order to convert the liberated ammonia into hexamethylenetetramine, and the excess of potassium hydroxide is titrated with $N/2$ acid.—A. S.

Radioactivity; Apparatus for measuring ——. B. Szilard. Chem.-Zeit., 1911, **35**, 539—540.

The magnetic needle, A (see Fig.), is mounted on the point, P, on the strip of amber, l, in the cylindrical vessel, B, whose bottom is removable. The thin strip of metal, R, is in conducting connection with the needle, and also with the removable wire, D, which serves to charge the needle. The cover, V, of the vessel is graduated in a circle. After adjusting the instrument so that the strip, R, which corresponds with zero graduation, is in the meridian, the sharp points, C, are pressed into the table, so that the instrument is stationary. The needle is then charged, the wire withdrawn, and the rate of discharge noted, when a standard radioactive material is in the cylinder. With this standard rate the rates for other materials may be compared. In the investigation of gases the bottom is replaced by a connection with an air-tight insulated vessel into which the gas can be passed. The gas does not enter the cylinder, but a discharging rod runs through the whole length of the vessel containing the gas to the needle system, being insulated from everything else.—W. H. P.

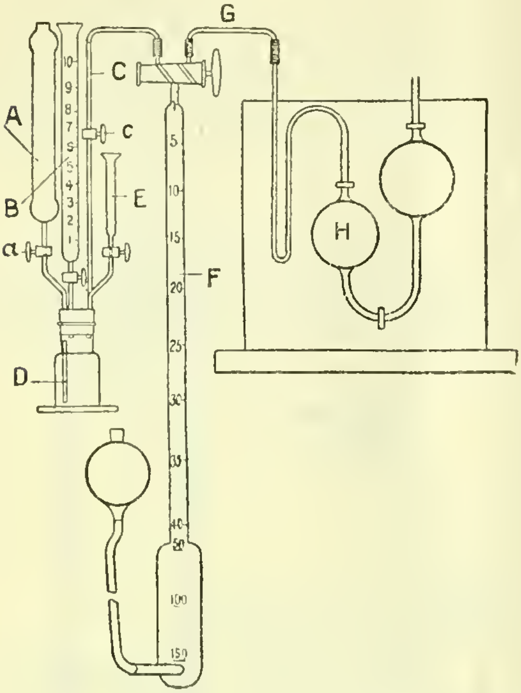


Liebermann's albumin reaction. W. A. van Ekenstein and J. J. Blanksma. Chem. Weekblad, 1911, **8**, 313—315. Chem. Zentr., 1911, **1**, 1559.

Only those proteins which contain a tryptophan and a hexose group give Liebermann's reaction (production of a dark blue colouration on boiling with hydrochloric acid). On heating with hydrochloric acid the hexose group is converted into ω-hydroxymethylfurfural and this gives the characteristic blue-violet colouration with tryptophan.
—A. S.

Aliphatic amino groups; Method for quantitative determination of ——. Applications to the study of proteolysis and proteolytic products. D. D. van Slyke. J. Biol. Chem. 1911, **9**, 185—204.

The method is based on the Sachs-Kormann reaction of aliphatic amino groups with nitrous acid, with liberation of nitrogen. All the air in the apparatus described is displaced by nitric oxide, and the amino solution is then introduced. Nitrogen mixed with nitric oxide is evolved, the latter is absorbed by alkaline permanganate (50 grms. of potassium permanganate and 25 grms. of potassium hydroxide per litre), and the pure nitrogen measured. The reaction is carried out in the bottle, D, (see Fig.) of 35—37 c.c. capacity, which is fitted with a four-hole rubber stopper held firmly in place by wire. All the tubing is capillary, of 6—7 mm. external and 1 mm. internal diameter. The cylinder, A, of 35 c.c. capacity, serves to hold water; the amino-acid solution is placed in the 10 c.c. burette, B. The tube, C, connects D with the gas burette. The cylinder, E, is used for amyl alcohol, 2 c.c. of which is added to prevent foaming in the analysis of viscous solutions. The operation is as follows: 28 c.c. of sodium nitrite solution and 7 c.c. of glacial acetic acid are placed in D and the stopper fastened in, cock *c*, being open. The air in D is completely displaced by letting in water from A: *c* is next closed, *a* left open, and D shaken to generate nitric oxide, which forces the solution back into A. The tap, *c*, is then opened and the nitric oxide is forced out of D by liquid from A, and with it any air which it has swept out of the solution. The operation is repeated and finally a gas space of about 20 c.c. is generated in D. The tap, *a*, is closed and the apparatus is joined to the burette, G and H being completely filled with permanganate solution and F with 1 per cent. sulphuric acid up to the top of the rubber connecting tube. These manipulations require about two minutes. The amino solution is now run in, and rapid evolution of nitrogen mixed with nitric oxide begins at once; after five minutes action is completed by thoroughly shaking D. The gas from D and C is then driven into F, and subsequently, by raising the levelling bulb, into H, where the nitric oxide is absorbed, the process taking about a minute. The nitrogen is returned to F, and measured, and the weight calculated. As the reaction gives double the amount of nitrogen present in the amino groups, the results are to be divided by two. Each milligram of amino nitrogen generates 1·7—1·9 c.c. of nitrogen gas. A correction of 0·16 c.c. is deducted from the nitrogen volume for the air dissolved in the 10 c.c. of amino solution.



The natural α-amino acids react quantitatively in five minutes at 20° C.; lysine, the only exception, requires 30 minutes. Ammonia and methylamine take about 2 hours; urea takes 8 hours. Proline and oxyproline do not react at all; tryptophane reacts with one-half, histidine with one-third, and arginine with one-fourth of their nitrogen. Amino-nitrogen bound in the —CO.NH— peptide linkage does not react. The method is applicable to measure the extent of proteolysis, it being possible to determine at any moment the ratio of the amino-nitrogen already set free to that freed by complete hydrolysis.
—E. F. A.

Liquid air; Use of —— in toxicology. E. Mameli. Estr. aus Boll. della Soc. Medico-Chirurgica di Pavia, 1910. Chem. Zentr., 1911, 1, 1614.

The author describes the advantages of liquid air as a medium for the preservation of specimens for toxicological examination. A special advantage is that materials which have been thus preserved are so hard that they can be powdered in a mortar.—A. S.

Analysis of mixtures of ceresin and paraffin wax. Chercheffsky. *See* IIa.

Titration of alkali carbonates in presence of bicarbonates or hydroxides. Tillmanns. *See* VII.

Detection of chlorides in bromides and iodides. Testa. *See* VII.

Determination of ozone by alkaline potassium iodide. Lechner. *See* VII.

Michaelis' boiling test for cement. Hentschel. *See* IX.

Determination of total carbon in iron alloys. Stadeler. *See* X.

Analysis of high-silicon iron-titanium alloys. Trautmann. *See* X.

Roasting of complex ores in assaying of gold. Hoare. *See* X.

Method of gold assay. Austin. *See* X.

Determining acid value of fats. Bödtker. *See* XII.

New method of examining turpentine oils. Klason. *See* XIII.

Technical testing of rubber and balloon fabrics. Martens. *See* XIV.

Polarimetric determination of sugars by Jolles' method. Bardach and Silberstein. *See* XVII.

Balling formula for the calculation of original gravity. Schönfeld. *See* XVIII.

Factors influencing the determination of gliadin [in flour]. Greaves. *See* XIXa.

Determination of sugars in grain and cattle goods. Bryan and others. *See* XIXa.

Volumetric determination of oxygen in air. Watson. *See* XIXb.

Determination of small quantities of morphine. Gottlieb and Steppuhn. *See* XX.

Standardisation of preparations of Indian hemp. Marshall and Wigner. *See* XX.

Assay of camphor. Lenz. *See* XX.

Detecting impurities in amidopyrine. Kollo. *See* XX.

Identification of diethylbarbituric acid (veronal). Jorissen. *See* XX.

Titration of salvarsan [dihydroxydiaminoarsenobenzene] with iodine solution. Gaebel. *See* XX.

Identification of creosote and guaiacol carbonates. Fernau. *See* XX.

Delicate reaction for formic acid. Denigès. *See* XX.

Determination of traces of water in ether. Tyrer. *See* XX.

PATENTS.

Gas, or gaseous mixture; Apparatus for automatically analysing a —— volumetrically, and recording the same. F. K. Woodroffe, Newton, Cheshire. Eng. Pat. 11,521, May 10, 1910.

In an apparatus for the continuous determination of carbon dioxide in flue gases, claim is made for the combination of an outer vessel adapted to receive and contain successive charges of water; a gas-measuring vessel disposed within the outer vessel; and a gas-venting conduit adjustable vertically in relation to, and within, the gas-measuring chamber. Means are provided at the lower end of the conduit for preventing sealing of the same within the measuring chamber.—W. E. F. P.

XXIV.—MISCELLANEOUS ABSTRACTS.

Copper oxide; Catalytic action of ——. [Flameless combustion]. J. Strachan. Chem. News, 1911, **103**, 241—242.

In the Barthel spirit Bunsen burner, a mixture of alcohol vapour, and air impinges against a disc of brass wire gauze and is burnt in the tube above the gauze. When the copper of this wire gauze has become partially oxidised after protracted use, the catalytic action of the copper oxide may be observed by extinguishing the flame and allowing the mixture of alcohol and air to impinge on the hot gauze. The latter then glows as the result of a flameless combustion of the alcohol vapour, induced by the alternate reduction and oxidation of the copper oxide; combustion is incomplete and a powerful odour of aldehyde is soon perceived. This combustion may be restarted at a relatively low temperature by shutting off the supply of alcohol vapour for a few seconds and allowing the gauze to cool. By means of asbestos impregnated with finely divided copper oxide, a similar experiment may be carried out with a gas Bunsen burner, and if the proportions of gas and air be correctly adjusted, the mixture may be ignited. The author thinks that under certain circumstances cellulose may be oxidised by the presence in paper of specks of oxidised metallic copper (so-called "dendritic growths"). Catalytic properties analogous to those described above are also recognised in the case of other oxides, *e.g.* iron oxide, and it is possible that such an action may prove dangerous in the case of miners' lamps, the gauze of which may have become rusty.—J. F. B.

Water; Rays which decompose ——, and the extreme ultra-violet spectrum of the mercury arc. A. Tian. Comptes rend., 1911, **152**, 1483—1485 (see this J., 1911, 25, 540).

The author has investigated the formation of hydrogen and hydrogen peroxide by the action of the light from a mercury vapour quartz lamp on water, and finds that the coefficient of absorption in water of the part of the light which effects this action, is a constant. Hence, this part of the light must consist of a single ray, or of a group of rays of nearly equal wave-lengths. The curve of absorption of light in water shows that these rays must have wave-lengths of about 1850 Ångström units (1 Ångström unit = 1×10^{-7} mm.). In confirmation of this, the author finds that the mercury spectrum contains a group of rays of wave-lengths, 1846, 1848 and 1851 Ångström units. This spectrum also contains rays of wave-lengths, 1941, 1971, and 2000 units. In view of the wide interval separating this group from the former, and the considerable variation of the coefficient of absorption in water, in this part of the spectrum, it is concluded that the decomposition of water is effected by the former group only, at least under the conditions of the experiments (a stratum of air 5—6 cm. thick, and a plate of quartz 1 mm. thick, separated the light from the water). This view is borne out by the fact that no rays of shorter wave-length than 1846 Ångström units were found in the mercury spectrum, though the absence of such rays was not absolutely proved. The light emitted by the spark discharge between aluminium electrodes, which contains rays of wave-lengths, 1854, 1857·5, and 1862 Ångström units, also decomposes water with the formation of hydrogen and hydrogen peroxide.—L. E.

Atmosphere; Some mineral constituents of a dusty ——. W. N. Hartley. Proc. Royal Soc., 1911, **85**, A., 271—275.

Spark spectra were photographed, with varying exposures, on one plate; the electrodes being cadmium, iron, nickel and copper; also a self-induction coil being interposed to eliminate the air spectrum and the short metallic lines. Similar photographs were made of spectra taken in an atmosphere of hydrogen, and a comparison of the series showed which lines were due to impurities in the electrodes, which to dust in the atmosphere. The chief of these differences proved to be due to the presence of calcium and copper, whose lines increased in strength as the air became more dusty day by day, during the continuance of a spell of fine weather. Copper has been proved to be a constituent of coal-ashes, of the flue-dust from gas- and chemical works, of soot, of dust from clouds in hail, snow and sleet. The repeated flashes from overhead cables provide a further source of copper in aërial dust. The traffic of tram and motor cars augments the amount of calcium which would otherwise be present. An attempt to determine the quantities of calcium and copper in normal atmosphere shows that these mineral constituents must be regarded as possible reagents in cases where there is evidence that very minute quantities of basic substances can initiate chemical reactions and isodynamic changes such as have generally been regarded as spontaneous; and in all cases where a solution in contact with air is liable to be affected.—R. C. P.

Books Received.

Edible Fats and Oils. Their Composition, Manufacture, and Analysis. By W. H. Simmons, B.Sc., and C. A. Mitchell, B.A. Scott, Greenwood and Son, 8, Broadway, Ludgate, London, E.C. 1911. Price 7s. 6d. net.

8vo volume, containing 143 pages of subject-matter, and an alphabetical index. The classification of the text is as follows :—I. Introduction. Fat as food. Physiological considerations. Constitution of fats and oils. II. Raw materials used in the manufacture of edible fats and oils. III. Refining, bleaching, and deodorising fats and oils. IV. Butter. V. Lard. VI. Margarine and other butter substitutes. VII. Salad oils. VIII. Analysis of raw materials and finished products. IX. Statistics of the trade in edible oils.

Yarn and Warp Sizing in all its Branches. By Carl Kretschmar, with the assistance of reliable collaborators. Translated from the German by Charles Salter. Scott, Greenwood and Son, 8, Broadway, Ludgate, London, E.C. 1911. Price 10s. 6d.

Large 8vo volume, containing 178 pages of subject-matter, with 122 illustrations, and an alphabetical index of subjects. The subject-matter is arranged as follows :—I. The materials to be sized :—Cotton. Linen or flax. Ramie and jute. Wool. II. Materials used in sizing. III. The sized material. IV. The sizing process. V. Sizing recipes for different effects. VI. Combined dyeing and sizing. VII. The purchase and testing of sizing ingredients.

Dressings and Finishings for Textile Fabrics, and their Application. Description of all the materials used in dressing textiles; their special properties; the preparation of dressings and their employment in finishing linen, cotton, woollen, and silk fabrics; fireproof and waterproof dressings, together with the principal machinery employed. By Friedrich Polleyn. Translated from the 3rd German Edition by Charles Salter. Scott, Greenwood and Son. 8, Broadway, Ludgate, London, E.C. 1911. Price 7s. 6d.

Demy 8vo volume containing 280 pages of subject-matter, with 60 illustrations, and an alphabetical index. The subject-matter is arranged according to the following scheme of classification :—I. The dressing process and materials for the same. II. Stiffenings and glazes. III. Adhesive dressings. IV. Material for soft dressings. V. Dressings for filling and loading. VI. Antiseptic dressing ingredients. VII. Dyeing and blueing agents. VIII. Various dressings. IX. Various adjuncts to dressing preparations. X. and XI. Appliances for the preparation of dressings. XII. Recipes for dressings. XIII. Dressings for linen. XIV. Yarn dressings. XV. Laundry glazes. XVI. Yarn sizing. XVII. Finishing woollen goods. XVIII. Finishing silk fabrics. XIX. Waterproof dressings. XX. Fireproof dressings. XXI. Special finishing processes. XXII. Application of dressing preparations.

Die Schwelteere. Ihre Gewinnung und Verarbeitung. Von Dr. W. Scheithauer. Otto Spamer's Verlag. Leipzig. 1911. Price M. 8.75.

8vo volume, containing 185 pages of subject matter, with 70 illustrations, and alphabetical indexes of authors and subjects. The subject-matter is classified as follows :—I. History of the industry of tar from destructive distillation at low temperatures. II. Bituminous raw materials. III. Recovery or production of low temperature tars (Schwelteere). IV. The tar and other products. V. Distillation of low temperature tars and tar oils. VI. Chemical treatment of low temperature tar and its distillates. Working up the by-products. VII. Paraffin manufacture. VIII. The low temperature tars and oils, etc. IX. Candle manufacture. X. Chemical composition of low temperature tars and their distillates. XI. The laboratory work. XII. Statistics.

Untersuchung und Nachweis organischer Farbstoffe auf spectroscopischem Wege. Von Jaroslav Formánek, unter Mitwirkung von Eugen Grandmougin. Zweite, vollständig umgearbeitete und vermehrte Auflage. Zweiter Theil. 1. Lieferung. Verlag von Julius Springer. Berlin. 1911. Price M. 10.

8vo volume of 164 pages, with three illustrations, and six lithographic plates, being the second part and first issue of the second edition of this work.

Bulletin of the Imperial Institute. Vol. IX. No. 1. Price 1s.

This issue of the Bulletin contains the results of investigations in connection with Ceará rubber from several Colonies, turpentine oil from India, rosin from India, flax from the East Africa Protectorate, cotton from the Cape Province of South Africa, and grape fruit from the East Africa Protectorate; also notices respecting the cultivation, production, etc. of castor seed, utilisation of Pará rubber seed, guano deposits of Assumption Island (Seychelles), preparation of calcium cyanamide and its uses as a fertiliser, etc.

Francesco Selmi e la sua Opera Scientifica. Reale Accademia della Scienze di Torino. Vincenzo Bona, Turin, 1911.

Large 4to volume of 272 pages, containing an account of the work of Selmi during the years 1840—1881. It is subdivided into the following chapters: 1. Biography. 2. Researches on physical chemistry. 3. Pseudo-solutions or colloidal solutions. Prussian blue, sulphur, silver chloride, and casein. 4. Researches on inorganic chemistry. 5. Researches on organic chemistry. 6. Contact or catalytic action. 7. Researches on biological chemistry. 8. Researches on toxicological and legal chemistry. 9. Chemistry applied to agriculture, industry, pharmacy, etc. 10. Miscellaneous researches. 11. Published works, translations, etc. 12. Letters. 13. Bibliography.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

Patent Specifications may be purchased at the Sale Branch of the Patent Office, Quality Court, Chancery Lane, London, W.C., fifteen days after the date on which acceptance of the complete specification is advertised. The price is 8d. each.

I.—GENERAL PLANT; MACHINERY.

Applications.

12,857. Ely and Masters. Evaporating and by-product recovering plant. May 29.

13,005. Piccard. Evaporation boilers. [Ger. Appl. June 10, 1910.]* May 30.

13,052. Fawcett, Ltd., and Bottomley. Fluid-tight joints for rotary kilns, furnaces, driers, etc. May 31.

13,127. Govan. High temperature furnace. June 1.

13,164. Liversedge and Dividson. Apparatus for washing gases, applicable also for distilling. June 1.

13,245. Broadbent and Sons, Ltd., and Broadbent. Hydro-extractors and like centrifugal machines. June 2.

13,342. Humphrey and Rusdell. Raising or forcing liquids. June 2.

13,512. Müntzing. Separating solid matter in suspension in a liquid which is under pressure in a closed vessel. [Appl. in Sweden. June 9, 1910.]* June 6.

13,613. Derriman (Siemens und Halske A.-G.) Production of dry heated air. June 7.

13,720. Rudolphs and Thisell. Effecting reactions between solids and gases or gas mixtures, and furnaces therefor. June 8.

13,737. Mazza. Separation of the elements of gaseous mixtures. [Belg. Appl., June 8, 1910.]* June 8.

Complete Specifications Accepted.

10,147 (1910). Macfarlane. Centrifugal drying machines. June 8.

13,470 (1910). Glass and Glass. Drying apparatus for liquid and pasty substances. June 14.

13,506 (1910). Seitz. Filtering and production of filtering media. June 8.

14,638 (1910). Vorraber. *See under* VII.

21,472 (1910). Weiss. Drier. June 8.

23,262 (1910). Wurth. Drying devices particularly for drying high furnace blast. June 14.

1628 (1911). Schou. Apparatus for absorbing gases or vapours. June 14.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

12,993. Epstein. Fuel and arrangements therefor. May 30.

13,021. British Thomson-Houston Co. (General Electric Co.). Electric conductors suitable for incandescing bodies for lamps, furnaces, etc. May 30.

13,093. Von Kerpely. Gasification of fine or pulverulent fuel. [Austrian Appl., June 1, 1910.]* May 31.

13,124. British Thomson-Houston Co. (General Electric Co.). Arc lamp electrodes. May 31.

13,125. Clarke and Campbell. Plant for the destructive distillation of coal. May 31.

13,169. Bruno. Manufacture of incandescent gas mantles. [Ger. Appl., June 4, 1910.]* June 1.

13,319. Leech. Vertical retort settings. June 2.

13,383. Gouthière et Cie., and Ducancel. Recovery of sulphur from gas purifying materials. [Fr. Appl., June 7, 1910.]* June 3.

13,424. Keeble and Keeble. Gas manufacture. June 3.

13,525. Richardson. Manufacture of filaments for electric incandescent lamps. June 6.

13,615. Richardson. Manufacture of filaments for electric incandescent lamps.* June 7.

13,691 and 13,692. Binz (Allgem. Feuertechnische Ges.). *See under* XXIII.

13,817. Gebr. Siemens und Co. Electric arc-lamp electrodes. [Ger. Appl., June 29, 1910.]* June 9.

Complete Specifications Accepted.

13,054 (1910). Grice's Gas Engine Co., and Purser. Suction gas producers using bituminous fuel. June 8.

17,732 (1910). Jones. Coke oven. June 8.

19,653 (1910). Hall-Brown. Gas producers of the rising-grate type. June 14.

21,157 (1910). Gilbert Arc Lamp Co., and Dowdell. Electrodes for arc lamps. June 14.

22,834 (1910). Zimmer and Forwood. Manufacture of fuel briquettes. June 14.

132 (1911). Ludecke, and Imperial Lamp Works, Ltd. Manufacture of metal filaments for electric lamps. June 8.

595 (1911). Schweiz Flussigas Fabr. L. Wolf A.-G. Manufacture of liquid illuminating gas. June 14.

5667 (1911). Fabry. *See under* VII.

III.—TAR AND TAR PRODUCTS.

Applications.

12,866. Higgins and Hablett. Volatile hydrocarbon. May 29.

13,777. Liversedge. Separation of water from mixtures of tar and water. June 9.

13,861. Silberrad. Production of relatively non-volatile liquid nitration products from coal tar. June 10.

IV.—COLOURING MATTERS AND DYES.

Applications.

13,076. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters and production of shades on the fibre. May 31.

13,277. Cann. Synthesis of haemachromogen and hematin. June 2.

13,304. Act.-Ges. f. Anilinfabr. Manufacture of monoazo dyestuffs for wool. [Ger. Appl., March 3, 1911.]* June 2.

13,550. Meister, Lucius, und Brüning. Manufacture of vat dyestuffs. [Addition to No. 16,584 of 1907. Ger. Appl., June 9, 1910.]* June 6.

13,618. Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of vat dyestuffs of the anthracene series.* June 7.

13,619. Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of a monoazo colouring matter suitable for preparing pigment colours.* June 7.

Complete Specifications Accepted.

15,268 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of anthracene dyestuffs. June 14.

19,487 (1910). Newton (Bayer und Co.). Manufacture of trisazo dyestuffs. June 14.

20,334 (1910). Bayer und Co. Manufacture of azo dyestuffs. June 14.

24,690 (1910). Meister, Lucius, und Brüning. Isolation of alkali salts of indoxyl or its derivatives. June 14.

24,820 (1910). Meister, Lucius, und Brüning. Manufacture of indigo. June 8.

27,637 (1910). Meister, Lucius, und Brüning. Manufacture of alizarin red vat dyestuffs. June 8.

3980 (1911). Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of phenylglycine salts. June 14.

8305 (1911). Durand, Huguenin, und Co. Manufacture of leuco-dyestuffs of the gallocyanine series. June 14.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

12,794. Colburn, Bywater, and Thompson. Machines for treating or cleaning wool, etc. May 29.

13,088. Lumpp. Preventing the liability of wool to shrink.* May 31.

13,340. Mayo. Extraction of grease and similar matter from wool, skins, textiles, etc. June 2.

Complete Specifications Accepted.

13,753 (1910). Wedgwood. Apparatus for testing the tensile strength of paper, fabrics, etc. June 8.

18,189 (1910). Eichengrün. Production of celluloid-like masses. June 8.

1436 (1911). Soc. Anon. Fabr. Soie de Chardonnet. Treatment of solutions of cellulose. June 8.

3139 (1911). Wohl. Solutions of cellulose esters and their preparation. June 14.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Applications.

12,877. Newton (Bayer und Co.). Production of brown shades on wool. May 29.

13,076. Johnson (Badische Anilin und Soda Fabrik). *See under* IV.

13,426. Moyes. Production of decorative effects on cotton cloth. June 6.

Complete Specifications Accepted.

16,389 (1910). Calico Printers' Assoc., and Bentz. Production of resist effects in printing on textile fabrics. June 8.

22,876 (1910). Ransford (Cassella und Co.). Method of dry dyeing. June 14.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Applications.

13,081. Threlfall. Dehydration of hydrolytic chlorides.* May 31.

13,187. Pietzsch and Adolph. Vessels for making and storing hydrogen peroxide. [Ger. Appl., June 3, 1910.]* June 1.

13,260. Spence, Craig, and Spence and Sons, Ltd. Titanium salts and their production. June 2.

13,297. Pictet. Manufacture of pure hydrogen. [Ger. Appl., June 4, 1910.]* June 3.

13,636. Ashcroft. Decomposition of salts of alkali metals, and manufacture of amides, cyanamides, cyanides, hydrates, and other compounds and alkali metals therefrom. June 7.

13,643. Weston. Evaporation of brine for the manufacture of salt. [Divided Appl. on 8706 of 1911, April 7.] June 7.

13,878. Ramsay, Phillips, and Bulteel. Method of obtaining oxides of nitrogen. June 10.

Complete Specifications Accepted.

5657 (1910). Price. Manufacture of ammonium nitrate and compounding it with other salts for agricultural purposes. June 14.

13,415 (1910). Salt Union, Ltd., Malcolm, and Munton. Treatment of brine. June 8.

13,600 and 27,867 (1910). Barton. Manufacture of lead oxide. June 8.

14,638 (1910). Vorraber. Machine for the dust-free drying and grinding of ammonium sulphate. June 14.

16,693 (1910). Harger. Preparation of oxygen. June 14.

21,563 (1910). Bessler, Waechter, and Co., and Rouse. Soluble ferrated alkali silicate by addition of borax. June 8.

27,463 (1910). Pictet. Separation of nitrogen and oxygen in air. June 8.

29,165 (1910). Dubosc and Denis. Manufacture of formates. June 14.

5577 (1911). Wahnschaff and Savelsberg. Obtaining zinc oxide from materials containing zinc or zinc oxide. June 8.

5667 (1911). Fabry. Recovery of ammonium sulphate direct from coke oven or retort gas. June 8.

10,522 (1911). Meister, Lucius, und Brüning. Manufacture of pure nitric oxide and nitrogen peroxide. June 14.

VIII.—GLASS ; CERAMICS.

Applications.

13,697. Hassall and Mellor. Preparation of clay for use in the "semi-plastic" or "damped dust" process of manufacture. June 8.

13,734. Richardson. Manufacture of glass.* June 8.

Complete Specification Accepted.

14,206 (1910). Gregory. Furnaces for heating glass. June 14.

IX.—BUILDING MATERIALS.

Applications.

12,800. Galloway (Cohoe). Treatment of wood to preserve and fireproof it. May 29.

13,474. Abbott. Staining or colouring wood. June 6.

Complete Specification Accepted.

2347 (1911). Jochum. Method of cooling hot cement clinkers by liquids or gases. June 14.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

13,177. Stobie and Davenport. Electric metallurgical furnaces. June 1.

13,188. Baraduc-Muller. Treatment of melted metals, alloys, and steels. [Addition to No. 30,198 of 1910.]* June 1.

13,208. Murex Magnetic Co., and Lockwood. Treatment of ores. June 1.

13,228. Rousseau. Crucibles for smelting furnaces. [Divided Appl. on 4171 of 1911. Feb. 18.]* June 1.

13,478. Kohlhaas. Treatment of manganese-steel. [Ger. Appl., Feb. 17, 1911.]* June 6.

13,483. Vigneault and Hebert. Magnetic compound.* June 6.

13,499. Mackay. Extraction of metals from their ores. June 6.

13,603. Gutensohn. Recovery of metal from ore. June 7.

13,621. Gitsham. Recovery of gold and silver from ores.* June 7.

13,678. Cothias. Furnace for melting aluminium alloys or other metals or alloys. [Fr. Appl., June 23, 1910.]* June 8.

13,748. Thomas, Paull, and Bartle. Roasting arsenical and sulphurous ores containing tin, tungsten, copper, and other metals. June 9.

13,808. Rodeck. Electrodeposition of metals. [Austrian Appl., June 10, 1910.]* June 9.

Complete Applications Accepted.

13,304 (1910). Queneau. Casting metals of high melting point. June 8.

13,488 (1910). Island. Extraction of precious metals from ores. June 8.

14,192 (1910). Brooke and Mackintosh. Alloys. June 14.

20,634 (1910). Specialfabr. f. Aluminium-Spulen u. Leitungen. Securing oxide or salt insulating films on coils especially of aluminium and its alloys. June 14.

30,222 (1910). Naulty and Scanlin. Alloy. June 8.

30,287 (1910). Tooth. Crucible and melting-pot furnaces. June 14.

3078 (1911). Dor-Delattre. Separating useful from waste products in residues from zinc and other manufactures. June 8.

XI.—ELECTRO-CHEMISTRY.

Applications.

13,021. British Thomson-Houston Co. (General Electric Co.). *See under* II.

13,335. Elektrochem. Werke, and Rothe. Production of disc-like flame arcs for carrying out gas reactions. [Ger. Appl., July 8, 1910.]* June 2.

13,403. Bradbury. Electric resistance furnaces. June 3.

13,731. Soc. Anon. Electrométallurgique. Supplying furnaces with triphase currents. [Fr. Appl., June 9, 1910.]* June 8.

13,782. Pape. Manufacture of accumulator electrodes. June 9.

Complete Specifications Accepted.

15,139 (1910). Hering. Electric furnaces. June 8.

28,834 (1910). Rasmussen. Composition for use in electric insulating, etc. June 8.

3251 (1911). Pauling. Electric furnace for treating gases. June 14.

XII.—FATS; OILS; WAXES.

Applications.

13,094. Conway, Baron von Girsewald. *See under* XV.

13,519. Markel, and Crosfield and Sons, Ltd. Manufacture of oxy-fatty acids and their glycerides. June 6.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

13,527. Newton (Bayer und Co.). Manufacture of colouring-matter lakes. June 6.

13,530. Pigments, Ltd., and Thompson. Manufacture of pigments. June 6.

Complete Specifications Accepted.

13,600 and 27,867 (1910). Barton. *See under* VII.

17,796 (1910). Cline. Manufacture of anti-oxidising paints. June 14.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

13,009. Schopper. Apparatus for testing the elasticity of rubber, etc. May 30.

13,063. Pointon and Pointon. Preparation of rubber for industrial porposes. May 31.

13,823 and 13,824. Ingrams. Curing india-rubber. June 9.

Complete Specifications Accepted.

17,734 (1910). Bayer und Co. Manufacture of a caoutchouc substance. June 14.

25,087 (1910). Reynaud. Manufacture of india-rubber. June 8.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

12,887. Schimmel. Finishing or drying glue and the like. [Ger. Appl., May 31, 1910.]* May 29.

12,991. Lipman. Production of a substitute for leather.* May 30.

13,094. Conway, Baron von Girsewald. Extraction of fat from bones and materials suitable for glue manufacture. [Ger. Appl., Jan. 19, 1911.]* May 31.

13,126. Lewkowitsch and Wood. Manufacture of chamois leather and its by-products. June 1.

13,340. Mayo. *See under* V.

Complete Specification Accepted.

13,432 (1910). Lamb and Hall. Treatment of hides and skins. June 8.

XVI.—SOILS; FERTILISERS.

Applications.

13,504. Berk. Manures, fertilisers, insecticides, etc. June 6.

13,890 and 13,891. Newberry and Barrett. Production of fertilisers from natural phosphates.* June 10.

Complete Specification Accepted.

5657 (1910). Price. *See under* VII.

XVII.—SUGARS; STARCHES; GUMS.

Complete Specifications Accepted.

19,719 (1910). Homans. Separating scum and precipitates from sugar juice and solutions. June 8.

4519 (1911). Steffen. Extraction of the juice of sacchariferous plants. June 14.

XVIII.—FERMENTATION INDUSTRIES.

APPLICATIONS.

13,018. Meunier. Treatment of distillery wash. [Addition to No. 12,207 of 1911.]* May 30.

13,189. Bloxam (Caspari). Process of fermentation, particularly brewing. June 1.

COMPLETE SPECIFICATIONS ACCEPTED.

12,915 (1910). Shears and others. Manufacture of beer and other alcoholic liquids. June 8.

16,707 (1910). Wagner and Wagner. Manufacture of alcohol-free drinks. June 14.

18,665 (1910). Russell. Mash-tuns. June 8.

20,063 (1910). Lambert. Drying malt. June 8.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

APPLICATIONS.

13,006. Hoering. Treatment of milk. [Ger. Appl., July 9, 1910.]* May 30.

13,687. Henri, Helbronner, and von Recklinghausen. Apparatus for sterilising liquids by ultra-violet rays. [Addition to No. 6178 of 1911. Fr. Appl., June 11, 1910.]* June 8.

COMPLETE SPECIFICATION ACCEPTED.

6160 (1911). Koster and Goettler. Treatment of skimmed milk to produce solid material. June 14.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

APPLICATION.

13,526. Newton (Bayer und Co.). Manufacture of derivatives of cinnamic acid containing iodine in the side chain. June 6.

COMPLETE SPECIFICATIONS ACCEPTED.

17,356 (1910). Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. June 8.

25,873 (1910). Wellcome and Pyman. Manufacture of a therapeutic compound. June 8.

28,538 (1910). Wellcome and Pyman. Manufacture of a physiologically active base. June 8.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

COMPLETE SPECIFICATION ACCEPTED.

13,430 (1910). Dawson and Finlay. Colour photography. June 14.

XXII.—EXPLOSIVES; MATCHES.

APPLICATIONS.

13,442. Silberrad. Perchlorate explosive. June 6.

13,443. Silberrad. Chlorate explosive. June 6.

13,549. Ceipek. Safety explosives. [Addition to No. 9743 of 1911.]* June 6.

13,860. Silberrad. Manufacture of blasting explosives. June 10.

COMPLETE SPECIFICATIONS ACCEPTED.

2820 (1911). Macaulay. Reducing or neutralising the noxious fumes from the combustion of nitroglycerin explosives. June 14.

9742 and 9743 (1911). Ceipek. Manufacture of safety explosives. June 8.

XXIII.—ANALYTICAL PROCESSES.

APPLICATIONS.

12,841. Levy. Apparatus for automatically recording the percentage of carbon monoxide in gaseous mixtures. May 29.

13,691 and 13,692. Binz (Allgem. Feuertechnische Ges.). Process and apparatus for the automatic analysis of gases.* June 8.

Journal of the Society of Chemical Industry.

No. 13, Vol. XXX. JULY 15, 1911. No. 13, Vol. XXX.

Birmingham Section.

Meeting held at Birmingham University on Thursday, May 4th, 1911.

DR. T. SLATER PRICE IN THE CHAIR.

THE INFLUENCE OF IMPURITIES IN OXYGEN WHEN USED FOR CUTTING IRON AND STEEL.

BY ALEX. E. TUCKER, F.I.C.

Dr. L. T. Thorne (this Journ., 1890, 246) reviews the methods of obtaining oxygen commercially, and gives particulars of some 50 patents then already taken out for its manufacture, but he gives no particulars of the purity obtained. In the discussion which followed the opinion was expressed by some well-known chemists that the efforts of the inventors were futile, that there was no use for any quantity of oxygen and never would be. It is interesting to note that the output of oxygen in Germany is now about 2,000,000 cubic metres, in France 1,500,000, and in this country 1,000,000 cubic metres per year. In addition to this, hydrogen is obtained in enormous quantities and finds uses other than those of cutting, welding and balloon work, Possibly in the near future its use will be enormously expanded in purely chemical operations and also possibly it will be the oxygen which will be the by-product. These things, however, are not yet.

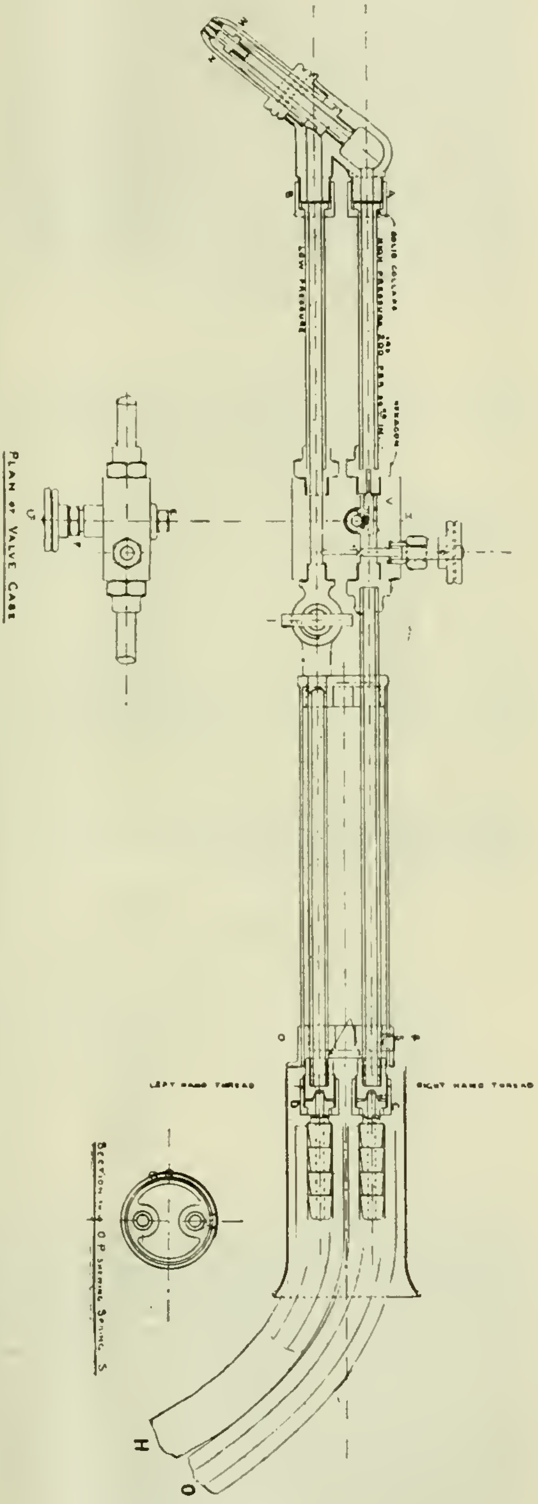
As indicating the present position of the cutting and welding industries, there are two journals devoted to them, one French and the other German. Three others are published in Germany in connection with the industry of compressed gas and acetylene, while England and America each have a journal on acetylene.

The first application of oxygen to the cutting of iron was made by Thos. Fletcher of Warrington in 1888. There is little doubt that the want of appreciation shown in the application of oxygen for the cutting of metal for industrial purposes during the many years following the publication of Fletcher's experiments was largely due to the cost and quality of the oxygen then produced as well as the difficulty of finding a satisfactory blow-pipe. Since then, as is well known, the methods of producing oxygen have been greatly improved and electrolytic processes have come into use. A very high degree of purity is now commercially obtained and blow-pipes are now obtainable which by their refinement in design and detail are in every way satisfactory.

The modern cutting blow-pipe consists essentially of two tubes, one passing a mixture of hydrogen and oxygen for heating the metal for starting the cut, and the other for passing the oxygen separately when the start is made. The starting or heating up may be made with other materials than hydrogen, such as acetylene, coal-gas, petrol, methane, propane, etc., and patents have been taken out covering the use of some of these bodies. But Fletcher's paper already alluded to would seem to invalidate any claim for hydrogen or coal-gas, and the portability and cheapness of hydrogen make it especially convenient for cutting.

As an example of cost, 42 girders, each 10 by 5, were recently cut in this district at an expenditure of 200 cb. ft. of oxygen and 300 cb. ft. of hydrogen in 4½ hours. This with labour comes out at 5d. per girder.

Some experiments, in respect to the effect of the purity of the oxygen used in such operations, will I think be of



Oxy-hydrogen blow-pipe for cutting iron and steel.

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interest because the reasons are not clear why such marked benefit occurs in using the purest oxygen obtainable. The impurities, which are entirely nitrogen and hydrogen, principally nitrogen, are not simply diluents, and very interesting problems arise in connection with this point. The matter may conveniently be approached by examining the conditions of the familiar experiment of burning iron wire in oxygen. It might be inferred that so long as the oxygen was fairly pure, the brilliancy of the experiments would be practically undiminished. "Fairly pure" is of course a comparative expression, and when oxygen was used from the old-fashioned bag, the experiment sometimes failed because diffusion had occurred and an originally poor gas had become poorer. The compressed gas in those days was often sent out at a low standard of purity. In connection, therefore, with the steel-cutting tests, I have examined this matter of burning iron in oxygen, thus eliminating the personal element of the operator in the works process. The iron wire may be regarded as of constant composition. These results are shown in Table 1, and strikingly confirm practical results.

TABLE 1.

Burning of Iron wire in oxygen.

Wire: 0·02 in. dia., 3 in. long.

Purity of oxygen.	Time in seconds.
Per cent.	
99·4	3·8
96·9	8 0
82·4	9·0
74·4	11·0
66·4	17·0
62·4	18·0
54·4	34·0
50·4	60·0
48·0	Will not burn.

0·036 in. dia. wire will not burn in a lower purity than 68 per cent.

It will be seen from the figures given that a lowering of the purity from 99·4 to 96·9 increases the time taken in burning no less than 110 per cent.

TABLE 3.

Iron wire in oxygen.

Impurity of oxygen.	Retardation in time of burning.
Per cent.	Per cent.
2·5	110
17·0	139
25·0	190
33·0	347

The physical explanation of this is not obvious. The facts, however, are undoubted. They find corroboration in the effect of carbon dioxide on the calorific and illuminating values of lighting gas. The effect is especially noticeable in the case of carburetted water gas, in which Dexter showed that 10 per cent. of carbon dioxide reduced the calorific value of 18 candle power from 144 to 117, a loss of 19 per cent., while it reduced its illuminating power from 18 to 8·9—a loss of 50 per cent.* The temperature of the oxyhydrogen flame has been measured by the emission and absorption of the flame for rays reflected from fluorspar by Planck's formula, and found to be 2240° C. By the reversal of the D line by the electric arc and system of absorbing prisms the figures obtained varied from 2300 and 2400° C., according to the proportion of oxygen (this Journal, 1909, p. 786). Some reduction of heating power and chemical reaction generally is to be expected from the introduction of so-called inert bodies in active agents, but I was not prepared even to imagine that their effect could be so considerable until it was demonstrated by the tests tabulated. Indeed, it becomes possible that the term "inert" is not a correct one and that the bodies under such conditions are active—very active indeed—in a negative direction in respect to thermal or other physical efficiency.

A remarkable and important effect of the use of pure gas is the superiority of the surface and edges produced. I have seen cuts approaching, in character, those produced by a milling cutter and with very square edges. The amount of metal consumed with pure gas is also very small, about an eighth inch being all that is wasted. The accuracy of the cut is increased by using machines in which the "feed" of the blow-pipe is done by a screw motion like a planing machine, and the feed may, by suitable mechanical adjustments, accordingly be linear or circular and beautiful results are obtained with these tools, because they ensure a steadiness of the nozzle of the blow-pipe which it is impossible for a workman to command when guiding it by hand.

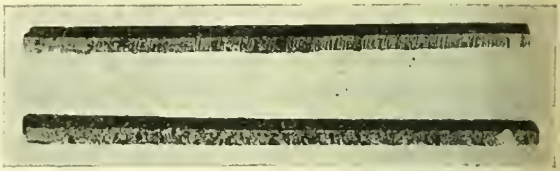

Photo of cuts on ¾ inch steel plate made with 99·5 and 98·0 per cent. of oxygen, respectively.

On the other hand when impure gas is used the cut is wider, more metal is melted instead of being burned away, and the resulting surface is slaggy with fused oxide covering it, leading to considerable work in trimming and machining. The differences are distinct with 2 per cent. of impurities, as shown in the accompanying figure.*

If, then, these figures as shown in the tables can be obtained with cutting, it may be regarded as certain that the loss in using impure oxygen in the welding process is equally serious, but similar tests on time and consumption in the operation of welding are not so easy because the work is generally intermittent and greatly depends on the skill of the workman and the character of the work done. The metal under the acetylene flame may be kept simply melted, and, it being a reducing flame, no result occurs except that of a waste of gas. With cutting the action is more positive and the path of the cut is a measure of efficiency which can be identified with given factors.

The important point is therefore that, both in cutting and welding, while with oxygen of inferior quality the time occupied in these operations is increased considerably and that therefore the labour cost, capital charges, etc., increase correspondingly, the additional consumption of oxygen is much more serious and may possibly prevent a commercial success of certain operations, which success with the pure gas would be assured.

Table 2 gives the mean of a much larger number of tests on the burning or cutting power of oxygen when varying percentages of impurities—nitrogen and a small amount of hydrogen—are present.

The method adopted in obtaining their different purities was to introduce into the bottles certain amounts of air corresponding to the percentage desired, and then ascertain the actual percentage as obtained by means of the apparatus shown. This apparatus is a convenient form of absorption burette, specially designed for works purposes.

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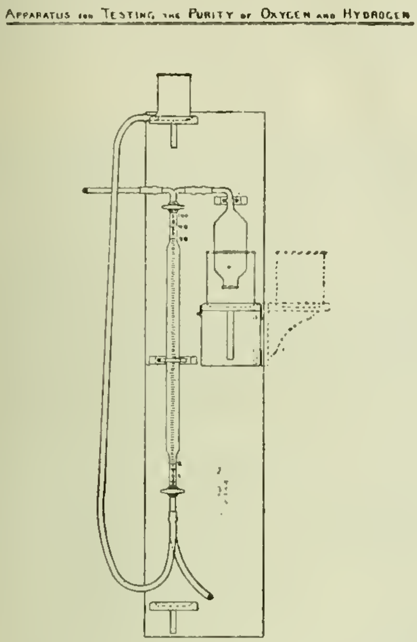
* Quoted in "The Gas Analysts' Manual," Jacques Abody.

* Dr. Goeth in his book entitled "Welding and Cutting Metals," published as recently as 1909 states, page 33, that 10 per cent. of impurities is of no importance.



Works burette for oxygen determinations.

Estimations of the purity of oxygen can be rapidly made with this instrument by any intelligent workman.

I should point out that in respect to the amount of oxygen used per foot run, the length of plate operated on is somewhat short for low consumption, and as at least three cuts were made in each case in order to get averages, the amount used per foot run is higher than it would be on a continuous cut of greater length, because of the oxygen used with the hydrogen in starting the cuts. But as many more cuts than those given were made, and the average of all were taken, the figures, with the above proviso, are as accurate as they are likely to be in tests of this kind. Some discrepancies are noticeable and inexplicable, but it is the general tendency which is to be noticed.

Table 2.

Results of tests on cutting power of oxygen of varying purity. Metal operated on : $\frac{3}{4}$ in. mild steel plate, 23 in. wide.

Test No.	Purity of Oxygen used.	Length of cut in inches.	Time taken in cutting (seconds)	Oxygen used in cub. ft.	Time taken per ft. run (seconds).	Ox. used per ft. run cub. ft.	Increase in time taken, per cent.	Increase in Ox. used, per cent.	Appearance of cut.
1	99·5	69	309	6·0	54	1·0	Taken as	unit	Very clean.
2	99·3	68	273	7·5	48	1·3	—	27·8	Good cut.
3	98·0	68	286	9·1	51	1·6	—	53·8	Fairly clean.
4	97·6	68	295	9·8	53	1·7	—	67·3	Rather rough.
5	96·8	66	363	11·8	64	2·1	18·5	101·9	Ragged.
6	95·0	67	377	11·6	67	2·1	24·0	98·0	Dirty and slaggy.
7	92·2	69	552	15·0	96	2·6	77·7	150·0	Very dirty.
8	88·2	69	615	16·2	107	2·8	98·1	170·1	Very rough and slaggy.
9	87·3	68	669	16·2	117	3·2	116·6	207·6	,, ,, ,,
10	83·3	68	855	18·9	152	3·4	181·4	222·6	Not properly cut through.

The blow-pipe reveals defects in many of the plates which, from the steel maker's point of view, are very interesting: thus, assuming the workman is cutting an inch plate, it will sometimes happen that he will come across a lamination or slag line, or it may be oxide, which interrupts the cut, the effect being a blowing back of the flame—a refusal to burn—not altogether unlike the result of dropping water on a lighted candle. A spluttering occurs and the blow-pipe flame has to be momentarily withdrawn, when the defective part fuses up and is made capable of burning by such fusion. The effect is noticeable with the purest gas, but when lower purities are used it is increasingly marked. The amount of metal fused instead of being burnt is much greater, and this blowing back is considerably more marked and often becomes dangerous to the workman. These interruptions of course proportionately increase the time taken and especially the amount of gas consumed. But, independently of these points, it is, in practical working, obvious that the time occupied, and consequently the amount of gas needed, is seriously greater when even 96 per cent. oxygen against 99 per cent. is used. In this connection therefore the tests on the rate of burning iron wire in varying percentages are important.

Discussion.

The Chairman said he had heard that it was impossible, or at least very difficult, to cut cast iron by the process. Was this so? The author had remarked that difficulties were experienced when the steel to be cut contained faults or slag, and it was possible that the presence of graphite in the cast iron might act similarly.

The President (Mr. W. F. Reid), alluding to Mr. Tucker's tables, pointed out the very considerable disappearance of energy as indicated by the results, and asked if Mr. Tucker could explain it. He suggested that part of it might be accounted for by formation of nitrogen compounds as in the electric furnace, which was notoriously wasteful of energy.

Mr. H. L. Heathcote said that though some might favour the view that the connection between the energy required for "cutting" and the percentage of impurities in the oxygen employed was due to some mysterious chemical action, he believed that it might be fully accounted for by the conduction of heat. The less the purity the less rapid the evolution of heat would be, and in the race between heat supply and heat removal even a small percentage of impurity might make a very great difference. The rate of heat conduction was enormous, as could be inferred from the fact that in removing ¼ inch from the end of a steel rail the thickness melted might be 1/8 inch, the solid slice being 1/8 inch. In other words, 1/16 inch from the centre of the middle of the burning steel the metal was solid, owing to the rapid conduction of heat.

Professor T. Turner offered what he regarded as the explanation of the apparently extraordinary effect produced by the presence of a relatively small quantity of impurity in the oxygen used. It was necessary to raise iron to a certain temperature, above its melting point, before it burnt readily in air. The temperature obtained by the oxyhydrogen flame, or by the use of oxygen, was not very greatly above this necessary minimum, when due allowance was made for conduction and radiation.

A ——————————B———D——C.

This might be represented diagramatically by the line A C, the length of which might be regarded as equivalent to the maximum heat obtainable in practice with pure oxygen. The length A B represented the minimum temperature of combustion of iron on the practical scale. If now a small amount of impurity were added to the oxygen and the temperature was reduced from C to D, the result on the efficiency was not the relatively small amount of $\frac{DC}{AC}$ but the much greater one of $\frac{DC}{BC}$. With 30 per cent. of impurity, or thereabout, the oxygen ceased to cut. In other words D C was equal to B C with about 30 per cent. of impurity, and any heat which only gave a temperature short of A B was useless for cutting purposes.

Mr. L. **Archbutt** asked what percentage of impurity commercial oxygen had been found to contain. He had been impressed by the fact that the plate which was being cut by the pure oxygen was much more locally heated than when the impure gas was being used. In the latter case, the metal strip which was being cut off was red hot to the outside, but with the pure oxygen the outside of the ½-inch strip was black. The much greater amount of slag and oxide produced by the impure gas must be largely due to the slowness with which the flame did its work. Another point he noticed was that the impure oxygen caused sparks to fly much more freely, and there was more danger to the workman. These points emphasised the advantage of using pure oxygen. He also wished to know if the hydrogen were required after the cutting process had been started.

Dr. T. J. **Murray** enquired whether the pressure of oxygen had much effect on the rate of cutting, and on the working cost. Comparing the first two lines of the statistical table, the time required for cutting with impure oxygen was less, and yet more gas was used. Evidently the pressure of oxygen was greater in the second case. How did the gas pressure vary during the different experiments ?

Mr. A. **Adams** asked for information as to the effect of the blow-pipe on copper.

Mr. **Alex. E. Tucker**, in replying, said cast iron could be cut well, but by reason of slag forming materials contained in it, it was not so easily cut as steel. Copper was more difficult to cut than steel, by reason of its high conductivity ; but with the use of acetylene as a starter the metal could be cut. The intensity of the acetylene flame was much greater, and on that account the heat was more localised. He could not follow Mr. Heathcote with regard to the question of the absorption of heat, but he thought an answer was afforded by directing attention to the experiments on iron wire which were quite outside the removal of heat by conduction, etc. That simple experiment proved the relative rate of burning of iron wire in oxygen of varying purity. He appreciated the point which Professor Turner had raised, but in this connection they should recollect the enormous temperature attained by the oxyhydrogen flame. The cutting depended of course on the oxygen ; at the same time he was not sure whether a temperature was not obtained in cutting considerably higher than one was disposed to think, in consequence of the extremely local action and the high pressure of the gas used. They knew that the oxyhydrogen blow-pipe produced a temperature of about 2400° C. Such temperatures were some 800 degrees higher than the melting point of iron, so that he did not quite follow Professor Turner as to the low amount of available heat, or the reduced intensity of heat remaining above that required for the melting of iron. It was a question of combustion and not of simple melting. As to the commercial purity of oxygen, he had found, having made very many tests, that commercial oxygen varied at the present time from 92 to 99·7 per cent., and in view of the figures produced, those percentages had great commercial significance. The question as to whether it was necessary to keep on the hydrogen in the blow-pipe during cutting was affected by considerations of practical convenience. The same consideration also arose with regard to the point raised by Dr. Murray as to pressure ; so much depended on observation and skill, which were only attained by experience, in the work of cutting. Broadly, the pressure of the oxygen was correspondingly increased to the depth of the cut desired. In the case of welding the heating flame of the acetylene was very greatly higher than that of the hydrogen flame, but here again, with welding, his tests in practical working showed the great economy obtained by using pure oxygen.

The President exhibited a number of articles, in order to demonstrate what may be achieved by the use of the oxy-acetylene blow-pipe, which he pointed out was quite easy of management. Samples were shown illustrating its remarkable "cutting" powers on metals. He incidentally mentioned that recently he visited a factory in the south-east of France, where nitric acid was made from the atmosphere. They had a big constructive undertaking on hand, in which large numbers of pipe connections and angles were required. They kept a stock of straight pipes, and by means of the acetylene burner all the joints and elbows required were made in a few hours. Formerly similar work would have been sent away to the nearest large city ; it would have taken probably several weeks to execute and probably the work would not have been so well done. The one great advantage of the system was that the gas for the blow-pipe could be developed, and regulated easily ; and that it was under complete control. Acetylene had got into discredit by reason of difficulty experienced with the generators, but that had been largely overcome. He spoke of the advantages of the modern system by which granulated carbide of calcium was first cemented by a fused mixture of sugar and sulphur and compressed into cakes. These cakes were then dipped into a protecting bituminous compound which enabled them to be kept for an indefinite time.

The President then exhibited a number of interesting pictures of the great fire at the Brussels Exhibition. He spoke of the comparative ease with which large masses of twisted iron girders were expeditiously cut up by means of the oxy-acetylene blow-pipe. It was a noteworthy instance of the great aid which was rendered by the chemist to the engineer.

London Section.

Meeting held at Burlington House on Monday, June 12th, 1911.

MR. E. GRANT HOOPER IN THE CHAIR.

OBSERVATIONS ON COTTON AND NITRATED COTTON.

BY H. DE MOSENTHAL, F.I.C.

Since submitting my last paper on this subject I have continued my investigations. Although the results obtained are all negative, I think that it is useful to record them, as it may prevent others travelling needlessly over the same ground. Moreover, there are one or two points in my previous papers which require rectification. I also wish to take this opportunity of submitting suggestions as to possible constitutional formulæ based on recent knowledge.

(1) *Dialysis.* To my first paper on this subject,* I added a note stating that I had succeeded in dialysing an

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*This J., March 31st, 1904, 292.

acetone solution of nitrocellulose, using acetone as the external liquid. In the paper of May, 1907,* I stated that the dialysis had succeeded with both vegetable and animal membranes, and that fractional dialysis had been attempted. I added, however, that the experiments were not sufficiently advanced to warrant publication.

It is evident that in dialysis, a solvent of constant composition must be chosen; therefore in the case of nitrocellulose ether-alcohol cannot be used. Acetone, dissolving practically all nitrocelluloses, appeared to be the most suitable solvent and was used, as indeed has been the case in nearly all my investigations.

I cannot find in literature any mention of dialysis or osmosis with acetone. The work hitherto done has been almost entirely confined to aqueous solutions, a few experiments being recorded in which alcohol was used.

The viscosities of water, alcohol, and acetone, are respectively: 0·0117 0·0135, and 0·0034 at 15° C. Acetone has a boiling point of 56·3° C., as against alcohol 78·4°. Thus working with acetone means dealing with a much more mobile and volatile liquid than those hitherto used in dialysis, and the fact that acetone is a solvent of such wide application still further increased the difficulties of experiment.

Having obtained what seemed to be dialysis with the bladder of the sturgeon, a large number of bladders were carefully tested, and it was found that whilst they were impervious to water and alcohol, acetone percolated through microscopic apertures. These bladders were, therefore, discarded, and a fresh stock of thicker bladders was obtained, among which a very few were found to be impervious to acetone.

A 12·2 solution of nitrocellulose was placed in one of these impervious bladders, and the bladder rested in a wide-mouthed bottle containing acetone, so that the liquids had approximately the same height inside and outside the bladder. The open end of the bladder hung over one side of the bottle, and the latter was stood inside another wide-mouthed bottle containing a little acetone. The larger bottle was then stoppered, and the whole left for more than six months. At the end of that time no appreciable evaporation had occurred, and no identifiable quantity of nitrocellulose had passed through the membrane.

Recourse was then had to glass dialysers with parchment paper. The parchment paper was fixed on to the glass dialysers in various ways, and the receptacle thus formed was filled with acetone. In all cases the acetone exuded. The defect did not seem to lie with the parchment paper, but with the method of attachment, and it became evident that a cement insoluble in acetone had to be found. After several unsuccessful attempts, gelatin dissolved in acetic acid was used to fix the parchment on to the ground edges of the glass dialysers, and a receptacle was thus obtained which held acetone. These dialysers were placed in suitable squat specimen jars with ground edges. The jars were closed by means of ground-glass discs to prevent any acetone evaporating, and it was decided to fix these covers by means of gelatin dissolved in water, a cement which would not be attacked by acetone and would allow easy removal of the covers. As the dialysers could not be suspended, they were each supported by three shaped pieces of cork which had been thoroughly extracted with acetone. Four such prepared dialysers were fixed upon an agitating table driven by an electric motor. The dialysis proceeded for two months with frequent prolonged spells of agitation.

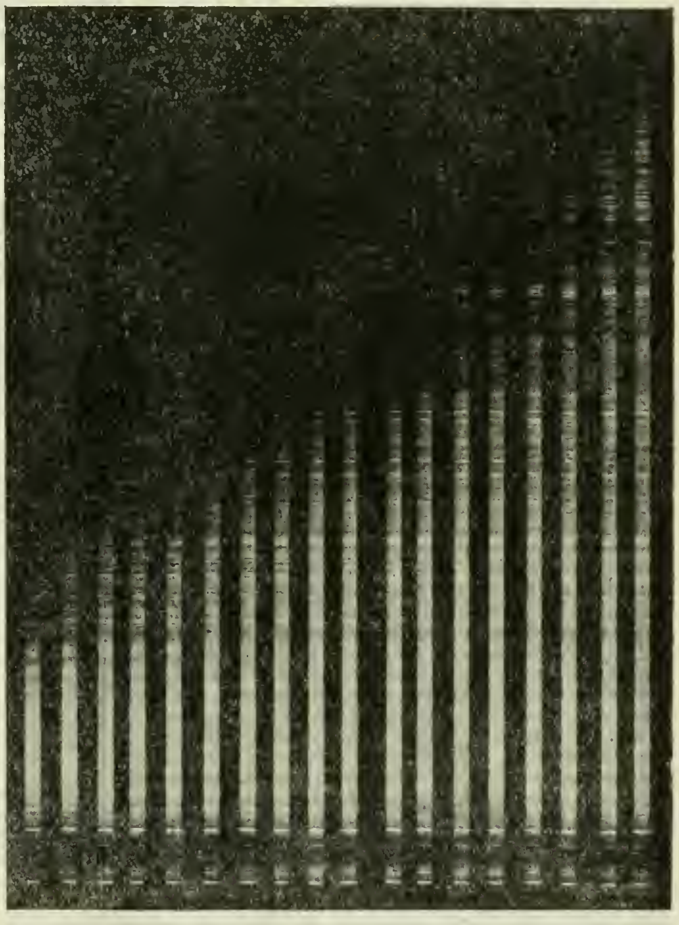
The result was that the amount of nitrocellulose found in the outer liquid was in the four cases 2·6 per cent., 59·5 per cent., 90 per cent., and 49·5 per cent. respectively.

I think that these results show that nitrocellulose does not dialyse, and that the substance found in the outer liquid has passed through in consequence of some defect in the dialyser. I may, however, add that the defect which must have existed could not be discovered in the paper, which was very carefully examined with a 1′ Coddington lens, and that to all appearances the cement had held perfectly. It was impossible to differentiate between the four dialysers. Kahlenberg, in a paper on "Osmosis and Dialysis,"* stated that dialysis is promoted by constantly changing the layer of liquid contiguous to the membrane. It was to effect this that the agitating table was used.

By running four experiments simultaneously I sought to eliminate the possibility of error. I think that it would be well to require a certain number of dialyses carried out as nearly as possible under the same conditions to give concordant results before drawing any definite conclusions, as evidently the sources of possible error are numerous and difficult to detect.

(2) *Osmosis.* Repeated attempts to obtain a pressure indication with solutions of nitrated cotton in acetone by means of the Pfeffer osmometer with different septa gave negative results.

Absorption Spectra. Dr. W. B. Tuck, of University College, with the kind permission of Sir William Ramsay,



Absorption spectrum obtained with a solution of Waltham Abbey guncotton in acetone.

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* This J., May 15th, 1907, 443.

* J. of Phys. Chem., 1906, **10**, 141.

was good enough to examine the following solutions with a view to determining their absorption spectra:—

	% nitrogen.	Relative viscosity.	Concentration. ‰	Solvent.
Nitrocotton	12·29	95	4·00	Acetone
,, ...	12·33	32	4·00	,,
,, ...	12·27	38	4·00	,,
,, ...	12·37	36	4·00	,,
,, ...	11·10	41	4·00	,,
,, ...	11·96	35	4·00	,,
Cellulose acetate (Cross' triacetate)	—	35	1·10	Chloroform
Nitrocotton	12·37	35	4·00	Ethyl acetate
,, ...	13·2	35	4·00	,,
Nitrated ramie ...	13·2	35	4·00	,,
Cellulose (cotton wool)	—	35	1·24	Zinc chloride in hydrochloric acid.

Dr. Tuck found in all cases a continuous spectrum which showed in the ultra-violet a shortening progressing with the concentration. The solution of cellulose acetate exhibited the same characteristics as the nitrate solutions, so that it can be stated that *the cellulose group absorbs ultra-violet light.* The absorption, however, is general, and not selective or banded, as will be seen from the illustration on p. 783.

As up to the present it has been impossible to draw any conclusions from general absorption in simple compounds, it is obviously impossible to draw conclusions in regard to substances the molecular weight of which is unknown. This method, therefore, affords at present no clue to the constitution of cellulose.

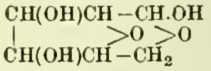
Constitution of Cellulose. The work which I have done during the last ten years in order to throw some light on the cotton fibre, more particularly in regard to its nitration, and the attempts to throw some light on the constitution of cellulose have not been attended by the results I hoped for. I think, however, that the determinations of the physical constants, and more particularly of the molecular refraction, have been of help. The microscopic examination of the cotton fibre, the precipitation from cuproammonium solutions, and of nitrated cotton both in the fibre and regained from solution by precipitation and evaporation shows, however, I think, that, in considering phenomena connected with cellulose and its esters, an entirely different mode of thought has to be applied. We cannot speak of cellulose or its derivatives, in which physical structure is maintained and plays an all-important part, in the same way as we do of other physically structureless organic compounds. Cellulose and nitrocellulose are spoken of as distinct chemical compounds, and solutions of nitrocellulose are discussed as if they were solutions of sugar, even their colloidal nature being frequently ignored. I believe that with the advance of knowledge as to the nature of organic colloids of great complexity, it will become possible in time to obtain a more comprehensive idea of such solutions. The colloidal state is now regarded as a two-phased condition in which a finely divided substance is suspended in another. At present the viscosity of such colloidal solutions is deemed a function of molecular weight. I am pleased, therefore, that the disturbing element created by the apparent dialysis of nitrocellulose has been removed by the experiments now recorded. The solution of cotton in cupro-ammonium, composed as it is of the different celluloses which constitute the fibre—the cuticle and intercuticular substances varying in constitution as they do—plus cupric oxide, water, and ammonia, is a polyphased colloid, so complex that little hope can be entertained to ascertain its exact nature. Some light may possibly be thrown on the question by an examination of solutions of what I would call the "physically broken down products" of nitrocellulose. It has been shown that by dissolving nitrocellulose and regaining it by precipitation or evaporation, and then redissolving the precipitate or film, the viscosity of the solution drops, so that if this procedure is repeated several times solutions of very low viscosity are obtained. If this can be carried far enough it is possible that a limit may be reached when the molecule attains a size which can be determined by our present physical methods.

Following a similar order of ideas Berl and Fodor * have examined the broken down products of nitrocellulose saponified with alkali, and have obtained bodies free of nitrogen, of which the molecular weight could be determined. Based on these they calculate that the cellulose penta-nitrate of the formula, $C_{24}H_{33}O_{16}(NO_2)_5$, has a molecular weight of 887·3, whilst two determinations by the boiling point method gave them 837·7 and 689·7 respectively. These, varying as they do, are, after all, of the same order of magnitude.

I was inclined to undertake the determination of the coefficient of esterification of cellulose as compared with glycol or glycerin, but I recognise that the difficulties of experiment were great, and that it was unlikely that this would lead to any useful result, because even if steric hindrance were proved, it would in the present state of our knowledge have very little stoichiometrical value.

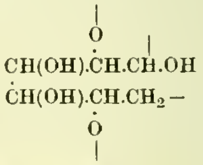
Berl and Fodor say that the aliphatic structure of cellulose to which my work points harmonizes well with observed reactions. They have proposed for cellulose a formula similar to that which was suggested by Kiliani,† in which they add H_2O to the ordinary hitherto accepted formula, their formula reading $nC_6H_{12}O_6—(n\text{-}1)H_2O$. This is based on the view that the dextro-cellulose of cotton is a polysaccharide, a condensation product of monose-complexes.

Possibly the pursuance of this order of ideas, the abandonment of iso-cyclic and heterocyclic formulæ, and a line of research in the direction of an aliphatic compound of a polysaccharide character, may prove fruitful. One might, for instance, work on the assumption that cellulose has the formula suggested by Green:—



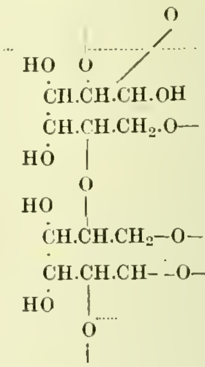
$$\begin{array}{l} CH(OH)CH-CH.OH \\ \vert \qquad\qquad\quad >O>O \\ CH(OH)CH-CH_2 \end{array}$$

not as a closed ring but an open chain, somewhat thus:—



$$\begin{array}{l} \qquad\quad\;\; \vert \\ \qquad\quad\;\; O \qquad \vert \\ CH(OH).CH.CH.OH \\ CH(OH).CH.CH_2- \\ \qquad\quad\;\; O \\ \qquad\quad\;\; \vert \end{array}$$

This formula with two atoms of bridge-oxygen would facilitate the conception of a large molecule condensed from monose-complexes somewhat thus:—

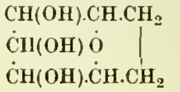


$$\begin{array}{l} \qquad\qquad\quad O \\ HO \;\; O \quad / \\ \;\; CH.CH.CH.OH \\ \;\; CH.CH.CH_2.O— \;—CH \text{ etc.} \\ HO \;\; \vert \\ \qquad O \\ HO \;\; \vert \\ \;\; CH.CH.CH_2—O— \\ \;\; CH.CH.CH—\;—O— \\ HO \;\; \vert \\ \qquad O \\ \qquad \vert \end{array}$$

The dotted lines delineate the monoses in their concatenation to an open chain.

Vignon's formula:—

thus:



$$\begin{array}{l} CH(OH).CH.CH_2 \\ CH(OH)\,O \qquad \vert \\ CH(OH).CH.CH_2 \end{array}$$

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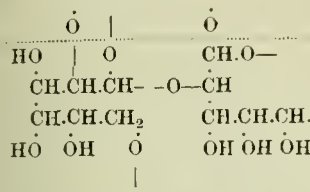
* See this J., 1910, 1083.

† Chem.-Zeit., 1908, **32**, 366.

could be similarly opened and would give us the following concatenation of monoses :—



This latter conception seems preferable because in it there are no ether linkages connecting the monoses but acetal linkages only. This would account for the facility with which cellulose hydrolises. It is moreover more probable that acetal condensations occur in the plant as they form very readily. Both open formulæ correspond to the empirical formula $(C_6H_{10}O_5)_n$ and the addition of water being possible in three places in each monose-complex innumerable celluloses or hydrocelluloses of the general formula $(C_6H_{12}O_6)_n$—$(n—x)$ H_2O can be derived therefrom wherein both n and x may vary within wide limits. The formation of glucose is much easier understood with these open formulæ as the result of hydrolysis than if we assume that a ring has to be broken. Buncke and Wolffenstein (Ber., 32, 2493) found that a neutral solution of hydrogen peroxide transforms cellulose into hydrocelluloses, and they showed that the hydrocellulose they thus obtained had one molecule of added water for about 6 molecules of $C_6H_{10}O_5$. By forming a phenylhydrazine they showed the presence of aldehyde groups. This reaction would hardly be expected if there were no acetal linkages.

It may be argued that an open chain formula would not explain the easy formation of furfurol by the action of hydrobromic acid on cellulose but the retort would be that fructose, which is now generally regarded as an open chain compound, and certainly not as a furfurol derivative, undergoes the same reaction with the same readiness. A series of additions and separations of hydrobromic acid to the suggested formula would account for the cyclic product obtained.

The recognition of the constitutional formula of cellulose, nay even the synthetic production of an amorphous cellulose would probably still leave unsolved the numerous problems which are constantly arising in connection with the treatment of fibrous celluloses in the industries. These problems are not purely chemical, the physical condition of the material plays at least an equally important part. The chemical aspect is complicated by the presence of different celluloses and the physical, when cotton is used, by the tubular structure of the fibre and consequent capillarity, as well as the manner in which reagents penetrate into the intercuticular substance, not to mention variations in the nature of different raw materials too subtle to be detected by any of the methods at our disposal. No wonder, therefore, that so much should remain to be done.

If we are candid we must confess that, *e.g.*, in the esterification of cellulose as used in the manufacture of both cellulose nitrates and acetates, all is empirical, and that it is not an exaggeration to say that there is not a single reaction which the chemist can fully explain.

Discussion.

The **Chairman** asked Mr. de Mosenthal whether, in connection with his dialysis experiments, he had tried the possibility of effecting a separation by the use of such a material as that employed for the Berkfeld filters, or other porous pottery substance of that kind ? There was some especially thin porous material now available. What he had specially in mind was the thin cell material used in the electrolytic arsenic apparatus. Possibly some useful result might be obtained by the use of such material.

Dr. **Robertson** said that he had made an experiment on the dialysis of a solution of nitrocellulose, using a membrane of sturgeon's bladder. The nitrocellulose used was undoubtedly a mixture of nitrocelluloses of which some, at least, were highly nitrated. The latter, from some experiments he had made, gave solutions of greater viscosity than those less highly nitrated, and, no doubt, contained large aggregates. It was found, however, on examining the outer solution after a year, that it contained dissolved in it nitrocellulose of the same degree of nitration as the original. As no separation of the nitrocelluloses had been effected, that experiment appeared to him to confirm the view of Mr. de Mosenthal that the dialysis was only apparent, and due to imperfection of the septum.

Mr. G. W. **MacDonald** referred to the viscosity of collodion cotton as used for the manufacture of blasting gelatin. His experience on this particular subject was as follows :—If collodion cotton was simply treated in a Soxhlet extractor with ether (sp. gr. 0·720), a very marked diminution in the viscosity of the collodion cotton resulted as compared with that of the original. The only chemical action which had gone on, as far as he knew, was the removal of about 0·5 per cent., of nitrated fatty matter arising from the original fatty matter in the cellulose. When the same collodion cotton was separated from blasting gelatine by removing the nitroglycerin with ether in a Soxhlet apparatus, a further and more marked drop in viscosity resulted. He had been puzzled, some time ago, by the extremely erratic results obtained with duplicate samples of the same collodion cotton when dissolved in acetone for the determination of viscosity. Suspicion arose as to the influence of light during the course of the preparation of the solutions. Experiments dealing with this point showed that a 2½ per cent. solution of collodion cotton in acetone fell in viscosity to about half the original figures on exposing the solutions for some seven days to the diffused light of the laboratory. Check samples standing in the dark for some seven weeks showed only a very slight decrease in viscosity. He would, therefore, venture to suggest to Mr. de Mosenthal that if he were searching for a diminution of the size of the molecule, as indicated by viscosity, the question of the influence of light upon the viscosity of collodion cotton solutions might be worth following up.

Mr. W. P. **Dreaper** said that Mr. de Mosenthal's researches into the dialysis of nitrocellulose were of great value to those interested in the theory of dyeing ; and it came as a shock to hear that the author now felt that his previous conclusions must be modified, if not reversed. It was probably necessary to consider in such work the nature of the solvent, and its possible action on the substance of the material through which dialysis took place, and that might possibly explain the differences which were clearly observed in the results now brought forward, and those obtained in dyeing, where the direct or indirect passage of substances in a state of high aggregation could be observed from a water solution. He had recently been doing some work on the relative rate of diffusion of dyes into filaments of cellulose of large diameter, and the results so far obtained did not agree with those now obtained by the author, if it was assumed that under no conditions could one observe the dialysis of substances in a state of high aggregation or molecular weight in the possibly equivalent action where they passed into the fibre substance, even if they did not again leave it.

Mr. **de Mosenthal**, in reply, said he had not used the Berkfeld material. In fact, he was very much surprised when he first found that nitrocellulose dialysed. When he found his later experiments contradicted the previous ones he did not go any further. He did not think acetone had any effect on the parchment paper ; when put into acetone, and then taken out again, it became instantaneously dry, and not the slightest alteration could be detected.

As to the manner in which dyes entered the fibre, he had shown in his first paper the existence of minute apertures (Stomata) in the cuticle of the fibre, and he was of opinion that the dyes enter the fibre through these and not by osmosis. He was much obliged to Mr. MacDonald for his suggestion, and would see whether by means of light a solution of lower viscosity could be obtained than by repeated dissolving and evaporating.

The experiments to which Dr. Robertson had referred, pointed to imperfections in the dialysing membrane, and had confirmed him in his suspicions as to the reliability of his dialysing experiments. The first idea of dialysis came to him when he found that he was able to draw a very dilute solution of nitrocellulose in acetone through a Pasteur filter. The precipitate obtained with water from the filtrate was structureless, whilst the precipitate from ordinary solutions, however clear they might be, had a fibrous appearance. Had the dialysis of nitrocellulose been confirmed it would have materially affected our conception of the complexity of the molecule of cellulose which was admitted.

A MODIFICATION OF RASCHIG'S THEORY OF THE LEAD-CHAMBER PROCESS.

BY EDWARD DIVERS.

(This J., May 31, 1911, 594—603.)

Erratum.

Page 594, col. 2, middle, *for* "nitroxysulphuric acid, $H_2N_2SO_5$," *read* "nitroxysulphurous acid."

New York Section.

Meeting held at Chemists' Buildings, 50 *East* 41*st Street, on May* 19*th,* 1911.

DR. CHARLES F. MCKENNA IN THE CHAIR.

THE ANALYSIS OF SHELLAC.

BY A. C. LANGMUIR AND F. S. WHITE.

A method for the determination of rosin in shellac based on the iodine absorption under fixed conditions with Wijs solution was published by Langmuir in 1905 (this J., 1905, **24**, 12). The method was subsequently investigated by a committee of the American Chemical Society and recommended by them as standard (J. Amer. Chem. Soc., 1907, 1221; this J., 1907, 1020). Since then the process has been in general use in the United States and has been the basis on which shellac has been bought and sold. This paper is written with the object of presenting some additional data obtained during the last few years and to answer some objections which have been made.

Briefly the process is as follows: 0·2 grm. of the finely-ground shellac is dissolved in 20 c.c. of glacial acetic acid diluted with water to 99 per cent. (melting point 14·8° C.), 10 c.c. of chloroform is added and the mixture brought to a temperatnre of 22—23° C.; 20 c.c. exactly of Wijs solution *prepared from acetic acid of the above strength* is run in and the temperature maintained between the above limits for just one hour; 10 c.c. of 10 per cent. potassium iodide is added and the solution immediately titrated with $N/10$ sodium thiosulphate. The number of c.c. used is deducted from a blank on the same amount of reagents and the iodine number calculated. Making the assumption that pure shellac has an iodine absorption of 18 and rosin 228, the percentage of rosin may be computed by the following formula:—

$$\text{Per cent. rosin} = \frac{100\ (\text{iodine value} - 18)}{228 - 18}$$

In our experience of six years with the method we have always been able to trace differences between analysts, when the opportunity has been afforded us, to a neglect of some of the conditions laid down, such as the use of acetic acid stronger or weaker than that called for or to the use of acid of different strength for the Wijs solution. Others have failed to hold the correct temperature and have altered the concentration by using different volumes of reagents. It should be noted that glacial acetic acid as bought seldom corresponds in value to the per cent. marked on the bottle, and its strength must be ascertained by a melting point determination before dilution. The thermometer used must of course be compared with a standard instrument. It has been hard to drive home these facts, and it is necessary to again state that the figures obtained are purely empirical, depending on the time, concentration, temperature, and strength of the acetic acid.

The method has been criticised on the ground that certain assumptions must be made in respect to the iodine absorptions of rosin and shellac, but similar assumptions must also be made in extraction methods. Parry prefers the Hübl solution because it is less affected by the conditions, but it will be shown that both the Hübl and Hanus solutions give results dependent on the time and temperature. There is an added objection to the Hübl solution in its well-known deterioration on keeping and even during the test. The length of time required for the absorption makes the control of the temperature difficult. The average figures for the absorption of shellac and rosin by the Hübl solution, 10 and 125, show a difference of 115 as compared with a difference of 210 by the Wijs solution. The latter method is therefore of greater sensitiveness and accuracy for the detection of rosin.

The effect of the temperature on the iodine absorption of shellac has been overlooked by a number of chemists working in this field. Singh in a recent paper (this J., 1910, **29**, 1435) while commenting on the impossibility of using the work of other chemists for comparative purposes because the conditions are not identical, neglects to state the temperature used in his own determinations of the iodine absorption of shellac by Hübl solution. Holley and Ladd, in their book on the "Analysis of Paints and Varnishes," recommend the use of Hanus solution at "room temperature." Wijs and Hanus solutions, such as are ordinarily used in fat and oil analysis, are not adapted for shellac analysis and are apt to lead to erratic results.

The multiplication of methods for the determination of the halogen absorption of shellac and similar materials is to be deplored. Each of these methods requires a large amount of work in the preparation of constants for comparison, and brings about an increase in standards which can only result in confusion. (Carter, Oils, Colours and Drysalters, **17**, 113; and Vaubel, Chem. Zeit., **34**, 991.)

Iodine absorption with Hübl solution, Parry's method.—Details of this method have not been published in full, and the following scheme was adopted: 1 grm. of the shellac is dissolved in 10 c.c. of 95 per cent. ethyl alcohol, 20 c.c. of Hübl solution is added and the mixture allowed to stand 8 hours at 22°; 20 c.c. of 15 per cent. potassium iodide solution is then added together with 50 c.c. of water and titrated with thiosulphate.

The standard sample of pure T.N. shellac used as a basis by the American Committee on shellac analysis shows by the above test an iodine absorption of 8·27, as compared with the figure 10 taken by Parry as the iodine absorption of pure shellac. This difference would result in nearly 2 per cent. lower rosin percentages in London than in New York, and as a matter of fact there is unfortunately about this difference between the London and New York standards.

Effect of time.—A sample of shellac tested as above showed an iodine absorption at 2 hours of 7·0; 4 hours, 7·6; 6 hours, 7·8; 8 hours, 7·9; and overnight (17 hours), 8·3.

A sample of "M" rosin 0·5 grm. with 80 c.c. of Hübl solution showed 136·1 at 2 hours; 142·2 at 4 hours; 151·6 at 8 hours; and 165·1 at 17 hours.

Effect of temperature.—The standard T.N. showed an iodine absorption under the above conditions except as to temperature: at 4 hours and 2°, 5·9; at 10°, 6·4; and at 35°, 8·9, in the last case one hour only.

The "M" rosin showed at 2°, 117·1; at 10°, 125·2; and at 35°, 173·2. The rosin was run on 0·5 grm. with 80 c.c. Hübl solution, time 4 hours.

It is clear that the Hübl method is subject to marked variations under varying conditions, exactly as is the case with the Wijs method.

Iodine absorption with Hanus solution.—This solution offers no advantages over the Wijs and is more difficult to prepare if properly made, *i.e.*, when the iodine and bromine are combined to the monobromide only and a slight excess of iodine is present. Nevertheless it was determined to examine shellac by this method, as many chemists are using the Hanus solution in the analysis of fats.

A large number of tests were made on various lots of shellac, and show that when the Hanus solution is prepared carefully from acetic acid of the right melting point, results are practically identical with those found by the Wijs solution, and the same constants may be used in calculating the per cent. rosin. Rosin produces with the Hanus solution a black-red colouration as contrasted with the deep red by the Wijs solution.

Results have been found to be dependent on the time, concentration, temperature, and strength of acid exactly as with the Wijs solution, and need not be quoted here as they are practically interchangeable with those quoted in the previous paper (this J., 1905, **24**, 12).

Iodine absorption of old shellac.—It has been suggested that the iodine absorption of shellac is variable with the year and season. A number of shellacs of various crops dating back to the year 1892 were therefore examined, with the following results: D.C. (1895), iodine value 15·5; T.N. (1892), 17·4; V.S.O. (1897), 16·1; Diamond I. (1894), 15·5; S.S. (1895), 13·6. None of these samples when tested by the modified Storch-Morawski reaction (see previous paper in this Journal) showed any indication of rosin, which is only evident by this test when the iodine figure reaches 20. This is additional confirmation that the figure of 18 adopted by the American Sub-Committee as the limit for rosin-free shellac is safe.

In this connection the following results on sticklac and seedlac are of interest. Three samples of sticklac showed 15·9, 16·6, and 15·9 iodine values. A sample of washed sticklac or seedlac tested 12·0, showing that the purification of the sticklac results in the lowering of the iodine absorption.

Iodine absorption of rosin.—One pound samples were drawn directly from the barrels, crushed and immediately analysed with the following results: "A" 212·4, "B" 200·8, "C" 190·1, "D" 216·5, "E" 220·7, "F" 211·6, "G" 210·8, "H" 216·5, "I" 225·6, "K" 264·5, "M" 229·0, "N" 235·6, "W" 235·4, "WG" 233·9, "WW" 233·6, French 237·2, Bleached 238·3. The average 224 is close to the figure taken by the Committee of 228. It will be noted that the lighter coloured rosins are progressively higher in iodine absorption, and it is probable that these grades are more largely used for adulteration.

Two other methods for the detection of rosin in shellac have been published recently, Endemann (J. Frankl. Inst., 1907, **164**, 285; this J., 1907, 1207), and McIlhiney (Proceedings of the Seventh International Congress of Applied Chemistry, 1909). The latter method, which is a direct process for extraction of the alcoholic solution of the shellac by means of petroleum spirit, has given good results in our hands, and can be used for the determination of rosin when certain corrections are made for the average figures obtained by the author on rosin and shellac.

The Endemann method is quite unreliable. It depends upon the condensation of the shellac by repeated treatments with alcohol and concentrated hydrochloric acid at 105° C. The residue is then extracted with alcohol and evaporated to dryness. The weight of the dry extract in the case of pure shellac is stated not to exceed 8 per cent., the greater part of the shellac being rendered insoluble in alcohol by this treatment, which is without effect on rosin.

A series of tests on various shellacs show the test to be inaccurate. A sharp separation of the portions soluble and insoluble in alcohol is impossible, and according to the length of treatment with alcohol almost any value may be found for the non-condensable resins. An Octagon B shellac, free from rosin, showed 11·40 per cent. alcohol extract instead of the 8 per cent. limit given by Endemann. Continued extraction brought up the amount to 22·1 soluble in alcohol. A D.C. shellac showed 14·4 per cent. alcohol extract. A mixture of the D.C. containing 15 per cent. rosin was then made by fusion and tested by the Endemann method. Only 20·1 per cent. extract was found. We can make nothing out of this method.

Shellac wax.—McIlhiney, in the paper referred to, determines shellac wax in the petroleum spirit extract after the removal of the rosin by agitation with alkali.

The determination may also be made as follows: Dissolve 100 grms. of the shellac in 500 c.c. of water and 20 grms. sodium carbonate. Decant from any insoluble residue, the wax remaining in suspension. Boil and add about 15 grms. of paraffin, the weight of which is known. Stir the melted paraffin through the solution to collect the wax. Stand until cold. Remove the cake, dry and weigh. Filter the solution, which sometimes contains small pieces of paraffin, wash and dry the filter paper. Dissolve the paraffin through the paper by petroleum spirit, evaporate, and weigh. Add the weight to that of the cake and deduct the original weight of the paraffin taken to obtain the weight of the shellac wax.

We obtained higher results by this method than by the McIlhiney process. A sample of bleached shellac showed by extraction of the finely-powdered material in a Soxhlet with petroleum spirit 3·4 per cent., by McIlhiney's method 3·1 per cent., and by the above method 5·25 per cent. McIlhiney emphasises the importance of increasing the quantity of petroleum spirit when wax is to be determined, and possibly by increasing it beyond the amount used by us, which was not the amount prescribed for the solution of the wax, higher figures would be obtained.

Arsenic.—It is well known that orpiment is used to lighten the colour of orange shellac. It may be present up to 0·15 per cent. in crude shellacs, to a lesser extent in the varnish made from these shellacs, and to a still smaller amount in bleached shellacs. The latter, however, are never entirely free from arsenic unless specially prepared, according to the quantity present method (1) or (2) may be adopted.

(1) Boil two grms. with 50 c.c. of concentrated sulphuric acid and 15 grms. of potassium sulphate in a porcelain dish until the organic matter is oxidised. Dilute, pass hydrogen sulphide, and filter. Treat the precipitate with ammonium carbonate to dissolve the arsenic sulphide, acidify the filtrate, and filter the pure sulphide on a Gooch filter, dry and weigh. This test will show the total arsenic. Some arsenic is dissolved by the fused shellac.

The orpiment may be determined by dissolving 100 grms. in alcohol and washing by decantation. The residue is dissolved in boiling nitric acid and evaporated with sulphuric acid until fumes are evolved. Ferrous sulphate is then added, together with hydrochloric acid, and the arsenic is distilled into water, and determined as usual. The alcoholic solution of crude shellac contains arsenic in traces even after filtration through paper.

(2) To test for traces weigh 10* grms. into a 300 c.c. Kjehdahl flask of Jena glass, add 50 c.c. arsenic free nitric acid and heat gently until solution is effected. Boil for a few minutes and add 15 c.c. arsenic free sulphuric acid. Boil down till fumes are evolved. The greater part of the sulphuric acid passes off and the mass of carbon is practically dry. Add 50 c.c. of a saturated solution of sulphurous acid and evaporate to dryness. Add 60 c.c. of water, boil down to about 40 c.c. and throw the contents of the flask on a filter. Wash until the volume of the filtrate is 75 c.c. Mix and take 15 c.c. corresponding to 2 grms. of shellac. Add 15 c.c. of dilute arsenic-free hydrochloric acid (1 : 6) and 3 grms. of arsenic-free zinc, in a 30 c.c. bottle provided with a thistle tube and bulb tube, carrying a little cotton soaked in lead acetate solution and dried, and followed by a strip of cold pressed drawing paper 4 mm. wide, sensitised by treating with 5 per cent. solution of mercuric chloride and drying. If arsenic is present a yellow to yellow-red deposit is formed on the paper, which should be compared with standards obtained by running blank tests on 2 grms. of arsenic-free organic matter (preferably shellac) to which have been added amounts of arsenic oxide ranging from 3 to 30 micromilligrams. The limit set by the British Royal

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* In the case of varnish take a quantity which will yield about 10 grms. on evaporation and dry down in the flask before the addition of acid.

Commission on Arsenical Poisoning of 1 part in 700,000 is 2·8 micromilligrams on the 2 grms. of shellac taken.

The apparatus is described in detail by Sanger (this J. 1907, 1115). A coloured reproduction is given in this paper showing the stains obtained by amounts of arsenic varying from 2 to 70 thousandths of a milligram (micromilligrams), and the statement is made that 1 micromilligram can be detected with certainty. This would correspond under the conditions of the above test to a sensitiveness of 1 part in 2,000,000.

If the stain obtained on 15 c.c. of the solution does not fall within convenient limits for comparison another aliquot may be taken from the balance of the solution of the 2 grms. of shellac.

Sampling.—Rosiny T.N. shellac is sometimes very irregular in rosin contents, probably because the commercial rosin standard is met by the mixture of pure and adulterated T.N. shellacs in finished form.

A delivery of T.N. shellac in cases was tested by individual packages as follows: 2·5 per cent., 5·8 per cent., 2·1 per cent., 7·25 per cent., 5·4 per cent., and 4·6 per cent. rosin. This is not common, but will serve to show the necessity for careful sampling from a generous proportion of the cases or bags.

A dirty T.N. was shaken on a 20 mesh sieve, 11·2 per cent. passing through. The fines tested 5·0 per cent. rosin, while the coarse residue showed 3·4 per cent. A T.N. containing small pieces of ground blocked shellac, tested as a whole 1·9 per cent. rosin, whereas the small pieces contained 8·9 per cent.

Specific gravity.—An examination of shellac under the microscope discloses the presence of numerous air cells, leading to irregularities in the specific gravity. A sample of good orange shellac showed by immersion 1·1141 and by floating 1·1350 at 60° F. referred to water at 60° F.

Shellac Varnish.

Solvent.—The two solvents in common use, wood alcohol and special denatured grain alcohol, are distinguished by the odour after some practice. A confirmatory test may be made by taking the boiling point of the shellac varnish. A large test tube will answer. The thermometer is held just above the shellac. Shellac in alcohol has little effect on the boiling point, which will closely approximate 78° C. for special denatured and 68° C. for wood alcohol shellac.

Detection of methyl alcohol in grain alcohol.—The presence of special denatured alcohol, which contains 5 per cent. of wood alcohol, as an impurity in grain alcohol shellacs is easily determined by a test for acetone in the distillate. Distil the alcohol from 150 c.c. of the shellac varnish. Re-distil the distillate, using a Linnemann fractionating tube, and collect the first 5 c.c. Dilute the fraction with water to 100 c.c. Take 4 c.c. in a test tube and add 4 c.c. of a solution of 5 grms. of precipitated mercuric oxide in 100 c.c. water and 20 c.c. sulphuric acid. Place the test tube in a boiling water bath and heat for 10 minutes. Acetone forms a white precipitate in combination with the mercury, appearing in a few minutes. By this procedure as little as 1 per cent. of special denatured in the grain alcohol will give a test; 2 per cent. will give a distinct reaction. Blank tests made on "straight" grain alcohol shellacs give no reaction with mercuric sulphate. The acetone reaction is adapted from the test described by Denigès (see this J., 1899, 179).

The admixture of acetone-free methyl alcohol is less likely on account of its price. We have tried the various tests recommended for the detection of methyl alcohol in presence of grain and find that given by Vorisek (this J., 1909, **28**, 823) to be preferred. If the methyl alcohol is first concentrated as described above we find no difficulty in detecting an addition of 2 per cent. of refined methyl alcohol to grain alcohol shellac.

Body and specific gravity of shellac varnish.—The weight or body of shellac varnish is usually expressed in pounds of shellac per gallon of alcohol taken. The shellac is weighed, but the alcohol is generally measured and its weight is therefore dependent on its temperature, which may vary between 50° and 70° F. during the year.

A delivery of special denatured alcohol had the specific gravity of 0·8164 at 60°/60° F. The weight of the U.S. gallon of 231 cubic inches at this temperature is 6·812 lb. At 50° C. the specific gravity referred to water at 60° F. is 0·8207 and one gallon weighs 6·849 lb. At 70° F. the gravity is 0·8118, one gallon weighing 6·775 lb.

To determine the body of a shellac varnish weigh 0·5 to 1·0 grm., according to its strength, in a weighing bottle. Rinse out with alcohol into a weighed dish containing 10 grms. of ignited sea sand and a weighted stirring rod. Heat for just one hour at 110° C. Divide the weight of the residue by 0·96 in the case of white shellacs and by 0·98 in the case of orange shellacs. Multiply by 100 and divide by the weight of varnish taken to get the per cent. of dry residue. If the residue is for instance 40 per cent. by weight and the alcohol 60 per cent., then in case the varnish had been made with alcohol at 60° F., the following proportion would hold good: 60 : 4 : : 6·849 : x=4·6 lb. shellac per gallon of alcohol.

We have found it necessary to expose a large surface during the drying of the varnish by spreading the shellac over sand. Bone dry white shellac invariably contains several per cent. of water and there is also some loss of weight at 110° C. with orange shellacs. Experience in laboratory tests on varnishes prepared on a factory scale have shown that the corrections above will yield fair results. The method at best will give only approximate figures, because of the irregularity in the water contents of the raw materials and the temperature of the alcohol.

The specific gravity of wood alcohol being practically identical with that of special denatured alcohol, the weights per gallon taken above may be used on wood alcohol shellacs.

A white shellac varnish made by dissolving 4 lb. of bone-dry bleached shellac in a gallon of special denatured alcohol at 60° F. (sp. gr. 0·8192 at 60°/60° F.) showed a specific gravity of 0·9295 at 60°/60° F. A solution of rosin prepared in the same way had a specific gravity of 0·9021. Orange shellac cut 5 lb. to the gallon of 95 per cent. wood alcohol had a specific gravity referred to water at 60° F. of 0·9440 at 50°, 0·9404 at 60°, and 0·9359 at 70° F.

Detection of adulterants in shellac varnish.—The addition of water or benzine to the alcohol can be determined by taking the specific gravity of the distillate from the varnish, or by thinning down the distillate with water when the benzine will separate.

Spirit soluble copals, sandarac, and rosin are still frequently found as adulterants of shellac, in spite of the present low price of shellac. Qualitative tests with Wijs solution will reveal these impurities. Old Wijs solution darkens in colour owing to the liberation of iodine. It may be bleached by adding a solution of iodine trichloride in glacial acetic acid. For use in qualitative work it should then be thinned down with 2 parts by volume of glacial acetic acid.

A few drops of the varnish are mixed with 2—3 c.c. of the dilute Wijs solution. Pure shellacs do not alter the colour, except on long standing. Rosin produces an immediate reddish colouration. Copal and sandarac give a red colour reaction, less pronounced than the rosin, and a curdy precipitate. This precipitate is also formed when an alcoholic solution of copal or sandarac is diluted with glacial acetic acid or when a large excess of alcohol is added. Shellac wax tends to settle after dilution, but a little experience will distinguish it from the curdy precipitate produced by copal and sandarac. The odour of the two latter gums, when the varnish is rubbed between the fingers, is characteristic.

When rosin alone has been used as an adulterant (and this is usually the case) the proportion may be roughly determined by comparative colour tests with Wijs solution and samples of white or orange shellac, of about the same body as the goods under examination, which contain one, two, and three pounds of rosin to the gallon in addition to the shellac.

A few years ago an alcohol-soluble preparation of casein was extensively used as an adulterant of shellac varnish. It was easily recognised by the high percentage of ash left on burning off the varnish and the green colouration of the flame from the burning alcohol, due to the presence of boric acid. Wijs solution gave no reaction. The varnish films left after the evaporation of shellac solutions containing casein were not waterproof and were loosened from the support after a short soaking under water. Synthetic shellac substitutes have proved to be more expensive than natural gums such as sandarac or copal, and of even less practical value as constituents of varnish ; we have never observed their presence in varnish.

THE ACID HYDROLYSIS OF STARCH GRANULES.

BY CHESTER B. DURYEA.

Much valuable work has been done in investigating the hydrolysis of starch pastes or solutions. Rolfe, Defren, and others have devoted much attention to acid hydrolysis of various starch pastes, while the well-known literature relating to corresponding enzymic actions is extensive.

Apart from the activities of a few of the earlier workers, including Fritzche (1834), C. Naegeli (1858), and perhaps Musculus (1860), who gave especial attention to the morphology of starch granules, and excepting also the important work by Brown and Morris on the action of moderately dilute acids upon potato starch granules in the cold (J. Chem. Soc., 1889, 449; see this J., 1889, 716), the great preponderance of effort has been expended in the chemical study of starch pastes and of the products resulting from their hydrolysis.

My own work has been somewhat extensive in connection with the acid hydrolysis of starch granules, under greatly varying conditions. At the same time I have had to deal with acid and enzymic hydrolysis of starch pastes through a wide range of concentrations and other variables.

The table following shows the averaged results of two closely agreeing sets of experiments in which great care was exercised. The work was carried out in order to develop and test certain conditions and theories in a more systematic way than I had done up to that time. The material used was washed crude green starch made by the sulphurous acid process.

"In-suspension" acid hydrolysis of maize starch granules.

About 20° B.—temp. 55° C. throughout—1·0 per cent. hydrochloric acid. Samples taken at hourly intervals, immediately neutralised with sodium carbonate and cooled to room temperature.

Sample.	Carbohydrates of undiluted filtrates. 100 c.c. filtrate contains soluble carbohydrates produced from 53·7 gms. original anhydrous starch.							Washed starch. Anhy. basis.
End of	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
1st hour	0·271%	0·145 grm.	R = 28·90	172·20°	0·042 grm.	Maltosazone formed (trace)	R = 0·078	R = 0·121
2nd hour	·307 0·578%	·165 0·310 grm.	6·85 R = 22·05	11·9 184·10°	·026 0·068 grm.	Increase over 1st hour	·050 R = 0·128	·092 R = 0·213
3rd hour	·411 0·989%	·221 0·531 grm.	3·50 R = 18·55	4·65 188·75°	·031 0·099 grm.	Increase over 2nd hour	·056 R = 0·184	·091 R = 0·304
4th hour	·486 1·475%	·261 0·792 grm.	1·95 R = 16·60	1·95 190·70°	·032 0·131 grm.	Increase over 3rd hour	·060 R = 0·244	·066 R = 0·370
5th hour	·490 1·965 %	·263 1·055 grms.	1·03 R = 15·57	2·65 193·35°	·033 0·164 grm.	Increase over 4th hour	·062 R = 0·306	·030 R = 0·400

I. Per cent. dissolved of original anhydrous starch.
II. Grams total carbohydrates per 100 c.c. filtrates, calculated as anhydrous starch from cupric-reducing power after converting into glucose.
III. Cupric-reducing power before converting into glucose as maltose percentages of carbohydrates in solution, the latter estimated in terms of anhydrous starch.
IV. Apparent specific rotation of carbohydrates in solution, computed on anhydrous starch equivalent basis.
V. Apparent grms. maltose per 100 c.c. filtrates, calculated from direct cupric-reducing power.
VI. Results from phenylhydrazine acetate tests.
VII. Apparent maltose of filtrates, in percentage relationships with original anhydrous starch.
VIII. Approximate cupric-reducing power, as maltose, of washed starches on anhydrous basis.
Note.—The interpolated figures, in the several columns, represent the numerical difference between successive members of the series.

The work of Brown and Morris already referred to seemed to ignore viscosimetric alterations. With the exception of one experiment at the end of eight and one-half years of acid treatment, they appear unfortunately to have also neglected to examine the starch by-products in solution, so that these investigations by themselves are of little use for broad applications of any kind. Musculus, however, as a result of his general starch researches, as early as 1860 advanced the theory that starch molecules break down by a series of hydrations and subsequent decompositions, sugar being formed at each splitting, together with a dextrin of lower molecular weight. An excess of water is of course presupposed. Later O'Sullivan (1872—1876, J. Chem. Soc.) established the fact that the characteristic sugar produced from starch by diastatic digestion and the primary one yielded by acid hydrolysis, was not dextrose, as had been generally believed, but maltose. This sugar, isolated in 1819 by De Saussure, was apparently first comprehensively recognised by Dubrunfaut in 1847, and named maltose. Musculus and Grüber in 1878, following O'Sullivan's re-discovery of maltose, improved the earlier theory of Musculus regarding the mechanism of starch hydrolysis, by stating the sugar fission product to be maltose.

In outlining what I believe to be the significance of the present tabulated data, I would like first to call attention to an apparently direct experimental proof on starch itself, that is on starch granules, of the idea of Musculus, acquiesced in by O'Sullivan, with respect to the early production of maltose.

In the table under heading VI, it will be seen that the presence of maltose was demonstrated in the menstruum after one hour of hydrolytic treatment, and that the amount in solution regularly increased thereafter. Columns I and II show that at the end of the first hour but 0·271 per cent. of the original anhydrous starch granules had appeared in solution as hydrolytic by-products, and that the filtrate tested with phenylhydrazine acetate contained only 0·145 grms. of by-products per 100 c.c. In view of the regularity of the increase in the amount of maltosazone formed, of the fact that a well defined positive test was had when the hydrolytic equivalents of but 0·271 per cent. of the original starch had become soluble, and further in view of the very low concentration of the solution tested, it appears undoubtedly reasonable to conclude that maltose was formed considerably earlier in the treatment, with a fair probability that it appeared concurrently with the beginning of hydrolytic cleavage. This conclusion is also borne out by the apparent maltose cupric-reducing power of the washed starches.

In support of my belief that I was actually dealing with free and combined maltose in this work, and to indicate the accuracy aimed at, the following is cited.

First: The osazone tests failed to show any glucose. Besides, the conditions and rates shown, particularly by columns II, III, IV, and V, strongly indicate that up to the end of the series no considerable amount of glucose could have been formed, either as a product inherent in the mechanism of primary change, or as a result of the continued action of the hydrolytic conditions upon primary products. Systematic iodine tests on the filtrates also supported this reasoning, the results showing that a preponderance of more highly organised dextrins or soluble starches, in relation to apparent combined and free maltose, increased with the duration of hydrolysis.

Second: A corn starch modified by a "drying-in" process, whose history was known to me, gave a total cupric-reducing power as apparent maltose, equal to 0·444 per cent. An aqueous extract of this material on the same basis of concentration as the tabulated work being discussed, yielded no glucosazone and showed a reducing power of 0·166 per cent., in terms of maltose referred back to the original starch. The difference between these figures, 0·278 per cent., ought to be the maltose cupric-reducing power of the fully water extracted starch, after drying. I determined this value and found it to be 0·276.

Next I might briefly refer to the viscosimetric changes determined at the time, but not shown in the table. On an absolute basis of comparative testing, the viscosities of the washed and dried starches of the tabulated series appeared to show a general logarithmic rate of change from a greater to a less viscosity very similar to the rate of increase in maltose reducing power of the same starches, as shown in column VIII. I should say here, that at the time of execution of the work I found it necessary to use Pavy's solutions for determining the reducing power of the starches, and in such use, until these powers became fairly well defined, the method was not very satisfactory, owing to technical reasons.

I believe the work submitted indicates that as an accompaniment to the production of maltose there is a general simplification of the molecular condition of the carbohydrate material composing the granules; so that at each succeeding moment of acid hydrolysis for each molecule of maltose produced there are formed a greater number of what might be termed starchy dextrins, and the other dextrins (including soluble starch), in the aggregate progressively simpler in constitution at each general cleavage instant, thus carrying the ideas of Musculus perhaps a little further with regard to dextrin formation.

In this connection it should be emphasised that fundamental condensation variations, exemplified in the stratified structure of starch granules, persist in starch pastes, as has been so well indicated by Duclaux (Ann. de l'Inst. Pasteur, 1895), and that the results of hydrolysis of both granules and pastes are influenced by certain limitations and peculiarities inherent in these facts.

The experimental work now presented was carried out at Cardinal, Ont., about the end of the year 1907. The results, which I expect to experimentally check and extend, were of considerable service in preparing my introductory address upon "Natural and Modified Starches," read before the American Chemical Society at the Chicago 1907—1908 meeting, on which occasion I stated my intention to complete and publish various starch and starch products investigations already partially developed. I shall shortly be in position to proceed with these matters, and therefore it seemed perhaps timely to present some of my older work without further waiting to complete certain lines and fill in gaps.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

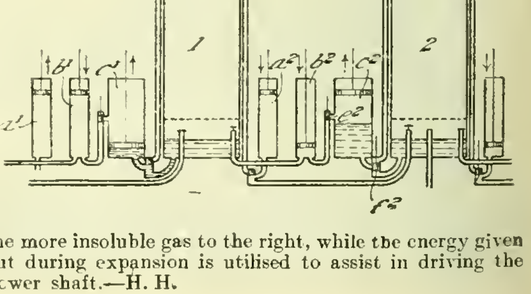
PATENTS.

Cooling, evaporating and moistening fluids. W. Tattersall, Accrington. Eng. Pat. 8883, April 13, 1910.

THE apparatus consists of a chamber through which air or gas is aspirated by a fan. In the lower part of the chamber is a tank containing liquid in which nests of pipes or other heat-transferring devices are immersed. Above the tank are arranged groups of plates alternating with groups of fixed or rotary evaporators which are exposed to the current of gas or air above and dip into the liquid below. Means are provided for spraying the liquid over the plates or evaporators. The current of air or gas is moistened by the film of liquid on the plates which is evaporated and the liquid is cooled by the evaporation.
—W. H. C.

Gaseous mixtures; Separation of the constituents of ——. J. T. Hewitt, London. Eng. Pat. 12,424, May 21, 1910.

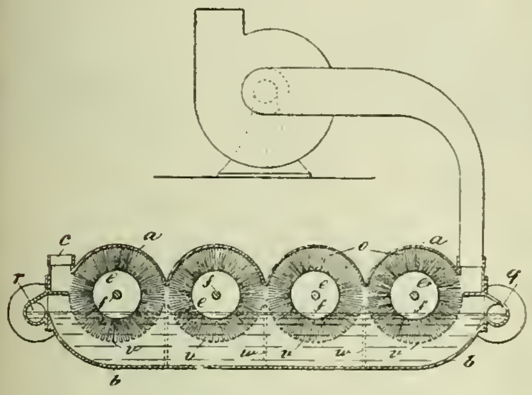
AN apparatus for recovering work in the operation of separating the constituents of a gaseous mixture by means of a solvent, comprises a number of saturation vessels 1, 2, etc., each having three pumps, a', b', c', driven from a common power shaft, which also controls the valves. At a certain point in the cycle of operations, the saturated liquid in one of the vessels, such as 2, is allowed to flow into the pump, c^2, until it is half full, whereupon the valve, f^2, is closed and further upward movement of the piston causes a liberation of gas from the liquid in the pump. Upon the down stroke of the piston this gas is forced out through a valve, e^2, into the pump, b^2, and the liquid is then forced back into the top of the saturator, 2. The pump, b^2, forces the liberated gas into the bottom of the saturator, 1, while the pump, a^2, withdraws gas from the top of the saturator, 1, and forces it into the bottom of the saturator, 2. The more soluble gas is thus passed continually through the series of chambers to the left and



the more insoluble gas to the right, while the energy given out during expansion is utilised to assist in driving the power shaft.—H. H.

Purification and like treatment of air; Apparatus for the —— and for the collection therefrom of dust or the like. F. M. Hotblack, Norwich, G. Wiley, Hove, and L. Venner, Redhill. Eng. Pat. 12,995, May 28, 1910.

The gas enters the casing, *a*, *b*, through the pipe, *c*, and passes across the brushes, *e*, in a direction at right angles to the shafts, *f*, by which they are rotated. The brushes dip into the washing liquid, *w*, which enters at *q*, and flows away through *r*. The lower parts of the brushes are protected by the curved perforated plates, *v*.—W. H. C.



Purifying gases and precipitating flue dust. G. G. M. Hardingham, London. From Metallurgische Ges. Act.-Ges., Frankfurt a/M., Germany. Eng. Pat. 13,591, June 4, 1910.

The gases are passed through a chamber in which they are subjected to a beating or whipping action from a number of radial arms or blades spaced spirally round a horizontal shaft so that the passage of the gases may not be restricted. The action of the beating causes the particles of dust to coalesce and fall to the bottom of the chamber which is formed by a water-seal. In order to facilitate the agglomeration and separation of the dust particles, the gases may be moistened with water from a spray either before or during their passage through the chamber. —W. H. C.

Evaporators or distilling apparatus. H. Hocking, Liverpool. Eng. Pat. 13,121, May 30, 1910.

The claim relates to tubular evaporators used for preparing fresh water from salt water. The heating tubes are formed of hard brass or other suitable alloy, and have coned ends which fit into or over the coned ends of the U-shaped bends by which they are connected at each end. The latter are made of cast metal which will stand the action of the salt water, and the ends are forced into metallic contact by a screw coupling ring.—W. H. C.

Vacuum evaporator or heater. J. E. Dunn, Philadelphia, Pa. Reissue No. 13,245, May 30, 1911, of U.S. Pat. 906,517, Dec. 15, 1908.

The evaporator comprises a vertical cylindrical casing divided horizontally into four chambers, viz., a large evaporating chamber at the top, an intermediate steam heating chamber, a lower liquid chamber, and a second steam chamber at the bottom. Vertical tubes passing through the intermediate steam chamber connect the two liquid chambers, and centrally through these tubes pass other tubes which connect the lower steam chamber with the upper liquid chamber. These steam tubes do not open into the upper liquid chamber but are fitted with vents at the top. A large central liquid-circulating pipe extends through the upper steam chamber, connecting the lower liquid chamber with the evaporator chamber, and a similar pipe enters the lower liquid chamber from below.—H. H.

Distilling apparatus. H. Hirzel, Leipzig-Plagwitz, Germany. U.S. Pat. 991,205, May 2, 1911.

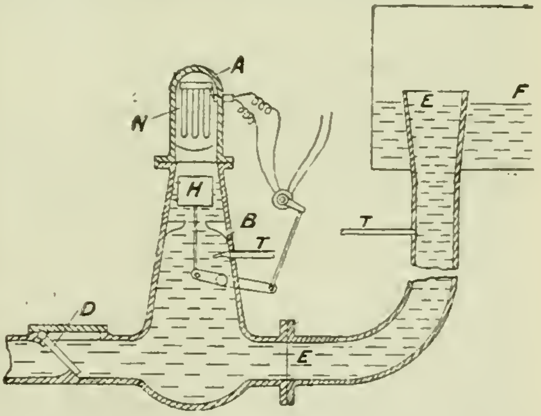
In order to separate a single constituent from a complex mixture of volatile liquids, a film of the liquid mixture, at a temperature somewhat below the boiling point of the constituent to be separated, is passed through a current of inert gas at a similar temperature and the separated constituent condensed out from this gas. The process is described as applied to the recovery of crude benzol from coal gas. The gas is first treated with a "wash oil" which absorbs the benzene along with other bodies, such as toluene and xylene, etc., and the crude benzol absorbed, is then extracted as above described, the temperature being maintained at about 130° C. (the boiling point of commercial crude "benzol" being taken as about 140° C.) and steam being used as the inert gas. The still employed consists of a tall cylindrical chamber having a number of steam coils arranged one above the other near the periphery. A dome-shaped baffle is arranged just above each coil so that the liquid descends as a thin film near the walls of the chamber. The chamber is lagged to maintain a uniform temperature, and heat is economised by utilising the hot gas (steam) passing from the still to heat the wash oil as it enters.—H. H.

Distillation; Utilising waste heat of ——. F. Shuman, Philadelphia, Pa. U.S. Pat. 992,814, May 23, 1911.

The vapours coming from the still are condensed in two stages in separate condensers. The cooling water is passed first through the second condenser and a part of it is then passed through the first condenser. The quantity passed through the first condenser is so proportioned that it is heated to a temperature high enough to convert it into steam.—W. H. C.

Pump for raising liquids. G. Poore, London. Eng. Pat. 20,934, Sept. 8, 1910.

A quantity of air under pressure contained in the chamber, A, is suddenly heated by an electric current which is passed through the resistance, N. The expansion of the air causes the liquid to be driven forward through the rising main, E, into the overhead tank, F. The momentum thus imparted to the water not only causes the whole quantity to pass from the chamber, B, but also draws some water through the supply valve, D. As the float, H, falls, the current is cut off and a small quantity of water returns through the narrow pipe, T, and acts as a spray condenser on the air in B, and cools it. When the outflow of water ceases, owing to the expenditure of the energy imparted to it, a return flow begins. This compresses the air in A, and when the float has risen sufficiently to make the contact again, the air is once more heated and the cycle recommences. To make up for any loss of air due to its solution in the water, a small valve is provided which admits enough air to compensate for the loss at each stroke.—W. H. C.



Drying by air circulation in dryers of the passage type; Method of and means for ——. K. Reyscher, Bielefeld, Germany. Eng. Pat. 21,191, Sept. 12, 1910. Under Int. Conv., Feb. 21, 1910.

The apparatus consists of a central heating chamber with a lateral drying chamber on each side. The material to be dried is caused to pass on suitable trucks or carriers in opposite directions through the lateral chambers. In each lateral chamber the air enters at the outlet end and passes first over the partially dried material going towards the outlet. At the centre of the chamber the current of air is deflected and after passing through the heating apparatus it is passed over the material entering the opposite chamber.—W. H. C.

Separation of granular or pulverised substances; Process and apparatus for the ——. J. S. Fasting, Frederiksberg, Denmark. Eng. Pat. 4410, Feb. 21, 1911. Under Int. Conv., Feb. 24, 1910.

The material to be treated is placed upon an inclined surface which is given a quick reciprocating motion in a vertical or mainly vertical direction, whereby the coarser ingredients or those of higher specific gravity will travel downwards, while the finer ingredients or those of less specific gravity will travel upwards. It is stated that the separation is caused by the small vibrations of the air immediately over the surface of the plate and not by contact with the moving plate. A number of plates arranged at different angles of inclination may be used to separate the granular material into several grades of fineness, or this may be effected by means of a single plate having different inclinations at different points, for instance warped plates or plates of double curvature. The apparatus may be used instead of sieves in all kinds of milling operations and is stated to be suitable for sifting cement.—H. H.

Desiccating air. H. T. Weston, Cleveland, Ohio. U.S. Pat. 992,829, May 23, 1911.

The air is passed through a series of chambers in which it is alternately subjected to high-tension electrical discharges which cause a reduction in the hygroscopic tension of the air, and to refrigerated surfaces which cause the condensation and deposition of the moisture released from the air. —W. H. C.

Drying and conveying moist materials. F. A. Bühler, Berlin. U.S. Pat. 992,939, May 23, 1911.

A current of heated air or gas is forced into the lower end of a stack or chimney, and the material to be dried is fed into the stack at the lower end. The material is dried by the current of air, and carried upwards to a baffle-chamber at the upper end of the stack, where the direction of the current is changed, and it is caused to pass down through a second tube in which the air or gas is separated from the dried material. The latter is passed through a cooler after its discharge.—W. H. C.

Separation of solids and liquids. E. G. Spilsbury, New Rochelle, N.Y., Assignor to Just Process Co., Syracuse, N.Y. U.S. Pat. 994,281, June 6, 1911.

The liquid is filtered off through a porous rigid septum capable of retaining liquid in the pores thereof, and the solid residue is removed by tilting the septum while the liquid is still retained therein and forcing air back through it.—H. H.

Separating solid particles from gaseous fluid; Apparatus for ——. E. G. Spilsbury, New Rochelle, N.Y., Assignor to Just Process Co., Syracuse, N.Y. U.S. Pat. 994,282, June 6, 1911.

The gas is forced through a rigid mineral sponge septum or series of them.—H. H.

Separating and collecting particles of one liquid suspended in another liquid; Process and apparatus for ——. F. G. Cottrell, Berkeley, Cal., Assignor to Petroleum Rectifying Co., San Fransisco. U.S. Pat. 994,377, June 6, 1911.

In the process for separating particles of one liquid suspended in another, in which the mixture is passed through a pervious septum initially wetted with a liquid readily miscible with the liquid forming the suspended drops (this J., 1911, 479), the septum is arranged in such a manner that the drops of suspended liquid which collect thereon drain to the lower extremity of the septum and collect there in masses essentially free from the other liquid. —H. H.

Centrifugal machine for separating solids or liquids from gases. Maschinenfabr. Buckau A.-G. Ger. Pat. 234,509, Dec. 1, 1909.

A rotating drum, *d* (see figs.), divided into compartments through which the incoming and outgoing gases flow in a direction parallel to the axis, is provided with annular conduits, *k*, having openings, *l*. The cross-sections of the conduits, between the openings, *g*, through which the crude gas flows from the drum into the conduits, and the openings, *h*, through which the purified gas re-enters the drum from the conduits, are closed by plates ϵ_1, so that the specifically heavier impurities are caused by the centrifugal force to pass through the openings, *l*, into a collecting chamber. Two or more annular conduits may be arranged in series on the drum, or one or more helical conduits may be employed, the pitch of the helix being so small that the motion of the gas remains essentially one of rotation around the axis of the drum.—A. S.

Fig. I.

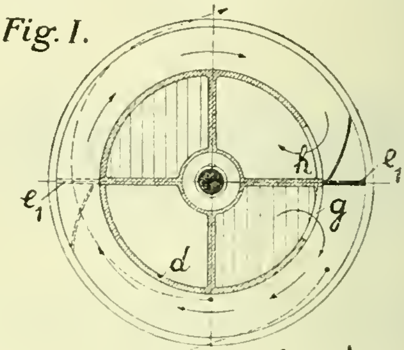
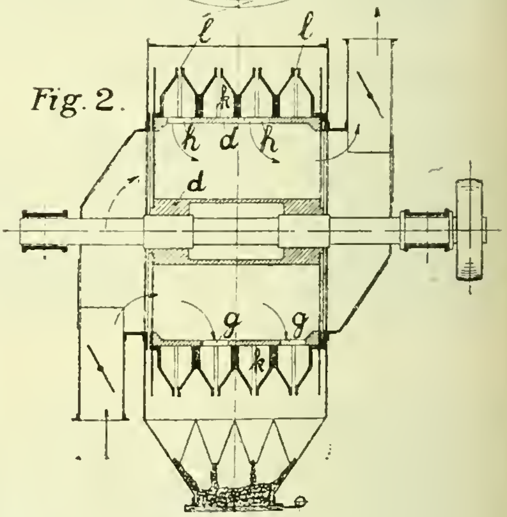


Fig. 2.



Apparatus [hydro-extractor] for the purification of liquids. G. Pinette, H. Benoist, and L. Graillot. Fr. Pat. 424,322, Dec. 30, 1910.

The apparatus, which is intended for the recovery of suspended matter from water used in washing coal, ores, starch, etc., consists of a rotary hydro-extractor with inverted drum, within which are a movable scraper and a collector. The liquid is delivered into the apparatus near the top, above a circular collar which acts as a distributor;

the suspended matter then becomes attached to the inner wall of the drum, and the liquid flows down and out over a rim at the bottom. A portion of the liquid, however, passes through special openings in the rim, and when a cloudiness is observed in this liquid, indicating a sufficient deposit of solid within the drum, the supply of liquid is stopped, and the scraper is turned into position so as to get rid of any remaining water by rubbing against the material ; when the water has been removed, the scraper is turned out of action, and the collector, which has a cutting edge, is turned round, by means of an endless screw engaging a toothed sector, until the edge comes into contact with the material ; owing to the rotation of the drum, which is continuous throughout, the material is thus detached, and, falling within the collector, is discharged from the apparatus. Finally, the collector is restored to its original inactive position, and a further supply of liquid is introduced into the apparatus.—F. Sodn.

Filtering and the production of filtering media. T. F. Seitz, Kreuznach on Nalse, Germany. Eng. Pat. 13,506, June 3, 1910.

See Fr. Pat. 417,944 of 1910 ; this J., 1911, 10.—T. F. B.

Filtering apparatus ; Rotary ——. A. J. Arbuckle, Johannesburg, Assignor to The Anglo French Exploration Co., Ltd., London. U.S. Pat. 994,235, June 6, 1911.

See Eng. Pat. 20,400 of 1908 ; this J., 1909, 130.—T. F. B.

Drying apparatus for liquid and pasty substances. H. J. and H. R. Glass, Leipzig, Germany. Eng. Pat. 13,470, June 3, 1910.

See Fr. Pat. 416,839 of 1910 ; this J., 1910, 1363.—T. F. B.

Dryer for potatoes and wet food for cattle, and for chemical products. C. Weiss, Meissen, Germany. Eng. Pat. 21,472, Sept. 15, 1910.

See U.S. Pat. 991,679 of 1911 ; this J., 1911, 731.—T. F. B.

Absorbing gases or vapours ; Apparatus for ——. P. Schou, Copenhagen. Eng. Pat. 1628, Jan. 21, 1911. Under Int. Conv., Jan. 24, 1910.

See Fr. Pat. 412,883 of 1910 ; this J., 1910, 1093.—T. F. B.

Separating substances in suspension ; Method of ——. B. Schwerin, Frankfort on Maine, Germany. U.S. Pat. 993,888, May 30, 1911.

See Ger. Pat. 233,281 of 1910 ; this J., 1911, 605.—T. F. B.

Distilling and rectifying apparatus ; Device for automatically regulating the flow of the head products or other condensation products proceeding from ——. E. Guillaume, Paris. U.S. Pat. 994,672, June 6, 1911.

See Fr. Pat. 365,417 of 1906 ; this J., 1906, 947.—T. F. B.

Liquid separation of solid constituents ; Process for the ——. F. I. Du Pont, Wilmington, Del. U.S. Pat. 994,950, June 13, 1911.

See Fr. Pat. 419,073 of 1910 ; this J., 1911, 120.—T. F. B.

IIa.—FUEL ; GAS ; MINERAL OILS AND WAXES.

Sulphur in coal ; A new method for the determination of ——. T. St. Warunis. Z. anal. Chem., 1911, **50**, 270—272.

One grm. of coal is intimately mixed with 2 grms. of copper oxide and 1 grm. of anhydrous sodium carbonate, and the mixture is heated in a porcelain crucible, with constant stirring with a platinum wire, until the coal is burnt. This usually takes about two hours. The ignited mass is allowed to cool, treated with bromine water, dissolved in hydrochloric acid and the excess of bromine boiled off. Any insoluble residue is then filtered off, hot barium chloride solution is added to the boiling solution and the precipitated barium sulphate is collected and weighed. —T. St.

Otto Hilgenstock [coke-oven] by-product process. E. Bury. J. Gas Lighting, 1911, **114**, 748—749.

The process consists in extracting the tar from the hot gas above its dew-point. This is effected by passing the gas through hot tar sprays. The gas is then at once passed to the saturator, where all the ammonia is extracted by sulphuric acid. In this way about five per cent. more ammonia is claimed to be recovered and as the hot gas is passed direct from the saturator to the heating flues of the ovens the trouble of disposing of the effluent is avoided. The use of coke-oven gas for lighting purposes has caused the question to be raised whether the passage through a bath of sulphuric acid would reduce its value for this purpose. The author, however, states that he has examined the gas and has found that its heating value is approximately the same as that of ordinary coal gas. In the present day when incandescence burners have almost entirely displaced the flat flame system it is the calorific rather than the illuminating or candle power that is important. The author has inspected the "Otto" plant which is supplying the town of Bochum with gas and gives many details respecting the installation. The plant consists of 50 "Otto" ovens capable of producing 70,630 cubic feet of illuminating gas per hour ; this is 48 per cent. of the total make. The ovens are provided with two mains so that the gas of the highest heating value can be drawn off separately for illuminating purposes. This is drawn off between the fifth and the fifteenth hours so as to get an average calorific value of between 4800 and 5100 calories. The gas is drawn by a "Connersville" injector through the tar spray apparatus and the saturator and is then passed through two coolers where the temperature is reduced to 48° or 50° C. The gas is purified from naphthalene in a standard washer placed between the coolers and the exhauster and supplied with "Ropert" oil, a mixture of anthracene oil free from naphthalene with four per cent. of benzol. The exhauster then forces the gas through three purifiers in which the hydrogen sulphide and part of the cyanogen are removed by oxide of iron. From the purifiers the gas goes into a gas holder to equalise the pressure and ensure a thorough mixing of the gas, and is then forced through a main by "Root's" blowers at about 40 inches pressure to the town's holders. Relief valves are provided to prevent any inconvenience from accumulation of pressure.—W. H. C.

Liquid fuels and their application in large internal-combustion engines. H. Loebell. Petroleum, 1911, **17**, 946—952.

The principal liquid fuels available for internal-combustion engines may be divided into three classes : 1. Crude petroleum and its distillation products ; 2. Light and heavy, so-called paraffin-oils obtained in the distillation of lignite ; 3. Coal-tar distillates. The tar oils derived from peat, shale and wood on account of their small production play a relatively quite unimportant part. Engines of the Diesel type which were originally designed to utilise a well rectified petroleum oil have undergone modifications and improvements so that they are now capable of employing a much larger range of liquid fuels. In the first of the above groups there are essentially four products : (*a*) *Benzine.*—A low boiling fraction of sp. gr. 0·700—0·710 (for Pennsylvanian) and 0·715—0·725 (for Indian) ; this type of oil is very widely used on account of the ease of evaporation and ignition and the large increase in volume produced on evaporation. With increasing specific gravity of the distillate the vapour density and boiling point rise and the volume of vapour produced from a given weight of liquid falls, consequently the proportion of air to vapour is materially increased, a condition rendering the attainment of intimate mixture of vapour and combustion-air much more difficult ; a heavy oil of this kind is the heavy benzine of Roumanian origin which distils between 140° and 160° C., has the sp. gr. 0·745—0·755 and contains 86·5 per cent. of carbon, 12 to 12·5 of hydrogen and 1 to 1·5 of oxygen. This comes on to the market denatured with a colouring material locally known as Sudan. (*b*) *Petroleum.*—A cheaper product less dangerous to handle from a fire point of view which, when mixed with a small quantity of benzine to facilitate ignition, can be utilised in Diesel engines, giving an efficiency of up to 40 per cent. The ignition difficulty may also be overcome by fitting the engine with a glowing surface on to which the petroleum is injected. (*c*) *Middle-oil.*—Sold under various names "Solar oil" (sp. gr. 0·860—0·880, b.p. 300°—350° C., calorific value 9500 to 10,800 calories per kilo., and denatured with 1 to 2 per cent. of crude oil). "Gas oil" and "Blue oil," is the product above the petroleum and of too low boiling point for use as a lubricant; it is capable of yielding an efficiency of 30 per cent. in Diesel engines. In the countries of production, Russia, Galicia and Roumania, this oil costs about M. 2·50 per 100 kilos. (1s. 3d. per cwt.) and is largely used as a source of power; the price in Germany is increased by M. 3·6 (3s. 6d.) duty and about M. 1 (1s.) cost of transport. (*d*) *Crude petroleum.*—Provided that this oil is as free as possible from ash and moisture it can be employed in the Diesel engine either by using a preheater in which the heat of the exhaust-gases is utilised, or, in the case of oils of high flash-point, with an admixture of benzine as an ignition oil. 2. *Lignite tar-oils.*—The so-called paraffin oil which comes on the market is the distillate from which the valuable paraffin has been almost completely removed; according to Rieppel the specific gravity of this oil lies between 0·860 and 0·926; it costs from M. 8 to 11 per 100 kilos. (4s. to 5s. 5d. per cwt.). From the distillation of lignite-tar five liquid distillates are prepared: 1. Lignite-benzine, sp. gr. 0·800—0·820; 2. Solar oil, sp. gr. 0·820—0·835; 3. Lignite tar-oil, sp. gr. 0·845—0·870; 4. Gas-oil, sp. gr. 0·875—0·900, and 5. Heavy paraffin oil; of these Nos. 3, 4 and 5 are utilised for large engines. The lighter oils contain from 13 to 14 per cent. of hydrogen, the heavier oils 11 to 13 per cent. The other constituent elements, oxgyen, nitrogen and sulphur together amount to some 3 per cent. and experience shows that these small amounts of oxygen and sulphur are without deleterious effect on the working of the engine. These oils consist of mixtures of several members of the saturated and unsaturated aliphatic hydrocarbon series. Rieppel has found as a result of extended operations that running difficulties are experienced when the natural paraffin content of the oil exceeds 2·5 per cent., while no such difficulties are encountered with oils to which even 15 per cent. of soft paraffin has been added; this he attributes not to the paraffin itself but to the probable presence of accompanying resinous bodies; the presence of creosote up to 12 per cent. is not detrimental. The paraffin oils are costly and are chiefly used as ignition oils for heavier driving oils. 3. *Coal-tar oils.*—The constituents of these oils are almost exclusively cyclic hydrocarbons. In the distillation the valuable benzol is removed and only the higher fractions, the anthracene and creosote oils, are available for power purposes. According to Rieppel, creosote oil contains 6·1 per cent. of hydrogen, anthracene oil 6·9 per cent., and the other power oils of this group from 7·5 to 8·2 per cent.; the net calorific value lies between 8960 and 9965 calories per kilo. The particularly stable nature of the cyclic hydrocarbons renders their use in Diesel engines more difficult than those of the open chain series and consequently the use of a small proportion of ignition-oil is necessary. Rieppel has found that the conditions of temperature and pressure under which an oil decomposes to form oil-gas is the best criterion as to how it should be applied in oil-engines. The oil is submitted to gradually increasing temperature in a bomb, the pressure and temperature alterations being noted; these are plotted as a curve with the pressures as ordinates and the temperatures as abscissæ; the point where the curve suddenly commences to take an almost vertical direction indicates the conditions under which oil-gas is produced; oils in which this change takes place at lower temperatures are more suitable than those which require higher temperatures. With crude benzol no such sudden rise is observed, showing that evaporation alone takes place. In the use of mixtures of lignite-tar oils with coal-tar oils Rieppel predicted that increase of the latter beyond 25 per cent. would lead to difficulties, and in this connection recommended the determination of the proportion of carbon to hydrogen in the mixture as the best test as to whether this limit had been exceeded. This prediction has been falsified by a series of trials carried out since 1909 on horizontal 100 h.p. Diesel engines; thin gas-works tar (8518 cals. per kilo.) and coke-oven tar (8533 cals. per kilo.), which had been subjected to a single distillation to remove free carbon, have been employed with continuous, heavy, variable loads without leaving any deposit in the cylinders. Tar obtained from vertical ovens, which is singularly free from moisture and free carbon (moisture 1·0 to 2·9 per cent., free carbon 1·13 to 4·26 per cent.) and which has a calorific value of 9015 to 9163 calories per kilo.—considerably higher than horizontal oven tar—has been satisfactorily employed in a horizontal Diesel engine without previous distillation, 213·3 grms. of tar with 3·7 grms. of paraffin oil being required per h.p. hour under full load. The author summarises the cost of running a 100 h.p. engine with paraffin oil at M. 8·5, tar-oil at M. 3·8, and tar at M. 3 per 100 kilos. (4s. 3d., 1s. 10½d., and 1s. 6d. per cwt.) at M. 4700, M. 2607, and M. 2133 (£230, £128, and £104) respectively under conditions of full load for a year of 3000 hours.—B. G. McL.

U.S. asphaltum production. Oil, Paint, and Drug Rep., June 12, 1911.

DR. DAVID T. DAY, of the U.S. Geological Survey, has prepared statistics of production of asphaltum and bitumen for the Mineral Resources of the United States. In this report the following facts are set forth:—Asphaltum is increasing in importance as one of the mineral products of the United States. Asphaltum residue, derived mainly from the oils of California and Texas, made up more than half of the 208,655 tons of asphaltum products in 1909. Bituminous rock is increasing in importance, and the output of hard asphaltum such as gilsonite, is being used in the manufacture of asphalt varnish.

In an effort to find a substitute for rubber, experiments have been made with elaterite and tabbyite. Material similar to rubber can be produced, for which good wearing qualities are claimed, when used in automobile tyres. During the year 1909 other bitumens similar to elaterite and tabbyite were discovered. One of these, known as wiedgerite, is a soft, moist material, like liver, which turns black on exposure. Wiedgerite, which is somewhat high in sulphur, is claimed to be especially valuable for the manufacture of rubber substitutes.

The increase in the production of oil asphaltum is an index of the development of good roads.

Standard specifications for retort and firebrick material. See VIII.

PATENTS.

Peat; Process for treating ——. G. E. Boberg, Alameda, Cal. U.S. Pat. 993,143, May 23, 1911.

AFTER the removal of foreign matter, "a liquid" is added to the peat and the mixture passed through a heated vacuum chamber in which the vegetable cells of the peat are broken down during the boiling which ensues. The product is then moulded into briquettes which are subsequently dried; the gases evolved in the vacuum chamber and during the drying of the briquettes are collected.—W. E. F. P.

Gas-producer system. C. Akerlund, Assignor to Gibb's Gas Engine Co., Atlanta, Ga. U.S. Pat. 992,840, May 23, 1911.

THE apparatus comprises a generator, cooler, scrubber, purifier and exhauster. The latter communicates with the purifier by means of a pipe, and with the generator by means of a separate up-draught pipe, the arrangement being such that the draught may be reversed without stopping or reversing the exhauster. Appropriate water-seals for the generator, cooler and scrubber are provided. —W. E. F. P.

Petroleum; Process of breaking up and separating the gaseous, liquid, and solid constituents of crude ——. L. W. Brown, Monrovia, Cal. U.S. Pat. 994,100, May 30, 1911.

The crude oil is passed in an emulsified condition along with steam through a common conduit, whereby they are thoroughly intermingled and the emulsion broken up. The steam and other gases are then allowed to escape and the solid and liquid products are discharged into hot water where they completely separate.—H. H.

Sweating crude paraffin or like mixtures of substances which melt at different temperatures. E. D. Pyzel, Amsterdam. Eng. Pat. 22,313, Sept. 26, 1910.

The cakes of paraffin or other material to be sweated are placed in tiers on suitable trucks which travel slowly through a sweating tunnel. The tunnel is provided at each end with an air sluice or lock and also with a return conduit for the air. Air is drawn by a fan from the cool end of the tunnel through the air return flue and is blown through a heating chamber provided with heating coils into the end of the tunnel from which the treated material is discharged. The hot air current passes in an opposite direction to the paraffin so that progressive and fractional sweating takes place. Gutters are provided by the side of the track in the tunnel to receive the melted portion of the material. The residual paraffin is completely melted off the trays in the air-lock at the discharge end of the tunnel which is provided with a heating coil for that purpose. By means of dampers placed in the partition between the tunnel and the return air flue, a portion of the air may be short-circuited, so as to regulate the temperature in different parts of the oven.—W. H. C.

Coal-mines; Process for preventing explosions of coal-dust in ——. H. Kruskopf, Dortmund, Germany. U.S. Pat. 995,261, June 13, 1911.

See Eng. Pat. 4592 of 1910; this J., 1911, 201.—T. F. B.

Block fuel, briquettes, and blocks generally; Process of manufacture of ——. E. Trainer, Dresden, Germany. Eng. Pat. 12,613, May 24, 1910.

See U.S. Pat. 974,001 of 1910; this J., 1910, 1365.—T. F. B.

Retort-furnace. T. M. Thom, Cheshunt, and H. Pryor, Saffron Walden. U.S. Pat. 995,268, June 13, 1911.

See Eng. Pat. 24,332 of 1908; this J., 1909, 1125.—T. F. B.

Illuminating liquefied gas; Method of treating distillation gases to produce an ——. H. Blau, Augsburg, Germany, Assignor to Blaugas Co. of America. U.S. Pat. 994,369, June 6, 1911.

See Fr. Pat. 398,839 of 1909; this J., 1909, 1026.—T. F. B.

Manufacturing watery solutions of oils, fats, asphaltum, etc. U.S. Pat. 992,313. *See* XII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Tar from hot distillation gases; Method and apparatus for extracting —— *by means of tar or tar and gas-water.* K. Huessener, London, J. Schaefer, Hochst a/Main, and E. Henss, Soden am Taunus, Germany. Eng. Pat. 6899, Mar. 18, 1910. Under Int. Conv., Sept. 2, 1909.

The hot gases are treated with a spray of tar or tar and gas-water which is introduced at the connection between the ascension-pipe and the hydraulic main of the distillation apparatus.—W. E. F. P.

Gas; Method of enriching —— *for illuminating purposes.* H. L. Doherty, Madison, Wis. U.S. Pat. 992,944, May 23, 1911.

The gas is passed through a heated chamber into which a fine spray of liquid hydrocarbon is continuously discharged.—W. E. F. P.

Tungsten filaments; Manufacture of ——. A. E. G. Union Elektricitäts Ges., Vienna. Eng. Pat. 19,095, Aug. 13, 1910. Under Int. Conv., Aug. 14, 1909.

See Fr. Pat. 421,427 of 1910; this J., 1911, 410. A mixture of ammonia and hydrogen may also be used. —T. F. B.

Producing exhausted vessels [lamp globes]; Method of and apparatus for ——. I. Langmuir, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 994,010, May 30, 1911.

The vessel, for example, a glass electric lamp globe, is heated to a high temperature approaching that at which the walls begin to soften, while the pressure is reduced simultaneously outside and inside, so that there is no tendency towards distortion.—H. H.

Candles for heating purposes, giving a feeble light. R. Scheuble. Ger. Pat. 234,340, April 1, 1909.

The candles are prepared from esters of amino- or imino-acids, and amides of ester-acids and mixtures of these, the melting point of which lies between about 50° and 130° C., and the boiling- or decomposition-point between 200° and 300 C.; ammonium nitrate or similar substances may be added. The candles burn with a hot, smokeless flame, especially when a salt which disengages oxygen, such as ammonium nitrate, is present.—T. F. B.

Gases given off in the destructive distillation of coal, etc.; Treatment of ——. G. Hilgenstock, Dahlhausen-Ruhr., Germany. U.S. Pat. 994,315, June 6, 1911.

See Ger. Pat. 223,469 of 1909; this J., 1910, 935.—T. F. B.

Photometer. U.S. Pat. 994,329. *See* XXIII.

Process of making ammonium sulphate and sulphite. U.S. Pat. 994,435. *See* VII.

III.—TAR AND TAR PRODUCTS.

Octohydroxyanthraquinone; Preparation and properties of ——. G. v. Georgievics. Monatsh. Chem., 1911, **32**, 347—352.

A mixture of 3 parts of rufigallol, 100 parts of sulphuric acid (monohydrate), 4 parts of boric acid and about 0·05 part of mercuric oxide, is heated at 250°—260° C., until a drop of the mixture dissolves in concentrated sulphuric acid with a greenish-blue colour. The product, after cooling, is thrown into water, and the resulting reddish-brown precipitate is washed with hot water, dried, and crystallised from a saturated solution in pyridine. The thick brownish-red crystals of octohydroxyanthraquinone thus obtained are washed first with hydrochloric acid, then with water and dried. The yield varies greatly but 70 per cent. of the theoretical quantity has been obtained. Octohydroxyanthraquinone is soluble in hot methyl alcohol and more freely so in hot pyridine; both solutions deposit glistening crystals on cooling. It dissolves in concentrated sulphuric acid with a greenish-blue colour (a test of the purity). In sodium hydroxide solution it dissolves with difficulty, giving a red-violet solution which rapidly becomes brown on exposure to air, especially on heating; with ammonia it behaves similarly but the solution is more stable. In other solvents it is either practically insoluble or very slightly soluble. Heated with an excess of acetic anhydride it yields the octoacetyl derivative.—A. Sbld.

Calcium and absolute alcohol; Hydrogenation [of phenanthrene] with ——. P. Breteau. J. Pharm. Chim., 1911, **3**, 580—582 (Cp. Marschalk and Nicolajewsky, this J., 1910, 808).

Phenanthrene is reduced to tetrahydrophenanthrene on treatment with metallic calcium, absolute alcohol, and ammonia gas, though with the two former reagents only, no reduction occurs. The procedure is as follows:—Fifteen grms. of calcium filings, contained in a flask fitted with a reflux condenser, are treated with a solution of 5 grms. of phenanthrene in 200 c.c. of absolute alcohol. The whole is heated to boiling, a current of dry ammonia gas then being passed through the solution. The reaction, once started, continues rapidly with violent evolution of hydrogen. When the calcium has all dissolved, the solution is kept boiling for 1 hour and then treated with dilute hydrochloric acid. On cooling, an oil separates; this is extracted with ether, the ethereal solution being dried and distilled, whereby a residue consisting solely of tetrahydrophenanthrene is obtained. The method is much more convenient and rapid than that of reduction with sodium.—L. E.

Hydrogenation by means of precipitated palladium and sodium hypophosphite. P. Breteau. Bull. Soc. Chim., 1911, **9**, 515—517. (Compare this J., 1909, 1169.)

Palladium precipitated from a solution of its chloride by sodium hypophosphite acts catalytically on an excess of the hypophosphite, an unlimited quantity of which can thus be oxidised to acid sodium phosphite with evolution of hydrogen. The reduction can be utilised for effecting reductions in acid, neutral or alkaline media, hot or cold, also in alcoholic solutions. Experiments made by adding the precipitated palladium to a solution of phenanthrene in 60 per cent. alcohol, heating to boiling and then slowly adding a concentrated solution of sodium hypophosphite, resulted in a partial reduction. A yield of 24—40 per cent. of tetrahydride was obtained, the remainder of the phenanthrene being unaltered. In a similar manner, however, nitrobenzene, nitronaphthalene, dinitrobenzene and dinitrotoluene were all completely converted into the corresponding amines.—A. Sbld.

Hydrogenation by means of nickel and sodium hypophosphite. P. Breteau. Bull. Soc. Chim., 1911, **9**, 518—519.

Nickel precipitated by sodium hypophosphite acts catalytically on an excess of the hypophosphite similarly to palladium (see preceding abstract) and the reaction can be used for effecting reductions. Care should be taken to precipitate the nickel as a fine powder and not in the form of thin metallic leaves. Experiments with phenanthrene, however, failed to effect even a partial reduction, but nitrobenzene, nitronaphthalene, dinitrobenzene and dinitrotoluene were all converted into the corresponding amines.—A. Sbld.

Patents.

Anthraquinone; Process for preparing ——. Chem. Fabr. Grünau, Landshoff und Meyer A.-G. Ger. Pat. 234,289, May 8, 1908.

Anthracene is converted into anthraquinone by treating it with nitric peroxide, or with a mixture of nitric oxide and air, at temperatures above 100° C., preferably at about 200° C. (Compare Ger. Pat. 215,335; this J., 1909, 1310.)—T. F. B.

Phenylaminoanthraquinone series; Halogenised carboxylic acid of the ——. F. Ullmann, Charlottenburg, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 993,915, May 30, 1911.

See Fr. Pat. 423,328 of 1910; this J., 1911, 610.—T.F.B.

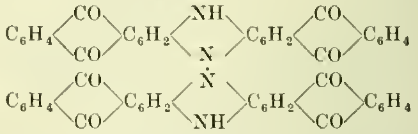
Manufacturing watery solutions of oils, fats, tar, etc. U.S. Pat. 992,313. *See* XII.

IV.—COLOURING MATTERS AND DYES.

Patents.

β-Aminoanthraquinone; Manufacture of an oxidation product of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 20,109, Aug. 29, 1910.

When β-aminoanthraquinone is treated with chloride of lime at 70°—90° C., a product is obtained, consisting of β-azo-anthraquinone, $C_6H_4(C_2O_2)C_6H_3.N:N.C_6H_3(C_2O_2)C_6H_4$, and anthraquinoneazhydrine,



The two substances are formed in varying proportions according to the conditions of the reaction. The product is a pale yellow powder which does not melt without decomposition; it is insoluble or nearly so in the usual organic solvents, but dissolves in organic solvents of high boiling point, such as aniline and quinoline, the solution rapidly becoming blue. By treatment with alkaline reducing agents the β-azoanthraquinone is re-converted into β-aminoanthraquinone, whilst the anthraquinoneazhydrine yields indanthrene and its leuco bodies; this transformation may be effected on the fibre by applying the product together with a reducing agent, and then steaming. When the product is heated with hydrochloric or hydrobromic acid, the azoanthraquinone remains unchanged, whilst the anthraquinoneazhydrine is converted into a mixture of indanthrene and chloro- or bromo-indanthrene.—T. F. B.

Dyestuffs of the triphenylmethane series; Process for preparing chrome ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 234,519, April 22, 1910.

Pentachlorobenzaldehyde or a derivative, such as pentachlorobenzal chloride, is condensed with salicylic acid or o-cresotinic acid or mixtures of these, and the leuco compound oxidised. The dyestuffs thus produced are fast to alkalis, fulling, and potting.—T. F. B.

Monoazo dyestuff; Manufacture of a ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 9003, April 11, 1911. Under Int. Conv., July 4, 1910.

The diazo compound of 4-chloro-2-aminophenol-6-sulphonic acid is combined with 2.3-naphtholcarboxylic acid. The dyestuff thus formed dyes on wool shades which become violet when chromed, and can also be converted into fast lakes.—T. F. B.

Nigrosines or Indulines soluble in water; Process for preparing deep black ——. L. Stange. Ger. Pat. 234,468, July 27, 1910. Addition to Ger. Pat. 233,600, May 25, 1910 (see this J., 1911, 678).

In place of using dinitrochlorobenzene as a means for introducing the nitro-group, it is now proposed to nitrate the sulphonic acids of Nigrosines and Indulines, preferably in their sulphonation mixtures. The products are similar in shade to those containing the dinitrophenyl group. —T. F. B.

Sulphide dyestuffs; Process for preparing yellow ——. B. Rassow. Ger. Pat. 234,638, July 23, 1910.

Dehydrothiotoluidines or their homologues or sulphonic acids are treated with sulphur sesquioxide, and the products are then acted upon by solutions of hypochlorites. The dyestuffs thus obtained dye cotton from alkali sulphide solutions in golden-yellow shades, fast to light, soap, and chlorine. The dyestuffs obtained from the sulphonic acids are somewhat redder in shade. Dehydrothioxylidines give similar products.—T. F. B.

Colouring matters of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 15,268, June 25, 1910.

See Fr. Pat. 417,332 of 1910; this J., 1911, 17.—T. F. B.

Benzanthrone compounds; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 16,271, July 7, 1910.

See Fr. Pat. 418,435 of 1910; this J., 1911, 78.—T. F. B.

Azo dyestuffs; Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 20,334, Aug. 31, 1910. Under Int. Conv., Sept. 3, 1909.

See Fr. Pat. 418,733 of 1910; this J., 1911, 78.—T. F. B.

[*Anthracene*] *Dye; Brown vat* ——. P. Thomaschewski and H. Raeder, Vohwinkel, and W. Mieg and P. Fischer, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Reissue No. 13,257, June 13., 1911, of U.S. Pat. 971,225, Sept. 27, 1910.

See this J., 1910, 1244.—T. F. B.

Vat [*anthracene*] *dye.* P. Thomaschewski, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 993,735, May 30, 1911.

See Eng. Pat. 2106 of 1910; this J., 1911, 412.—T. F. B.

Vat [*anthracene*] *dye.* P. Thomaschewski, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 993,736, May 30, 1911.

See Addition of Sept. 17, 1910, to Fr. Pat. 362,140 of 1906; this J., 1911, 350.—T. F. B.

Vat [*anthracene*] *dye.* M. Kugel, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 994,756, June 13, 1911.

See Fr. Pat. 418,908 of 1910; this J., 1911, 78.—T. F. B.

Aminobenzoylaminobenzoyl-2-amino-5-naphthol-7-sulphonic acid. W. Neelmeier, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 994,420, June 6, 1911.

See Ger. Pat. 230,595 of 1910; this J., 1911, 350.—T. F. B.

Dye. *4-m-Chlorophenylamino-1-anthra-N-methylpyridone.* O. Unger, Leverkusen, and P. Thomaschewski, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 994,803 and 995,306, June 13, 1911.

See Eng. Pat. 1212 of 1910; this J., 1911, 275.—T. F. B.

Alkali salts of indoxyl or its derivatives; Process of isolating ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 24,690, Oct. 24, 1910. Under Int. Conv., Oct. 25, 1909. Addition to Eng. Pat. 22,288 of 1910, dated Sept. 27, 1909.

See Addition of Oct. 21, 1910, to Fr. Pat. 420,947 of 1910; this J., 1911, 412.—T. F. B.

Vat [*anthracene*] *dyestuffs; Manufacture of alizarine-red* ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 27,637, Nov. 28, 1910. Under Int. Conv., Jan. 26, 1910.

See Fr. Pat. 422,202 of 1910; this J., 1911, 613.—T. F. B.

Leuco-dyestuffs of the gallocyanine series; Manufacture of ——. Farbwerke vorm. L. Durand, Huguenin, und Co., Basle, Switzerland. Eng. Pat. 8305, April 3, 1911. Under Int. Conv., April 11, 1910.

See Ger. Pat. 228,369 of 1910; this J., 1911, 18.—T. F. B.

Azo dye and process of making same. E. Richard, Assignor to The Aniline Color and Extract Works, formerly J. R. Geigy, Basle, Switzerland. U.S. Pat. 993,549, May 30, 1911.

See Fr. Pat. 404,536 of 1909; this J., 1910, 268.—T. F. B.

Anthraquinone series; Vat dye of the ——. W. Herzberg and W. Bruck, Schöneberg. Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 993,992, May 30, 1911.

See Ger. Pat. 232,711 of 1910; this J., 1911, 612.—T. F. B.

Cotton [*azo*] *dyes; Orange* ——. A. L. Laska, Offenbach on Maine, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 995,160, June 13, 1911.

See Fr. Pat. 422,842 of 1910; this J., 1911, 612.—T. F. B.

Disazo dyes for wool. A. L. Laska, Offenbach on Maine, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 995,161, June 13, 1911.

See Eng. Pat. 28,678 of 1910; this J., 1911, 412.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Balloon-envelopes; Materials used in making —— and in producing gas-tightness. H. Hoernes. Gummi-Zeit., 1911, 25, 1281—1282.

The following materials employed in making balloon-envelopes are referred to: (1) *Ponghee-silk.* The advantage of this material over other fabrics is its great tensile-strength combined with lightness. Its disadvantages are its high cost, its great tendency to become brittle, and its electrical properties. (2) *Cottons* such as *Perkal* or *Calico.* These possess the advantage over silk of greater stability towards atmospheric influences, but they are much heavier and less strong. They are generally employed in the form of a double layer of the fabric, with the threads either parallel or at an angle of 45° to one another, united by an intermediate layer of rubber. (3) *Fine linen.* This is almost as costly as silk, without the advantage of lightness in weight, and therefore does not recommend itself for this purpose. (4) *Gold-beater's skin* is very costly, difficult to repair, and very sensitive towards atmospheric influences. Its advantages are its low porosity and its comparatively high tensile strength per unit weight. (5) *Aluminium* is used in the form of strips of sheet about 0·2 mm. thick riveted or welded together. It is not advisable, however, to make the entire envelope of aluminium sheet on account of the great risk of damage. The materials used for securing gas-tightness are:—(1) *Linseed oil varnish.* The advantages of this material are its low cost and ease of application, together with its great efficiency in rendering the fabric gas-tight. The disadvantages attending its use are the need for constant attention during storage, the risk of spontaneous inflammation of the freshly varnished fabric, in the absence of a sufficient supply of air, the slowness of the repairing process, and tackiness, especially at an elevated temperature. (2) *Rubber,* in the form of a layer of vulcanised rubber between the layers of fabric. With this repairs are easily and rapidly effected, the fabric always remains supple, and there is no tackiness at high temperatures. The disadvantages of rubber are its high price, the possibility of electric discharges, its great weight, and its susceptibility to the action of violet and ultra-violet rays. The other gas-tight materials referred to are "Ballonin"—a solution of guttapercha in benzol; "Konjaku"—a Japanese vegetable product which comes on to the market in the form of a white powder, soluble in warm water, bichromated gelatin, and "Pegamoid."—E. W. L.

Proteins [*silk fibroïn, etc.*]; *Products of partial hydrolysis of* ——. E. Abderhalden. Z. physiol. Chem., 1911, 72, 1—14.

The dipeptide, *d*-alanyl-glycine, previously obtained by the author from silk fibroïn (this J., 1910, 687) has now been isolated also from the fibroïn of de-gummed Canton silk and Bengal silk. It separates from solution in 50 per cent. alcohol in crystals sintering at 245° C. and melting at about 250° C. The crystals obtained by concentrating an aqueous solution decompose at about 240° C. (*loc. cit.*). In working up the products of the acid hydrolysis of the fibroïn of Italian silk the author obtained not only *d*-alanylglycine, but glycyl-*l*-tyrosine and a tripeptide having all the characters of the *d*-alanyl-glycyl-*l*-tyrosine synthesised by E. Fischer in 1907, except that its rotatory power was somewhat higher. This is the first tripeptide to be isolated from the products of hydrolysis of a protein. It is probably formed by the partial hydrolysis of the tetrapeptide prepared from silk fibroïn by Fischer and Abderhalden in 1907, which contained *l*-tyrosine, *d*-alanine and two molecules of glycine. The methods used in isolating and characterising the tripeptide are given fully. From 3 kilos. of silk waste 25 grms. of the crude substance were obtained, which on purification were reduced to 5·6 grms. of a product having $[\alpha]_D = +44\cdot5°$. From the products of hydrolysis of the horny material of cow's-foot, by heating with saturated baryta water, the author has isolated a peptone crystallising in long bent needles, melting at about 275° C. It is evidently very complex, producing on complete hydrolysis tyrosine, cystine, tryptophane and glutamic acid, besides other amino-acids not identified with certainty. The separation of the products was a matter of greater difficulty than usual owing to their optical inactivity, hydrolysis with baryta having caused racemisation. From the products of the digestion of casein with pancreatin a crystalline substance was isolated resembling leucine in appearance but containing sulphur. Analytical results indicate a formula such as $C_{14}H_{28}S_2N_3O_5$ or $C_{12}H_{26}S_2N_3O_4$.—J. H. L.

Absorption of moisture by paper in damp air; Course of the ——. P. Klemm. Wochenbl. Papierfabr., 1911, **42**, 2105—2108.

Small samples of paper of known weight and containing a known quantity of moisture were loosely folded in zigzag fashion so as to have a maximum surface exposure and then put into tared cylindrical weighing glasses. The open glasses were placed underneath a glass bell set up in a room of constant temperature, and the air inside the bell was kept saturated with moisture by means of wet filter paper. At definite intervals glasses were taken out of the bell, quickly covered and weighed so as to enable the course of the absorption of moisture by the paper to be determined. The experiments led to the following conclusions:—(1) The initial rate of absorption is much greater than the final rate. Thus samples of chart paper absorbed almost as much moisture in the first 24 hours as in the five subsequent days. (2) The sizing of paper does not materially affect the rate or the amount of absorption. (3) The method of manufacturing the paper and the presence or absence in it of soluble salts are amongst the factors which markedly influence the absorption of moisture.—P. F. C.

Cotton wax. Knecht and Allan. *See* XII.

Patents.

Silk; Art of treating [de-gumming] ——. S. B. Rains, Assignor to J. Keeton, Brooklyn, N.Y. U.S. Pat. 992,803, May 23, 1911.

A thread from a spool of thrown silk is led through a vat containing a suitable boiling-off liquor to remove gum and other foreign matter, and is then passed in proximity to a heated finishing roller, whereby the silk is dried and the fibre laid.—J. F. B.

Hair; Treatment of —— *for felting or like purposes.* B. Ronjat, Paris. U.S. Pat. 993,461, May 30, 1911.

The hair is treated with a solution containing sodium nitrite and tin nitrate.—P. F. C.

Cellulose solutions and process of making same. M. Weertz, Bradford. Eng. Pat. 12,422, May 21, 1910.

Solutions of cellulose are made by dissolving fibres from plants of the silk-cotton family (*Bombaceæ*), preferably after treatment for the purpose of cleaning and bleaching. Solutions of these fibres and of kapok fibres in cuprammonium, zinc chloride, etc., for instance, are claimed for the manufacture of artificial silk, etc.
—J. F. B.

Paper coated on one side with metals, colours, glass, emery, etc.; Process and apparatus for manufacturing ——. O. F. von Redwitz, Kempten, Bavaria. Eng. Pat. 14,200, June 11, 1910.

Various materials are applied to the surface of sized paper, in the course of its manufacture on the paper machine, at a point behind the press-rolls. The powdered material may be mixed with a liquid adhesive and applied by means of rolls or brushes. The machine particularly specified is adapted to apply the powdered coating materials in the dry state. Above the paper as it passes from the press rolls on a supporting felt, is arranged an endless sieve running over two cylinders. The coating powder is fed on the upper surface of this sieve, which is supported by an impermeable band. Adjacent to one of the guide rolls of the sieve are arranged several rotary brushes which brush the coating material into the meshes of the wire. When the endless wire with the coating material underneath is passing back directly above the paper, it receives a number of rapid vibrations by means of a tapping mechanism, whereby the coating material is shaken off the wire and distributed uniformly over the surface of the paper. The paper with its felt then passes over a roll in a downward and backwardly inclined direction, when it passes under a second tapping mechanism which shakes off the excess of coating material into a trough.
—J. F. B.

Paper pulp; Refining drums [strainers] for ——. M. Lamort, Vitry-le-François, France. Eng. Pat. 332, Jan. 5, 1911. Under Int. Conv., Jan. 5, 1910.

In rotary strainer drums the strips serving to unite the metal strainer sheets are arranged to form the points of support of the sheets on the crowns or bases. The sheets abut against the bevelled crowns or bases on their inside edge, allowing them to bend under the action of strains without splitting. Hoods may be placed between the strips and the sheets to reinforce the same at their ends near the crowns or bases of the drum, the assembling strips being so arranged as to clamp between them the crenelated edges of the sheets along the whole line of junction.—J. F. B.

Celluloid-like masses; Production and application of —— *capable of being moulded and pressed.* A. Eichengrün, Berlin. Eng. Pat. 18,189, July 30, 1910. Under Int. Conv., Aug. 14, 1909.

See Fr. Pat. 418,744 of 1910; this J., 1911, 79.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Mercerised sateen; The microscopic appearance of bleached and ——. J. Hübner. J. Soc. Dyers and Col., 1911, **27**, 128—129.

Photo-micrographs are given showing the appearance of fabrics under transmitted light, and by reflected light at right angles and parallel to the direction of the weft threads, both in the grey, bleached, and when mercerised with or without tension. The illustrations show that the cloth appears more open after mercerisation under tension, and the material loses considerably in thickness.—B. N.

Caustic soda on cotton ; An historical note on the action of ——, and on the dyeing manganese bronze (colour). J. Hübner. J. Soc. Dyers and Col., 1911, **27**, 126—128.

Persoz, in a work published in 1846, refers to the value of strong caustic soda solution in the dyeing manganese bronze on cotton, and to the shrinkage which the fibres undergo, showing that the action on cotton was known in France before or at the time when Mercer made his discovery. Persoz states that manganese bronze was first applied in dyeing piece goods by Hartmann de Munster in 1815, though a reference to the same has been found by the author in "Experimental Researches Concerning the Philosophy of Colours," by Bancroft, published in 1813.—B. N.

Isatin in the dyeing of indigo ; Formation of ——. R. E. Crowther. J. Soc. Dyers and Col., 1911, **27**, 146—148.

On oxidising a normal indigo-hydrosulphite vat, then filtering off the precipitated indigo and evaporating the yellow filtrate to dryness, a residue was left containing isatin and a sulphur compound which strongly resembles it ; possibly it is the thio compound corresponding to the pseudo isomeride of isatin. Having detected the presence of indoxyl in appreciable quantity in a normal hydrosulphite vat, the author suggests that the isatin is formed by the oxidation of indoxyl by hydrogen peroxide, which, as Schönbein, and Herzog and Manchot proved, is always present in an oxidised indigo vat.—P. F. C.

Anthraquinone derivatives ; The mordant dyeing properties of —— and the nature of the colour lakes. G. v. Georgievics. Monatsh. Chem., 1911, **32**, 329—345.

A continuation of the author's previous researches on the relation between the constitution of the hydroxyanthraquinones and their mordant dyeing properties (this J., 1902, 1530 ; 1905, 493). The author maintains his former statement that the dyeing properties of quinizarin (1.4-dihydroxyanthraquinone) are decidedly weakened by the introduction of further hydroxyls in the 5- and 8-positions, and that the reduced dyeing power of these derivatives is not owing to their insolubility in water as stated by Möhlau, who obtained good mordant dyeings from a dilute pyridine solution (this J., 1907, 1080). It is found that quinizarin dyes more strongly than the 1.4.5.8-tetrahydroxyanthraquinone from an aqueous pyridine solution as well as from aqueous solutions only. The effect of doubling the hydroxyl groups in 1·3-dihydroxyanthraquinone (xanthopurpurin) is seen in the greater mordant affinity of 1.3.5.7-tetrahydroxyanthraquinone (anthrachrysone) but in the case of 1.2.3-trihydroxyanthraquinone (anthragallol) and 1.2.3.5.6.7-hexahydroxyanthraquinone the introduction of the additional hydroxyls results in diminished dyeing power. The dyeing properties of the newly prepared octohydroxyanthraquinone (see under III.) are discussed and it is shown that such a hydroxyanthraquinone containing the hydroxyl groups in the ortho position may have not only no greater but even less mordant affinity than a hydroxyanthraquinone containing no ortho hydroxyl groups such as quinizarin. Liebermann and Kostanecki's rule thus loses practically all validity. Contrary to a formerly expressed opinion the author finds that 1.6 and 1.7-dihydroxyanthraquinone has only a very slight dyeing power. The 1.2.4.6-, 1.2.4.7-, and 1.2.4.8-tetrahydroxyanthraquinones have 2.6-dihydroxyanthraquinones. The 2.7-dihydroxyanthraquinone has only a very slight dyeing power. The 1.2.4.6-, 1.2.4.7-, 1.2.4.8-tetrahydroxyanthraquinones have at least as strong a mordant affinity as purpurin, the 1.2.4.8-derivative giving the fastest lake (particularly fast to acids). As in the case of alizarin the introduction of a hydroxyl in the 6-position results in a yellowish tone. The alkyl- and alphylaminoanthraquinones possess no mordant affinity. As only 34 of the 75 theoretically possible hydroxyanthraquinones are known conclusions drawn as to the relation between their constitution and mordant dyeing properties have a restricted value. It can, however, be stated that : the α-position favours red to blue colours, the β-position yellow to brown ; sometimes the influence of the first predominates, in other cases the second. The position of the hydroxyls to one another is of particular importance. For example, if a hydroxyl is introduced into the alizarin molecule in the non-substituted nucleus, an unimportant alteration of the colour takes place : in positions 5 and 8, a change towards blue is caused and in 6 and 7 a change towards yellow ; if, however, one is introduced into the β-position in the substituted nucleus a complete change of colour to brown (anthragallol) is effected. If in the anthragallol molecule a fourth hydroxyl is introduced into the substituted nucleus—the colour changes to red again (1.2.3.4-tetrahydroxyanthraquinone), whilst the entrance of a hydroxyl group into the β-position of the non-substituted nucleus in anthragallol causes practically no alteration of the colour. Liebermann and Kostanecki's rule, as already shown has lost all validity—but it remains established that between the mordant dyeing properties and the ortho position of two hydroxyl groups a close relationship exists.—A. Sbld.

Picric acid ; Study of the phenomena of dyeing with ——. G. v. Georgievics. Monatsh. Chem., 1911, **32**, 319—327.

The addition of an acid to the dyebath is not essential for the adsorption of picric acid as it is in the case of other acid dyestuffs. Experiments made in dyeing worsted yarn with two different concentrations of picric acid showed that in one case the adsorption of the dyestuff was impeded by the addition of sulphuric acid whilst it was increased in the other. As regards the influence of temperature picric acid also differs from other acid dyestuffs, the shades obtained with it on wool in the cold from a bath acidified with sulphuric acid, showing the same fastness to water as those produced on boiling. Deep shades are obtained on silk without the addition of an acid and the fastness of the colours to water is also found to be independent of the temperature of dyeing. The author's experiments are in close agreement with those of Walker and Appleyard (this J., 1896, 650) and show that when silk is dyed with picric acid an equilibrium is obtained whatever the original distribution of the materials ; this is also found to be independent of the temperature. Experiments with naphthalene are quoted to show that there is no real analogy between the adsorption of picric acid by such substances and its adsorption by animal fibres—and the large amount of sulphuric acid found by Sisley (this J., 1908, 895) to be necessary for the adsorption of picric acid by anthracene (1 grm. of acid for 0·1 grm. of anthracene) is also held to support the author's view. The darkening of picric acid on keeping is stated to be due to the formation of ammonium picrate, and the darkening of picric acid shades on wool by boiling, to the combination of some of the adsorbed picric acid with the basic decomposition products formed from wool on boiling. This is in agreement with the fact that addition of a mineral acid checks the darkening caused by boiling. The darkening produced on boiling an aqueous solution of picric acid to which some hydrochloric acid has been added is still unexplained.—A. Sbld.

Patents.

Bleaching and softening jute fibre ; Process of ——. S. A. Flower, New York. U.S. Pat. 994,508, June 6, 1911.

The fibre is treated with a hot alkaline solution of chloride of lime and soap, then washed, and worked in an aqueous solution containing chloride of lime, sodium carbonate and glycerin. A final treatment with a mixture of glycerin, chloride of lime, soap and sodium carbonate completes the process.—P. F. C.

Mercerising cotton, preferably in the form of skeins ; Method of ——. P. Hahn, Niederlahnstein, Germany. U.S. Pat. 994,076, May 30, 1911.

The yarn is stretched, then immersed in the mercerising lye and allowed to contract by reducing the tension. As soon as the yarn is sufficiently shrunk, the tension is again applied, whilst the yarn is still immersed. The ordinary finishing operations complete the process.—P. F. C.

Textiles ; Apparatus for dyeing or treating ——. J. C. Hebden, Providence, R.I., and F. H. Daniell, Franklin, N.H. U.S. Pat. 993,324, May 23, 1911.

In an apparatus for treating textile materials with fluids, a porous or perforated tube compressible longitudinally is claimed in combination with a container for the material arranged around the tube, the container being adapted to contract longitudinally when pressure is applied to compress the material. The container is constructed of several sections, with flanges to close the ends.—J. F. B.

Thioindigo vats ; Process for preparing concentrated —— Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat, 234,306, Feb. 2, 1910. Addition to Ger. Pat. 231,927, May 15, 1909 (see this J., 1911, 617).

The thioindigo dyestuff is reduced in presence of soap, or the leuco dyestuff solution is mixed with soap, and the magma or solution is treated with acid ; the precipitated mixture of leuco-compound and fatty acid is then filtered off, and incorporated with an alkali solution, whereby a homogeneous vat is obtained, which does not throw out a deposit.—T. F. B.

Zinc-sulphite sludge from hydrosulphite-indigo vats ; Process of utilising ——. A. A. Claflin, Medford, Mass. U.S. Pat. 994,502, June 6, 1911.

The zinc sulphite contained in the residual sludge of a hydrosulphite-indigo vat is converted into zinc carbonate by boiling the sludge with an aqueous solution of sodium carbonate. The sodium sulphite formed by the double decomposition is recovered.—P. F. C.

Dyeing hairs ; Process for ——. J. Colman. Ger. Pat. 234,462, May 25, 1909.

Hair is treated with a solution of an aromatic diamine or other dyestuff-forming substance, and a normal sulphate, together with an oxidising agent, or the oxidising agent may be applied after the hair has been treated with the diamine solution. For example, a solution of 2·5 parts of *p*-toluylenediamine and 5 parts of crystallised normal sodium sulphate in 100 parts of water, is applied to the hair, and the dyestuff is formed by treatment with hydrogen peroxide.—T. F. B.

Calender bowls ; Heating ——. The Bradford Dyers Association, Ltd., and J. Graham, Bradford. Eng. Pat. 14,087, June 10, 1910.

Into a hollow calender bowl open at both ends is inserted a tube having its ends closed but provided along its length with perforations. A mixture of coal gas and air in suitable proportions is forced into this tube and burned at the perforations. To remove the combustion gases a number of pipes which are of smaller diameter than the tube and have open ends, are arranged beneath it and connected with a suction apparatus.—P. F. C.

Dyeing fabrics ; Apparatus for ——. L. Derreumaux-Bulteau, Brussels. U.S. Pat. 993,435, May 30, 1911.

See Fr. Pat. 405,290 of 1909 ; this J., 1910, 419.—T. F. B.

Fibre ; Apparatus for treating —— *with liquids.* J. F. White, Bradford. U.S. Pat. 994,625, June 6, 1911.

See Fr. Pat. 416,481 of 1910 ; this J., 1910, 1372.—T. F. B.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Filling material for acid towers ; Testing of ——. H. Petersen. Z. angew. Chem., 1911, 24, 972—975.

Form of the filling body.—In order to ensure the whole cross-section of the tower being concerned in the upward passage of the gas, the openings between the layers of material must be as small as possible, without interfering with the draught. The sectional area of the gas passage at its narrowest part must, in the Gay-Lussac tower, be at least twice, and not more than four times, that of the pipe connecting the last chamber and the first tower; with the Glover tower, three to six times may be reckoned. For the avoidance of dust and slime deposits from the gases and acid, broad faces and hollows on the upper side of the filling bodies should not be adopted. *Structure of the material.*—The material for packing Gay-Lussac and other "reaction towers" may be sintered, but such material would crack if used in Glover and other towers, in which the entering gases are at a temperature above 200° C. For Glover towers, material rich in alumina and burnt at not too low a temperature must be employed. Material burnt at the temperature of Seger cone 9 and suitable for the Glover tower was found to be ten times as soluble in dilute acid as the same material burnt at the temperature of Seger cone 11. *Test for acid resistance.*—The material is left for some months in the lower part of a Glover tower, or is treated with hot 60 per cent. acid, and then, after removal, is exposed for a fortnight to the action of moist air. No change should be observed in its surface.—F. Sodn.

Alkali bicarbonates ; The dissociation pressures of the ——. *Part I. Sodium hydrogen carbonate.* R. M. Caven and H. J. S. Sand. Chem. Soc. Proc., 1911, 27, 147.

The dissociation pressures of sodium carbonate monohydrate and of sodium hydrogen carbonate have been examined by means of a specially designed tensimeter. Difficulty was experienced in the latter case, particularly from the formation of impermeable crusts on the bicarbonate. Satisfactory results were obtained only when the amount of bicarbonate employed was four or five hundred times that theoretically required to evolve the necessary volumes of gas at the highest temperature reached in the experiments. It was found that the vapour pressure, in mm. of mercury, of sodium carbonate monohydrate can be represented with sufficient accuracy by the equation :

$$\log p = 10{\cdot}825 - \frac{3000}{T},$$

and that of sodium hydrogen carbonate by the equation :

$$\log p = 11{\cdot}8185 - \frac{3340}{T},$$

From these equations the heat of dissociation of one gram-molecule of sodium carbonate monohydrate is calculated to be 13,800 calories, and that of two gram-molecules of sodium hydrogen carbonate to be 30.700 calories. The latter figure is in sufficient agreement with the number 29,700 calculated from thermochemical results given by de Forcrand (Comptes rend., 1909, 149, 719 ; also this J., 1909, 834 and 1312). The pressures corresponding with the four-phase equilibrium—anhydrous sodium carbonate, sodium carbonate monohydrate, sodium hydrogen carbonate, vapour—have also been calculated.

Sodium potassium carbonates. Y. Osaka. Mem. Coll. of Sci. and Eng., Kyoto Imp. Univ., 1911, 3, 55—61.

The solubility of sodium and potassium carbonates in water in the presence of each other at 25° C. expressed on a triangular co-ordinate diagram, leads to the conclusion that the only double salt which can exist in contact with its solution at that temperature is $Na_2CO_3,K_2CO_3,12H_2O$. —W. H. P.

Carbon dioxide in carbonates and nitrogen pentoxide in nitrates ; Use of sodium paratungstate in the determination of ——. F. A. Gooch and S. B. Kuzirian. Amer. J. Sci., 1911, 31, 497—500.

Experiments with calcium, strontium and barium carbonates and potassium, barium and strontium nitrates are described, the results of which show that sodium paratungstate, $5Na_2O,12WO_3$, is well suited for use as a flux in the rapid determination of carbon dioxide in carbonates or of nitrogen pentoxide in nitrates by loss on ignition. The sodium paratungstate is readily prepared by dehydrating and fusing normal sodium tungstate adding an equal weight of previously ignited tungsten trioxide, and heating till the mixture is completely fused. The amount of sodium paratungstate used in the determination should be in excess of ten times the weight of carbon dioxide or four times the weight of nitrogen pentoxide to be expelled.—A. S.

Acid sodium acetates. R. Abe. Mem. Coll. of Sci. and Eng., Kyoto Imp. Univ., 1911, **3**, 13—17.

The author has determined the solubility of sodium acetate in acetic acid solutions of various concentrations, expressing the composition of the solution and residue in a system of triangular coordinates. By this method it is possible to deduce the existence at 20° C. of the three solid phases, $C_2H_3O_2Na,3H_2O$; $C_2H_3O_2Na,C_2H_4O_2$; and $C_2H_3O_2Na,2C_2H_4O_2$.—W. H. P.

Aluminium double silicates; The description of some ——. Z. Weyberg. Sprechsaal, 1911, **44**, 281—282; 296—298.

The author has examined the action of a number of salts of the alkalis and alkaline earths on kaolin and on mixtures of alumina and silica. In nearly all cases the raw materials were fused together for some hours or even days, and any definite products formed were freed as far as possible from other reaction products, or from unaffected raw material. The most important product of the fusion of kaolin with a large excess of calcium chloride consisted of regular crystals of the composition, $3(Al_2O_3.SiO_2.2CaO),2CaCl_2$. When calcium bromide was substituted for the chloride, tetragonal prisms having the formula, $Al_2O_3,SiO_2,2CaO$, were obtained. The calcium-alumino-silicates easily form compounds similar to sodalite, but this tendency is not shown by the corresponding strontium- and barium-alumino-silicates. These had the composition: $4SrO,4Al_2O_3,7SiO_2$ and $4BaO,4Al_2O_3,7SiO_2$, and, though differing in composition, were similar to nephelin ($Na_2O,Al_2O_3.2SiO_2$) in optical properties and crystalline form. The ratio $4Al_2O_3$, $7\ SiO_2$, was also found in a chromium sodalite prepared artificially. Natural crystals of kaliophelite are hexagonal, but rhombic and tetragonal crystals of the composition $K_2O,Al_2O_3,2SiO_2$ have been prepared, and from a slightly alkaline or neutral melt, prismatic crystals of the same composition but with different optical constants were also obtained. By fusing together kaolin and potassium chromate at a higher temperature, a compound, K_2O,Al_2O_3,SiO_2 was obtained. It appears that with potassium compounds at high temperatures, kaolin behaves as alumino-silicic acid, $H_2Al_2Si_2O_8$, and the products are amorphous, and that crystalline products are obtained only in the presence of free bases or alkali carbonate. With lithium salts, however, crystalline products are obtained much more easily, the kaolin is continuously decomposed, and the melt acquires an alkaline reaction. The product obtained has the composition, $3Li_2O,Al_2O_3,2SiO_2$, and is analogous to natural gehlenite, $3CaO,Al_2O_3,2SiO_2$, though not isomorphous with it. Lithium sulphate, however, unlike the chloride, gives a salt of the composition, $Li_2O,Al_2O_3,2SiO_2$, similar to the potassium compound. Presumably this reaction is due to the greater stability of the sulphate, and the consequent presence of a smaller amount of free oxide in the melt. By fusing kaolin with lithium bromide, a lithium bromo-sodalite, $7(Li_2O,Al_2O_3,2SiO_2),2LiBr$, is formed, which indicates that the production of such compounds depends not only on the base of the source of the alumino-silicate, but also on the acid of the salt added (thus products containing no chlorine and no sulphate are obtained when chlorides and sulphates are employed in the melt). The author also endeavoured to produce double silicates in which alumina was replaced by ferric or chromium oxide. Crystals of the composition, $Na_2O,Fe_2O_3,4SiO_2$, were produced, and also similar compounds with other alkali and alkaline earth salts. Several alkali-chromium-silicates were produced, some of which were very rich in silica and were not decomposed by acids, except hydrofluoric acid. No chromium-silicate compounds containing potassium, lithium, calcium, strontium, or barium, could be isolated. On the whole the double salts obtained with ferri- and chromium silicates are not like sodalite, or nepheline, but are spinel-like compounds. By fusing a mixture of $Li_2O,Al_2O_3.2SiO_2$ with lithium sulphate, strongly double refracting grains of the composition, Li_2O,Al_2O_3, are obtained. Although this compound is not like the spinels, the analogous, Li_2O,Cr_2O_3, which can be produced by fusing together kaolin and an excess of lithium chromate, has a distinct spinel-like character. Similarly, by fusing kaolin with a large excess of calcium chromate in the presence of lime, a spinel-like compound of the composition, CaO,Cr_2O_3, is obtained. An analogous calcium ferrite, $2CaO,5Fe_2O_3$, has also been produced. By fusing the constituents together and heating the glass thus obtained to 1080° C. for a long time, E. T. Allen has succeeded in producing a sodium anorthite of the composition, $Na_2O,Al_2O_3,2SiO_2$. It is a curious fact that by fusing the mineral nepheline ($Na_2O,Al_2O_3,2SiO_2$, with a small potash content) only a product like nepheline in its optical properties separates, whilst from the chemically pure melt of the composition, $Na_2O,Al_2O_3,2SiO_2$, the triclinic sodium anorthite is obtained, to which the name carnegieite has been given.
—W. C. H.

Bisilicates; Fusion experiments with some ——. P. Lebedew. Z. anorg. Chem., 1911, **70**, 301—324.

The binary systems, $CaSiO_3—CaS$, $MgSiO_3—MnSiO_3$, $CaSiO_3—BaSiO_3$, and $BaSiO_3—MnSiO_3$ have been studied by the method of thermal analysis, combined with microscopic observation, and a melting-point diagram for each is given. The metasilicates concerned have the following melting points (compare Wallace; this J., 1909, 793):—Calcium 1512° C., magnesium 1535°, manganese 1210°, and barium 1438° C. In the system, $CaSiO_3—CaS$, which was studied only up to a concentration of 50 mols. per cent. of calcium sulphide, mixed crystals are formed, but these are decomposed, in process of cooling, by a reaction in the solid state; melts rich in calcium sulphide fall to powder on cooling. Magnesium and manganese silicates are regarded as cryptoisodimorphous, two series of mixed crystals (rhombic and triclinic) being formed, according to the proportions. Barium and calcium silicates form a continuous series of mixed crystals, and the same is probably true of the silicates of barium and manganese, but, in this case, observations were only possible with melts containing 0—12·5 and 90—100 mols. per cent. of barium silicate, in consequence of a tendency to solidify in the form of glass; this tendency likewise prevented results being obtained with mixtures of sodium silicate and the silicates of strontium and manganese respectively. The author concludes from his experiments that the tendency to form a glass on cooling a mixture of minerals, which individually solidify to well-defined crystals, is dependent on the composition of the mixture and the time allowed for solidification; the more closely the composition approximates to that of the eutectic, or, in the case of solid solutions, to that of the lowest-melting member of the series, the more readily is a glass formed and the longer is the time required for crystallisation; moreover, by lowering the melting point of the mixture, the viscosity of the system may be so increased, that crystallisation becomes impossible, and the whole solidifies to an amorphous glass.—F. Sodn.

Arsenic pentoxide; Hydrates of ——. D. Balareff. Z. anorg. Chem., 1911, **71**, 73—78.

Crystallisation of arsenic acid solutions, under various conditions, was found to yield neither ortho-, pyro-, nor meta-arsenic acid, but only the compounds, $H_2As_2O_9$ ($H_3AsO_4,1/2H_2O$) and $H_5As_3O_{10}$($H_4As_2O_7,HAsO_3$), the latter being invariably obtained by evaporating the solutions, whether at 40° or 180° C., and the former, or a mixture of the two, by allowing the solution to stand at the ordinary temperature or by cooling; prolonged heating at a high temperature before crystallising had no effect, but above 200° C. arsenic pentoxide separated directly from the solution. The hydrate, $H_3AsO_4,1/2H_2O$, when dried over phosphoric oxide or sulphuric acid, gave the hydrate, $H_5As_3O_{10}$, and, showing that no intermediate products are formed, the rate of dehydration was found to be uniform; the former hydrate also partially melts on heating, yielding the latter compound as solid residue. —F. Soddy.

Lead; Determination of the higher oxides of lead, and some new reactions of the salts of ——. A. Chwala and H. Colle. Z. anal. Chem., 1911, **50**, 209—249.

The authors have made an extensive and detailed examination of the many methods of determining lead peroxide in samples of this material and in red lead. Having shown that low results are given by all the methods which are based on the liberation of iodine when lead peroxide is dissolved by the combined action of acetic acid, sodium acetate and potassium iodide, they investigated in detail the reactions of lead salts with the substances named and with those formed in the course of the reaction. From these experiments they conclude that the chief source of the low results mentioned is the interaction of lead acetate with the liberated iodine to form methyl acetate, carbon dioxide and lead iodide: $(CH_3CO_2)_2Pb + 2I = CH_3CO_2CH_3 + PbI_2 + CO_2$. The action is slow and consequently the quicker methods are the more accurate. The iodometric method is in fact capable of giving results sufficiently accurate for practical purposes but in view of the accuracy and speed of the Lux method as modified by them, the authors have no doubt that iodometric methods will disappear from analytical practice. The method which they recommend is as follows:—To 1—2 grms. of lead peroxide are added 100 c.c. of $N/1$ nitric acid and 25 c.c. of $N/1$ oxalic acid solution. The mixture is boiled until the action is completed (from 10 to 15 minutes) and the solution is then quickly titrated at a temperature of 70° to 80° C. with $N/1$ or $N/5$ potassium permanganate solution. Peroxides and chlorates of other metals must of course be absent.—T. St.

Arsenic; Adsorption of —— by aluminic and ferric hydroxides. G. Lockemann and M. Paucke. Z. Chem. Ind. Kolloide, 1911, **8**, 273—288. (See this J., 1910, 1202.)

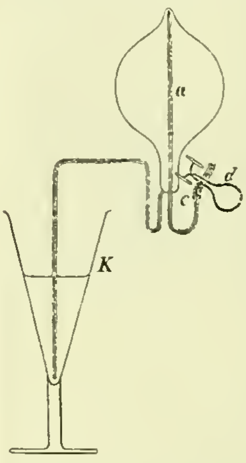
The object of the research was to determine the quantities of aluminium and ferric hydroxides which are capable of practically completely adsorbing various quantities of arsenic and arsenious acids. Egg-white and blood serum adsorb a certain quantity of arsenic from aqueous solutions on coagulation. Animal charcoal (especially the finely divided preparation "Makanite") adsorbs a certain quantity of arsenic when shaken with aqueous solutions. Aluminium hydroxide adsorbs arsenic from aqueous solutions when precipitated by ammonia (better in the hot than in the cold). Quantities of arsenic up to 0·02 mgrm. can be completely adsorbed at water-bath temperature by very large quantities of aluminium hydroxide. Ferric hydroxide on precipitation with ammonia adsorbs considerable quantities of arsenic. The most favourable conditions are:—lowest possible temperature (ice-cooling) and smallest possible excess of ammonia (stoichiometrical quantity). The adsorption is markedly diminished by the use of caustic soda or potash. With small quantities of arsenic, up to about 10 mgrms. in 100 c.c., adsorption by ferric hydroxide can be performed quantitatively, under the most favourable conditions. With larger quantities of arsenic the adsorption rises to a certain limit with increasing quantities of ferric hydroxide, after which it no longer increases markedly, even on greatly increasing the quantity of hydroxide. After filtration the arsenic still in solution can be removed by small quantities of ferric hydroxide. Total adsorption of arsenic (*i.e.*, when the amount remaining is as $1:\infty$) by ferric hydroxide proceeds according to the formula $E = \beta . A^p$ (E = mgrms. of ferric hydroxide; A = mgrms. of arsenic in 100 c.c.; β at 0° C. = 62; at 25° = 80; at 80° = 120; p for all temperatures = 0·6). The adsorption is greater when the hydroxide is precipitated within the solution. The method can be used to free salts from the last traces of arsenic. —H. E. P.

Chromotellurates. A. Berg. Comptes rend., 1911, **152**, 1587—1589.

The author describes some of the salts of chromotelluric acid, $4CrO_3TeO_32H_2O$, which has not yet been isolated. On cooling a concentrated solution containing one molecular equivalent of potassium bichromate, one of telluric acid, and two of chromic anhydride, potassium chromotellurate $4CrO_3TeO_32K_2O$, separates in crystalline orange crusts. This salt is slightly soluble in cold water which does not decompose it appreciably, and it dissolves very slowly in boiling water. The ammonium salt may be obtained in a similar manner; it is more soluble in water than the potassium salt. The sodium and the chromic salts are extremely soluble and the author has not yet obtained them in the pure state. Calcium does not form a chromotellurate, but yield a tellurate instead. The chromotellurates are to be regarded as being derived from the first anhydride, $TeO(OH)_4$, of the normal acid, $Te(OH)_6$. The potassium salt will then be represented by the formula $TeO(OCrO_2OK)_4$.—L. E.

Nitric oxide; Preparation and determination of ——, and its behaviour to water. L. Moser. Z. anal. Chem., 1911, **50**, 401—432.

Pure nitric oxide is best prepared (1) by allowing sulphuric acid (1 : 1) to drop into a solution of 1 part by weight of potassium iodide and 2 parts by weight of potassium nitrite (Winkler, Ber., 1901, **34**, 1408); or (2) by the action of mercury on a solution of nitrous acid in sulphuric acid (Emich, Monatsh. Chem., 1892, **13**, 72). Nitric oxide reacts with water forming nitrous and hyponitrous acids. The latter is very unstable, especially in acid solutions, decomposing with formation of nitrous oxide and ammonia: $H_2N_2O_2 = N_2O + H_2O$; $3H_2N_2O_2 = 2N_2O_3 + 2NH_3$. The ammonia reacts further with nitrous acid giving rise to nitrogen: $NH_3 + HNO_2 = N_2 + 2H_2O$. Nitric oxide cannot therefore be preserved over water, the best material to use being mercury. In the absence of nitrous oxide the best absorbent for the estimation of nitric oxide is a solution of ferrous sulphate. When nitrous oxide is present the best method of determining nitric oxide is by the action of a $N/10$ acid solution of potassium permanganate. A measured quantity of the standard permanganate solution is taken and after the absorption the unused permanganate is determined by titration. The author finds that Lunge's method, in which the gas is slowly passed through a 10-bulb tube containing the permanganate solution, gives low results, and is useless for small quantities of nitric oxide. In order to bring the gas and the solution into more intimate contact, thereby ensuring oxidation of all the nitric oxide present, the author uses the apparatus shown in the diagram, a later modification having a two-way tap in place of the clip, *d*. The absorption vessel, *a*, which has a capacity of 120 to 130 c.c., is first filled with the permanganate solution from the vessel, K, by suction. The gas under test is then passed in at *c* from a burette. Absorption is assisted by shaking. When the level of the solution remains constant, indicating that absorption is at an end, the solution is run off, the absorption vessel is washed out with water and the unused permanganate is titrated. Results obtained in this way are slightly low due to the presence of dissolved oxygen in the permanganate solution, but the method is accurate enough for all practical purposes.—T. St.



Bromine; New characteristic reaction for ——. G. Denigès. Bull. Soc. Chim., 1911, **9**, 542—544.

The reagent is prepared as follows:—5 c.c. of pure hydrochloric acid and 4—5 grms. of pure granulated zinc (or thin amalgamated zinc plates) are added to a 1 per cent. aqueous solution of strychnine sulphate, the mixture is heated to boiling, allowed to stand for a few minutes, then cooled and the clear liquid decanted for use. It should be freshly prepared. 1 c.c. of the reagent shaken with 5 c.c. of a bromine solution (containing not more than 1 grm. per litre) develops almost at once a fine purple colouration. The reaction is characteristic, being quite different from that given by iodine, and from the red colouration given by chlorine and other oxidising agents such as nitrous and nitric acids, hydrogen peroxide, ferric chloride, etc. The limit of sensitiveness of the reaction is about 0·01 mgrm. of bromine in 1 c.c. of liquid. Traces of bromine in the atmosphere can be detected by aspirating the air through 5 c.c. of *N*/10 or *N*/20 alkali hydroxide and adding 1 c.c. of the reagent. The hydrogenised derivatives of brucine give a greenish olive colouration with all oxidising agents.—A. Sbld.

Extraction of bromine and iodine simultaneously liberated in aqueous solution by means of chloroform and carbon bisulphide. Labat. *See* XXIII.

Patents.

Formic acid; Process for preparing —— from formates and sulphuric acid. H. Schröder. Ger. Pat. 234,580, Feb. 8, 1910.

The alkali formate and sulphuric acid are contained in vessels of suitable size, connected by cocks or other similar means with the reaction flask, which is of comparatively small capacity, and is provided with a stirring apparatus and with cooling means. Beneath it, and connected with it by a valve, is the distilling apparatus. The formate and acid are run simultaneously, in small quantities at a time, and in the calculated proportions, into the reaction flask, where they are thoroughly mixed by the stirrer and distributed over a considerable space; the heat generated by the reaction is thus easily removed. When the reaction is at an end, the connection between the reaction flask and distilling apparatus is opened, and the acid is distilled as usual.—T. F. B.

Ammonia-stills; Apparatus for supplying lime to ——. J. S. Unger, Chicago, Ill. U.S. Pat. 994,431, June 6, 1911.

Lime and water are mixed in a "pressure tank," which is provided with pneumatic means for agitating its contents, and for raising the same into an adjacent ammonia-still. A valve controls the discharge of material from the tank to the still, and means are provided for the intermittent opening of the valve, whereby the pressure forces a suitable quantity of material into the still. The discharge valve and its controlling valve are operated automatically by the help of an additional timing valve.—O. R.

Ammonium sulphate and sulphite; Process of making ——. F. Wolf, Bochum, Germany. U.S. Pat. 994,435, June 6, 1911.

The gases which are evolved in the dry distillation of fuel are freed from tar by condensation, and are washed with water to form ammoniacal liquor. The unabsorbed gases are then burnt, and the products of combustion, which contain sulphur trioxide and sulphur dioxide, are treated with the ammoniacal liquor first obtained, with the formation of ammonium sulphate and sulphite.—O. R.

Sodium bichromate; Manufacture of ——. T. J. I. Craig, Assignor to P. Spence and Sons, Ltd., Manchester. U.S. Pat. 994,129, June 6, 1911.

A mixture of sodium and ammonium chromates in dilute aqueous solution, is concentrated and treated with superheated steam under pressure, with the removal of ammonia and the formation of sodium bichromate. The steam, which is used for acting on the concentrated liquor, is derived from the operation of concentrating the dilute solution.—O. R.

Carbonic acid; Process of and apparatus for liquefying ——. F. Hildebrand, Wilmersdorf, Berlin. Eng. Pat. 19,336, Aug. 17, 1910. Under Int. Conv., June 3, 1910.

Highly compressed carbonic acid gas, or a mixture of this gas and another (such as air), is allowed to expand in a system of pipes, in which it is pre-cooled by means of carbonic acid snow, formed continuously by conducting liquid carbonic acid, which may be a portion of the condensate, into a sieve-like structure (of linen or wire-mesh for instance) surrounding the first part of the pipe system: the pre-cooled carbonic acid liquefies by performing internal work within the condenser, whilst any air present is separated mechanically and may be utilised for cooling the gas to be liquefied. The gas evaporated from the snow may be made to reunite with the snow-cooled carbonic acid, previous to its liquefaction, by means of a jet device, built into the pipe system in such a manner that the carbonic acid evaporated is drawn into the system and flows with the rest of the gas through a reducing valve into the actual liquefying vessel. The snow may also be obtained by using carbonic acid liquefied by an external compressor and condenser, forming an independent circuit. The pipe system comprises a nest of coiled pipes, which may be of square or hexagonal section and lie closely adjacent one within the other, thus constituting a tubular structure in which rapid interchange of heat takes place. This tubular structure may be pyramidal in cross-section, so as to secure reduced contact with the snow as the gas approaches the outlet, and, in lieu of a single sieve-like receptacle, several such may be arranged radially around the coil system.—F. Sodn.

Nitrogen from air; Apparatus for obtaining ——. C. Blagburn, San Francisco, Cal. U.S. Pat. 993,017, May 23, 1911.

The apparatus consists of a furnace, the area of which is considerable in proportion to its height; this is provided at one end with means for the supply of sulphur and air, and, at the other, with a conduit for the resulting gases, at the further end of which conduit a suction pump may be installed to promote the flow of air and gases through the apparatus; there are also means for removing sublimed sulphur from the gases, for absorbing sulphurous acid, and for collecting the residual nitrogen. The whole of the air supplied is brought into contact with the sulphur; for instance, by sloping the top, or both top and bottom, of the furnace downwards from inlet to outlet.—F. Sodn.

Nitrogenous compounds; Process of making ——. G. Erlwein and K. Warth, Assignors to Siemens und Halske A.-G., Berlin. U.S. Pat. 994,095, May 30, 1911.

Calcium carbide (or other carbide reacting with water to produce a hydrocarbon) is heated alone, or in admixture with a halogen compound, in an inert atmosphere and at a temperature ranging between 300° C. and 1100° C. until the product no longer yields a hydrocarbon on treatment with water. By subjecting this material to the action of nitrogen under suitable conditions, a product is obtained which yields ammonia when heated with water at high temperatures.—W. E. F. P.

Silicon-oxygen product. F. J. Tone, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 993,913, May 30, 1911.

Claim is made for a product, consisting essentially of silicon monoxide, SiO, which is condensed from the gases produced by electrically heating a mixture of silica and carbon. The material is light brown in colour, has a specific gravity of about 2·22, and yields a residue of amorphous silicon on treatment with hydrofluoric acid. —W. E. F. P.

Nitric-acid and other vapours; Process of dehydrating ——. H. Pauling, Assignor to Salpetersäure-Ind.-Ges., Gelsenkirchen, Germany. U.S. Pat. 993,868, May 30, 1911.

See Fr. Pat. 422,902 of 1910; this J., 1911, 541.—T. F. B.

Ammonia from peat; Process of producing ——. H. C. Wolterck, Assignor to P. Mason, London. U.S. Pat. 994,048, May 30, 1911.

SEE Eng. Pat. 15,285 of 1910; this J., 1911, 620.—T. F. B.

Formates; Manufacture of ——. O. L. A. Dubosc, A. D. Luttringer, and H. Denis, Paris. Eng. Pat. 29,165, Dec. 15, 1910. Under Int. Conv., Dec. 15, 1909.

SEE Fr. Pat. 421,227 of 1909; this J., 1911, 542.—T. F. B.

Alkaline-earth oxalates; Process of precipitating ——. D. Strauss, Assignor to Soc. of Chem. Industry in Basle, Basle. U.S. Pat. 995,041, June 13, 1911.

SEE Eng. Pat. 7092 of 1910; this J., 1910, 878.—T. F. B.

Oxygen and nitrogen in atmospheric air; Process for separating the ——. R. P. Pictet, Wilmersdorf, Germany. Eng. Pat. 27,463, Nov. 25, 1910. Under Int. Conv., Nov. 29, 1909.

SEE Fr. Pat. 409,787 of 1909; this J., 1910, 817.—T. F. B.

VIII.—GLASS; CERAMICS.

Glassware; Zinc oxide in chemical ——. A. M. Smoot. Eng. and Min. J., 1911, **91**, 1098.

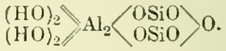
GLASSWARE which owes its refractory nature to the presence of oxide of zinc and boric acid is comparatively resistant to water and acid saline solutions, but not to solutions containing fixed alkalis, nor to alkaline saline solutions. Three or four mgrms. of zinc oxide may easily be dissolved from a 300 c.c. beaker in a comparatively short time by a 2 per cent. solution of sodium or potassium hydroxide. With ammoniacal solutions the amount dissolved is small even in a long time. (See also P. H. Walker, this J., 1905, 845).—T. ST.

China clay. J. M. Coon. Trans. Eng. Ceramic Soc., 1910—1911, **10**, 81—92.

CHINA clay rock is the name given to the decomposed portions of the granite bosses of Devon, Cornwall, etc., from which commercial china clay is obtained, the average yield being about 20 per cent. of the china clay rock. In the author's opinion, the decomposition of the felspar of the original granite, resulting in the formation of china clay rock, is to be referred to the fluorine and boron of the tourmaline. Microscopically, china clay consists of vermicular aggregates, often broken down to powder-like micro-crystalline flakes. The vermicules have a slightly pearly lustre, and a refractive index of about 1·558. The traces of crystal faces or cleavages are so indefinite that the extinction cannot be determined with certainty, and apparently the vermicules have no definite relation to the cleavages of the felspar. The granite formation in the St. Austell district has one series of joints approximately parallel to the surface contours (bedding joints) and two others more or less inclined from the vertical and roughly at right angles to each other (heading joints). There is a considerable difference in level between the granite bosses, and consequently water can circulate along these joints. The theory of the formation of the china clay rock is that the granite becomes infiltrated with water, which, in circulating through the deeper parts takes into solution agents, probably containing fluorine and boron, which attack the felspar, and remove much of its silica, and its alkalis, and introduce water into combination with the residue, and thus convert the potassium aluminium silicate into hydrated aluminium silicate. The bedding joints in the granite bosses would in section appear as an ascending series on one side and a descending series on the other; the former would form inlets for water from the next higher boss, and the latter outlets to a still lower boss or spring. The rock generally is more decomposed and whiter near the "inlets" than near the "outlets," and the clay from the deeper parts is always whiter, more uniform, and larger in amount than near the surface.
—W. C. H.

Kaolinite molecule; The chemical constitution of the ——. J. W. Mellor and A. D. Holdcroft. Trans. Eng. Ceramic Soc., 1910—1911, **10**, 94—120.

IN attempting to determine the constitution of the kaolinite molecule no definite temperature of dehydration was found, but the rate of dehydration is increased by raising the temperature and by diminishing the pressure. The observations of Le Chatelier and others that an endothermal reaction occurs at about 500° C., and an exo-thermal reaction at about 800° C. were repeated. It is argued that if the elements of combined water, or hydroxyl groups, were arranged unsymmetrically in the molecule, the heating curve of kaolinite would show signs of dehydration taking place in stages, but this apparently is not the case. From their experiments the authors consider that "the action of aqueous solutions of sodium hydroxide, and of sulphuric acid on kaolinite follow the normal course of heterogeneous reactions," and show no sign of unsymmetrical aluminium groups. These assumptions are in agreement with Groth's formula, which, by a slight re-arrangement may be written:—



$$\begin{matrix}(HO)_2\\(HO)_2\end{matrix}\!\!>\!Al_2\!<\!\begin{matrix}OSiO\\OSiO\end{matrix}\!>\!O.$$

Kaolinite that has been more or less dehydrated is more soluble in acids than the original kaolinite. Clay that has been heated to 500° to 800° C. appears to absorb moisture and gases from the air to a larger amount than either raw kaolinite or kaolinite that has been calcined at above 800° C., and in this respect bears a resemblance to alumina, though the order of magnitude of the absorption in the latter case is about 30 times larger than in the former. On heating clays up to about 600° C. the specific gravity diminishes and then increases beyond that of the raw clay. The specific gravity of alumina increases as the sample is calcined at temperatures rising from 600° to 1000° C. successively, but the percentage amounts of water lost by the alumina at these temperatures are larger than those lost by clays at the corresponding temperatures. The endothermal change shown on heating kaolinite to about 500° C. might be due to the decomposition of the material into water and a compound $Al_2Si_2O_7$, or, as suggested by Le Chatelier, to a decomposition into free silica, free alumina, and water. In support of the latter view, it has been found that when calcined kaolinite is heated with steam under pressure, a partial recombination with water occurs, which might correspond with rehydration of either the silica or the alumina. Also, crystals of sillimanite, $Al_2O_3SiO_2$, have been detected in kaolinite that has been heated above 1200° C. and the formation of these crystals could be easily explained by the recombination of the free alumina with some of the free silica. The exothermal change in kaolinite at about 800° C. has always been attributed to a physical change in the alumina, by which it becomes less soluble in acids, less hygroscopic, and more dense. It is suggested that kaolinite may represent one member of a series of aluminodisilicic acids, and other minerals represent other groups, namely, alumino-mono-di-, tri-, tetra-, penta-, and hexasilicates.—W. C. H.

Retort and firebrick material; Standard specification for ——. (Report of the Refractory Materials Committee of the Institute of Gas Engineers.) J. Gas Lighting, 1911, **114**, 843—845. (See also this J., 1910, 869; 1911, 28.)

THE following specification is suggested as being generally applicable to refractory material manufactured from fireclay containing not more than 75 per cent. of silica; provided the results of the tests are satisfactory, however, material made from fireclay containing as much as 80 per cent. of silica is to be considered as conforming to the specification. *Refractoriness.*—A compressed air-gas furnace of the Meker type, or the electric furnace of Hirsch, is recommended for this test, which is conducted in an oxidising atmosphere, the temperature of the furnace being increased at the rate of about 50° C. per 5 minutes. Material showing no sign of fusion when heated to a temperature of not less than Seger cone 30 (about 1670° C.) is classed as grade 1, while that withstanding a temperature of not less than Seger cone 26 (about 1580° F.) is classed as grade 2. The latest scale of Seger cone temperatures is to be used;

and each piece of material is to be stamped "1" or "2," by a figure not less than 1 inch long, to indicate the grade to which it belongs. *Chemical analysis.*—When required by the purchaser, a complete analysis of the material is to be provided, silica being determined by two evaporations with an intervening filtration, and alumina, lime and magnesia, by two precipitations; titanic oxide, potash, and soda are to be separately reported. *Surfaces and texture.*—The material shall be of uniform texture, evenly burnt and free from holes or flaws; all surfaces shall be reasonably true. *Porosity.*—No tests are specified, as the matter is still under consideration. *Contraction or expansion.*—When heated to a temperature of Seger cone 12 (about 1350° C.), for 2 hours, the material shall not show a greater linear contraction or expansion than 0·75 per cent. in the case of grade 1, or 1 per cent. in the case of grade 2. The test-piece shall be 5 to 6 cm. long, the ends being ground flat, and the alteration in length measured by means of vernier callipers reading to 0·1 mm. *Variations from measurements.*—Bricks of standard sizes shall not vary from the specified dimensions by more than ± 1½ per cent. in length, or ± 2½ per cent. in width or thickness, and in all cases shall work out their own bond with not more than ⅛ in. allowance for joint. With special bricks, blocks or tiles, the variation from any of the specified dimensions shall not exceed ± 2 per cent. *Crushing strength.*—The material shall withstand a crushing strain of not less than 1800 lb. per sq. in. This is to be determined by placing a whole brick, with its long side vertical, between the jaws of an Avery machine giving a vertical thrust; the ends of the brick are to be sawn or ground flat and parallel, and not less than three bricks are to be tested. *Cement clay.*—This material may contain a suitable percentage of fine grog, but must be machine ground, and of the same degree of refractoriness as the bricks, etc., with which it is to be used.
—W. E. F. P.

Some aluminium double silicates. Weyberg. *See* VII.

Fusion experiments with some bisilicates. Lebedew. *See* VII.

Patents.

Glass furnace or like crucibles; Tongs for use in connection with ——. Soc. Anon. des Glaces de Sainte Marie d'Oignies, and J. B. Loubriat, Aiseau, Belgium. Eng. Pat. 21,312, Sept. 13, 1910.

The arms which grip the crucible can be tilted in a longitudinal direction in order to free the crucible from the bottom of the furnace before removing it. By mechanical means the tongs can be made to lift the crucible out of the furnace, convey it to any convenient position, tilt the crucible to pour out its contents, and then return it to the furnace. The controlling mechanism for all these operations can be housed in a "cab." The tongs are attached to a frame, which is suspended by lifting gear from the turn-table of a travelling crane. The frame is provided with tenons, which engage with guides carried by the crane, so that oscillation or gyration of the frame is prevented when the crucible is being tilted for pouring.
—W. C. H.

Glass-furnace. V. L. Martin, Arnold, Pa. U.S. Pat. 995,267, June 13, 1911.

The circular glass furnace comprises a bed and a surrounding wall, and a glass melting pot is placed on the bed of the furnace, an annular space being left between it and the wall of the furnace. A vertical separating cylinder, provided with openings in its lower portion, is placed inside the melting pot. The crown of the furnace is composed of sections, which extend over the outer portion of the melting pot, and are supported upon the wall of the furnace and on the upper end of the separating cylinder. The central portion of the crown is open to allow of the removal of the glass from the interior of the separating cylinder.
—W. C. H.

Mica sheets; Process and apparatus for making ——. M. Meirowsky, Porz, Germany. Eng. Pat. 3874, Feb. 15, 1911.

Aspirated air is used to pick up and hold the particles of mica before they are rendered adherent, and compressed air is employed to release the particles from the suction surface, and to apply them to the adhesive surface. The apparatus consists of a rotating perforated hollow cylinder, which encloses a stationary inner cylinder, in the periphery of which are two openings or chambers. One of these is arranged as an aspiration air chamber, and extends over the distance from the point where the pieces of mica are supplied, nearly up to the adhesive surface, and the other, arranged in the direction of rotation, acts during a short part of the time of rotation as an air compression chamber.
—W. C. H.

Clay and similar substances; Rotary dry pan mills for grinding and pulverising ——. R. C. Penfield, New York. Eng. Pat., 24,660, Oct. 24, 1910.

The patent relates to mills of the type in which the dry material is operated upon by heavy rollers or mullers in a rotatory pan, the latter being provided with, or forming, a screen for effecting the separation of the fine from the coarse product. Claim is made for an apparatus in which the grinding and screening elements—which are concentric and situated in practically the same horizontal plane—are operated independently, the former being rotated more rapidly than the latter. The provision of a secondary screening element and devices for facilitating the separate discharge of the screened clay, and the tailings, is also claimed.—W. E. F. P.

Clay and the like; Grinding and mixing machines for ——. L. Hinterschweiger, jun., Lichtenegg b. Wels, Austria. Eng. Pat. 1221, Jan. 17, 1911.

The apparatus comprises an inclined, rotatory drum in which a spring-mounted rotatory roller is disposed eccentrically. In addition to the usual stripping blade, a series of short, parallel blades, disposed in the direction of a helical line, press against the surface of the roller, cutting the material raised by the latter into narrow strips, and assisting the forward travel of the same; the blades are carried by arms mounted loosely on the shaft of the roller. The drum is open at both ends, but by means of inclined, segment-like screens the free lower space of the drum is closed at the inlet and outlet end.—W. E. F. P.

Kilns for pottery, earthenware, etc. C. J. Tidy, Hightown, Lancs. Eng. Pat. 29,521, Dec. 20, 1910.

The patent relates to kilns of the muffle type, claim being made for the direct heating of the closed or back end of the oven or muffle by means of a separate flue connecting the fire-hole with the stack.—W. E. F. P.

IX.—BUILDING MATERIALS.

Patents.

Wood; Process of impregnating ——. C. S. Smith, Berkeley, Cal. U.S. Pat. 992,918, May 23, 1911.

The wood is placed in an airtight cylinder and subjected to the action of a bath of oil at a temperature of about 220° F. until most of the water is vapourised, when the oil is withdrawn. An air pressure of about 50 lb. per sq. in. is then applied, a preservative oil at a temperature of about 120° F. is introduced, and the air pressure is increased to 157 lb. per sq. in. When the desired degree of impregnation is attained, the pressure is released and the unabsorbed oil drawn off; the wood is then subjected to reduced pressure for the purpose of withdrawing a portion of the oil contained in the cell cavities.—W.E.F.P.

Cement; Substance for rendering —— waterproof. Deutsche Rekord Cement Werke. J. Krümpelmann & Co., and J. Krümpelmann. Lüdinghausen, Germany. Eng. Pat. 30.091. Dec. 28, 1910.

FINELY powdered, bituminous (lias) shale, preferably containing about 25 per cent. of bitumen. 15 of lime and 2 of magnesia, is made into a paste with 28 per cent. of its weight of crude hydrochloric acid; and after the carbon dioxide has escaped, the mixture is subjected to a steam pressure of 5 atmospheres for about 3 hours. 15 per cent. of mineral oil and 15 of gas tar are then incorporated with the mass which, on being quickly dried at a temperature of about 100° C., assumes a homogeneous, powdery form. For rendering Portland cement waterproof, 1 part of this product is mixed or ground with 8 of the cement.
—W. E. F. P.

Cement-mixer. F. Clemens. What Cheer, Iowa. U.S. Pat. 994.978. June 13, 1911.

THE rotating shaft of the mixer carries series of blades, fixed with respect to each other. One series consists of a number of reversely curved blades, and the other of a number of concave blades, the concave faces of which are arranged to face the reversely curved blades. The adjacent lateral edges of the concave blades are fixed out of alignment, so that one of the lateral edges of the reversely curved blade is opposite the intermediate portion of a concave blade.—W. C. H.

Furnace for burning cement and the like. F. Ernst and H. Trachsler. Zürich, Switzerland, Eng. Pat. 12.525, May 23, 1910. Under Int. Conv., May 26, 1909.

SEE Fr. Pat. 416,781 of 1910; this J., 1911, 431.—T. F. B.

Treating [purifying] refractory electric-furnace products. U.S. Pat. 992,875. *See* XI.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Blast-furnace; Attempt to calculate the amount of direct reduction in the ——. F. Wüst. Stahl u. Eisen, 1911, **31**, 953—955.

BY "direct" reduction is meant the reduction of iron oxides by carbon, whilst "indirect" reduction is that effected by carbon monoxide. The author calculates the amounts of carbon employed to convert the oxygen of the blast into carbon monoxide, to react with the moisture of the blast, to supply the carbon contained in the pig iron, that leaving the furnace as methane in the gases, and that needed for the direct reduction from their oxides of the manganese, silicon, and phosphorus found in the pig iron; the sum of these amounts (all taken per ton of pig iron) subtracted from the total amount of carbon supplied in the coke, leaves the amount employed directly in reducing iron oxides. He applies these calculations to the four sets of data given by Gillhausen (this J., 1910, 1384) in his paper on the blast furnace, and obtains the following results:—

Percentage of	1. Ten per cent. Spiegeleisen.	2. Bessemer pig.	3. Hæmatite pig.	4. Basic pig.
Total carbon employed in direct reduction	6·5	10·3	11·0	13·4
Total oxygen in ore, removed by direct reduction	23·6	28·1	26·1	47·3
Oxygen contained as ferrous oxide in ore removed by direct reduction	34·2	40·8	39·2	63·6

—J. T. D.

Iron; The action of salt solutions and of sea-water on —— at various temperatures. J. A. N. Friend and J. H. Brown. Chem. Soc. Proc., 1911, **27**, 156. (See also this J., 1911, 626.)

THE authors exposed thin plates of pure iron to the corrosive action of various concentrations of common salt and of sea-water at different temperatures. Below 13° C. it was found that dilute solutions exert a more corrosive action than distilled water at the same temperature; above 13°, on the other hand, they exert a less corrosive action. At 13° the corrosive action is practically the same for dilute solutions of common salt, for ordinary sea-water, and for distilled water. This temperature is therefore styled by the authors the "inversion temperature."

Steels; The resistance of —— to crushing, and its variations as a function of the temperature. F. Robin. Rev. Mét., 1911, **8**, 423—435.

THE study of the practical conclusions relating to the resistance of steels to crushing (this J., 1910, 1912) follows that relating to the resistance to abrasion (this J., 1911, 215.) Using a cylinder of which the height is the same as the diameter of the base, the resistance to crushing is given by dividing the number of kilogram-metres necessary to reduce the height of the cylinder by one-fifth, by the volume of the metal in cubic centimetres. The curve of resistance is hyperbolic and is obtained by plotting the work performed by each shock against the total work necessary to produce equal deformation, and it depends on the hardness and elasticity of the metal, the direction of the curve changing when heat diminishes the resistance of the hard metal. In a hard metal the curve lies asymptotically to the axes of co-ordinates, while in a soft metal, such as lead, the curve turns towards the origin. In steels the curve lies as above for a hard metal up to a temperature of 400° C. when it turns to the direction of the curves of soft metals. The effect of crushing iron-carbon alloys is discussed, and the curves obtained by plotting the resistance to crushing at varying temperatures are given for steels containing nickel, nickel and chromium, and chromium, tungsten, and manganese. Phosphorus increases the resistance to crushing, but with more variations according to the temperature, and metals dissolved in the iron appear to have a similar action. Curves of the hammer-hardness in relation to temperature of carbon steels, and chromium tungsten steels are given and show a maximum at 300° C. with a fall to about 700° C. and then a variation depending upon whether the metal can be tempered or not. Forgeability is defined as the diametric enlargement on crushing, and when plotted against the temperature of crushing gives curves which show maxima at about 0° C., and 300° C., a minimum at 500° C., and then a very rapid rise to 1000° C., followed by a rapid fall. Curves of some special steels are given which show a similar nature, but one containing 30 per cent. of nickel, 0·40 of carbon, and 1·0 of manganese gave an almost horizontal curve with a maximum at 500° C. Nickel, German-silver, and brass show a minimum at about 300° C.—A. H. C.

Steels; The fragility of —— on exposure to crushing strain. Micrographic examination of the surfaces of the bases of cylinders crushed at different temperatures. F. Robin. Rev. Mét., 1911, **8**, 436—455. (See this J., 1910, 1312.)

INTERGRANULAR fissures result from the imperfect union of neighbouring grains of different crystalline orientation at the moment of crushing and do not traverse the grains unless the metal is liable to intergranular brittleness. Fine fissures due to impurities or to loss of adhesion developed on the bases of certain cylinders are found, and are mostly disposed parallel and perpendicular to the radii of the surface of the base of the cylinders. Their nature is difficult to determine, but their characteristica are:— 1. They are terminated by the contours around the areas in which they have originated in the case of a very malleable metal. 2. They are radial or perpendicular in direction. 3. They do not often border the line of deformation, and appear to have originated in metal which has been very little disturbed. It is suggested that these fissures are due to two causes. 1. To the enlargement of spaces containing slag, oxides, or perhaps to gas present in the ferrite. 2. To the loss of adhesion of bands of ferrite. Twelve micro-photographs illustrate the formation of fissures at slag pools, and also the formation of slip bands in the grain of the metal. Phosphoric steel is the most typical instance of intergranular fission; at 650° C. the grains forge well but at 660° C. the lines of Neumann appear and are very fine in structure, while at 500° C. forging produces a rapid separation of all the grains, a maximum occurring at this temperature. Carbon steels show fission in the pearlite, while the graphite of cast-irons is the seat of origin of fissures which open easily.—A. H. C.

Ferro-vanadium; Analysis of —— and determination of vanadium in presence of arsenic. W. Trautmann. Z. anal. Chem., 1911, **50**, 371—372.

In a hot sulphuric acid solution, arsenious acid reacts with potassium permanganate as shown by the equation :—

$$4KMnO_4+5As_2O_3+6H_2SO_4=$$
$$5As_2O_5+2K_2SO_4+4MnSO_4+6H_2O.$$

The reaction may be used either for standardising a solution of permanganate or for a quantitative determination of arsenic. When a solution containing vanadium, arsenious acid, and sulphuric acid is oxidised with potassium permanganate, and subsequently treated with sulphur dioxide, only the vanadium is reduced. The arsenic acid remains unchanged. It is therefore unnecessary to remove arsenic before titrating the vanadium with potassium permanganate. The determination of vanadium in ferro-vanadium is now carried out as follows. 0·2 to 0·3 grm. of the alloy is fused with a mixture, in equal parts, of sodium peroxide and sodium hydroxide. The melt is leached out with hot water and the residue fused again. The two solutions are mixed, strongly acidified with sulphuric acid, boiled, and oxidised with a few drops of potassium permanganate solution. The solution is then reduced by means of an aqueous solution of sulphur dioxide, and the excess of the latter boiled off, passing a current of carbon dioxide meanwhile. The solution is then ready for titration. As a control determination, it can be afterwards again reduced and titrated. Attempts to determine both arsenic and vanadium in one portion by first titrating the two elements together, then reducing the vanadium with sulphur dioxide, and titrating again, thus obtaining the arsenic by difference, did not succeed : the titration in the same solution of arsenic and vanadium together consumes less permanganate than theory requires.—R. W. N.

Cyanide; Electrolytic regeneration of ——. J. E. Clennell. Eng. and Min. J., 1911, **91**, 1064—1066.

The loss of cyanide during the treatment of ores, apart from the amount actually consumed in the extraction of the precious metals, arises (a) from conversion into hydrocyanic acid which is volatilised, and decomposition into carbonic anhydride and ammonia, and (b) from conversion into thiocyanates and ferrocyanides, and other complex combinations, such as double cyanides of zinc, etc. Regenerative processes can only deal with (b). An ordinary working solution, containing 0·049 of free, and 0·073 of total potassium cyanide, showed no sign of regeneration on electrolysing either with or without aeration, the cyanide content in fact slightly diminishing. The addition of lime caused a slight apparent regeneration of cyanide at the beginning of the electrolysis, but this afterwards disappeared and was probably due to decomposition of double cyanides rather than to regeneration from thiocyanate. Tailing solutions containing free cyanide, gold, and silver were electrolysed, using carbon electrodes and varying current densities. On electrolysis, the cyanide strength diminished until sodium chloride, in the proportion of 5 lb. per ton of solution, was added. The apparent cyanide strength then rose immediately from 0·045 to 0·053 per cent. The gold and silver were precipitated in about six hours. A strong (qualitative) reaction of thiocyanate was obtained until near the finish, when it became faint and at the same time the cyanide strength fell off rapidly, notwithstanding a high alkalinity. Slime carrying manganese and copper was treated with cyanide in the ordinary way for 68 hours, and then electrolysed for 27 hours, being meanwhile agitated without aeration. The cyanide strength, originally 0·073 per cent., first rose to 0·104, afterwards falling to 0·056 per cent. After 20 hours of electrolysis with aeration, the cyanide strength was found to have increased from 0·073 to 0·091 per cent. Thiocyanate was present throughout. Treatment of refractory ores showed that a slightly higher extraction was obtained with the aid of electrolysis, though the silver extraction was far from complete, and in one case diminished on prolonging the electrolytic treatment beyond a certain point. On the whole the regeneration of cyanide from working solutions seems imperfect, and the action may in many cases be reversed. —R. W. N.

Gold; Assay of used plumbago crucibles for ——. J. Watson. J. Chem. Met. Soc., S. Africa, 1911, **11**, 462—464.

The material investigated by the author consisted of ground bricks from the bed of a Tavener furnace, which contained a large proportion of old ground plumbago crucibles. This material carried more than 100 oz. of gold per ton. Preliminary tests in which potassium nitrate, potassium chlorate and manganese dioxide respectively were used as oxidising agents, gave low results, most of the gold remaining in the slag after fusion. The method devised by the author gave very uniform results, and over 99 per cent. of the gold was obtained in the lead button in the first fusion. The sample was passed through a 60-mesh sieve, and 0·10 assay ton taken for each determination. This was mixed with 0·2 assay ton of manganese dioxide and roasted in a muffle at a bright-red heat for half an hour. After cooling, the roasted mass was pulverised and mixed with a charge yielding 35 to 40 grms. of lead, and the assay finished in the usual way. —T. St.

Radium in some uranium ores; Amount of ——. W. Marckwald and A. S. Russell. Chem. News, 1911, **103**, 277—278.

The authors have determined the radium in a number of uranium ores by dissolving in strong sulphuric acid (in which radium sulphate is soluble), and measuring the emanation evolved by means of its ionising power. Taking the ratio of radium to uranium in Joachimsthal pitchblende as 100, they find for thorianite 98·1 and for African pitchblende 101·5, but for autunite numbers varying from 20·7 to 68·0. A determination of ionium in autunite showed, however, that the ratio of ionium to uranium is much more uniform than the above, and is also relatively higher than the radium ratio, being nearer the corresponding ratio for pitchblende. Since ionium has a mean duration of life of not less than 30,000 years, this is taken to indicate that autunite cannot be of a less age than some 100,000 years, and the relatively low numbers obtained for the radium ratio cannot, therefore, be explained by assigning to it a recent origin, as suggested by Soddy. The authors account for the facts by supposing that, in consequence of its spongy structure, as compared with the very dense pitchblende and thorianite, radium and lead have been partially extracted from the mineral by water, the occlusion of helium also being very slight ; this view is supported by results obtained with the mineral rutherfordite.—F. Soddy.

Copper; Electrodeposition of —— free from arsenic from electrolytes containing arsenic. Ching Yu Wen. Met. and Chem. Eng., 1911, **9**, 318—319.

The author has investigated the electrolysis of copper sulphate solutions containing arsenic and antimony, with a view to preventing the deposition of arsenic with the copper, which gives a brittle metal and an inconvenient dendritic deposit. At ordinary temperatures the most troublesome effect is found with concentrations of from 1·5 to 6 per cent. of arsenic. At higher temperatures (50°—60° C.) and with over 6 per cent. of arsenic the effect is much less pronounced. Hydrochloric acid, sodium sulphate, aluminium chloride, and sodium chloride when present in small amounts all have a distinct action in improving the physical and chemical properties of the copper. It appears that any salt whose kation is more electropositive than copper is a suitable "addition agent." In the case of organic "addition agents" both gelatin and tannin produce a greatly improved copper deposit. Peptone exerts a detrimental influence. The best results of all are obtained by the use of gelatin and sodium chloride (0·01 to 0·02 per cent. of gelatin and 0·01 per cent. of chlorine as sodium chloride).—W. H. P.

Aluminium and its alloys; Analysis of ——. G. Kleist. Chem.-Zeit., 1911, **35**, 668—669.

THE following methods are recommended for technical purposes:—I. "*Pure*" *aluminium*.—The total *silicon* is determined by Smith's method (this J., 1911, 289) excepting that no sulphuric acid is added separately. *Iron*.—2—5 grms. of turnings are boiled in an Erlenmeyer flask with 100 c.c. of dilute sodium hydroxide till dissolved; the solution is made strongly acid with sulphuric acid (1 : 1) and filtered; the filtrate, diluted to about 600 c.c., is titrated with permanganate. *Copper* and *tin* are precipitated in the filtrate from the silicon by hydrogen sulphide, the precipitate after washing with cold water is ignited and the mixed oxides weighed. If tin be present, the copper in the weighed oxides is determined as stated below and the tin found by difference. *Zinc*.—The filtrate from the copper and tin sulphides is concentrated to 100 c.c., the iron precipitated by heating with sodium hydroxide and filtered off (dissolving the precipitate and reprecipitating if the iron exceeds 1 per cent.); in the alkaline filtrate the zinc is precipitated by hydrogen sulphide and the precipitate well washed with water containing hydrogen sulphide, the filter is burnt and the residue after being strongly ignited is weighed as oxide. The aluminium is found by difference. II. *Alloys*.—The *silicon* and *iron* are determined by the above methods. *Copper* and *tin* are precipitated together as stated above and the tin determined as follows (the copper being found by difference):—1—2 grms. of turnings are boiled in a 300 c.c. Erlenmeyer flask (fitted with a bored rubber cork) with 150 c.c. of hydrochloric acid (sp. gr. 1·19) till dissolved, and the hot solution is titrated with ferric chloride (standardised against tin) until a lemon yellow turbidity appears. Alternatively the weighed copper and tin oxides are treated with 2 c.c. of nitric acid (1·4 sp. gr.), and the stannic oxide filtered off; the filtrate after addition of 5 c.c. of sulphuric acid (1 : 1) is diluted to 120 c.c. and electrolysed, or the copper determined by means of potassium cyanide. *Zinc*.—The filtrate from the mixed copper and zinc sulphides is concentrated to 100 c.c., rendered ammoniacal, and sulphuric acid then added cautiously until the alumina is dissolved (an excess must be avoided); the solution is diluted to 400—500 c.c., and the zinc precipitated by hydrogen sulphide; the precipitate is washed with water slightly acidified with sulphuric acid and containing some ammonium sulphate and hydrogen sulphide, and then dissolved on the filter with hot dilute hydrochloric acid; the solution is slightly acidified with sulphuric acid and treated as before. The filter with the precipitate is moistened with alcohol, ignited at once, and the residue weighed as oxide. The aluminium is found by difference. (See also this J., 1896, 136, 830; 1902, 724; 1906, 92; 1909, 24; 1910, 217.)—A. SELD.

Alumina; Determination of —— *in ores, slags, etc.* T. W. Cavers. Eng. and Min. J., 1911, **91**, 1105.

Manganese absent.—Working on 0·5 grm., the matter insoluble in hydrochloric (or nitric) acid is fused with fusion mixture, and the whole taken to dryness twice with hydrochloric acid to separate silica. The filtrate from the silica is made just alkaline with ammonia, 5 grms. of ammonium chloride added, and the solution brought to the boil. The precipitated hydroxides are filtered off, washed, and then transferred to a beaker with as little water as possible. 10 c.c. of hydrogen peroxide and 10 c.c. of approximately *N*/1 sodium hydroxide are added and the solution brought to the boil. The ferric hydroxide is filtered off and washed twice with hot water, with the addition each time of 1 c.c. each of the sodium hydroxide and hydrogen peroxide solutions to the wash water. The ferric hydroxide is again transferred to a beaker and the treatment repeated. The filtrates are mixed, made distinctly acid with hydrochloric acid, and the solution is taken to dryness to separate any introduced silica. The aluminium in the silica-free solution is then precipitated by the addition of 5 grms. of ammonium chloride and a slight excess of ammonia. The precipitated aluminium hydroxide is well washed with hot water, ignited and weighed. *Manganese present*.—The filtrate from silica, as above, is made almost neutral with sodium carbonate, and iron, aluminium and chromium (if present) are precipitated with barium carbonate emulsion. After allowing to stand in a stoppered flask for 3 or 4 hours, with frequent shaking, the precipitate is filtered off and washed well by decantation. The filtrate contains the manganese. The precipitate containing iron and aluminium is treated with sodium hydroxide and hydrogen peroxide, and the alumina determined as described above, but the filtrate from the ferric hydroxide precipitate is made acid with nitric instead of with hydrochloric acid before precipitating with ammonia. Blanks must be run on the hydrogen peroxide and the sodium hydroxide for presence of alumina.—T. ST.

Slags; Explanation of the rôle of —— *in smelting processes.* C. Dichmann. Stahl u. Eisen, 1911, **31**, 749—759, 797—804, 891—897.

THE solubility of silica, bases, and silicates in each other is discussed, and it is stated that the slags of heating furnaces are simple solutions of iron oxide in silicates, and that the furnaces therefore should be repaired with silica and not with bases. Each kind of furnace used in the steel industry is discussed and tables are given showing the composition of both the metal and the slag at varying times during the process, and it is shown that iron phosphide is removed by ferrous silicate, being oxidised into phosphate, and that to ensure its removal the slag must contain plenty of oxygen.—A. H. C.

Alkali metals; Preparation of ——. L. Hackspill. Bull. Soc. Chim., 1911, **9**, 446—451.

THE method published in 1905 (this J., 1905, 848) for preparing rubidium and caesium by the action of metallic calcium on the chlorides, has been considerably modified. It has also been applied to the preparation of potassium. The apparatus now used consists of a glass tube about 35 cm. long and 3 cm. in diameter, closed at one end. A smaller tube, about 20 cm. long, is welded into the middle of the large tube, nearly at right angles to it. This small tube is closed at its free end, and halfway between this and its junction with the large tube it is drawn out to a smaller diameter. The large tube being placed in a nearly horizontal position, the smaller side-tube hangs vertically. The fused and powdered alkali chloride is mixed with about four times the amount of metallic calcium theoretically necessary, and, contained in an iron tube, is then placed inside the large glass tube, near to the closed end. The open end of the large glass tube is then connected with a pump capable of maintaining a vacuum of at least 0·01 mm., and exhausted. The reaction is brought about by heating the closed end of the large glass tube by means of a resistance coil of nickel wire. Throughout the operation the temperature must be raised slowly. At 320° C. there is a sudden evolution of nearly pure hydrogen, due to the reaction of water or calcium hydroxide on the metallic calcium. At about 500° C. the alkali metal begins to distil over and condense in the vertical tube, above the constriction. After three or four hours a temperature of 700° C. may be attained. The metal thus obtained always contains some calcium, and can be purified by redistilling in a similar apparatus to the above. Lithium appears to be more volatile than calcium, but, as it attacks glass rapidly, cannot be

prepared in the above apparatus; therefore the mixture of lithium chloride and calcium is heated in an iron tube and the vapour condensed on a water-cooled metallic surface. The lithium thus prepared contains 3 to 4 per cent. of calcium, if an excess of the latter be contained in the mixture. If an excess of chloride be present, a black substance is obtained, containing lithium and chlorine, probably due to the formation of a sub-chloride.
—R. W. N.

Melting points of certain metals; Influence of pressure on the ——. J. Johnston and L. H. Adams. Amer. J. Sci., 1911, **31**, 501—517.

An apparatus is described in which it is possible to heat small quantities of substances under pressures up to 2000 atmospheres and at temperatures up to somewhat above 400° C. (the highest temperature the oil used for transmitting the pressure will stand without serious charring), and to measure both pressure (by means of a gauge) and temperature (by a thermo-element) with precision. The pressure vessel or bomb consists of a steel cylinder on which are shrunk a nickel-steel ring and a number of narrower rings of boiler plate, the whole being enclosed in an outer cylinder which is also shrunk on. Between the rings of boiler plate are spaces through which, and around the inner cylinder, a cooling liquid can be circulated. The ends of the bomb are closed by steel plugs held in place by a hydraulic press, the pressure being kept about 20 tons in excess of that inside the bomb. In order to ensure a tight joint, a copper washer is inserted between a V-shaped ridge on the steel plug and a corresponding groove in the wall of the bomb. The pressure in the bomb is produced by means of a pump of the type ordinarily used with hydraulic presses and is transmitted by means of a high-boiling paraffin oil. The heating is effected by a small electric resistance furnace, inside the bomb, consisting of a copper tube with a wrapping of thin asbestos paper, wound with "nichrome" wire and inserted in a cylinder of soapstone, the intervening space being packed with "magnesite" mixture. Between the ends of the furnace and the steel plugs closing the bomb are plugs of soapstone through which pass the wires of the thermocouple and the wires conveying the heating current. Efficient electrical connection between the inside and outside of the bomb is attained by threading the wires through holes in soapstone cylinders, and then forcing the latter by a pressure of 20 or 30 tons into specially drilled holes in the steel plugs closing the bomb. The material under examination is placed in a graphite crucible which is suspended by steel rods from the upper plug; the lid of the crucible is held in place by a screw-clip. An important feature of the apparatus is the simple method of obtaining pressure-tight pipe joints. The end of the pipe is turned to an angle of 60° and has a left-handed thread cut on it just above the conical portion; a small round nut is screwed on and the whole is held in place by a large nut screwed on to the smaller one. The end of the pipe fits into a conical hole also turned exactly at 60°, and just before assembling the joint, the conical end of the pipe is struck squarely with a hammer so as to enlarge the tip slightly. It is stated that joints of this kind have withstood satisfactorily pressures up to 8000 atmospheres with both liquids and gases. They have the advantage also that they may be repeatedly taken apart and put together again without the efficiency being impaired. With the apparatus described the effect of pressures up to 2000 atmospheres on the melting points of tin, bismuth, cadmium, and lead was examined, and the change was found to be a linear function of the pressure, the melting point of bismuth decreasing and that of the other metals increasing with increase of pressure. The melting points of the metals at atmospheric pressure and at 2000 atmospheres respectively were:—tin, 231·0°, 237·18° C.; lead, 326·7°, 341·38°; cadmium, 320·4°, 331·39°—331·42° C.; bismuth, 270·7°, 262·18° C. (at 2010 atmospheres). A copper-constantan couple was used for measuring the temperature, and the data are tabulated for the plotting of a standard curve for the calibration of copper-constantan thermo-couples at temperatures from 0° to 425° C.—A. S.

Metals [zinc]; Decomposition of water by ——. M. Kernbaum. Comptes rend., 1911, **152**, 1668—1670.

When zinc dust is shaken with water in the presence of air, hydrogen and hydrogen peroxide are produced. The latter substance is not formed in the absence of all traces of oxygen. Hydrogen is formed whether oxygen is present or not.—F. Shdn.

Metallic borides; Production of ——. Mining World, Chicago, June 3, 1911.

A Norwegian patent has been granted covering a process for the production of metallic borides by the reduction of borates with simultaneous addition of the proper metallic sulphide. The metallic boride is formed in the electric furnace, while the sulphur combines with the metal of the borate. Carbon is used as reducing agent, and colemanite, $Ca_2B_6O_{11},5H_2O$, as borate. The process takes place according to the equation: $Ca_2B_6O_{11}+11C=Ca_2B_6+11CO$; $Ca_2B_6+FeS=2CaS+Fe_2B_6$. In practice an excess of carbon and ferrous sulphide is necessary, as iron sulphide is very difficultly soluble in ferroboron (and the reverse). Therefore, after the fusion is completed, the mass separates into several layers. The boron expels the sulphur from the iron so violently that the process can be used for the purification of steel from sulphur. When colemanite is used a layer of almost sulphur-free ferroboron is first obtained, which can be purified by re-fusing with new colemanite. Above the ferroboron comes a layer of the ferrous sulphide and finally a cover of bright slag, consisting mainly of calcium sulphide. Molybdenum, nickel, or cobalt sulphide may be used instead of ferrous sulphide.

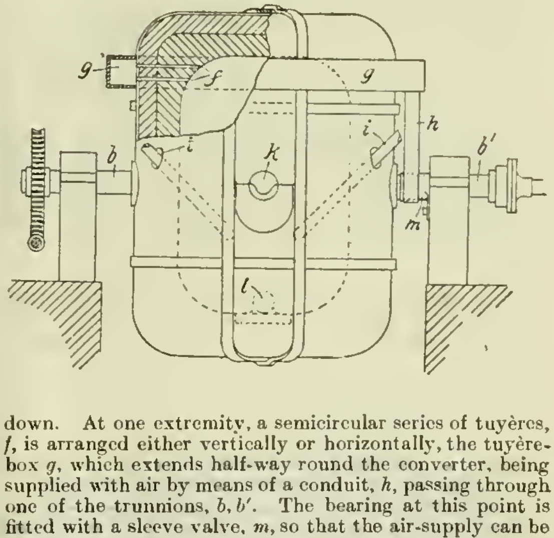
Patents.

Iron and steel; Carburisation of ——. S. S. Eveland, Bryn Mawr, Pa., U.S.A. Eng. Pat. 12,343, May 19, 1910.

The dried fibrous remnant left after the extraction of sugar from beet, either with or without grinding and charring, is used, as the carburising agent in case-hardening or cementation processes.—R. W. N.

Steel; Process and apparatus for the production of ——. V. O. Cutts and E. Hoult. Fr. Pat. 424,009, Dec. 7, 1910.

The converter to which the molten iron is transferred consists of a closed cylindrical receptacle mounted on trunnions *b, b′*, so that it can be turned completely upside down. At one extremity, a semicircular series of tuyères, *f*, is arranged either vertically or horizontally, the tuyère-box *g*, which extends half-way round the converter, being supplied with air by means of a conduit, *h*, passing through one of the trunnions, *b, b′*. The bearing at this point is fitted with a sleeve valve, *m*, so that the air-supply can be regulated or cut off entirely according to the angle at which the converter is placed. The other extremity of the receptacle, where the metal is refined and finished, is provided with adjustable electrodes, *i, i*, which can be



replaced when necessary by tuyères blowing on the surface of the metal. In addition, the receptacle is provided with a charging hole, *k*, in the centre, in line with the trunnions, whilst a tap-hole, *l*, is placed below the electrodes. The metal having been introduced, the converter is brought to a vertical position and the metal is blown in the ordinary manner. The receptacle is then inverted, the air supply being cut off automatically, and the metal is finally refined electrically at the other extremity, which has been previously heated by means of the hot gases evolved in the first stage.—C. A. W.

Pulp agitators. W. C. Paterson, Denver, Colo., U.S.A. Eng. Pat. 9844, April 26, 1909.

The apparatus is of the class in which a funnel-shaped tank is employed and in which the pulp is carried up through a central pipe, overflowing at the top thereof. The tank is cylindrical with a conical bottom. Circulation is effected by means of a centrifugal pump, drawing pulp from the tank through a pipe communicating therewith at a suitable distance from the bottom. The action of the pump also draws in air through a valve-controlled supply-pipe, this air being mingled with the pulp and thoroughly aerating it. The pulp delivered by the pump enters the bottom of the tank through a vertically-directed nozzle inside, and in the axis of, the large central pipe, which is provided, near the bottom, with lateral openings. Through these the pulp from the tank is drawn in by the upward flow from the pump, thus circulating and aerating the whole contents of the tank. At the top of the central tube the pulp overflows on to a circular plate which carries it outwards toward the circumference of the tank, where it falls on to a shallow funnel-shaped plate supported at the circumference and open at the centre, where it surrounds the central pipe at a small distance. This plate is provided with circular riffles, over which the pulp flows towards the centre, finally dropping back into the body of the tank through the annular opening between the plate and the central pipe. The tank is both filled and discharged by means of the pump, through valve-controlled pipe-lines, and at the end of the treatment the solution containing the dissolved metals is decanted through a branch pipe.—R. W. X.

Welding; Fusing metals electrically for ——. H. L. J. Siemund, New York. Eng. Pat. 12,724, May 25, 1910. Under Int. Conv., June 3, 1909.

An arc is established between the object to be repaired or welded, and the material to be added thereto, in such a manner that the heating effect is restricted to the immediate locality of the weld. The welding wire is held in a clamp which, by means of a solenoid, can be strongly magnetised. The particles of molten metal detached from the fused end of the welding wire follow the lines of force and immediately attach themselves to the desired place. Welding can thus be effected in any position. A resistance automatically equalises the load during interruptions of the welding arc. The composition of the metal deposited in the weld may be modified by coating the welding wire with appropriate substances, or introducing them as a core. (Reference is directed to Eng. Pats. 7988 of 1890 and 16,952 of 1907).—R. W. X.

Copper, silver, and copper alloys; Purifying and casting of ——. E. Weintraub, Lynn, Mass., U.S.A. Eng. Pat. 25,031, Oct. 27, 1910. Under Int. Conv., Oct. 27, 1909.

See Fr. Pat. 422,441 of 1910; this J., 1911, 553. The process is also applicable to silver.—T. F. B.

Copper; Apparatus for extracting ——. V. A. Brewer, Los Angeles, Cal. U.S. Pat. 994,301, June 6, 1911.

The electrolytic tank is provided with a number of ore-holders which can be immersed in the bath during the process and removed at any time. Similarly, the metallic copper is allowed to precipitate in a removable tank suspended in the electrolyte.—C. A. W.

Rocks or the like; Separating the constituents of ——. G. S. A. Appelqvist and E. O. E. Tyden, Stockholm, Sweden. Eng. Pat. 1211, Jan. 17, 1911. Under Int. Conv., Feb. 5, 1910.

The finely powdered rock is treated with gaseous or gasified hydrocarbons, fat, or oil. By this treatment some of the fatty substance adheres to or is absorbed by the rock particles. The consumption of hydrocarbons is much lessened by employing them in the gaseous state, as compared with the amount used in similar methods employing liquids. On stirring the material with water, the constituents of the rock separate from one another and form well-defined layers, which may be separated by currents of water.—R. W. X.

Furnaces; Electric ——. G. von Schatzl, Klagenfurt, Austria. Eng. Pat. 3533, Feb. 11, 1911.

The furnace, which is adapted for smelting metals direct from ores, comprises a hollow chamber, arranged vertically, and adapted for rotation about a horizontal standard. A series of electrodes is arranged about the circumference of the chamber, the electrodes being adapted to make contact with the metal bath, and in succession with a contact supplying current. Adjustable bar electrodes extend through the cover into the furnace chamber, and by connecting these in series, the revolving electrodes being out of circuit, a surface heating effect may be obtained. With the surface and revolving electrodes in circuit, and connected in parallel, "a mass or bodily heating effect is obtained, or in other words, a fan-shaped arrangement of diverging conductors that are constantly varying the direction of the current, and serve to conduct the current downwards through the material." The standard may be arranged to carry the charging hoppers, gas-exit pipe, bar electrodes, the contacts and cooling arrangements, and the automatic electric devices for adjusting the bar electrodes.—B. N.

Furnace; Electric —— [*for refining iron*]. J. B. Nau, New York. U.S. Pat. 990,765, April 25, 1911.

The furnace, which is intended for the refining of pig iron, by the process described in U.S. Pat. 984,590 of 1911 (this J., 1911, 370), comprises a movable hearth, consisting of a crucible and forehearth separated by a partition with a suitable connecting passage. The crucible is provided with an ore shaft extending upwards, and means are provided for oscillating the crucible and shaft simultaneously relatively to a common axis of rotation. Below the top of the shaft is an inlet for molten pig iron, having its centre located approximately on the axis of rotation, and the forehearth is provided with an outlet, which is normally above the bottom of the crucible and the forehearth. The internal shape and dimensions of the forehearth are such as to cause the level of the molten iron to rise therein, and consequently in the crucible, when the furnace is oscillated in one direction, and to fall when oscillated in the opposite direction. Electrodes are disposed in the forehearth and in the crucible for passing an electric current for heating purposes.—B. N.

Molybdenum; Preparation of ductile ——. A. C. Hyde, Ealing. Eng. Pat. 4159, Feb. 18, 1911.

Wire, strip, or sheet molybdenum is rendered ductile and malleable when cold by the incorporation of 0·5 per cent. of iron or nickel, or 0·75 per cent. of manganese. The added metal and the molybdenum are mixed, in the form of powder, with a suitable binding material, and the mass is then pressed through a die or between rollers in the usual manner. The thread or sheet thus produced is heated to about the melting-point of the added metal, in a non-oxidising atmosphere. The product is then perfectly ductile.—R. W. X.

Metallic oxides; Process of reducing refractory —— *or oxides or other compounds of vanadium, molybdenum, tungsten, or similar metals and of producing alloys of these metals.* G. Boericke, Philadelphia, Pa. U.S. Pats. 993,338 and 994,055, May 30, 1911.

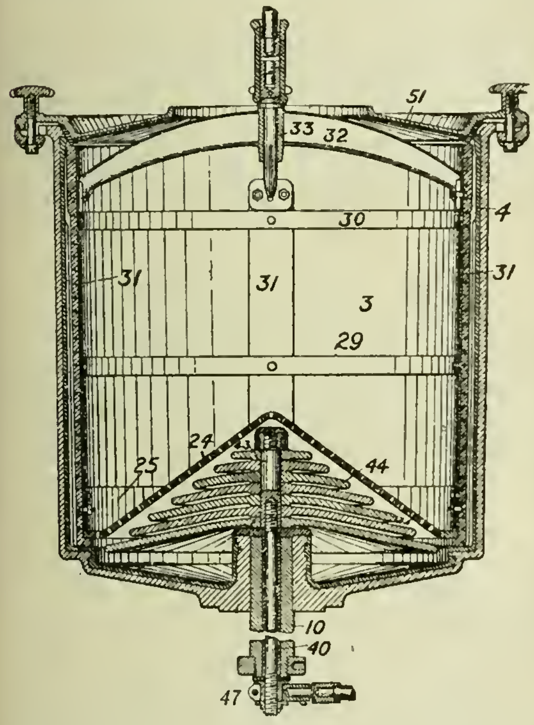
Oxides or compounds of vanadium, tungsten, molybdenum, and other similar metals are reduced in the presence of heat by the use of manganese, ferro-manganese, or a compound containing manganese, together with a suitable flux. In this manner the metals or their alloys are obtained.—R. W. N.

[*Mercury*] *Ore treatment.* T. J. Lovett, Chicago, Ill. U.S. Pat. 994,472, June 6, 1911.

The ore, containing native mercury and other metal values, is suspended in water and the air is exhausted from the mixture. The liquid mass is then brought into intimate contact with a large bulk of clean mercury supported on plates, so that as the ore rises in the vessel the metallic values are intercepted. At the same time a suitable reagent is added, in order to render also the native mercury capable of amalgamation.—C. A. W.

Electroplating ; Apparatus for ——. M. Reid. Fr. Pat. 424,126, Dec. 27, 1910.

A cylindrical receptacle of metal or porcelain, lined with an inert non-conducting material, 4, such as ebonite, is supported above an inverted triangular frame so that it can be rotated about a vertical axis. The frame itself is swung with vertex downwards between uprights, an endless screw with gear-wheel being provided on one side, so that the whole frame and receptacle can be set at any angle to the vertical. A shaft passing through the bearing on the other side engages with a bevel wheel at the bottom of the receptacle, and serves to rotate it. A basket, 3, of vulcanised rubber fits closely inside the outer vessel, except at the bottom, where a conical chamber is formed. The conical bottom, 24, of the basket is removable and is provided with holes which permit the circulation of the electrolyte, whilst the whole fabric is strengthened by means of galvanised wire gauze moulded into the rubber. The cathodes are formed by three circular bands, 25. 29, 30, of copper, nickel or zinc, placed at different heights in the interior of the basket and connected with one another by means of vertical strips, 31, the latter being united to horizontal arms, 32, which radiate from a central terminal, 33, at the top of the vessel. The anode is composed of a number of superposed discs, 44, of different diameters, mounted on a rod, 43, which passes through the hollow shaft, 10, on which the vessel is rotated. The bottom, 40, of this rod rotates in electrical contact with a ring, 47, connected with the second terminal. The objects to be plated are introduced with the electrolyte into the apparatus, which is then closed by means of a tightly fitting cover, 51, containing a central opening. The vessel having been set at a suitable angle, it is rotated in this position during the whole of the operation.—C. A. W.



Carburising ; Processes of and apparatus for ——. A. F. Rockwell, Bristol, Conn., U.S.A. Eng. Pat. 12,440, May 21, 1910.

See Fr. Pat. 416,106 of 1910 ; this J., 1910, 1458.—T.F.B.

Precious metals from ores ; Process of extracting ——. J. S. Island, Toronto. Eng. Pat. 13,488, June 3, 1910.

See U.S. Pat. 965,714 of 1910 ; this J., 1910, 1063.—T.F.B.

Alloy. J. Naulty and J. Scanlin, Philadelphia, U.S.A. Eng. Pat. 30,222, Dec. 29, 1910. Under Int. Conv., Jan. 4, 1910.

See U.S. Pat. 959,156 of 1910 ; this J., 1910, 885.—T. F. B.

Metallic alloy. A. Huber, Assignor to Kunheim und Co., Berlin. U.S. Pat. 993,998, May 30, 1911.

See Eng. Pat. 16,210 of 1909 ; this J., 1910, 359.—T. F. B.

Aluminium alloy. C. H. H. Claessen, Berlin. U.S. Pat. 995,113, June 13, 1911.

See Fr. Pat. 384,187 of 1907 ; this J., 1908, 409.—T. F. B.

Electroplating ; Apparatus for ——. M. Reid, Cleveland, U.S.A. Eng. Pat. 580, Jan. 9, 1911.

See Fr. Pat. 424,126 of 1910 ; preceding.—T. F. B.

Magnesium and magnesium alloys ; Purification of ——. B. Hoffmann and R. Suchy, Griesheim, Assignors to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 993,373, May 30, 1911.

See Eng. Pat. 23,440 of 1909 ; this J., 1910, 1315.—T. F. B.

Metals ; Method for reducing ——. R. J. McNitt, Niagara Falls, Assignor to Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 993,391, May 30, 1911.

See Fr. Pat. 420,288 of 1910 ; this J., 1911, 369.—T. F. B.

Furnace ; Electric ——. F. Sartori, Monteponi, Assignor to Societa di Monteponi, Turin, Italy. U.S. Pat. 993,414, May 30, 1911.

See Fr. Pat. 420,922 of 1910 ; this J., 1911, 368.—T. F. B.

Auriferous and argentiferous ores ; Treatment of ——. A. A. Lockwood, Assignor to Murex Magnetic Co., Ltd., London. U.S. Pat. 993,451, May 30, 1911.

See Eng. Pat. 27,558 of 1909 ; this J., 1911, 493.—T. F. B.

Zinc or similar furnaces ; Means for withdrawing dust and fumes from ——. E. Dor-Delattre, Liege, Belgium. U.S. Pat. 993,513, May 30, 1911.

See Fr. Pat. 391,513 of 1908 ; this J., 1908, 1158.—T. F. B.

Nickel alloy for high resistances. U.S. Pat. 993,042. *See* XI.

XI.—ELECTRO-CHEMISTRY.

Carbon [*electrodes, etc.*] *; Microscopic examination and identification of* ——. G. A. Roush. J. Ind. Eng. Chem., 1911, 3, 368—372.

A brief description of the application of metallographic and petrographic methods to the examination of carbon articles such as electrodes, brushes for dynamos and motors, and contacts and resistance material in electrical apparatus and machinery. Sections of the material are ground, polished, and etched either by heating to redness so that the less resistant portions are oxidised ("heat-etching") or by rubbing on a yielding material such as chamois skin or broadcloth ("relief polish"), or by a combination of the two methods. Of the four principal kinds of carbon used for the purposes mentioned, petroleum coke and retort carbon can be readily recognised, the former by a characteristic striated appearance and the latter by a finely pitted surface apparently made up of very fine granules. The microscopic characters of artificial graphite vary according to the original raw material used and it has not yet been possible to recognise this variety of carbon with certainty under the microscope. Natural graphites also show no characteristic markings, but can generally be recognised by the shape of the flakes. The paper is accompanied by a series of photomicrographs.—A. S.

PATENTS.

Storage batteries ; Negative plates for ——, and processes for the manufacture thereof. P. G. Salom, Philadelphia, Pa., U.S.A. Eng. Pat. 12,625, May 24, 1910.

PLATES are made in a "formed" condition by pressing superficially oxidised spongy lead into a grid. A mass of spongy lead, preferably obtained by electrolytic reduction or deposition, is comminuted in a wet state, and exposed to the atmosphere, when the water evaporates, and a thin superficial coating of suboxide is formed on the lead. The correct point is reached when the mass still retains about 5 per cent. of moisture. At this stage sufficient suboxide has been formed to prevent coalescence of the particles, while permitting cohesion. The mass is then applied to the grid and consolidated by heavy pressure. Plates so prepared carry a greater quantity of spongy lead than those prepared by "forming" from litharge or other compounds, and are also more homogeneous.—R. W. N.

Secondary-battery plates ; Process of making ——. J. E. Frederickson, Revere, Mass. U.S. Pat. 994,451, June 6, 1911.

IN order to form a positive electrode, lead tetroxide (minium) is mixed into a paste with sodium carbonate solution and applied to the grating. For negative electrodes, lead monoxide is employed instead and subjected to a similar treatment. The pasted plates having then received a coating of some quick-drying alkali-proof material, are placed in a sodium carbonate solution, and a current of electricity is passed through them.—C.A.W.

Anodes for electrolytic purposes. H. E. Beach, Birmingham. Eng. Pat. 20,180, Aug. 30, 1910.

THE anode is provided with an enlargement on which is seated a sealing washer, and a suspension rod, also conveying current, is screwed directly into the anode. The rod is surrounded by an insulating sleeve, and a "pressure nut" screwing on the rod presses the sleeve on to the sealing washer.—B. N.

Gases ; [Electrical] Method of producing endothermic compounds from ——. Elektrochem. Werke, G.m.b.H., Berlin. Eng. Pat. 5281, March 2, 1911. Under Int. Conv., March 2, 1910.

A FLAMING arc is produced between electrodes disposed opposite to one another within a cylindrical furnace, and by means of a "violent gas-whirl" the arc is dispersed laterally and spread out in the form of a closed disc-like flame.—B. N.

Refractory electric-furnace products [carbon silicide] ; Method of treating [purifying] ——. G. N. Jeppson, Assignor to Norton Co., Worcester, Mass. U.S. Pat. 992,875, May 23, 1911.

CARBON silicide is purified by roasting the material (suitably subdivided), under oxidising conditions, and separating the oxidised impurities from the purified grains (*e.g.*, by "mulling").—F. SODN.

Nickel alloy for high resistances. W. B. Driver, East Orange, N.J. U.S. Pat. 993,042, May 23, 1911.

THE alloys referred to have a higher specific resistance than nickel-manganese alloys. They consist of over 50 per cent. of nickel, with 10 to 30 per cent. of manganese, and the remainder of copper. The use, as electrical resistances, is claimed of alloys containing 50 per cent. or over of nickel with more than one other ingredient.
—R. W. N.

Furnaces ; Electric ——. C. Hering, Philadelphia, U.S.A. Eng. Pat. 15,139, June 23, 1910. Under Int. Conv., July 6, 1909.

SEE Fr. Pat. 419,715 of 1910 ; this J., 1911, 221.—T. F. B.

Furnace ; Electric ——. J. Thomson, Assignor to Imbert Process Co., New York. U.S. Pat. 994,217, June 6, 1911.

SEE Eng. Pat. 15,167 of 1910 ; this J., 1911, 432.—T. F. B.

Insulating films on coils especially of aluminium and its alloys ; Process for securing oxide or salt ——. Specialfabr. f. Aluminium-Spulen u. Leitungen G. m. b. H., Berlin. Eng. Pat. 20,634, Sept. 5, 1910. Under Int. Conv., Sept. 4, 1909.

SEE Fr. Pat. 419,961 of 1910 ; this J., 1911, 221.—T. F. B.

Electrolytic manufacture of glycollic acid. Eng. Pat. 26,546. *See* XX.

XII.—FATS ; OILS ; WAXES.

Almond and apricot kernel oils. R. Ross and J. Race. Analyst, 1911, **36**, 263—265.

A SAMPLE of almond oil and one of apricot kernel oil of undoubted authenticity were examined chiefly with the view of determining the characteristics of the fatty acids. The following results were obtained :—

Insoluble fatty acids.

	Almond oil.	Apricot kernel oil.
Iodine value	99·2	103·4
Saponification value........	201·6	199·8
Zeiss butyro - refractometer reading at 25° C.	58·0	59·0
Refractive index at 25° C.....	1·4644	1·4645

Throughout the six fractions obtained by distillation at 40 mm. of the fatty acids of almond oil, the butyro-refractometer readings gradually increased from 44·0 to 55·5, that of the residue being 82·0 ; the iodine values increased from 82·9 to 96·7, residue, 119·3 ; the saponification value of the first fraction was 205·1 and of the residue 194·6. Similarly apricot kernel oil gave Zeiss readings of 46·0 to 57·0, residue, 86·5 ; iodine values of 85·2 to 97·5, residue, 129·6 ; and saponification values of 203·7 (first fraction) and 193·7 (residue).—J. H. J.

Lipase of bacteria. N. L. Söhngen. Koninkl. Akad. van Wetensch., Amsterdam, Wisk. en Natk. Afd., 1911, **19**, 1263—1274. Chem. Zentr., 1911, **1**, 1708. (See this J., 1911, 140.)

THE action of lipase is retarded by hydrogen ions and is entirely stopped when the acidity of the medium is higher than *N*/50. Lipase behaves as a weak base, forming compounds with acids, from which it can be again liberated by the action of bases. These acid-lipases do not decompose fats ; they diffuse through gelatin- and agar culture media just as ordinary lipase does ; the lipase-compounds of the higher fatty acids, however, do not diffuse. The action of lipase is accelerated by hydroxyl ions, calcium and magnesium ions, trimethylamine, and sodium glycocholate; it is retarded by monohydric alcohols, and is unaffected by sugar and glycerol. The presence of air and exposure to light have a favourable effect. The lipase of bacteria is also capable of synthesising fats; from oleic acid and glycerol, the monoglyceride is chiefly formed.—A. S.

Fatty acids of the acetylene series; Oxidation of higher ——. A. Arnaud and V. Hasenfratz. Comptes rend., 1911, **152**, 1603—1606.

On oxidation with nitric acid, stearolic acid yields pelargonic and azelaic acids, whilst its isomeride, tariric acid (this J., 1892, 619; 1902, 413), yields lauric and adipic acids. The authors find that on oxidation with potassium permanganate in alkaline solution, stearolic acid yields pelargonic and suberic acids as main products, and caprylic and azelaic acids in smaller quantity, whilst tariric acid yields lauric and glutaric acids as main products, and undecylic and adipic acids in smaller quantity. Investigation has shown that on restricted oxidation, stearolic and tariric acids yield the corresponding diketonic acids, *viz.*, stearoxylic acid, $CH_3(CH_2)_7CO\cdot CO(CH_2)_7COOH$, and taroxylic acid, $CH_3(CH_2)_{10}CO\cdot CO(CH_2)_4COOH$. The formation of the acids obtained by the authors finds an explanation in that the excess of potassium permanganate transforms into carbon dioxide one of the CO-groups of the stearoxylic or taroxylic acid formed as intermediate product. The oxidation of the CO-group nearest the COOH-group (principal reaction) leads to the formation of the main products above mentioned; the oxidation of the CO-group remote from the COOH-group leads to the formation of the acids produced in smaller quantity.—L. E.

Cotton wax. E. Knecht and J. Allan. J. Soc. Dyers and Col., 1911, 27, 142—146.

By extracting raw cotton in a Soxhlet apparatus, first with light petroleum spirit and then with benzol, the wax it contained was obtained in two fractions. The first product was an odourless dull yellow substance closely resembling beeswax in texture and fracture. On repeatedly treating this fraction with boiling 96 per cent. alcohol, 18·82 per cent. of an insoluble wax of glassy appearance was left; it melted at 78° C. and its iodine value was 11·28. The portion soluble in alcohol was more plastic; it melted at 62° C. and had an iodine value of 33·42. The wax on prolonged heating with *N*/2 alcoholic potash under a reflux condenser was only slightly saponified and to complete the process the *N*/2 glycerin caustic soda solution suggested by Leffmann was used. It was then found to contain 47·5 per cent. of unsaponifiable matter melting at 67°—68° C. This product was acetylated and from it were obtained two hydrocarbons in crystalline form, one melting at 68·1° C. and giving on analysis figures agreeing closely with those for hentriacontane ($C_{31}H_{64}$), and the other melting at 70° C. and agreeing on analysis with the formula for dotriacontane or dicetyl ($C_{32}H_{66}$). From the acetylated alcohol a crop of crystals were separated on cooling its ethyl alcohol solution. They melted at 127·2° C. and the substance was evidently a phytosterol. By separating and acidifying the saponified part of the wax 0·21 per cent. of glycerol was isolated, a small quantity of an acid of m. pt., 74·4° C. (which was almost certainly cerotic acid), and stearic and palmitic acids. The second fraction of wax, obtained by benzol extraction was a dark green granular mass, m. pt., 68° C., acid value 4·03, saponification value, 83·3. The unsaponifiable matter yielded 33·55 per cent. of a reddish brown, sticky wax of m. pt. 63·4° C. After acetylation a considerable proportion of the acetate of a phytosterol alcohol m. pt. 122·4° C. was obtained. From the fatty acids obtained from the saponified portion of the wax was separated a small quantity of a crystalline acid melting at 70·8° C. and having a mean molecular weight of 455; possibly this is melissic acid ($C_{30}H_{60}O_2$).—P. F. C.

Cacao butter. Oil, Paint, and Drug Rep., June 19, 1911.

D. Steengrafe, of New York City, has prepared a comprehensive treatment of the cacao butter situation, which is of all the more significance in view of the sharp advance in values recently recorded at the Amsterdam auction, as well as in the local trade. The report follows:

For years the brand of "Van Houten" has been the regulator of prices for cacao butter which was offered for sale in public auction in Holland. Statistics show that the following quantities have been sold, and the below named prices have been realised for this brand since 1906, viz.:—

Year.	Quantity sold.	Average price.
1906	880 tons	72½ Dutch cents.
1907	860 tons	96¼ Dutch cents.
1908	900 tons	78¾ Dutch cents.
1909	947 tons	62¼ Dutch cents.
1910	950 tons	66 Dutch cents.

Holland is the largest export country for cacao butter, but Germany is the largest producing country of that article. A much larger business in cacao butter is being done in Germany than in Holland, but a much larger amount of cacao butter is also used for the manufacture of chocolate in Germany than in Holland.

In former years England exported some cacao butter, but her export is very limited to-day.

Comparing the quantities exported yearly from Holland and Germany with the demand of the countries importing cacao butter, the result is:—

Available for export from Holland and Germany.

	Tons.		Tons.
1907	5,005	1909	6,054
1908	4,850	1910	6,617

Demand for foreign cacao butter in twelve countries.

	Tons.		Tons.
1907	4,948	1909	5,959
1908	4,612	1910	6,679

The figures of the last four years prove that the demand for cacao butter has increased considerably; that Holland has satisfied this demand more than ever, so that no stocks could accumulate in Holland; that Germany's export has decreased because more cacao butter was consumed in that country. Although many German factories pressed more cacao butter than ever, it was impossible to accumulate any stock in Germany. The slow sale of cacao powder has had the effect of checking the production of cacao butter to some extent.

The above gives an explanation of the high prices ruling for cacao butter despite the fact that cacao beans are selling at very low prices. It seems unreasonable to hope for a decline in values.

Commercial position of glycerin. Times, June 13, 1911.

Glycerin appears on the market in three forms—"crude glycerin," "dynamite" or "industrial glycerin," and "pharmaceutical" or "pure."

In the beginning of 1907 the price of crude was £28 10s. per ton, and that of "industrial" £50 per ton. Assuming crude to contain 80 per cent. of glycerin, the real glycerin in crude at £28 10s. per ton cost the refiner £35 10s. per ton, and he then had £14 10s. to pay for the cost of refining, including loss. In 1907 "industrial" glycerin began to rise in price, till it was quoted at £105 per ton at the end of the year. The corresponding price of crude was £68, and the margin provided by these figures to cover the cost of refining was thus £20. During the interval the difference in favour of the refiner has been still higher, as much, indeed, as £31 10s. For a long time the refiner had the advantage of the producer; now the producer has gained on the refiner, and, with crude at £70 a ton, is dividing the profit with him.

The explanation of this advance in the value of glycerin is to be found in four circumstances. First, an advance in the prices of oils and fats. At the beginning of 1907, refined cotton seed oil fetched £24 a ton; in the interval it has reached £34 10s.; whilst tallows have advanced from £29 to £34. Thus the general soap-maker has to pay more for his raw materials, but got nothing more for his soap and crude glycerin. But this can only account for a small proportion of the advance in glycerin.

A more potent cause is to be found in the development in the production of margarine, which involves a large consumption of cotton-seed and cocoanut oil. This utilization of oils and fats is the chief cause of the advance in their price; but in regard to glycerin the effect has been accentuated. An increase in the consumption of oils and fats for soap-making, corresponding to the increase which has taken place in their consumption for the manufacture of margarine, would have sent down the price of glycerin. The soap-maker sets free his glycerin, the margarine manufacturer locks it up. A third cause is the increase in the demand for blasting agents in South Africa, and the United States, with the Panama Canal. The final cause is alleged to be commercial manipulation.

The world's soap trade. Times, June 17, 1911.

The average consumption of soap in England and the United States is about 14lb. per head per annum. In Russia it is at present only about 1½ lb. Yet to supply the people Russia imports tallow, copra, and palm oil in great quantities. If South America, India, and China largely increase their consumption, the present sources of the supply of soap ingredients will be totally inadequate.

England has maintained her position as a soap-exporting country. In 1900 the total export was 43,630 tons; in 1910 it had risen to 74,712 tons. The exports of "household soap" in 1910 were as follows:—

To China	6,620 tons
To British South Africa	6,211 tons
To British East Indies	14,806 tons
To other British Possessions	17,767 tons
To other countries	21,864 tons

Neatsfoot oil. Fahrion. *See* XV.

Examination of butter fat by Ewer's method. Amberger. *See* XIXa.

Emulsion colloids (emulsoids). Wiegner. *See* XXIV.

Patents.

Oils and fats or essences; Extraction of vegetable and other —— and apparatus therefor. W. S. Simpson, London. Eng. Pat. 4661, Feb. 24, 1910.

Oxidation of the oil is obviated by expressing the material *in vacuo*, and special apparatus for carrying out this process is also claimed.—C. A. M.

Oils, fats, tar, asphalt [asphaltum], etc.; Process of manufacturing watery solutions of ——. L. S. van Westrum, Berlin, Assignor to Westrumite Co. of America, Chicago, Ill. U.S. Pat. 992,313, May 16, 1911.

Substances, such as those enumerated in the title, which are not naturally soluble or emulsifiable in water are heated with a saponifiable oil, the heated mixture is agitated, *e.g.*, by passing a current of air through it for from 20 minutes to one hour, water is added and the mixture further agitated. A volatile alkali (ammonia) is then added and the mixture again agitated until complete emulsification results, when more water may be added.—E. W. L.

Miscible oil. C. Ellis, Montclair, N.J. U.S. Pat. 993,827, May 30, 1911.

An organic metallic compound insoluble in water (*e.g.*, one per cent. of a copper soap) is dissolved in an oily base, also insoluble in water, and the solution mixed with a concentrated aqueous solution of a water-soluble soap. —C. A. M.

Fat; Art of producing edible and odourless —— from cocoanuts and other similar nuts. G. C. Warr, New York. Assignor to Edfa Produce Co. U.S. Pat. 992,525, May 16, 1911.

A mass of fresh disintegrated or macerated kernels is first subjected to a dry heat at a temperature above that at which the albuminous or mucilaginous matter coagulates or sets and below 212° F., whereby fermentation is checked through such coagulation and through the volatilisation of some of the volatile acids. The mass is next subjected to a moist heat at a temperature between the same limits; the oil-cells are thus softened and the volatile acids removed. The oil is then extracted by pressing the mass, the oil-free mass forming a by-product of desiccated nut. The oil is purified by coagulating the albuminous and other similar matters present in it and removing them from the oil, then subjecting the oil to a succession of baths containing weak solutions of caustic soda and sodium chloride, at a temperature below 212° F., in order to remove free fatty acids and flocculent matters. The oil thus purified is agitated with dry animal charcoal at a temperature below 212° F., filtered from the charcoal, and finally subjected to the drying action of a dry gas at a temperature above 212° F. By this final process the melting-point of the product is raised.—E. W. L.

Cotton-seed; Preparing stock food and oil from ——. W. A. Willis and J. H. Beland, Fort Worth, Tex. U.S. Pat. 994,088, May 30, 1911.

The mixture of kernels and hulls is cooked for about 40 minutes under a steam pressure of about 40 lb. and at a temperature above 100° C., and then expressed, and the residual press-cake made into stock food.—C. A. M.

Detergent compound. R. Haddan, London. From F. D. Thorne, Los Angeles, Cal., U.S.A. Eng. Pat. 3880, Feb. 15, 1911.

A mixture of powdered maize, Irish moss, borax, sodium benzoate and paraffin wax (with or without terpineol). —C. A. M.

Polyglycerins; Production of ——. A. J. Boult, London. From S. H. Fleming, Camden, N.J., U.S.A. Eng. Pat. 15,829, July 1, 1910.

See U.S. Pats. 969,159 and 978,443 of 1910; this J., 1910, 1168, and 1911, 95. The mixture is heated to 230°—250° C., whilst the pressure is reduced to the equivalent of 5 to 10 inches of mercury.—T. F. B.

Grease; Method of preserving ——. S. Fenger, Nakskov, Denmark. U.S. Pat. 995,240, June 13, 1911.

See Eng. Pat. 13,382 of 1907; this J., 1907, 1099.—T. F. B.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Arsenic in Schweinfurt green; Determination of ——. A. Heiduschka and A. Reuss. Z. anal. Chem., 1911, **50**, 269.

0·5 grm. of the sample, and about 5 grms. of small crystals of ferrous sulphate are distilled with 60 c.c. of hydrochloric acid (sp. gr. 1·19) until about three-quarters of the acid have distilled over. The distillation flask is round, of 150 to 200 c.c. capacity, and is provided with a bulb-tube similar to those used in Kjeldahl estimations. The acid is distilled into a solution of caustic soda contained in an Erlenmeyer flask of about 700 c.c. capacity. To this flask is attached a Péligot tube which also contains caustic soda solution. A total weight of about 40 grms. of caustic soda is contained in the solutions. The delivery tube should reach nearly to the bottom of the Erlenmeyer flask and the connection with the bulb-tube should be "glass to glass." The Erlenmeyer flask is kept cool by means of ice-water. After the distillation the alkali solutions are mixed and neutralised with hydrochloric acid. An excess of sodium bicarbonate is then added and the solution is titrated with $N/10$ iodine solution.—T. St.

Dammar resins; Properties of different varieties of ——. C. Coffignier. Bull. Soc. Chim., 1911, **9**, 549—561.

The results of the author's investigation are summarised in the following table:—

Source of resin.	Padang.	Borneo.	Singapore.	Pontianak.	Sumatra.	Batyan.
Density at 18° C. ...	1·036	1·048	1·057	1·025	1·004	1·032
Melting point, °C. ...	95°	120°	95°	110°	190°	105°
Acid value	31·4	35·1	30·1	19·9	59·6	18·5
Saponification value..	33·7	64·5	39·3	30·9	64·5	19·6
Percentage of total insoluble in:—						
Ethyl alcohol	20·30	23·60	19 10	22·40	45·50	32·80
Methyl alcohol	53·00	31·90	24·60	29·40	52·20	40·00
Amyl alcohol	7·60	12·20	5·80	3·70	34·20	10·90
Ether.............	4·50	9·60	1·00	4·10	37·90	3·20
Chloroform	soluble	7·40	soluble	soluble	13·10	3·60
Benzene	soluble	7·50	soluble	soluble	18·30	3·10
Acetone...........	14·70	20·40	14·00	16·40	45·30	21·30
Spirit of turpentine	soluble	4·60	soluble	soluble	12·60	2·70
Benzaldehyde	soluble	8·00	soluble	soluble	24·70	soluble
Aniline	soluble	16·00	soluble	soluble	32·80	soluble
Amyl acetate......	6·20	10·10	4·10	4·60	30·00	7·30
Carbon tetrachloride	soluble	8·40	2·50	soluble	31·60	11·40

The Sumatra dammar is easily distinguished by its greater hardness, certain pieces being quite hard. The other varieties are softer and much alike in this respect. The following details are given to supplement the author's previous investigation (this J., 1902, 918). *Batavia dammar*:—Total insoluble in methyl alcohol, 34·30 per cent., in acetone 16·50 per cent.; soluble in aniline and benzaldehyde. *Sandarac*:—35·80 per cent. insoluble in methyl alcohol, 17·80 per cent. in acetone and 18·20 per cent. in benzaldehyde; soluble in aniline. *Mastic*:—12·50 per cent. insoluble in methyl alcohol, 9·30 per cent. in acetone, 6·10 per cent. in aniline; soluble in benzaldehyde. (See also this J., 1899, 593; 1903, 808, 1139; 1905, 203; 1906, 894; 1909, 348, 664, 1260.)—A. Sbld.

Determination of the higher oxides of lead and some new reactions of lead salts. Chwala and Colle. *See* VII.

Erratum.

This J., 1911, 698, col. 1, l. 5 from bottom, *for* "70°" *read* "90°." Also in table, col. 2, delete "(aromatic hydrocarbons)."

Patents.

Printing-inks and the like; Moving-stirrer apparatus for mixing ——. E. and H. Bush, Leeds. Eng. Pat. 16,728, July 13, 1910. Addition to Eng. Pat. 8623 of 1908.

In apparatus, of the type described in the main patent, for mixing printing-inks and the like, a tilting bowl or basin, with locking and operating devices is employed, in order to facilitate removal of the ink, etc., after each mixing operation.—E. W. L.

[*Wood waste*]; *Apparatus for recovery of by-products* [*e.g., turpentine, etc., from* ——]. P. M. Hamlin, Pittston, Pa., Assignor to C. H. Unverzagt, New York. U.S. Pat. 990,862, May 2, 1911.

The apparatus consists of a horizontal, cylindrical boiler, braced internally to withstand 30 to 60 lb. per sq. in.: the braces serve incidentally to break up the mass of material being treated as the boiler revolves. The boiler is supported on two track-bands running on flanged, rotatable wheels. Manholes are provided on one side of the boiler, and, adjacent to these, running longitudinally inside the boiler, is a perforated pipe, closed at both ends, through which the volatile products can be removed from the upper part of the boiler. The pipe is provided with a cock outside the boiler, and with a snap coupling to enable it to be connected with a receiver when the boiler is not in motion. Inside the boiler, opposite the perforated pipe, is a perforated screen distant about one inch from the shell and arranged so that the liquid products can drain through it from the wood-shavings, etc., which have been under treatment. The screen covers about one-third of the inner surface of the boiler. Below the screen the shell is perforated along a line parallel to the axis of the boiler, and a leader, provided with an outlet, cock, and coupling, is riveted to the boiler-shell outside the perforations. The leader serves to collect the drainings, and to pass them out through the cock into a trap with which it is connected when the boiler is not in motion. In operating, chipped, crushed or broken wood, sawdust, shavings, or other material is fed into the boiler through the manholes by means of screw conveyors. The manholes are closed, the boiler set in motion and steam or hot air admitted through a pipe, passing through a stuffing-box in one end of the boiler axis. The turpentine and other volatile products collect at the top of the boiler, and when the boiler has been in motion a sufficient time to volatilise the turpentine, oils, etc., and melt out the resin, pitch, and other heavy by-products, it is stopped, with the screen and outlet at the bottom. The couplings are made, and the valves opened; the volatile products pass first into a receiving vessel where the heavier portions are condensed and run through a connecting pipe to the trap already referred to, whilst the more volatile products pass on to be condensed in a tubular condenser. The heavier by-products drain direct from the boiler through the screen into the trap. When the flow of by-products ceases, the couplings are broken, and the boiler set in motion again, steam being introduced as before. A second fraction of by-products is thus obtained, and the process may be repeated. When the material is exhausted it is shot out through the manholes and carried away by conveyors either to a disintegrating digestor, or for use as fuel.—E. W. L.

Turpentine and rosin; Process for extracting —— *from resinous woods.* H. T. Yaryan, Assignor to Yaryan Naval Stores Co., Toledo, Ohio. U.S. Pat. 992,325, May 16, 1911.

The wood is comminuted, placed in a suitable chamber, and treated with steam, with or without the aid of a partial vacuum, in order to remove the more volatile turpentines, and the mass is then treated with a hot hydrocarbon solvent. The solution thus obtained is distilled in order to recover the solvent, and again in order to separate the remainder of the turpentine from the rosin. Finally the wood is further treated with steam in order to recover the last traces of the hydrocarbon solvent.—E. W. L.

Solvent for dried on oil colours and varnishes; Non-inflammable and non-explosive ——. B. Szanyi. Ger. Pat. 234,264, Jan. 22, 1910.

The claim is for a mixture of carbon tetrachloride, trichloroethylene, and pentachloroethylene, or of two of these substances, to which such a quantity of paraffin has been added, that when the mixture has been applied to the surface covered with the oil colour or varnish, a thin film of paraffin is formed which hinders the volatilisation of the solvent. A small quantity of acetic anhydride may also be added to the mixture.—A. S.

Solutions of resins and certain other organic substances; Method of producing ——. A. Hesse, Wilmersdorf, Germany. Eng. Pat. 12,633, May 24, 1910.

See Ger. Pat. 227,667 of 1909; this J., 1910, 1398.—T.F.B.

Resin-oil from wood; Process of extracting ——. E. Ljubarski, Tscheboksary, Russia. Eng. Pat. 13,128, May 30, 1910.

See Fr. Pat. 414,919 of 1910; this J., 1910, 1321.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; Coagulation of —— by means of acetic acid. W. Crossley. Indiarubber J., 1911, 41. 1205—1207.

The figures published relating to the amount of acetic acid required to coagulate a given volume of latex vary considerably. The author has experimented with a plantation *Hevea* latex, which was normal, except that it appeared to have been diluted with about 3·4 times its own volume of water. It had been preserved by the addition of formalin. It contained rubber, 7·0, and protein (N×6·25), 0·49 per cent. and had a sp. gr. of 0·997 at 15° C. The minimum amount of acid required to coagulate the latex was ascertained by adding varying quantities of a standard solution of acetic acid to 10 c.c. of latex. It was found that 1·6 c.c. of a solution containing 0·0053 grm. of acetic acid per c.c. was necessary to coagulate 10 c.c. of latex, ignoring the effect of any fermentation acids present. This represents 1 part by weight of acetic acid per 1176 parts by volume of latex. The latex contained 0·009 grm. of "natural" acid calculated as acetic acid per 10 c.c. and, allowing for this, 1 part by weight of acid coagulates 575 parts by volume of latex. The author is able to confirm the statement of Parkin (this J., 1910, 1464) that "the percentage of acid necessary is proportional only to the original volume of latex present and is independent of its dilution with water." and to show that the statement holds good over a long range of values. The figures bearing upon this point are given in the following table:—

Percentage concentration of latex.	"Natural" acid in grm. per 100 c.c. (as acetic acid).	Acetic acid added in grm. per 100 c.c.	Total acid in grm. per 100 c.c.
86·2	0·0766	0·0733	0·151
75·0	0·0675	0·0636	0·131
50·0	0·0450	0·0450	0·090
25·0	0·0225	0 0230	0·045
10·0	0·0090	0 0106	0·019
5·0	0·0045	0·0053	0·0099
1·0	0·0009	0·0032	0·0041

The maximum amount of acid allowable for perfect coagulation increases, however, with the dilution, for on adding water to a latex which had been overdosed with acid complete coagulation took place. The author finds that the amount of adsorption of acetic acid by the coagulated rubber can only be extremely small in the case of *Hevea* latex, whereas in the case of *Plumeria* considerable quantities of the acid were adsorbed (*cf.* Kaye, Indiarubber J., 1910, 40, 903). Finally, as coagulation is carried out on plantations, the amount of protein contained in the finished rubber is not determined (beyond very narrow limits) by the amount of acetic acid added.
—E. W. L.

Vulcanisation; Theory of ——. D. Spence and J. H. Scott. Z. Chem. Ind. Kolloide, 1911, 8, 304—312.

The authors have measured the velocity of extraction of free sulphur from vulcanised rubber by acetone. They find that the velocity of extraction of the last portions is very small. Caustic soda was found to be more effective. There is, however, a limit, beyond which extraction will not go. This amount of combined sulphur is shown to replace bromine quantitatively in the tetrabromide. It is concluded:—(1) The "combined" sulphur is chemically combined with the rubber, and not merely adsorbed. (2) An adsorption of sulphur occurs in vulcanisation, but is limited to the so-called free sulphur, rather than to the combined sulphur as other investigators have considered. (3) The so-called free sulphur actually consists of adsorbed sulphur and a larger or smaller amount of "free" sulphur, depending on the conditions of vulcanisation.—H. E. P.

Materials used in making balloons and in producing gas-tightness. Hoernes. *See* V.

Patents.

Caoutchouc and an intermediate product [isoprene]; Synthetic manufacture of ——. F. E. Matthews and E. H. Strange, London. Eng. Pat. 4189, Feb. 19, 1910.

Isopentane, $CH_3CH(CH_3)\cdot CH_2\cdot CH_3$, is converted into a di-chloro-, dibromo-, or chloro-bromo-compound by treatment with bromine, or with chlorine, or first with chlorine and afterwards with bromine. The di-halogen compound is then converted into isoprene by heating with an agent capable of removing two molecules of halogen acid, and the isoprene transformed into caoutchouc in any known or suitable manner. For example, 10 lb. of isopentane are mixed with 1 oz. of iodine, and chlorine passed into the mixture until its weight reaches about 20 lb., when it is poured into water, washed with dilute alkali and fractionally distilled. The portion distilling between 140° and 170° C. (consisting almost entirely of dichloropentanes) is decomposed by dropping it into a substance or solution of a substance, capable of combining with hydrochloric acid (*e.g.* potassium hydroxide dissolved in ethyl or amyl alcohol, diethylaniline, sodium ethylate in ethyl alcohol) at a temperature of about 200° C. (in the case of alcoholic potash) and isoprene is obtained by fractional distillation of the product.—E. W. L.

Caoutchouc and an intermediate product [isoprene]; Synthetic manufacture of ——. F. E. Matthews and E. H. Strange, London. Eng. Pat. 4572, Feb. 23, 1910.

Any one of the four hydroxy-isopentanes, $CH_3(CH_2\cdot OH)\cdot CH\cdot CH_2\cdot CH_3$; $(CH_3)_2\cdot C(OH)\cdot CH_2\cdot CH_3$; $(CH_3)_2:CH\cdot CH(OH)\cdot CH_3$; $(CH_3)_2:CH\cdot CH_2\cdot CH_2(OH)$, or a mixture of two or more of them, is converted into isoprene by replacing the hydroxyl group of the compound, or compounds, by bromine or chlorine, and by subsequently replacing one atom of hydrogen by bromine, or chlorine, thus obtaining a dihalogen derivative which can be converted into isoprene. If the dihalogen compound is to be a mixed one the chlorine should be introduced in the first stage. As an example, 100 parts by weight of isoamyl chloride (obtained from fermentation amyl alcohol) are chlorinated in presence of a carrier, *e.g.* iodine or antimony chloride, until the weight has reached about 140 parts. The mixture is poured into water, well washed with water and with sodium carbonate solution, dried over calcium chloride and fractionated. From the fraction distilling at 140°—170° C. isoprene is obtained as described in the preceding abstract.—E. W. L.

Caoutchouc and an intermediate product [isoprene]; Manufacture of ——. F. E. Matthews and E. H. Strange, London. Eng. Pat. 4620, Feb. 24, 1910.

Rosin, colophony, or equivalent substances such as Manila copal, Borneo copal, Pontianac copal, jelutong resin, jelutong, or by-products from such substances, for instance, rosin-oil, or copal-oil, are heated in a still, from which air can be excluded, at a high temperature—say from 250° to 450° C.—whereby the molecules are "cracked." The main portion of the rosin, etc., is converted into volatile liquids and gases. The liquids and some of the gases are condensed and subjected to fractional distillation. The fraction distilling between 30° and 40° C. contains isoprene which can be converted into caoutchouc by any suitable or known process of condensation and polymerisation. Those portions of the distillate which have a higher molecular weight than isoprene may be again "cracked" and isoprene obtained from them.
—E. W. L.

Raw rubber; Process for the treatment of ——. J. Thame, East Sheen, Surrey. Eng. Pat. 11,576, May 10, 1910.

The object of the process is the removal from the crude raw rubber of matter causing putrefaction and of resin. The rubber is first heated in a tank of boiling water to which a constant supply of alkali silicate solution (3 per cent. potassium silicate solution) is added. When the dirt has been disengaged by this treatment, the rubber is immersed in a weak acid solution, and is then freed from acid by thorough washing. It is then pressed into blocks and cut up into thin sheets, which are placed on perforated trays and immersed in a 2—5 per cent. warm solution of antimonial, ammonium, or tannic salt under a vacuum. The trays with the rubber on them are then thoroughly washed in water to remove any residual salt, and immersed in a bath of toluene to dissolve any residual resin that may be present, and simultaneously to "pectise" the rubber. This process is also carried out under a vacuum, and the bath is heated electrically. The rubber is next sheeted between rollers, and hung up or otherwise distributed in a closed chamber, electrically heated, until thoroughly dry, when a current of air mixed with the vapour of phenol, cresol, etc., at a temperature not exceeding 65° F. is passed over it.—E. W. L.

India-rubber ; Curing [raw] ——. R. Derry, Singapore. Eng. Pat. 6858, March 18, 1911.

Latex is carried by an endless band from a trough, fed from a reservoir, into a heating and smoking chamber, or chambers, where it is coagulated, forming a pellicle on the endless band. The latex reservoir is actuated by the same mechanism driving the endless band in such a manner as to replenish the supply of latex in the trough at the same rate as it is depleted by the endless band. The latter is kept in motion until the band of rubber is of sufficient thickness, when it is removed, passed through the pressing rollers, and returned to the smoke-chamber for further curing. The endless band is prevented from sagging under its increasing load of rubber by means of a counterweight attached to a cable passing over a pulley and fastened at its other end to the journals of the pulley which carries the band, these journals being arranged to slide in guides. Smoke is supplied to the smoking chamber from a fire of wood and leaves, and is distributed through a long inclined pipe, situated underneath and parallel to the endless band. The smoke issues from the pipe through orifices in its under side, impinging upon the sides of a V-shaped trough by means of which it is distributed and partly freed from moisture, naphthalene, and other objectionable ingredients, before rising and coming in contact with the latex. The smoke pipe is capable of adjustment parallel to the endless band by means of a link-work mechanism. The heating may be done by means of the hot smoke itself, or it may be effected separately by means of steam or hot water pipes. The band used is preferably 2 feet wide by 42 feet long ; the latex is supplied at the rate of about 12 gallons in 3½ hours, the temperature of the smoke chamber being 100° F. The band then makes 34—40 revolutions per hour.—E. W. L.

India-rubber ; Process for vulcanising ——. W. Clarkson, Lesmahagow, N.B. Eng. Pat. 18,497, Oct. 24, 1910.

Rubber or other latex is mixed with sulphur or other vulcanising agents and loaded with any of the following or other suitable materials : diatomite, kieselguhr, fossil-meal, infusorial earth, granite chips, pebbles, etc. The whole is then put into a mixer and passed to the coagulating mixture, after which the compound may be moulded and rolled into any shape or form. A colouring agent may also be added to the latex before coagulation. (Reference is directed to Eng. Pat. 25,291 of 1905 ; this J., 1907, 59.)—E. W. L.

Rubber stock ; Desulphurising and devulcanising ——. W. W. Wildman and J. Christy, Akron, Ohio. U.S. Pat. 993,485, May 30, 1911.

The finely divided rubber is boiled in an acid solution at atmospheric pressure until all fabric and other objectionable constituents are destroyed. The acid is then either driven off, or neutralised by boiling with weak alkali carbonate solution, and the rubber is finally heated, for about three to five hours, in a strong solution of caustic soda in a closed vessel at a temperature of about 310°—335° F., washed to remove alkali, and milled.—E. W. L.

Caoutchouc substance [from isoprene] ; Manufacture of a ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 17,734, July 26, 1910. Under Int. Conv., Sept. 11, 1909.

See Fr. Pat. 419,316 of 1910 ; this J., 1911, 226.—T. F. B.

Indiarubber ; Industrial manufacture of ——. G. Reynaud, Paris. Eng. Pat. 25,087, Oct. 28, 1910. Under Int. Conv., Nov. 6, 1909.

See Fr. Pat. 419,860 of 1909 ; this J., 1911, 226.—T. F. B.

Plastic substance [substitute for rubber, etc.] from carbohydrates and alkali albuminates ; Method of manufacture of a ——. H. Timpe, Amsterdam, and J. G. Jurgens, Vymegue, Holland. Eng. Pat. 25,400, Nov. 1, 1910.

See Fr. Pat. 420,164 of 1910 ; this J., 1911, 376.—T. F. B.

Elastic caoutchouc-like substance from animal matter ; Process for the manufacture of an ——. W. van der Heyden, Assignor to Naamlooze Vennootschap Algemeene Uitvinding Expl. Maatschappy, Amsterdam. U.S. Pat. 993,626, May 30, 1911.

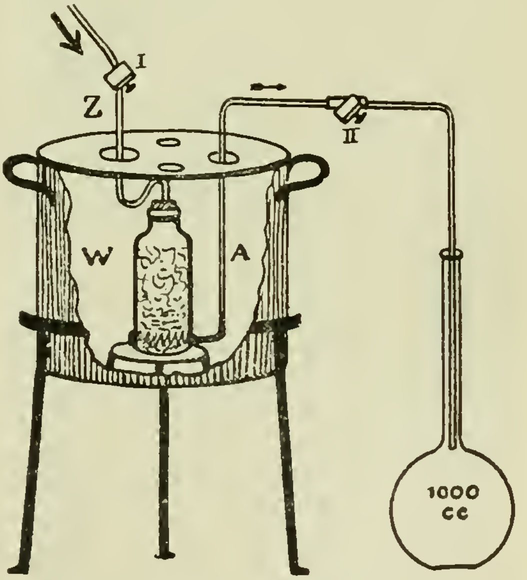
See Fr. Pat. 416,644 of 1910 ; this J., 1910, 1466.—T. F. B.

Manufacturing isoprene. U.S. Pat. 991,450. *See* XX.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Extraction of tannin ; A modification of Koch's apparatus for the ——. M. Wegner. Collegium, 1911, 212—214.

The exit tube, A, which is covered with gauze, is fastened in the lower opening of the extraction bottle by means of a rubber cork which is kept in position by a spiral spring around the bottle. The bottle is filled as far as the mouth of the tube (3 cm.) with coarse sand and then for 1 cm. with fine sand. The ground material is then introduced, and the bottle closed by a rubber cork containing the supply tube, Z. The bottle is filled with water through the tube, A, by gentle sucking through the tube, Z, and the material well wetted by shaking. The tube, A, is then closed by means of a rubber tube and pinch-cock and the bottle placed in a water-bath. The supply tube is connected with a Koch's water-reservoir and the exit tube elongated with a right-angled glass tube to dip into a litre flask. Extraction is started by opening the cock II. The bottle can be shaken during extraction in order to avoid the formation of channels. The extraction bottle is made in sizes of 75, 175, 300 and 1000 c.c. capacity. —D. J. L.



Neatsfoot oil; Notes on ——. W. Fahrion. Collegium, 1911, 209—212.

NEATSFOOT oil, in spite of its high price (M. 120—130 per 100 kilos. or £60—£65 per ton) is the oil most frequently used in the manufacture of chrome leather. The reason for this lies in its great resistance to oxidation and rancidity and the somewhat low temperature at which it solidifies. The admixture with it of oil extracted from the feet of sheep and pigs or the hoofs of horses can hardly be counted as adulteration as all these oils have a similar chemical composition. The same applies to bone oil which is frequently added after a process of refining by which the dirt, free fatty acids and most of the glycerides are removed. Real adulterations consist of additions of vegetable oils, principally rape and cotton-seed oil. Analyses of eleven samples of neatsfoot oil and four of bone-oil are given and compared with numbers found in literature. The *acid value* was higher than 7 in four cases. A high acid value certainly indicates a lesser resistance to cold and increases the danger of "spueing." A good oil should be practically neutral and the acid value should not exceed 6. *Saponification value* was between 190 and 198 in all cases except one, in which adulteration with rape oil seemed likely, and which had a value of 186·7. *Hehner value* lies between 95 and 96. *Iodine value* exceeded the number found in literature (65—78) in seven cases. These oils are suspicious, as Holde and Stange (Mitt. Kgl. Techn. Versuchsanst., 1900, 18, 255) found 10 samples of adulterated neatsfoot oil with iodine values of 78·3—85·2. *Melting-point of fatty acids* exceeded the normal value in three cases and was lower in six cases: it may be assumed that the less fatty acids an oil contains the greater will be its resistance to cold. The melting-point of the fatty acids should therefore be as low as possible and the high value found in the three cases is due to admixture of another oil. *Mean molecular weight of fatty acids.*—Coste and Shelbourn (this J., 1903, 755) have shown that neatsfoot oil contains no linolic or linolenic acids but of unsaturated fatty acids only oleic acid. From the iodine and Hehner value it is calculated that the fatty acids contain 10—24 per cent. of unsaturated acids. The molecular weight should lie between 275 and 284. Values of 286·8, 288·6 and 294·8 which were obtained probably indicate adulteration with rape oil. The solid fatty acids and their iodine value were estimated in some of the samples and a sample which showed values of 20·6 per cent. and 105·4 in the two cases was taken as certainly adulterated.—D. J. L.

Bookbinding leathers; Report of the Society of German Librarians on ——. Gerber, 1911, 37, 143—144.

SOME of the conclusions and regulations of the recent commission appointed to investigate the nature of modern bookbinding leathers are as follows:—I. *General.*—(*a*) Suitable leathers for bookbinding purposes may be made from goat-, pig-, calf-, cow-, and sheepskins. (*b*) The use of mineral acids in the manufacture of the leather is dangerous and should be avoided. II. *Tannage.*—The suitable and harmless tanning materials for this purpose are pure sumach, pure oak-bark and gall nuts. Other materials, such as pine bark, birch bark, chestnut wood, quebracho, cassia, myrobalans are to be condemned. III. *Finishing.*—(*a*) The leather must not be made too thin, and split sheepskins are to be excluded. (*b*) Leathers with artificial grain are to be avoided. (*c*) Bleaching of leather is to be avoided as no harmless bleaching agent is known. (*d*) It is possible to produce fast light colours without the use of sulphuric acid or other mineral acids. (*e*) Leather dyed through has no advantage over leather dyed only on the surface. IV. *Designation.*—In order to prevent confusion, arbitrary and fancy names are to be avoided and the nature of the skin should be given, *i.e.*, whether it is goat, pig, sheep or calf leather. V. *Guarantee.* Leathers fulfilling the necessary conditions should be stamped. "Prepared according to the regulations of the Commission of the Society of German Librarians."—J. R. B.

Chrome leather; Analysis of ——. W. Fahrion. Collegium, 1911, 205—206.

To determine rapidly if a chrome leather is sufficiently freed from acid, the following method is recommended: 2 grms. of the finely divided leather are heated on the water-bath with 10 c.c. of 8 per cent. alcoholic caustic soda until the alcohol has been expelled. The residue is acidified with hydrochloric acid, evaporated to dryness, and finally taken up with hydrochloric acid and hot water. The solution is filtered and the filtrate precipitated with ammonia. The new filtrate is evaporated, acidified with hydrochloric acid and the sulphate precipitated with barium chloride, and estimated in the usual way. From this figure and from the amount of chromium oxide in the leather, the ratio of $Cr_2O_3 : SO_3$ is determined. In an experiment on hide powder which was chrome tanned and then neutralised with borax, the ratio was 1·56 : 1, and this serves as a standard to determine the efficiency of the neutralisation.—J. R. B.

Gelatin; The action of dilute acids and salt solutions on ——. H. R. Procter. Kolloidchem.-Beihefte, 1911, 2, 243—284.

THE research was undertaken in a hope that the study of simple colloidal swelling would throw light on the processes of pickling and mineral tanning, but it was found that much more important scientific principles were involved, including the whole theory of colloidal swelling. The process of pickling consists in immersing the skins in a very dilute bath of sulphuric acid, in which they swell, followed by treatment in a saturated salt solution, in which the swelling is removed and the hide-fibre strongly dehydrated. In studying these effects upon actual skin, capillary effects complicate the study of the colloidal action, so gelatin was used in which the former effect is absent. Purest French gelatin in the air-dry condition was cut into pieces of about 1 gram weight, immersed in the liquid until equilibrium was reached and, after removing as much adherent moisture as possible, weighed to determine the amount of swelling. The concentrations of acid and salt were then determined both in the jelly and in the liquid and the results calculated in terms of mgrm.-mols. of electrolyte per gram of ash-free dry gelatin. The extent of the swelling of gelatin in cold water is influenced by the amount of hydrolysed products which are always present in gelatin which has been melted and are the cause of the variation of the reaction of gelatin. It was found by experiment that the swelling maximum of gelatin was influenced by the volume, at the solidifying point, of the original mass of the gelatin, but that this was not the only determining factor. The swelling of gelatin jelly is reduced by alcohol, and in absolute alcohol a hard dry mass is obtained which regains its original condition on treating with water, so the action of alcohol is, apparently, purely physical. Quite weak gelatin jellies are impermeable to alcohol, and a marked osmotic pressure is produced if alcohol is placed in a porous cell coated with gelatin. The extent of the swelling of gelatin in alcohol of a series of strengths up to absolute alcohol was determined; by dissolving the gelatin afterwards and distilling, no alcohol was found to have penetrated into the gelatin. Similar results for the amounts of swelling were obtained when gelatin, previously swelled in water, was used. The curve of swelling was of the form to be expected from the action of an osmotic pressure on a material which has, itself, a certain elasticity, and it does not seem necessary to consider other forces. The equilibrium is apparently:

$$\left.\begin{array}{r}\text{Cohesive affinity of the gelatin}\\ \times\text{ Affinity of alcohol for water}\end{array}\right\} = \left\{\begin{array}{l}\text{Affinity of the}\\ \text{gelatin for water.}\end{array}\right.$$

This is only a reverse way of expressing the phenomenon from the osmotic point of view since osmotic pressures are kinetic partial-pressures and can be expressed as negative internal pressures of the solvent. Much greater swelling was produced in a concentrated gelatin jelly made with a mixture of water and alcohol than in one of an equal strength made with water only as, in the first case, not only had the gelatin to adsorb water to its maximum swelling, but the alcoholic emulsion particles had also to be diluted. Such jellies would almost certainly show the microscopic cellular structure described by Bütschli and van Bemmelen. Gelatin is only slightly swelled by weak acids, such as boric and carbonic acids and hydrogen sulphide, but with more highly ionised acids a gelatin which would only adsorb 7—8 times its weight of pure water may swell more than 50 times. The action of hydrochloric acid was studied at great length, and it was found that while, with phenolphthalein, the whole of the acid in the jelly could be titrated, with methyl orange only a part of this was shown. It is thus apparent that part of the acid is dissociated less through combination with gelatin either chemically or through adsorption. It was assumed that the acid solution in the jelly was of the same concentration as the outer solution, and that the excess, always found with phenolphthalein, was fixed by the gelatin. This was never greater than 1·25 mgrm.-mols. per grm. of dry gelatin. The curves for swelling, total acid adsorbed, and fixed acid at various concentrations are plotted and are those of a regular equilibrium and agree well for several series of experiments. The experimental errors are not greater than would be expected when the influence of undetermined factors, such as the cohesion elasticity of the gelatin, is considered and the extremely small forces which would produce great changes of volume near the swelling maximum. The curve for fixed acid is nearly horizontal after a certain concentration has been reached. The very distinct maximum shown in the curve representing the volume of the swollen mass (S) is significant, and follows naturally from the combination of the two other curves, the total acid per grm. of gelatin (a) and the fixed acid (f) according to the formula $S=a-f/x$, where (x) is the concentration of the outer solution. No distinct maximum swelling was observed with weak acids, the adsorption of the liquid increasing with the concentration of the solution till solution of the gelatin began. Formic acid showed a maximum at 0·07 grm.-mol. per litre. Experiments with actual sheep-skin and hydrochloric acid showed corresponding results to the gelatin. Concentrated salt solutions have an extremely strong dehydrating effect on acid hide fibre or gelatin, and warm gelatin is precipitated as a coherent mass by these solutions. Neutral gelatin is not so affected, saturated salt solution even increasing the swelling somewhat. Sulphates of weak bases, especially ammonium and zinc, have the strongest action. Similar results are obtained if the acid jelly is placed in the salt solution or the acid added to the salt solution. With acid of equal strength, the total acid adsorbed is less when salt is present, as both acid and water are expelled by the salt; the fixed acid, however, is greater. It may be thus assumed that the amount of acid adsorbed is greater when salt is present, but that its dissociation or hydrolysis is less. But it cannot be concluded that the unproved supposition, that the acid concentration of the adsorbed solution is equal to that of the outer, is incorrect. If, as is probable, the concentration of the adsorbed solution is sensibly less, then the fixed acid will be increased if the amount of adsorbed solution is lessened. The weaker acids will be less ionised in the salted gelatin than in the weakly acid gelatin and their action on methyl orange therefore less, and it is also probable that methyl orange is not absolutely insensitive to the acidity of the acid gelatin. If this is not the case, the action of the acid gelatin will be the greater, the greater the acid concentration in the salt contracted gelatin, as methyl orange is reddened by many organic acids in strong but not in dilute solution. All direct action of the acid gelatin on methyl orange will lessen the amount of fixed acid, determined as above described. The curve for the swelling of gelatin in presence of acid and salt corresponds to a hyperbola, which with increasing salt concentration approaches asymptotically to a value somewhat greater than 0. All acids in presence of their neutral salts exert a dehydrating effect on swollen gelatin, the intensity of which varies with the electrolytic dissociation of the acid and increases with the salt concentration. To produce dehydration it is not necessary that the salt should have the same anion as the acid, and if the salt of a strong acid is present in sufficient concentration, a good de-swelling effect is obtained by adding very weak acids.

A jelly may be looked upon as consisting of a network of gelatin molecules with interstices of molecular dimensions filled with water or aqueous solution; since these are within the sphere of molecular forces they may be taken as a semisolid solution in the gelatin and to have a common internal pressure with it. The sphere of molecular attraction is never greater than 10 $\mu\mu$ and, since a 2 per cent. gelatin solution is necessary to form a jelly, the gelatin molecule of volume $(10\ \mu\mu)^3$ is 13 million times heavier than the hydrogen molecule. Such molecules are of a sufficient size to form a network of molecular dimensions. This network is assumed to be much finer than that described by van Bemmelen and Bütschli, the cellular structure of which was of microscopic dimensions and the observation of which was made on hardened and shrunken gelatin. A dilute gelatin solution shows only isolated and apparently extraneous particles with only a weak Tyndall effect under the ultra-microscope, and appears to be a true molecular solution. No shrinking or flocking out occurs on cooling, and the formation of a cellular structure is difficult to conceive. If the view is taken that the gelatin jelly is the solution of a liquid in an elastic solid the problem consists in the consideration of the question of the distribution between two immiscible solvents. In the ordinary case of osmosis the molecular attraction of the common solvent acts only in overcoming that of the dissolved substance and to produce an equilibrium so that in the solution finally an equal and common internal pressure prevails, the kinetic energy of which is directed against a semi-permeable membrane, *i.e.*, in the gas equation, V remains constant and P varies. In the case of equilibrium of immiscible fluids, on the other hand, the kinetic energy is constant and it is the varying internal attraction of the two solvents for their molecules which determines the distribution coefficient, and since the diffusion surface is freely movable, P is constant and V variable. The latter condition is somewhat modified with jellies through the force of cohesion of the solid component which resists a change of volume. This force is very small in the neighbourhood of the point of maximum swelling. The explanation of the swelling of gelatin on the osmotic theory accounts in a very satisfactory manner for the dehydrating effect of alcohol, the jelly being easily permeable to water but almost impermeable to alcohol. Since gelatin jelly is very permeable to acids and salts and their ions, the production of a direct osmotic pressure by means of these substances is not easily apparent. The constant amount of “fixed acid” in the presence of excess of acid suggests the formation of a hydrolysable chemical complex of the nature of a salt in which the gelatin functions as base. If such a salt exists (*e.g.*, gelatin chloride) it is probably less permeable to hydrochloric acid and other chlorides than neutral gelatin, or, if the gelatin is looked upon as a solution, the solubility of salts with the same anion in acid gelatin is less than in neutral, while its affinity for water is greater perhaps on account of greater ionisation. In this case the conditions would be similar to those which occur when solutions of an acid and its salt are separated by a movable membrane which is permeable for the acid and water but not for the salt solution. As the salt cannot diffuse, water must pass the membrane till equilibrium is reached. The common anion must exist in both solutions at equal concentration and, on account of the salt anions, the free acid must be considerably less in the salt solution than in the other. The acid anions in the salt solution must also be in equilibrium with the anions of the salt, and this can only happen if water and acid are absorbed or expressed till the ionisation pressure of the salt is equal to that of the acid which is contained in the salt solution. The amount of gelatin salt ionisable but not hydrolytically dissociated therefore depends, for a certain amount of the base, on the hydrion concentration of the acid and the dissociation constant of the salt. When acid is used up to strengths below that at which appreciable lessening of swelling is produced and with an excess of salt of the same anion, the dissociation of the gelatin salt is practically nil. Under these conditions the total amount of acid adsorbed by 1 grm. of gelatin is about 1·3 mgrm.-mols., while it does not exceed 0·05 mgrm.-mol. in the adsorbed solution. It can also be assumed that 1000 mgrms. of gelatin combine with 1·28 mgrm.-mols. of acid or that the equivalent of gelatin, assumed as monobasic is about 780. The swelling curve, which first rises rapidly and then falls more slowly, can be explained by the above theory. The swelling is ascribed to the greater solubility or affinity for water of the ionised gelatin chloride in comparison with the non-ionised neutral gelatin and must increase with the increased proportion of chloride. It is however checked by the anions of the acid solution which increase the concentration of the gelatin not only by expression of water, until its ionic pressure is equal to that of the acid, but also effects the expulsion of free acid from the gelatin against the same pressure (x) until the total ionic pressure of the jelly mass remains equal to x. From the mathematical consideration of this theory the value $\frac{0{\cdot}6\times10^{-14}}{0{\cdot}5\times10^{-2}}$ was calculated for the dissociation constant of neutral gelatin which was confirmed by direct measurement.

In explanation of the nearly vertical rise of the "fixed acid" at the beginning and the quickly-attained maximum corresponding to the maximum of the swelling curve, it might be assumed that the uncombined gelatin first adsorbs acid without combination, and that this adsorption is favoured by the large volume of the jelly at its maximum swelling point where the curve of fixed acid shows a low maximum. This adsorption would naturally tend to increase the fixation of acid and would vanish with the free base as it is improbable that the chloride would still adsorb hydrochloric acid.

According to the above theory, the statement that hydrion concentration is the determining factor in the swelling of gelatin is only indirectly correct in so far as the hydrion concentration is a measure of the avidity of the acid and therefore of its facility of forming salts. It is possible that, as is the case with salts of ammonium and weak organic bases, hydrion enters into the salt. Potassium and sodium chlorides have a powerful dehydrating action on gelatin swollen not only with hydrochloric acid but with other acids, in which case a quadruple equilibrium results in which each acid is in equilibrium with its own neutral salt. When an excess is present, the dehydrating effect of the salt of a strong acid is the same whether a strong or weak acid is used. In the case of the swelling of gelatin by neutral salts it is probable that, in many cases, part of the salt is electrolytically or hydrolytically dissociated so that the acid as well as the base combines with the gelatin. Alkali swelling is not repressed by neutral salts, so the OH-ion and not the kation is the swelling agent.—D. J. L.

Gelatin; Sulphur dioxide in commercial ——. H. Leffmann and C. H. La Wall. Analyst, 1911, **36**, 271—272.

The enforcement of the food acts in the United States has caused attention to be directed to the occurrence of sulphur dioxide in commercial gelatins. The method of examination was to dissolve a known weight of the sample in water, distil with phosphoric acid in an atmosphere of carbon dioxide, and receive the distillate in excess of iodine, the resulting sulphuric acid being precipitated and weighed as barium sulphate. From the results obtained it was evident that it should be quite possible for the manufacturer to keep the amount of sulphur dioxide so low as to be negligible. Out of 86 samples from one factory, only two contained more than 15 parts of sulphur dioxide per million; from another factory, all three samples examined contained less than 10 parts per million; while from two other sources, four samples contained from 200—800 parts per million.—J. H. J.

Products of partial hydrolysis of proteins. Abderhalden. *See* V.

Patents.

Elastic cellular, foamy or spongy material [*from gelatin*]; *Manufacture of* ——. R. J. Caldwell, Southampton, and Pfleumatic (1910) Limited, London. Eng. Pat. 7735, Mar. 28, 1911.

In order to obtain a gelatinous mass, prepared according to the general method described in a previous patent (this J., 1909, 1052), containing approximately 13½ per cent. of water, which percentage renders the cellular mass less cork-like than that prepared according to Eng. Pat. 2796 of 1908, without unduly diminishing its tensile strength, the following details are attended to. The glycerin employed has a density of 1·240 and contains 10 per cent. of water; a commercial powdered gelatin containing an average of about 16 per cent. (14—18 per cent.) of water is used; the glycerin and gelatin are employed in the proportion of 9 parts to 12. According to the duty expected of the mass, the proportion of water present in it may vary between the limits of 9 and 19 per cent. The hardening agent, preferably pyrogallol, is dissolved in glycerin and introduced into the chamber containing the mass after the latter has been beaten to a foam.—E. W. L.

XVI.—SOILS; FERTILISERS.

Soil fertility; Influence of bacteria upon ——. C. M. Hutchinson. Agric. J. India, 1911, **6**, 97—113.

A general description of the laboratory methods in use to determine the reaction of soils to the various agricultural operations. Attention is called to the increased fertility produced by hot weather ploughing in India. Partial sterilisation and an alteration in the bacterial content of the soil is effected by the high temperature (about 60° C.) to which the surface soil is raised during April, May and June. The desiccation of the soil causes the death of most protozoa, whilst the complete aëration produces conditions favourable to nitrification and preventing acid fermentation of humus.—E. F. A.

Phosphoric acid; Organic —— *of the soil.* G. S. Fraps. Texas Agric. Expt. Stat., Bull. No. 136, Feb., 1911. Pp. 33.

Phosphoric acid is present in the soil in the form of organic phosphates and as phosphates of calcium, iron and aluminium. That soluble in ammonia is partly organic and partly inorganic, but chiefly derived from iron and aluminium phosphates. Certain soils are able to fix phosphoric acid from ammonia solution. When the amount of soil used is increased, the concentration of the phosphoric acid dissolved by ammonia or by $N/5$ nitric acid also increases, but the total amount of phosphoric acid extracted from the soil grows less. The quantity of other soil constituents dissolved by ammonia is but small, and the exposure of soil phosphates by the solution of protecting material is probably negligible. The phosphoric acid fixed in the soil is partly extracted by ammonia, partly by acid, whilst part remains undissolved. The phosphoric acid soluble in ammonia is increased by the addition of organic matter to the soil. As the organic matter decays the phosphoric acid soluble in ammonia usually decreases, although it sometimes increases. This increase does not necessarily imply an increase in organic phosphoric acid, and the acid soluble in ammonia is partly inorganic, since phosphoric acid is dissolved by ammonia from ignited soils. From these more phosphoric acid is dissolved by ammonia after previous extraction with acid than before. Ammonia has a greater solvent action upon some mineral phosphates (wavellite) than have 1 per cent. or 12 per cent. hydrochloric acid, and the latter acid is unable to extract all the phosphoric acid of wavellite, variscite or dufrenite. After ignition these three phosphates become almost completely soluble in acid. $N/5$ nitric acid dissolves ten times as much phosphate from the ignited minerals. Other constituents, particularly iron oxide and alumina, are also more soluble in 12 per cent. hydrochloric acid after ignition. This behaviour on ignition is, however, no evidence that such phosphoric acid is in organic combination, nor can it be used to estimate the organic phosphate of the soil. The ignition-soluble and the ammonia-soluble phosphoric acid do not represent the same thing, and there is no definite relation between them. A large proportion of ignition-soluble phosphoric acid is associated with a high proportion of nitrogen, but the reverse relationship does not hold. The average content of nitrogen, iron oxide and alumina in soils increases as a rule with the average ignition-soluble phosphoric acid. The methods of estimating the organic phosphate of the soil are discussed and it is shown that none of them are satisfactory.—E. F. A.

Lime-magnesium ratio; A contribution to the knowledge regarding Loew's ——. R. Stewart. J. Ind. Eng. Chem., 1911, **3**, 376—378.

The author describes the results obtained on one of the experimental farms belonging to the Utah Experimental Station, where the soil has been formed by the disintegration of limestone, quartzite, and dolomite, and contains over 40 per cent. of calcium-magnesium carbonate, of which nearly one-third is magnesium carbonate. The soil is fairly well supplied with phosphoric acid, but is low in nitrogen and humus. It is remarkably fertile and produces excellent crops, as the following average yields (8 years) show:—oats, 82 bushels; wheat, 50·4 bushels; potatoes, 262·3 bushels; sugar beets, 21·8 tons. For the first three crops the soil was not manured, but for the sugar beets it received an addition of barnyard manure. These results indicate that it may be possible to use finely ground magnesian limestone to correct the acidity of acid soils. As possible reasons for the fact that the magnesium has no injurious effect on plant growth, it is suggested that: (1) the ratio of magnesia to lime, which falls within the limit (1 : 3) given by Loew (this J., 1904, 27), may be favourable to plant growth; or (2) the calcium and magnesium may be present in the form of a double salt, such as a dolomite.—A. S.

Lime and magnesia; Action of different proportions of —— in some soils on higher plants and micro-organisms. O. Lemmermann, A. Einecke, and H. Fischer. Landw. Jahrbb., 1911, **40**, 165—254. Chem. Zentr., 1911, **1**, 1760—1761.

Pot experiments extending over three years with oats, barley, wheat, rye, mustard, buckwheat, vetches, and crimson clover, on six different soils, showed that the yield was not notably affected by variations in the ratio of lime to magnesia within wide limits. The addition of lime and magnesia was without influence on the yield even on soils containing only 0·08 per cent. of lime and 0·04 per cent. of magnesia, or 0·067 per cent. of lime and 0·09 per cent. of magnesia. The authors' observations showed that it is necessary to continue experiments for several years in order to obtain reliable information. Regard must be paid to the solubility and adsorption of calcium and magnesium compounds in attempts to calculate and define the most suitable ratio of lime to magnesia. Experiments with limestone and magnesite showed that whereas no considerable difference could be observed with distilled water, lime is more readily and rapidly dissolved than magnesia by water saturated with carbonic acid. Experiments on the lixiviation of soil with water saturated with carbonic acid indicated that lime and magnesia are supplied to the plants by the soil solution in proportions quite different from those in which they are present in the soil. With regard to the bacterial life of soils, whereas addition of calcium oxide causes first a decrease and then an increase in the number of micro-organisms, addition of magnesium oxide causes an increase from the beginning, but the final effect is not quite so pronounced as with lime; magnesium carbonate is considerably less effective than magnesium oxide in this respect. No evidence could be gained of a specially beneficial effect of a definite ratio of lime to magnesia on the bacterial activity of a soil.—A. S.

Lime requirement of soils; Investigations on the —— on the basis of soil analyses and vegetation experiments. O. Lemmermann, O. Foerster, and A. Einecke. Landw. Jahbb., 1911, **40**, 255—324. Chem. Zentr., 1911, **1**, 1761—1763.

The effect of manuring with calcium carbonate, lime, and calcium sulphate was investigated by means of pot experiments with rye, barley, vetches, mustard, carrots and peas on ten different soils. A favourable action was observed only in the case of acid soils deficient in lime, and appeared to be due rather to neutralisation of the acids of the soil than to utilisation of lime by the plants, for no notable effect could be observed on neutral or faintly acid soils deficient in lime. No injurious effect of calcium sulphate on the leguminous plants was observed. In determining the need of a soil for lime, much greater stress should be laid on the determination of the acidity of the soil than has hitherto been the case. None of the methods which have been proposed for determining the available lime in soils proved of much value for the purpose of ascertaining the lime requirement of the soil.—A. S.

Lime and potash in the ash of cereals; Determination of ——. F. Thompson and H. H. Morgan, jun. J. Ind. Eng. Chem., 1911, **3**, 398—400.

Lime.—The following modification of the official (U.S.A.) method is proposed; it depends upon the solubility of calcium and magnesium phosphates in dilute acetic acid, in which the phosphates of iron and aluminium are insoluble. 50 c.c. of the hydrochloric acid solution of the ash (corresponding to 0·5 grm.) are heated to boiling, made slightly ammoniacal, and then acidified with acetic acid, an excess of about 10 c.c. of 50 per cent. acetic acid being added; the total volume of the solution should not be more than 75 c.c. After boiling for a few minutes, the phosphates of iron and aluminium are filtered off, and washed with hot water. The filtrate is treated with about 10 c.c. of saturated ammonium oxalate solution and the lime determined in the usual way. When large amounts of alumina are present, a re-precipitation of the aluminium phosphate is necessary. It is stated that a "quite appreciable" amount of alumina has been found in every sample of ash of wheat straw and grains examined. *Potassium oxide.*—The following modification of Adie and Wood's cobaltinitrite method (Chem. Soc. Trans., 1900, 77, 1076) is recommended. The hydrochloric acid solution of 0·5 grm. of ash is neutralised with sodium hydroxide and acidified again with acetic acid, 10 c.c. of 50 per cent. acetic acid in excess being added. After boiling the solution the phosphates of iron and aluminium are filtered off, washed with hot water, and the filtrate concentrated to 75 c.c., cooled, and treated with 25 c.c. of sodium cobaltinitrite solution. After standing over night, the precipitate is collected on asbestos felt in a Gooch crucible, washed with 10 per cent. acetic acid and once with water, and then heated to boiling with 40 c.c. of a saturated solution of barium hydroxide. The solution is filtered into a 200 c.c. flask, the precipitate washed with hot water, and the filtrate made up to 200 c.c. This solution is then used to titrate 25 c.c. of standardised permanganate solution to which 5 c.c. of sulphuric acid (1 : 1) and 150 c.c. of hot water have been added. 1 c.c. of a 0·1274*N* solution of permanganate is equivalent to 1 mgrm. of potassium oxide. The sodium cobaltinitrite solution is prepared by dissolving 113 grms. of cobalt acetate in 400 c.c. of 20 per cent. acetic acid, and adding a solution of 220 grms. of sodium nitrite in 400 c.c. of water. After standing for 24 hours, during which the nitric oxide formed is removed by means of a pump, the solution is filtered.—A. S.

Calcium cyanamide; Analysis of ——. A. Monnier. Chem.-Zeit., 1911, **35**, 601—602. (See also this J., 1905, 1129; 1909, 1097; 1910, 1171, 1218.)

The author determines the cyanamide nitrogen by the following method (suggested by Friderich), based on the conversion of the cyanamide into urea by the action of acids: 1 grm. of the fertiliser is agitated for 2½ hours with 100 c.c. of water, the mixture filtered, and 25 c.c. of the filtrate, with addition of 10 c.c. of formic acid, are evaporated nearly to dryness; the residue is taken up with 25 c.c. of water, and 10 c.c. of the solution are treated with sodium hypobromite in a ureometer, comparison being made with a 0·5 per cent. solution of pure urea. Caro's method (this J., 1911, 23) is stated to give low results owing to the silver cyanamide being somewhat soluble in ammonia. A sample of freshly manufactured crude calcium cyanamide gave the following results on analysis: Total nitrogen by the salicylic acid method, 21·5 per cent.; nitrogen, by the usual Kjeldahl process, 20·5; nitrogen, as cyanamide, by the above method, 18·98 per cent. The nitrogen is thus present in at least 3 different forms, viz.: I., 18·98 per cent. as cyanamide; II., 1·52 per cent., partly or wholly derived from the raw materials, used; III., 1 per cent. in an unidentified combination, but which is easily oxidised to nitrous and nitric acid. A gravimetric determination made with "nitron" by Busch's method (this J., 1905, 291, 458, 638) of the nitric acid formed on oxidising the fertiliser with hydrogen peroxide gave 4·66 per cent. of nitric acid equivalent to 0·99 per cent. of nitrogen. The nitrogen existing as dicyanamide was not separately taken into account, the amount not exceeding 0·1 per cent.—A. Sbld.

Hormones ; Function of —— in regulating metabolism. H. E. and E. F. Armstrong. Annals of Botany, 1911, **25**, 507—519.

The term hormone is applied to substances that pass through differential septa, such as are met with in the barley grain and in the leaves of the laurel, aucuba, etc., and excite activity in the cells when they have gained an entry. Hormones as a class have but slight attraction for water. In the laurel leaf entry of the hormone causes hydrolysis of the glucoside, prulaurasin, which is present, this being indicated by the escape of hydrogen cyanide. In the aucuba leaf a glucoside, aucubin, becomes hydrolysed and a black colouration is formed by the secondary decomposition of aucubigenin, one of the products of hydrolysis. The active hormones are mercuric chloride (but not nitrate or sulphate), cadmium iodide (not chloride), sodium and potassium fluorides. Iodine, carbon dioxide and hydrogen sulphide act slowly, ammonia very rapidly. Acids of the acetic series and alcohols of the methylic series are increasingly active as they become less soluble and of higher molecular weight. Volatile hydrocarbons, chloroform, ethers and esters, aldehydes, ketones, camphor, and phenols are all very active excitants. On the other hand weak solutions of mineral acids, alkali hydroxides and carbonates and most metallic salts are entirely unable to penetrate the differential septa. The main effect produced by the entry of hormones into the living cell is the stimulation of enzyme action: in consequence they exercise a determining influence in regulating plant and animal metabolism. A number of examples in plant metabolism are discussed. It is suggested for example, that the superior fertility of partially sterilised soils is due to the fact that they are richer in both ammonia and carbon dioxide than the unsterilised soil. In considering the advantages of ammonium sulphate as a manure the stimulative influence of ammonia must also be taken into account. The leaves of *Azara microphylla* become a rich brown in chloroform vapour ; the seed pods of many leguminous plants become black just before the seed is ripe when exposed to hormones. The black-brown colour of the ripe banana skin is easily produced on exposing the unripe fruit to the vapour of a hormone. The ester of the banana fruit itself acts as a hormone towards the laurel or aucuba leaf and it is probable that under natural conditions the blackening of the outer skin is due to the escape of an ethereal salt produced within, a signal being thus given that the fruit is ripe. The autumn colouration of leaves and their fall, also the ripening of seeds, may be conditioned by similar processes—a sudden outburst of hormones which either determine or hasten enzyme changes. It is suggested that in glucosides the compound associated with dextrose functions simply as a hormone. The primary effect of the hormone is to condition the separation from each other of the successive layers constituting the protoplasmic complex.—E. F. A.

Patent.

Manure ; Method of making ——. F. Schäcke, Cologne, Germany. U.S. Pat. 993,463, May 30, 1911.

See Fr. Pat. 386,512 of 1908 ; this J., 1908, 821.—T. F. B.

XVII.—SUGARS ; STARCHES ; GUMS.

Sugar beet ; Hereditary character of nitrogen in ——. J. Urban. Z. Zuckerind. Böhm., 1911, 35, 443—450.

The hereditary character of the sugar content of the beet has been incontestably proved and forms the basis of selection. The inheritance of the internal characters—with the exception of the sugar content—has hitherto not been followed by direct researches, but as Maercker showed, with the increase in sugar content produced by selection in the course of years, the quantity of non-sugars diminishes. Among the non-sugars it is the substances containing nitrogen which are of chief importance for the value of the beet in the factory. The great influence which these substances exercise on the production of sugar in the beet, and on the purity of the concentrated juice induced the author to approach the question whether the nitrogen content was dependent or not on the sugar content. For this purpose he selected from one stock 30 beets, each about 700 grms. and showing from 18 to 18·5 per cent. of sugar. The average percentage of nitrogen was 0·118. As parent beets two were chosen with the lowest percentage of nitrogen, 0·088 and 0·095 and grown side by side for cross fertilisation, and the two highest in nitrogen, containing 0·135 and 0·136 per cent. were treated similarly. The seeds from these two sets yielded beets which gave an average of 0·133 and 0·151 per cent. of nitrogen respectively. The nitrogen in the beet was thus shown to have a hereditary character, not absolute but relative, like the sugar content. The nitrogen content of the stock was found not to be always in direct correlation with that of the sugar. In the selection of beets for seed growing, attention should be paid to the nitrogen content and purity and not merely to high content of sugar.—L. J. de W.

Beet sugar factory ; Undetermined losses of the ——. H. Pellet. Sucr. Belge, 1911, **39**, 287—294.

It has been previously observed by the author that the polarisation of a beetroot juice, treated by cold saturation, always corresponds with the polarisation of the raw juice defecated in the ordinary way with a little basic lead acetate, whereas the polarisation of the same juice submitted to hot saturation is appreciably less, generally to the extent of 0·5—0·8, but sometimes even to as much as 1 per cent. of the amount of sugar present. Suspecting the influence of the various substances other than sucrose contained in beet juice, such as glutamine, glutamic acid, asparagin, aspartic acid, reducing sugars, and raffinose, experiments were made investigating their behaviour in neutral, alkaline (containing basic lead acetate), and acid (containing hydrochloric acid) solutions. In the cases of glutamine and glutamic acid, dextro-rotatory in neutral, solution, basic lead acetate caused a strong lævo-rotation ; while hydrochloric acid on the contrary, made the dextro-rotation greater than in a neutral medium. With asparagin and aspartic acid the effects observed were different, since with both basic lead acetate and hydrochloric acid a change of rotation to the right was observed. Similar experiments were carried out with the sodium and potassium salts of aspartic and glutamic acids, the most marked effect observed being with sodium and potassium aspartates, a slight rotation in neutral solution passing to one very strongly dextro-rotatory in basic lead acetate solution. So as to obtain an idea of what actually occurs in the case of ordinary diffusion juice, 50 c.c. of juice were made up to 100 c.c. with (*a*) 5 c.c. of basic lead acetate and water, and (*b*) 50 c.c. of basic lead acetate, and the difference in polarisation observed. It was found that the excess of basic lead acetate caused a decrease in the polarisation, to the extent of 0·2—0·4 per cent. of the sugar, which pointed to the presence of more glutamine than asparagin substances in the juices examined. Next the effect of small amounts of alkalis, corresponding to the conditions of hot and cold saturation were tried, and from these experiments results were obtained showing clearly that an appreciable decrease in polarisation takes place as the result of the hot treatment. Neither reducing sugars nor raffinose showed any sensible change under the same experimental conditions. The author concludes that the decrease of polarisation observable after hot saturation is to be ascribed to the action of the potash and soda, set free by carbonatation on the non-sugars of the juice, chiefly glutamine and glutamic acid.—J. P. O.

Sugar juices; Preliminary purification of raw —— by the Menoscal process. M. Descamps. Bull. Assoc. Chim. Sucr., 1911, **28**, 859—861.

The pectin substances precipitated from raw sugar juices by lime are viscous, and it is necessary to add much more lime than is actually required for precipitation, in order to obtain, after carbonatation, a deposit which can be filtered easily. In the Menoscal process the raw juice is first treated with calcium hydrosulphite in quantities of 5—10 grms. per hectolitre of juice. The pectin substances are thereby decomposed and the amount of lime added for defecation may be reduced by at least one-third.—J. H. L.

Cane sugars; Acidity of raw ——. W. E. Cross. Intern. Sugar J., 1911, **13**, 305—308.

Although the determination of the acidity of a raw sugar does not at present receive much attention, recent investigations have shown that it is of importance, especially as regards the keeping qualities during storage. Often the exact measurement of the degree of acidity of ordinary cane sugars is difficult, owing to the obscuration of the end-point by the colour of the solution. The author, however, has found that reasonably accurate results can be obtained by titrating a solution of 10 grms. of the sample in 200 c.c., or 500 c.c. if the sugar is very dark, of neutralised water, against a weak standard solution of alkali, using phenolphthalein as indicator. It is stated that after a little practice the end-point, indicated by a distinct pink tinge of the liquid can easily be distinguished. The neutralised water is prepared by adding 1—2 c.c. of 30 per cent. phenolphthalein solution to each litre of recently boiled distilled water, and then sufficient weak sodium hydroxide solution to produce a plainly visible pink colouration. Using this method a series of Louisiana raw cane sugars have been examined, and the acidity found to vary within the limits of 0·0045 to 0·056 per cent., expressed as calcium oxide.—J. P. O.

Cane sugars; Analyses of —— of different qualities and from different sources. H. Pellet. Intern. Sugar J., 1911, **13**, 328—335.

So as to compare the results obtainable by different methods of sugar analysis, the author has examined a number of samples of raw cane sugars, of varying grades, from Javan basket to Phillipine mat. In doing this, the three following procedures were used: (1) the ordinary method, *i.e.*, determining the sugar from the direct polarisation, obtaining the reducing sugars volumetrically, without clarification of the solution, and taking the sulphated ash, less one-tenth; (2) determining the sugar by Clerget, the reducing sugars gravimetrically on a solution previously clarified by basic lead acetate, and using the sulphated ash; and (3) determining the sucrose by Clerget, the reducing sugars gravimetrically, without clarification, and using the soluble sulphated ash. It was found that in the case of the higher grade sugars, *i.e.*, those polarising above 90°, there is little difference in the figure for sucrose whether determined by direct polarisation or by Clerget. With, however, the sugars polarising less than 90°, the sucrose by Clerget exceeded the sucrose by direct polarisation by 0·4 to 1·9 per cent., this difference being approximately in direct proportion to the amount of reducing sugars present. As to the reducing sugars, these vary according to whether or not the solution is clarified by basic lead acetate, differences amounting to 0·5 per cent., depending upon the amount of ash, being observed. In some samples, even in those of low grade, the total sulphated ash was found to differ very little from the soluble sulphated ash, whereas, in other sugars, the difference was sufficient to make a very appreciable difference in the calculated *rendement*. It is argued by the author that the purchase of raw cane sugars should only be made on the basis of the sucrose by Clerget, and not on that of the sucrose by direct polarisation, since the latter value is capable of considerable variation according to the amount of reducing sugars present. Further, it is held that in the cane sugar factory an accurate account of the quality of the different products can only be accurately rendered by the Clerget process.—J. P. O.

Sugar solutions; Solubility of lime in ——. H. Claassen. Z. Ver. deut. Zuckerind., 1911, 489—509.

Lime dissolves in solutions of sucrose to the greatest extent when added in the form of caustic lime, and least when added in the form of milk of lime that has been kept for some days. Thus, a 13 per cent. solution of sucrose treated for 1 hour at 80° C. with 2·5 per cent. of lime added in the form of caustic lime was found to contain 0·366 grm. of dissolved lime per 100 c.c., whilst, when treated under the same conditions with 2·5 per cent. of lime in the form of an old preparation of milk of lime, the solution was found to contain only 0·272 grm. of dissolved lime per 100 c.c. The solubilities of calcium hydroxide and freshly prepared milk of lime lie between these extremes. The solubility of lime in sucrose solution increases to a maximum as the quantity of lime added is increased to 2—2·5 per cent., after which it remains practically constant or even decreases slightly. The solubility decreases with increasing temperature; at low temperatures, the lime dissolves slowly in the sucrose solution, but at 70° C. and upwards, the maximum quantity of lime is dissolved within a few minutes, and on further stirring the mixture, the amount of dissolved lime decreases appreciably. With increasing concentration of sucrose, the solubility of lime increases (per 100 parts both of solution and of sucrose). If a mixture of a sucrose solution saturated with lime at such low temperatures as 0°, 20° and 50° C., with excess of lime be heated, part of the dissolved lime is precipitated, not as calcium sucrate but as lime; considerably more lime remains in solution, however, than would be dissolved directly at the higher temperature. If the filtrate from a sucrose solution that has been saturated with lime at 0° or 20° C. is heated, lime and a gelatinous precipitate of calcium sucrate are thrown down; the filtrate from a sucrose solution that has been saturated with lime at 50° C., yields little or no precipitate on warming to 90°—100° C. Sucrose solutions which have been saturated with lime at a high temperature dissolve a further quantity of lime when allowed to cool in presence of excess of lime. It is also found that the behaviour of impure sugar solutions (thin juice) towards lime resembles that of pure sucrose solutions of the same sucrose content. These results show that in the practical defecation process, after addition of the lime, sugar is not precipitated either by heating or cooling; the quantity of lime dissolved depends almost entirely on the method of defecation and on the temperature, since the sugar-content of the juices to be defecated generally varies very little, and the quantity of lime added (within the limits of practice) has scarcely any influence. If the defecation is properly carried out, *i.e.*, if the temperature is maintained at 80°—90° C., the alkalinity (lime-content) of the defecated and filtered juice must be at least 0·20—0·25 per cent. with wet defecation and 0·25—0·35 per cent. with dry defecation.—L. E.

Sucrose; Action of ultra-violet rays on ——. H. Bierry, V. Henri. and A. Ranc. Comptes rend., 1911, **152**. 1629—1632. (See this J., 1910, 1029; 1911, 386.)

The authors have investigated the action of the ultra-violet rays from a quartz mercury vapour lamp on 5 per cent. solutions of sucrose at 40° C. *in vacuo*, and at 20° C. in presence of air, and both with and without addition of calcium carbonate. It is found that under the influence of the ultra-violet light, the sucrose is hydrolysed to an extent which is quite appreciable after 20 hours exposure at 40° C., whilst if the solution is exposed for 48 hours at this temperature, it is found to contain formaldehyde. In absence of calcium carbonate, gas is liberated, but this is a secondary phenomenon; it is scarcely perceptible before 72 hours and becomes marked on the fifth or sixth day of exposure at 40° C. Of the combustible part of this gas, 50 per cent. consists of carbon monoxide.—L. E.

Gum in syrups; Determination of ——. X. Rocques and G. Sellier. Ann. Chim. Analyt., 1911, **16**, 218—220.

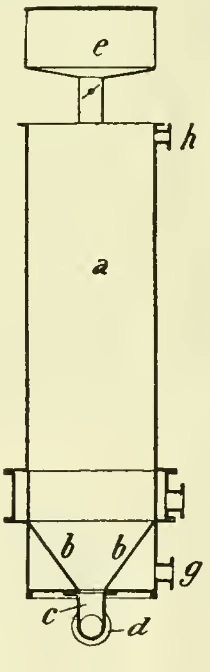
The authors confirm Chauvin's statement (Monit. Scient., May, 1911), that gum is completely precipitated from alcoholic solution by normal lead acetate and state that they have used the method for several years for the determination of gum in syrups. 25 grms. of the syrup are treated with 80 c.c. of 90 per cent. alcohol, the first portions of the latter being added drop by drop, with vigorous agitation, 2 c.c. of a saturated solution of lead acetate in 95 per cent. alcohol are then added and the whole well shaken. Or, 20 c.c. of the syrup may be mixed with 10 c.c. of water, and 2 c.c. of a saturated alcoholic solution of lead acetate added, followed, after shaking, by 90 c.c. of 95 per cent. alcohol. In either case, the mixture is allowed to stand for 20 minutes, the precipitate collected on a weighed filter, washed with 75 per cent. alcohol, dried and weighed. It is next ignited with fuming nitric acid, and again weighed. The difference between the two weights gives the quantity of "pure gum" and this, multiplied by $\frac{100}{85}$, gives the quantity of "actual gum," gum arabic having been found to contain about 85 per cent. of "pure gum."—A. S.

Manufacture of alcohol from sugar beets. Antal. *See* XVIII.

PATENTS.

Sugar beet; Method and apparatus for extracting the juice of the —— by continuous lixiviation in a single vessel. P. J. Wolff. Fr. Pat. 423,487, Dec. 9, 1910. Under Int. Conv., Dec. 24, 1909.

In the figure, *a* is a cylindrical diffusion vessel, open at the top, in the lower part of which is a conical sieve, *b*, communicating through *c* with the pipe *d*, which is connected outside the diffusion vessel with the filling arrangement, *e*, placed at a higher level than the rest of the apparatus. Slices, mixed to a paste with raw juice obtained in a previous operation, are introduced into *e*, pass through the pipe, *d*, and enter the bottom of the diffusion vessel through *c*, while water is run in through the inlet *h*, and juice drawn off through the outlet *g*. Owing partly to the force of gravity afforded by the higher level of the filling arrangement, and partly by means of a suitable appliance, such as an archimedian screw, the slices gradually rise in the diffusion vessel, being finally discharged at the top. When diffusers of large diameter are used, and the slices are apt to form a hard mass at the bottom, a horizontal, in place of a vertical, conical sieve may be used, or else an archimedian screw may be placed in the conical space. Another means of securing a uniform distribution of the mass of slices is afforded by the insertion of a grating over the top of the conical section.—J. P. O.



Sugar juice and solutions; Separating scum and precipitates from ——. J. J. Homans, Samarang, Java. Eng. Pat. 19,719, Aug. 23, 1910.

See U.S. Pats. 978,450 and 978,750 of 1910; this J., 1911, 102.—T. F. B.

Sugar manufacture; Process of purifying raw juices in the ——. M. Kowalski, Lemberg, Austria-Hungary. U.S. Pat. 994,646, June 6, 1911.

See Fr. Pat. 372,770 of 1906; this J., 1907, 541.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Yeast; Cultivation of pure —— and the importance of the method of culture for the chemical and physiological character of the product. F. Schönfeld and H. Krampf. Woch. f. Brau., 1911, 28, 157—160, 174—177, 182—184.

The authors have carried out a thorough investigation of the composition and character of two yeasts grown under different conditions but both originally derived from the same top-fermentation yeast (A). The first was cultivated in the apparatus of Stockhausen and Coblitz, and afterwards used four times in the brewery at a fermentation temperature of 12°—16° C. The yeast-crop obtained was 4·5—5·5 litres per cwt. of malt. The second yeast was cultivated in Lindner's pure culture apparatus by the aeration process at 22° C., and afterwards used once in the fermentation vats at a temperature of 20°—22° C., with aeration. The yeast crop in this case amounted to 10—12 litres per cwt. of malt. The yeast obtained by the first method was characterised by a much higher protein-content (66·33 as compared with 47·53 per cent. of the dried yeast), a higher ash-content, and a much lower content of glycogen (13·27 as compared with 39·9 per cent.) than that obtained by the warm aeration method. It contained also more soluble phosphoric acid, a larger quantity of which was in organic combination. Its specific gravity was somewhat lower, flocculation was more satisfactory, and the yeast settled better. Physiologically, its working power was greater, the attenuation produced was lower, and the yeast was less resistant towards the influence of heat and water, as was shown by the greater quantity of salts and phosphoric acid extracted during digestion and decoction. The two yeasts did not differ appreciably in their content of lime and magnesia, but a greater proportion of the salts of these bases was extracted on digestion, in the case of the yeast grown by the first method. Although the two methods of culture were not carried out under exactly corresponding conditions (*e.g.*, different worts were employed), any differences in the yeasts arising from this cause would be small compared with those actually observed. The experiments, therefore, show clearly the influence of the two methods of cultivation on the character of the yeast produced.—J. H. L.

Yeast-fermentation; Contributions to the knowledge of ——. H. Euler and G. Lundeqvist. Z. physiol. Chem., 1911, 72, 97—112.

By following the course of the fermentation of maltose solutions polarimetrically, and determining at the same time the amount of carbon dioxide evolved, the authors found that hydrolysis of the maltose keeps only slightly in advance of fermentation; the amount of dextrose in the solution at any instant is small. In spite of this, however, solutions of maltose were found to be fermented almost as rapidly as dextrose solutions of the same concentration. It does not necessarily follow that maltose is capable of being fermented directly. The velocity of fermentation depends, primarily, not on the concentration of dextrose in the solution but on that in the yeast-cells, and since hydrolysis of the maltose occurs in the cells, the concentration of dextrose there may be as great as when solutions of dextrose of considerable strength are fermented. From further experiments the authors found that fermentation of mannose, unlike that of dextrose, is not accelerated by addition of monosodium phosphate. This indicates that the intermediate reactions are somewhat different in the two cases. The influence on the fermenting power of yeast, of a preliminary treatment for 2 hours with a 2 per cent. solution of monosodium phosphate or with a 10 per cent. sucrose solution was also investigated. In the case of one yeast, the phosphoric acid-content of which was abnormally high, neither treatment alone, nor both together, had any appreciable influence on the rate of subsequent fermentations. The activity of a second yeast, of normal phosphoric acid-content, was, however, increased by 40 per cent. as the result of treatment for two hours with a solution containing both phosphate and sucrose, but neither substance alone had any but a very slight effect. Increase in the activity of yeast produced in this way is probably due, not to any change in its zymase-content, but to an increase in the quantity of other substances present which assist the enzymic action.—J. H. L.

Yeast: Decomposition of nitrogenous substances by ——. O. Schwarz. Biochem. Zeits., 1911, **33**, 30–31.

It is found that starch, glycogen, alanine, the sodium salt of aspartic acid, and casein, which are not decomposed by yeast under ordinary conditions, can be decomposed by yeast in presence of suprarenine (adrenaline) tartrate with liberation of appreciable quantities of carbon dioxide. This decomposition does not occur, however, if the tartrate is replaced by the hydrochloride of adrenaline whence it appears that the activation of the yeast is not effected by the adrenaline *per se*. Since it has been shown by Neuberg and Hildesheimer (this J., 1911, 379) that, amongst other substances, pyruvic and tartaric acids can be fermented by yeast in absence of sugar (cp. also Neuberg and Tir, *loc. cit.*, 705), it appears probable that in the activation of yeast by suprarenine tartrate, the tartaric acid furnishes the energy requisite for the decomposition of starch, glycogen, etc.—L. E.

Yeast; Influence of antiseptics on the autodigestion of ——. E. Navassart. Z. physiol. Chem., 1911, **72**, 151—157.

The author has carried out experiments to determine to what extent the autodigestion of yeast is affected by various antiseptic substances which, as compared with chloroform, have previously been found to accelerate the autolysis of liver-tissue. The method used was the same as that described in an earlier paper (this J., 1911, 103), determinations being made of the total nitrogen, and also of the purine bases, passing into solution. The results indicate the extent of yeast-autolysis which occurs in presence of the substances tested, as compared with that occurring in presence of chloroform. Boric, benzoic, and salicylic acids, and alcohol (in 5 and 10 per cent. solutions) were found to have the same effect as chloroform. Similar results were obtained with solutions of formaldehyde of 1/32 per cent. concentration, but autolysis was completely arrested by 1 per cent. solutions. Saturated solutions of mustard oil were also without effect; half-saturated solutions, whilst not affecting the amount of total nitrogen passing into solution, increased the quantity of purine bases, *i.e.*, accelerated nucleolytic action. Toluene in saturated solutions behaved like chloroform. In presence of half-saturated solutions autolysis was accelerated, but as the liquid did not remain sterile, this result is not conclusive. The author concludes that the proteolytic and nucleolytic enzymes of yeast behave, towards most antiseptics, differently from the enzymes of liver-tissue. —J. H. L.

Brewing waters; Calcium carbonate in ——, *and its influence on brewhouse processes.* F. Pott. Woch. Brau., 1911, **28**, 249—252.

Calcium carbonate may be present during brewing operations in three forms:—as normal carbonate, solid and in solution, and as polycarbonate (a term the author uses in preference to bicarbonate). The solid carbonate does not exercise much influence on wort-acidity. A wort prepared with calcareous water was found to undergo no appreciable reduction of acidity by boiling with calcium carbonate for 10 minutes. The acidity of experimental worts produced by mashing with distilled water in presence of the solid carbonate was more than half that of worts similarly produced with distilled water alone. The carbonate had no influence whatever on the aroma or the time taken in saccharification. Quite different results were obtained when the mashing water consisted of a solution of calcium polycarbonate (bicarbonate). The acidity of the wort was greatly diminished, as compared with the other experiments, saccharification was retarded and the aroma affected. This is not due to the polycarbonate, as such, for it is quite neutral (*e.g.* to phenolphthalein), but to the normal carbonate produced on warming, which is alkaline in reaction and, in the moment of its formation, unites with the plant acids. The higher the temperature at which decomposition of the polycarbonate occurs, the more injurious is the influence of the normal carbonate produced, for it becomes more soluble and more reactive towards acids. Salts of mineral acids, which confer hardness on water (*e.g.*, calcium sulphate), facilitate decomposition of the bicarbonate, which therefore occurs at a lower temperature, with less harmful effect, in their presence. For this reason a calcareous water is the more suitable for brewing the higher is its mineral acid-hardness. The author recommends that the testing of water, as to its suitability for brewing, should include an investigation of the decomposition of polycarbonate within the temperature-interval of 10°—100° C. —J. H. L.

Nitrogen; Determining —— *in liquids* [*beer wort*]. O. Fürnrohr. Woch. Brau., 1911, **28**, 257—258.

In determining the nitrogen-content of wort, a weighed quantity of the wort is usually treated with a trace of yeast and allowed to ferment, prior to concentration and decomposition with sulphuric acid. As a result of the fermentation, the liquid is less liable to froth during concentration, and the danger of caramelisation and consequent loss of nitrogen, are diminished. The yeast, however, contains nitrogen, and since it is added in unknown quantity to the wort, the author condemns its use. He recommends that the wort should be concentrated at a uniform temperature of 150° C., and to this end, the flasks containing the samples of wort are placed in an evaporating apparatus maintained at this temperature; the wort may thus be evaporated to a syrup without the occurrence of any frothing or caramelisation. The author shows that the determination of nitrogen in the syrup thus obtained, gives uniform results, whereas if the wort is evaporated at 200° C., or on an asbestos card over a naked flame, the results may differ considerably. —L. E.

Alcohol; Manufacture of —— *from sugar-beets.* K. Antal. Z. Spiritusind., 1911, **34**, 239—240, 252—253.

Within recent years sugar-beets have come to be used extensively in Austria-Hungary as a substitute for potatoes in the production of spirit, the quality and quantity of potato-crops having fallen off in consequence of disease. Maize and molasses have also been employed as substitutes but the latter is now too expensive to be worked economically. A number of new distilleries have been erected in which the extraction of sugar from the beets is carried out by the diffusion process, but it has been found possible to use the plant hitherto employed with potatoes, for extracting the beets by heating with steam under pressure (*e.g.*, in a Henze converter). The author deals only with the latter process. The beets are freed from leaves in the autumn and then topped, so that the top forms a kind of pyramid. The roots and tops are stored separately in heaps covered with earth, but open at the top for evaporation until early frosts, when they are completely covered. The beets so stored lose sugar during the winter and should therefore be used as soon as possible after harvest (*i.e.*, before potatoes). The loss of sugar by the middle of March should not exceed 3 per cent. in normal winters, and as it is somewhat greater in the case of tops than with roots the former should be worked off first. For the steaming operation a pressure of two atmospheres, maintained for 1¼—1½ hours, is sufficient, all the sugar being dissolved, and the beet tissue reduced to a pulp. When potatoes and beets are worked together the lower half of the converter is filled with potatoes and the upper half with beets. After the steaming of the potatoes is completed they are blown out into the fermenting vessel and treated with the requisite quantity of malt for saccharification of the starch. The beets require longer steaming and are left in the converter for another half-hour. "Potato-, lactic acid- or sulphuric acid-yeast" is employed for fermentation. This method of working, however, is not always satisfactory. It is better to steam the potatoes (or maize) and beets separately, the potato mash being fermented at a temperature not exceeding 25° C. for 24 hours, after which the beet mash is well stirred in with it, and fermentation allowed to proceed for another 24 hours, by which time it is complete. In working pure beet mashes alone, beer yeast is sometimes used, 15—20 litres of pressed yeast being added to 1000 litres of the mash, and after 24 hours, during which about two-thirds of the sugar is fermented, a further quantity of fresh beet mash is added, and fermentation continued for another 24 hours. Culture yeasts are, however, preferable to beer yeast and the best results have been obtained with a pure culture wine yeast capable of fermenting sucrose and raffinose. In working by this method the yeast is grown for 24 hours in a portion of the beet mash which has been treated with sulphuric acid (to bring its acidity up to 0·7°) and with Bauer's yeast extract, the temperature being kept below 30° C. After 24 hours this partially fermented mash is mixed with fresh beet mash, a portion of the latter being reserved for growing the yeast for the following day's brew. The temperature of the main mash is maintained at 29° C. for 8—10 hours, after which the temperature does not tend to rise. Fermentation is complete 24 hours after mixing. It is immaterial whether the fermenting vats are closed or open, since there is little danger of infection. The distillation may be carried out as in the case of potato spirit. The quantity of absolute alcohol produced per 100 kilos. of sugar is about 60·4 litres, whereas when beer yeast is employed the yield of alcohol is only 54—55 litres. Economically the use of beets compares favourably with that of potatoes, and the residue from distillation, being used as fodder, passes again into the ground as manure.—J. H. L.

Alcohol denatured with wood spirit ; Injurious effect of —— on workers' health. Horbaczewski. Oesterr. Chem.-Zeit., 1911, **14**, 139—141.

The Bohemian Sanitary Authorities recommend that the use of wood spirit should no longer be permitted for denaturing alcohol for any purpose, as it is found that the health of those working with such denatured alcohol is liable to be seriously affected by the more or less poisonous impurities contained in the wood spirit together with the greater toxicity of the methyl alcohol itself in comparison with ethyl alcohol. For polishing and lacquering it is already permitted to use alcohol denatured with 5 per cent. of oil of turpentine or with pyridine bases, both relatively harmless mixtures, but the use of shellac is advocated as a denaturing agent for these industries.—A. Sbld.

Starch ; Determination of —— in brewers' grains. C. Kreuzer. Z. ges. Brauw., 1911, **34**, 277—280, 290—293.

None of the methods previously proposed, such as treatment with malt extract, give accurate values for the proportion of starch remaining in brewers' grains. The author employs the following method, which is found to give good results. An average sample of the dried grains, washed or unwashed, is ground as finely as possible in the Seck mill. 2·5 grms. of the well-mixed sample are stirred with 10 c.c. of water and then with 20 c.c. of sulphuric acid of sp. gr. 1·7. After a quarter of an hour, the whole is washed into a 100 c.c. flask by means of sulphuric acid of sp. gr. 1·3, which is also used to make the volume up to 100 c.c. after addition of 5 c.c. of 8 per cent. phosphotungstic acid solution. The liquid is vigorously shaken and filtered through a double filter, 50 c.c. of the filtrate, placed in a stoppered bottle of about 200 c.c. capacity, being cooled to 1° C. by immersion in ice-water. Exactly 5 c.c. of $N/100$ iodine solution are then added, the liquid being well mixed and placed for a few minutes in the ice-water. 100 c.c. of petroleum spirit at 1° C. are then introduced into the bottle, which is stoppered and shaken vigorously for a minute. After again cooling in ice-water, 50 c.c. of the red petroleum spirit solution of iodine are placed in a flask of about 75 c.c. capacity and titrated with $N/100$ sodium thiosulphate solution, about 5 c.c. of starch solution being well shaken up with the liquid towards the end of the titration. In this way the iodine which has not combined with the starch is determined, and that which has combined can hence be calculated ; from the latter number the amount of starch is given, 1 c.c. of $N/100$ iodine corresponding with 0·025 grm. of starch. The results are rendered more accurate by allowing for the volume occupied by the grains, this being 1·85 c.c. per 2·5 grms. Since the amount of material employed for the determination is so small, it is advisable to duplicate or triplicate the results and take the mean of the values obtained. As a smaller quantity of the grains than 2·5 grms. could hardly be used advantageously, the method is applicable only where the air-dried grains contain not more than 4 per cent. of starch.—T. H. P.

Patents.

Priming malt liquors ; Preparation for ——. J. and H. Heron, London. Eng. Pat. 18,925, Aug. 11, 1910.

Sweet whey (freed from most of its protein matter), whey powder or milk sugar is brought to a syrup of gravity 1200—1250 or more, and heated with 2 per cent. or more of a suitable acid such as sulphuric acid, whereby the milk sugar is converted into a mixture of galactose and dextrose. After neutralising the acid with chalk, lime, etc., and filtering, the filtrate may be used as priming directly or after concentration, or may be further treated with sucrose, dextrose, caramel or other carbohydrate. It is possible by this process to make use of whey powder or crude milk sugar containing objectionable protein matter, for the latter is removed by the treatment described.
—J. H. L.

Non-alcoholic extracts suitable for the manufacture of liqueurs ; Manufacture of concentrated ——. A. Zwergel, Stettin, Prussia. Eng. Pat. 16,857, July 14, 1910.

See Fr. Pat. 418,196 of 1910 ; this J., 1911, 44.—T. F. B.

XIXa.—FOODS.

Perishable foodstuffs ; Handling, transportation and storage of ——. J. S. Hepburn. J. Franklin Inst., 1911, **171**, 585—598.

This paper is the first part of a review of the work of the Food Research Laboratory of the Bureau of Chemistry of the U.S. Department of Agriculture. It deals with the function and equipment of the laboratory, and briefly indicates the results of the study of the changes taking place in poultry preserved by cold storage. In the preparation of an aqueous extract of flesh, the meat and water are placed in stoppered bottles on an upright wheel which revolves so slowly that extraction is brought about without the formation of an emulsion ; the bottles are then transferred to a centrifuge and revolved, after which the supernatant liquid is removed by filtration and the extraction repeated. The ammoniacal nitrogen in the flesh is estimated by mixing the meat with magnesia and water in a flask and drawing a current of air through, the ammonia liberated being drawn into standard acid. The results of the study of the distribution of nitrogen in the flesh of fowls show that under prolonged freezing, proteolysis goes on and the relative amount of nitrogen as amino-acids increases. The fat also undergoes change, its acid value increasing from 0·8 to 2·5 after four months' storage. At the same time the saponification value and the Hehner value of the fat both show marked decreases, indicating a type of decomposition differing from that observed at ordinary temperatures. In the bacteriological examination, it was found that organisms easily survived the freezing even for four years, but they were mainly of an aërobic type. Histological examination of muscle revealed progressive changes during cold storage suggesting auto-digestion and differing greatly from those occurring during putrefaction.—J. H. J.

Lecithin [; Determination of —— in foods]. R. Cohn. Z. öffentl. Chem., 1911, **17**, 203—217.

This is a long paper reviewing the methods of estimation of lecithin in foods and giving results of the author's own experiments. The chief points brought out may be summarised as follows:—The reason that lecithin cannot be extracted completely by ether is that it is in the colloidal state and is adsorbed by the colloidal albumin. This is borne out by the fact that the use of hot alcohol is not necessary for completing the extraction, cold alcohol being sufficient. By extracting with ether and cold alcohol in succession the whole of the lecithin is recovered except a very small amount present as phosphatide insoluble in cold alcohol. Extraction of lecithin by ether followed by alcohol is satisfactory provided it is done in the cold. The use of a mixture of ether and alcohol is not reliable in presence of phosphoric acid; in this case the alcoholic extract should be treated with chloroform and the estimation carried out on this latter extract.—J. H. J.

Butter fat; The examination of —— by Ewers' method. C. Amberger. Z. Unters. Nahr. Genussm., 1911, **21**, 598—606.

The investigations carried out by the author show that abnormal milk is yielded by cows at the end of the lactation period, particularly if the cows are old or are fed largely upon cocoanut cake. Such milk gives a butter fat which has a very low Reichert-Meissl value and when examined by Ewers' method (this J., 1910, 712), gives results which are similar to those quoted by Ewers for butter fats containing 10 per cent. and upwards of palm fats. For the examination of such butters Ewers' method possesses no advantage over other known methods.—J. A.

Sulphur dioxide in commercial gelatin. Leffmann and La Wall. *See* XV.

Determination of lime and potash in the ash of cereals. Thompson and Morgan. *See* XVI.

Determination of gum in syrups. Rocques and Sellier. *See* XVII.

Determination of starch in brewers' grains. Kreuzer. *See* XVIII.

Treatment of creamery sewage by the septic tank process. Bowles. *See* XIXb.

Patents.

Baking powder; Manufacture of ——. E. Oetker, Bielefeld, Germany. Eng. Pat. 842, Jan. 12, 1911.

Claim is made for a baking powder containing sodium bicarbonate, ammonium phosphate ($NH_4H_2PO_4$) and tartaric acid (or other organic acid) preferably in the proportions 23·5 : 20 : 2 of the respective constituents. The organic acid is intended to prevent any injurious effect on the colour, flavour or aroma of the baked article, caused by ammonia left free or as ammonium carbonate after completion of the reaction between the sodium bicarbonate and ammonium phosphate. In order therefore that the acid may dissolve after the other constituents on baking, it may be coated with wax, or if the other ingredients are also coated (*e.g.*, with 2 per cent. of wax) the acid may have a thicker coating (*e.g.*, 4 per cent.) or one of a wax of higher melting point.—J. H. L.

Milk; Method of concentrating ——. E. E. Claussen, Hartford, Conn. U.S. Pat. 993,224, May 23, 1911.

The milk flows continuously and is subjected at different points, where it is made to accumulate, to the action, suitably varied, of heat and compressed air, in such a way that no coagulation of albumin occurs. Or it may be submitted to progressively decreasing temperatures and to air under progressively decreasing pressures.—J. H. L.

Soya flour and its derivatives, and food and condimentary products having a soya bean basis. Yu Ying Li. Fr. Pats. 424,124 and 424,125, Dec. 27, 1910.

(1) Flour is prepared from the soya bean, either by grinding selected material containing relatively little fat, or by pressing out the oil from the beans and grinding the pressed cake. The flour thus obtained (mixed with other flour if desired) is used in the preparation of articles of food, such as pastes (of the macaroni type), soup, bread, biscuits, etc., bread made from soya flour being recommended in cases of diabetes. (2) Claim is made for two classes of food products made from cooked soya beans: (*a*) Fermented and salted products; (*b*) non-fermented sugared products, such as sweetmeats and powder for use in cooking and confectionery. For the former, the beans are cooked, and the cooked product, which may be mixed with other flour, is kept at a suitable temperature, after adding ferments such as the soya bacillus. When fermentation has reached the proper stage, the product is placed in vessels containing salt water and is kept warm until mature: it is then crushed, if soya paste be required, or more salt water is added and the mixture is filtered, which gives soya sauce, spice or sugar being added if desired; either sauce or paste may be desiccated. To prepare the sweetmeat, the beans are decorticated, cooked, and crushed, and the pulp is mixed with one-third of its weight of sugar. Dried fruits, etc., may also be added, or the product may be dried and used as powder.—F. Sodn.

Starch and gluten from flour; Apparatus for the extraction of ——. G. Baugue. Fr. Pat. 424,131, Dec. 27, 1910.

The machine consists of a perforated cylindrical drum of corrugated iron (about 1·5 mm. in thickness), which is mounted on an axle over a trough and is supplied with water by a perforated pipe arranged longitudinally above. The corrugations, which are 4—6 cm. deep and run parallel to the axis of the drum, serve in turn, as this is rotated, to collect the water and deliver it uniformly and continuously to the interior: the whole of the starch is thus extracted with a minimum quantity of water, and, moreover, no paste is lost through the perforations, even if flour of inferior quality be employed. A hinged door is provided in the drum for the introduction of paste and the removal of gluten.—F. Sodn.

Producing edible and odourless fat from cocoanuts. U.S. Pat. 992,525. *See* XII.

Preparing stock food and oil from cotton-seed. U.S. Pat. 994,088. *See* XII.

XIXb.—WATER PURIFICATION; SANITATION.

Creamery sewage; Treatment of —— by the septic tank process. J. T. B. Bowles. J. Ind. Eng. Chem., 1911, **3**, 400—403.

Creamery sewage consists essentially of pieces of cheese, butter, skim milk, whey, etc., diluted by washings from the floor, churns, and pasteurisers. It contains much more organic matter than ordinary town sewage and differs from the latter in that a considerable time elapses before putrefaction begins, the putrefactive bacteria being suppressed by the lactic acid organisms until the latter have decomposed the sugar present. Experiments have shown that if the creamery sewage be left in the septic tank for six days, there is a reduction of 60—65 per cent. of the organic matter, the solid particles are liquefied and decomposed, and a stable effluent, free from putrid odour, is obtained. This effluent, if it cannot be discharged into a stream, should be run on to a pasture or field or on to a gravel bed.—A. S.

Water; Rapid test for nitrites and nitrates in —— by means of a new hydro-strychnine reagent. G. Denigès. Bull. Soc. Chim., 1911, **9**, 544—546.

A hydrogenised strychnine solution used by the author as a test for bromine (see under VII., page 802), also serves as a delicate reagent for detecting and determining colourimetrically traces of nitrites and nitrates in potable waters. 0·5 c.c. of the reagent added to 10 c.c. of the water gives a rose tint with as little as 0·01 mgrm. of nitrous acid per litre.

In the absence of nitrites, nitrates can be detected by the reagent, but only after the addition of about 5 c.c. of pure concentrated sulphuric acid. If both nitrites and nitrates are present and the latter in greater quantity, the former are determined colourimetrically first, and the increase of colouration obtained after addition of sulphuric acid indicates the nitrates. If the nitrites be present in larger quantity, 10 c.c. of the water are evaporated to dryness after addition of 2 drops of ammonia and 3—4 drops of acetic acid, and the residue taken up in 10 c.c. of distilled water. This operation may require repetition 2 or 3 times. No reaction should now be obtained with the reagent alone, and if nitrates be present a colouration is obtained by the further addition of 5 c.c. of sulphuric acid. The limit of sensitiveness of the reaction in the case of nitrates is 0·5 mgrm. of nitric acid per litre. Chlorides do not interfere with the reaction.—A. Sbld.

Patents.

Liquids; Apparatus for treating —— with ultra-violet rays. V. Henri and A. Helbronner, Paris, and M. von Recklinghausen, Bas Meudon. France. Eng. Pats. 12,948, May 27, 1910, and 18,458, Aug. 4, 1910.

Various forms of apparatus are described for treating opaque liquids with ultra-violet rays, the essential feature of each modification of the apparatus being that the liquid is caused to pass before the lamp in the form of a thin layer. For this purpose the liquid may be passed through a shallow channel or tube, preferably of circular cross section, the lamp being suspended in the centre of the circular vessel. The side of the channel opposite the lamp is constructed of quartz or of glass which is permeable to the rays, and this side of the channel may be cooled by means of sprays of water. The cooling may also be effected by filling the space between the lamp and the channel with water. The liquid may also be passed between plates which are permeable to the rays, or a number of flat channels may be employed.—W. P. S.

Water; Combined apparatus for producing perfectly pure —— by distillation, and combining the same with oxygen. J. S. Pearson, Liverpool. Eng. Pat. 30,247, Dec. 30, 1910.

Steam from a boiler is admitted into a coil fitted at the bottom of a distilling chamber, this chamber being supplied with hot water from a condenser. The evaporated water from the distilling chamber passes through the condenser and is collected in a tank which also receives the excess steam from the heating coil, both water and steam passing through baffle-plates or sieves at the top of the tank. The hot water collecting in the latter is then delivered through a valved pipe into a second distilling chamber which is also heated by the steam from the boiler. The vapours from this chamber are conducted to a condensing chamber where they are mixed with oxygen and subjected to an electrical discharge, and the condensed water is then collected.—W. P. S.

Waste-waters; Apparatus for the purification of ——. H. Desrumaux. First Addition, dated Dec. 30, 1910, to Fr. Pat. 411,428, Jan. 10, 1910 (this J., 1910, 974).

An increased rate of fermentation, in the apparatus previously described, is brought about by conserving the heat generated in the process. This is effected by mixing the filling material in the neighbourhood of the supply pipes and in the stratum below the active portion of the bed with waste asbestos, a layer of which also covers the active zone; oxidation of the organic matter is thereby greatly accelerated.—F. Sodn.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Atropa Belladonna; Influence of nutritive elements on the growth and on the content of total alkaloid of ——. S. Vreven and C. Schreiber. Ann. de Pharm., March, 1911, 97. Pharm. J., 1911, 86, 843.

Wild belladonna is generally more active than the cultivated plant, and this may usually be attributed to the influence of the nutritive elements of the soil upon which it grows. The small proportion of alkaloid so often found in the cultivated plants may be attributable either to deficiency or excess of the necessary food, or to a want of equilibrium among the nutritive elements, *i.e.*, nitrogen, phosphoric acid, and potash. Experiments have been made with soil deprived of the nutritive elements, and adding to it suitable manure. The results are summarised thus:—Belladonna is shown to be very susceptible to the action of phosphoric acid, nitrogen, and especially potash. The want of these elements is seen in a distinct lowering of the yield. Plants cultivated in pots containing no added manure perish rapidly. The depression in the yield is much more pronounced in the roots than in the other organs of the plant. The time of flowering is retarded by absence of nitrogen and phosphorus, but not by that of potash. Plants deprived of the three elements referred to present a characteristic colouration; without nitrogen, they are chlorotic; without phosphorus, there is a violet tint, particularly of the veins; without potash the plants are flabby. As to the alkaloidal content, the leaves of plants, grown on soil poor in nitrogen or phosphorus, contain little alkaloid, while in the case of plants cultivated in the absence of potassium salts, the leaves are rich in alkaloid. The experiments were made with a fertiliser having the following composition:—Ammonium nitrate, 10 grms.; disodium phosphate, 12 grms.; potassium carbonate, 5 grms.; calcium carbonate, 4 grms.; magnesium carbonate, 4 grms. The results obtained by omitting one or other of the ingredients are as indicated above. The cultures were made on a muddy earth of average consistence (*l'alluvion de la Herck*), to 22 kilos. of which the above quantity of nutritive mixture was added.

Strychnine; Theory and rational modification of Malaquin's reaction for ——. G. Denigès. Bull. Soc. Chim., 1911, **9**, 537—542.

Malaquin's colour reaction for strychnine, obtained with concentrated sulphuric acid after reduction of the alkaloidal solution by means of zinc and hydrochloric acid (this J., 1910, 108), is found to be due to the presence of traces of nitric or nitrous acid, which give red colourations with the tetrahydrostrychnine and strychnidine formed on reduction of the strychnine. Several other oxidising agents give red colourations with these reduction products (see this J., 1898, 945). Sodium nitrite solution (1:1000) added alone to the reduced alkaloidal solution gives a red colouration characterised, when sufficiently intense, by two absorption bands in the greenish blue portion of the spectrum ($\lambda = 495$ and 510). The reaction is discernible with as little as 0·003—0·004 mgrm. of strychnine in 1 c.c. of liquid. Sodium nitrate solution (1:1000) gives a similar colouration but requires the addition of concentrated sulphuric acid, the limit of sensitiveness being about 0·005 mgrm. per c.c. Bromine water gives a fine purple colouration, the test being of equal delicacy. These reactions can be utilised for colourimetric determinations. All the colourations disappear on addition of some stannous chloride, but return on heating with hydrogen peroxide.—A. Sbld.

Buphane disticha; The constituents of the bulb of ——. F. Tutin. Chem. Soc. Proc. 1911, **27**, 149.

Buphane disticha, Herb., is a bulbous plant, indigenous to South Africa, and has long been known to possess toxic properties. The living, inner portions of the bulb contain an abundant amount of alkaloid, whilst the dry, outer layers are free from such a substance. An alcoholic extract of the inner portions of the bulb, when distilled with steam, yielded a small amount of an essential oil containing furfuraldehyde. The portion of the non-volatile product which was soluble in water yielded a small amount of acetovanillone (4-hydroxy-3-methoxyacetophenone), a quantity of chelidonic acid, and considerable amounts of copper and lævulose. It also gave a mixture of alkaloids, the principal constituent of which is an amorphous, strongly basic product, designated *buphanine*, which possesses a physiological action similar to that of hyoscine. A weakly basic alkaloid, and one soluble in water, together with small amounts of narcissine,

$C_{16}H_{17}O_4N$, were also obtained. The weakly-basic alkaloid is a convulsant poison, whilst the base soluble in water resembles colchicine and narcissine in its action. Buphanine, on hydrolysis, is converted into a crystalline alkaloid, *buphanitine*, $C_{23}H_{24}O_6N_2$, which melts at 240° C. *Buphanitine hydrochloride* and *methiodide* were also prepared. The portion of the original extract which was insoluble in water consisted of amorphous products, together with pentatriacontane, a phytosterol, ipuranol, $C_{23}H_{38}O_2(OH)_2$, and a mixture of fatty acids, both free and combined.

Microsublimation methods; Development of ——; and the recognition of arbutin in plants. O. Tunmann. Ber. deuts. Pharm. Ges., 1911, 21, 312—319.

The plant-material to be examined is powdered as far as possible and placed on an object-glass with 2—3 drops of 10 per cent. hydrochloric acid. The whole is stirred and then allowed to stand for a few minutes. The glass is placed on an asbestos plate and covered with another glass, a space of 3 mm. separating the two. The arrangement is supported 50 mm. above the base of a spirit-lamp flame, which is 10 mm. high. Using 0·03 to 0·05 grm. of substance, several crystalline sublimates can be obtained. If arbutin be present in the plant, it is hydrolysed by the acid, and a sublimate of quinol is obtained. The crystals in the sublimate have a characteristic appearance and diagrams of them are given. When the sublimate is dissolved in ammonia on the object-glass and the solution allowed to evaporate, colourless crystals are obtained surrounded by a reddish-brown ground-substance. The presence of arbutin was recognised in the following plants by this means: *Arctostaphylos uva ursi* Sprengel, *Vaccinium myrtillus* L., *Kalmia angustifolia* L., *Pirola rotundifolia* L. —F. Shdn.

Meliatin, a new glucoside hydrolysable by emulsin, from marsh trefoil. M. Bridel. Comptes rend., 1911, **152**, 1694—1696.

The entire plant of the marsh trefoil (*Menyanthes trifoliata* L.) was extracted with boiling alcohol. A glucoside, meliatin, $C_{15}H_{22}O_9$, was isolated from the extract. The yield was about 30 grms. from 23 kilos. of the plant. It has a bitter taste which becomes stronger after a short time. It melts at 223° C. on the Maquenne block and at 222° C. (corr.) in a capillary tube. The optical rotation in aqueous solution is $[\alpha]_D = -81{\cdot}96°$. It has no reducing action upon Fehling's solution, and when hydrolysed by emulsin, dextrose is produced.—F. Shdn.

Kolatein, a second phenolic constituent of kola. A. Goris. Bull. Sci. Pharmacol., March 1911, 138. Pharm. J., 1911, **86**, 809.

The compound in question is quite distinct from kolatin (this J, 1907, 484 and 713), but, like the latter, it dissolves in hot water, from which solution it is reprecipitated on cooling. In the mother liquors of the crystallisation of kolatin, the author found a certain number of large crystals, up to 1 cm. long and 2 to 5 mm. thick, which could easily be separated by hand. These crystals may be purified by successive crystallisations from water after decolourisation with animal charcoal, or by solution in acetone and treatment with chloroform. In the first case, acicular crystals analogous to those of kolatin are obtained; in the second case, very bulky prisms. The compound burns without residue, does not disengage carbon dioxide with potassium bicarbonate, is precipitated by lead acetate, coloured green by ferric chloride, and the solution becomes violet-red by the addition of ammonia. It is soluble in hot water, less so in cold, soluble in alcohol, acetone, methyl alcohol; insoluble in ether, chloroform, petroleum ether, and xylol. It yields hydrated crystals with water, anhydrous with but acetone. It behaves in some respects like phloroglucinol, it differs in its bitter taste, phloroglucinol being distinctly sweet; in the green colouration with ferric chloride, phloroglucinol giving a violet-blue; in its melting point, which is instantaneous at 257°—258°; that of phloroglucionol being 127°, while kolatin melts at 148°. While the author has not yet determined the precise nature of the new compound, he has provisionally given it the name *kolatëin*.

Caulophyllin; Reaction for ——. J. F. H. Gilbard. Analyst, 1911, **36**, 270—271.

For the identification of caulophyllin, a brownish-grey powder prepared from the Blue Cohosh (*Caulophyllum thalictroides*), 5 c.c. of an alcoholic extract, obtained by digesting 0·1 grm. of the powder in 25 c.c. of 80 per cent. alcohol and filtering, are evaporated to dryness in a flat porcelain capsule. The residue is taken up with 1 c.c. of water, 2 c.c. of concentrated sulphuric acid are slowly added, and the mixture is well stirred. An intense purple-blue colour, sometimes reddish purple, is produced within five minutes. The reaction appears to be characteristic, and may be applied to the detection of caulophyllin in a mixture of drugs by repeatedly extracting 0·1 grm. of the sample with 80 per cent. alcohol, filtering, and applying the test to the filtrate.—J. H. J.

Rosemary oil. P. Jeancard and C. Satie. Rev. gen. Chim. pure et appl., 1911, **14**, 125—131. Chem. Zentr., 1911, **1**, 1690.

Genuine rosemary oil, whether of French, Austrian (Italian), Spanish or African origin, should possess the following characters:—Sp. gr. at 15° C., 0·900—0·920; optical rotation, 0° to +12°; saponification value after acetylation, 35—60; total borneol, 9—18 per cent.; soluble in 0·1 to 0·5 part of 90 per cent., and in 0·5 to 1 part of 86 per cent. alcohol at 15° C. It is stated that determinations of solubility in 80 per cent. alcohol and of the content of bornyl acetate have no special value. Adulteration with sage oil can be easily detected by the different characters of the latter oil: sp. gr. at 15° C., 0·925—0·930; optical rotation, +10° to +20°; saponification value after acetylation, 70—90; soluble in 1—2 parts of 80 per cent., 1·5—5 parts of 75 per cent., and 8—12 parts of 70 per cent. alcohol respectively.—A. S.

Wallflowers; Essential oil of ——. Kummert. Chem.-Zeit., 1911, **35**, 667—668. (See also this J., 1908, 138; 1909, 106, 1164; 1910, 1131).

By extracting the flowers of *Cheiranthus Cheiri*, L., with low-boiling solvents, a dark coloured pasty extract is obtained, which (after evaporation of the solvent and separation from fatty and waxy matters by strong alcohol) yields on distillation with steam, a yellowish oil of unpleasant odour, having a specific gravity of 1·001, and distilling under 3 mm. pressure between 40° and 150° C. The yield is about 0·06 per cent. The alcoholic solution shows a feeble bluish fluorescence. A highly diluted alcoholic solution possesses the characteristic odour of the flowers. The oil is found to contain: Compounds resembling mustard oil, ketones and aldehydes (having the odours of violets and hawthorn), nerol, geraniol, benzyl alcohol, linalool, indole, methyl anthranilate, acetic acid (probably in combination with benzyl alcohol and linalool) salicylic acid (probably as methyl salicylate), and traces of phenols and lactones.—A. Sbld.

Limonene; Hydrogenation of ——. G. Vavon. Comptes rend., 1911, **152**, 1675—1677. (See this J., 1910, 44 and 706).

Limonene, when shaken with platinum black in an atmosphere of hydrogen, absorbs the latter to form the fully saturated cyclic hydrocarbon, $C_{10}H_{20}$. It is now found that the reaction takes place in two stages, a dihydride being formed first. This may be followed by observing the change in the optical rotation, which is slow during the formation of the dihydride, and rapid during the latter part of the reaction when the fully saturated compound is being formed. Dihydrolimonene was prepared from limonene by stopping the hydrogenation at the end of the first stage. This substance boils at 175°—177° C., has $n_D = 1{\cdot}4563$ at 18° C., and sp. gr. 0·8246 at 18°/4° C. The optical rotation for yellow light is $[\alpha]_{578} = +118°$, and for blue light $[\alpha]_{436} = +234°$. The dibromide, $C_{10}H_{18}Br_2$, boils at 136°—140° C. at 16 mm., and the nitrosochloride melts at 95°—96° C.—F. Shdn.

Pyridoacetopyrocatechol and related bases. C. Mannich and O. Hübner. Ber. deuts. Pharm. Ges., 1911, **21**, 294—297.

Bases analogous to adrenaline can be obtained by heating pyridine and the like with chloracetopyrocatechol. Occasionally ω-bromacetoveratrone $(CH_3O)_2{:}C_6H_3{\cdot}CO{\cdot}CH_2Br$. can be used, and combined with the same bases, the products being subsequently demethylated. The hydrochloride of the condensation product of pyridine and chloracetopyrocatechol. $(HO)_2:C_6H_3{\cdot}CO{\cdot}CH_2(NC_5H_5)Cl$, melts at 272° C., and the free base at 199° C. Bromacetoveratrone and pyridine condense to form a hydrobromide melting at 258° C.; the free base could not be separated. The methyl groups were removed by heating with hydrochloric acid, when the same substance was produced as that obtained by condensing pyridine and chloracetopyrocatechol. Piperidine and chloracetopyrocatechol condense in the same way, the hydrochloride of the product melting at 257° C., and the free base at 199°—205° C. Quinoline and bromacetoveratrone give a similar product, the hydrobromide of which melts at 222° C. When demethylated with hydrochloric acid, a hydrochloride was obtained melting at 248° C., and giving the reactions for pyrocatechol.—F. Shdn.

Ethyl acetate; Preparation of ——. A. Kurtenacker and H. Habermann. J. prakt. Chem., 1911, **83**, 541—552. (See this J., 1909, 1222).

Alcohol and acetic acid were boiled with various metallic salts and the rate of esterification was determined. Sodium metaphosphate has no influence on the rate of esterification. Sodium sulphate has practically no action. The sulphates of copper, zinc, and magnesium increase the formation of the ester, the influence of each being about the same. Nickel sulphate was found to have the greatest accelerating effect. The following method for the preparation of ethyl acetate is stated to give the most satisfactory yield. Equivalent quantities of alcohol and acetic acid are mixed in a flask. Anhydrous nickel sulphate is then added in quantity more than sufficient to combine with the water liberated in the reaction. The flask is connected with a condenser, which can serve as a reflux or for distillation. The whole is heated on the water-bath till the vapour shows a temperature of 73° C. The ester is then distilled off, care being taken that the temperature does not exceed this point. When the temperature rises, the distillation is stopped and the flask heated under a reflux till 73° C. is reached again. The ester is then distilled off. The ethyl acetate obtained by this process is purified in the usual way.—F. Shdn.

Fatty acid esters; Catalytic preparation of —— *in the wet way.* J. B. Senderens and J. Aboulenc. Comptes rend., 1911, **152**, 1671—1673.

The following esters can be prepared directly from the alcohols and acids on an industrial scale, using sulphuric acid (1—2 per cent.) as a catalyser:—Methyl and ethyl formates, methyl, ethyl, propyl and amyl acetates, ethyl propionate and isoamyl isovalerate. The yields are as good as those obtained by decomposing a salt of the organic acid by means of an acid in presence of the alcohol, and the method is much simpler.—F. Shdn.

Water, ethyl alcohol, ether; Equilibrium in the system ——. S. Horiba. Mem. Coll. of Sci. and Eng., Kyoto Imp. Univ., 1911, 3, 63—78.

The author has determined the three physical properties, specific gravity, index of refraction, and specific viscosity at 25° C. for various mixtures of water, ethyl alcohol, and ethyl ether. From these data, curves have been obtained representing mixtures of given specific gravity, given refractive index and given viscosity. With the aid of these series of curves it is possible to analyse the ternary liquid mixtures in certain parts of the system. The part of the binodal curve which corresponds to the composition of the upper layer was determined directly, since in that part of the system the above curves are almost parallel and the point of intersection is difficult to locate. Determination of conjugate points leads to the completion of the diagram and to a complete determination of the equilibrium by means of the binodal curve and tie lines joining conjugate points. The critical point of the system at 25° C. is water, 40; alcohol, 28·4; and ether, 31·6 per cent.
—W. H. P.

Anaesthetics; Chemistry of ——. *I. Ethyl ether.* C. Baskerville and W. A. Hamor. J. Ind. Eng. Chem., 1911, 3, 301—317, 378—398.

The authors discuss in detail the requisite quality of ether for anæsthetic and analytical purposes; the impurities which may be present, or produced in consequence of improper storage; and methods for their detection, determination, and removal. They have adopted the following classification as a basis for discriminating the various grades of ether:—(A). Pure ether. (B). Anhydrous ether—free from water, but may contain traces of ethyl alcohol and acetaldehyde. (C). Anæsthetic ether—should comply with pharmacopœial requirements; may contain up to 4 per cent. of ethyl alcohol, and traces of acetaldehyde, acids, and water, but in the authors' opinion it would be preferable to exclude completely the three last mentioned. (D). Commercial ether—should contain at least 95 per cent. by weight of ether. For ordinary analytical purposes, anæsthetic ether is suitable. The standards prescribed in the different pharmacopœias are not uniform; some of the tests are unnecessarily rigid, others might be replaced by better ones, and in some cases new tests for impurities not hitherto considered should be incorporated. The most common impurity of anæsthetic ether is acetaldehyde and its presence may account for some of the abnormal effects observed in practice. It is stated that all impurities objectionable in ether for anæsthetic purposes can be removed by treatment with sodium (see Stollé, this J., 1903, 227). With regard to the production of explosive compounds in ether during improper storage (compare this J., 1887, 680; 1896, 919; 1902, 789; 1905, 288, 558, 816), experiments are described which show that peroxides or peroxidised compounds may be formed in ether of all grades which is improperly stored, especially when partly filled containers are exposed to varying atmospheric conditions for prolonged periods. The degree of oxidation is dependent upon the nature of the container, the purity of the ether, the amount of air present, and in the case of glass containers, the intensity of the light, which accelerates the oxidation. With regard to the nature of the containing vessel, reference is made to the work of Barnes and Shearer (J. of Phys. Chem., 12, 155, 468) who showed that it is probable that all metals which exhibit anomalous anodic conductivity are likely to develop hydrogen peroxide in contact with water and oxygen. Ether should not be stored in glass vessels for any length of time without being tested for oxidation products before use. In laboratories ether should always be kept over mercury or sodium in completely filled, well-stoppered dry glass bottles, preferably those made of "non-soluble" blue, green, or brown glass, excluded from the light, in cool dry places. Peroxides may be removed from ether by means of ferrous hydroxide (see Garbarini, this J., 1909, 1004), as well as by mercury as recommended by Ramsay. It has been frequently assumed that vinyl compounds are formed in ether during storage, but it is pointed out that the reactions ascribed to vinyl compounds are also given by acetaldehyde, which is almost invariably present in ether. The following scheme is recommended for the examination of ether for anæsthetic and analytical purposes:—1. *Specific gravity.*—This should not exceed 0·720 at 15° C. if ether containing minimum quantities of water and alcohol is required, but as the presence of ethyl alcohol is frequently regarded as desirable in ether for anæsthetic purposes, a sp. gr. of up to 0·724 may be allowed for ether in which alcohol is the only foreign substance. (Compare also Squibb, this J., 1884, 531; Klar, this J., 1896, 612). 2. *Boiling point.*—For anæsthetic ether at least 97 per cent., and for anhydrous ether 99·5 per cent. should distil between 34° and 36° C.; the former should distil completely at 37° and the latter at 36° C. In the case of ether for manufacturing purposes it is sufficient to specify that at least 98 per cent. should distil below 42° C., and that less than 0·002 per cent. of residue should be left after 1 hour at 100° C. (See also Wade and Finnemore, this J., 1909, 1222). 3. *Organic impurities.*—20 c.c. of the ether are added, drop by drop, to 20 c.c. of concentrated sulphuric acid, shaking gently after each addition, and keeping the acid cool. No colouration should be produced (see Traub, this J., 1893, 629). 4. *Odour.*—50 c.c. of the ether when allowed to evaporate on filter paper should impart no odour to the latter. 5. *Residue* (*extractive matter, odour, and acidity*).—(1) When 25 c.c. of the sample are allowed to evaporate in a glass dish, the moist residue should be odourless and should neither redden nor bleach blue litmus paper, and when evaporated on the water-bath should leave no residue. (2) 100 c.c. of the sample are allowed to evaporate until the volume is reduced to about 15 c.c.; the colourless residue should comply with the following tests:—(*a*) When 5 c.c. are mixed with 2 c.c. of water and allowed to evaporate, the residue should neither redden nor bleach light-blue litmus paper. (*b*) When 5 c.c. are allowed to evaporate on a 9 cm. filter paper, no foreign odour should be perceptible as the last portions evaporate from the paper, and the latter should be left odourless. (*c*) When 5 c.c. are mixed with 5 c.c. of concentrated sulphuric acid, no colouration should be produced. 6. *Acidity.*—When 20 c.c. are shaken with 10 c.c. of water and 2 drops of phenolphthalein, the same depth of colour should result on adding an equal volume of $N/100$ potassium hydroxide solution as is produced in a control test with water alone. Addition of 0·3 to 0·5 c.c. of $N/100$ potassium hydroxide should produce an alkaline reaction with 20 c.c. of ether intended for analytical purposes, whilst if more than 1 c.c. of the alkali solution is required, the ether is unfit for anæsthetic purposes. The determination of the acidity is specially important in the case of ether to be used for manufacturing purposes. 7. *Water and alcohol.* (*Exclusion tests for pure and anhydrous ether*).—(1) For ether which does not possess the correct specific gravity, 10 c.c. are added to a minute quantity of powdered rosaniline acetate, which has been dried at 100° C., and the containing tube is corked and well shaken. Not even a faint amethystine colour should be produced; if a considerable colouration be produced, the amount of impurity is determined approximately by Allen's method (Analyst, 2, 97). It is suggested that rosaniline tannate, which is insoluble in water but soluble in alcohol, might be used for detecting the latter and for determining whether any colouration obtained with rosaniline acetate be due to water or to alcohol. (2). 10 c.c. of the ether are treated with a few mgrms. of anthraquinone and the same quantity of sodium amalgam; no formation of red (due to water) or of green (due to alcohol) substances should occur. This test serves to detect both water and alcohol, but for the latter water should only be present in traces. 8. *Water.* (*Exclusion tests for pure and anhydrous ether*).—Tests with anhydrous copper sulphate and with amalgamated aluminium (see Wislicenus and Kaufmann, this J., 1895, 898). (Compare also Vitali, this J., 1898, 864). The test for water depending on the production of a turbidity on shaking with carbon bisulphide is described as lacking in delicacy and comparatively worthless. 9. *Water and aldehyde.* (*Exclusion tests for pure and anhydrous ethers*).—15 c.c. of the sample are treated with a small piece of sodium; there should be only a slight evolution of gas, and after 6 hours the sodium should not have a white or yellow coating, and the ether should not be coloured or turbid. 10. *Acetaldehyde.* (1). The fuchsin-sulphurous acid test (François, this J., 1897, 704). (2). 5 grms. of solid potassium hydroxide in freshly broken pieces about 5 cm. diam., are covered with 30 c.c. of the sample and the mixture left for 6 hours, with occasional shaking, in a tightly closed vessel protected from the light: no colouration should be produced and the ether should not become turbid. This test is sufficient for anæsthetic ether, but for pure or anhydrous ether, the period of standing should be extended to 24 hours. (3) In the absence of alcohol, the presence of aldehyde may be detected by the yellow colouration or black precipitate produced when 10 c.c. of the ether are shaken with 2 c.c. of Nessler's reagent. Pure ether is indifferent towards Nessler's reagent, but the best of the samples purchased by the authors showed a yellow colour within 15 minutes. For anhydrous or anæsthetic ether it is sufficient to specify that no black precipitate should be deposited. 11. *Alcohol.*—(1) If water be present, the ether is dried over anhydrous potassium carbonate and then tested, in 10 c.c. portions, with (*a*) rosaniline acetate and (*b*) anthraquinone and sodium amalgam. (2) If not more than traces of acetaldehyde be present, alcohol may be detected by Lieben's iodoform test (see Hager, Z. anal. Chem., **9**, 492). (3) If acetaldehyde be present, the amount is determined in 25 c.c. by François' method (*loc. cit.*); and another 25 c.c. are shaken with an equal volume of water, the alcohol in the aqueous layer is oxidised with potassium bichromate and sulphuric acid, and the amount of aldehyde is then again determined; from the difference between the two results, the amount of alcohol can be calculated. For the rapid approximate determination of alcohol, a modification of the method of Nicloux (this J., 1906, 611) may be used. 12. *Peroxides.* (*Exclusion test for ether of all grades*).—There should be no liberation of iodine within 1 hour when 2 c.c. of a 10 per cent. solution of cadmium potassium iodide are shaken well with 10 c.c. of the sample. Jorissen's vanadic acid test (this J., 1903, 653) and other confirmatory tests may also be applied. The well known chromic acid test is considered inferior to the vanadic acid test owing to its comparative lack of delicacy and the instability of the blue colouration. (See also this J., 1892, 835; 1895, 295; 1903, 1067).—A.S.

Radium; Biological and therapeutic action of ——. Loewenthal. Z. angew. Chem., 1911, **24**, 1130—1131.

The therapeutic action of certain springs has been found to be due, in great part at least, to their radium content. The effects are probably to be traced to the action of radium emanation on the enzymes present in the body, for the author in conjunction with others has shown that diastatic enzymes, the autolytic enzyme, pepsin, and trypsin are rendered more active by the emanation. Radium emanation in small quantities also has a favourable effect on the growth of plant seedlings and lower fungi, but in larger quantities has an injurious action. Fofanoff has shown that the properties of white blood corpuscles are considerably modified by the action of radium emanation. Gudzent found that the solubility of monosodium urate is considerably increased by radium emanation (the effect is stated to be due solely to radium D, one of the disintegration products), and the use of radium emanation in the treatment of gout, based on this observation, has given favourable results.—A. S.

Camphor production in German East Africa. Board of Trade J., June 15, 1911.

According to the "Leipziger Neueste Nachrichten" of 28th May, Herr Lommel, the head of the Biological Station at Amani, German East Africa, has been successful in his attempt to grow camphor in that colony. It is hoped that the colony will be able to produce camphor in sufficient quantities to compete with the exporters from China and Formosa, who at present control the market. It is further stated that a method of obtaining the camphor from the leaves, that is to say without destroying the tree, has been successfully practised at the Biological Station.

Strobilanthes Dalzellii; Essential oil from ——. J. C. Umney. Perfumery and Ess. Oil Record, 1911, 2, 96.

The author has examined an oil distilled from the flower buds of the *Strobilanthes Dalzelli* (*S. lupulinus*), a coarse-growing, hairy plant, with glandular hairs, which is very common in the ghauts near Bombay, where it grows almost to the exclusion of other plants. It could probably be obtained in plenty. The oil has a very strong, decidedly pleasant odour, reminiscent of tarragon and lavender. It might be serviceable for the perfuming of soaps.

It has the sp. gr. 0·9648; refractive index, 1·4688; optical rotation, 16°30; acid value, 1·7; and ester value, 257.

Synthetic perfumery products. J. C. Umney. Perfumery and Ess. Oil Record, 1911, 2, 134—135.

The science of perfumes is one of the most delicate branches of chemistry. It is often not sufficient that a body should be chemically pure, from an analytical point of view, but it must be olfactorily pure, an indeterminable trace of impurity sometimes completely spoiling or altering the odour. These impurities also may not be in the first instance noticeable, but may react in the perfumes themselves, transforming the products. Synthetic perfumes as a class sometimes have been hastily condemned for this reason, whilst in addition it takes time and infinite skill to differentiate in the choice of products and to effectively use or blend them.

ALCOHOLS. *Alcohol Phenylethylic* gives the odour which is characteristic of the South of France roses, and which is so marked in French rose waters. It is a most valuable auxiliary to all rose-scented preparations, and harmonises well with all odours. It must, however, be chemically pure.

Alcohol Cinnamic, of hyacinth odour, very sweet, and particularly lasting. Principally prepared by extraction from storax and subsequent purification.

Alcohol Benzylic, weak in odour, and much used in compounding perfumes without alcohol.

Linalol, prepared from either Linaloe or Bois de Rose oils, and used in preparing artificial jasmine, ylang-ylang, orange, etc.

Rhodinol, extracted from geranium oil, and when purified to the utmost, gives a very beautiful odour. Readily distinguished from the geraniol from palmarosa or citronella oil. The latter always retains an unpleasant reminiscence of citronella.

Terpineol, one of the oldest and most generally employed of all synthetic products as a basis for lily of the valley and lilac perfumes.

ALDEHYDES AND KETONES. *Acetophenone* is useful for syringa perfumes, and has a very powerful odour. More especially useful in soap perfumery.

Aldehyde Duodecylic has a peculiar indescribable freshness, blending especially well with neroli types.

Anisic Aldehyde, or aubepine, has the delightful odour of hawthorn blossom, and is prepared both in solid and liquid forms.

Benzaldehyde, bitter almond oil, is principally employed in cheap soap manufacture.

Citral.—Three types are prepared, of which that from lemon oil is the most expensive. That from *Backhousia citriodara* ranks slightly above that prepared from ordinary lemongrass oil.

Citranellal is more retentive than citral, and is used in eau-de-Cologne soaps.

Methylacetophenone is used principally in mimosa and cassia perfumes.

Musks—Artificial.—Three types are prepared :—

1. *In small crystals*—melting point 113° C., but only sparingly soluble—7 grms. per litre—in alcohol, but more soluble in benzyl benzoate (200 grms. per kilo.).

2. *Musk ketone* 100 per cent., melting point 135° C., which better recalls natural musk.

3. *Musk ambrette*.—melting point 85° C., the odour of which differs from ordinary musk, and is much more powerful than the preceding.

ESTERS.

ACETATES.—*Phenylethyl Acetate* has the sweet odour of peach.

Benzyl Acetate has a fruity odour useful for essences of jasmine, ylang-ylang and neroli.

Geranyl Acetate, principally used for lavender types of soaps.

Linalyl Acetate is prepared especially from Bois de Rose femelle oil in preference to linaloe. It contains 85 to 92 per cent. of acetate, and is, of course, useful for bergamot types of perfumes.

Rhodinol Acetate is finer than acetate of geraniol, as in the case of the corresponding alcohols.

BENZOATES.—*Ethyl and Methyl Benzoates* are used in perfumes of the new-mown hay and meadowsweet types, the latter under the title of Niobe.

Benzyl Benzoate is used as a fixative, and especially as a vehicle for perfumes without alcohol.

Amyl Benzoate has a pleasant odour of anise.

SALICYLATES.—*Amyl Salicylate* is an excellent ingredient in clover perfumes.

Benzyl Salicylate is inodorous and used as a fixative, etc.

Ethyl Salicylate is similar to, but sweeter than, wintergreen oil.

Methyl Salicylate is very largely used for soap-scenting.

Irisones are offered in many varieties, but all of 100 per cent. purity, according to the purpose for which they are required, each having a different type of odour. The colourless alpha irosone is the most interesting product for the finest extracts of violet, the beta irosone most useful for soaps.

Storax. J. C. Umney. Perfumery and Ess. Oil Record, 1911, 2, 126—127.

STORAX is produced in the forests of the south-west of Asia Minor, and whilst that imported direct possesses its old-time fragrance and undoubted value for perfumery, as also for medicinal purposes, the character of the material shipped from certain ports, notably Trieste and also Marseilles, has completely changed during the past four years, owing either to the abstraction of essential constituents being more boldly carried out, or to the demand for these constituents having increased with corresponding larger output of the impoverished balsam.

The following figures will serve to illustrate the change—all the samples being obtained in the ordinary way of commerce from dealers (not producers) :

Year.	Acid value.	Ester value.	Cinnamic acid : free and combined.
			per cent.
1907.......	68·9	111·9	19·0
1907.......	67·1	120·9	15·2
1908.......	96·4	94·0	14·1
1909.......	95·9	65·4	11·6
1909.......	111·6	63·£0	11·7
1910.......	101·5	92·4	9·3
1910.......	93·7	84·4	8·2
1910.......	97·1	90·2	8·3
1910.......	99·4	30·3	7·6
1911.......	110·3	82·8	7·5
1911.......	107·0	81·1	5·6
1911.......	99·7	14·5	4·0
1911.......	100·1	79·6	3·5
1911.......	96·5	72·4	2·5

Two samples supplied by Professor Greenish, and in his possession 11 years or more, had the following characters :

	Acid value.	Ester value.	Cinnamic acid free and combined.
			per cent.
Crude	50·6	100·4	20·6
Strained ...	55·2	126·6	26·3
Purified from above sample of "crude"	60·1	130·1	25·5

The utilisation of the valuable properties by extraction from storax appears to have two ends. The one is in the manufacture of a concentrated essence of storax, prepared by extraction by certain selected solvents from storax, and stated to be 50 times as strong as natural storax, whilst representing the perfect and true odour of the balsam. The other and more important end is in cinnamic alcohol, which possesses a very sweet odour recalling hyacinth, very retentive and most serviceable as a fixative, especially as a soap perfume. It is being produced in increasing quantity, and is undoubtedly one of the most useful products for blending with certain artificial perfume compounds.

The idea naturally occurs that cinnamic alcohol might be produced more economically by synthetic processes, but the odour of the natural alcohol is undoubtedly preferable, and so long as a free market exists for the "impoverished" drug the cost of production is naturally much diminished. For perfumery purposes the natural drug should be employed, and it is suggested that the following will prove suitable characters and tests for determining purity and high quality.

Styrax Purificatus. The balsam obtained from the trunk of *Liquidambasientalis*, purified by solution in alcohol and removal of the solvent.

Characters and tests.—A brownish yellow viscous balsam transparent in thin layers, with an agreeable odour and balsamic taste. Entirely soluble in alcohol and in ether. Heated on a water bath for one hour it should lose not more than 5 per cent. When boiled with sulphuric acid and potassium bichromate it evolves an odour of oil of bitter almonds.

Acid and ester values.—The acid value and ester value determined in the usual manner, should be between 60 and 90, and 110 and 140 respectively.

Total Cinnamic Acid (Free and Combined).—Evaporate the alcohol from the saponified solution, and dissolve the residue in 50 c.c. of water. Transfer to a separator, wash with 10 c.c. of ether and reject the ethereal layer. Acidulate the aqueous solution with $N/1$ sulphuric acid and extract the liberated acids with ether. Evaporate the ethereal solution and extract the residue with 100 c.c. of boiling distilled water. Filter while hot, allow to cool to 15° and collect the crystals of cinnamic acid on a counter-balanced filter. Twice repeat the extraction of the residue with the filtrate heated to boiling and collect the crystals. Dry the crystals at 100° C. and weigh. Add 0·030 grm. to correct for solubility. At least 0·375 grm. should be obtained from 2·5 grms., corresponding to at least 15 per cent. of free and combined cinnamic acid. The crystals obtained should give the reactions of cinnamic acid. Examined by this method the best samples yield 20 to 25 per cent. of total cinnamic acid.

Patents.

Pharmaceutical [mercury] compounds; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 17,356, July 21, 1910.

See Fr. Pat. 414,563 of 1910; this J., 1910, 1227. Ammonia or amines may also be used in the same way as the other amino- and imino-compounds.—T. F. B.

Glycollic acid; Electrolytic manufacture of ——. G. W. Johnson, London. From Deutsche Gold- und Silber-Scheide-Anstalt vorm. Roessler, Frankfort on Maine, Germany. Eng. Pat. 26,546, Nov. 15, 1910.

Solutions containing 40 per cent. and more of glycollic acid, and less than 4 per cent. of mineral acid, may be obtained by the electrolytic reduction of oxalic acid if the following conditions are observed: Fresh oxalic acid, either solid or in solution, is constantly added to the cathode compartment during the electrolysis, care being taken that the hydrogen evolved at the cathode always meets with oxalic acid. The cathodes should be of large area, similar to those used as storage battery plates. Current densities exceeding 250 ampères per square metre (preferably 500 to 600 amps.) are used, and the concentration of the initial oxalic acid solution is correspondingly increased, say to 20—30 per cent., with addition of not more than 10 per cent. of mineral acid. Finally, the penetration of the oxalic acid into the anode space is prevented by maintaining the liquid in that space at a higher level than that of the liquid in the cathode chamber.—T. F. B.

Isoprene; Process of manufacturing ——. W. H. Perkin and C. Weizmann, Manchester, Assignors to Research Synd., Ltd., London. U. S. Pat. 991,453, May 2, 1911.

Either of the four amyl alcohols derived from isopentane, or a mixture of them, is converted into the corresponding amylene, or mixture of amylenes, by dehydration, and this is treated so that it loses two atoms of hydrogen, forming isoprene. *Example:* A mixture of two parts of fermentation amyl alcohol and one part of zinc chloride is allowed to stand in the cold for 24 hours and is then distilled; the amylene thus produced is passed through a tube heated to redness, or is treated with chlorine or bromine, and the halogen compound treated with alcoholic potash, diethylaniline, or other agent which will remove the hydrohalogen acid.—T. F. B.

Phenyl esters of a-iodo-isovaleric acid. R. Berendes, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 994,494, June 6, 1911.

The phenyl esters of a-iodo-isovaleric acid, prepared as described in Ger. Pat. 233,327 of 1910 (this J., 1911, 648), are soluble in alcohol and chloroform, and decomposed by dilute alkali hydroxides. They are of therapeutic value. The guaiacol ester of a-iodo-isovaleric acid melts at 76°—79° C.—T. F. B.

Acetylsalicylosalicylic acid; Process for preparing ——. A. Einhorn. Ger. Pat. 234,217, Feb. 24, 1910.

Acetylsalicylosalicylic acid may be prepared by the action of tertiary bases at the ordinary temperature on acetylsalicylic carbonic alkyl esters, ($CH_3.CO.O.C_6H_4.COO.COOR$), prepared by the action of chlorocarbonic esters on acetylsalicylic acid in presence of a tertiary base), or on acetylsalicylic anhydride, or on a mixture of salicylic acid with an acetylsalicylic carbonic ester or acetylsalicylic anhydride; it is also obtained by the prolonged action of a salicylate on acetylsalicylic carbonic esters.—T. F. B.

1-Phenyl-2·3-dimethyl-4-dimethylamino-5-pyrazolone citrate; Process for preparing secondary ——. R. Otto. Ger. Pat. 234,631, Nov. 28, 1909.

The secondary citrate of 1-phenyl-2·3-dimethyl-4-dimethylamino-5-pyrazolone is prepared by heating one mol. of citric acid with two mols. of the base, with or without addition of water. It melts at 85° C., and is more easily soluble in water than the base; it is also soluble in alcohol, and with difficulty soluble in ether, benzene, and chloroform.—T. F. B.

Camphor; Process of preparing ——. O. Aschan, Helsingfors, Russia, and W. Kempe, Assignors to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 994,437, June 6, 1911.

See Fr. Pat. 398,361 of 1909; this J., 1909, 854.—T. F. B.

Methoxymethylmenthol. M. Dohrn and A. Thiele, Assignors to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 994,445, June 6, 1911.

See Eng. Pat. 2344 of 1911; this J., 1911, 648.—T. F. B.

Morphine; Acyl derivative of ——. H. Hoerlein, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 994,465, June 6, 1911.

See Ger. Pat. 222,920 of 1909; this J., 1910, 901.—T. F. B.

Acid ferric phosphor-tartrate. Acid ferric arsen-tartrate. C. Sorger, Niederlahnstein on Rhine, Germany. U.S. Pats. 995,038 and 995,383, June 13, 1911.

See Eng. Pat. 23,330 of 1908; this J., 1909, 442.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photochlorides of silver; The nature of —— and their light-potentials. K. Sichling. Z. physik. Chem., 1911, 77, 1—57.

As a result of extensive determinations of the potential of silver photochlorides prepared in various ways and of electrometric solubility determinations, the author concludes that the photochlorides are one-phase systems, being solid solutions of amorphous silver and silver chloride. There is no evidence that silver subchloride forms any part of the system. Colloidal silver and silver chloride probably show complete miscibility, and there is a distinct range of stability of photochloride in presence of crystalline silver and silver chloride. The author has also studied the behaviour of the photochlorides on illumination. Jellies of silicic acid and photochloride with potassium chloride as electrolyte and platinum gauze electrodes were prepared and their behaviour in light was studied electrometrically. On illumination with the ultraviolet lamp potential changes in the positive direction of as much as 0·5 volt were observed. These illumination potentials are constant and easily reproducible. The temperature coefficient of the potential change is negative. Blue, violet, yellow and white light have similar effects, green light acts less strongly, while red light leads to a fall of potential. The maximum potential increases almost logarithmically with the intensity of illumination. Photochlorides of all compositions appear to be sensitive to light. Prolonged illumination leads to fatigue and to some diminution from the maximum potential, while the removal of the light source causes the potential to fall rapidly to a value considerably below its original value in the dark. After passing through this minimum there is a slow rise to the normal dark-value.—W. H. P.

Radiographic image; Physical development of a —— after fixing by sodium thiosulphate and prolonged washing. M. Chanoz. Comptes rend., 1911, **152**, 1576—1577.

It is known that an exposed photographic plate when treated with thiosulphate and then washed, appears transparent, and that on subsequent treatment with a so-called physical developer (*e.g.*, a solution of sodium-silver sulphite and *p*-phenylenediamine), the image gradually appears. The author finds that radiographic images produced on photographic plates by the rays from a Crookes' tube can be developed in an exactly similar manner. The opacity of the radiographic image thus produced increases, within limits, with the time of development, but never attains that of the image developed in the usual manner before fixing. In order to obtain a visible image by physical development after fixing, an exposure is required about 10 times as long as that ordinarily necessary. For prolonged exposures, sharper negatives are obtained by physical development after fixing than by the usual method.—A. S.

Patents.

Colour photography. S. Manners, London. Eng. Pat. 25,646, Nov. 4, 1910.

Temporary supports, consisting of paper coated with gelatin and glycerin or sugar, are used for the re-assembling of the colour prints which have been developed on glass or other supports; the colour prints are transferred to the temporary support successively, and the composite print is finally transferred to its permanent support in a manner similar to that used in the carbon process. In order to ensure uniform stretching of the prints when wet, the paper is used in such a way that its longest stretch, when wet, is in the direction of the narrower dimension of the print.—T. F. B.

Colour photography; Manufacture of colour plates or screens for ——. J. H. Christensen, Sölleröd, Denmark. U.S. Pat. 994,977, June 13, 1911.

See Eng. Pat. 20,971 of 1908; this J., 1909, 491.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Explosives; Thirty-fifth Annual Report of H.M. Inspectors of —— for 1910. [Cd. 5685.]

Factories and magazines.—There were 33 factories under continuing certificates and 106 under licence, and 257 visits were paid to these factories during the year. There were 88 magazines under continuing certificate and 355 under licence, and 445 visits were paid to these magazines during the year. *Accidents.*—The total number of accidents of which the department had cognizance was 442, divided as follows:—In manufacture (65) causing 6 deaths and 25 injuries. In keeping (11) causing 3 deaths and 11 injuries. In conveyance (nil). In use and miscellaneous (374) causing 57 deaths and injuries to 406 persons. In manufacture the number of accidents (65) and deaths (6) gives, on the 4958 persons employed, an average of about 13 accidents per 1000, and about 1 death per 1000. *Workpeople employed in factories.*—In the year under review, the department has had its quinquennial statistics prepared as to the number of workpeople employed in explosives factories. In the 22 factories used for the manufacture of gunpowder and nitrate mixtures there were 729 workpeople in danger buildings, and 814 in non-danger buildings, with a total of 1543. In the 42 factories engaged in the manufacture of dynamite, guncotton, small arms nitro-compounds, and chlorate mixtures there were 1914 workpeople in danger buildings and 2293 in non-danger buildings with a total of 4207. In 59 factories employed in the manufacture of fulminate and ammunition of all sorts, including fuses (safety and otherwise), detonators, sporting, blasting and cannon cartridges, there were 1732 workpeople in danger buildings and 6162 in non-danger buildings, with a total of 7894. In 16 fireworks factories there were, in danger buildings, 583 workpeople, and 363 in non-danger buildings, with a total of 946. The grand total in danger buildings was 4958, and in non-danger buildings 9632, with an aggregate of 14.590. In addition to the above there were 10 small fireworks factories and 11 toy fireworks factories, employing in all 1144 workpeople. The totals for previous years were as follows:—1895 (7484), 1890 (9820), 1895 (10,023), 1900 (11,098), 1905, (14,567), 1910 (14,590). During the past 25 years the number of factories has increased by about 29 per cent., and the number of persons by over 133 per cent. *Importation.*—The importations were as follows:—

	1909.	1910.
Nitroglycerin enplosives .... lb.	1,311,488	1,098,625
Non-nitroglycerin explosives .... lb.	11,635½	3,265
Detonators .... number	18,146,815	1,060,000
,, ... lb.	—	81,274
Fireworks .... tons	392	370
,, ... cases	28	20

Of the nitroglycerin explosives mentioned above (1,098,625 lb.), 51,134 lb. were transshipped to other countries in 1910, and 2598 lb. of detonators.

Chemical advisers' report.—Messrs. Dupré examined 520 samples during the year, of which 88 were rejected for the following reasons:—Heat test (27), incorrect composition (53), exudation (8).

Conveyance by sea.—Mr. R. J. Lewis, the Chief Inspector of Explosives in Melbourne, forwarded to the department two reports dealing with the question of charcoal insulation for the holds of ships carrying explosives. One such vessel had a fire in one of the coal bunkers which was extinguished, but broke out again a couple of days later. When the vessel arrived at Melbourne the bunker fire was out; but on removing the hatches of the adjoining hold smoke was observed, which increased so rapidly that the hatches could not be replaced. The hold which contained a general cargo and no explosive was flooded. Subsequent investigation showed that the charcoal insulation, which was separated from the coal bunker by an iron bulkhead only, had commenced to smoulder owing to the heat from the fire in the bunker, and when air was admitted, through the opening of the hatches, this fire spread rapidly. A somewhat similar occurrence took place in another vessel, carrying explosives to Australia, and Mr. Lewis draws attention to the danger of charcoal insulation, although in this latter case the insulation was not involved in the fire. He explains that should the insulation of the hold, in which the magazine is situated, become ignited, all chance of jettisoning the explosive would be gone, owing to the deadly fumes which would overcome any persons attempting to approach the magazine.

Danger buildings struck by lightning.—An interesting and full account is given of the circumstances attending an accident by lightning at the Schlebusch Factory, Germany, on June 7th, 1910. Although the buildings were were efficiently protected according to the regulations

drawn up by the German State Departments, these precautions were unavailing, and three buildings were struck at the same instant. As regards damage to surrounding buildings, it is noted that all the buildings consisting of concrete and all Monier roofs completely resisted the explosion, and not the slightest crack was observable, whilst corrugated iron and wooden roofs were very seriously damaged. It is, therefore, recommended that in the case of all buildings and plant not exposed to the danger of explosion, as massive a construction as possible should be adopted, best of all carried out in the Monier fashion.
—G. W. McD.

Nitrocellulose solutions; Viscosity of ——. C. Piest. Z. angew. Chem., 1911, **24**, 968—972. (Compare this J., 1911, 50.)

Experiments have been made with a view to determine the nature of the conditions which affect the viscosity of nitrocellulose solutions and the comparative merits of different viscosimeters. Besides the viscosimeters of Engler and Cochius, a new instrument was employed, a description of which is given; this is of the Cochius type, determinations being made by measuring the rate at which a hollow glass sphere rises through a fixed depth of liquid. The solutions used contained 2 grms. of nitrocellulose in 100 c.c. of acetone or ether-alcohol. It was found that the results given by the three methods are not comparable, even with the same solution, the ratio between the values obtained altering as the viscosity of the solution changed with keeping. There was no appreciable decrease in the viscosity of a solution which had been standing for 21 days, but at the end of 6 months a marked diminution was observed. This reduced viscosity is considered to depend, not on a decreased molecular complexity, but on changes in the colloidal condition of the solution, there being a gradual diminution in the size of the particles constituting the solid phase. The state of the solution is influenced, not only by prolonged standing, but by the presence of impurities, such as traces of acetic acid and aldehyde in the solvent, or of esters of oxy- and hydrocellulose in the nitrocellulose, due to the washing process employed, the use of mercerised or strongly bleached cotton, or to a high nitration temperature or unduly long period of nitration; all of these cause a reduction in the viscosity. Changes in the viscosity of a solution may also be detected by observing its rate of filtration.—F. Sodn.

Camphor in smokeless powders; Determination of ——. M. Marqueyrol. Ann. Chim. Analyt., 1911, **16**, 209—210.

If an ethereal solution of a few decigrams of camphor be allowed to evaporate over sulphuric acid in a desiccator and weighed at intervals, then the curve obtained by plotting the weights against the times shows an abrupt change of direction when the solvent has completely evaporated, and thus the weight of camphor can be ascertained. In applying this to the analysis of smokeless powders, 10 grms. of the sample are extracted with ether for 10 hours in a Soxhlet apparatus, and the amount of dissolved matter in the ethereal solution is determined as indicated above. The residue is then heated at 30°—40° C., until the camphor is completely expelled, and again weighed. The difference between the two weights gives the quantity of camphor.
—A. S.

Explosion; Circumstances attending the —— *of a "Store" belonging to the Granville Colliery Company, Limited, at Swadlincote, in the County of Derby, which occurred on March* 24, 1911. Major A. Cooper-Key, H.M. Chief Inspector of Explosives. [Cd. 5702.]

The building in which the explosion occurred was 10 feet long by 7 feet wide, and was stoutly built of bricks and covered with slates. There were 800 lb. of bobbinite, 200 lb. of gunpowder, and 50 lb. of rippite (a permitted nitro-glycerin explosive) in the building at the time. The effect of the explosion was that the walls of the building were each thrown at right angles to their previous position. On one side, where there was a certain screening effect owing to trees, *débris* was only thrown a distance of 100 yards, whereas in the other three directions substantial fragments were found from 180 to 195 yards distant. Major Cooper-Key arrives at the conclusion that the explosion occurred whilst a case of rippite was being opened, and that there is a strong probability that it was caused by a cartridge being crushed by the copper tool used (in the absence of a screw-driver) to force open the screwed-down lid of the case. The temperature at the time was somewhat low (36°—38° F.), and in all probability the rippite was frozen, in which condition all nitroglycerin explosives are specially sensitive to explosion by fracture or crushing. Attention is drawn to the following points: (1) The relatively great danger in handling nitroglycerin explosives when the cartridges have become hard from exposure to cold. (2) Possibility of the artificial heating of magazines and stores. The safest method is undoubtedly hot water, and if the following precautions are observed, the risk may be considered to be negligible. The furnace should be placed on the side of the building furthest from the door, and should be at the distance of one dozen yards or so, and screened from the building by a shield of corrugated iron. Only coke or anthracite should be used after the fire is once lit, and strict orders should be given that the doors of the magazine or store should be closed whilst the fire is being stoked. The actual heating should be effected by means of a hot water radiator standing on the floor of the building, and in such a position as to avoid the liability of explosives being inadvertently placed in contact with it. A spark arrestor should also be fitted on the top of the flue. (3) In spite of this accident, Major Cooper-Key considers that for fastening the lids of the cases, screws are to be recommended in preference to nails. Screws can be removed without the slightest risk of touching the explosive, but when nails are used there is always the danger that, when one is being driven home, a hard knot in the wood may turn the point inwards. When cold weather sets in these turned-in points may become frozen into the cartridges. He considers that a steel screw-driver may be used for opening the cases in a magazine or store, provided it is removed as soon as the work is done. (4) The construction of danger buildings is also dealt with, and reference is made to the proposals of Guttmann (this J., 1908, 669; 1910, 114, 930), who suggested that if expanded metal, or stout wire netting, were inserted in the concrete walls of a magazine, *débris* would only be projected to very short distances, and buildings so constructed would also be lightning proof, provided the metal in the walls was thoroughly well earthed. The proposals advocated by the Home Office in respect to the construction of danger buildings is that, in working buildings where the danger arises inside, the lightest possible material is the best, but that in storage buildings, where the danger is more likely to arise from the outside, a substantial construction is preferable. There is, even on theoretical grounds, a strong probability that material such as concrete or cement, which is not cut up into small blocks by lines of least resistance, (as is the case with brickwork) would in all circumstances give the more satisfactory results. It is suggested, that, where practicable, stores should preferably be built of fine gravel concrete with an arched roof of the same material; the construction to be as light as possible with due regard to security—a condition which can be furthered by the use of expanded metal or stout wire netting in the concrete.—G. W. McD.

Explosives Laws of the Union of South Africa. Board of Trade J., June 22, 1911.

With reference to the proposed consolidation of laws affecting the importation, sale, etc., of explosives in the Union of South Africa, the Explosives Act, 1911 (No. 8 of 1911) is to come into operation on a date to be fixed by the Governor-General by Proclamation in the "Gazette."

The provisions of the Act, with regard to the importation, exportation and use of explosives are the same as those originally proposed—viz., that no person shall import into or export from the Union, or cause to be imported thereto or exported therefrom, any explosive unless he has obtained a permit issued, in the case of blasting materials, under the authority of an Inspector, or, in the case of other explosives, by any person authorised by the Minister to issue such a permit.

No person shall manufacture any unauthorised explosive unless it be manufactured solely for purposes of chemical experiment and not for sale, and in quantities not exceeding 1 lb. in weight at any one time, or 5 lb. in all; or unless it be manufactured solely for practical trial as an explosive and not for sale in such quantities and under such conditions as may be in writing prescribed by an Inspector.

The term "explosive" is defined to mean :—

(*a*) Gunpowder, nitro-glycerine, dynamite, guncotton, blasting powders, fulminate of mercury or of other metals, coloured fires, and every other substance, whether similar to those herein mentioned or not, which is used or manufactured with a view to produce a practical effect by explosion or a pyrotechnic effect.

(*b*) Any fuse, rocket, detonator, cartridge, and every adaptation or preparation of an explosive as herein defined; and

(*c*) Any other substance which the Governor-General may from time to time by Proclamation in the "Gazette" declare to be an explosive.

An "unauthorised explosive" shall mean an explosive not named in the list of authorised explosives approved by the Minister of Mines or other person administering the Act and published by notice in the "Gazette."

PATENTS.

Nitro-glycerin; Apparatus for the purifying of ——. F. M. Wharton and T. G. Shacklady, Cliffe-at-Hoo, Kent, and Curtis's & Harvey, Ltd., London. Eng. Pat. 23,871, Oct. 14, 1910.

THE tank in which the preliminary washing of nitroglycerin is carried out ("prewash tank") is usually at such a height that the bottom of the prewash is on a higher level than the top of the final washing tank. Claim is made for the use of these two tanks upon approximately the same level. Between the two tanks is fixed a short length of pipe, so situated that the rubber draw-off pipe from the bottom of the pre-wash tank can be attached to it at one end, and a similar pipe at the bottom of the washing tank to its other end—the joints being made water-tight. When thus connected the nitroglycerin can, by a sufficient head of water, be forced from the bottom of the prewash tank into the washing tank. The rubber pipes can then be pinched off and tied up in the usual manner. The advantages gained are, a reduction in the height of the nitrating house and the acid and glycerin tanks, a decrease in the cost of erection, and increased facilities of escape for workmen in case of danger.—G. W. McD.

Tubes for plastic materials [*explosives*]; *Manufacture of* ——. M. B. Lloyd and Curtis's & Harvey, Ltd., London. Eng. Pat. 27,700, Nov. 28, 1910.

THE invention is designed more particularly for use in the manufacture of explosives, such as cordite, in tubular form. The explosive is squirted through a die furnished with a core which is hollow. The bore of the core communicates with the air through an air chamber formed in the upper part of the body of the core which is in turn supplied with air by a hole bored through one of the supporting arms of the core, and the wall of the die, into the outer air. The pressure of air in the newly-formed tube will now be less than that of the atmosphere by only such slight amount as is necessary to suck in air, through the hollow core and supply hole, in sufficient quantities to maintain a plenum, and will therefore for the same speed of pressing be constant throughout the whole length of the cord.—G. W. McD.

Explosives. W. Fairweather, London. From E. I. du Pont de Nemours Powder Co., Wilmington, Del., U.S.A. Eng. Pat. 4099, Feb. 17, 1911.

BUTYLENEGLYCOL (50 parts) is introduced in a fine spray and with agitation, into 350 parts of nitrating acid such as is used for the manufacture of nitroglycerin. The acid is previously cooled to −5° C., and during nitration the mixture is kept at this temperature. On standing, the butyleneglycol nitrate rises to the surface as a yellow oil, and may be separated. Its gelatinising power towards cellulose nitrate is said to be greater than that of nitroglycerin. It has a lower freezing point, and a lower temperature of explosion than nitroglycerin. The following explosives may be prepared with this body: Butyleneglycol nitrate (1 part), nitroglycerin (3 parts). Butyleneglycol nitrate (1 part), nitroglycerin (2 parts), and nitrocellulose (1 part). Butyleneglycol nitrate (3 parts), trinitrotoluene (1 part), and nitronaphthalene (1 part).—G. W. McD.

Explosive. F. M. Marshall, Stockholm, Sweden. U.S. Pat. 993,534, May 30, 1911.

A MIXTURE of zinc (1 to 5 parts), ammonium perchlorate (30 to 40), potassium nitrate (35 to 45), dinitrotoluene (8 to 15) and sawdust (8 to 15 parts).—G. W. McD.

Explosive. H. Hibbert, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pats. 994,841 and 994,842, June 13, 1911.

SEE Eng. Pat. 4099 of 1911; preceding.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Aluminium; Some new applications of amalgamated —— *and its use in analysis.* E. Kohn-Abrest. Bull. Assoc. Chim. Sucr., 1911, 28, 938—943.

IT has been known for some time that amalgamated aluminium oxidises rapidly in presence of water, with evolution of hydrogen. Amalgamation may be conveniently effected by dipping the metal into a solution of mercuric chloride. The quantity of mercury fixed by the aluminium and the rapidity of the subsequent reaction with water depend upon the concentration of the mercuric chloride solution and the length of time of immersion. A piece of aluminium foil weighing 0·7517 grm. was oxidised to the extent of four-fifths within 30 hours, after 14 amalgamations (each time by dipping for six seconds in a 1 per cent. solution of mercuric chloride and then washing with water), the total quantity of mercury used being about 0·001 grm. The greater part of the mercury is afterwards to be found in the alumina precipitate, partly in the metallic state and partly in a form soluble in dilute hydrochloric acid; none passes into the water. Amalgamated aluminium precipitates tannin from solution in the form of aluminium tannate. Thus, the whole of the tannin was removed from 100 c.c. of a 1 per cent. solution, in 5 hours, by 0·2 grm. of aluminium containing 4 mgrms. of mercury. The amalgamated metal may find use in the purification of certain industrial waste-waters, for besides tannin a number of colouring matters are precipitated by it. As a substitute for basic lead acetate it may be used for the clarification of certain liquids, such as extracts of vegetable matters, before analysis. For this purpose the metal is amalgamated by immersion for three minutes in 0·5 per cent. solution of mercuric chloride. If, for example, 5 grms. of such metal are employed with 200 c.c. of the solution to be treated, the action continues for 6—7 hours.—J. H. L.

Manganese; Determination of —— *by the sodium bismuthate method.* W. F. Hillebrand and W. Blum. J. Ind. Eng. Chem., 1911, 3, 374—376.

THE statement of Brinton (this J., 1911, 574) that if the permanagate employed in the bismuthate process be standardised by means of sodium oxalate or iron, the empirical factor 0·1656 should be used for converting the oxalate figure into that for manganese is opposed to the experience at the Bureau of Standards (U.S.A.). It is pointed out also that the theoretical factor is 0·16397 and not 0·16024 as stated by Brinton. A set of experiments with permanganate solution standardised by means of sodium oxalate and then reduced with sulphurous acid and treated according to the bismuthate process, showed that the latter is quantitative within the limits of experimental error, and hence the theoretical factor should be employed.—A. S.

Thorium; Detection and determination of —— with iodic acid. R. J. Meyer. Z. anorg. Chem., 1911, 71, 65—69. (Compare this J., 1910, 486).

Iodic acid is found to be a very delicate and reliable reagent for the detection of thorium. Two solutions are required, containing (*a*) 15 grms. of potassium iodate, 50 c.c. of nitric acid (sp. gr. 1·4), and 100 c.c. of water, and (*b*) 4 grms. of potassium iodate, 100 c.c. of dilute nitric acid (sp. gr. 1·2), and 400 c.c. of water. 2 c.c. of the solution to be tested, which must contain no free hydrochloric acid, but a large proportion of nitric acid, are mixed with 5 c.c. of solution *a*, and then 10 c.c. of solution *b* are added, and the mixture is boiled. The iodates of cerium and yttrium earths are thus completely dissolved, that of thorium alone remaining, but a further addition of solution *b* may be added to test the permanency of any precipitate. 0·1 grm. of thorium oxide per litre can be detected. Zirconium iodate, which may also be precipitated, is readily distinguished by its solubility in oxalic acid, and the precipitation of ceric salts can be prevented by boiling the solution to be tested with a little sulphurous acid. The quantitative separation of thorium and scandium may be effected as follows :—The earths, separated as oxalates and converted into oxides, are dissolved in hydrochloric acid, the solution is evaporated to dryness, and the residue taken up with water; thorium and scandium are then precipitated from boiling solution with ammonium thiosulphate, and, after decomposing the precipitate with hydrochloric acid, the precipitation is repeated. The second thiosulphate precipitate is decomposed with nitric acid, the separated sulphur washed, and the filtrate evaporated to dryness. The residue is taken up with a little water and a few drops of nitric acid, and then, after diluting to about 5 c.c., 5—10 c.c. of iodate solution *a* (according to the quantity of the precipitate), and 10—20 c.c. of iodate solution *b* are added; the mixture is digested for a quarter of an hour at 60°—80° C. and allowed to stand until the precipitate has completely settled; the iodate is then filtered off, washed with solution *b*, and decomposed by boiling with ammonia, the thorium hydroxide, thus obtained, being filtered off, washed, and ignited to the oxide, ThO_2. Scandium is precipitated in the boiling iodate filtrate by adding a large excess of ammonia.—F. Sodn.

Bromine and iodine, simultaneously liberated in aqueous solution; Extraction of —— by means of chloroform and carbon bisulphide. A. Labat. Bull. Soc. Chim., 1911, 9, 503—506.

The author discusses the errors which may arise in the analysis of mixtures of bromides and iodides, owing to the formation of iodine tribromide, when agents capable of liberating both halogens simultaneously are employed; for this reason chlorine is unsuitable for the detection of small quantities of an iodide. The use of sodium nitrite for liberating the halogen is discussed at some length, and though useful for the detection of iodine, it is shown to be quite unsuitable for the detection of bromine; for the latter halogen Baubigny's method is considered satisfactory. (See this J., 1898, 183; 1899, 176,709.)—A. Sbld.

Nitrates; Detection of —— by diphenylamine. H. Caron. Ann. Chim. Analyt., 1911, 16, 211—215.

The author finds that the sensitiveness of the diphenylamine test for nitrates depends mainly upon the proportion of diphenylamine and the concentration of sulphuric acid in the reagent and the rise of temperature produced on mixing the solution with the reagent. The best results are obtained with very low concentrations of diphenylamine and high concentrations of sulphuric acid, and the method of carrying out the test recommended is to add 5 c.c. of a solution of 2 mgrms. of diphenylamine in 100 c.c. of concentrated sulphuric acid to 2 c.c. of the solution under examination. If the solution contain chlorides, it is better to use a reagent prepared by dissolving a few mgrms. of diphenylamine in a mixture of 100 c.c. of sulphuric acid, 40 c.c. of water, and 2 or 3 c.c. of 10 per cent. hydrochloric acid: 5 c.c. of reagent are added to 0·5 c.c. of the solution to be tested. The reaction may be masked by organic substances such as methyl and ethyl alcohols, glycerol, ether, acetone, hydrocarbons, salicylic acid (see this J., 1911, 711), and phenol, especially when the solution of diphenylamine in concentrated sulphuric acid is used, and it is therefore better to use the dilute reagent containing hydrochloric acid, mentioned above, when organic matter is present. (See also this J., 1911, 44, 708.)—A. S.

Hydrogen cyanide; Detection of traces of ——. G. D. Lander and A. E. Walden. Analyst, 1911, 36, 266—268.

This paper gives the results of an investigation into the sensitiveness of the ferrocyanide reaction for the detection of cyanide in minimal quantity in poisoning cases. It was found that definite positive results were obtained with 0·000002 grm., and that excessively dilute solutions could be boiled down with alkali without loss. For quantities of less than 0·00002 grm. per c.c. the test is conducted thus: Add to the solution 2 drops of 10 per cent. caustic soda solution, concentrate, and evaporate finally in a test-tube nearly to dryness; add a drop of 2 per cent. ferrous sulphate solution and leave in the cold for 10—15 minutes; then add 2 drops of concentrated hydrochloric acid, warm, and finally cool. The liquid is now blue-green in colour and on careful dilution becomes blue. For quantitative estimation, known quantities of cyanide solution should be taken, evaporated, and treated in exactly the same way as the sample, when the colours may be compared.
—J. H. J.

Determination of sulphur in coal. St. Warunis. *See* IIa.

Use of sodium paratungstate in the determination of carbon dioxide in carbonates or nitrogen pentoxide in nitrates. Gooch and Kuzirian. *See* VII.

Determination of the higher oxides of lead and some reactions of lead salts. Chwala and Colle. *See* VII.

Preparation and determination of nitric oxide. Moser. *See* VII.

Characteristic reaction for bromine. Denigès. *See* VII.

Zinc oxide in chemical glassware. Smoot. *See* VIII.

Analysis of ferrovanadium and determination of vanadium in presence of arsenic. Trautmann. *See* X.

Assay of used plumbago crucibles for gold. Watson. *See* X.

Analysis of aluminium and its alloys. Kleist. *See* X.

Determination of alumina in ores, slags, etc. Cavers. *See* X.

Determination of arsenic in Schweinfurt green. Heiduschka and Reuss. *See* XIII.

Analysis of chrome leather. Fahrion. *See* XV.

Determination of lime and potash in the ash of cereals. Thompson and Morgan. *See* XVI.

Analysis of calcium cyanamide. Monnier. *See* XVI.

Determination of gum in syrups. Rocques and Sellier. *See* XVII.

Determining nitrogen in liquids [beer wort]. Fürnrohr. *See* XVIII.

Determination of starch in brewers' grains. Kreuzer. *See* XVIII.

Determination of lecithin in foods. Cohn. *See* XIXa.

Rapid test for nitrites and nitrates in water. Denigès. *See* XIXB.

Theory and rational modification of Malaquin's reaction for strychnine. Denigès. *See* XX.

Reaction for caulophyllin. Gilbard. *See* XX.

Development of microsublimation methods and recognition of arbutin in plants. Tunmann. *See* XX.

Chemistry of anaesthetics. I. Ethyl ether. Baskerville and Hamor. *See* XX.

Determination of camphor in smokeless powders. Marqueyrol. *See* XXII.

PATENTS.

Photometer. D. M. Moore, Newark, N.J., Assignor to Moore Electrical Co., New York. U.S. Pat. 994,329, June 6, 1911.

A PORTABLE photometer for measuring the intensity of light in vacuum tubes comprises a box provided with a transverse opening at one end adapted to receive and fit around a section of the tube and with a standard light at the other. An opaque sleeve or shield, which can be adjusted to vary the amount of light, is arranged round the tube and an index pointer is connected with this movable shield by means of which the intensity of the light as compared with the standard light can be read off.—H. H.

Impurities in fluids; Method and apparatus for determining the amount of ——. W. P. Digby and C. W. V. Biggs, London. U.S. Pat. 993,586, May 30, 1911.

SEE Eng. Pat. 23,706 of 1907; this J., 1908, 1036.—T. F. B.

Gas supply for calorimetric and other purposes; Apparatus for producing a constant ——. H. Fahrenheim, Essen, Germany. U.S. Pat. 994,990, June 13, 1911.

SEE Eng. Pat. 3641 of 1910; this J., 1910, 867.—T. F. B.

Liquids which develop gas on addition of appropriate reagents; Apparatus and method for the continuous analysis of ——. "Hydro" Fabrique d'Appareils Spéciaux de Précision (J. von Geldern und Co.). Fr. Pat. 424,724, Jan. 9, 1911.

GER. Pat. 233,529 of 1910; this J., 1911, 712.—G. W. McD.

XXIV.—MISCELLANEOUS ABSTRACTS.

Emulsion colloids (emulsoids) with observations on the method of counting particles by means of the ultra-microscope. G. Wiegner. Kolloidchem. Beihefte, 1911, 2, 214—242.

EMULSIONS of olive oil and water were made to such a degree of fineness by means of the Laval emulsor that 1 c.c. of the emulsion contained 5×10^9 particles of oil. Emulsions of olive oil and water with $2—3 \times 10^9$ particles in 1 c.c. were perfectly stable for four months when precautions were taken to exclude bacterial action; such emulsions contained not more than 0·02 per cent. of oil. The number of particles in the oil-water emulsion could be obtained quite satisfactorily by means of the ultra-microscope if a sufficient number of determinations were made so that the errors balanced each other. Such emulsoids with a specific surface up to $0 \cdot 9 \times 10^5$ showed colloidal properties, which were those of negative sols as follows: (*a*) Hysteresis effects. The number of particles is continually changing until a relatively stable condition is reached. The changing by age is influenced by the method of formation, the so-called previous history of the emulsoid. Temperature appears to have a very slight effect. The final state appeared to be quite unchanging during the time of observation (four months); (*b*) Coagulation by electrolytes. The emulsoids so prepared had a negative charge and coagulated on the addition of electrolytes. On adding negative OH ions the appearance of the so-called swelling-value ("*Schwellenwert*") was observed. The coagulation with positive ions proceeded with a precipitating value the same as was to be expected in the case of negative sols. The coagulating action of the electrolyte increases with rise of temperature; (*c*) Forcing of precipitation. Colloidal albumin had a marked influence on the coagulating reaction. The negative protective action thus exercised was termed "precipitate-forcing" (*Fällzwang*). If two colloids A and B are mixed together, and A is more sensitive to precipitating agents than B, B can have a protective action on A while A will have a "precipitate-forcing" action on B. If olive-oil is so finely divided in water as dispersion-medium, that the disperse phase can no longer be separated by the action of gravity, the system has colloidal properties.—D. J. L.

Ferric thiocyanate; Catalytic action of ——. H. Colin and A. Sénéchal. Comptes rend., 1911, **152**, 1586—1587 (Cp. Wolff and de Stocklin, this J., 1908, 772).

QUINOL is rapidly oxidised to quinhydrone under the combined influence of hydrogen peroxide and ferric thiocyanate, and potassium iodide is also oxidised under these conditions. It is found, however, that both oxidations can also be effected if the iron salt is replaced by potassium thiocyanate. Tarugi has shown that by the action of hydrogen peroxide on thiocyanates, peroxysulphur acids are formed, and the authors find that potassium persulphate readily converts quinol into quinhydrone. Moreover, if hydrogen peroxide is allowed to act on a dilute solution of potassium hydrogen sulphate and sulphuric acid (conditions favourable to the formation of peroxy-sulphur compounds) in presence of quinol, a precipitate of quinhydrone is formed after some time. It is also found that the action of potassium thiocyanate and hydrogen peroxide is considerably accelerated by addition of traces of a ferric salt. Hence, it is concluded that the oxidation of phenols by the combined action of ferric thiocyanate and hydrogen peroxide is due to two causes, *viz.*, destruction of the thiocyanate group with formation of persulphuric acid, and the specific catalytic action of the iron.—L. E.

Enzymes in the latex of the paper mulberry (Broussonetia papyrifera). Gerber. Comptes rend., 1911, **152**, 1611—1614.

THE latex of the paper mulberry is found to contain very active lipolytic, amylolytic, and proteolytic enzymes, and thus resembles pancreatic juice. The proteolytic enzyme is very resistant to heat, its coagulating action on milk being greatest at about 75° C., and still fairly considerable at 85° C. Again, the proteolytic enzyme is not weakened, and in some cases, its action is accelerated by the metals which exert the most toxic effect on the amylase from the same source and on coagulating enzymes from other sources, whilst the action of the proteolytic enzyme is distinctly accelerated by the metals which are indifferent or slightly toxic towards the other enzymes. The three enzymes of the latex are most active at the beginning of March; their activity decreases slowly until the end of August, more rapidly in autumn, and still more rapidly in winter, though it never disappears completely. —L. E.

Ultra-violet light upon amylase, invertase, and mixtures of the same; Action of ——. A. Chauchard and B. Mazoué. Comptes rend., 1911, **152**, 1709—1711.

BOTH amylase and invertase lose their activity when exposed to ultra-violet light at a distance of 12 cm. from a quartz mercury vapour lamp working at 110 volts. The decrease of the activity is rapid at first, then becomes slower. Amylase is more sensitive to the light than invertase, either alone or when the two enzymes are mixed. —F. SHDN.

Books Received.

Die Zustandsgleichung. Von Dr. J. D. Van der Waals. Akademische Verlagsgesellschaft m. b. H., Leipzig. 1911. Price M. 1.50.

8vo pamphlet containing 24 pages of subject matter. The substance of an address delivered in Stockholm on Dec. 12th, 1910, on the occasion of the presentation of the Nobel prize for physics.

Catalysis. Von Wilhelm Ostwald. Zweite Auflage. Akademische Verlagsgesellschaft m. b. H. Leipzig. 1911. Price M. 1.50.

8vo pamphlet, containing 39 pages of subject matter. The substance of an address delivered on Dec. 12th, 1909, on receiving the Nobel prize for chemistry.

Radiumnormalmasse und deren Verwendung bei radioaktiven Messungen. Von E. Rutherford. Translated by Dr. B. Finkenstein. Akademische Verlagsgesellschaft m. b. H. Leipzig. 1911. Price M. 1.50.

8vo pamphlet, containing 45 pages of subject matter, with three illustrations. The text is sub-divided under the following heads: I. Necessity of a radium unit. II. Comparison of radium standards. III. Changes of a radium standard with time. IV. Measurement of the emanation. V. Small radium units. VI. The application to thorium products. VII. Proposals for a radium unit.

Die Farbenmischungslehre und ihre praktische Anwendung. Von Karl Meyer. Verlag von Julius Springer. Berlin. 1911. Price M. 4.

8vo volume in pamphlet form, containing 83 pages of subject matter, with 17 illustrations and six tables. The subject matter is subdivided according to the following scheme: I. Theoretical Doctrine of Colour Mixtures. (i) Spectrum colours and coloured substances. (ii) The three colour system. (iii) Saturated and diluted colours. (iv) Theoretical colour nomenclature. II. Practical Doctrine of Colour Mixture. (v) Preparation of mixed colours. (vi) Practical colour analysis and synthesis. (vii) Colour problems.

Mischen, Rühren, Kneten, und die dazu verwendeten Maschinen. Von Dr.-Ing. Hermann Fischer. Otto Spamer's Verlag. Leipzig. 1911. Price M. 5.75; bound M. 7.

This volume forms one of a series published by Dr. Ferd. Fischer of Göttingen and termed "Chemische Technologie in Einzeldarstellungen." It is an 8vo volume, and contains 88 pages of subject matter, with an alphabetical index and 122 illustrations in the text. The subjects are grouped as follows: I. Introduction: (i) Objects of mixing. (ii) Mixing processes. (iii) Arrangements for dealing with obstructed flow. (iv). Intermittent and continuous mixing. (v.) Testing the mixtures. II. Intermittent Mixing. (i.) Thin fluid mixtures. (ii.) Frothy mixtures. (iii.) Stiff mixtures. (iv.) Dry mixtures. III. Continuous Mixing. (a) General. (b) Distributing in a continuous stream. (i.) Distributing arrangements for gases and liquids. (ii.) Distributing arrangements for frothy and stiff materials. (iii.) Distributing arrangements for accumulated matter. (c). Distribution in sections or during periods. (d.) Mixing proper. (i.) Thin liquid mixtures. (ii.) Frothy mixtures. (iii.) Stiff mixtures. (iv.) Mixtures of dry materials. IV. Some Special Mixing Apparatus.

Sulfurieren. Alkalischmelze der Sulfosäuren. Esterifizieren. Von Dr. H. Wichelhaus. Professor an der Universität Berlin. Otto Spamer's Verlag. Leipzig. 1911. Price unbound M.7.50; bound M.8.75.

8vo volume, containing 124 pages of subject matter, with 32 illustrations, one table, and an alphabetical index. The text is classified as follows: I. Sulphonation and treatment with sulphuric acid. II. Preparation of Turkey-red oil. III. Hydrolysis of fats. IV. Preparation of sulphonic acids. V. Alkali fusion of the sulphonic acids. VI. Esterifying process.

Kolloidchemische Beihefte (Ergänzungshefte zur Kolloid-Zeitschrift). Monographien zur reinen und angewandten Kolloidchemie. Herausgegeben von Dr. Wo. Ostwald. Theodor Steinkopff's Verlag. Dresden. 1911. Price of vol. II., including parts 1 to 9 complete, M. 12.90.

Bd. II.—Heft 1—2. Ernst Pribram. "Die Bedeutung der Quellung und Entquellung für physiologische und pathologische Erscheinungen." (Beiträge zu einer Physiologie der Zelle). 78 pages of matter with one illustration.
Heft 3—5. Naima Sahlbom. Kapillaranalyse kolloider Lösungen." (141 pages, with 20 illustrations. Giov' Malfitano. "Ueber den mizellaren oder 'Kolloiden' Zustand." (71 pages).
[*] Heft 6—7. Georg Wiegner. "Ueber Emulsionskolloide (Emulsoide) nebst Bemerkungen zur Methodik der ultramikroskopischen Teilchenbestimmungen." Henry R. Procter. (30 pages). "Ueber die Einwirkung verdünnter Säuren und Salzlösungen auf Gelatine." (40 pages of matter with four illustrations.)
Heft 8—9. E. Ramann. "Kolloidstudien bei bodenkundlichen Arbeiten." (19 pages of matter with six illustrations). M. H. Fischer. "Beiträge zur kolloidchemischen Analyse der Absorptions- und Sekretionsvorgänge.' (Die Absorption aus der Bauchhöhle). (39 pages of matter.)

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Beckurts, Prof., R. *Orth*, and *Spitta*. Gutachten des Reichs-Gesundheitsrats, betr. die Versalzung des Wassers v. Wipper u. Unstrut durch Endlaugen aus Chlorkalium-Fabriken. [Aus: "Arbeiten a. d. kais. Gesundh.-Amte."] (III, 124 S. m. 13 Fig. u. 1 farb. Taf.) Lex. 8°. Berlin, J. Springer. 1911. M. 6.

Bock, O.: Der Ziegelofen. Einrichtung u. Ausführg. v. Brennöfen, Ofengebäuden u. Schornsteinen f. Ziegeleien. 3., neubearb. Aufl. (IV, 39 S. m. 35 Abbildgn.) Lex. 8°. Leipzig, C. Scholtze. 1911. Cloth M. 2.25.

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[*] See pages 818 and 838.

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Tardivo, C.: Manuale di fotografia, telefotografia, topofotografia dal palone. Torino, 24° fig., p. xv., 251, con 10 tav. 1911. Lire 4.50.

Technology; International library of ——. [Automobile lib., 5 v.] Scranton, Pa., Int. Textbk. Co., 1911. c. il. 8°, ea., ¾ mor., $5, boxed.

Contents: v. 1, Electricity and magnetism, electrodynamics, electrical resistance and capacity, the magnetic circuit, electro-magnetic induction, chemistry and electrochemistry, primary batteries, electrical measurements; v. 2, Heat, combustion and fuels, principles of the gas engine, automobile and marine engines, stationary gas engines, gas-engine details, gas-engine lubrication and bearings; v. 3, Carburettors, electric ignition devices, automobile and marine engine auxiliaries, power-gas producers, management of automobile engines, management of marine gas engines, management of stationary gas engines, troubles and remedies, power determination; v. 4, Automobile engine auxiliaries, automobile carburetors, electric ignition, transmission and control mechanism, bearings and lubrication, automobile tires; v. 5, Gasoline automobiles, gasoline automobile engines, automobile operation, troubles and remedies, overhauling and repairs.

Utz, L.: Fabbricati ed impianti industriali moderni. Ediz. italiana. Traduzione dell'ing. E. N. Campazzi. Milano, 8° fig., p. xxv., 507, con 21 tav. 1911. Lire 12.50.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding list can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

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I.—GENERAL PLANT; MACHINERY.

Applications.

13,990. Allgem. Ges. f. Chem. Industrie. Manufacture of a drying agent. [Ger. Appl., June 22, 1910.]* June 12.

14,044. Broadbent. Centrifugal machines. June 13.

14,161. Trumble. Evaporation of liquid.* June 14.

14,285. Anderson and Meikle. Evaporation and distillation process. June 16.

14,412. Bühler. Apparatus for drying and conveying moist material.* June 17.

14,492. Soc. d'Exploit. de Proc. Evaporatoires. Evaporation apparatus. [Fr. Appl., June 30, 1910.]* June 19.

14,670. Eschellmann and others. *See under* VII.

14,981. Weir, Ltd., and Weir. Sea-water evaporators. June 27.

15,134. Greville. Apparatus for drying slurry, etc. June 28.

15,173. Smallwood. *See under* X.

15,195. Von Eicken. Manufacture of non-oxidising protective gas. [Ger. Appl., June 29, 1910.]* June 29.

15,230. Testrup. Apparatus for treating liquid substances. June 29.

15,233. Appleton. Stop-valve for acids. June 30.

15,291. Mueller. Filling for cooling towers.* June 30.

15,372 and 15,373. Hines. Apparatus for heating, drying, and otherwise treating materials. July 1.

Complete Specifications Accepted.

14,487 (1910). Deacon, Gore, and Palatine Engineering Co. Filtering apparatus. June 21.

14,500 (1910). Ohren. Tunnel kilns. June 28.

14,506 (1910). Sutcliffe. Tunnel kilns. June 21.

15,820 (1910). Humphrey. Raising or forcing liquids and apparatus therefor. July 5.

15,999 (1910). Hildebrandt. *See under* VII.

16,953 (1910). Grossmann. Method and apparatus for drying organic matter and substances containing the same. July 5.

17,623 (1910). Baldwin. Apparatus for separating dust and other materials from gases. June 21.

17,696 (1910). Fowler and Medley. Apparatus for subjecting gases or vapours to the action of liquids. June 28.

22,861 (1910). Still. Mixing apparatus or stirrers for liquids. July 5.

25,225 and 29,964 (1910). Smith. Filtering apparatus. June 28.

28,514 (1910). Broadbent and Sons, Ltd., and Broadbent. Hydro-extractors and like centrifugal machines. June 21.

29,145 (1910). Porges, Singer, and Steinschneider. Distilling vessels. July 5.

3269 (1911). Still. Reflux condensers. July 5.

6865 (1911). Pye-Smith. Apparatus for making solutions or their filtrates. July 5.

II.—FUEL; GAS; MINERAL OILS AND WAXES; DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

13,912. Dempster and Sons, Ltd., and Toogood. Vertical gas retorts. June 12.

14,061. Matthews. Incandescent gas mantles. June 13.

14,065. Clarke and Campbell. Means for the discharge of tar and liquor from hydraulic mains of gas plant. June 13.

14,131. Rigby and Testrup. Supply of heat in wet carbonising installations, etc. June 14.

14,232. Bingham. Gas generators. June 15.

14,323. Otto-Hilgenstock Coke Oven Co. (Otto und Co.). Supply of gas to the flues of coke ovens.* June 16.

14,440. Burstall. Machine for treating gases in the production of sulphate of ammonia.* June 19.

14,588. Guignard and Watrigant. *See under* VII.

14,729. Conradty. Electrodes for electric arc lamps.* June 21.

14,734. Bailey. Apparatus for making trials relative to explosions in coal mines. June 21.

14,735. Hiby. Regenerative coke ovens.* June 21.

14,767. Kunze. Gas generators.* June 21.

14,774. Dor-Delattre. Gas producers.* June 21.

14,841. Phillips and Phillips. Manufacture of coal briquettes.* June 26.

14,843. Brown. Gas-retort ovens and other heating furnaces. June 26.

14,896. Hellmann. Treatment of petroleum. June 26.

14,976. Livens and Senior. Suction gas producers.* June 27.

15,030. Kunze. Production of gas from coal.* June 27.

15,034. Mueller. *See under* VII.

15,059. Epstein. Fuel. June 27.

15,195. Von Eicken. *See under* I.

15,227. Petersen-Hviid. Removing the volatile constituents of wood.* June 29.

15,388. Von Unruh and Weigel. Manufacture of incandescent gas mantles.* July 1.

Complete Specifications Accepted.

6041 (1910). Testrup. Wet carbonising of peat. June 21.

12,210 (1910). Greaves. Coke ovens. June 28.

17,048 (1910). Jones. Gas producers. July 5.

18,406 (1910). Phillips. Retorts to improve the quality of coke. June 21.

23,125 (1910). Tanne and Oberländer. Separation of solid hydrocarbons from naphtha residues and tars. July 5.

25,336 (1910). Macklow-Smith. Gas calorimeters. July 5.

26,045 (1910). Kranniehfeldt. Production of electric incandescence bodies. June 28.

29,709 (1910). Stelfox. Water-gas apparatus. June 28.

2138 (1911). Hutchins. Gas producers. July 5.

3197 (1911). Fabry. Horizontal or inclined regenerative coke ovens. July 5.

III.—TAR AND TAR PRODUCTS.

Complete Specifications Accepted.

22,097 (1910). Newton (Bayer und Co.). Manufacture of sulphaminobenzoylaminonaphthols and their sulphonic acids. June 21.

23,125 (1910). Tanne and Oberländer. *See under* II.

IV.—COLOURING MATTERS AND DYES.

Applications.

14,225. Newton (Bayer und Co.). Manufacture of vat dyestuffs from arylaminoanthraquinone derivatives. June 15.

14,499. Newton (Bayer und Co.). Manufacture of a vat dyestuff. June 19.

14,904. Meister, Lucius, und Brüning. Vat dyestuffs. [Ger. Appl., Sept. 12, 1910.]* June 26.

15,205. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds and colouring matters of the anthracene series. June 29.

Complete Specifications Accepted.

12,264 (1908). Badische Anilin und Soda Fabrik. Manufacture of colouring matters of the anthracene series. June 21.

14,448 (1910). Levinstein, Baddiley, and Levinstein, Ltd. Azo dyestuffs and their production. June 21.

15,069 (1910). Levinstein, and Levinstein, Ltd. Manufacture of azo dyestuffs derived from halogenated naphtholsulphonic acid. July 5.

15,646 (1910). Ransford (Cassella und Co.). Manufacture of azo dyestuffs from aminophenylnaphthimidazole-oxysulphonic acid. July 5.

15,649 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of condensation products and colouring matters of the anthracene series. July 5.

24,886 (1910). Meister, Lucius, und Brüning. Manufacture of reddish-blue to violet-blue vat dyestuffs. July 5.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

14,142. Lilienfeld. Rendering pliant layers, masses, or threads of cellulose or its derivatives. [Austrian Appl., June 15, 1910.]* June 14.

14,167. Hooker. Treatment of flax. June 14.

14,266. Timpe. Manufacture of artificial silk.* June 15.

14,714 to 14,718. Campbell. Processes of preparing flax.* June 21.

14,871. McRae and Malcolmson. Production of paper.* June 26.

15,334. Butterfield. Treatment of fibres for the production of paper pulp or paper. July 1.

Complete Specifications Accepted.

14,559 (1910). Hübner. Production of threads from cellulose. June 21.

29,246 (1910). Verein. Glanzstoff-Fabr. Manufacture of non-inflammable materials similar to celluloid. June 21.

30,010 (1910). Wickel. Production of transparent metallic paper. June 28.

433 (1911). Van Hemelryk. Apparatus for treating old paper, etc., to produce paper pulp. July 5.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

13,969. Murray. Apparatus for supplying liquid to wool fibre. [U.S. Appl., Feb. 6, 1911.]* June 12.

13,982. Schlumpf. Shifting hanks of yarn when dyeing. [Ger. Appl., June 10, 1910.]* June 12.

14,099. Reddaway. Compound for waterproofing fabrics, etc. June 14.

14,190. Higgins and Rhodes. Dyeing and washing machines. June 15.

14,292. Calico Printers' Assoc., and Davis. Printing textile and other fabrics and materials. June 16.

14,643. Taylor. Apparatus for dyeing cloth or piece goods. June 21.

14,901. Newton (Bayer und Co.). Production of blue shades on wool. June 26.

14,973. Taylor. Bleaching linen, cotton, and like fabrics. June 27.

15,051. Bradford Dyers' Assoc., and Wilkinson. Dyeing with sulphide colours. June 27.

15,325. Lishman. Kiers for washing, sterilising, bleaching, etc. July 1.

Complete Specifications Accepted.

14,645 (1910). Spenle. Apparatus for drying proofed and like fabrics. June 28.

14,962 (1910). Steven. Dyeing and finishing frames. June 21.

11,420 (1911). Meister, Lucius, und Brüning. Printing carpet yarns. June 28.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

13,934. Nerking. Production of rhodan compounds.* June 12.

13,988. Banes. *See under* X.

14,058. Ashcroft. Manufacture of ammonium chloride and by-products. June 13.

14,121 and 14,122. Pauling. Absorption of nitrous gases. [Ger. Appls., Nov. 17, 1910.]* June 14.

14,420. Rosenheim, Meyer, and Koppel. Production of hypophosphoric acid and hypophosphates. [Ger. Appl., June 21, 1910.]* June 17.

14,440. Burstall. *See under* II.

14,502. Thompson (Chem. Fabr. Gedeon Richter). Preparation of stable solid hydrogen peroxide compounds.* June 19.

14,588. Guignard and Watrigant. Recovery of hydrocyanic acid from gases. [Fr. Appl., Jan. 16, 1911.]* June 20.

14,628. Teed, Sulman, and Picard. Recovery of sulphur from gases. June 20.

14,631. Wallace and Wassmer. *See under* XVI.

14,665. Woltereck. Production of formic acid. June 21.

14,670. Eschellmann, Harmuth, and Ges. der Tentelewschen Chem. Fabr. Apparatus for cooling the hot gases from pyrites kilns, etc. June 21.

14,703. Pictet. Manufacture of a hydrogen mixture. [Addition to No. 13,397 of 1911. Ger. Appl., June 22, 1910.]* June 21.

14,762. Chance, and British Cyanides Co., Ltd. Manufacture of cyanide. June 21.

15,034. Mueller. Recovery of ammonium sulphate from distillation gases.* June 27.

15,181. Perret. Extraction of compounds of vanadium, molybdenum, tungsten, etc. [Fr. Appl., Nov. 24, 1910.]* June 29.

15,188 and 15,189. Soc. Anon. des Usines de Riouperoux. Effecting the peroxidation of the alkali metals. [Fr. Appls., July 11 and 12, 1910.]* June 29.

Complete Specifications Accepted.

6273 and 6274 (1910). Heide (Bailey). *See under* XIII.

15,817 (1910). Christie. Manufacture of ammonium sulphate. June 28.

15,877 (1910). Burkheiser. Preparation of ammonium sulphite or sulphate from gases. July 5.

15,999 (1910). Hildebrandt. Fractional distillation of liquefied air and like gaseous substances. June 21.

VIII.—GLASS; CERAMICS.

Applications.

14,012. Adams. Vitreous enamelling of metals. June 13.

14,033. Marino. Superficial metallisation of silicious articles.* June 13.

14,647. Pagen. Drying china-clay and the like. June 21.

14,923. Debroux. Furnaces for the manufacture of coloured glass. June 26.

Complete Specification Accepted.

20,414 (1910). Demongeot. Fusing of vitrifiable substances. June 21.

IX.—BUILDING MATERIALS.

Applications.

13,924. Calthorp, Hill, and Child. Production of artificial stone and the like. June 12.

14,433. Botson and Borlée. Product for painting on cement. June 17.

14,435. Botson and Borlée. Manufacture of artificial stones or marbles. June 17.

Complete Specifications Accepted.

16,691 (1910). Smart. Manufacture of bricks. June 21.

23,354 (1910). Colletas. Treatment of plaster, cement, and like surfaces. June 28.

30,035 (1910). Hippe. Manufacture of artificial stone. June 21.

5079 (1911). Fraser. Manufacture of artificial stone. June 28.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

13,964. Murex Magnetic Co., Ltd., and Samuel. Magnetic separation of ores or the like by the wet method. June 12.

13,978. Liebig. Roasting or calcining zinc blende or other minerals. [Ger. Appl., June 10, 1910.]* June 12.

13,988. Banes. Treatment of sulphide ores to remove sulphur and to produce sublimed white lead and zinc oxide. [Australian Appl., June 10, 1910.]* June 12.

14,060. Vickers, Sons, and Maxim, Ltd., and Benthall. Manufacture of armour plates. June 13.

14,239. Soc. Anon. Electrométallurgique. Process of refining steel. [Fr. Appl., June 15, 1910.]* June 15.

14,537. Burgess. Coating with metal. June 20.

14,612. Sieurin. Reduction of metal ores.* June 20.

14,648. Barker. Bright annealing of non-ferrous metals. June 21.

15,071 and 15,072. Barron and Barron. Deposition of metals and solution therefor. June 28.

15,150. Testrup. Production of finely divided metals. June 28.

15,173. Smallwood. Furnaces for heating, puddling, smelting, calcining, treating chemicals, etc. June 29.

15,181. Perret. *See under* VII.

15,292. Malkemus and Pletsch. Washing ores containing sulphides. [Ger. Appl., Aug. 10, 1910.]* June 30.

Complete Specifications Accepted.

6664 (1910). Vickers, Sons, and Maxim, Ltd., and Benthall. Manufacture of armour plates. June 28.

14,940 (1910) and 9227 (1911). Smart. Aluminium alloys. June 28.

14,955 (1910). Beardmore. Manufacture of steel for armour plates, guns, etc. June 28.

15,674 (1910). Zohrab, Evans, and Brown. Blast furnaces. June 21.

17,238 (1910). Buess. Crucible furnaces. June 28.

22,777 (1910). Massip. Electric furnaces and the manufacture of steel. July 5.

23,331 (1910). Harris. Mechanical ore roasting furnaces. June 28.

23,817 (1910). Herdman. Manufacture of slag wool. July 5.

25,092 (1910). Marks (Langbein-Pfanhauser-Werke). Manufacture of detachable electrolytic iron deposits. June 21.

29,830 (1910). Boucher. Manufacture of iron and steel. June 28.

XI.—ELECTRO-CHEMISTRY.

Application.

15.128. Siemens und Halske, A.-G. Manufacture of manganese peroxide anodes. [Ger. Appl., June 29, 1910. Addition to No. 605 of 1909.]* June 28.

Complete Specifications Accepted.

11,693 (1910). Billiter. Electrolysis of liquids. June 21.

13,946 (1910). British Thomson-Houston Co. (General Electric Co.). Electric insulating material. June 21.

18,969 (1910). Higgins (Higgins). Electrolytic reduction of organic bodies. June 28.

29,299 (1910). Serpek. Revolving electric furnaces. June 21.

XII.—FATS; OILS; WAXES.

Applications.

14,728. Cookson (Saunders). Manufacture of palm oil.* June 21.

14,934. Engel. Raw tallow substitute for lubricating purposes.* June 26.

15,062. Tyrrell. Candles. June 28.

15,146. Moretti. Process for making candles consisting of a mixture of stearine and paraffin, opaque.* June 28.

Complete Specifications Accepted.

15,288 (1910). Koller. Organic chloro-compound soaps and cleansing compositions. June 28.

28,765 (1910). Borrill. Cleansing fluid. July 5.

4586 (1911). Joehlinger. Manufacture of soap. July 5.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

13,988. Banes. *See under* X.

14,315. Schindelmeiser. Refining raw pitch pine oil, turpentine oil, etc.* June 16.

14,354. Pigments, Ltd., and Thompson. Manufacture of pigments. June 16.

15,198. Pigments, Ltd., and Thompson. White lead. June 29.

Complete Specifications Accepted.

6273 and 6274 (1910). Heide (Bailey). Process and apparatus for the production of lead oxide and white lead. June 21.

14.293 (1910). Peters. Protective coatings or varnishes. June 21.

27,076 (1910). Marks (Southern Manufacturing Co.). Apparatus for extracting products from wood. June 28.

1980 (1911). Leishman. Substitute for boiled linseed oil, etc., in varnishes, paints, waterproof compositions, linoleum, etc. July 5.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Application.

14,131. Taylor and Penang Sugar Estates Co., Ltd. (Miller). Curing and preparing rubber.* June 28.

Complete Specifications Accepted.

5931 and 5932 (1910). Perkin and others. Synthetic manufacture of caoutchouc and its homologues, and intermediate products. June 21.

6486 (1910). Bloxam (Callender). Production of rubber or substances resembling rubber. June 21.

10,056 (1910). Rankin. Treatment of the latex obtained from rubber and like trees. July 5.

14,040 and 24,236 (1910). Heinemann. Production of isoprene. June 21.

14,041 and 24,237 (1910). Heinemann. Polymerisation of isoprene. June 21.

25,850 (1910). Bayer und Co. Manufacture of substances similar to caoutchouc. July 5.

6642 (1911). Bayer und Co. Production of products similar to vulcanised caoutchouc. June 28.

7325 (1911). Zierow, and Kammer und Reinhardt. Manufacture of plastic substances. June 28.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

14,943. Delahaye. Manufacture of imitation leather. [Fr. Appl., July 23, 1910.]* June 26.

15,014. Kelly. Flexible composition or glue. June 27.

15,118. Albert and Berend. Preparation of condensates from casein, phenols, and formaldehyde.* June 28.

XVI.—SOILS; FERTILISERS.

APPLICATION.

14,631. Wallace and Wassmer. Treatment of phosphate ores. June 30.

COMPLETE SPECIFICATION ACCEPTED.

18,523 (1910). Cusatelli. Manufacture of superphosphates. June 28.

XVII.— SUGARS; STARCHES; GUMS.

COMPLETE SPECIFICATION ACCEPTED.

14,657 (1910). McMullen. Sugar producing products and process of producing same. June 28.

XVIII.—FERMENTATION INDUSTRIES.

APPLICATIONS.

14,664. Finch, and International Pfaudler, Ltd. Fermenting vats and the like.* June 21.

15,121. Stein. Compounds for use in brewing fermented beverages. [U.S. Appl., July 26, 1910.]* June 28.

15,203. Fernbach and Strange. Manufacture of products of fermentation. June 29.

15,204. Fernbach and Strange. Manufacture of higher alcohols. June 29.

COMPLETE SPECIFICATIONS ACCEPTED.

9777 (1910). Kuhn. Production of etherified and clarified fermented beverages. July 5.

19,024 (1910). Jarraud. Artificial ageing of wines, spirits, and liqueurs. July 5.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

APPLICATIONS.

14,013. Mestern, and Ozongenerator Ges. Apparatus for producing pure air containing ozone.* June 13.

14,114. Howe and Davis. Artificial human milk.* June 14.

14,415. Remington. Treatment of flour. June 17.

14,630. Von der Mülbe. Process and apparatus for disinfecting.* June 20.

14,720. Kwilecki. *See under* XXIII.

14,912. Banque du Radium. Apparatus for sterilising liquids by ultra-violet rays. [Fr. Appl., June 27, 1910.]* June 26.

14,981. Weir, Ltd., and Weir. *See under* I.

14,983. Box and Sunderland. Treatment of refuse. June 27.

15,010. Banque du Radium. Apparatus for sterilising liquids by ultra-violet rays. [Fr. Appl., Oct. 15, 1910.]* June 27.

15,074. Edwards. Nutritive chocolate. June 28.

15,166. Callender. Antiseptic or disinfectant compound. June 29.

COMPLETE SPECIFICATIONS ACCEPTED.

15,313 (1910). Hutcheon. Foods containing certain bacteria. June 28.

23,184 (1910). Anderson and Meikle. Obtaining valuable extracts from vegetable substances. July 5.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

APPLICATIONS.

14,471. De Szendeffy. Production of radioactive aromatic compounds of iodine and bromine.* June 19.

14,699. Johnson (Verein. Chininfabr. Zimmer und Co.). Manufacture of carbonates of tertiary alcohols. June 21.

14,907. Johnson (Verein. Chininfabr. Zimmer und Co.). Manufacture of quinine esters of aromatic amino acids. June 26.

15,204. Fernbach and Strange. *See under* XVIII.

COMPLETE SPECIFICATIONS ACCEPTED.

14,040, 14,041, 24,236, and 24,237 (1910). Heinemann. *See under* XIV.

18,969 (1910). Higgins. *See under* XI.

28,378 (1910). Mathys (Bleiberger, Weber, und Co.). Menthylated oil of wintergreen and process of producing same. July 5.

29,907 (1910). Von Wülfing. Therapeutical preparations containing formaldehyde. June 28.

778 (1911). Schmidt. Radioactive materials for rendering solids, liquids, or gases radioactive. June 21.

2375 (1911). Bloxam (Ornstein). Production of acetylene tetrachloride. July 5.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATION.

14,744. Caldwell. Development of photographic images. June 21.

COMPLETE SPECIFICATIONS ACCEPTED.

8761 (1910). Palmer. Photographic colour screen plates. June 21.

14,420 (1910). Günther. Photographic paper. June 21.

16,421 (1910). Herzka. Manufacture of photographic plates which avoid halation. July 5.

XXII.—EXPLOSIVES; MATCHES.

COMPLETE SPECIFICATION ACCEPTED.

7625 (1910). Silberrad. Explosives. July 5.

XXIII.—ANALYTICAL PROCESSES.

APPLICATION.

14,720. Kwilecki. Apparatus for determining the amount of albumin in liquids. [Ger. Appl., Feb. 24, 1911.]* June 21.

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PROCEEDINGS

OF THE

THIRTIETH ANNUAL MEETING.

SHEFFIELD.

WEDNESDAY, JULY 12TH, 1911.

The Thirtieth Annual General Meeting of the Society of Chemical Industry was held at the Cutlers' Hall, Sheffield, on Wednesday, July 12th. The chair was occupied by the President (Mr. Walter F. Reid), who was supported by the President-elect (Dr. Rudolph Messel), the Chairman of the local Executive Committee (Councillor Cecil H. Wilson), the Hon. Treasurer of the Society (Mr. Thomas Tyrer), and the Secretary (Mr. Charles G. Cresswell). At a later stage the Master Cutler (Alderman George Senior) arrived, and remained at the meeting a short time.

The Minutes of the last Annual Meeting, held at Glasgow, having been read and confirmed, COUNCILLOR WILSON said the Lord Mayor would give an official welcome to the Society on the following night, but it was thought by the Executive that the Corporation should, at the first meeting, express their welcome, and he had been asked to undertake this duty as a member of the City Council. Those who were associated with the city were glad to welcome the Society to their midst. How it came about that the city had never done so before, he was somewhat at a loss to understand. He could only suppose it was because they had been waiting to become the most important, or the largest, city in Yorkshire. He hoped that they would not find Sheffield so black a place as it was generally painted, and that they would take away nothing but kindly feelings about the city. The local manufacturers had placed facilities at their disposal, which he was quite sure would be greatly appreciated. He hoped their visit to Sheffield would be thoroughly enjoyable.

The PRESIDENT, in thanking Mr. Wilson for the welcome, said they all knew Sheffield by reputation—some, like himself, by personal experience—and that Sheffield knew how to treat its guests well. There was no city in the United Kingdom which offered more points of interest, especially to those who were engaged in industrial pursuits.

The MASTER CUTLER, on arriving at the meeting shortly after, was heartily welcomed by the President. ALD. SENIOR, in reply, expressed his pleasure at the visit of the Society to Sheffield. He regretted that, owing to the meeting of the City Council taking place that day, and to other engagements, he was not able to spend much time with them.

The PRESIDENT, in announcing the result of the elections which had taken place to fill the vacancies on the Council during the year, said : In the first place, the President retires, and I should like to take this occasion of thanking the members for placing me in the highest position which it is possible to bestow in connection with our Society. I am an original member of the Society, and one of those who have worked for many years in connection with it, but I cannot help feeling that there were many other original members and others who might have better filled the office that I am now vacating. I hope that during my term of office the importance of the Society has not been diminished. I have found by actual experience that the importance and position of our Society are growing from year to year. It is fully recognised by our kindred Societies. Your President is invited to the meetings and banquets of all the other Societies who are in any way associated with us. As you know, we are represented on several Government bodies, and members of our Society, although not officially elected on other bodies as representing the Society, are elected, one knows, because they occupy an influential position in our Society. It was through this Society that I have attended a great many international exhibitions. I am a member of the Board of Trade Committee on International Exhibitions, and it is owing to my position in this Society that I have had that honour bestowed upon me. The only pleasure—and real pleasure—I feel in vacating the office is that I am handing it over to one who will more worthily represent the Society than I have been able to do myself—Dr. Rudolph Messel. There are some of you here who do not perhaps fully appreciate the merits of Dr. Messel from the point of view of technical chemistry. He has been an enthusiastic and industrious worker for the Society from the commencement, but he has not been one to advertise himself. He has done things, and he has not, as some do, continually published researches which have occupied so many years of his time. But we know from the results of those researches—from the great industry of which he was the originator, sulphuric acid manufacture by the contact process—that his work has been successful. We are very pleased indeed to welcome him as our coming President. According to the by-laws, I have been nominated a Vice-President, with the following gentlemen : Mr. H. Hemingway, who has done excellent work on the Council for many years ; Professor G. G. Henderson, who has taken such a prominent part in technical education in Glasgow, and Sir William Crookes, O.M., F.R.S. It would be presumptuous to say a word about Sir William Crookes. He is known to all of us. As ordinary members of the Council, Dr. Martin O. Forster, Mr. W. J. Leonard, Mr. N. H. Martin, and Professor W. Lash Miller have been elected. Some of them have already served on the Council, and we are very glad to have them back again. Owing to our democratic by-laws, nobody can be a fixture on the Council. After the lapse of a certain period of service, each one has to retire.

I am sure you will welcome those gentlemen who have previously served, and I am quite sure also, that you will approve of the choice of those gentlemen who are now for the first time joining the Council. It seems almost unnecessary to say that we have elected as our Honorary Treasurer Mr. Thomas Tyrer, but annual election is the usual procedure. He does not tire of his heavy duties, and he is willing to work for us in all sorts of capacities, and to bring his unrivalled experience to our aid on every occasion. Our President-elect has for some time—since the death of our previous Foreign Secretary, Dr. Ludwig Mond—carried out, with distinction, the duties of Honorary Foreign Secretary of our Society. Nobody could be better fitted than Dr. Messel, both from his knowledge of languages and his connections on the Continent, to carry out that duty, but it has been our practice not to let the same gentleman fill two offices in this Society. Therefore, as he becomes President, it was felt that the office of Foreign Secretary should devolve upon someone else, at any rate for the time, and we could find no one better qualified and better fitted to occupy that post, both from his knowledge of chemical technology and of languages, and his connections on the Continent also, than Dr. Julius Lewkowitsch. I put to you the names that I have read, and I hope you will show your approval of the choice of the Council.

The meeting signified its agreement with the elections made.

The Secretary then read the Report of Council as follows :—

REPORT OF COUNCIL.

The number of members now on the register of the Society is 4300 as compared with 4299 at the last Annual Meeting. During the year 245 members have been elected as compared with 253 last year, and the losses have been 244 as against 277 last year. There were 45 deaths as compared with 38 last year.

The names of the members who have died are :—Lord Airedale, H. W. Alder, Dr. John Attfield, H. Harper Baird, R. H. D. Benn, Jos. Brown, Dr. B. S. Bull, Dr. H. Caro, W. H. J. Clarke, Edw. Collins, Prof. A. W. Cronquist, W. Donald, R. A. Duncan, Dr. H. Erdmann, Dr. C. Fahlberg, F. A. Fifield, W. M. Fuller, F. A. Genth, W. T. Gibbs, Colin Gordon, J. A. R. Greaves, F. Barnes Grundy, Andrew Gunn, Oscar Guttmann, Edw. Johnson, L. P. Kinnicutt, A. S Kotibhaskar, F. Livingstone, G. C. Lomer, Prof. N. W. Lord, Dr. W. McCowan, J. McCulloch, R. McVitie, E. Maertens, Dr. L. Oliver, W. R. Quinan, Jos. E. Riley, W. B. Roberts, F. C. Robinson, H. F. Rolker, G. A. Schwarz, James Sharp, H. G. Shaw, H. Wood Smith, John Spencer, T. S. Timmis, and T. Wolcott.

From the Council of the Society four Ordinary Members retire, and as four nominations have been made to the vacancies, no ballot is needed.

The following Chairmen of Local Sections retire :—Dr. Slater Price (Birmingham), Dr. W. Lash Miller (Canada), Mr. R. H. Clayton (Manchester), Dr. W. H. Walker (New England), Dr. C. F. McKenna (New York), and Mr. S. J. Pentecost (Nottingham). The following have been elected to succeed them :—Mr. E. C. Rossiter, Dr. A. McGill, Dr. G. J. Fowler, Mr. C. L. Gagnebin, Mr. M. C. Whitaker and Mr. S. R. Trotman. The following Hon. Local Secretaries retire :—Mr. W. Roscoe Hardwick (Liverpool), Mr. J. Hübner (Manchester), Dr. H. Schweitzer (New York) and Mr. S. R. Trotman (Nottingham). They are succeeded by Mr. Alexander Rule, Mr. W. H. Coleman, Dr. Parker C. McIlhiney, and Dr. H. J. S. Sand. The Council is glad of this opportunity to thank the retiring Chairmen and Secretaries for their services, which, in the case of Dr. Schweitzer, have extended over sixteen years.

The Eighth International Congress of Applied Chemistry will be held in Washington and New York, U.S.A., from September 4th to September 13th, 1912, and the Executive Committee invited this Society to take steps on its behalf to further the objects of the Congress. The Council therefore invited other learned Societies to nominate representatives to a Joint Organising Committee. Twenty of these Societies responded, and a strong Committee having been formed, progress was at once made with the necessary business. The General Secretary of this Society has, with the concurrence of the Council, undertaken the duties of Hon. Secretary of the Congress Committee.

The New York Section has availed itself of the opportunity of the meeting of the Congress in America to invite this Society to hold its next Annual General Meeting in New York, so that members of the Society may take part in both proceedings. This invitation has been accepted by the Council, and it is hoped that the meeting in New York will be in every way representative.

The balance sheet and annual statement of account, which has already appeared in the Journal, will be laid before the meeting.

On the report of Dr. Divers, urging the need of a Department of Chemical Technology at the Imperial College of Science and Technology, the Council passed a resolution expressing the opinion that the governing body should forthwith proceed to formulate and carry out some complete scheme of training in Chemical Technology, and authorised Dr. Divers, as the Society's representative on the Board, to express this formally as the opinion of the Council. The proposal has been favourably received, and, when a scheme is formulated, the Sections of the Society will have an opportunity of considering it.

The Council has further collaborated with others in an endeavour to obtain a reduction of postage on scientific and other journals which are at present excluded from the newspaper rates. The postage of the Journal amounts to about £800 a year, making a very heavy charge on the Society's funds.

One of the practical results of the Seventh International Congress of Applied Chemistry was the formation of an International Commission for the purpose of compiling and publishing Annual Tables of Constants and Numerical Data. It is hoped that ultimately this enterprise may become self-supporting, but in its initial stages it requires assistance, and the Council has granted a sum of £10 and two annual sets of the Society's Journal in furtherance of the work.

In consequence of the steady growth of Applied Chemical Science there is a constant increase in the size of the Society's Journal, notwithstanding the efforts of the Publication Committee and Editorial staff to secure brevity and the exclusion of all unimportant matter. It is unlikely that this growth will cease or even slacken. At the present moment, the new members elected only suffice to balance those lost by death and other inevitable causes, but the Council trusts that the valuable work of the Society will appeal to a continually widening circle, so that an increase of membership and not a mere balancing of members may be recorded in future years.

Professor SMITHELLS, in proposing the adoption of the report, said, they were very grateful to the Council for the pains they bestowed upon the work of the Society, which they took so seriously and discharged so efficiently.

Mr. R. B. BATTY seconded the adoption, which was unanimously carried.

The PRESIDENT said they would all regret the absence, through illness, of Sir Henry Roscoe ; he had sent a very kind personal message to the meeting wishing them success, and said he was always at the disposal of the Society, as he always had been. He (the PRESIDENT) thought it would be a graceful act to send him a telegram wishing him a speedy recovery. He had drafted the following telegram :—" Sir Henry Roscoe, London. The Society of Chemical Industry desires me to express their sincere regret at the absence of their first President at their Annual Meeting, and their hopes for his speedy recovery.—Reid, President."

It was agreed that the telegram be sent.

Mr. THOMAS TYRER, in presenting the statement of accounts and balance sheet (see this J., June 15th, 1911, 657 and 658), said it told its own story. The point that most of them looked at in a balance sheet was to see if the receipts equalled the expenses. If the receipts were below expenditure, they looked gloomy, but when they were above, they were happy—with reservations. In the present case, the income exceeded the expenditure by £773 19s. 3d. But because they had that surplus, it must not be supposed that there was no need to obtain new members. There was. The cost of printing, and other standing charges, were proportionately diminished by the increase of members, and it was necessary that there should be an increase, looking at it merely from the honorary treasurer's point of view. Moreover, that £773, while it was an excess of receipts over expenditure for the year, was not what one would call in business a profit. Under by-law 58, two items of revenue must always be treated as capital—the life composition fees and entrance fees. That was a wise provision. The revenue derived from these two sources bad not been actually set aside, but a larger sum had been invested at the beginning of the current year. As shown in the balance sheet, the investments of the Society, on December 31st, amounted to £16,900 5s. With the income coming from that sum, they could easily see where the £773 came from. The interest on the investments averaged just a shade over 3 per cent. It was not very much, but the investments were safe. True, within the last few weeks, one of their so-called gilt-edged securities had fallen considerably in value, but that was more or less a matter of form in these days, when trustee securities—gilt-edged securities—had a wider range. There was nothing in the by-laws which said that the interest on their securities should not be used for the purposes of the Society, but he thought every sensible man would admit that it should be treated as a reserve. As long as they were in the position shown by the statement, it did not very much matter, but, as Treasurer, he must always take care that, apart from the earmarking of the two items he had referred to, the rest should always be conserved as much as possible. He had nothing more to say about the accounts, except to point out that one could not find fault with the increase of expenses of the Sections. Last year there was only a few pounds difference. In fact it was satisfying, from a Treasurer's point of view, that all the items ran so concurrently. He would say, however, that in his opinion they did not get from the Sections the return that they ought to get in two directions. He thought they ought to give the Society more papers—not long ones, necessarily—and more members. Each sectional officer, Chairman, and Secretary, might be, and ought to be, an active, living missionary, and the members ought to be the same. If people properly realised the benefits, social and otherwise, of membership of the Society and of its sections, the gains in membership would far more than balance the losses.

Mr. CHARLES E. GROVES, F.R.S., moved the adoption of the Treasurer's Report, and also a vote of thanks to the Honorary Treasurer. The Society had greatly benefited by having him as Treasurer, from his knowledge of personal character and of finance. It was invidious to draw comparisons, but he knew some Societies which would be in a better position if they had the Treasurer of the Society of Chemical Industry.

Mr. George Ward, in seconding, expressed appreciation of the deep interest which Mr. Tyrer had taken in the Society for so many years.

The President, in putting the resolution, said his very old friend had done a great deal more for the Society, as Honorary Treasurer, than any of them who were not members of the Council could understand. The work that they saw and heard of was only a small fraction of what he had to perform. When they considered that there were nearly 4500 members, and that the Treasurer had to communicate not once, but in many cases several times, with all of them, they would fully understand that when they called him their Honorary Treasurer, it was they who were honoured by his accepting the office and carrying out the duties so efficiently.

The resolution was carried unanimously.

Mr. Tyrer, in reply, said he was deeply thankful to have such kindly words said of him. It was true that a lot of work was done behind the scenes. They did not all work in the limelight. But the extent of his work had been exaggerated. Second communications were only necessary in perhaps 1 or 2 per cent. of the cases. Occasionally, there were amusing incidents. Some people would cut their 25s. postal order into three in a funny way. In other cases, they forgot to sign their cheques, or to put in the name of the payee. These things called for a little correspondence, which helped one to have a joke on paper, and generally elicited some extremely nice remark, which was in the nature of a lubricant to the dry business of finance. He was not the originator of the present system of finance. He had been in office three years, and had but followed in the footsteps of his predecessors, and if there was any solidity or solidarity in the system it was due to Mr. Cook and Mr. Hall. He was allowed to have an assistant, whose honorarium, together with clerical assistance, amounted to £77 10s., which he thought was uncommonly well earned.

The President then delivered his address, as follows :—

PRESIDENT'S ADDRESS.

There is no period in the history of chemical industry when progress has been so varied and so rapid as at the present moment. New apparatus, methods and products appear with such rapidity that it has become extremely difficult to keep pace with all the applications of science to our industries. One number of our Journal will probably contain more new information than would have seen the light in a whole year a century ago. It is now quite impossible for any one individual to keep up to date in all branches of applied science, and the tendency of the present age is towards specialisation. But too minute sub-division has its disadvantages; all sciences are more or less dependent upon each other, and the higher officials of a chemical factory, for instance, must have some knowledge of a number of subjects besides chemistry. Not every factory, however, is of sufficient magnitude to engage the services of electricians, physicists, engineers, and other similar experts and, in the organisation of new industries, the cost would prove prohibitive. There will, therefore, always be a demand for trained men who have a good knowledge of science generally, and especially of the methods of applying it.

Manufacturing chemists frequently receive the advice from those engaged in other industries to employ more skilled assistants in their factories. The advice is no doubt well-meant; but it is those who give it who need it most. Mr. Barker North, in his Presidential Address delivered before the Association of Teachers in Technical Institutions at Southport last month, pointed out that chemical factories stand at the head of all our great industries as regards the proportion of skilled supervision employed. If we take each £100 paid in salaries and wages combined, we find that the chemical manufacturer expends £11·7 in salaries and £88·3 in wages, while in the nine chief industries of the country the average is £4·5 in salaries and £95·5 in wages. That this intelligent appreciation of the needs of modern industry on the part of chemical manufacturers brings its reward is shown by the figures of the Industrial Census of 1907. Taking again the nine chief trades of the country, we find the net annual output per head of those employed as follows :—

Trade.	Net Annual Output. Per Head £
1. Engineering Factories	108
2. Cotton Factories	82
3. Iron and Steel Factories	118
4. Woollen and Worsted Factories	76
5. Shipbuilding Yards and Marine Engineering Factories	96
6. Railways Construction and Repair Factories	71
7. Bleaching, Dyeing, Printing and Finishing Factories	101
8. Chemicals, Coal Tar Products, Drugs and Perfumery Factories	185
9. Jute, Linen, and Hemp Factories ..	61
Average	93

With this example before them, it would be well if other manufacturers were to follow our lead.

It is sometimes alleged that the nature of the training given to students is not of a sufficiently practical character and that some foreign nations are superior to us in this respect. I do not think it can at present be said that the facilities for acquiring knowledge are less in Great Britain than in any other country; in fact, in some of our institutions they are superior. Not only our seventeen universities, but also a number of technical colleges and institutes devoted to special trades or industries, afford ample opportunity for the acquisition of such technical knowledge as they teach to their students. Even the fees are in many cases provided for by scholarships granted to those who show most aptitude in the earlier stages of their education. Quite recently a scheme of Industrial Bursaries has been instituted by the Royal Commission for the Exhibition of 1851, and was published in the last number of our Journal. This scheme goes a little farther than the ordinary scholarships, in that it provides assistance for the student after he has gone through the college or university course. The object aimed at is to provide practical instruction in factories for a period varying from one to three years.

All these schemes for assisting students have one feature in common: they provide out of public funds educational expenses which would otherwise be borne by the parents or relatives of the students. Those who believe in the principles of heredity will ask themselves whether the fitness of parents to provide for their own children is not in itself the best proof available for the ability of the stock. There can be little doubt that the examinations which lead to scholarships are of little practical use to the student, and that the time devoted to preparation for them is not always well spent. I was much struck in the United States by finding university students during their vacations driving tram-cars, wheeling bath chairs, and in various other ways earning the money to pay their fees. I felt, as an employer, that I would give such men the preference did I require their services, as compared with others who had made no effort to help themselves.

The most divergent opinions have been expressed as to the merits of various systems of training, and there can be little doubt that the same goal may be reached by various paths. The most important piece of evidence, upon which a final judgment might be based, is wanting. We have no information as to the careers of students after they leave their colleges or universities. This alone is the final measure of success; degrees or examinations are but milestones along the road, although they are sometimes quoted as if they were the main end to be attained. Each centre of tuition can no doubt give the names of some former students who have been successful in their careers; but what interests me most is the ultimate fate of the rank and file, for it is these who supply the bulk of our assistants. For obvious reasons employers are reticent on this subject, and information can only be obtained in very general terms. It has been my duty on many occasions and in connection with various industries to engage assistants who were frequently students fresh from their colleges or universities and in many cases brought excellent testimonials. In one respect, however, they were all deficient. They had not been taught and did not realize that the object of the industrial chemist, like that of the alchemist, is to produce gold, and that every factory operation must yield a profit, failing which it must inevitably cease. In this direction our German colleagues are, perhaps, more advanced, for "Waarenkunde," or knowledge of merchandise, is a recognised subject of tuition, and current price lists are not unknown to students.

In another respect the modern student meets with difficulties at the commencement of his career. He is frequently called upon to fit up a laboratory for his work, and usually makes out a list of such apparatus and fittings as he has been accustomed to use. In most technical colleges these are far more expensive than the majority of manufacturers can afford, and the employer is therefore led to the conclusion that the employment of a chemist and the fitting up of a laboratory are very expensive things. While all will agree that our students should have the advantage of the most up-to-date apparatus and reagents, yet it is at the same time absolutely necessary that they should be taught what kind of apparatus and plant is likely to be available for them in practice. Teachers who have themselves been engaged in chemical industry know the pitfalls that await the student on his entry into practical work, and prepare him accordingly. Those who have not themselves worked in factories cannot, of course, teach what they do not themselves know, and no teacher can claim to teach students practical work in industrial chemistry unless he has had some experience in a factory himself.

Much has been said and written recently about research work for students, and doubts have been expressed as to its utility. Probably these doubts are due to the word being used in more than one sense. From the scientific point of view the working out of any new problem may be called research; but technological research should have a definite aim, some application of the knowledge gained for the benefit of mankind. Much of the so-called scientific research work with which our chemical publications are encumbered is, unfortunately, of the poorest possible description from the mental point of view. Simple facts, easily ascertained, are strung together without literary ability and without the slightest attempt at drawing any useful conclusions or indeed any conclusions at all from them. Technological research, on the other hand, must have a definite object in view, and that object must be attained under certain defined conditions. Regarded as a means of mental development, technological research has a much higher value than so-called "pure" scientific research, for it not only includes the latter, but adds to it further conditions of such complexity that men of high scientific repute often fail utterly when confronted with the difficulties of carrying out reactions on a large scale.

As things are at present, the problem for the student is how to acquire practical knowledge at the commencement of his career. In this, I think, employers might materially assist by giving their younger employees more leisure to attend meetings of societies, such as our own, and by procuring journals and other literature that the assistant is unable to purchase. A good factory library is of the greatest pecuniary benefit to both employer and employed, but in how many factories do you find one? As I have already pointed out, the rapid march of progress in chemical industry necessitates continuous study if we wish to keep up to date; whether we like it or not, we are all and must remain students.

One often hears the complaint that times are not so good as they were, and that profits on manufactured goods are very small. In the older industries this is no doubt true; but there are many new industries in which the manufacturer reaps a very satisfactory harvest, sometimes from an extremely small beginning. Bearing this in mind, every employer should encourage his assistants to make and investigate new observations bearing on his business. Sometimes an apparently casual observation may lead to important results if it is followed up; but if the factory chemist is taught to consider himself merely as a kind of testing machine, and original observation is discouraged, the business cannot progress.

It may not be unprofitable in this connection to recall to memory how great industries have arisen from small beginnings. Let us take an industry which is still in its infancy—the fixation of atmospheric nitrogen. In 1781 Cavendish found that on passing an electric spark through a mixture of carbon dioxide and hydrogen, nitrous acid was produced. He communicated his observation to Priestley and Lavoisier, neither of whom could obtain the same result. Cavendish's observation was more accurate than his method, for he had made his experiments in vessels containing only a partial vacuum, and the nitrogen of the residual air yielded the nitrous acid that he had detected. In 1784 R. Kirwan repeated the experiment with atmospheric air, and again found acid. Here we have the English origin of what is destined to become one of the great industries of the world, but which is being developed chiefly in foreign countries. When Tyndall made his classical researches on glaciers he little imagined that factories would arise in the Alps with a glacier at one end of the system and nitric acid of 98 per cent. running into carboys at the other.

While the student is practically obliged to study contemporary literature, it is not advisable that he should neglect the past. Some of the old records teem with useful suggestions to the technologist, and the alchemists undoubtedly laid the foundation for many of our industries. In fact, some of the ancient craftsmen produced results which we do not find it easy to imitate. We in this country have made considerable progress in the metallurgy of iron; but 1500 years ago the Hindus were able to make and set up near Delhi a wrought-iron pillar weighing ten tons, and it is still free from rust. All our iron rusts; but why? We have hitherto looked upon rusting as an undesirable, but inevitable, property of iron, and a variety that will not rust could find many applications. Soon after graduating at the Royal School of Mines in Berlin I read about that iron pillar and other iron articles made by the Hindus in ancient times, such as a 24-feet cannon, and I carried out such experiments as time and other circumstances permitted, with the object of finding out the cause of rusting. Those experiments were never completed; but I found that iron reduced from a pure ore by means of charcoal had little tendency to rust, and that sulphur was present in all samples that rusted easily. Here is a subject for real research that some of our younger members might take up.

Those who are in search of suitable subjects for investigation may find many in the works of the old alchemists, who were at least untiring experimenters. It is true that the language is to us somewhat obscure; but when the reader realises that each metal was given the name of a planet, and that there were only four acknowledged elements, it becomes easy to decipher the meaning of the writer. Our own writings are much more technical in their language, and a Liebig or a Tyndall would be unable to understand at least half of the formulæ and terms used in modern chemistry. We must recollect that the natural laws that have since been recognised were unknown to those early workers, and there were very few who were able to test the precious metals and distinguish between a yellow alloy and gold, for instance. In the *Mappæ Clavicula*, which was written about the tenth century, there are a number of formulæ, several of which would produce a yellow alloy resembling gold in appearance. These alloys were sometimes sold as gold, and in 290 the Emperor Diocletian ordered that all works on alchemy should be burnt so that the Egyptians should not become rich and revolt against Rome. Even in those days, before the Christian fashion of burning wizards and witches had commenced, it was dangerous to know more than one's neighbours. It is recorded that in the reign of Tiberius a factory was started in Rome in which unbreakable glass was made. Instead of rewarding the inventor the Emperor ordered him to be executed, so that the produce of his factory should not render gold and silver valueless.

In the time of the Romans metallic zinc does not appear to have been known in the western world, although the Hindus and Chinese were probably acquainted with it. Nevertheless it had been discovered that certain stones, heated with copper, gave a yellow alloy, and brass was made for centuries in this way, by heating copper or copper ores with calamine. As an instance of rule of thumb practice, the production of quicksilver is interesting. Vitruvius, who wrote at the beginning of the Christian era, tells us that in Spain there were certain stones which, on being beaten long enough with iron rods, began to perspire, and that the perspiration was mercury. One would like to have a record of the series of experiments that culminated in this crude method of reducing cinnabar by metallic iron.

Some of the most important technical discoveries have been made almost by accident; I say almost, because it takes two things to make a discovery—the occurrence itself and an observer capable of drawing conclusions from it. I will give a few instances for the encouragement of those of our younger members who may be commencing their careers. Many alleged discoveries are well-known, such as Pliny's description of the incident that led to the making of glass. Vitruvius, in describing the manufacture of red lead by calcining white lead in a furnace, states that this invention was the result of observation in the case of an accidental fire, and that the material made artificially was much better than that which is procured from mines.

The origin of the use of tin-salts in dyeing is, perhaps, not so well-known. Cornelius Drebbel, who died in London in 1634, was making experiments with some extract of cochineal when he accidentally broke a bottle of aqua regia standing on a shelf above it. The acid ran down a window into the dye and produced a splendid red colour. The effect could not be reproduced by aqua regia, and Drebbel had to undertake a research to find the cause. Part of the window frame was covered with an alloy of tin, and it seemed that this metal must be the useful re-agent. The experiment was tried and an important dyeing material found.

The history of the invention of black gunpowder carries us back into ages so remote that historic records fail us; but this material undoubtedly originated in the far East, whence the knowledge of saltpetre also first came. The earliest record I have been able to find dates from the time of Alexander the Great. Aristotle records that Alexander did not enter the country of the Oxydracæ because they submitted and sent tribute, but a later Greek traveller tells a different story. He states that the Oxydracæ were wise men, beloved of the gods, and that if an enemy entered their country they did not fight him in the open field, but retired behind their walls, whence they slew the enemy with thunder and lightning. There was probably a beginning of gunpowder, although similar compounds may again have been worked out by Bacon or Schwartz, or by both. It seems highly probable that mixtures containing sulphur and saltpetre were used for incendiary purposes long before they were used in firearms.

The history of the development of modern smokeless powder has never been told, and some of the facts may be of interest. Soon after graduating at Berlin I was commissioned by the Argentine Government to report on the mineral resources of the country, and in carrying out the work I had to penetrate into wild districts where my gun was the chief source of our daily food. There were few opportunities of cleaning the weapon, and when the work was finished the gun was ruined by rust. A good sportsman feels a kind of affection for his gun, and when I returned to England I endeavoured to find means whereby such rusting might be prevented. I heard of the work done by von Lenk with gun-cotton, but I also heard from the officials of the Patent Safety Gun-cotton Company at Stowmarket that the manufacture of nitrocellulose powder for firearms had been abandoned because of the great irregularity of explosion and the number of accidents that had happened. I made a long series of experiments, and finally found that by gelatinising the nitrocellulose, either completely or partially, the explosion could be rendered quite uniform. Some of the first experiments were made with a paste forced through a perforated plate in a press similar to those used in the gutta-percha industry. The threads thus produced were cut into short lengths and gave good results; but in those days all cartridge cases and gun or rifle chambers were adapted to black powder which was twice the bulk of the new product. A partially gelatinised bulky powder had therefore to be made for the market. It was called the E. C. Powder, the initials being those of the Explosives Company, Ltd., the then owners of the Stowmarket works. It is only recently that sporting guns and cartridge cases have been made specially to suit the fully gelatinised powder which has now almost supplanted black powder for sporting purposes.

The utility of the new powder for military purposes was evident to civilians from the beginning; but our military authorities, after testing it, stated that it could not be adopted in the service because the trajectory was so much flatter than that of any powder then in use, that the sights of all the army rifles would require alteration. The British rifles being so shortsighted, I had no option but to turn to our neighbours in France. In November 1881 I showed the powder and method of manufacture to the military attaché at the French Embassy; but it was some time afterwards before the French produced their Poudre B, and thus forced the hand of our military authorities. To-day even the sights of our rifles have been altered; in fact, I believe there is no part of either rifle or cartridge that has not been altered, and the art of war has been changed throughout the world. Incidentally, smokeless powder has given such a superiority to the civilised races of mankind that none of the savage races are now able to resist them.

I was not, however, the first to dissolve nitrocellulose and utilise the product for propulsive purposes. Fifteen years after the process had been worked out I learnt that a German botanist, Hartig, had made experiments in this direction in 1847. The pamphlet in which he refers to his experiments is extremely scarce; I know of only one copy in Great Britain, and I have been unable to obtain it in Germany, therefore my ignorance on the subject in 1881 may, perhaps, be excusable.

One of the industries that I was once connected with was based on an observation of Liebig.

In 1867 he published a method of silvering glass by reducing an alkaline silver solution by means of a sugar solution made by inverting cane sugar with tartaric acid. In order to obtain a uniform deposition of silver a small proportion of copper had to be added, and this interfered not only with the colour, but also with the durability of the silver film. In publishing his method Liebig stated that it had been tried in a Nuremberg factory, but that the mirrors made did not sell. He adds a curious note to the effect that, in consequence of his experiences with other processes, he would answer no requests for further information on the subject.

The experiment was a fascinating one, and, although it was not easy to obtain a perfect mirror, yet the process seemed feasible, and I carried out a number of experiments with a view to eliminating the defects. After many failures I found a better reducing agent, and was soon able to produce perfect mirrors. Some of these I showed to mirror manufacturers, who could not deny their quality; but they all came to the conclusion that silver could not compete with the tin amalgam then in use, and no one would adopt the process. In visiting the workshops, however, I had seen the effects of the mercury upon the workpeople, and determined to persevere in my endeavours. In those days the Thames Plate Glass Co. existed at Blackwall. One of the directors listened to my story, and in a short time I had not only started a mirror factory, but the mirrors were so much better and cheaper than the old ones that I was soon able to sell the business to one of the firms which would not entertain the idea of even testing the process at the beginning. It is very difficult now to get mirrors made by the old tin amalgam process, and mercury sickness exists no longer among the workers.

When Aspdin, a Leeds mason, discovered Portland cement, he did so as the result of a number of practical experiments, and for many years no chemist ever went inside a cement works. The consequence was great irregularity and unreliability of the product, and civil engineers were unwilling to use a material that might cause the ruin of structures of which it was a component part. In starting the Portland cement industry at Rugby I was confronted with the difficulty that the raw material, consisting of a large number of layers of limestone of the lias formation, varied very materially in chemical composition, and it was necessary to analyse each layer before the correct composition of the cement could be arrived at. Fortunately, at this time Scheibler invented his calcimeter for the estimation of lime in the char from sugar factories, and it seemed to be an apparatus that might well be adapted to the cement industry. I went to Berlin, obtained one of the instruments, and with its help was soon able to place the cement industry at Rugby on a secure footing. Since then, I believe, the calcimeter has been introduced into nearly every cement factory, and the chemist is one of the most important officials.

Sometimes an apparently trivial observation may lead to important results. Most of us who are photographers have met with "fogged" plates which we discard and perhaps blame the makers. Röntgen once noticed that some plates were badly "fogged," and found, on examination, that they had been lying near a Crookes' tube. Subsequent research, based on this slender foundation, led to the discovery of the Röntgen rays.

In the interesting handbook of the industries of Sheffield, prepared for our use, Mr. E. A. Smith records how Bolsover, in repairing the handle of a knife, composed partly of silver and partly of copper, noticed that these metals adhered to one another when fused, and thus laid the foundation of "Sheffield plate." Dr. John Wright's invention of the use of cyanide of potassium in electro-plating was the outcome of research, and about the same time another inventor was busy on the same subject. One of the brothers Siemens found a method of electro-plating which he considered new, and brought it to England, where he offered it to Elkington. Elkington, however, was able to show him an almost identical process already at work. Siemens, while in England, attended a meeting of the Society of Arts, at which a new product, gutta-percha, was exhibited. It was mentioned that this material was an excellent insulator, and Siemens sent a sample to his brother in Germany. I believe that was the origin of the firm of Siemens Bros.

The discovery of the vulcanisation of indiarubber by Hancock is interesting, as showing the necessity not only of patient work, but also of careful observation. He had made a number of mixtures of indiarubber with various substances, none of which appeared to offer any particular advantages. The samples were put on one side for some months, when the whole of them were treated with oil. It was noticed that a portion of one sample was not acted upon by the oil, and, on looking up the records of the samples, it was found that this particular one had been heated to about 300° F., and that it contained sulphur.

Instances of this kind could be multiplied; but I hope I have now quoted sufficient to show our younger members the advantages, first, of original work in connection with their industries; secondly, of careful observation and diligent inquiry into anything that may appear new to them; and, thirdly, perseverance until they have obtained some definite result.

The future of our Society and of our industry lies in the hands of our younger members, and it is for this reason I have addressed myself chiefly to them. I look forward to that future with the greatest confidence.

Dr. MESSEL, in proposing a vote of thanks to the President for his address, said his task would have been somewhat easier if the President had not, before starting his address, referred to him in terms far too flattering, and if the members had not received those remarks in such a very kind way. He thanked them most heartily, and assured them it would be his earnest endeavour to do all he could for the Society as its future President. The only point he might be allowed to bring out was that Mr. Reid had not laid sufficient stress on his own excellent work in connection with explosives, and especially with the gelatinisation of guncotton. His were the first practical attempts to tame what had up to then been an untameable material. They did not discuss or criticise the address of the President on those occasions. They wanted to see and inwardly digest what Mr. Reid had so ably put before them. His address was fully equal in standard to the many who had preceded it, and they would all look forward to reading it when printed in the Journal. The Council and members of the Society knew full well what advantages they had derived from Mr. Reid's ripe experience during his year of office, and he was sure that the younger members would benefit from the advice he had given them.

Dr. RUSSELL W. MOORE, in seconding, said the address was extremely interesting and instructive. People talked about the good old times, but chemists knew that from a chemical standpoint the good old times never existed. They were participators in very much better times, and they were anxious to hand over their experience to the young men, for their use. A very good test of the appreciation of young men for their technical schools and institutions was what they had done in return. He belonged to a body of old students of Princeton College, who met every two or three years to decide on the best way in which they could benefit an institution which had given them a good start. He did not speak in a bragging spirit, but would mention that so far they had given in scholarships, prizes, and other things, about £8000 to the University. They had not hampered the gifts with any conditions, but had simply handed the money over in order that the University might help some of the younger generation as they came along and seemed deserving. He said nothing of a large donation of something like £100,000 which was given by an individual, because that was not given through the class. It would be a great pleasure for him next year to hear the Presidential Address of Dr. Messel in New York. In 1904, they had the pleasure of welcoming 105 members in New York, and sending them all over the country. He hoped that next year that number would be doubled. He understood that there was also to be a Congress of Applied Chemistry over there, but that would be simply a side show compared to what the meeting of the Society of Chemical Industry was going to be. The local committee charged him to give the heartiest good wishes to the Society and every member of it. They included Drs. Schweitzer, Parker, Love, and Coblenz, and Mr. Zabriskie. When he mentioned these as the gentlemen to whom the members of the Society were to be entrusted, he thought they need feel no qualms as to what the future had in store for them after they left Sheffield. They had a fine Chemists' Club in New York, and the members of the Society would be heartily welcome. It would be another of those occasions of international good feeling, in two of which he had participated.

The resolution was carried unanimously.

On the motion of Mr. FRANK TATE, seconded by Mr. CHRISTOPHER RAWSON, Messrs. Norton, Feasey, and Slade were re-elected auditors of the Society, at a fee of £21.

The PRESIDENT proposed a vote of thanks to the local committee for the arrangements they had made for the meeting. He said the programme was an excellent one, and the members felt that they were very much indebted to them. The secretary, Mr. Thomas Fairley, who should have undertaken the work, was unfortunately very ill and not able to be with them, and they ought to include in the vote an expression of sympathy with him, and a hope for his speedy recovery. Mr. Fairley had rendered yeoman service to the Society in times gone by. He associated with the resolution the names of Mr. Cecil H. Wilson, Sir John Bingham, Mr. G. E. Scott-Smith, and Mr. John Evans.

Mr. EUSTACE CAREY seconded, and said it was impossible to exaggerate the services of the local committee.

The resolution was carried, and Mr. CECIL H. WILSON briefly replied.

After the meeting the members lunched at the Grand Hotel, by invitation of Mr. E. A. Brotherton (Chairman of the Yorkshire Section), who was not, however, able to be present. The toast of "the Yorkshire Section" was drunk on the call of the President and Dr. Messel, and was acknowledged by Mr. F. W. Branson.

THE ANNUAL DINNER.

The Annual Dinner of the Society was held on the evening of July 12th, at the Grand Hotel, Sheffield, the President, Mr. **Walter F. Reid**, being in the chair.

After the loyal toasts, Dr. **Rudolph Messel** proposed "The Society of Chemical Industry." He spoke of the fascinations of the science of chemistry, and of its innumerable ramifications. They only needed to glance at their Journal to see the number of sections into which they had to divide their subject matter. There was no other science with so many ramifications, and none which entered into daily life, into every industry and every other science, to anything like the extent that chemistry did. He thought he might well say that the Society had fulfilled the tasks which it set itself. The fact that, from very small beginnings thirty years ago, it had now a membership of nearly 4500, showed that certainly there was a place to be filled by such a Society. They had, of course, seen how industry advanced everywhere, and how industries had their centres where people met, but, until the formation of that Society, they had no such body in England. The great German colour industry, of course, had forged ahead, and was requiring more and more chemists. He had no idea of lamenting or going back on an industry which unfortunately had been lost to this country, but he asked himself, "If another industry of this kind was again in the grasp of England, is England in a position to avail itself of it ?" and to that he answered most emphatically "Yes." Quite apart from the colour industry, many articles, such as indigo, were being made artificially, and there were innumerable other products which were possible—camphor and indiarubber among them. Education had so far progressed in England that she was perfectly fitted to deal with anything that might offer itself in the future. Their Society had done a great deal by getting chemists together—men engaged in applied chemistry and in pure chemistry—and the advantage had been very great. The Society had been a centre for chemists, who had mutually benefited through the interchange of ideas, and through knowing each other. The latter, in his opinion, was one of the most important points. Frequently they had to deal with people whom they did not know, and who, from the nature of their letters, they considered cantankerous, or ignorant, or bad in some other way. But when they met the same people personally, they found them very different, and in many cases they entered into close and lifelong friendships with them. Another important point was that they realised the importance of showing those who followed pure chemistry as a science only, the great need of educating men in such a way that the industrial chemists could make use of them—impressing on them that they should keep in touch with the Society, just as it was of the foremost importance to the Society to keep in touch with the advances of pure science. He did not think he need say any more to show that the Society had come up to the high ideals which it had sketched out at the beginning. Its Journal was an asset second in value to very few possessed by other societies, and it enabled everybody to get full information of what was going on not only in England, but on the Continent and all over the world. They might think he was too full of praise for what the Society had done, but he did not think so. He could also assure them that the Council and past Presidents had always been fully alive to what it was necessary to do to keep the Society on the high pinnacle which it had reached. He coupled with the toast the name of Mr. Reid, and bore testimony to the high efficiency with which that gentleman had carried out his presidential duties, and the great advantage which the Society had received through having him in that office.

The **President**, in reply, said he had responded to that toast, at the banquets of kindred Societies, many times during the past year, and, before he had held his office six months, he found that the field of chemical industry included the whole of the Societies to which he was invited. He had sometimes been asked, "What does chemical industry mean ? What do you do ?" In reply, he had inquired what trade the questioner was interested in, and had always found that it was one in which chemical industry played a very considerable part. When they spoke of chemical industry, they referred to a branch of science which was related to nearly every other branch. Those who knew the position of chemical industry at the present time knew that it was not a question of what they could do, but what it paid to do. No doubt the time would come when they would be able to produce nourishment for themselves from the atmosphere, as they had been able to produce nourishment for the plants from the air around them. That, a few years ago, was considered an idle dream. The industrial chemist could not stand alone. He must be associated with his relatives in other sciences—electricity, engineering, and others. Not long ago he was in a large factory in the Alps, where they were producing very large quantities of nitric acid from the atmosphere. What struck him most particularly was how very helpless the manufacturers and electricians were without the chemists, who controlled every step that they were carrying out as a manufacturing operation, and also how very helpless the chemists in the laboratory were when it came to the electrical plant and the mechanical appliances by which the forces of nature were applied to their ends. Nowadays, they could not all be specialists in everything, and they must all work together. He thought that the key to success in modern industry was the appreciation of each other's ideas by men engaged in different branches of technology, and the co-operation of the capitalist who had confidence in the knowledge thus brought together for the benefit of mankind. He thanked Dr. Messel for his very kind remarks. He was proud to belong to the Society, and he should always be ready to do active work for it as long as he was able.

Mr. **Eustace Carey** proposed "Yorkshire Industries." He dwelt on the wide diversity of those industries—fishing, shipping, agriculture, mining of coal, lead, and other substances, metallurgy, and dyeing. He quoted some recent remarks by Sir Robert Hadfield, acknowledging the great assistance which he and other metallurgists had received from the University of Sheffield, and said that in the same way the University of Leeds had given great help to the dyeing industry. There was no doubt that University professors and practical men must work together for the national prosperity. He thought the difficulty of the present time was very greatly increased by the gradual raising of the price of coal. The New York "Engineering and Mining Journal" recently had a very interesting article on that subject. It showed that in 1886 the average price of coal in Belgium was 6s. 7½d. at the pit; in France, 8s. 11d.; Germany, 4s.; England and Wales, 4s. 11½d. In 1907 the prices were as follows:—Belgium, 13s. 8d.; France, 12s. 1d.; Germany, 8s. 11½d.; England and Wales, 8s. 6½d.; while the figures for 1909 were:—Belgium, 12s. 11½d.; France, 12s. 10d.; Germany, 10s. 2½d.; England and Wales, 8s. 10½d. Some unfortunate figures which followed showed that the working colliers—he did not know whether it was because they were getting rather better wages than formerly—were putting out less per man than they used to. In 1899, the production per man per annum was:—Belgium, 173 tons; France, 211; Germany, 264; England, 311. In 1908 the figures were:—Belgium, 160; France, 189; Germany, 246; England, 279. So that England was putting out more per man than any of the other countries, but still the quantity was less than it used to be. Now that meant that, unless the scientists came to the aid of the manufacturers, the cost of power must be increased. Their great interest was to reduce the cost of power. In their industries they had to compete with waterfalls all over the world, and the price of power at those falls was in many cases considerably less than power from the best machinery. But they all knew that so far as the thermal value of coal was concerned, they did not extract anything like the quantity that they ought to do. Sheffield engineers had done an enormous amount of work in connection with the lessening of the cost of power, which was one of the most important subjects before them. He urged the engineers to come to the rescue and help them to get more value out of the coal than they now did. Touching on the relation between the Universities and practical work, he recalled the statement of Professor Ira Remsen, at Glasgow last year, that in the United States the demand for University graduates for positions in chemical industry was so great that they found it difficult to supply the demand for teachers. In England we had not got quite into the way of taking full advantage of the knowledge of pure science which our young graduates possessed. Of course, graduates could not expect to step immediately into the management of works directly they got their degrees, but if they would only have patience to attend to practical matters there was no doubt they would find their theoretical knowledge of the utmost possible value. The longer they saw the way in which works were managed, the more they were confirmed in the belief that a sound knowledge of theoretical science was the one thing needful as a foundation for everything else in the future life of those young graduates. They need not go any further than Sheffield for an acknowledgment of that fact.

Mr. **George Blake Walker** (President of the Sheffield Society of Engineers and Metallurgists) in responding, said that Mr. Carey had referred to the natural wealth of the county, but he had not alluded to another raw product which was of supreme importance in the development of these resources. The West Riding of Yorkshire had a population of something like three millions, and possessed some of the most highly skilled labour in the world. Unfortunately, however, from time to time there was a lack of harmony in the labour world which militated against the achievement of that great prosperity which everyone desired. The natural resources of the earth were of no value unless labour and capital were jointly available to exploit them. There were unfortunately many fallacious ideas abroad, ill-considered opinions, which misled simple people and made them forget these elementary facts. The greatest misfortune for labour would be to be deprived of the assistance of capital. Unfortunately from time to time, without much apparent reason, storms arose and labour got the impression that it was being unfairly treated by capital. With a truer knowledge of the real facts, and, in fact, with a more practical form of education those mischievous errors would lose their force, and there would be a better appreciation of the mutual dependence of those two factors in industry. So much had been done in the world of science in producing useful combinations from the apparently opposite elements, that one could not help hoping that in the social sphere the same brains might be able to bring about harmony.

Dr. **Julius Lewkowitsch** proposed "The Yorkshire Section of the Society of Chemical Industry." He said the Section had fulfilled all the demands which the Society might reasonably make upon it. Its early association with the Yorkshire College—now the Leeds University—was a very good step. A large number of papers had come, not only from the University, but also from the chemists engaged in industrial pursuits in Leeds, from public analysts and manufacturing chemists, and also from those who had to deal with chemical apparatus. Another great help had been the association with the Bradford Technical College, where again there had been a happy blending of science and practical application, especially in connection with the wool industry. Further, Sheffield had been doing its best. There was still a great future for the Section if the Sheffield University did the same work that the Leeds University and the Bradford College had done by associating themselves with those who were engaged in industrial pursuits, and helping them to apply scientific thought to industrial problems. Perhaps such fruition as they would like to see would come in the future. If they applied the rule laid down by the Treasurer at the Annual Meeting, he thought the Yorkshire Section had done very well. The expenditure had been small, but the return in the way of papers had, he thought, been very satisfactory. The output, he believed, had been at the rate of about a dozen per annum. In that respect he thought the Section fully came up to the expectation of the Society. He warmly acknowledged the hospitality of Yorkshire, and expressed regret at the absence of the Secretary of the Section.

Mr. **F. W. Branson**, in reply, said Mr. Fairley was much better than he had been a week previously. Referring to the concealed coalfield of Yorkshire, he said it presented great possibilities to chemists and others. They had under their feet resources of enormous extent, and it was their duty to utilise them to the best advantage.

Professor **G. G. Henderson** proposed "Kindred Societies." Referring to the large number of societies which claimed kinship with their own, he said chemistry was an absolutely fundamental science. It must necessarily be so, because after all each one of them was in one sense nothing better than a peripatetic chemical laboratory, carrying on mysterious transformations unceasingly. So that one might almost claim that the stage to which the civilisation of a country had reached, and the degree of prosperity of that country, could be measured by the extent to which chemical science had penetrated in its operations. He associated with the toast a Society which at first sight did not seem to have very much to do with chemical industry—the Society of Public Analysts. Yet a moment's reflection would convince them that no more proper association could be found. For he ventured to say that the members of that Society, taken as a whole, had perhaps done more in the past for chemical industry than many of those who were now known as technological or technical chemists.

Mr. **E. W. Voelcker** (President of the Society of Public Analysts) in response, said the Society was to be congratulated on having selected Sheffield as its place of meeting this year, for Sheffield, the great centre of the steel industry, had shown in a very marked way its appreciation of the value of scientific research. Another reason why he personally felt very grateful for the opportunity of being able to attend at Sheffield was that Sheffield was associated in his own mind, and in the mind of his colleagues, with Alfred Allen. To Mr. Allen, public analysts and all analytical chemists owed a debt of gratitude which could never be repaid. The citizens of Sheffield also owed him a similar debt, which he hoped they would never forget.

Councillor **Cecil H. Wilson** gave the toast of "Our Guests," which Mr. **A. Chaston Chapman**, as President of the Institute of Brewing, acknowledged, in a gracefully-phrased speech, referring especially to the regretted absence, through illness, of one of their hosts, Mr. Fairley.

During the evening an excellent musical programme was carried out by Miss Ida Bloor, Messrs. Harry Heath, A. S. Harper, and Collin Smith; and sketches from Dickens were given by Mr. C. Everitt.

VISITS TO WORKS.

Wednesday Afternoon, July 12th 1911.

Spring Grove Mills, Oughtibridge. (Peter Dixon & Son, Ltd.)

Leader :—Mr. Cuthbert Dixon.

The firm manufacture only paper for the daily press, using as their raw materials both chemical and mechanical wood pulp from Scandinavia. These pulps differ materially in the percentage of moisture which they contain, the mechanical pulp containing as much as 50 per cent., whereas the chemical pulp contains much less. As the percentage of moisture is of the greatest commercial importance, the method of sampling the pulp, which must be done by independent analysts, has been agreed upon by both buyer and seller, and consists in folding a sheet in a particular manner, whereby a wedge-shaped piece is cut out, which represents an average sample much better than pieces torn off here and there from a sheet.

The two pulps are mixed together in beating engines with a large percentage of water, and the watery pulp is pumped on to the paper-making machine, from which it passes over an endless wire gauze, where the water passes through and the paper is formed, the process being repeated until paper of the desired thickness is obtained. In this state it contains about 80 per cent. of moisture. The moist paper is passed through pressing cylinders on to a long series of drying cylinders where the remainder of the moisture is taken out; it is finally passed through a stack of calenders which give it the required finish. The paper is wound on rolls at the end of the machine, and when this contains about 10,000 yards it is taken to the reeling machine and cut up into the required width and length for the printing presses. The first waters passing through the wire gauze, which still contain a considerable amount of small fibre, are passed through two pulp strainers.

After inspecting the works, the party was entertained at tea by Mr. Dixon, in whose garden was seen an interesting collection of New Zealand tree and other ferns growing in the open.

The Sheffield-Simplex Motor Works, Ltd., Tinsley.

Leader :—Mr. A. H. Constantine.

These works were built some five years ago for the manufacture of high-class motor cars. Only six-cylinder cars are manufactured, of 25 h.p. and 45 h.p. respectively, the demand for which is increasing daily ; a speciality is a gear-box-less car.

Cars in course of construction, from the unfinished material to completed chassis, and cars ready for testing and delivery were shown.

Victoria Works, Millhouses. (Messrs. W. S. Laycock, Ltd.)

Leader :—Mr. S. Watkinson.

Messrs. W. S. Laycock, Ltd., are manufacturers of furniture and appliances for railways, tramways, steamships, carriages, and motor cars. Among the firm's specialities may be mentioned a patent roller blind, an automatic coupler, an improved window lift, designed to obtain greater and more even lifting power than similar arrangements; destination indicators for tramcars; an improved "torpedo" ventilator; tram-car seats; elastic journal packing for carrying and applying the oil in the axle boxes of railway carriages and other rolling stock; spring seats and backs; dust and draught excluders; racks, brackets, coat and hat hooks, and bottle holders; lamps and fittings; electric heaters, and numerous specialities for decoration and for upholstery. The firm also do a large business in the heating of railway carriages, etc. The party was entertained to tea after the inspection.

Messrs. Thos. Firth & Sons, Ltd.

This firm was founded in the year 1840 by the late Mark Firth and his father Thomas Firth. At this period the manufacture was solely crucible cast steel. Later on the operations were extended to include large forgings for ordnance and marine purposes, and then came the Siemens-Martin process with all that which it has meant for the steel industry.

At Norfolk Works there are four Siemens furnaces of a total capacity of 110 tons, one electrical furnace on the Héroult system, and one Stock furnace. The firm have one of the largest steel foundries in this country, where steel castings up to any weight and size can be dealt with.

At the West Gun Works are situated most of the large steam hammers employed on forging work, *i.e.*, tyres, axles, crank axles, projectiles, etc. The hammers vary in weight from four to thirty tons. Here is also a very large machine shop for the heaviest class of work, such as gun forgings, marine shafting, torpedo air vessels, rotor wheels, and so forth. The next section is the East Gun Works, where the heavy forgings are dealt with under the two hydraulic presses, of 2,000 and 3,000 tons respectively, together with extensive annealing furnaces for such forgings.

In addition to this the firm have an extensive file factory, with an annual output of one-and-a-half millions of files; a department for edge tool manufacture; a plant for the production of high-speed twist drills, and forges for the manufacture of motor car and lorry axles, shoes and dies for stamper batteries, etc.

The crucible steel manufacturing plant, together with the rolling mill, has been, within recent years, transferred to the new works at Tinsley, the output of which is about 6,000 tons of high-grade crucible steel per annum.

In all, the Sheffield works of Thos. Firth & Sons cover more than forty acres. The party was shown round the works by several members of the staff.

Messrs. James Dixon & Sons, Cornish Place.

Leader :—Mr. W. Beaumont.

This business was commenced in the year 1805, in Silver Street, by Messrs. Dixon & Smith, manufacturers of Britannia metal, pewter ware, and Sheffield plate. In 1821 Mr. Smith severed his connection with the firm, and Mr. James Dixon, the founder, carried on the business alone. In 1822 the works were removed to Cornish Place, on the banks of the Don. The processes carried out include modelling, casting, stamping, punching, chasing, engraving, and a number of mechanical arts.

The materials to be plated consist principally of silver, copper, nickel, zinc, and tin, and the melting and casting of these metals for the production of sterling silver, nickel silver, and Britannia metal, etc., is the first process. A foreman gives out to the workers the proper quantities of copper, zinc, nickel, etc., which is melted in wind furnaces and afterwards cast into ingots. When cold the ingots are passed through steel rollers, worked by steam power, by which they are reduced to sheets of the gauge required. After this the sheets are re-annealed and then cut up into the required sizes and passed on to the various shops. In the stamp shops, entrée dishes, tea and coffee pots, and numerous other goods get their proper form, the huge dies and powerful presses readily forcing the sheet metal into the required shape. Spinning is carried on to a considerable extent at the factory, especially where circular or oval bodies, rims, and many shapes are required which cannot be produced by dies.

The chief department now manufactures sterling silver goods of every description. The firm employs upwards of 900 workers.

Exchange Brewery. (Messrs. Tennant Brothers, Ltd.)

Leader :—Mr. A. S. Harper.

The Exchange Brewery was originally founded in the year 1820 by Messrs. Proctor & Co., in what is now the Market Place. Early in 1840 the brewery passed into the hands of the Tennant family. In 1852 the firm removed to its present site on the banks of the Don.

Besides this building the firm have a cooperage at Millsands and a bottling stores and stableyard in Castle Green. The Castle Green buildings are connected to the brewery by a subterranean tunnel hewn through solid rock, passing under Bridge Street.

The stables and stores were once used as a malting-house, but the air and general conditions were found unsuitable. These are built on the site of the old Sheffield Castle.

The brewery consists of a 100-quarter plant. The malt is conveyed to the mill at the top of the building by means of a pneumatic suction apparatus. The mash tuns, 70 quarters and 30 quarters respectively, are fitted with outside mashing machines. The wort runs direct to the coppers, two of which are pressure coppers capable of holding 150 barrels each. The wort is cooled by means of three vertical and one horizontal refrigerators, in a hermetically-sealed room, through which passes nothing but purified air. Fermentation is conducted in copper-lined fermenting vessels each having a capacity of 110 barrels. The wort during fermentation is roused by electrically-driven centrifugal pumps. The casking of the finished beer is conducted by a patent racking machine, which delivers the beer into the casks without coming in contact with the air. The holding capacity of the mild beer cellar is 1050 hogsheads (54 galls. each), and the stock beer cellars 800 hogsheads. The bottling stores are fitted up with the machinery capable of turning out 1680 dozen bottles per day, on the non-deposit and naturally-conditioning systems. Tea and light refreshments were provided by the firm.

Messrs. Newton, Chambers & Co., Ltd. Works at Rockingham.

Leader :—Mr. M. Wynter Blyth.

This firm employ 6,000 hands and raise over one million tons of coal per annum. They are also considerably interested in the chemical industry.

Disinfectant Works.—Izal disinfectant fluid is an emulsion containing 45 per cent. of izal oil, of a high germicidal power. The special form of emulsification enables it to be mixed in any proportion with hard or soft waters or with organic fluids.

Izal oil itself is the product of a special type of coke oven, which yields a tar containing little, if any, benzene, naphthalene, anthracene, or carbolic acid. This tar is distilled, treated with soda, and finally fractionated and refined, the final product being a clear yellow oil, of which 90 per cent. distils between 205° and 350° C., with a specific gravity of about 1·04. One of the chief features of the finished product is its freedom from carbolic acid and cresols and its comparatively non-toxic character.

Rockingham Koppers Ovens.—This battery of 30 retort ovens has been working for two years, and an additional 15 ovens will shortly be ready. The original battery carbonizes 1100 tons of coal per week. The coal is damped and stamped into a cake, which is pushed into the oven by electric power, and an electrically-driven ram similarly discharges the coke. The latest types of coolers, exhausters, washers, and scrubbers are installed, together with tar stills, crude and rectifying benzol stills, and ammonium sulphate plant. The surplus gas feeds a 500 h.p. Mather and Platt gas engine, and provision is made for the addition of a second one. The electric power generated by this engine is carried to two collieries and used for various purposes above and below ground.

Joint Colliery Rescue Station.—The Tankersley Rescue Station was established in 1902, chiefly on the initiative of Mr. M. H. Habershon and Mr. George Blake Walker. At this Rescue Station men are regularly trained in the use of breathing apparatus, which enables them to work underground in irrespirable atmospheres, the conditions being artificially reproduced in the experimental gallery of the station. The men are trained in ambulance work underground, and the Draeger and Meco type of breathing apparatus is always kept in readiness day and night.

The party were received by Mr. and Mrs. W. Newton Drew and Mr. Habershon at the Rescue Station, where five qualified men, equipped with the Draeger breathing apparatus, gave a demonstration in a closed gallery filled with smoke. During the completion of their allotted task, which included removing fallen timber and building a brattice wall, and lasted for two hours, the company inspected the Rockingham Works with its Izal Laboratory and witnessed the drawing of a coke oven. At the end of their inspection, they returned to the Rescue Station and saw the men emerge from the experimental gallery somewhat exhausted by their labours at a high temperature under a weight of 34 lb., but otherwise in good condition. At the luncheon which followed, Dr. R. Messel proposed the health of their hosts, and Messrs. Allott, Newton Drew, and M. Wynter Blyth responded.

The Wharncliffe Silkstone Collieries, Tankersley.

Leader :—Mr. G. Blake Walker.

There are two main drawing shafts: The No. 1 Pit, 165 yards deep, 12 ft. diameter, sunk to the Silkstone seam, from which is drawn the Parkgate, Thorncliffe thin, and Fenton coal; the No. 4 Pit, 225 yards deep, 14 ft. diameter, from which is drawn the Silkstone and Whinmoor coal. The output from these shafts is about 10,000 tons a week, to which No. 1 Pit contributes about two-thirds of the total tonnage. About 100 tons a week are drawn from the Lidgett seam at Knoll Drift day-hole. About 200 gallons of water per minute are pumped from No. 1 Pit bottom by direct-coupled 6-stage centrifugal pumps.

Winding Engines.—No. 1 Pit, vertical engine, cylinder 33 in., 5 ft. stroke; diameter of drums, 12 feet.

The cages hold four tubs of about one-third of a ton capacity; the shaft has wooden guides and locked coil winding rope 3¾ in. in circumference. No. 4 Pit, horizontal cylinders, 26 in. diameter, 5 ft. stroke, 14 ft. drum, rope guides.

Ventilation.—Produced by a Schiele fan 12 ft. 6 in. diameter, belt driven by a horizontal engine, 33 in. cylinder, 3 ft. stroke, with *vis-à-vis* spare cylinder. The quantity of air in circulation is about 160,000 cubic feet at a 4 in. water gauge. There is an auxiliary fan at No. 2 Pit drawing about 25,000 cubic feet of air at about 1·5 in. water gauge.

Haulage in No. 4 Pit is by endless rope both under and over the tub. In the No. 1 Pit, chiefly main and tail, there is a large electric haulage (150 h.p.) underground.

Generating Plant.—Driven by waste gas from the Simon Carvês by product ovens, and consists of four units :—

(A) 300 B.H.P. Mather and Platt 2-cycle engine.

(B) 350 B.H.P. Robey 4-cycle engine.

(C D) 200 B.H.P. Hornsby Stockport *vis-à-vis* 4-cycle engines.

A 70 h.p. Crossley gas engine drives the lighting generator. There are two steam stand-by units of about 350 h.p. each driving shunt-wound generators. The Mather and Platt engine drives a 200 k.w. Mather and Platt generator with cast-steel frame by means of square-section hemp ropes; the Robey engine drives a 250 k.w. Siemens generator also by square ropes; the Hornsby Stockport engines drive by means of belts B.T.H. 150 k.w. generators. These four generators are coupled in parallel, and successfully share the peak loads occasioned by the large intermittent haulages without overloading any one machine. The pressure is 550 volts.

The calorific value of the gas employed is 400 B.T.U. (high value); the compression in the engine cylinders is 100 lb. to the square inch. The gas is purified from sulphur, ammonium chloride, tar, and benzol, and passes through ferric oxide purifiers and a Cripp's washer.

Screens are erected on the pit bank, and are of the Zimmer type, and at present are steam driven.

The Washery is of the Luhrig type, and is steam driven. A belt conveyor 90 yards long conveys the washed slack to the by-product ovens.

The Coke Ovens are in two batteries of 37 and 8 ovens respectively; they are of the horizontal flue Simon Carvês type; in the smaller battery each oven has its own separate flues. An electric ram has recently been installed. About 800 tons of coke are produced per week from these ovens, and 15 tons of ammonium sulphate, ammonium chloride, tar, and benzol are also recovered. Four boilers are fired by a mixture of waste and live gas. There are about 140 beehive coke ovens from which coke only is obtained. Five boilers are fired by the waste heat.

Lamps.—The lamps in use are of the Mueseler type and have proved thoroughly reliable. The lead rivet is in universal use throughout the pit; no re-lighting is performed.

Ambulance and Rescue Apparatus houses are provided.

A Brick Yard is run in connection with the pit, as excellent fireclay is available.

The party were received by Mr. G. Blake Walker, Managing Director of the Colliery. Some went down the pits and others inspected the coke ovens. After the inspection, the party was entertained to tea by Mr. and Mrs. Blake Walker at Tankersley Grange.

The Sheffield United Gas Light Company.

Leader :—Mr. J. W. Morrison.

The Sheffield Gas Company, which was first formed in 1818 to supply the town with gas, have now three works as follows :—Neepsend, with a capacity for making eleven million cubic feet of gas per day, Grimesthorpe, five million cubic feet per day, and Effingham Street, four million cubic feet per day. At the two former works the whole of the charging and discharging of the retorts is done by machinery. In the year 1910, 350,793 tons of coal were carbonized, and the gas made therefrom was 3,812,036,000 cubic feet. The number of consumers supplied is 92,217, and the prices charged are from 1s. 4d. to 1s. per thousand cubic feet according to consumption, the average for the year 1910 being 1s. 2.94d. per thousand cubic feet. The length of mains laid is 586 miles. At Grimesthorpe, in addition to the Gas Works, there are also Chemical Works, where the Company manufactured last year 4,173 tons of sulphate of ammonia, and about 3,000 tons of sulphuric acid.

A branch of the Company's business which is developing rapidly at the present time is the selling of furnaces for various purposes connected with Sheffield trades. The following are some of the purposes for which they are now being used :—tempering table blades, Britannia metal work, annealing German silver and silver goods, steel tool hardening, lead and tin melting, forging files, hardening bayonets, heating fish plates, heating shovels and machine knife sections, wire hardening, hardening springs, heating bars, heating galvanizing tanks, smelting brass, fork forging, forging crank shafts, and annealing steel.

There is also a special room containing sample furnaces, where manufacturers are at liberty to bring their own material and to make their own tests.

MESSRS. JOHN BROWN & COMPANY, LTD.

Leader :—Mr. J. W. Ashbury.

The Atlas Works at Sheffield were founded about 58 years ago by Messrs. John Brown & Company. Mr. Brown in 1854 acquired the Queen's Steel works, previously carried on by Messrs. Armitage, Frankish, & Barber ; he re-organized the establishment and re-named it the Atlas Works. The changes necessitated by the introduction of the Bessemer system in 1858, suggested in 1864 the expediency of converting the firm into a limited liability company, with a capital of one million sterling.

The Atlas Works cover an area of over 40 acres. Although the area has increased thirteen-fold since the works were first commenced, the actual turnover of the Company has increased from £40,000 per annum to £5,000,000 per annum ; and this fact in itself affords clear evidence of the beneficial influence of modern mechanical methods. The output 58 years ago probably did not exceed 5,000 tons per annum, whereas to-day it is approximately 100,000 tons. In all the works of the Company about 25,000 workers are employed.

In addition to the manufacture of armour plates, the Company make marine and other engine crank shafts ; shafting of all kinds ; gun forgings ; turbine rotor drums, wheels, dummy rings, etc. ; boiler flues ; steel castings of all descriptions ; tool steel of all kinds ; railway material such as tyres, axles, springs, buffers, etc.

The Company are also proprietors of collieries near Rotherham, having an output of 2.500.000 tons per annum.

In 1899 the Company acquired the Clydebank Shipbuilding Works, one of the most important in the country, having an area of 80 acres and employing 8,000 men. John Brown & Co., Ltd., have now taken up the manufacture of the Brown-Curtis Turbine in Great Britain, which they have recently fitted with marked success to a cruiser for the British Navy. (See also this Journal, 1898, p. 643.)

TINSLEY STEEL, IRON, AND WIRE ROPE WORKS (MESSRS. WILLIAM COOKE & CO., LTD.)

Leader :—Mr. E. Jones.

This firm, established in 1866, manufacture wire ropes, wire rods, and horse shoes. The firm's industries include puddling of iron, in the old-fashioned way, the rolling of bar iron of different sections in three mills, the spinning of wire ropes, the rolling of steel wire rods in two mills, driven respectively by compound condensing engines of 1,200 h.p. and 1,800 h.p.—these rods are for drawing into wire for ropes, cords, and other purposes, and the making of horse shoes by machinery.

The wire rope factory was erected in 1887, enlarged in 1897, and again in 1902, and recently still further enlarged. It is equipped with modern machinery for dealing with all kinds of wire ropes. Every piece of wire is tested before it is sent to the rope factory, and detailed records kept of the manufacture of every rope. Their largest trade is for winding and hauling ropes for collieries and mines. The firm also make noiseless tyre bars for motor cars and other vehicles. The horse-shoe department has grown considerably during the last few years. In 1904 a new rod mill was started, and the firm have recently erected another one of still larger capacity.

MESSRS. WILLIAM HUTTON & SONS, LTD., WEST STREET.

Leader :—Dr. R. S. Hutton.

This firm was founded in Birmingham, in the year 1800, by William Hutton. W. C. Hutton, his son, founded a branch in Sheffield in 1832, and introduced to Sheffield the process of close plating or welding a thin sheet of silver on the steel blades of dessert knives, as well as spoons and forks of nickel silver. The firm claim to have been the first to use nickel silver in Birmingham for making spoons and forks, for which they employed nickel first refined in England in 1830 by P. N. Johnson, of Hatton Garden, London, the founder of the firm of Johnson, Matthey, & Co.

In 1843 they commenced electro-plating with the use of batteries, and in April, 1845, they purchased a magneto machine by J. S. Woolrich, and managed for many years to silver plate with it all the work made in their Sheffield factory.

The firm make their own alloys—German silver, Britannia metal, etc., and manufacture sterling silver, electroplate, and table cutlery. Whilst from the manufacturing point of view the great variety of patterns in this industry has the disadvantage of limiting the use of automatic machinery, it does much to encourage individual skill and to keep alive the art of hand working.

ROYAL PLATE WORKS, NORFOLK STREET. (MESSRS. MAPPIN & WEBB, LTD.)

Leader :—Mr. J. H. Bramhall.

The firm of Mappin & Webb is of respectable antiquity. The earliest records go back to the year 1797, when the name of Mappin was first identified with the manufacture of Sheffield plate and cutlery. Last year the firm celebrated their centenary, being actually founded in 1810, when Joseph Mappin & Son started a business as engravers in Fargate, Sheffield.

Occupying about three acres of ground, and employing over six hundred hands, the Works are complete in themselves, and all the processes of the manufacture of silver, electro-plate, cutlery, and Britannia ware may be there observed.

Perhaps the process which possesses the most attraction for the visitor is the silver plating of the spoons and forks and holloware articles by electrical deposition. This department is a very extensive one and contains some twenty vats with dynamo and all the necessary apparatus for plating.

The firm's output of sterling silver runs into many thousands of ounces a week, and they are amongst the largest buyers of ivory in the kingdom.

In another department razors are made and handles of all kinds shaped and fitted to their blades. All steel blades are forged, ground, and finished in spacious " hulls " or " wheels," and here may be seen representatives of that interesting local type, the Sheffield grinder.

THE METALLURGICAL DEPARTMENT OF THE UNIVERSITY OF SHEFFIELD, ST. GEORGE'S SQUARE.

Leader :—Prof. L. T. O'Shea.

The Department of Metallurgy.—Sheffield has adopted that new system of metallurgical education, in which the ordinary scientific laboratory equipment is supplemented by a working plant, not, of course, on a commercial, but on a manufacturing scale. In 1890 the Technical Authorities decided to erect a small steel works, including a 25-cwt. Siemens furnace and a full-size 4-crucible Huntsman furnace. This departure having been attended with success, it was decided twelve years later to expand the scheme and erect an experimental steel works. This unique practical laboratory was erected on an island site, close to the other buildings of the Applied Science Department, and contains gas, crucible, and Siemens furnaces, and Tropenas surface-blown Bessemer plant ; also a 7-cwt. electric pneumatic hammer, a 36-inch cupola, a heat treatment furnace, a hardening laboratory, a shock and dynamic testing laboratory, and finally a 120 horse-power electric induction steel melting furnace, capable of melting about 300 lb. of steel. The whole of the operations in this laboratory are carried out with the assistance of the best obtainable scientific instruments of precision.

The provision to be made for the new non-ferrous department includes three large laboratories, lecture rooms, furnace laboratories, apparatus for melting by electricity, gas and coke, a micrographic analysis laboratory and an electro-plate department with vats, stamps and other apparatus used in the electro-plate trade.

A small party of members visited the department.

Professor Arnold, in an address which he gave to the visitors, said that they carried out their work on an actual manufacturing, though not on a commercial, scale. They had the old Huntsman process of crucible steel making; the Bessemer process, by which they could make ingots weighing up to 30 cwt.: the chief method of structural steel manufacture—the Siemens open hearth process—by which they had made casts up to 2½ tons; and also the latest departure in steel making—an electric induction furnace, in which they could make ingots up to 2 cwt. They had recognised that they must work on a manufacturing scale if they were to give the students reliable training.

Students of the Royal School of Mines of the Imperial College of Science, if they wish to obtain the School of Mines diploma for iron and steel metallurgy, must—by an order of the King in Council—take their fourth year in the metallurgical department of the University of Sheffield and must pass its examination. So that, said Dr. Arnold, the applied science department was practically the iron and steel branch of the Royal School of Mines. This was a tribute paid by the Imperial College of Science to the public-spirited action of the public men of Sheffield, particularly the City Council, in giving the department such a magnificent equipment. It was quite fitting that the iron and steel education should be in the North, leaving to the Royal School of Mines the other metals.

Under the guidance of Professors Arnold, McWilliam, and O'Shea, the party made a complete tour of the department. They saw two ingots of crucible steel actually cast, and the remarkable influence of a slight trace of aluminium was explained. The ingot to which ·01 per cent. of this metal was added was free from blowholes, while the other was so full of gas that it was about three inches longer than the first, although both were of the same weight. The addition of aluminium, said Professor Arnold, eliminated the whole of the gas. Why this was so, they did not know. It was a phenomenon that they had never solved.

The Kjellin electric furnace was shown with its rings at a red heat, and the operation of the electrically-heated barium chloride furnace for hardening tool steel was practically demonstrated. Various methods of testing steel, kinetic and static, including Professor Arnold's alternating stress test, were shown, as well as the processes of analysing steel and other metals.

MESSRS. STEEL, PEECH, & TOZER, LTD.

Leader :—Mr. B. Methley.

The above firm are the owners of the Phœnix Special Steel Works, which are situated at The Ickles, near Sheffield. When acquired by the present proprietors in 1875 the works were comparatively small, but there has been gradual expansion until, to-day, they cover nearly 50 acres.

In the early days the business was confined to the manufacture of steel by the Bessemer process, of which railway rails formed the principal part, but later on three Siemens furnaces were added to the plant, which number has since grown to seven. There are also cogging and rail mills for rolling railway and tramway rails, girders, blooms, and billets, the necessary equipment for dealing with an output which exceeds 2,000 tons per week. There is also a forge department, which contains four steam hammers varying from 30 cwt. to 7 tons. The largest hammer is engaged on crank axles, piston rods, connecting rods, and general forgings and blooms, whilst the other hammers make wagon and carriage axles and smaller forgings. In the tyre department there are punching and becking hammers, also a rolling mill for finishing the tyres. The merchant mills possess four trains of rolls, and the production comprises spring steel in a considerable range of sizes. Rounds, flats, squares, and sectional bars are also produced by these mills. There is also a spring department for the manufacture of laminated springs for locomotives, carriages, and wagons. In addition to the above there are fitting shops and foundries, locomotives, and extensive sidings, and also chemical and physical laboratories of the most modern type.

The firm employ about 2,000 hands, and the output of steel ingots totals more than 150,000 tons per annum. The party was entertained to tea by the firm.

RIVER DON STEEL WORKS. (MESSRS. VICKERS, LTD.)

Leader :—Mr. F. E. M. Chambers.

The manufactures of this firm include ships, naval and mercantile; guns, naval, field, and coast defence; engines, marine, electric, and hydraulic; armour-plates; castings; railway material; motor cars, etc.

The business was established in Sheffield in the closing years of the eighteenth century by George Naylor and James Sanderson. The works of the parent company were at Millsands, but in 1863 it was found necessary to erect new works; these are situated on the river Don at Brightside, and occupy 60 acres. The company make all the steel for their productions. There are seven furnaces for open-hearth steel, with capacities ranging up to fifty tons each. There is also an extensive equipment for preparing the raw material, the pig-iron, scrap-steel, nickel, chrome, etc.

At one point the river Don, which here has a width of 120 feet, is spanned by a travelling crane, the supports of which run on rails on either bank, and the arms of which extend over the stores of material on one side of the river, and on the other over the railway which conveys the material to any place where it may be required. This structure picks up loads of any necessary weight and carries them at the rate of 600 feet a minute across the river, while the whole structure travels along the bank at the rate of 200 feet per minute. The cranes for lifting the ingots, the armour-plate, or the heavy guns have capacities as high as 120 tons; the forging presses for the larger guns range from 1,700 tons to 8,000 tons pressure; the largest lathes have a length of 90 feet, with 60 inch centres.

Previous to the late 'sixties the Company's principal productions were tool steel and railway castings and forgings, which they still manufacture, but in 1868 they began making marine shafting, and four years later they cast their first screw propeller. In 1897 the Company purchased the establishment of the Naval Construction and Armaments Company, Limited, at Barrow-in-Furness. (See also this Journal, 1898, p. 644.)

GRIMESTHORPE STEEL AND IRON WORKS. (MESSRS. CAMMELL, LAIRD & CO., LTD.)

Leader :—Mr. Rushby.

Established in 1837, in the steel and file trade, at Furnival Street, Sheffield, the firm became a limited company in 1864, and in the same year acquired the Yorkshire Steel and Iron Works. In 1902 an amalgamation was effected with the shipbuilding and engineering firm of Laird Bros., the title of the Company being altered to the present style of Cammell, Laird & Co., Ltd.

The party were received by Mr. John Little (General Manager) and Mr. Deby (Chemist), and were shown the casting and rolling of armour-plates, the making of railway tyres, the pressing of marine forgings, and other processes.

The Grimesthorpe establishment, covering 22 acres, is engaged in producing heavy guns, forgings, projectiles of every description, large crank and propeller shafts for warships and mercantile marine, railway tyres, steel forgings, and castings of any weight up to 100 tons. The works include a number of 40-ton and other Siemens-Martin acid steel-melting furnaces, arranged so that several can be tapped into the large No. 1 casting pit. From the top level a tramway communicates with the press for compressing ingots during solidification on the Harmet system. There are four steel foundries. No. 1

is devoted to heavy gearing bed plates, large dynamo castings, etc., and the others are all engaged in certain definite classes of work.

A new armour-plate mill has been put down at the Grimesthorpe Works which will be the most powerful of its kind. The housings are enormous steel castings, and were made in their own foundry; they also forged all the steel rolls and other forgings. Each of the main rolls for this mill weighs 42 tons, and they were forged from ingots weighing 82 tons. Besides these rolling mills, there are three others, two of them adapted for large and one for small plates. The smallest mill is usually employed on "deck" plates and very thin armour. (See also this Journal, 1898, p. 644.) Afternoon tea was provided for the visitors.

The Parkgate Iron & Steel Co., Ltd., Rotherham.

Leader:—Mr. F. J. Merrils.

The works of this firm were commenced on a small scale in 1823, and were purchased in 1864 by the present owners.

At that time the staple industry was the manufacture of iron rails, but after the introduction of the Bessemer process the manufacture of iron rails on a large scale ceased.

It was at these works that the original trials were made of ironstone from the present field of Lincolnshire ore at Frodingham. When larger plates began to be used for purposes of construction plate mills were erected, in which the plates for the steamship "Great Eastern" were rolled. Another point of interest is that rolled armour plates were first made at these works, and for nearly five years rolled armour plates were obtainable only from the Parkgate works. Up to the year 1888 the company manufactured wrought iron only, but in that year the steel works were erected. In 1908 the manufacture of wrought iron was given up entirely.

The present constitution of the works is as follows:—

Blast Furnaces.—There are five furnaces, three at the Holmes Works, near Masbro' Station, and two at Parkgate. The furnaces at the Holmes are of the open-top type. In the two Parkgate furnaces the blowing engines are driven by the waste gas from the furnaces. Altogether there are four gas-driven engines, each of 700 i.h.p. Two of them are used for blowing the blast furnaces, and the other two drive the dynamos for generating electric supply for the works.

Steel Works.—Both acid and basic steels, Siemens open-hearth process only, are made. There are eight 40-ton and one 60-ton melting furnaces and a 200-ton metal mixer. The rolling power of the steel works consists of a plate slabbing mill, a bloom and billet mill, and a large plate mill in which plates can be rolled up to 11½ feet wide and up to 60 feet long.

The manufactures include steel plates, steel bars, high tensile steel in plates, sheets, and bars, slabs and billets of dead soft quality and guaranteed carbons, welding and case-hardening steel, and pig iron for foundry and forge.

The total output of the works per week is over 2,000 tons of rolled and finished material. The daily consumption of fuel is about 700 tons. The works employ between 1,400 and 1,500 men.

Messrs. Joseph Rodgers & Sons, Ltd., Norfolk Street

Leader:—Mr. H. Nixon.

These works consist of five factories covering, approximately, five acres of ground, and the number of persons employed is over 1,600. The steel used by the firm is manufactured on the premises. In 1910 the output exceeded 1½ millions each of pocket knives and table cutlery, half a million razors, 250,000 scissors, besides carvers and silver and electro-plated goods. The amount of ivory used in the manufacture of table knives has fallen off considerably in recent years, owing to its high price, but still the demand requires the use of about twelve tons per annum.

Messrs. Walker & Hall's Electro Works, Howard Street.

Leader:—Mr. E. Bellamy.

The firm originated, some seventy years ago, in the invention of the process of depositing silver by means of electricity.

George Walker, a working cutler, acquired a knowledge of the electro-plating process, discovered in 1840 by Dr. Wright, and having gained sufficient experience to apply the process practically, founded the business.

Mr. Walker was soon after joined by Mr. Henry Hall, and the two partners eventually succeeded in perfecting the process. The present senior partner, Colonel Sir John E. Bingham, Bart., V.D., entered the business at the age of sixteen. With him is now associated in co-partnership his son, Mr. Albert E. Bingham.

The firm possess the original vat and apparatus and the recipe for the first pint of solution used, by the aid of which silver was deposited upon two teaspoons. The capacity of the vat used was one quart, while the vats now in use in the plating rooms contain about 31,000 quarts.

At first the attention of the firm was wholly confined to electro-deposition, but now Messrs. Walker & Hall manufacture on their own account, though they continue to electro-plate for the trade. So greatly has their industry increased since then that the weight of silver they now deposit upon their own goods far exceeds that which was ever deposited by them in former times for the united trade. The firm have in their employ, including branches and outworkers, over 2,000 employees. Among the many interesting operations shown to the party were the stamping of sheets of metal by means of blows from heavy descending weights, the annealing of these stamped pieces, the etching and embossing processes, the soldering and brazing, the actual plating, and finally the duffing and burnishing, whereby the articles acquire a reflecting power equal to that of the finest mirror. Specially noticeable were the arrangements for collecting every particle of silver and gold in those buildings where the precious metals were worked. The floors are covered with steel gratings, which are removed and the floors swept at regular intervals, the sweepings being freed from iron by means of a magnet and then sent to the refinery for the recovery of the silver and gold dust. (See also this Journal, 1898, p. 645).

The University Buildings and Laboratories, Western Bank.

Leaders:—Prof. L. T. O'Shea and Mr. W. E. S. Turner.

The University Buildings occupy a commanding situation. To the west and north they abut on Weston Park, one of the public parks of Sheffield. The whole length of the west wing is open to the park, the level of which is a storey higher than the ground level on the inner or quadrangle side of the building. The buildings are in the Tudor style of architecture, of red brick, and form three sides of a quadrangle, the fourth side being reserved for future extensions. The beautiful University Hall, named the Firth Hall in memory of the late Mr. Mark Firth, which is capable of accommodating about 800 persons, is lighted by eighteen windows. It is partly panelled in oak, and has an open-work oak roof, supported by arches and mouldings of the Tudor period. In the same block are the Administrative Offices, Council Room, Common Rooms, and in the basement the Refectories. The buildings adjoining Weston Park and forming the west side of the quadrangle are devoted to the Faculties of Arts, Law, and Pure Science; those on the north side to the Faculty of Medicine. The Faculty of Applied Science is accommodated in the buildings, formerly the Technical School, in St. George's Square, a few minutes walk from the rest of the University. The Edgar Allen Library, opened in 1909 by H.M. King George V, then Prince of Wales, occupies a site at the south-west corner of the University buildings, and is approached by a covered way from the main floor of the University. In form it is octagonal, and consists of two storeys and a basement, providing a total accommodation for about 120,000 volumes.

The Chemistry Department occupies about two-thirds of the top floor in the western block. It is provided with a lecture theatre, seating 110 students, a lecture preparation room, and a class room to seat 30 students.

The two general laboratories are provided with pitched roofs and, in part, are lighted from the roof. The ventilation is carried out on the plenum system, the fan and heating coils being placed in a chamber above the lecture preparation room. The laboratory for students of intermediate standard, 72 feet by 36 feet, is fitted with sixty benches. The laboratory for students beyond the intermediate stage is 60 feet by 25 feet, and is designed for 30 students. It will become the Organic Chemistry laboratory in the enlarged Chemistry Department of the future.

A third laboratory, added to the department in January, 1908, has been assigned temporarily to the Sorby Fellow, Dr. J. F. Thorpe, F.R.S., and equipped for research work in organic chemistry. The instruction in practical physical chemistry is given partly in a laboratory lent by the Physics Department and partly in two small rooms on the chemistry floor.

The usual practice of providing separate rooms for special operations has not been followed, except in the case of gas and water analysis, owing to want of space. The research laboratory is small, 25 feet by 20 feet, but self-contained, so that work can be carried on in it during vacations.

The Applied Science Department (St. George's Square). Like most other modern Universities, that in Sheffield has a bias towards one particular subject. The metallurgical industries of the city have a strong claim on the shaping of University courses, and the University authorities have ever been alive to the necessity of keeping in close connection with the requirements of the city's chief industry. Such equipment is therefore provided as to afford the students not only a sound training in the theory of their subject, but also, as far as is possible, in practical manipulation under works conditions. In addition to metallurgy, both iron and steel and non-ferrous, the applied science section includes engineering, mining, and applied chemistry. Each of the departments is in close touch with the needs of the city and district.

To-day most firms have fine chemical laboratories, well staffed, and in addition scientific appliances for static, shock, and dynamic mechanical testing. The development of pyrometry, including observations of recalescence and of micrographic analysis in works practice, has, in the last few years, proceeded very rapidly.

It may be well to recall the fact that the science of metallography was founded in Sheffield by the late Dr. Clifton Sorby in 1863, and that his fine series of pioneer sections are still in use in the micrographic laboratory of Sheffield University. Since 1889 Dr. Sorby's work has been steadily carried on in what is now the University of Sheffield, and the whole of the nine undisputed micro-constituents of steel were discovered in Sheffield.

The introduction of science into its industries naturally caused some of Sheffield's leading citizens to consider the best means of providing a training for students of Applied Science. In 1884 the Sheffield Technical School was established as a department of the then Firth College.

The Engineering and Metallurgical Departments of the new School steadily progressed owing to the interest and efforts of a powerful Committee, now known as the Applied Science Committee of the University. This progress was made possible owing to large grants from the City Council, made annually on the recommendation of the Education Authorities of the city.

The Applied Science Department is at present undergoing considerable extension. For some time past the present buildings in Charlotte Street have been found to be quite inadequate for the demand made on the Department, particularly in regard to mining and applied chemistry. More recently, the non-ferrous industries, including the silver, Britannia metal, brass and allied trades, applied to the Committee for educational assistance, pointing out the great advantages which the work of the Department has provided for the steel trades and asking for similar treatment. The munificent gift of £15,000 by the Drapers' Company encouraged the Committee to seek further assistance in other quarters, and great success has crowned their efforts. Almost the whole of the estimated amount required, £35,000, has been raised.

The Department of Applied Chemistry was founded in 1905, to offer scientific assistance in the development of the industry of the coking of coal now operating throughout South Yorkshire and North Derbyshire.

The work of the Department deals with chemistry in relation to mining and to the manufacture of coke and illuminating gas. It is carried on by means of lectures and laboratory practice in both day and evening classes. The subjects included are the chemistry of fuel, especially of coal; the coking of coal and recovery of by-products; mine gases and safety lamps; the manufacture of explosives, and colliery explosions; gas manufacture and distribution.

The present accommodation is limited. Under the new extension scheme of the Applied Science Department of the University is included more adequate accommodation, which it is hoped will meet the present requirements of the Department. The proposed extensions include a laboratory to accommodate 30 students, a lecture room to hold 81 students, preparation room, fireproof furnace room, lamp testing and photometric room, gas analysis room, and balance room.

It is expected that the new buildings will be ready for the session 1912–13.

A small party visited the University and were entertained by the Professors.

Reception by the Lord Mayor.

In the evening the members of the Society were entertained at a reception at the Town Hall by the Lord Mayor and Lady Mayoress, and Alderman and Mrs. H. K. Stephenson, who received the guests in the Lord Mayor's parlour.

The band of the 3rd W.R. Brigade of the Royal Field Artillery provided the music, and the lower end of the large reception room was turned into a concert hall for a part of the evening. The vocalists included Miss Ida Bloor, Mr. A. S. Burrows, and Mr. Foden Williams.

Friday, July 14th.

The last day of the meeting was devoted to a tour in Derbyshire and a smoking concert. Shortly after 9 o'clock some 120 members and ladies left the Grand Hotel in four-in-hands, landaus, and motor cars, specially lent for the purpose by Mr. Gladstone Adams, Councillor P. J. Benson, Messrs. Cammell, Laird & Co., Col. A. W. Chadburn, Mr. T. Chatterton, Mr. Claude Creswick, Mr. Cuthbert Dixon, Mr. T. Dobb, Mr. J. F. Eardley, Mr. Benjamin Hind, Mr. J. W. Morrison, Mr. George Preston, Mr. E. Ridgill, Mr. Albert Senior, Mr. T. W. Ward, and Councillor Ernest Wilson.

The routes taken were various, but the main party followed that by Fox House to Chatsworth. Here they were received by Dr. Wrench, body physician to the Duke of Devonshire, and an authority on the art treasures of the Mansion, who showed them over the house and grounds. Among the exhibits were the Leyden jars used by Cavendish. They appeared somewhat archaic, but the work done with them led to most important results.

Luncheon was served after the inspection, the President being in the chair. The President, in proposing the health of the Duke and Duchess of Devonshire, referred to their kindness in throwing open Chatsworth House to them on a day when it was usually closed to visitors. That, however, was not the first time that a member of the Cavendish family had rendered service to chemists, for as they passed through the beautiful house they saw the apparatus which Cavendish used for his experiments in 1781. That representative of the family did some excellent work, but he was a man who did not court publicity. He worked for the sake of obtaining knowledge, and he gave to the world results which subsequently found their explanation in the isolation of argon. The achievement of Cavendish was one of which any scientific man might be proud. It was, therefore, only natural that the little apparatus they had seen that day appealed to them as chemists probably even more than the beautiful works of art with which Chatsworth was filled.

Dr. Wrench acknowledged the toast, and expressed regret that the duke was not there to welcome them. Had His Grace been there he would have alluded to the valuable work the Society had rendered to civilisation. Surgeons were greatly indebted to chemists for providing chloroform and other anæsthetics which were so much used to-day. He remembered the days of the Crimea when they had no chloroform, and he realised what an invaluable aid it had been in the profession of surgery.

Thanks were accorded to the local committee for arranging the tour, and to the gentlemen who had placed motor-cars at the disposal of the visitors for that day. Mr. Walter Tyzack responded on behalf of the local committee, and Colonel Chadburn for those who had lent cars.

From Chatsworth to Haddon is only a short drive. At Haddon the visitors spent a delightful time wandering through the fine old Hall, and afterwards had afternoon tea in the grounds. The return journey was by way of Owler Bar, Sheffield being reached about 9 o'clock.

The last item on the programme of the meeting was a well-attended smoking concert at the Grand Hotel, when Mr. B. E. R. Newlands presided, supported by the President and the President-elect. Miss Ethel Griffiths gave violin solos, Miss Maud Royal and Messrs. Aubrey Dakin and Harry Heath rendered songs; Professor O'Shea and Mr. Victor Tlach gave recitations, and Professor McWilliam and the chairman also contributed to the programme. Mr. Frank Rodgers was the accompanist.

The Handbook and Guide.

An excellent handbook was compiled for the Local Executive Committee by Mr. Ernest A. Smith, A.R.S.M., assisted by Mr. W. E. S. Turner, M.Sc., of the University of Sheffield. For Sections II. and III. and much information in other sections, the Editors are indebted to the 1908 Handbook of the British Medical Association, courteously placed at their disposal by the compiler, Dr. Wm. S. Porter, and the information on the industries of the city to the British Association Handbook, 1910. Articles on the "Iron and Steel Industries," by Profs. Arnold and McWilliam, the "Silver Industries," abstracted in part by Mr. Ernest A. Smith from an article by Mr. Arnold T. Watson, and the "Coking Industry," by Prof. L. T. O'Shea, add to the technical value of the work. The particulars regarding the works visited are derived from this source.

London Section.

Meeting held at Burlington House on Monday, June 12th, 1911.

MR. E. GRANT HOOPER IN THE CHAIR.

METHODS OF TESTING SAFETY LAMPS OR OTHER APPARATUS FOR THE DETECTION OF COMBUSTIBLE GASES AND VAPOUR.

BY ARNOLD PHILIP, B.SC., A.M.I.E.E., AND T. STENHOUSE, JUN., B.SC., F.I.C.

Section I.—Introduction.

In order to test inflammable gas and vapour detectors, they must either be immersed in an enclosure containing a mixture, in known proportions, of air and some combustible gas or vapour, or a current of such a mixture must be passed through the apparatus itself at some convenient rate. It is generally desirable that the composition of the mixture of air and combustible vapour shall remain constant during each experiment, and sometimes over considerable periods of time.

We propose to give a short description of the methods which are available for this purpose. They may be classed under one of two heads.

A. Testing in static mixtures.—Either a weighed amount or a known volume of a volatile combustible liquid such as petroleum, ether or pentane is evaporated in an enclosure containing a known volume of air or else a measured volume of a combustible gas is introduced with suitable precautions into the enclosure containing a known volume of air. In either case the complete mixture of the combustible vapour or gas is effected by efficient stirring or agitation. The device to be tested (usually a lighted miner's safety lamp of some form) is introduced into the mixture by a suitable opening in the roof or floor of the enclosure and after again closing this opening the behaviour of the flame is observed through a window in the side of the box, precautions being taken to exclude any other light than that of the lamp under test. This general method has been very carefully worked out by Dr. Clowes and is fully described in his book on "The Detection and Measurement of Inflammable Gas and Vapour in the Air," and in papers in which he has read before various societies. There are evidently several inherent objections to this method which are as follows:—*1st.* The preparation of the atmosphere of the desired composition takes some little time. *2nd.* The atmosphere having once been prepared tends to change during the period of conducting the tests on account of (*a*) The flame of the lamp under test burning a certain proportion of the inflammable vapour or gas and oxygen present; (*b*) The introduction or withdrawal of the lamp into the enclosure containing the prepared atmosphere also tending to alter the proportion of air and inflammable gas or vapour. Dr. Clowes has discussed these difficulties in the papers referred to and for experiments which do not extend over long periods or are not required to be made in large numbers no doubt these sources of inaccuracy are not of great importance.

B. Testing in gas currents.—This may, in contradistinction to what we have described under the first heading be entitled the kinetic method of testing. It consists in arranging a pump or source of gas pressure in such a manner as to provide a uniform stream of air mixed with a constant proportion of the inflammable vapour or gas with which it is desired to experiment, and this gas stream is then either passed through the detector or the detector is completely immersed in it according as is most suitable to the apparatus under test. It is usually but not always necessary that the relative proportions of the air and the combustible constituents of such gas streams shall be known and the volume which the stream shall have, in general, depends upon whether it is to be passed through the detector apparatus or whether the apparatus is to be immersed entirely in it. In practice we have found that such streams may vary between a minimum of 2 cubic feet per hour up to as much as 30 cubic feet per hour, depending on the character of the apparatus tested.

Section II.—Sources of combustible gas or vapour.

These may be either of the following:—

(1) *Coal gas.*—This has the advantage of being available in large amounts and of fairly constant composition and constant pressure at any given locality; on the other hand it varies considerably in composition in different places. Nevertheless for a certain class of tests it is extremely satisfactory.

(2) *Hydrogen.*—A stream of this gas may be generated by means of the electrolysis of water in the usual manner, and can be very accurately measured by means of an ammeter. For some forms of detectors it offers a very useful standard method of test and calibration when suitable electrical pressure is available.

(3) *Dry air saturated with the vapour of volatile organic liquids at a fixed temperature.*—A stream of dry air passed through chemically pure liquids kept at a constant temperature may be saturated with the vapour of the liquid at that temperature and by a suitable choice of liquids and temperatures a very wide range of strength of combustible

vapour is obtainable and by this means repeat tests at different times and places may be readily made under precisely similar conditions.

(4) In certain cases, as for instance when it is desired to test the behaviour of inflammable gas and vapour detectors towards special gases such as carbon monoxide, methane, etc., it becomes necessary to store convenient volumes of the gases in gas holders and to adopt means of delivering them under constant pressure.

(5) A further very convenient source of hydrogen or acetylene is found in the cylinders of these compressed gases.

Section III.—Methods of mixture of the combustible gas or vapour with air to obtain an atmosphere suitable for the test which it is desired to carry out.

This operation may in general be carried out in one of the three following ways :—

(1) An electrically driven pump, a hand or foot bellows, or a water pump P sucks from two pipes both fitted with an adjustable cock T_1 and T_2 capable of fine regulation. One of these opens directly to the air and the other is connected at A with any one of the sources of combustible gas or vapour enumerated above. For a given source of inflammable gas or vapour and a given speed of pump the composition of the mixed air and combustible gas or vapour delivered by the pump depends only upon the adjustment of the cocks on each of the two circuits. That is to say the composition of the mixed air and inflammable gas or vapour delivered by the pump depends only upon the ratio of the volumes of air sucked by the pump from one pipe to the volume of either inflammable gas or air saturated with combustible volatile organic vapour, as the case may be, drawn from the other pipe. A diagram of this arrangement is shown in Fig. 1.

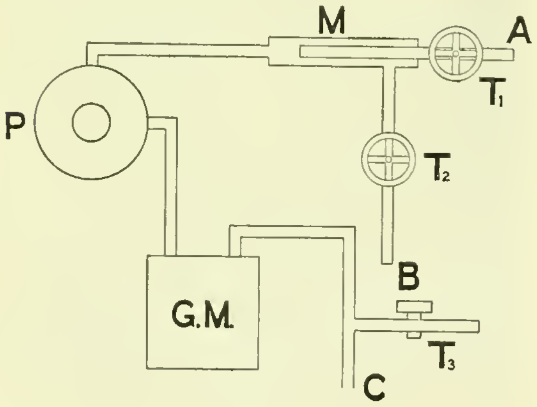


FIG. 1.

Combustible gas or vapour enters at A. M=mixer. Air enters at B. P=pump. T_1T_2=fine adjustment taps. G.M.=gas meter. Mixed gas or vapour and air pass to detector under test at C. T_3=tap for sampling mixed gases.

(2) A pump P blows a stream of air through a hydrogen voltameter V. The composition of the mixture of hydrogen and air delivered by the pump depends upon the strength of the electric current passing through the voltameter and the adjustment of the cock in the air delivery tubes. For a given setting of the air cock and a given adjustment of the electric current through the voltameter a resultant current of mixed air and hydrogen of constant composition will be delivered by the pump for any desired period.

A diagram of this arrangement and of a suitable form of hydrogen voltameter is shown in Figs. 2 and 3.

(3) A stream of dry air is blown through a chemically pure volatile organic liquid maintained at a fixed temperature. If this liquid is chosen so as to possess a suitable vapour pressure at the fixed temperature selected (which is usually that of melting ice) a resulting stream of a mixture of air and combustible vapour of practically any desired composition may be maintained unaltered as long as is desired.

A greater flexibility is obtained by combining this method with that of blowing air at the same time in any desired proportion through a second circuit.

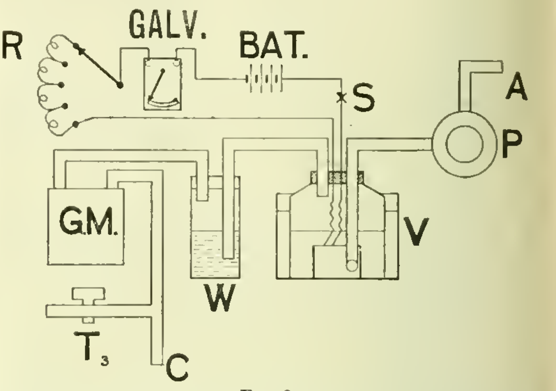


FIG. 2.

Air enters at A. P=pump. V=voltameter. W=wash bottle. G.M.=gas meter. Mixed air and hydrogen pass to detector under test at C. T_3=tap for sampling mixed air and hydrogen. Galv.=ammeter. S=switch. R=adjustable resistance.

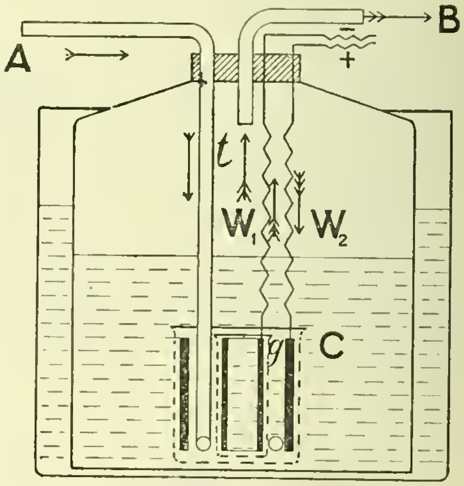


FIG. 3.

Section IV.—Methods of determining the chemical composition of the mixture of air and inflammable vapour or gas prepared by the foregoing methods.

The composition of the stream of mixed air and combustible gas or vapour obtained by any of the methods described in the last section may be determined as follows :

(1) Using the hydrogen voltameter referred to above and more fully described later on. It is clear that the volume of the mixture of air and hydrogen under standard conditions may be measured by means of a suitable gas testing meter, G.M., the pressure and temperature of the mixed gas passing through the meter is read at the meter. The volume under these conditions is registered by the meter and the volume under standard conditions can therefore be calculated, whilst as the volume of hydrogen under standard conditions can be ascertained from the ammeter reading of the current passing through the hydrogen voltameter the precise percentage of hydrogen in the mixed gases delivered by the pump can be accurately determined.

The expression for the percentage of hydrogen present is as follows :—

$$H = \frac{186{\cdot}6A}{V} \left\{ \frac{1 + 0{\cdot}003665\, t_m}{B + b - \beta_m} \right\} \quad .. \quad .. \quad (1)$$

Where H = The percentage of hydrogen present in the mixed gases.
V_m = The change in reading of the gas meter in ten minutes expressed in cubic feet.
A = Amperes passing through voltameter.
B = Reading of barometer in millimeters of mercury.
b = Excess pressure of gases passing through gas meter over the external air pressure in millimeters of mercury.
t_m = the temperature of water in gas meter in degrees Centigrade.
β_m = The pressure of aqueous vapour at temperature "t_m" degrees Centigrade in millimeters of mercury.

The value of " b " is usually so small that it may be neglected but it is as well at least to see by inspection that it is small by means of a gauge attached to the meter. In the meter used in experiments made by ourselves when the current of mixed gases passing through it was 9·36 cubic feet per hour the gauge at the point of entry into the meter read 11 mm. of water and at the point where the gases left the meter read 8 m.m. of water and this, taking either reading, is not much more than 0·5 m.m. of mercury which is negligible compared with the barometric pressure.

(2) Using the method (4) Section II. above it is evident that if the volume and temperature of a gas such as marsh gas, carbon monoxide, etc., delivered in a given time from a gas holder delivering at a constant known pressure into an air stream is known and also if the mixed stream of air and gas is measured by means of a meter and the temperature and pressure at the meter are observed, the composition of the mixed stream is fully determined.

The precise method which we have adopted to measure the volume of gas delivered from a gas holder and to maintain the pressure of the gas constant during the time the stream of gas was being run off, is as follows :—A gas holder of the well-known form shown diagrammatically in section in Fig. 4 was used. The gas was prepared and collected in the usual manner in the lower portion as shown extending down to the line, *a*, both the taps, *b* and *c*, being closed. The tap, *b*, was then opened and by running a wire through it the pipe to which it was opened was cleared of any bubble of air or gas. The tap, *b*, was then closed and the upper reservoir, *d*, of the gas holder was completely emptied of water by baling and finally wiping it out. The tap, *b*, was again opened, and its tube just filled to the top with water, when it was found that the water gauge, *g*, read a length, *h*. This is therefore the excess pressure of the gas in the holder in terms of water above the barometric pressure. Two marks were made on the gauge tube at *m* at a distance of about 2 mm. apart, and it was found that for streams of gas allowed to flow from the holder used by us (which had a capacity of one cubic foot), by opening the screw tap, T up to a volume of 3·75 cubic feet per hour it is quite easy to maintain the excess pressure, *h*, constant within the limits of the two marks 2 mm. apart by running water into the reservoir either from a tap or by pouring from a vessel. At the end of the experiment the volume of gas which has been delivered from the gas holder may be very accurately measured by determining the total volume of water in the upper reservoir. For the purposes of the experiment therefore the volume of the gas delivered in a given time and also its temperature and pressure are known and hence the volume under standard conditions can be readily calculated and as the pressure and the resistance to flow are constant throughout the test, the volume delivered per unit of time is constant and calculable.

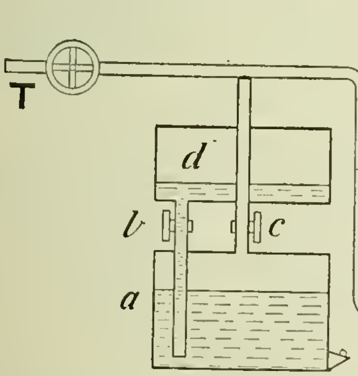


FIG. 4.

The arrangement of the apparatus used in this method of obtaining a uniform stream of a mixture of air and an inflammable gas of a known percentage composition is the same as that shown in Fig. 1 if the end of the tube, A is connected to a gas holder such as is shown in Fig. 4. An expression for determining the percentage of the combustible gas in the mixed air and gas expressed in terms of dry gases is as follows :—

$$C = \frac{100\, V_g}{V_m} \times \frac{B + h - \beta}{B + b - \beta_m} \times \frac{1 + 0{\cdot}003665\, t_m}{1 + 0{\cdot}003665\, t} \quad .. \quad (2)$$

Where C = The percentage by volume of the combustible gas present in the stream of mixed gases calculated on the dry gases.
V_g = The volume of combustible gas delivered from the gas holder at the temperature *t* degrees Centigrade measured in any convenient unit of volume.
h = The excess pressure of the gas in the gas holder above the barometric pressure expressed in millimeters of mercury.
B = The barometric pressure in millimeters of mercury.
β = The pressure of aqueous vapour at the temperature of the gas holder in millimeters of mercury.
β_m = The pressure of aqueous vapour at the temperature of the gas meter in millimeters of mercury.
b = The excess pressure of the gas in the gas meter above the outside air in millimeters of mercury.
t = The temperature of the gas holder in Centigrade scale.
t_m = The temperature of the gas meter in Centigrade scale.
V_m = The volume of gas passing through the gas meter at the temperature t_m in the same time that the volume V_g flows from the gas holder, measured in the same units of volume as V_g.

If the temperature of the gas holder is equal to the temperature t_m of the gas meter which may be readily arranged by leaving the meter and holder in the same room overnight, then $t = t_m$ and $\beta = \beta_m$ and the above expression is simplified to

$$C = \frac{100\, V_g}{V_m} \times \frac{B + h - \beta}{B + b - \beta} \quad .. \quad .. \quad (3)$$

(3) If the method (3) Section III. of obtaining a mixture of air and combustible vapour is employed, the amount present in a stream of dry air which has been saturated by bubbling it through any pure volatile organic liquid at any fixed and known temperature may be accurately determined either (*a*) by measuring the volume of the stream by some suitable means and ascertaining the loss of weight of the organic liquid caused by this known volume of mixed air and vapour stream bubbling through it or (*b*) by carrying out separate preliminary experiments with the particular organic liquid which it is desired to use in order to determine the weight (or the volume of the vapour at standard pressure and temperature) which is contained in each cubic foot of the mixed dry air and vapour issuing from the saturating apparatus at the fixed temperature which is to be used in the actual experiments.

So far, only two volatile organic liquids have been employed by us for testing inflammable vapour detectors by the above method and the results of the determinations of the weights and volumes of these compounds which are contained in one cubic foot of dry air saturated with those vapours at 0° C. are as follows :—

Kahlbaum's pure m-xylene (*b pt.* 137° *C.*)—One cubic foot of dry air saturated with *m*-xylene at 0° C. contains 0·2918 grm. of *m*-xylene. That is to say, it contains 0·217 part per cent. by volume of *m*-xylene vapour reduced to standard conditions of pressure and temperature.

Kahlbaum's pure toluene (*b. pt.* 110° *C.*)—One cubic foot of dry air saturated with toluene at 0° C. contains 1·1049 grms. of toluene, *i.e.*, 0·9466 part per cent. by volume of toluene vapour reduced to standard conditions of pressure and temperature.

The method adopted for determining these values was that of passing a slow stream of air through Geissler bulbs or other suitable saturators which contained the particular volatile combustible organic liquid under experiment. The air was cooled to 0° C. and dried over calcium chloride before entering the Geissler bulbs which were immersed in a bath of melting ice. The volume of the air and vapour which passed out of the bulbs at 0° C. was calculated from the volume as measured by an experimental gas meter into which the gas passed from them. The pressure at the meter for so slow a stream of gas was evidently the same as at the point where the gas left the bulbs. The temperature at the meter was measured and from this the correct volume of the dry mixture of air and combustible vapour when the dry air was saturated with the vapour at 0° C. (V_b) was calculated from the following expression :—

$$V_b = \frac{V_m \quad (B + b - \beta_m)}{(B + b)(1 + 0{\cdot}003665\ t_m)} \quad .. \qquad .. \quad (4)$$

V_b=The volume of mixed air and vapour of volatile organic compound issuing from the Geissler bulbs in a given time in cubic feet.

V_m=The volume of gas observed to pass through the meter in cubic feet in the same time.

B=The barometric pressure in mm. of mercury.

b=The excess pressure in mm. of mercury of the bubbles of gas just leaving the Geissler tubes above that of the barometer.

β_m= The pressure due to the tension of aqueous vapour in mm. of mercury corresponding with the temperature of the meter t_m.

t_m=The temperature of the gas in the meter expressed in degrees Centigrade.

The weight of the Geissler bulbs was determined both before and after the experiment and if w is the change of weight in grams of the bulbs caused by the volume V_b of mixed air and vapour of volatile organic compound issuing from them in the given time the weight in grams W of the particular liquid under test which is contained in one cubic foot of dry air saturated with the vapour at 0° C. can be calculated from the formula

$$W = \frac{w(B + b)(1 + 0{\cdot}003665\ t_m)}{V_m \quad (B + b - \beta_m)} \quad .. \qquad .. \quad (5)$$

Finally, the volume percentage composition C (or volume of the combustible vapour contained in one hundred volumes of the dry air saturated with the vapour at 0° C.) expressed in terms of the dry air and dry vapour can be obtained from the expression :—

$$C = \frac{200\ \overline{W}}{2{\cdot}537\ m} \quad .. \qquad .. \quad (6)$$

Where $\overline{W}$ is obtained from equation (5) above.

m=the molecular weight of the volatile organic substance

and 2·537=the weight in grams of one cubic foot of hydrogen at 0° C. and 760 mm. of mercury.

The error of the experimental gas meter was determined by direct calibration of the volumes of air forced through it by water pressure and the readings were found to be correct to within 1 per cent.

If it is desired to vary the proportion of the combustible vapour present in the mixture of air and vapour to some smaller amount than that contained in the air saturated with the vapour at 0° C., this may be done by forcing air from the pump P through two separate paths to the gas meter, one path controlled by a cone-seated fine adjustment needle valve cock T_1 passes through the drying, cooling and saturating apparatus, and then through a heating coil HC and a mixer M where it is met by the stream of pure air, this stream being also controlled by a suitable tap T_2. This arrangement is shown in Fig. 5.

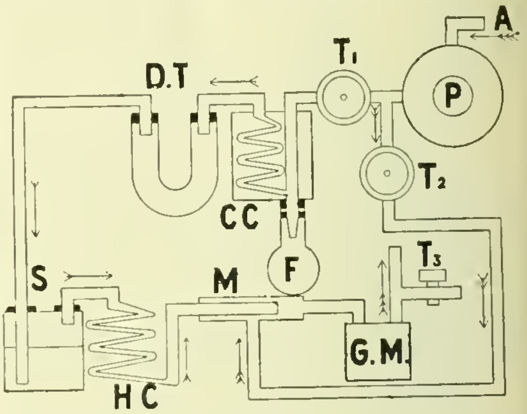


FIG. 5.

Air enters at A. P=pump. T_1 and T_2=fine adjustment taps. CC=cooling coils. F=flask to catch condensed moisture. D.T=drying tube. S=saturator or carburettor. H.C=heating coil. M=mixer. G.M.=gas meter. T_3=tap for sampling mixture of air and vapour.

It is clear that by this means a mixture of air and combustible vapour of any desired content of the latter can be obtained up to the concentration of a mixture of dry air saturated with the vapour at 0° C. When by suitably manipulating the taps a stream of a mixture of the required character has been obtained, as shown by the behaviour of the apparatus under test, it can be kept constant both in volume and composition for any reasonable period. The volume of dry gas and vapour passing through the meter in a given time from both paths reduced to 0° C. and 760 mm. pressure of mercury is obtained from the expression

$$V_h = \frac{V_m (B + b - \beta_m)}{760\{1 + 0{\cdot}003665\ t_m\}} \quad .. \qquad .. \quad (7)$$

Where V_m=The change of the meter reading in cubic feet in the given time.

B=The barometric pressure in mm. of mercury.

b=The excess pressure of the gas in the meter above that of the barometer, also in mm. of mercury.

β_m=The pressure of aqueous vapour in the meter at the temperature, t_m, expressed in mm. of mercury.

t_m=The temperature of the gas in the meter in degrees centigrade.

The volume of organic vapour V_v reduced to 0° C. and 760 mm. of mercury pressure in this mixture can be calculated by the expression

$$V_v = \frac{2\ w}{2{\cdot}537\ m} \text{ cubic feet.} \quad .. \qquad .. \quad (8)$$

Where w=The alteration of weight in grms. of the Geissler bulbs in the period during which the meter gave the reading.

m=The molecular weight of the volatile organic substance (H=2).

2·537=The weight in grams of one cubic foot of hydrogen at 0° C. and under 760 mm. pressure.

Hence finally the volume percentage composition C (or the volume of the combustible vapour contained in one hundred volumes of dry air saturated with the vapour at

0° C. and 760 mm. pressure) expressed in terms of dry air and dry vapour is obtained from the expression

$$C = \frac{200}{2{\cdot}537m\ V^{c}} \quad .. \quad .. \quad (9)$$

The symbols having the same meaning as in equations (7) and (8) above.

(4) It may often be convenient to determine the proportion of the combustible gas or vapour present by means of chemical analysis. Samples of the mixed air and gas or vapour stream may either be collected in gas sampling tubes or may be passed directly through a combustion tube from a by-pass outside the point where the gas stream passes through or around the particular inflammable gas and vapour detector under test. Such a by-pass tube with a tap, T_3, which is used for this purpose is shown in Fig. 5. This tap is normally kept closed but may be readily used for the purpose of obtaining samples for chemical analysis.

Section V.—Streams of known and constant mixtures of combustible gas or vapour and air may be used for demonstrating to coal miners, ship's stokers, or others whose occupation necessitates that they should have a practical knowledge of the way in which the presence and amount of combustible gases or vapours in air are indicated by the safety lamp or other indicator which they are required to use.

This, in our opinion, may be best carried out where a supply of illuminating gas is available by means of the method described on under II (1). The arrangement of the apparatus is shown in Fig. 1. This necessitates (*a*) a gas supply; (*b*) a cone-seated screw valve capable of fine regulation; (*c*) a mixer tube; (*d*) a small motor-driven air pump; and (*e*) a testing chamber. It is also desirable, but not necessary, to be provided with an experimental gas meter by means of which the volume of the stream of mixed air and coal gas may be ascertained. The cost of such a testing or instructional set complete should be about £7 to £16, according as an experimental gas meter is used or not.

The form of testing chamber which we have used is shown diagrammatically in Fig. 6. It consists of a metal box whose capacity is about 0·625 cubic feet (the internal dimensions being 15 in. high, 6 in. deep and 12 in. across the front face), provided in front with a glass inspection window 8 in. wide and 7 in. high. The glass of this window is clamped at the edges between two metal frames, one on the box and one a loose external frame which is screwed to the other. Packing strips of rubber on both sides of the edges of the glass are provided to prevent it coming into direct contact with the metal and to maintain a gas-tight joint. The box is made of copper, brazed at the joints. Two openings are provided, one A in the middle of the floor of the box and the other C in the middle of the lid. It is, in fact, substantially identical in most details with the test chamber devised and used by Dr. Clowes in his well-known experiments with static mixtures of air and combustible gases or vapours. The main differences being that the volume of the box we use is only about one-sixth part of that used by Dr. Clowes, whilst we find that wood, as being liable to warp and crack, is less suitable than brazed metal which is always gas-tight. Round the top outer edge of the box is a gallery E, also made of copper and brazed on to the box. This gallery is to contain water in order to form a water seal when the lid B is in position. The lid itself is made of as light sheet copper as possible and stands in the gallery on short legs at each corner in order that, in the event of an explosion, the lid may lift readily and the water blow back beneath it. The gallery is provided with a drainage pipe and tap to permit the water being readily run off when the box is not in use. Inside the bottom of the box is a perforated zinc false bottom D which stands on suitable legs and is provided with two rings for lifting.

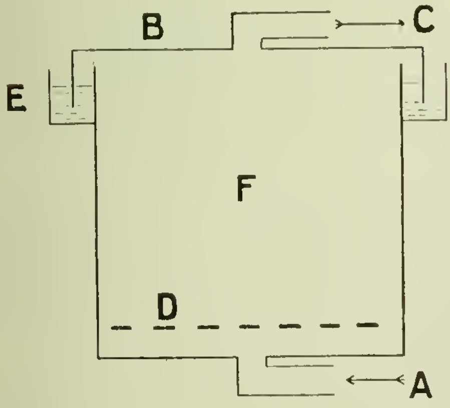


Fig. 6.

A drainage tap to permit the box to be washed out and drained in the event of any oil leaking from a lamp while under test, is provided at the bottom. The box is painted a dull black inside, and the inside of the water seal gallery should also be well painted in order to prevent damage by corrosion due to water standing in it.

The opening into the bottom of the box is kept large to permit the velocity of an entering stream of gas to be low, and the perforated zinc false bottom also further assists in causing the stream to rise uniformly and at a low velocity round the lamps under test. It is sometimes convenient to cover the middle portion of the false bottom with a layer of canvas or bunting to assist in checking the jet action of the entering gas.

The exit for the gas in the lid of the box is also kept large to assist in reducing the inconvenience of an explosion. It is hardly necessary to add that the end of the outside pipe from this opening should be directed away from the side of the box in which the observation window is placed.

When experimenting with coal gas or carbon monoxide, or, in fact, with any gas or vapour, it is convenient to attach a flexible tube to the pipe C from the opening in the lid of the box, and either carry the outer end of this tube to a suitable burner or to the outer air. When using a burner for this purpose the end of the tube should be properly protected to prevent back-firing.

The method of procedure which we have adopted in using this test chamber is first to remove the flexible pipe connecting the pump to the lower opening into the box, and to see that the coal gas supply at Fig. 1 is turned off and the tap, T_1, is closed, whilst the air tap, T_2, is open. The pump is then started running, the gas supply tap is next turned on and the tap, T_1, is gradually opened, the mixed stream of air and gas delivered by the pump being tested by means of collecting some of it in a gas cylinder by displacement and trying it with a lighted taper. The gas supply is gradually increased until the mixture will just ignite, and is then reduced until ignition is no longer possible. The pump is then connected to the testing chamber and the lamp under test is lighted, its flame adjusted, and it is stood on the middle of the floor of the box and the lid is placed in position.

The motor and pump which we have used for this testing set gave a current of just 14 cubic feet per hour. With this air stream the contents of the test chamber are removed about every two to three minutes, a change of composition of the gas in the chamber caused by a readjustment of the gas admission valve is therefore complete in this time.

By the above procedure all appearances of the flame cap may be produced at will from a gas strength of just under the explosive limit down to pure air in a very short period of time. If it desired to observe the behaviour of the flame cap above the explosive limit this may also be safely and rapidly done by suitably increasing the gas supply and cutting down the air.

For estimating with the highest accuracy the percentage of inflammable gas in a danger area as indicated by the flame cap in a safety lamp we consider it desirable to use a gas holder containing either coal gas or perhaps better marsh gas. This is the method of obtaining a mixed stream of air as described in (2) Section IV. above, and the arrangement of which is shown in Figs. 4 and 1.

Using the gas holder which we have employed in which the capacity of the gas vessel is about one cubic foot, it is not possible to deliver more than the capacity of the upper or water reservoir portion marked *d*, in Fig. 4, at a constant pressure. In a specially designed gas holder the volume of this water reservoir could easily be made equal to that of the gas vessel portion and thus the whole of the gas in the holder could be delivered at a constant pressure.

In the holder we have used the capacity of the upper water reservoir portion was about half a cubic foot and consequently this was the limiting volume available for our experiments.

With this holder, however, containing a volume of half a cubic foot of marsh gas or coal gas available for delivery at constant pressure and with a pump delivering 14 cubic feet of gas per hour, it is possible to pass a constant stream of known composition of air and marsh gas or air and coal gas through the test chamber for one hour, the percentage of the combustible gas being as high as 6·9 per cent. by volume. This is well above the lower explosive limit for marsh gas which is usually given, namely, from 5 to 6 per cent. and coal gas 6 to 9 per cent., depending upon its composition. As it would be only necessary to carry out such quantitative tests with much smaller percentages of combustible gas, it is clear that even with a gas holder of only one cubic foot of gas capacity and having the water reservoir of only one-half cubic foot capacity continuous experiments lasting more than two hours can be readily carried out with a stream of 14 cubic feet of the mixed air and gas passing through the test chamber. If the upper water reservoir is increased in size to one cubic foot capacity, an alteration which can be readily made, experiments of this character lasting as much as five hours, can be carried out and the behaviour of the flame of the safety lamp can be observed in mixtures of air and marsh gas, etc., of accurately known composition. In making these quantitative experimental demonstrations the use of an accurate experimental gas meter is, of course, necessary.

(2) Comparing the merits of the different constructions of safety lamps with each other or with those of other forms of inflammable gas and vapour detectors.

The operation of comparing two different types of safety lamps may clearly be very readily performed by placing the two lamps with their flames correctly trimmed for testing purposes side by side in the testing chamber. The space available inside the chamber which we use has been made amply sufficient to take two of the largest types of safety lamps now in use; on the other hand in order to permit the rapid change of the atmosphere in the chamber, and the removal of products of combustion, its volume has been kept down as low as was possible consonant with its conveniently holding two lamps.

During the comparison test a black metal separating screen is slipped between the lamps so that the reflections from the light of the one will not interfere with the observations made on the other. It is also desirable in most forms of safety lamps, when under test, to place a piece off carbon paper or brown paper inside the glass of the lamp at the back of the flame, thus cutting off the troublesome reflections from this surface. When working at some temperatures we have found that the inspection window of the test chamber becomes misty and partly obscured by reason of the condensation of moisture on its inside surface; this inconvenience may, however, be easily avoided if the inside surface of the glass is wiped over with a mixture of two parts of glycerine to one of water just before making the tests. The deposition of moisture which is also troublesome on the inside of the glass of some safety lamps can only be avoided by keeping them lighted for some little time before commencing to test in order to get the glass surface sufficiently heated to prevent the deposition taking place.

A very simple and useful form of test chamber which may be used for lecture demonstrations when suitable precautions are taken consists of a glass bell jar with an opening at the top which is closed with a cork inverted over the lamp. The mixture of gas and air produced as already described is led in to the jar either by a tube through a cork in a tubular at the bottom of the jar or by a long tube passing to the bottom of the jar through the cork in the top. In either case the gas passes off to the open air through a tube in the cork at the top of the jar. The reflections from the surface at the back of the bell jar are cut off by the insertion of a small sheet of stiff brown paper and the condensation of moisture on the inside of the front of the jar is prevented by wiping it inside with diluted glycerine. The jar may conveniently be stood upon a sheet of wetted indiarubber or if its lower surface is ground flat a good joint is obtained by standing it on a wet sheet of plate glass. Two lamps installed in testing chambers of this simple form are shewn on the table to-night.

The internal volume of these jars for testing a single lamp is under a quarter of a cubic foot and the atmosphere can easily be changed by a current of air such as is available from an air pump giving 14 cubic feet per hour, in about one minute.

To provide the necessary atmosphere for carrying out these tests a mixture of coal gas and air is pumped through the test chamber exactly as described in the preceding section. It is not usually necessary to compare the lamps for mixtures containing accurately known percentages of the combustible gas or vapour. The simplest arrangement, namely, that of using air mixed with coal gas alone will therefore, in general, be found to answer quite satisfactorily.

If it is desired to compare the indications of a safety lamp with those of an inflammable gas detector of a different type, this can be very simply performed by dividing the mixed stream of air and combustible gas or vapour into two parts just before it enters the test chamber. One of these streams is passed through the test chamber in which the safety lamp under comparison is of course placed, and the other stream is passed according to circumstances, either through or round the other form of inflammable vapour detector.

With reference to the amount of atmospheric air necessary to keep ordinary safety lamps burning satisfactorily when turned down sufficiently for testing purposes we find that with a current of 15 cubic feet per hour two of the ordinary pattern safety lamp as used in the Navy will burn side by side in the larger testing chamber we have described above for four hours, and it must be remarked that this extinction sometimes takes place in a shorter period even in the open air, due to the fact that lamps turned down so low were somewhat unsatisfactory.

If placed in this chamber without a current of air passing they are extinguished in about 3 minutes. In the 3·5 cubic feet capacity testing chamber used by Dr. Clowes, these two lamps only burnt from 20 to 25 minutes. One important advantage amongst others of the air current method of test of inflammable gas and vapour detectors over the static method is thus seen to be the much longer period over which such tests can be carried out.

The use of hydrogen for the testing of inflammable gas and vapour detectors as described in (1) Section IV. is only available for instruments of a form in which the flame cap is not employed. Hydrogen will not give a flame cap in any form of safety lamp unless over about 2 per cent. is present and even then the cap is very difficult to see, and hence this gas is not available for carrying out tests on such detectors.

Hydrogen is, nevertheless, a very useful gas to employ for calibrating detectors of that form in which the catalytic action of platinum is used to give an indication.

The fact that hydrogen can be so readily produced and so accurately measured on an ammeter makes the use of this gas particularly convenient for comparing and especially for calibrating inflammable gas and vapour detectors other than the safety lamp form. Manufacturers of such instruments desiring to set them to a given sensibility before issuing them have here a ready and convenient method of securing that all their detectors are correctly adjusted to the same standard.

The form of hydrogen voltameter which we have used and which is shewn diagrametically in Fig. 3, is of a simple and convenient construction. It consists of two cylindrical sheets of platinum foil shewn in thick black lines placed inside two glass beakers, g and G. The sides and bottoms of these beakers are pierced throughout with holes. Between the outer platinum sheet and the outer surface of the inner beaker a glass tube, t, passes, and is bent round the bottom of the inner beaker. The bent part of this tube is pierced with holes along its upper surface and the stream of air which is pumped through the tube, t, when the voltameter is in use enters at A and bubbles up through the holes pierced in the bent portion of the tube and passes on through the tube B to the test chamber. The platinum electrodes are connected by platinum wires, W_1, and W_2, which pass through the indiarubber cork in the neck of the bell jar to the galvanometer, switch, battery, and regulating resistance as shewn in Fig. 2. The glass bell jar of the voltameter under which the platinum electrodes and their glass separators are placed, is itself contained in an outer glass or earthenware vessel which holds the acidulated water required for the electrolysis.

In general, it may be said that the use of the particular combustible gas or vapour employed for standardising or testing an inflammable vapour detector must always depend on the nature of the detector and also upon the uses to which it is to be applied.

If, for instance, the detector is of the flame cap type, it is, as has already been pointed out, useless to employ hydrogen for standardising or testing it. Further, if a flame cap detector is to be used in coal mines or coal bunkers it is probably better to test it with marsh gas delivered from a gas holder as described in (2) Section IV., whilst if a detector is to be used on gas works or producer gas plant the suitable gases to test it with are, no doubt, coal gas and producer gas respectively. Finally, in a detector for use in works for controlling the escape of volatile organic liquids such as occur in rubber works, etc., the vapour of the particular liquid in question should be employed by the method described under sections II. 3, III. 3 and IV. (3).

In certain cases a detector instrument has been of such a design that its action depended upon it sucking in a constant air stream from the surrounding atmosphere by its own chimney action or by diffusion, the excess temperature of the chimney being fixed by an electric incandescent lamp or other heater burning at a constant voltage. When the air streaming through the apparatus under these conditions contains combustible gas, this is burnt on the surface of the heated catalytic metal and thus the temperature of the gas passing through the chimney becomes raised and this rise of temperature being recorded by some thermometric device the readings of the thermometer indicate the amount of combustible gas present. Such an apparatus at first appeared to be only capable of satisfactory test by immersing it in a moderately sized room filled with the suitable mixture of combustible gas or vapour and air; because, if a stream of these mixed gases of known composition were pumped through the instrument the whole conditions of thermal equilibrium upon which its action depended would be upset and its behaviour would therefore be quite different under test from what it would be in actual practical use. If on the other hand it were placed in the box enclosure described above for the use of the more ordinary pattern of miners' lamp detectors which are always used with quite small flames, the rate at which the gases passed through would render the thermal balance between the atmosphere in the lamp and outside it different to what it would be when immersed in a very large space containing a static atmosphere.

Under these circumstances a device was employed which is a general method suitable for all instruments in which, when in use, a stream of the atmosphere surrounding them is caused to flow through them by their chimney action. This chimney action occurs only to a very small extent in miners' lamps when used for testing, for they are always employed with the flame turned down and even in so far as it does occur under these conditions it is somewhat variable in amount due to the fact that the precise height and form of the flame in the same lamp differs with the condition of the trimming of its wick and the adjustment which has been made in turning down the flame for testing. These differences cause comparatively large percentage variations in the volume of air sucked through such lamps. In that type of indicator in which the chimney action is employed, a constant heater of a considerable thermal value is used under all conditions and as far as possible is not varied whilst the detector is in action. It forms, in fact, for a given external temperature, a pump yielding a stream of constant value.

The method of test employed under these circumstances was as follows. The apparatus was allowed to stand for some time in an open room the heater being run under its normal conditions. After the lapse of a certain period depending upon the make of the apparatus the temperature indicator of the instrument ceased to rise and became constant. This temperature was carefully read and the bottom of the detector was then closed up by a suitable cover and through a pipe passing through this cover a current of air was forced at some probable rate, and this current was adjusted until the reading of the thermometer of the instrument remained fixed for a considerable period at the same point as when the stream of air passing through the instrument depended merely upon the excess temperature of the chimney. As the stream of air thus pumped through the instrument was passed through a meter, the readings of this showed the actual normal stream of air which the instrument sucked through itself due to its chimney action.

Next, in place of the stream of pure air a stream of the same volume of a mixture of air and hydrogen, coal gas, etc., adjusted by one of the methods described above, was pumped through the instrument and the difference between the temperature when pure air was pumped through and the temperature reading observed when the thermometer ceased to rise with the mixed stream of air and combustible vapour, gives the correct reading of the instrument, that is to say, the reading which it would give when employed in an atmosphere of the same composition but of indefinite extent.

In conclusion, we wish to record our thanks to Mr. F. H. Newington for his assistance in carrying out experiments on the amounts of organic vapours required to saturate given volumes of air under standard conditions.

A NEW TYPE OF AUTOMATIC INFLAMMABLE GAS AND VAPOUR DETECTOR.

BY ARNOLD PHILIP, B.SC., A.M.I.E.E., AND LOUIS J. STEELE, M.I.E.E.

The appliances for the detection of inflammable gases and vapours which have hitherto been practically employed have in most cases consisted of variations of the original Davy safety lamp. It is true that some instruments depending upon the catalytic action of the surface of platinum have also been used, and notably the instrument devised by Dr. Liveing, but as far as we are aware all detectors designed on this principle have been found to be unsatisfactory for two reasons. Firstly, the activity of the platinum changes in the course of time and use, that is to say, it has been found to become either less sensitive or less certain in its action. Secondly, if the atmosphere into which the detector is introduced contains more than a certain proportion of available potential thermal energy per cubic foot in the form of a mixture of oxygen and a combustible organic gas or vapour, the temperature of the catalytic platinum becomes so elevated that if it is a wire it fuses and thus the mechanism of the device is completely broken down, or if in the form of platinum black or spongy platinum its surface becomes fused and the sensitiveness of its action it thereby much diminished.

The form of instrument which we have devised, although depending upon the catalytic action of heated platinum surfaces to secure the combustion of mixtures of oxygen and combustible gas or vapour which may be passed through it, is so arranged that it is completely guarded against any danger of overheating whatever the proportion and nature of the mixture of combustible gas and vapour and air may be.

Our detector, Fig. 1, consists of two coils of platinum wires, C_1 and C_2, of approximately the same resistance and arranged in parallel with one another. In series with each of these coils is one of the coils of a differential galvanometer, G_1 and G_2—this is, in fact, a relay. The armature or relay tongue, *t* (Fig. 2) of this relay is capable of being moved by a very small alteration in the strength of the current flowing in either of its coils. The two platinum coils of the detector are enclosed in glass tubes, and the gas which is to be examined as to its contamination with or freedom from combustible gas or vapour is pumped by a small electric motor driven pump over the outside of one of these tubes enclosing the coil, C_2, and does not come into contact with the platinum wire. the gas current then passes on to the second glass tube inside which it flows, and is thus brought directly into contact with the hot platinum coil. C_1.

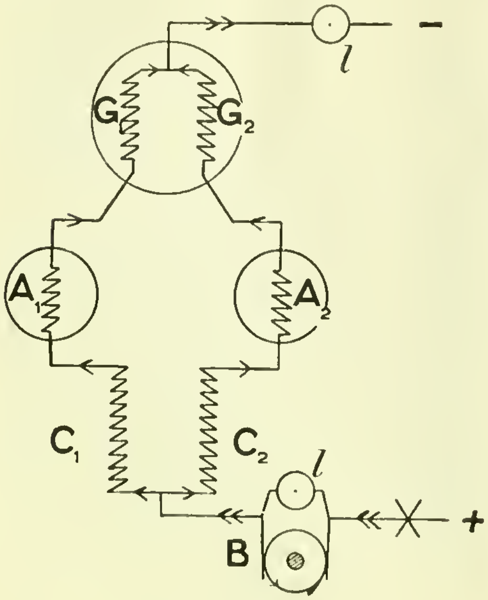


Fig. 1.

In the diagram, Figs. 1 and 2, the glass tubes protecting the platinum coils, the system of pipes connecting the apparatus with the pump, and also the casing of the instrument, are all absent, but these may be clearly seen in the photographs of the actual instrument shown in Figs. 3 and 4. Fig. 3 shows the instrument with the casing closed and locked, and Fig. 4 shows it with the doors all open.

Connected in series between each of the platinum wire coils, C_1 and C_2, and the coils of the relay, G_1 G_2, to which they are joined, is a small low-resistance annunciator coil. These two coils are marked respectively A_1 and A_2, in Fig. 1. When the switch of the instrument is closed, they indicate visually whether the currents are actually passing through both of the platinum coils. In the event of either of the platinum coils being fused or broken the corresponding annunciator shows a red spot marked "*right*" or "*left hand platinum coil fused.*" On the other hand, if the coils are carrying the correct currents each annunciator shows the letters, O.K.

The electric circuits of the relay, which are quite separate from those of the platinum coil circuit, are for the sake of simplicity not shown in Fig. 1, but are shown separately in a diagrammatic form in Fig. 2. In this diagram the relay tongue marked "*t*," moves between two stops, S_1 and S_2, and is itself connected to a point between two electric incandescent carbon filament lamps marked R and W. These two incandescent lamps are arranged in series across the supply mains to which the detector is connected. One lamp, R, is contained in a red glass, and the other, W, in a colourless glass shade.

It is evident that when the relay tongue is against either of the stops, S_1 or S_2, the corresponding lamp is short-circuited through the stop and relay tongue, and is therefore extinguished whilst the other lamp has the full voltage of the supply mains on it, and is consequently burning at full brightness. In the diagram shown in Fig. 2, the red light, R, is short-circuited and the white lamp, W, is lighted. This is the normal condition of the detector when connected to the mains if the air under test contains no inflammable gas or vapour.

Let us suppose that the instrument is connected to the mains, then a current of electricity flows through the series of coils, C_1, A_1, G_1 (Fig. 1), and another of approximately the same strength flows through the series of coils, C_2, A_2, G_2. If the relay tongue is then properly adjusted for these particular current strengths it will rest as shown in Fig. 2, so that the white lamp, W, is burning, and the red lamp, R, is extinguished, whilst the annunciators, A_1 and A_2, will show O.K. It should be remarked here that the current passing through the coils, C_1 and C_2, is sufficiently strong to raise these to a temperature high enough to permit them to scorch paper held against them, whilst both the annunciator coils, A_1 and A_2, and the relay coils, G_1 and G_2, are of so low a resistance that the same currents passing through them do not even sensibly warm them.

As the electric circuits through the motor pump and also through the platinum wire and the relay coils shown in Fig. 1 and those through the indicating lamps shown in Fig. 2 are all three in parallel across the supply mains, directly the current is switched on to the instrument a current of air is pumped over the hot platinum coils. If no combustible gas or vapour is present in this air stream the white lamp remains lighted whilst the red lamp, being short-circuited, shows no light. If now the air passing through the instrument becomes contaminated with a combustible gas or vapour the temperature of the right-hand platinum coil, C_2, remains unaffected as the air does not come directly into contact with it. It does, however, come into contact with the left-hand coil, C_1, and as the combustible material burns by the catalytic action of the surface of the hot platinum it further heats the wire to a degree corresponding with the amount of inflammable gas or vapour present in the air. The result is that there is a corresponding rise in resistance of the platinum coil, C_1, and this causes a diminution of the current flowing through the relay coil, G_1. The diminution of the current in C_1 causes the release of the relay tongue and it therefore swings over against the other stop, S_2. This action breaks the short circuit of the red lamp, which becomes lighted, whilst the white lamp is at the same time short circuited, and thus extinguished, and by this means a visual signal is given that a definite percentage of inflammable gas or vapour is present in the air under test. In parallel with the red signal lamp and with one another are arranged two other circuits, viz., a single-stroke electric bell, B, and secondly a valve coil, V. These, however, may be arranged as in the instrument here shown in series with each other, and in parallel with the red signalling lamp. The use of the bell coil is to supplement the visual signal —the white lamp becoming extinguished and the red lamp being lighted—of the presence of combustible gas by an aural one. It may be installed at any suitable distant point. The valve coil actuates a gas cut-off valve which is described below.

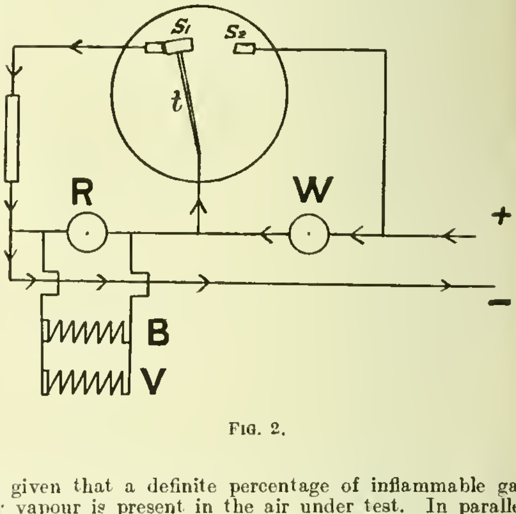


Fig. 2.

It is now necessary to point out two further very important devices upon which its successful action of this apparatus largely depends.

These devices consist of :—1st, a current vibrator—an arrangement for causing a constant joint fluctuation of the two parallel currents flowing through the relay coils. On the instrument we are now exhibiting this is done by means of a rotating contact breaker, B (Fig. 1). in the main electric circuit, which is actuated by the pump motor. This contact maker periodically completes a short circuit of an incandescent carbon filament lamp *l* of low resistance in the main circuit, thus causing the whole of the main current voltage on the instrument to fall momentarily in value about once in every two seconds, the precise periods are not of great importance provided the action is fairly frequent and continuous. The effect of the current fluctuation thus caused is to make the action of the relay which contains iron cored electro magnets much more sensitive and is in fact a method of avoiding hysteresis effects in the magnetised iron in the relay coils. Such hysteresis effects cause the magnetisation of the iron to lag behind the magnetising force and can, as is well known, be overcome mechanically by tapping the relay. A fluctuating current is, however, generally easier to use and more satisfactory than a tapping device. Another alternative is that of periodically injecting an e.m.f. into the circuit by means of a coil rotating in a magnetic field or by a magnet moving through or over a stationary coil or by other similar known methods of producing an injected e.m.f. By whatever means this reduction of hysteresis effects is attained, namely, either by a varying current produced by changes of resistance or e.m.f. in the actuating circuits or whether produced by a mechanical or electro magnetic tapper or vibrator, or by a small varying magnetic field superimposed on that of the relay from a varying current in a separate circuit, in every case the certainty and sensibility of an electro magnetic indicator or relay containing iron is markedly increased.

We find in our sentinel form of detector, which is the form which we are now exhibiting, that, unless it is installed upon the bulkheads of a ship or other structure which can be relied upon to be kept in a state of sufficient vibration whilst the detector is in use, by reason of the transmission of the vibration of the pump motor of the detector or of the vibration caused by the machinery of the ship itself, a special mechanical vibrating or a current fluctuating device is necessary if the highest sensibility is desired.

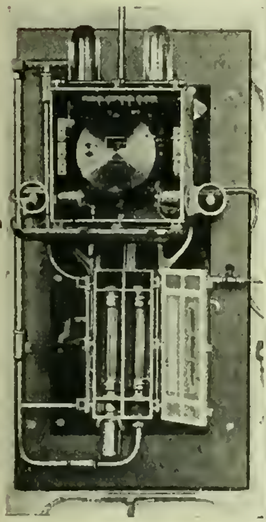


FIG. 4.

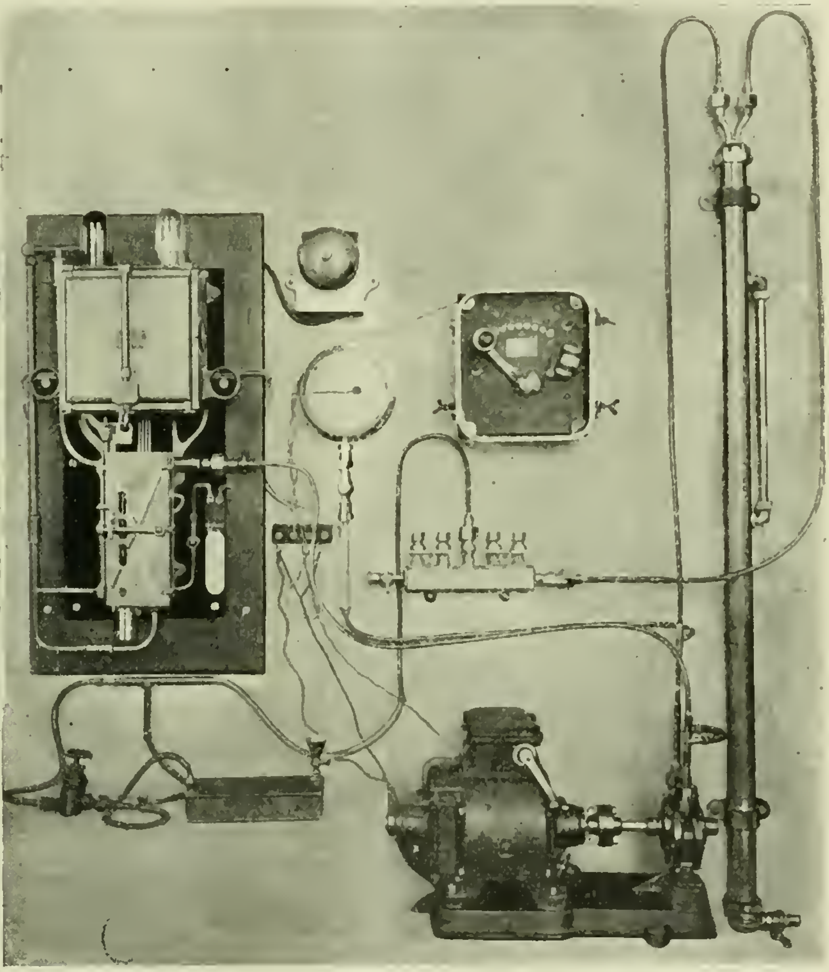


FIG. 3.

2nd. *The gas cut off valve.* is for the purpose of cutting off the stream of air which contains the combustible gas or vapour directly the proportion of the combustible material present in the air under test is large enough to raise the temperature of the platinum sufficiently for the relay to signal the fact. Thus in the detector now exhibited directly the temperature of the exposed platinum wire rises sufficiently to cause the relay tongue to break the short circuit to the red lamp, not only does this lamp light up, and, if desired, a bell ring, but at the same time the current passes round the coils of the valve, V, and actuates this, cutting off the stream of mixed air and combustible gas flowing over the exposed platinum coil, and opens it to a pure air supply. This coil now ceases to rise in temperature, due to its catalytic combustion of the combustible gases or vapour present in the stream of air under test, and it is also further cooled by a stream of pure air being drawn in over it by the combined chimney action of the hot tube and the ejector effect of the gas from the pump travelling along a bye pass across the outer end of the tube containing the platinum coil, C, These two actions combined cause the wire to drop rapidly to its original temperature when the relay tongue swings back once more into its original position, the red lamp is short-circuited and extinguished, and the white lamp lights up once more. The cycle is thus completed, and as the stream of mixed air and combustible gas or vapour again flows through the instrument and over the surface of the exposed platinum coil as before, the red lamp will once again light up and the cycle will be repeated indefinitely until the instrument is switched out of circuit, or the supply of air under test once more becomes free from combustible gas or vapour.

The particular instrument which we have described above and which we exhibit in action to-night is only one of a class and is primarily designed to act as a sentinel detector on the air of any space which it is considered may become dangerous from the accumulation of combustible gases or vapours. It may be left to itself and directly the combustible material is diffused in the air of the space under its guardianship it will immediately give visual and audible indications at any desired point or points at any distance and will continue to do so until either the combustible gas or vapour disappears or until the appeals of the detector that the space may be ventilated or otherwise dealt with are attended to. Used in this manner we have found this sentinel detector may be employed with advantage on warships, submarines, petrol tank vessels, coal mines, producer gas installations, gas works, oil tank land and ship depots, boiler plants on which it is desired to watch the air supply, and for many other purposes.

We have also made a portable detector upon the same principle, but in this the electric motor pump is replaced by a hand pump, and the massive protective casings of the sentinal detector are done away with. With this portable instrument which may be employed on board warships, or other vessels, for testing coal bunkers, double bottoms, oil tanks, etc., the instrument is connected to the electric light system either on a ship or from the shore by wandering leads, and is set up near to but not within the space to be tested. A flexible tube is taken into the space to be examined, and the air pumped through it by hand into the detector, which shows by its indications whether the air passing through it is or is not free from combustible vapours or gases.

This detector apparently gives indications equally well with all combustible gases or vapours, its action only depending upon the proportion of combustible gas or vapour present. Hydrogen, coal gas, acetylene, marsh gas, carbon monoxide, petrol vapour, and many other combustible vapours have already been tried, and none has yet been found which did not cause the instrument to give a satisfactory indication.

For ordinary purposes and when fitted as a sentinel indicator this detector is made to act when the combustible gas or vapour present in the air under test rises to one-quarter of the amount which would just render the mixture inflammable; it can, however, readily be made to indicate and record much less than this amount, namely, down to about one-fortieth of the amount necessary to render the mixture of air and gas or vapour just combustible.

The platinum coils of our detector can be easily removed and replaced like cartridge-form electrical fuses, but our experiments have shown that the platinum coils will last unaltered over very long periods in constant use certainly up to a year or two. In fact we have never known a coil to break down in use in the form of instrument now shown.

In the sentinel form of our nstrument the whole of the apparatus is contained in a very substantial locked gas tight case, and is absolutely "fool proof." If the case is opened the electric current is automatically cut off from the whole of the instrument by an enclosed gas tight switch and the electric circuit cannot again be closed until the protective case is once more shut.

The exterior indicating annunciators on the detector show by inspection directly the current is switched on as to whether the instrument is in correct order in all respects, and as to whether the electrical and air currents are flowing and of the correct value.

The indications given by our instrument as compared with those of a safety lamp flame cap test speak for themselves and are conveniently shown by passing the same gaseous current over a safety lamp contained in the testing chamber described by one of us in the previous paper on "*The methods of testing inflammable vapour and gas detectors*," and after observing the cap thus exhibited passing the same gas through our detector.

Discussion.

Sir Boverton Redwood said that about a year ago he was present at the Official Admiralty Test of the Philip and Steele Petroleum Vapour Detector as fitted on the Royal Fleet Auxiliary "Isla," and he could bear testimony to its value. There was no doubt that by means of it the presence of far less inflammable vapour than was needed for ignition was at once demonstrated visually and orally, and that the instrument was, therefore, amply sensitive enough for the purpose, though in delicacy it might not be quite equal to the hydrogen-flame test, which he had been accustomed to employ for many years. In this connection he said that it was the practice to collect samples of atmosphere of tanks and other spaces on petroleum-tank steamships for testing, and that men were never sent into the tanks with a portable hydrogen-lamp in the manner suggested by Mr. Philip.

Admiral E. Little said that in ships the sources of dangerous gases were much more numerous than might be generally anticipated. For many years in H.M. ships the coal bunkers were regarded as the only spaces requiring the use of the Davy safety lamp, on account of liability to contain explosive gases. After some bad experiences, good ventilation had come to be relied upon mainly for safety from such explosions, although the use of the ordinary safety lamp as a means of detecting a dangerous condition of the air in bunkers was strongly insisted upon by the Admiralty. The extensive use of mineral oils for fuel and other purposes, in more recent years, formed a further danger, to which might be added the generation of hydrogen and hydrocarbons, either in boilers or different parts of a ship, owing to the decomposition of various stores, all necessitating the exercise of continued precaution in carrying on the daily business of a warship. He had had an opportunity while at Portsmouth of seeing the detector at work, and very much admired its ingenuity and cleverness. If it could be conveniently installed in ships, it would overcome some of the dangers to which the men were exposed, and the present difficulties experienced in meeting them. One principal difficulty arose from the fact that the use of an ordinary safety lamp as a detector required special care and a degree of refinement in observation which could not reasonably be expected of the type of man generally required to use the lamp. They could not afford to carry a specialist for using any kind of detector lamps with which he was, so far, acquainted. The detection by observation of "flame caps" was so delicate an operation that, on board ship, the "spiring" of the flame of the lamp when in a fairly strong mixture was the rough indication most likely to be relied upon. It became a question whether the ordinary Davy lamp as manufactured and supplied was to be depended upon as really safe under many circumstances, and in his opinion it admitted of a few simple improvements in detail. In considering the use of detectors in ships it was to be observed that some tanks or compartments in which light inflammable gases might collect, were liable also to contain heavy gases, not necessarily explosive, but otherwise dangerous to men working in the compartments. On entering such places the safety lamp was employed to serve the double purpose of indicating by the behaviour of the flame, the presence of dangerous amounts of carbon dioxide in the lower parts and also of light explosive mixtures when tried in the upper parts of the same space, and for that double purpose the flame of the ordinary safety lamp seemed to be peculiarly suitable. Any detector appliance for naval purposes should certainly combine both uses. In his earlier experiences afloat it was generally considered that the naked flame of a candle afforded sufficient warning of danger in confined spaces other than in coal bunkers, but Mr. Philip had, he believed, recently assisted the Admiralty by clearly accounting for explosive gas where its presence had not previously been suspected as a probable danger, and where the use of a naked flame was therefore prohibited. He was inclined to think with regard to the apparatus under consideration, that it was somewhat over sensitive for ordinary ship's use. Considering the small number of ships in which explosions actually occur, it seemed highly probable that a great deal of useful work was accomplished in the presence of non-explosive quantities of inflammable gases. So long as the men obtained sufficient warning before the dangerous condition was reached, the presence of small and harmless percentages of gas need not be considered. As a means of safety a war vessel was very extensively sub-divided into so large a number of separate water-tight compartments, that the application of the apparatus shown by Mr. Philip would entail a large amount of piping and valves, and a very undesirable perforation of water-tight bulkheads. In avoiding by this means the danger of gas explosion, dangers of another kind might be incurred. Where the number of compartments was few, the contrivance seemed to be perfectly suitable. In a portable form, however, it would be still more useful, and he hoped Mr. Philip would be able to introduce into the Admiralty service a portable form of his detector. Some attempt had been made in the instruction of stokers to show them by means of an apparatus such as that shown by Mr. Stenhouse, the behaviour of a safety lamp in the presence of inflammable gases. Explosions happened so rarely in H.M. ships that unless the men had previously seen the flame under dangerous conditions and had so learned to know the language of the lamp, its warnings in the presence of danger when it did arise would be entirely missed. In ignorant hands the safety lamp itself might become a source of danger; should the protecting gauze become overheated by deposit of soot or dust, or, by being too long retained in the presence of inflammable gas, it ceased to be a means of safety. The conditions on board ship were entirely different from those in mines. The form of lamp used in H.M. service has a single gauze and is without a shield, a form not considered suitable to the conditions in some mines. Those who were now engaged in devising a lamp which would be perfectly safe in mines, should bear in mind the needs of ships, and bring out a portable and perfectly safe lamp. That would confer a very great boon upon the Naval Service.

Mr MILTON thought Mr Philip had himself thrown some little doubt on the prolonged efficiency of the apparatus, by saying that platinum lost some of its properties in course of time. As the lamp depended entirely upon the catalytic action of platinum, perhaps Mr. Philip would say whether the platinum was used in a form in which it passed through no change, because if it did change, the value of the instrument as a detector would appear greatly to be reduced. He agreed with Admiral Little, that if people were warned of danger long before a dangerous mixture was obtained, they would get so used to seeing the warning that they would pay no attention to it. Perhaps that difficulty might be overcome by making the instrument less sensitive. It appeared to him that the permanence of the efficiency of the platinum and the question of the point at which the red lamp showed the presence of a dangerous mixture, were essential matters in considering the use of the instrument in ordinary tank steamers. Then there was another point. In the case of all large spaces, there must be means of testing different parts of such spaces. The whole of the atmosphere in a ship's hold should be thoroughly free from explosive mixture, if the men were to work in it. Therefore, a pipe laid down into one part only would not be a suitable means of testing the whole. There must be either a portable machine or a portable pipe, so that the test could be made at every part of the space about which they required to be assured.

Mr. W. J. A. BUTTERFIELD said that in the absence of Sir Henry Cunynghame, he would like to call attention to the great importance of the improvement of the miners' safety lamp as a means of testing for inflammable gas effected less than a year ago by Sir Henry Cunynghame and Professor Cadman. It consisted merely in introducing at intervals into the flame a comb or slip of asbestos board impregnated with a sodium salt. The result was that the cap on the flame was rendered visible when the proportion of inflammable gases was very much smaller than could be observed by the flame cap without the use of the impregnated asbestos. The device had answered so well in connection with the detection of small quantities of fire damp in coal mines, that he wondered whether it had yet been tried for the detection of petroleum vapour in tanks. The ordinary safety lamp equipped with the Cunynghame-Cadman device, if it were put outside the tank and the air drawn through it, was after all the simplest of all arrangements for detecting inflammable gas; and the only respect in which the author's apparatus appeared to be very much better was that it gave a warning by a bell; and this certainly constituted a great advance upon anything earlier of which he knew. The safety lamp with the device of Sir Henry Cunynghame and Professor Cadman was useful for detecting much smaller proportions of inflammable gas than could otherwise be detected, and moreover the proportion of such gas in the air could be estimated over a wide range by its use. It could be used by people whose sight was so defective that they could not observe the cap on the Davy lamp flame when it was not covered by the sodium salt. In regard to the second paper, the simplest of all means of preparing a mixture of air and another gas in definite proportions for experiments such as those carried out by the authors was to pass the air through one wet experimental gas meter and the gas through another—while the axles of the drums of the meters were geared together so that the ratio of the number of revolutions of the one meter to that of the other (which might be of a different size) was such as to give the required proportions of air and gas in the mixture. Such an arrangement could be run continuously, and the proportions varied by altering the gearing.

Mr. PHILIP, in reply, said that the objections to making their instrument too sensitive had always been in their mind and they fully agreed to the danger existing in such an adjustment from the point of view of raising unnecessary alarm. The instrument could, however, readily be made as insensitive as was desired by simply turning the relay key. He considered, on the other hand, that an instrument should give an alarm with at least about $\frac{1}{3}$ to $\frac{1}{4}$ of the explosive limit. If this limit was passed the space under examination should be pumped out and retested until found to be free from combustible gas or vapour. A portable form of their instrument which had just been completed, would easily read to one-tenth of the amount indicated by the sentinel form which they had shown working, that is, it would indicate about one fortieth of the proportion of combustible gas or vapour necessary to form the minimum explosive mixture and would give equally reliable tests with hydrogen, carbon monoxide, or any other combustible gas or vapour.

With regard to the alteration in the catalytic activity of the platinum used, to which Mr. Milton had referred, they had used the same platinum wire coil for at least two years, with constant testing, and could discover no alteration in its behaviour or resistance. The deterioration in platinum in other instruments based on this principle was due to the fact that sooner or later in use the platinum was brought into contact with gaseous mixtures containing large proportions of inflammable gas and either the wire fused and broke or if platinum black or spongy platinum was employed its surface became fused, and its activity altered; this could not occur in their instrument.

They considered Sir Henry Cunynghame's lamp to be quite an interesting and important advance, but he was sorry to say that they had not yet had sufficient time to examine it properly, and they had not therefore referred to it specifically in their paper. He was interested in Mr. Butterfield's proposal to obtain streams, of known composition, of combustible gas and air, by using two meters, one for air and the other geared to it at some fixed ratio, say one hundredth, to measure the combustible gas; he could not, however, see how such an arrangement could give more than a mixture of one percentage composition, and in that respect the method appeared to have little flexibility, whilst the apparatus was expensive as requiring two meters. The methods they had described were, on the other hand, very flexible, permitting large ranges of mixtures and required comparatively cheap apparatus, whilst the accuracy with which the percentage composition of the mixtures was known was very high.

Nottingham Section.

Meeting held at Nottingham, on Monday, May 29th, 1911.

MR. S. J. PENTECOST IN THE CHAIR.

THE EMPLOYMENT OF THE ELECTROMETRIC METHOD FOR THE ESTIMATION OF THE ACIDITY OF TAN LIQUORS.

PART II.

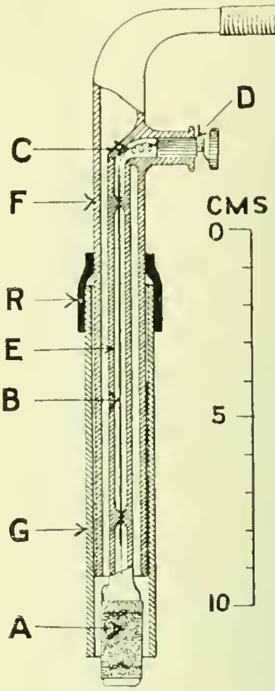
BY J. T. WOOD, H. J. S. SAND, AND D. J. LAW.

In Part I. of this paper (this J., 1911, **30**, 3) a brief description of the electrometric method was given as employed by us for the estimation of the acidity of tan liquors. Several details, regarding particularly the form of hydrogen electrode most suitable for our purpose, were at that time left open. We have now had the opportunity to examine these matters, as well as to consider thoroughly other practical points in the application of the method.

In Part I. the special advantages of the electrometric method for the determination of hydrion concentrations were pointed out, and the probable importance of such concentrations, particularly in the swelling of hide, was referred to. As the last named matter had, however, been already previously indicated by Procter and Seymour-Jones in their exhaustive paper on the methods hitherto in use for the determination of the acidity of tan liquors (this J., 1910, **29**, 1354), and is, we understand, being further pursued by them at the present time, we do not propose to enter into this matter beyond giving a few analyses of tan liquors.

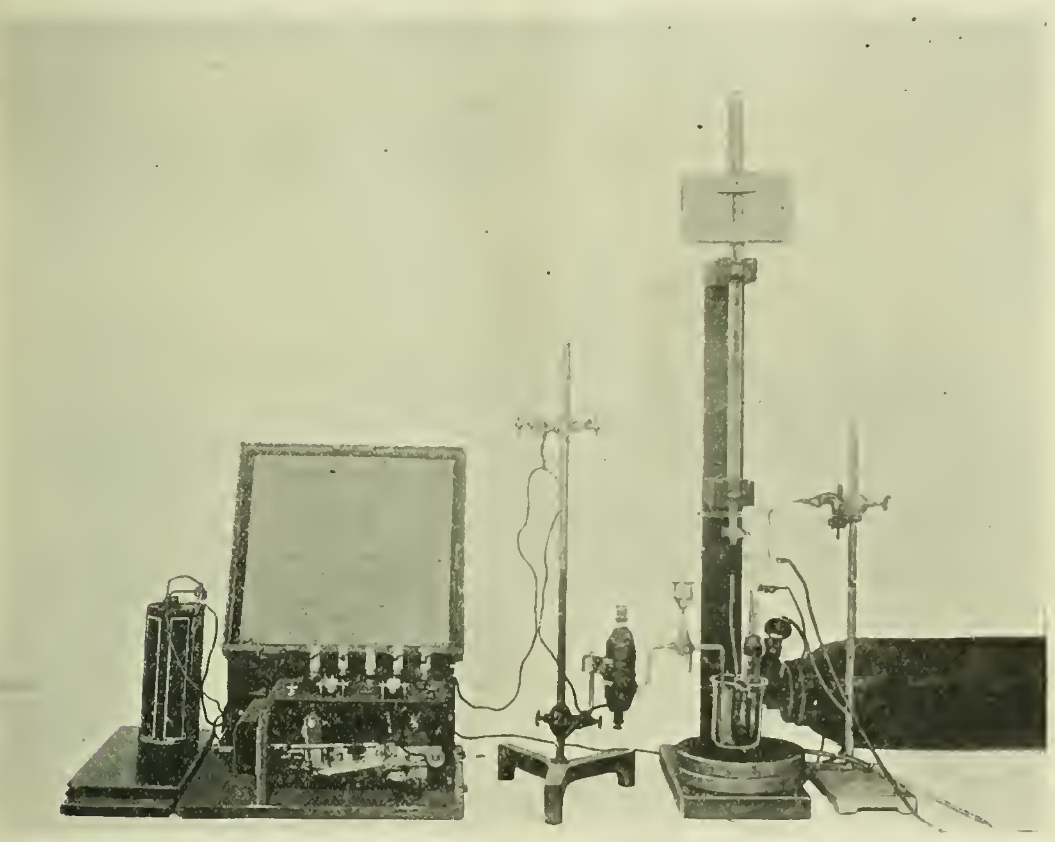
With regard to the hydrogen electrode, we hoped to be able to recommend a form in which platinum or iridium was burnt on to a surface of glass, and subsequently coated electrolytically with platinum black according to the proposals of Luther-Brislee (Z. Physik. Chem., 1903, **45**, 222). We have found, however, that the tendency of the metal coating to flake off the glass during the process of platinizing is so great as to render the electrode unsuitable for practical purposes. Even when the platinizing current was only a few milliampères per square cm. the platinum coating has been known to flake off completely. We have also compared a stationary form of hydrogen electrode at present on the market (Köhler) for purposes of titration, in which the liquid is stirred only by the escaping hydrogen bubbles, with the forms we have hitherto used in which the liquid is stirred by hand by the hydrogen electrode itself, the latter being suspended by a cord at a distance of a few millimetres above the bottom of the beaker. As the result of this comparison we have found that the latter form is more convenient and rapid to work with. In the annexed figure (col. 2) we show an electrode which we have designed with a view more especially to combine rigidity with rapidity of saturation, and ease of manipulation. The electrode was made for us by Universitätsmechaniker Fritz Köhler, Leipzig, and embodies the results of experiments on the most suitable size of platinum plate. The latter are in agreement with those of Salm (Z. Physik. Chem., 1907, **57**, 471).

The platinum plate consists of a piece of very thin foil which is wrapped round a cylindrical body of glass, A, and is held to the latter by some platinum wire, which passes through the glass and up the stem, E, where it is continued in the copper wire, B, the platinum wire, C, and finally in the terminal, D, fitted in the manner described by one of us in connection with the auxiliary electrode (Sand, Trans. Faraday Soc., 1909, **5**, 159). The stem, E, is fused in the manner depicted into a wider glass tube, F, which can be connected to the rubber supply tube, H, for the hydrogen.



The tube, F, ends a short way above the platinum foil, and over it is slipped the tube, G, which is just wide enough to allow it to slide up and down F readily. A piece of thick walled soft rubber tubing, R, holds G firmly, and F sufficiently to keep G in position without hindering it from being pushed up and down when desired. During the operation of platinizing, G is pushed up completely. While the electrode is in use G is adjusted to be a few mm. above the bottom of the foil, thus allowing the latter to dip into the liquid by this amount, whereas during the time the electrode is left filled with hydrogen when not in use, G is pulled down as far as possible, and at the same time the rubber delivery tube, H, is clipped as close to the electrode as possible. We have found that hydrogen may now be obtained commercially in cylinders of a degree of purity sufficient to allow it to be employed for the saturation of the hydrogen electrode without further purification (The Knowles Oxygen Co., Wolverhampton). The electrode is made of fairly thick glass tubing to make it as little fragile as possible. It will be seen that its form causes the hydrogen to sweep past the platinum plate fairly rapidly, thus ensuring rapidity of saturation, and that the plate has at the same time a very considerable degree of rigidity. Its dimensions are, external diameter of the cylinder 11 mm., height 16 to 20 mm. As already mentioned, the electrode is suspended from a ring fixed to the burette stand by a piece of string, so as to be a few mm. above the bottom of the beaker. Attention may here be drawn particularly to the advantage which the hydrogen electrode offers for the titration of tan liquors in that the escaping gas hinders oxidation during neutralization. Thus a solution of gallotannic acid may be neutralized completely with *N*/10 alkali without any appreciable darkening when the hydrogen electrode is employed, whereas darkening always occurs at the neutral point during ordinary titration, oxidation also alters the amount of alkali used. It has already been pointed out by Sörensen (Comptes Rend., Laboratoire de Carlsberg, 1909, **8**, 59) that large quantities of proteid matter in a liquid render all ordinary indicators unreliable, in contrast to which, the hydrogen electrode remains unaffected. Such proteid matter derived from the skins is always met with in tan liquors, the weaker the liquor, the greater being the proportion of proteid to tannin.

With regard to the other apparatus employed, there is little to add to what has already been stated in Part I. As will be pointed out later an accuracy of 1 centivolt is very considerably greater than anything that has ever been attempted hitherto with ordinary indicators, and it is, therefore, more important to arrange the method of working in such a manner that gross errors are unlikely to occur at any time, than to attempt to push the accuracy higher in any one direction.



The voltmeter attached to the potentiometer box gives readings to one fifth centivolt, and if checked from time to time by reference to a standard cell is perfectly reliable. The instrument we have used has been in constant use for three years without any variation in its accuracy. Seeing that other sources of error, such as contact potential, between the liquids, are greater than the error of reading the potentiometer, this is considerably quicker and more convenient than the method in which the slide wire is used. We adhere to our recommendation of the normal calomel electrode with 3·5 *N* potassium chloride as the connecting liquid. The reasons we have for avoiding a saturated ammonium nitrate solution as the connecting liquid have been stated by one of us (Faraday Soc. Trans., 1910, 6, 18, Discussion). We protect the auxiliary electrode from light by wrapping it round with insulating tape. When not in use, the limb containing the 3·5 *N* potassium chloride solution should be kept empty in order to prevent the liquid from diffusing back into the main body of the electrode, and thus producing small errors. It should be pointed out here that any error produced in this way would, under similar circumstances, be very much greater with a decinormal than with a normal calomel electrode. In addition to this, the latter has the advantage that the conductivity of the connecting thread of liquid is greater in consequence of which the zero instrument will respond more sharply, and any slightly faulty insulation will be less likely to cause serious error through leakage. It is advisable to keep a second standard electrode for reference, and to check the auxiliary electrode against it periodically, using normal potassium chloride solution as the connecting liquid. Another very useful check, not only on the auxiliary electrode, but also on the potentiometer box, consists in determining the hydrogen potential of normal sulphuric acid, normal potassium chloride being the connecting liquid. The value 0·328 volt should be found (Wilsmore, Z. Physik. Chem., 1900, **35**, 300).

In the first part of this paper the question regarding the voltage to be taken as the end point of the titration was left open pending the determination of a value which might be found to correspond to a hydrion concentration just producing a plumping effect on skins. In the meantime, we recommended the use of the value 0·69 volt corresponding to the hydrion concentration of pure water. As already explained, we have still left this question open, and therefore still adhere to our provisional recommendation. In the meantime, it may be found useful by many to have the formula by which the voltage observed with our apparatus corresponding to the exact point of neutralization of any weak monobasic acid, or in other words, by which the hydrogen voltage of solutions of its sodium or potasium salts may be calculated. The corresponding hydrion concentration, C, is given by the formula,

$$C_{H} = \sqrt{\frac{k \quad k_a}{c}}$$

(Salm and Friedenthal, Z. Elektrochem., 1907, **13**, 128) in which k_w is the dissociation constant of water, k_a that of the acid, and c the concentration of the salt (sodium or potassium formed by neutralization and expressed in grm.-molecules per litre. Making $k_w = 1{\cdot}2 \times 10^{-14}$ and substituting into formula (1) of Part I. of our paper we find :—

$$\pi = 0{\cdot}683 + 0{\cdot}02875 \log \frac{c}{k_a}$$

Thus taking for acetic acid $k_a = 1{\cdot}8 \times 10^{-5}$, we find for a normal solution of sodium acetate $\pi = 0{\cdot}82$ vol ; for a decinormal solution $\pi = 0{\cdot}79$. These numbers confirm the fact, probably not generally recognised in ordinary titration, that the alkalinity of a salt such as sodium acetate increases with the concentration. It must not be supposed that a determination performed on the solution of a commercially obtained sample of a pure salt will lead to the calculated hydrion concentration. It must be borne in mind that ordinarily prepared salts usually contain traces of occluded acid, which are sufficient to vitiate the results owing to the delicacy of the method.

Table I.

Acid.	Concentration.	Determined volts.	Calculated volts.	K.
Acetic	*N*/10	0·445	0·448	$1{\cdot}8 \times 10^{-5}$
Formic	,,	0·412	0·418	21×10^{-5}
Lactic	,,	0·402	0·423	14×10^{-5}
Iso-butyric	,,	0·450	0·451	1·[illegible] $\times 10^{-5}$
Normal-butyric	,,	0·446	0·450	$1{\cdot}5 \times 10^{-5}$
Carbonic	Saturated	0·510	0·511 for *N*/25	3×10^{-7}
Gallotannic	1%	0·500	——	——

Thus the potential of *N*/10 sodium acetate (Kahlbaum) in ordinary distilled water was found to be 0·69 volt. In boiled out water it was 0·71 volt, and it only became equal to the calculated value 0·79 volt, after adding two drops of *N*/10 alkali to 25 c.c. In his very thorough recently published study of the quantitative theory of indicators (J. Amer. Chem. Soc., 1910, 32, 8158 ; *see* this J., 1910, 1039) to which special attention is drawn, Noyes recommends (p. 839) that the ratio between the hydrion concentration corresponding to the correct neutralization of an acid, and that shown by the indicator employed in the titration, should if possible be kept within the limits 3·5 and 1/3·5. Translating this into terms of the electrometric method this would mean that an accuracy of ±3·1 centivolts should be aimed at.

A question that may frequently occur when an acid such as acetic is to be titrated in the presence of a much weaker one like carbonic or gallotannic, is the following : What is the potential and hydrion concentration when an amount of strong alkali has been run in just equivalent to the acetic acid originally present ? Questions of this kind are by no means new, and are closely related to the theory of the "avidity" of acids. We indicate the original concentration of the first acid (acetic) by c_1, the original concentration of the second acid (carbonic or gallotannic) which is treated with sufficient accuracy as a monobasic acid, by c_2, and the concentration of the base added by b. Then it may be readily calculated, *e.g.*, from equations given in Abegg and Von Ende, Electrolytic Dissociation Theory (Wiley, 1907), p. 97, that the concentration, H, of the hydrogen ions is represented by the equation,

$$H^{\cdot 2} + \left(K_1 + K_2 - \frac{k_1 c_1 + k_2 c_2}{b} \right) H + K_1 K_2 \left(1 - \frac{c_1 + c_2}{b} \right) = 0$$

in which K_1 and K_2 are the dissociation constants of the two acids respectively. For the case proposed above, the amount of base added is just equivalent to the amount of the first named acid present, we therefore have $b = c$, which by substitution to the equation given yields,

$$H^{\cdot 2} + K_2 \left(1 - \frac{c_2}{c_1} \right) H - \frac{c_2}{c_1} K_1 K_2 = 0$$

This equation may be utilised to give an answer to questions like the following : When carbonic acid is present in a solution of sodium acetate what must be its molecular ratio to that of the sodium acetate in order that the solution may show the hydrion concentration of pure water ? (10^{-7} grm.-mols. per litre corresponding to 0·69 volt). Substituting $H = 10^{-7}$, $K_1 = 1{\cdot}8 \times 10^{-5}$ for acetic acid, $K_2 = 3 \times 10^{-7}$ for the first dissociation constant of carbonic acid, we find the value 0·7 per cent. for the ratio C_2/C_1. This means, for example, that N/10 solution of sodium acetate would have its hydrogen potential reduced from 0·79 to 0·69 volt by a carbonic acid concentration of 0·0007 gram-molecules per litre.

In the following table (I) we give hydrogen voltages determined for various pure acids occurring in tan liquors. The concentration of these was found by titration with caustic soda, phenolphthalein being the indicator. Where possible, the voltage has also been determined by calculation, the hydrion concentration being derived with sufficient accuracy from the formula $C = \sqrt{Kc}$, in which K indicates the dissociation constant of the acid and c its concentration in gram-molecules per litre (vide e.g., Abegg-Von Ende p. 41). From this we find the hydrogen voltage by substitution into equation (1) (Part I) to be $\pi = 0{\cdot}283 - 0{\cdot}02875 \log Kc$.

The differences between calculated and experimentally determined values do not exceed 1 centivolt in the majority of cases, and are probably due to contact potential at the junctions of the liquids. The hydrogen potential of an artificial tan liquor made up as follows was also determined : Acetic acid, 0·35 grm. ; lactic acid, 0·25 grm. ; tannin, 0·50 grm. ; glucose, 1·00 grm. ; water, 100 c.c. The value 0·440 volt was found, and when the tannin and glucose were omitted the practically identical result 0·445 volt was obtained. On comparing these numbers with those given below for liquors actually taken from the tannery we observe very considerable differences, the actual tan liquors exhibiting hydrion concentrations which are between approximately one-fifth and one-hundredth of the hydrion concentration shown by the artificial liquor. The reason for this was found to lie in the presence of calcium and other salts which find their way into the liquors from the goods brought into them. We are probably not wrong in assuming that the plumping and other effects produced on the skin by the liquor will also be correspondingly diminished by these calcium salts, and that the older a tan liquor is, and the more lime salts have therefore been allowed to accumulate, the feebler will be its acidic action on the hides, and also, that a certain quantity of acid added to an old liquor containing large quantities of lime salts will produce less effect in plumping the goods than a corresponding amount added to a fresh liquor almost free from such salts.

In the following table (II) we give numbers which illustrate the effect produced on the hydrogen potential of various acids of decinormal strength by adding salts to them.

It will be seen from the table that the effect produced on the hydrion concentration of decinormal acetic acid by the addition of sodium chloride in normal strength is small, in fact the hydrion concentration is slightly increased. The addition, however, of sodium acetate crystals ($NaC_2H_3O_2 + 3H_2O$) in 0·604 normal strength reduces the hydrion concentration to about one two-hundred-and-fiftieth of its former value (by calculation from equation 1, Part I.). The hydrion concentration, C, which was required in order to arrive at the calculated value of the potential from formula 1, Part I., was derived from the formula, $C \times A = Kc$, in which the acetic-ion concentration, A, was assumed to be about 0·4 normal, the sodium acetate being supposed to be dissociated approximately to 65 per cent. The concentration, C, of the undissociated acetic acid was taken as decinormal, and the value shown in Table I was given to the dissociation constant, K. The concentrations of the calcium salts taken approximate roughly to hundredth normal, decinormal, and normal respectively. It will be seen that increasing the concentration of the salt ten-fold raises the hydrogen potential by about five centivolts, and that the effect fully explains the potentials observed in the case of actual tan liquors.

Table II.

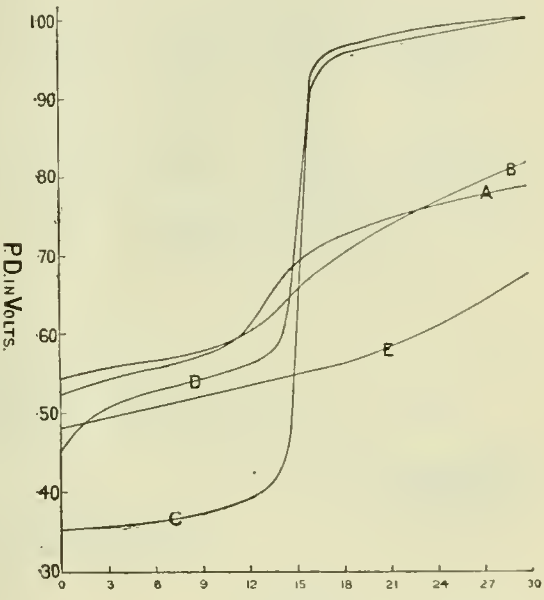
Acid.		Salt added.		Hydrogen potential.	
Name.	c.c.	Name.	Grams.	Observed.	Calculated.
Acetic	—	—	—	0·445	0·448
,,	25	Sodium chloride	1·462	0·440	—
,,	25	Sodium acetate	2·050	0·586	0·590
,,	20	Calcium acetate	0·0158	0·498	—
,,	20	,, ,,	0·1580	0·552	—
,,	20	,, ,,	1·580	0·608	—
Butyric	—	—	—	0·446	0·450
,,	20	Calcium butyrate	0·0215	0·508	—
,,	20	,, ,,	0·2150	0·560	—
,,	20	,, ,,	2·150	0·612	—
Lactic	—	—	—	0·402	0·423
,,	20	Calcium lactate	0·0218	0·450	—
,,	20	,, ,,	0·218	0·498	—
,,	20	,, ,,	2·18	0·522	—
Formic	—	—	—	0·412	0·418
,,	20	Calcium formate (dried in oven)	0·013	0·452	—
,,	20	,, ,,	0·130	0·498	—
,,	20	,, ,,	1·300	0·540	—

A few words should here be said about the acidic effect of tannin. As may be seen from Table I., the hydrogen potential of a 1 per cent. solution of gallotannic acid (Kahlbaum) indicates a hydrion concentration greater than that met with in many tan liquors. The titration of this liquid with $N/10$ caustic potash, however, showed that only 1·8 cc. of alkali were required to bring the hydrion concentration of 20 c.c. of the solution to that of pure water. The hydrion concentration of a freshly made quebracho extract solution showing 1 per cent tannin (by the hide power method) was P^{+}_{H} 4·53.* It required the addition of 4·6 c.c. $N/10$ caustic potash to 100 c.c. of the solution to bring it to the neutral point 0·69 volts, P^{+}_{H} 7·0. The determination of the original acidity of freshly made infusions of various tanning materials is of importance, as it may safely be predicted that they will vary considerably. From the above figures (4·6 c.c. of $N/10$ alkali per 100 c.c. liquor) it will be seen that the acidity of the stronger liquors (*e.g.*, Table IV.) is partly due to the tannin present. We have come to the conclusion that the free acidity of tan liquors for the purposes of the tanner is very accurately shown, or best shown for control purposes, by means of Procter's lime-water method. Where the liquors contain little tannin a small quantity of a 1 per cent. solution of quebracho extract may be added, and a small correction made for the acidity of this.

In the following tables (3–7) we give results obtained with actual tan liquors. The hydrion concentration of the acid is probably influenced by the presence in the liquors of other salts besides those of calcium. That these are present is shown by the alkalinity of the ash produced on evaporating and igniting some of the liquors. The alkalinity is greater than that due to the calcium salts found by precipitation as oxalate.

In titrating some of the heavy leather liquors containing lime salts it was noticed that a turbidity was produced before neutrality, as indicated by the P.D., was reached. This precipitate was produced at 0·65 to 0·67 volts P.D. and apparently while it was being formed the voltage remained constant during the addition of more alkali, the P.D. afterwards rising to 0·69, when sufficient alkali had been added. The precipitate thus appears to be the lime salts thrown out of solution by the neutralization of the acid which had hitherto kept them in solution. This supposition would also account for the constancy of the P.D. during the precipitation. This precipitation is only observed with the weaker liquors, in the case of the liquors stronger in tannin, the precipitate is colloidal, and appears at no definite point.

In conclusion, we give the complete neutralization curves of three tan liquors, together with those obtained for $N/10$ sulphuric acid, and $N/10$ acetic acid. It will be seen that the curves for the tan liquors differ from each other in a very appreciable manner, and it will be realised that in making these differences manifest, the electro-metric method is giving information which can be obtained from no other process of titration. It should be noted that slight differences in the curve may be produced by the traces of carbonic acid in the caustic potash used for the titration. It will be realised that the indications of the electro-metric method have a degree of certainty and objectiveness which is not approached by other methods. It still remains, however, to interpret the results in terms of direct value to the tanner. We would suggest that the research laboratories of the leather industry might well undertake this matter, and that by continuous investigation much valuable information would undoubtedly be accumulated. We may say that the Leather Industries Department of the University of Leeds has already taken a step in this direction.



A—Light Leather Tan Liquor.
B—1st Suspender Sole Leather Liquor.
C—Deci-normal Sulphuric Acid.
D—Deci-normal Acetic Acid.
E—"10-day Liquor," from Sole Leather Yard.

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* P^{+}_{H} is the exponent of hydrion concentration. See Sörensen, *loc cit.*

TABLE III.

	Description of liquor.	Normality of acids by titration.	Initial P.D. in volts.	Lime in grams per litre.	Normality of calcium salts.	Normality of hydrion.
1	1st suspender	0·084	0·560	1·870	0·067	0·000020
2	Intermediate round	0·305	0·498	0·720	0·026	0·000229
3	Last layer	0·375	0·494	1·050	0·037	0·000275
4	End suspender	0·044	0·500	1·2250	0·044	0·000209
5	Middle suspender	0·076	0·500	0·9250	0·033	0·000209
6	Top suspender	0·136	0·480	1·0000	0·036	0·000478
7	Weak pit (light leather)	0·070	0·568	1·550	0·055	0·000014
8	Strong pit (light leather)	0·106	0·519	0·925	0·033	0·000066
	Deci-normal acetic acid	0·100	0·448	—	—	0·001333

TABLE IV.

Tan liquors from a sole leather tannery.

No.	Barkometer Degrees.	Tannin grs. per 100 c.c.	Initial P.D. Volts.	P_{H}^{+}	*N*/10 Alkali per 10 c.c. liq. by electrometric method.	c.c. *N*/10 lime water.	* $\frac{E}{L}$	
1	20·8	0·67	0·560	4·7	8·4	7·2	1·17	Cloudy at 7·2 c.c. *N*/10 KOH.
2	36·8	2·88	0·522	4·05	14·7	11·0	1·34	,, ,, 13·3 ,, ,,
3	46·0	4·80	0·511	3·86	19·3	13·4	1·44	,, ,, 17·2 0·675 v. ,,
4	62·5	8·97	0·500	3·68	27·3	16·4	1·67	Darkened, but no pp. apparently below 0·69 v.
5	67·4	9·52	0·499	3·65	29·1	16·8	1·74	
6	71·1	9·91	0·498	3·64	30·5	17·1	1·79	
7	74·4	10·56	0·499	3·65	33·5	19·1	1·76	
8	86·5	13·07	0·494	3·56	35·3	20·6	1·71	
9	94·7	16·96	0·490	3·50	36·5	20·7	1·76	
10	96·3	15·65	0·494	3·56	37·5	22·2	1·70	

Nos. 1 & 2 = suspenders.
Nos. 3 & 4 = handlers.
Nos. 5 & 6 = intermediate rounds.
Nos. 7—10 = layers.

* Ratio of figures obtained by electrometric and lime water methods.

TABLE V.

Suspender liquors from sole leather tannery.

Description of liquor.	Tannin grms. per litre.	Lime water method.	*N*/10 potash till turbid.	*N*/10 potash to 0·69 volts.	Initial P.D. in volts.	P_{H}^{+}
End suspender 15°	9·3	2·95	3·04	4·4	0·50	3·68
Middle suspender 20°	13·4	5·4	5·94	7·66	0·50	3·68
Top suspender 28°	20·2	7·55	8·44	13·6	0·47	3·15

Acidity expressed as *N*/10 alkali per 10 c.c. tan liquor.

TABLE VI.

Tan liquors from sole leather tannery.

No.	Description of liquor.	Tannin in grms. per 100 c.c.	Initial P.D. Volts.	P_{H}^{+}	c.c. *N*/10 potash per 10 c.c. liq. (to ·690 v.).	
81	Colour pit	0·89	0·545	4·44	7·3	Faintly turbid at 6·2 c.c. (·658 v.).
82	6 day liquor}	2·14	0·520	4·02	10·9	Cloudy at 9·6 c.c. (·660 v.).
83	10 day liquor}	4·58	0·494	3·56	20·9	Cloudy at ·690 F.
84	5 weeks liquor	8·61	0·484	3·40	29·6	No turbidity with excess of alkali.

TABLE VII.

Light leather liquors.

No.	Tannin in grms. per 100 c.c.	Initial P.D. in volts.	P_{H}^{+}	c.c. *N*/10 potash per 10 c.c. to ·690v.
1	0·73	0·568	4·84	7·0
2	0·96	0·540	4·34	9·1
3	1·45	0·525	4·10	10·0
4	1·80	0·533	4.24	10·6
5	2·03	0·530	4·20	10·3
6	2·09	0·532	4·25	10·45
7	2·31	0·532	4·25	10·65

DISCUSSION.

Prof. PROCTER said that Mr. Seymour-Jones and he had found that the addition of sodium chloride to very dilute acetic acid slightly increased the hydrion concentration of the mixture, indicating the actual presence of free hydrochloric acid liberated by the much weaker acetic, and confirming the hypothesis of a quadruple equilibrium of acetic and hydrochloric acid and sodium acetate and chloride.

He agreed with the authors that the apparent alkalinity of sodium acetate was due to hydrolysis of the normal salt. He confirmed the usual presence of lactones in commercial lactic acid, and mentioned a recent patent of Eberle for their use as neutral deliming agents, since in presence of lime they formed lactates.

He suggested that as the swelling power of liquors was too complicated a function to be determined chemically, it was possible that empirical results might be obtained by soaking a weighed portion of thin sheet gelatine in the liquid for 24 hours or some other definite time, and weighing or measuring the absorption of liquid, since the tannin did not penetrate but merely formed a thin semipermeable layer on the surface.

He also mentioned that the perforated chimneys often used for incandescent burners formed very effective centrifugal stirrers if inverted in a beaker so that the holes were below the surface of the liquid and rotated.

Dr. E. **Stiasny** thought the acidity of tannins themselves, as found by the authors, might not have any influence on the swellings of hides in the suspenders, because the low hydrion concentration would still be naturally lowered by the presence of the stronger organic acids (lactic and acetic acids) which exerted an inhibitory effect on the ionisation of the tannic acids.

Mr. J. M. **Wilkie** asked with regard to the water used in the experiments, had the authors taken any special precautions to ensure the absence of carbon dioxide. He had found considerable difficulty in getting water reef from carbon dioxide and had always found that, though boiled in Jena glass, such boiled out water possessed a distinct acidity towards phenolphthalein. Were the salts used in the research the ordinary pure chemicals of commerce, or had any precautions been taken to ensure that they were of the correct composition. Finally, it was not unlikely that the discrepancies observed with lactic acid were due to the presence of lactones which it was well known were present in the ordinary lactic acids of commerce, so that by direct titration, low results would be obtained.

Mr. R. A. **Seymour-Jones** remarked that the work done by Professor Procter and himself indicated a "plumping" limit of about $10^{-5}N$ hydrion concentration. Had the authors determined that point? Had they made any experiments on quadruple equilibria, as interesting results had been obtained at Leeds? Could they reduce the hydrion concentration of their "conductivity" water below $10^{-6\cdot2}N$ by the ordinary means of purification?

Mr. **Wood** said, in reply to Dr. Stiasny, the authors did not for a moment imagine that the acidity of the tannins had any swelling action on the skins; they merely drew attention to the fact that the tannins increase the quantity of potash consumed to bring the liquor to the neutral point. The hydrion concentration named by Mr. Seymour-Jones, namely, 10^{-5} normal, would no doubt be somewhere about the limit of swelling power, although the point at which the authors found the liquid go cloudy during titration with potash was about $10^{-6\cdot2}$.

With regard to the water used, no special precautions to expel carbon dioxide were taken beyond boiling, so that it was certainly not so pure as $10^{-6\cdot2}$. In reply to Mr. Wilkie, the chemicals used were Kahlbaum's pure salts and acids. They thought it sufficient to use the purest salts they could procure commercially than to give figures for those which could only be prepared by an excessive expenditure of time and trouble. His suggestion as to the presence of lactones in the lactic acid being the cause of the discrepancy from theory was probably the correct one.

With reference to Professor Procter's remarks, they had tried the experiment of adding salt to acetic acid at an early stage of the work, and called attention to it in the paper. They noticed a slightly increased hydrion concentration, but had not followed up the subject. What he said about quadruple equilibria was extremely important to the tanner, because he might get free mineral acid in his leather quite unwittingly.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Cold storage equipment. Times Eng. Suppl., June 28, 1911.

The ammonia system requires less power than the carbon dioxide system and is better adapted for cooling by direct expansion in tubes in the refrigerating chamber. For small plants, the compressors are now often driven by electric motors, and for large plants, by suction-gas plant. Atmospheric condensers, consisting of tubes cooled by exposure to air and a water spray, require 50 to 70 per cent. less water than submerged condensers cooled by water alone. The power required for the compressors is about 1½ horsepower per ton of "refrigerating capacity" per day, corresponding to about 3 horsepower per ton of actual ice-making capacity. When the refrigerating chamber is cooled by a current of air, previously cooled electrically driven fans are employed. A motor of 5 or 6 horsepower is sufficient for driving the fans for an air, cooler supplying 80,000—100,000 cub. ft. of storage space.—A. T. L.

Patents.

Drying machines; Centrifugal ——. J. W. Macfarlane, Cathcart, N.B. Eng. Pat. 10,147, April 26, 1910.

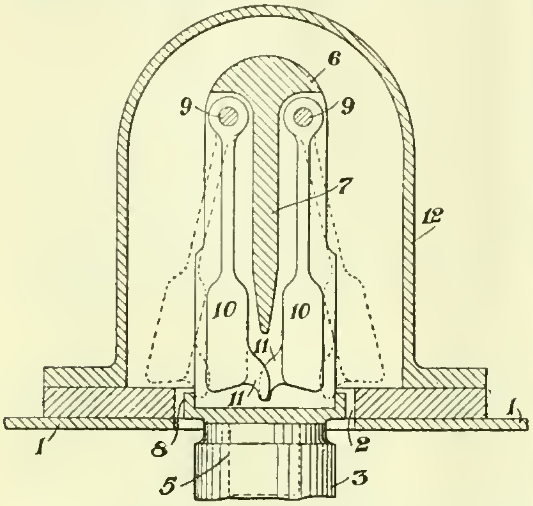
In order to overcome the gyration and/or vibration of the machine the springs which support the head of the rotating spindle are limited as to their unstressing. Consequently although they can be subjected to greater stresses and take up the gyration and/or vibration, their unstressing being limited they cease to act as soon as their object has been attained. (See also Eng. Pats. 24,794 of 1901 and 29,549 of 1909; this J., 1911, 118).—W. H. C.

Drying devices, more particularly for use in drying high [Blast-] furnace blast. P. Würth, Luxembourg, Germany. Eng. Pat. 23,262, Oct. 7, 1910.

Gases are dried by passing them through a tower containing a number of superposed trays of calcium chloride, arranged about a central shaft which may either serve as an inlet or as an outlet for the gases, the annular space between the walls of the tower and the peripheries of the trays serving as an outlet or an inlet respectively. Each tray contains a cooling coil round which the calcium chloride is packed, so that it does not become heated while absorbing moisture, and a wiper similar to a stirring device rotates in each tray to prevent the formation of air passages through the calcium chloride. The calcium chloride is regenerated from time to time by means of a hot air blast introduced at a temperature of 250° C. The cooling coils are arranged at such a slope that they can be completely emptied of water before the heating commences. A number of deflecting cones are arranged within the central shaft to guide the gases over the surfaces of the trays and prevent them from passing straight through the tower. —H. H.

Hydro-extractors and like centrifugal machines. T. Broadbent and Sons, Ltd., and H. Broadbent, Huddersfield. Eng. Pat. 28,514, Dec. 8, 1910.

In order to prevent the lid or cover of the centrifugal machine being lifted when the machine is in motion, an aperture, 2, is made in the cover, 1, of the machine. A frame, 6, 7, is attached to the spindle, 3, and is provided with two or more arms, 10, which are suspended from the pins, 9. When the machine is at rest, the arms, 10, hang down as shown and allow the cover, 1, to be lifted off. When the machine is in motion, the arms swing into the position indicated by the dotted lines, in the manner of ordinary governor balls and extend over the cover, 1, so as to prevent it lifting. The wings, 10, are prevented from swinging out too far by the lugs, 11, which engage with the rim, 8. The device is covered by a dome, 12, attached to the cover of the machine. —W. H. C.



Dryer. W. H. Ford, Assignor to The Shredded Wheat Co., Niagara Falls, N.Y. U.S. Pat. 994,915, June 13, 1911.

The material to be dried is caused to pass down the annular space between two concentric vertical cylinders spaced apart. The outer cylinder is provided with a series of slat-work openings and the inner cylinder is perforated and arranged to be rotated on anti-friction bearings. The inner cylinder is connected with an exhaust chamber.—W. H. C.

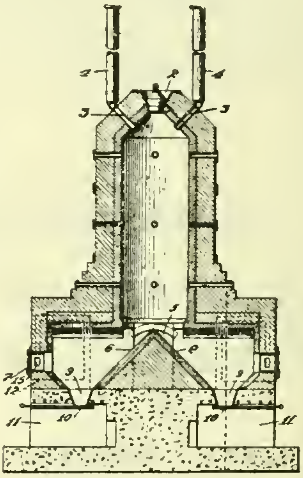
Pumping and conveying inflammable liquid; Apparatus for ——. Maschinenbau-Ges. Martini und Hüneke m. b. H., Berlin. Eng. Pat. 11,252, May 9, 1911. Under Int. Conv., May 10, 1910.

A safety device for use with pumps for drawing off inflammable liquids from a tank containing inert gas above the liquid comprises a by-pass conduit on the suction pipe of the pump having a liquid seal, the action being such that when the pressure of the inert gas is normal, the liquid seal is shut, but should the pressure fall below atmospheric, the liquid seal is broken and air is admitted through the by-pass to the pump, which then pumps air instead of liquid.—H. H.

Kilns; Tunnel ——. E. R. Sutcliffe, Leigh, Lancs. Eng. Pat. 14,506, June 15, 1910.

The material to be treated in the kiln is stacked on suitable trucks which pass through the kiln. The latter is heated by gas which is introduced in a horizontal direction from above, at about the centre point of the kiln. Two inlets for the gas are provided, pointing in opposite directions. Through the inlet facing the delivery end of the kiln a smaller portion of the gas is introduced, serving to give a final heating to the air for combustion which is introduced by a top flue at the delivery end of the kiln. The air receives a preliminary heating by passing over the hot material going towards the outlet and then passes through a somewhat constricted portion of the tunnel beneath the gas inlet. In this way its velocity is increased and this prevents the zone of combustion from extending towards the outlet. The major portion of the gas is introduced in a direction pointing towards the inlet end of the kiln. In the combustion portion of the tunnel the material is heated to the requisite temperature and the products of combustion are withdrawn by a flue to the chimney at a point short of the inlet, in order that the incoming material may not be exposed to the action of the hot products of combustion. The material however receives a preliminary heating in the first portion of the tunnel. For this purpose a current of air is drawn along a base flue situated beneath the tunnel. It enters at a point near the outlet end of the latter and after becoming heated, passes from the base flue to the tunnel at a point just after that at which the products of combustion have been withdrawn. The direction of the gases is controlled either by dampers or preferably by keeping the whole furnace under a plus pressure.—W. H. C.

Kiln. B. J. Bither, Berkeley, Cal. U.S. Pat. 994,054, May 30, 1911.



The material to be calcined is charged through the central opening, 2, and the gases escape through the lateral openings, 3, and the stacks, 4. The material is calcined by the fire gases from the external grates, 9, and slides down the inclined surfaces, 6, through the slide doors, 10, into the ash-pits, 11.—W. H. C.

Furnace. J. R. Fortune, Detroit, Mich. U.S. Pat. 994,830, June 13, 1911.

The furnace is provided with a double row of inclined fire-bars arranged in the form of a V beneath a combustion chamber. The fuel is fed from a magazine arranged at the upper end of the bars on each side and spaced apart from the wall which forms an air-chamber below the bars. Air is supplied under pressure to this chamber and passes through the bars and between the wall of the magazine and the outer wall to the fuel.—W. H. C.

Thermometers. F. A. Dawson and J. Dawson, Ltd., Milnrow, Lancs. Eng. Pat. 16,594, July 12, 1910.

The claim is for the use of a metal pipe, the lower portion of which is perforated, and which encloses the lower end of the thermometer where it projects into the space the temperature of which is to be ascertained. The upper end of the metal pipe is coned internally and the joint between it and the thermometer is made by a perforated conical india-rubber plug through which the stem of the thermometer passes and which is retained in position by a clip made in two halves and fastened together and to the base by screws.—W. H. C.

Separating dust and other materials from gases; Apparatus for ——. W. J. Baldwin, Brooklyn, N.Y., U.S.A. Eng. Pat. 17,623, July 25, 1910.

In apparatus of the type in which the gas is passed through a rotating fan and screen whereby the dust, etc., is projected radially by centrifugal force, while the purified gas passes forward in an axial direction, (1) the gases are caused to pass from the fan through an annular passage formed between the screen and a central "filler" which prevents return eddies, (2) an adjustable sleeve is fitted to the screen to regulate the available surface thereof, (3) the fan and screen may be adjusted in an axial direction so as to leave a space between the fan and the casing through which any gas which may have passed through the screen may return to the suction inlet of the fan. Water or other liquid may be introduced into the apparatus in known manner.—H. H.

Freezing liquids and plant therefor. M. C. J. Bannister, Dublin. Eng. Pat. 20,801, Sept. 6, 1910.

In an ice-making machine the ice is formed upon the exterior of a rotating drum which dips into water and is cooled internally by cold brine and externally by a current of cold air. Hollow radial partitions are preferably arranged to project from the periphery of the drum so as to divide the ice into blocks of convenient size, the outer surfaces of the blocks being trimmed as they near completion by a cutting roller rotating in proximity to the outer edges of the partitions. The water in the tank is maintained above freezing point, and the formation of ice elsewhere than on the drum is prevented by local heating if necessary.—H. H.

Emulsifier. J. C. Alexander, Roseburg, Oreg. U.S. Pat. 994,554, June 6, 1911.

Superposed, horizontal plates are fitted in a centrifugal drum, being spaced apart and so arranged that alternate plates reach nearly to the periphery of the drum whilst the intermediate plates are fixed to the outer wall and have openings at their centres. The liquid is introduced at the top of the drum, flows over the upper plate and over its outer edge, then over the next lower plate towards its centre and through the central opening on to the next plate, and so on, leaving the drum through openings at its lower part. Means are provided for rotating the drum, and the apparatus is enclosed by a casing which serves to collect the liquid flowing from the drum.—W. P. S.

Evaporator. C. Mykolashek, Raymond, Wash. U.S. Pat. 995,629, June 20, 1911.

The evaporator consists of a vertical boiler provided at the lower end with a "mud leg" having a stop valve, and near the upper end with a projecting tubular arm. A "rock shaft" is supported so that it can oscillate in the tubular arm and is connected at one end with a float, and at the other end with the stop valve, so that the latter is closed when the float is in its normal or lowered position. —W. H. C.

Evaporating and concentrating apparatus. J. E. Dunn, Philadelphia, Pa. U.S. Pat. 995,776, June 20, 1911.

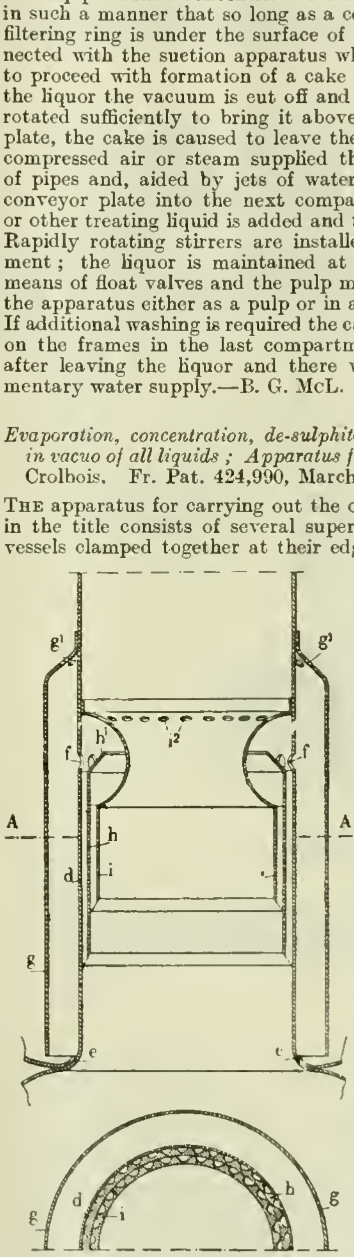
The apparatus consists of vertical evaporator tubes which extend into a supply chamber below, into a separating chamber above and pass through an intermediate heating chamber. A second set of tubes extend from a heating chamber situated below the supply chamber into the interior of the first-mentioned tubes.—W. H. C.

Filtering machines. J. Drage. Fr. Pat. 424,857, Jan. 14, 1911. Under Int. Conv., Feb. 21, 1910.

The machine, specially adapted for the filtration and washing of pulp in stages, consists of a long trough of semicircular section divided into several compartments by transverse perforated plates and is surmounted by an axle to which, in each compartment, wheel frames are attached. The filtering frames, which extend from the periphery of each wheel inwards towards the axle for a distance about equal to one-fourth of the radius, are formed of perforated conduits on which the filtering media are fixed. These conduits are connected by a series of radial pipes with a concentric valve device which operates in such a manner that so long as a certain portion of the filtering ring is under the surface of the liquor, it is connected with the suction apparatus which causes filtration to proceed with formation of a cake of pulp; on leaving the liquor the vacuum is cut off and when the frame has rotated sufficiently to bring it above a sloping conveyor plate, the cake is caused to leave the frame by means of compressed air or steam supplied through the same set of pipes and, aided by jets of water, it slides down the conveyor plate into the next compartment where water or other treating liquid is added and the process repeated. Rapidly rotating stirrers are installed in each compartment; the liquor is maintained at a constant level by means of float valves and the pulp may be removed from the apparatus either as a pulp or in a semi-dry condition If additional washing is required the cakes may be retained on the frames in the last compartment by the vacuum after leaving the liquor and there washed by a supplementary water supply.—B. G. McL.

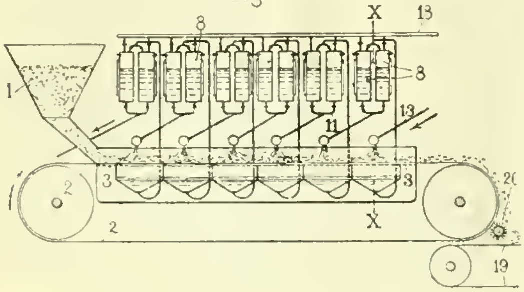
Evaporation, concentration, de-sulphitation and distillation in vacuo of all liquids; Apparatus for the ——. J. J. A. Crolbois. Fr. Pat. 424,990, March 26, 1910.

The apparatus for carrying out the operations mentioned in the title consists of several superimposed lens-shaped vessels clamped together at their edges by vertical stays fixed to the bottom of a surrounding cylindrical vessel. Extending from the dome of each vessel upwards into the interior of the one immediately above to a distance of about three-quarters of its vertical height is a connecting tubular device the lower portion of which is shown in section in the figure. The upper part consists of a simple device for prevention of frothing. In passing from one vessel to the one immediately below it, the lowest layer of liquid passes upwards between the tubes, *g*, and *d*, and thence, through the holes, *f*, it descends in thin layers on the flutings between the tubes, *d*, and *h*, in a condition suitable for rapid treatment; should the volume of liquid passing be sufficiently great, layers are also formed between the tubes, *h*, and *i*, and on the inside of the wall of the tube, *i*, access being gained over the lip, h^1, of the tube, *h*, and through the holes, i^2; the liquid passes round the corner, *e*, and spreads over the dome of the under vessel; the holes, g^1, serve to prevent siphoning of the liquid. A similar tower is employed for the initial introduction of the liquid, while the tower in the lowest vessel is provided with a small collecting trough from which the treated liquid is run off alternately into two receivers. The exhauster is connected with the top and the heating takes place by means of hot water which fills the outer cylinder. Rapidity, regularity and economy in heat are claimed for the apparatus, while de-sulphiting may be effected without risk of the production of a burnt taste.—B. G. McL.



Extraction or washing; Machine for continuous and regular ——. C. Bardy. Fr. Pat. 424,978, Mar. 26, 1910.

Fig 1



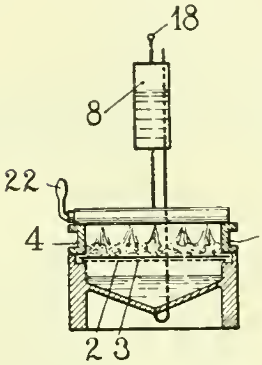
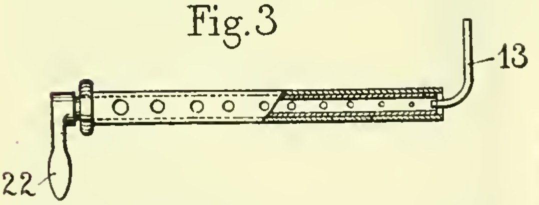


Fig. 2

Fig. 3



The machine aims at obviating irregularities caused by sinking, channelling and blockage which are frequently encountered in extracting or washing powdered materials such as saccharified sawdust, by causing the extraction to take place on thin layers of material in stages. The diagrams show the principle of operation. The material is fed from the hopper, 1, on to the continuous filter-cloth, 2, which is supported on a perforated metal plate, 3, with which it is caused to make contact by means of a rubber packing fixed under the plates, 4 (Fig. 2); this packing also serves to prevent loss of the material laterally. According to the speed of rotation of the drums the material is caused to undergo the treatment at any desired speed, the brush, 20, effecting its removal to the conveyor band, 19. The water or other extracting liquid, heated if desired, passes down the tube, 13, and is caused to spray on to the material by a specially designed distributing tap (see Fig. 3), and is drawn through into the receiver below by suction transmitted from the pipe, 18, the liquid being at the same time elevated to one of the two upper reservoirs, 8. While this reservoir is filling, the other reservoir of the set is supplying liquid to the next distributing tap, 11, which liquid after passing through the material on the next section of the filter-cloth is similarly and independently collected and elevated to one of the second set of reservoirs. Any convenient number of stages may be employed, six being shown in the diagram. The distributing taps are capable of being regulated by the handles, 22, which is necessary as successive extractions may render the liquid viscous. A series of rollers may be substituted for the perforated metal base-plate.—B.G.McL.

Centrifuge for separating liquids from one another or solids from liquids. Jahn-Kommandit-Ges., Maschinenbau-Anstalt, Eisengiesserei and Kesselschmiede. Fr. Pat. 425,382, Jan. 30, 1911.

The liquid escaping from hydro-extractors and centrifugal separators leaves the apparatus at great velocity; it is proposed to recover this waste velocity by converting it into power by means of a turbine.—B. G. McL.

Insulating material [lampblack, kieselguhr, etc., etc.] for Dewar vessels. M. Smoluchowski. Fr. Pat. 425,542, Feb. 2, 1911. Under Int. Conv., Feb. 4, 1910.

The patent involves the results of the claimants' investigations (see this J., 1911, 71). Provided that the surfaces of contact of the particles of the insulating material are very small, relatively little heat can be transferred by conduction and the vacuity of the intervening spaces prevents transmission by radiation.—B. G. McL.

Liquefaction of "permanent gases." R. Mewes. Fr. Pat. 425,546, Feb. 2, 1911.

The heat of vapourisation of a liquefied gas is notably greater under a high vacuum than at atmospheric pressure; the present invention, by taking advantage of this phenomenon, claims to effect greater thermal economy. A high vacuum is maintained at the expansion valve, part of the energy necessary to produce this vacuum being obtained from the expanding gas.—B. G. McL.

Kilns; Tunnel ——. G. E. Ohrn, Stockholm. Eng. Pat. 14,500, June 15, 1910. Under Int. Conv., June 15, 1909.

See U.S. Pat. 948,243 of 1910; this J., 1910, 260.—T. F. B.

Mixing fluids in given proportions; Regulating device for —— *and for measuring the same.* Comp. pour la Fabr. des Compteurs et Matériel d'Usines à Gaz, Paris. Eng. Pat. 27,703, Nov. 28, 1910. Under Int. Conv., Dec. 1, 1909.

See Fr. Pat. 420,733 of 1909; this J., 1911, 347.—T. F. B.

Drying air; Apparatus for ——. P. Würth, Luxemburg. U.S. Pat. 995,513, June 20, 1911.

See Eng. Pat. 23,262 of 1910; preceding.—T. F. B.

Exhaust-gases from internal-combustion engines; Method of deodorising ——. L. Bregha, Assignor to H. Kaiser, Vienna. U.S. Pat. 996,205, June 27, 1911.

See Eng. Pat. 14,403 of 1909; this J., 1910, 746.—T. F. B.

Gases; Process and apparatus for separating smoke, dust, and other impurities suspended in ——. R. F. Pearce. Fr. Pat. 424,919, Jan. 16, 1911. Under Int. Conv., Oct. 21, 1910.

See Eng. Pat. 24,509 of 1910; this J., 1911, 732.—T. F. B.

Electrical purification of gases. Fr. Pat. 425,593. *See* XI.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Combustion spectra of hydrocarbons and of various metals. J. Meunier. Comptes rend., 1911, 152, 1760—1762.

The author considers that the finely-banded spectrum of Swan—which is yielded by the mantle of the innermost cone of the Bunsen gas-flame—is not exclusively dependent upon hydrocarbons but also upon the actual combustion, with the mechanism of which latter it is intimately connected. The formation of the spectrum is regarded as evidence that the reactions of combustion are mainly accomplished in this restricted portion of the flame; but it is pointed out that the presence of oxygen is not indicated by any spectrum line. Attempts to obtain a corresponding spectrum from a Bunsen hydrogen-flame were unsuccessful. With a hydrogen flame 4 to 5 cm. in height a persistent spectrum of calcium was obtained by the use of chalk alone, whereas in the ordinary gas flame this spectrum is very fugitive and requires calcium chloride and hydrochloric acid for its production. By means of this hydrogen flame the spectra of combustion of various metals were found to be as follows :—*Magnesium* gives splendid green bands degraded towards the violet, that corresponding to solar *b* λ 5172 being less sharp than another more refrangible green band situated towards λ 5000. *Iron* and *aluminium* give no result, so that an iron wire may be employed as support for other metals. *Zinc* burns with a blue flame and gives a spectrum particularly beautiful in the blue and in the violet, with neither line nor band. *Cadmium* shows a persistent, single, green line λ 5379. *Nickel* gives a regular succession of good bands degraded towards the red ; a red band towards 6250, a green one (the best) towards 5540 and others towards 5170 and 5000. Nickel oxide (prepared by calcination of the nitrate) gives no spectrum. *Cobalt* gives no result. *Copper* gives irregularly disposed bands, the largest extending from about 5600 to about 5200. *Lead* gives numerous beautiful bands in the red. The spectrum of *bismuth* presents a red, intermittent line (much less refrangible than the red line of lithium), a succession of small regular bands from λ 6400 to λ 5200, and then the fine line 4720 ; it is abruptly cut off at the side of the violet on a level with solar G approximately. Antimony gives a green band without a spectrum properly so-called.—W. E. F. P.

Naphthalene in crude coal-gas ; Determination of ——. A. Albrecht and F. Müller. J. Gasbeleucht., 1911, 54, 592—594.

The authors recommend a modification of Rutten's method (this J., 1909, 875) as follows :—2·5 grms. of picric acid are placed in approximately equal parts in two wash-bottles of 100 c.c. capacity, 25 c.c. of water are added to each bottle and the contents shaken till the solutions are saturated and contain crystals of picric acid in suspension, the bottles are connected together, the glass tubes being made to meet and so prevent contact between the gas and the rubber joint ; the gas is passed through the solutions at the rate of from 40 to 50 litres per hour until from 0·05 to 0·2 grm. of naphthalene is judged to have been absorbed ; the contents of the wash-bottles are then quantitatively transferred to a 250 c.c. flask and the free picric acid completely dissolved by the addition of water and gentle warming. After cooling, the solution is made up to 250 c.c., filtered and 200 c.c. are titrated with $N/10$ potassium hydroxide solution using lacmoid indicator ; at the same time a similar quantity of a solution containing 2·5 grms. of picric acid in 250 c.c. of water is similarly titrated ; the difference in the number of c.c. of potassium hydroxide solution required multiplied by the factor $5/4 \times 0{\cdot}0128$ gives the quantity of naphthalene in grams. The accuracy of the method is shown by a series of figures obtained by using weighed quantities of naphthalene carried in dry nitrogen. In applying the method to coal-gas precautions must be taken to remove tar, cyanogen, hydrogen sulphide and ammonia ; the use of scrubbing apparatus containing wood-shavings, moist iron ore, etc., is shown to lead to quite unreliable results. Good results are obtained by simple washing of the gas in two wash-bottles with dilute sulphuric acid followed by two containing dilute potassium hydroxide ; the traces of tar which come over are without influence on the absorption and subsequent titration. The authors have carried out tests on the gas obtained from several different kinds of coal in horizontal and in vertical retorts and find that the higher percentage of naphthalene in crude gas from vertical retorts as compared with horizontal retorts (10·7 grms. per cb. m. with a gas temp. of 71° C. compared with 8·6 grms. per cb. m. with a gas temp. of 54° C. for English coal and 8·6 grms. per cb. m. with a gas temp. of 60° C. for Upper Silesian coal) is due simply to the higher temperature and is not dependent on the class of coal employed. From determinations of the naphthalene in the gas from vertical retorts before and after the oil-washer, the authors consider that the employment of the washer is unnecessary during the warm season.—B. G. McL.

Annual report on alkali, etc., works. See VII.

Patents.

Washing coke, coal, and other granular materials. R. S. Benson, Middleton St. George, Durham, and Head, Wrightson and Co., Ltd., Thornaby-on-Tees, Yorks. Eng. Pat. 24,268, Oct. 19, 1910.

The coal is introduced into a tank containing a wash-box having an inclined and perforated bottom with a sill at the lower end adjustable both as to its upper and lower edges. Two shoots inclined upwards and arranged one above the other lead from the lower end of the wash-box, and when the latter is reciprocated in a suitable manner, coal is delivered from above and below the sill on to the respective shoots, up which it passes.—H. H.

Fuel briquette and process for the manufacture thereof. A. A. A. Zimmer, London, and G. F. Forwood, Limpsfield, Surrey. Eng. Pat. 22,834, Oct. 3, 1910.

A cellulose nitrate or any of the compounds of nitrocellulose is mixed with coal, coke or peat dust or the like, with or without pitch, tar, or rosin. In an example 6 lb. of nitrocellulose dissolved in 8 galls. of benzol and 2 galls. of acetone are mixed with 10 lb. of pitch and one ton of coal. About 50 per cent. of the volatile constituents are allowed to evaporate and the briquettes are then moulded and dried in a heating chamber.—H. H.

Agglomerated materials ; Manufacture of homogeneous —— with a minimum of agglomerant. C. Bardy. Fr. Pat. 424,979, Mar. 26, 1910.

The powdered material, for example sawdust, is mixed with a small quantity of an agglomerant, such as resin or tar, in the presence of a liquid in which the agglomerant is not soluble, for example water, which is afterwards removed by pressing and drying.—H. H.

Fuel or ore briquettes ; Manufacture of ——. J. J. Shedlock. Fr. Pat. 425,227, Jan. 25, 1911. Under Int. Conv., Nov. 15, 1910.

The ground material is mixed with a hydrocarbon and fed into a closed horizontal heating chamber through which it is forced by an Archimedean screw. The material is then passed into a second mixing chamber where any volatile products not expelled in the heating chamber are given off, and is finally moulded into briquettes.—H. H.

Atomisers for liquids [*e.g. oil in liquid fuel burners*]. R. S. Parks, Fitchburg, Mass., U.S.A. Eng. Pat. 16,992, July 16, 1910.

The apparatus is described as applied to a burner for liquid fuel. The oil is supplied to a central jet through a valve at comparatively low pressure and is atomised by a blast of air also at low pressure which acts on the issuing oil at a tangent and completely atomises it. The atomising jet is surrounded by a chamber having an adjustable, conical, annular nozzle through the centre of which the jet of atomised oil passes. An annular jet of air issues from the nozzle and surrounds the divergent jet of atomised oil, with the result that a cylindrical jet is formed which passes forward to the combustion chamber. —W. H. C.

Coke ovens. A. O. Jones, Whitley Bay, Northumberland. Eng. Pat. 17,732, July 26, 1910. Addition to Eng. Pat. 12,923, May 27, 1910.

The patent relates to vertical coke ovens of the type described in Eng. Pat. 11,660 of 1906 (this J., 1906, 1138) wherein the ovens are charged through an open top, emptied by means of a removable sole plate, and heated by horizontal heating-flues extending round the oven, and in particular to those of the kind described in the principal patent (this J., 1911, 734) in which U-shaped superposed horizontal heating flues are employed located entirely in each side wall of the oven so that the coking action takes place entirely from the sides of the coking chamber and not from the ends. According to the present invention the heating flues extend straight through from end to end of the side walls and communicate by vertical passages at the ends with regenerative chambers by means of which the air supply is heated.—H. H.

Retorts ; Construction of —— to improve the quality of coke. S. Phillips, Peterborough. Eng. Pat. 18,406, Aug. 4, 1910.

Retorts for the distillation of coal are provided with horizontal extensions projecting outside the furnace, so that when the retorts are charged with fresh coal the hot coke is forced into the extensions and cooled therein. No partitions are fitted between the retorts and the extensions.—H. H.

Coke ovens ; Horizontal regenerative —— with constant direction of flame. Stettiner Chamotte-Fabr. Akt.-Ges. vorm. Didier. Fr. Pat. 425,133, Jan. 23, 1911. Under Int. Conv., Jan. 31, 1910.

In the walls between the ovens are arranged numbers of vertical heating chambers, for example sixteen in each wall, each of these chambers having an upright partition extending nearly to the top so as to divide it into two parts. The right hand part of each chamber has a gas burner at the bottom and is connected with a common air inlet conduit passing beneath the heating chambers, while the left hand part of each chamber is similarly connected with a flue. The air conduits and flues are connected with regenerative chambers fitted with reversing valves in the usual manner, the arrangement being such that the direction of the current in the heating chambers is always the same.—H. H.

Coke oven. G. Siebel. Fr. Pat. 425,245, Jan. 26, 1911.

In a coke oven adapted to work either with or without recovery of by-products, the air supply for the heating flues is first conducted through a passage in the base of the furnace in close proximity to a flue through which the hot products of combustion are passing, and then enters a series of four flues passing horizontally from end to end of each partition separating contiguous ovens. When the distillation products from the ovens are to be recovered, the combustible gas for heating the ovens is burned in an upright channel connecting the first and second of the horizontal flues which run along the bottom and top of the partition respectively, but when the distillation products are not to be recovered, they are led directly from the top of the coke ovens to the uppermost heating flue where they are burned, the other gas supply being cut off.—H. H.

Coking briquettes ; Process of and apparatus for ——. C. Garz. Fr. Pat. 425,348, Jan. 28, 1911. Under Int. Conv., July 27, 1910.

The briquettes are passed through a hopper on to a rotating drum having a number of small compartments on the periphery formed by radial partitions which closely fit a cylindrical casing disposed round the lower surface of the drum, so that the briquettes are carried almost completely round before they are discharged by gravitation on to a second drum rotating beneath the first and so on for any desired number of drums. The walls of the drums are perforated, and hot gases passing upwards through the chamber containing the drums freely circulate through the briquettes which are dried or baked to any desired extent in accordance with the temperature and number of drums used.—H. H.

Coking briquettes and analogous articles. Diamant-Brikett-Werke G. m. b. H. Fr. Pat. 425,442, Jan. 31, 1911.

The apparatus works in a similar manner to that described in Fr. Pat. 425,348 (see preceding abstract) but has the following additional features : (1) The passages leading to and from the various drums communicate with a larger vertical passage, fitted with flap valves, by means of which the briquettes may be caused to pass through all the drums successively or discharged after passing through only one or two. (2) A valve is situated in the supply hopper having an indicator attached to record the rate of supply. (3) An adjustable sliding plate is fitted in the entrance passage to the topmost drum to regulate the rate of supply. (4) A safety device is provided to stop the rotation of the drums in the event of their becoming partially clogged. For this purpose two portions of the driving gear are connected by comparatively thin pins or keys which would break before the strain became excessive.—H. H.

Suction gas producers using bituminous fuel. Grices' Gas Engine Co., Ltd., and W. H. Purser, Carnoustie, N.B. Eng. Pat. 13,054, May 30, 1910.

A producer of the type having an upper combustion chamber in which the fuel is partially burned and a lower combustion chamber into which the volatile products from the upper chamber are conveyed together with air and steam, is fitted with a steam-jacketed rotatory cylindrical hopper valve between the chambers for allowing the partly burned fuel from the upper chamber to fall intermittently into the lower chamber where complete combustion is effected.—H. H.

Gas producers of the rising grate type. E. Hall-Brown, Glasgow. Eng. Pat. 19,653, Aug. 23, 1910.

A plate or tray is inserted through a slot in the producer wall above the rising grate for the purpose of keeping the fuel in position when the grate is lowered. This tray is formed of two comparatively thin sheets of metal between which cooling water is circulated. The plates are welded together at the entering edge and are strengthened by stiffening pieces which act as baffles for the cooling water. A number of hollow eyelet-like rivets hold the parts together and also permit a certain amount of air to pass through the plate to maintain the fire in the producer. —H. H.

"Liquid" illuminating gas ; Manufacture of ——. Schweiz. Flüssiggas-Fabrik L. Wolf, Zurich, Switzerland. Eng. Pat. 595, Jan. 9, 1911. Under Int. Conv., Jan. 13, 1910.

In the process of liquefying illuminating gas by compressing it and cooling by means of a portion of the gas which has been allowed to expand after being compressed and cooled, the gas which has been used as the cooling medium is added to the illuminating gas that is still to be cooled, whereby a preliminary cooling is effected.—H. H.

Residues from purification of illuminating gas ; Treatment of ——. H. Simonin. First Addition, dated Mar. 19, 1910, to Fr. Pat. 412,305, April 29, 1909 (this J., 1910, 999).

The process described in the principal patent is modified by extracting the residues first of all with an alkaline liquor and evaporating to dryness. The object is to separate the residues from iron oxide before treatment with acid.—A. T. L.

Cyanogen wash-liquors obtained in gas purification ; Process for working up the —— into Prussian blue. K. Burkheiser. Ger. Pat. 235,006, March 4, 1910.

The spent gas-purifying material, free from cyanogen, and containing ferric compounds, is dissolved in acid and treated with the cyanogen wash-liquors. It is stated that not only are the cyanogen and iron recovered as Prussian blue, but the sulphur content of the residue, freed from iron, is increased.—A. S.

Wax ; Refining and decolourising of mineral ——. Wachs- und Ceresin-Werke J. Schlickum und Co. Fr. Pat. 425,401, Jan. 30, 1911.

Crude mineral wax, extracted from resinous lignite by organic solvents, is treated with strong nitric acid to destroy the resins, and is then mixed with paraffin wax and further purified by treatment with strong sulphuric acid and finally with a decolourising powder.—A. T. L.

Coke ovens or retort furnaces; Devices for preventing formation of graphite in ——. A. Klönne. Fr. Pat. 425,278, March 31, 1910.

See Eng. Pat. 7704 of 1910; this J., 1911, 273.—T. F. B.

Furnaces with inclined retorts, especially for the production of coke. A. Klönne. Fr. Pat. 425,472, April 5, 1910.

See Eng. Pat. 8174 of 1910; this J., 1911, 529.—T. F. B.

Rectification of crude petroleum and other volatile liquids; Process and apparatus for the ——. E. Guillaume, Paris. U. S. Pat. 996,081, June 27, 1911.

See Fr. Pat. 390,119 of 1908; this J., 1908, 1013.—T. F. B.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Incandescence lighting; Method of —— *much more economical than by carbon filament lamps.* Dussaud. Comptes rend., 1911, **152**, 1849—1850.

The method consists in passing a current of 1·3 ampères at 16 volts through a fine tungsten wire wound into a coil like a solenoid; the coil occupies a space of about 30 cb. mm. It is stated that in order to obtain an illumination equal to that obtained with 20 watts by the above method, 200 watts are required with carbon filaments. There is no sensible heating with the tungsten coil, owing to its small size, and hence for projections it can be used with an optical system of very short focus; for this purpose the 20 watts give an illumination equal to that obtained with 4000 watts by means of an arc light, for which a system of much longer focus is necessary. The method of lighting described is quite safe for use with cinematographs, projections of prints, etc., of inflammable material, for the illumination of delicate living microscopic specimens, etc., and also for beacon lights in conjunction with a small lens of very short focus. In order to prevent deterioration, the coil is placed in a suitable magnetic field. This can be effected without greatly complicating the device.—A. S.

The wood-spirit industry in Germany. J. Roy. Soc. Arts, July 7, 1911. [T.R.]

The wood-spirit industry in Germany made slow progress until 1880, when the law providing for the denaturation of alcohol was passed, but about the same time the importation of wood spirit and pyrolignite of lime from the United States began, and a number of the wood distilling firms bought up these imported raw products and manufactured them into acetic acid, methyl alcohol, and denatured wood spirit. The largest concerns, however, soon established their own distilling plants in the thickly-wooded surrounding countries of Galicia, Hungary, and Russia, and imported their raw products to their refining plants in Germany. Exact figures of the production of wood spirit and pyrolignite of lime are not published, but according to a reliable estimate there were produced in a recent year, in Austria, Hungary, and Germany, about 6,500 metric tons of the former and 27,000 to 28,000 metric tons of the latter. The industry has also suffered somewhat of late years on account of the competition of denatured potato and grain spirit produced in Germany. The fact that deciduous varieties of wood are comparatively scarce in Germany is another reason why the wood-spirit industry is not so far advanced. Chemists and distillers state that wood from coniferous trees produces only about one-half the wood alcohol and pyroligneous acid produced by wood from deciduous varieties, and that the profitable distillation in the former case depends upon the quality and quantity of the pine oil and tar obtained. On account of the costliness and general application of these woods the stumps of coniferous trees are practically all that are distilled. The distillation of sawdust and wood refuse has not proved profitable, because practically all these products in Germany come from coniferous woods, which not only produce little alcohol and pyroligneous acid, but very little tar and pine oil.

Patents.

Peat; Wet carbonising of ——. N. Testrup, London. Eng. Pat. 6041, Mar. 10, 1910.

Wet peat containing about 90 per cent. of water is heated to about 180° C. at a pressure of 20 to 25 atmospheres and carbonisation then allowed to proceed without further addition of heat by utilising the heat evolved by reaction within the mass. The process is carried out in a large number of double concentric pipes, the inner pipe of each pair being caused to rotate and carrying a spiral screw on its outer surface which forces the peat mass through the pipes. The pipes are enclosed for a portion of their lengths in a furnace maintained at a temperature of 180° C. The peat travels under the combined action of a pump and the spiral screws, through the outer annular spaces between the pipes and back through the inner pipes, the heat generated by reaction within the mass in the inner pipes serving to heat the fresh peat entering through the annular spaces.—H. H.

Metal filaments for electric lamps. G Lüdecke and The Imperial Lamp Works (Brimsdown), Ltd., Brimsdown, Middlesex. Eng. Pat. 132, Jan. 3, 1911.

The filament, made for example of colloidal tungsten with a relatively small amount of an organic binding material, is heated on an insulated support in an open electric tube furnace containing an atmosphere of a reducing agent such as hydrogen free from water vapour and an inert gas such as nitrogen introduced under such a pressure as to completely drive out the air from the furnace. The proportion of inert gas is largely in excess of that of the reducing agent, for example 90 per cent. of inert gas may be used, so that no combustion of the mixture can take place either within the furnace or at the open end thereof. The filaments are kept straight by weighting their lower ends by dipping them in tungsten paste.—H. H.

Conductors of the second class; Process for increasing the conductivity of ——. Banque du Radium. Fr. Pat. 424,905, Mar. 24, 1910.

Refractory bodies which become conductors when heated, such as are used in the Nernst lamp and in certain arc lamps, are rendered conductive at ordinary temperatures by the addition of a radioactive oxide.—A. T. L.

Tungsten and like filaments for incandescence electric lamps; Process for consolidating ——, *and furnace therefor.* W. C. Heraeus Ges. m. b. H. and C. Trenzen. Fr. Pat. 425,112, Jan. 18, 1911. Under Int. Conv., Jan. 20, 1910, and Jan. 13, 1911.

The filaments are heated, without the passage of an electric current through them, in an atmosphere of hydrogen or other reducing gas. The furnace comprises a vertical iridium tube open at the lower end, and heated by the passage of a current. The contacts are of platinum and are resilient to permit expansion. The hydrogen is admitted at the top of the tube, and a current of hydrogen is also passed down the exterior of the tube. The supports for the filaments are of iridium.—A. T. L.

Incandescent mantles; Process for the manufacture of ——. J. Visseaux, Lyons, France. U.S. Pat. 995,740, June 20, 1911.

See Fr. Pat. 408,807 of 1909; this J., 1910, 618.—T. F. B.

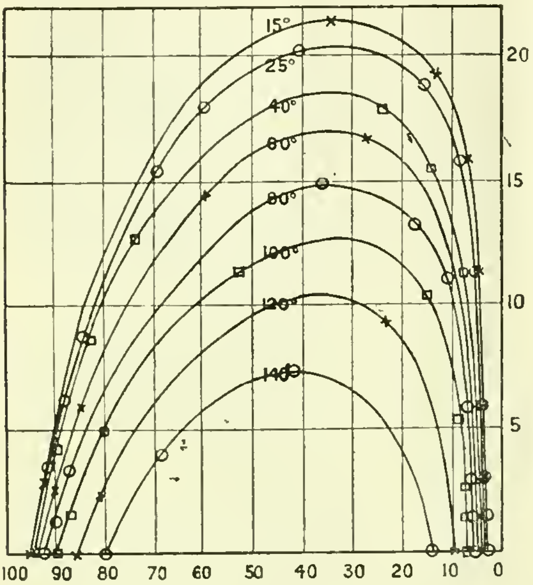
Lamp-filaments; Manufacture of ——. J. T. Marshall, Metuchen, N.J., Assignor to General Electric Co., New York. U.S. Pat. 996,420, June 27, 1911.

See Eng. Pat. 14,867 of 1908; this J., 1909, 360.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Aniline ; Solubility of —— in aqueous solutions of its hydrochloride. N. V. Sidgwick, P. Pickford, and B. H. Wilsdon. Chem. Soc. Trans., 1911, 99, 1122—1132. (See also this J., 1883, 536 ; 1910, 409.)

The solubility of aniline in water and in solutions of its hydrochloride of various concentrations was measured at all temperatures up to that of complete miscibility.



The results are given in tables and curve diagrams. The critical solution temperature of aniline and water was found to be 168° C. The partition coefficient of aniline hydrochloride between water and aniline at 25° C. was also determined. In a triangular diagram the complete isothermal curve for 25° C. is given, together with tie-lines, the points of intersection of which with the curve indicate the compositions of the upper and lower layers respectively of the series of conjugate solutions. At 25° C. the solubility of aniline hydrochloride in water is 52·1 per cent. (grms. of the salt in 100 grms. of solution) and in aniline 8·89 per cent. The influence of aniline hydrochloride on the mutual solubility of aniline and water at 15° C., 25°, 40°, 60°, 80°, 100°, 120°, and 140° C., respectively, is best shown in the accompanying diagram, in which one axis represents the percentage of aniline hydrochloride and the other the ratio of free aniline to aniline plus water (A/A+W).—A. S.

Acenaphthenequinone from acenaphthene ; New method of obtaining ——. A. Reissert. Ber., 1911, 44, 1749—1752.

By the action of amyl nitrite on a boiling solution of acenaphthene in amyl alcohol, through which a current of hydrochloric acid gas is passed, or by passing a mixture of ethyl nitrite vapour and hydrochloric acid gas through a boiling solution of acenaphthene in ethyl alcohol, a mixture of isomeric acenaphthenequinone-mono-oximes is obtained, one of which (see Eng. Pat. 19.341 of 1910 ; this J., 1910, 1295) begins to melt, with decomposition, at 220° C., whilst the other, which is much less soluble than the first in hot sodium carbonate solution, decomposes suddenly at 207° C. The latter oxime can be converted into the first by prolonged boiling in glacial acetic acid solution. By dissolving the oxime melting at 220° C. in 75 per cent. sulphuric acid and heating the solution on the water bath, the oxime is converted into acenaphthenequinone, a valuable intermediate product for the preparation of indigoid dyestuffs.—A. S.

Indene series ; Researches in the ——. R. Weissgerber. Ber., 1911, 44, 1436—1448.

Continuing his work on the sodium derivative of indene (this J., 1908, 303) the author has prepared certain derivatives and condensation products of indene. Benzylindene crystallises in yellow prisms, m. pt. 33°—34° C. Di-indene, $C_{18}H_{16}$, is obtained by condensing indene by means of glacial acetic acid ; it melts at 51° C. Indenecarboxylic acid, prepared from the sodium compound and carbon dioxide, melts at 156°—157° C. By the action of hypochlorous acid on indene, chlorohydroxyhydrindene is formed and from this the corresponding glycol can be prepared by boiling it with acetic anhydride and potassium acetate. Indene absorbs hydrogen chloride in the cold to form *a*-chlorohydrindene which with water gives a small amount of indene together with *a*-hydroxyhydrindene and *a*-hydrindyl ether.—J. C. C.

Annual report on alkali, etc., works. See VII.

Patents.

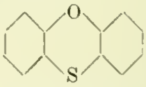
Phenylglycine salts ; Manufacture of ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 3980, Feb. 16, 1911.

When monochloro-acetic acid reacts with three or more molecular proportions of aniline, "melts" are obtained containing phenylglycine anilide, the aniline salt of phenylglycine, and aniline hydrochloride. By treating such melts with one molecular proportion of a neutralising agent, the aniline hydrochloride is decomposed, whilst the phenylglycine compounds are unaffected : the aniline set free acts as a solvent for these compounds, so that they can be readily separated from the solution of alkali salts, and the phenylglycine salt obtained in a pure condition from them by treatment with alkali and distilling with steam. *Example*—61 parts of calcined sodium carbonate are added to the "melt" obtained by heating 500 parts of aniline with 100 parts of chloro-acetic acid for two hours at 120° C. When the reaction is complete, the sodium chloride is filtered off and washed with aniline, and the oily filtrate converted into potassium phenylglycine by heating with 110 parts of a 50 per cent. solution of caustic potash to 130°—150° C., for one to two hours, under a pressure of 2 to 3 atmospheres.—T. F. B.

6-Nitro-4-chloro-2-amino-1-hydroxybenzene ; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 234,742, March 5, 1910.

p-Chloro-*o*-acetaminophenol is treated with hot, dilute nitric acid, and the acetyl group is then removed from the nitro-compound ; the nitro group enters the other position *ortho* to the hydroxyl group.—T. F. B.

Phenoxthine and its derivatives ; Process for preparing ——. Act.-Ges. f. Anilinfabr., and F. Ackermann. Ger. Pat. 234,743, May 19, 1910.

Phenoxthine, 

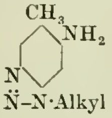
, and its derivatives are obtained by heating diphenylether or its derivatives with sulphur in presence of aluminium chloride ; the yields are stated to be good.—T. F. B.

Aminoanthraquinones, aminonaphthanthraquinones, or their derivatives ; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 234,917, May 29, 1910.

Halogenated diarylketone-*o*-carboxylic acids are heated under pressure with ammonia in presence of copper or a copper salt, and the aminodiarylketone-*o*-carboxylic acids are converted into the aminoanthraquinones by means of condensing agents.—T. F. B.

Azimino-o-toluidine; Process for preparing derivatives of —— alkylated in the imino-group. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 234,966, Jan. 6, 1910.

2·4-Diacidyldiamino-5-nitrotoluene is reduced and the amino group diazotised; the acidylazimino-acidyl-o-toluidine formed is treated with cold alkali solution to remove the acidyl group attached to the azimino ring, the product is alkylated, and the other acidyl group eliminated; in this way compounds of the general formula,



are produced, which may be used for preparing dyestuffs. —T. F. B.

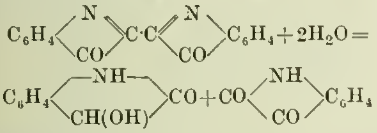
Sulphaminobenzoylaminonaphthols and their sulphonic acids; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 22,097, Sept. 23, 1910.

See Fr. Pat. 421,846 of 1910; this J., 1911, 411.—T. F. B.

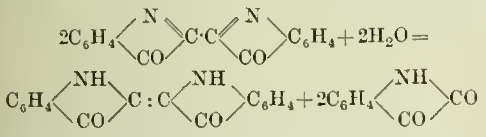
IV.—COLOURING MATTERS AND DYES.

Dehydroindigo. III. Decomposition by acids and alkalis. L. Kalb. Ber., 1911, 44, 1455—1464.

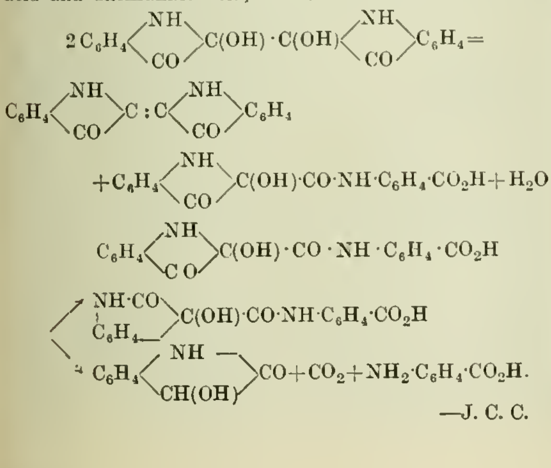
By the action of aqueous mineral acids dehydroindigo is decomposed into dioxindole and isatin (together with isatide) mainly according to the equation:



In addition to this the reaction also yields indigo and isatin according to the equation:



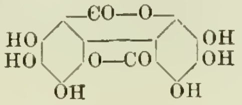
By the alkaline decomposition of dehydroindigo about 50 per cent. is converted into indigo, about 30 per cent. into di-isatic acid and 16—19 per cent. into anthranilic acid and isatin. It appears probable that an additive compound of dehydroindigo with water, dihydroxyindigo white, is first formed which then decomposes into indigo and a hypothetical 2-hydroxyindoxyl-2-carboxyanilide-2′-carboxylic acid which mostly changes into di-isatic acid, the remainder decomposing into dioxindole, carbonic acid and anthranilic acid, thus:



—J. C. C.

Hydroxybenzoic acids; Some oxidation products of the —— Part III. A. G. Perkin. Chem. Soc. Proc., 1911, 27, 194.

The substance $C_{14}H_6O_{10}$, now termed *coeruleoellagic acid*, previously obtained by heating ellagic or flavellagic acid with sulphuric acid (this J., 1906, 258), can also be prepared by the action of arsenic acid on the sulphuric acid solutions of these compounds. The *acetyl* derivative $C_{14}O_{10}(C_2H_3O)_6$ melts at 330°—332° C., and is in reality colourless, and the *benzoyl* compound $C_{14}O_{10}(C_7H_5O)_6$ forms needles melting at 343—345°. By distillation with zinc dust, coeruleoellagic acid gives fluorene, and with boiling potassium hydroxide solution a substance $C_{12}H_{10}O_8$, which crystallises in prismatic needles, and is evidently an *octohydroxydiphenyl*, the *acetyl* derivative of which, $C_{12}H_2O_8(C_2H_3O)_8$, forms colourless needles, melting at 177°—178° C. Coeruleoellagic acid, to which the constitution:



is assigned, dyes mordanted fabrics similarly to flavellagic acid, but somewhat more strongly.

Patents.

Trisazo dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 19,487, Aug. 19, 1910.

The tetrazo compound of *p*-aminobenzene-azo-2-amino-8-naphthol-6-sulphonic acid, or of *p*-aminobenzeneazo-2-amino-5-naphthol-7-sulphonic acid, is combined with one mol. of 1·8-naphthylenediamine-4-sulphonic acid and with one mol. of *m*-phenylenediamine, *m*-tolylenediamine, phenol, resorcinol, cresols, *m*-aminophenol, or their derivatives, the order of combination being immaterial. In this way a series of dyestuffs is obtained which dye cotton shades which can be developed with diazotised *p*-nitraniline, fast deep blue-black to black shades being produced. —T. F. B.

Triphenylmethane dyestuffs capable of being chromed and their immediate products; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 425,676, Feb. 6, 1911. Under Int. Conv., Feb. 12, 1910.

The leuco-compounds obtained from 1 mol. of an aminobenzaldehyde and 2 mols. of an aromatic hydroxycarboxylic acid are treated with halogenated dinitrobenzenes or their sulphonic acids and the products oxidised. Example: 90 kilos. of the leuco-compound from 1 mol. of o-chloro-*m*-aminobenzaldehyde and 2 mols. of o-cresotic acid are dissolved in 400 litres of water and 33 kilos. of sodium carbonate. 44 kilos. of 1-chloro-2:4-dinitrobenzene are added and the whole boiled for 8—10 hours. On cooling the leuco-derivative separates out and is collected and dried. For the oxidation 66 kilos. of the sodium salt of this leuco-compound are dissolved in 350 kilos. of concentrated sulphuric acid, a solution of 7 kilos. of sodium nitrite in 100 kilos. of concentrated sulphuric acid is added and the mixture heated to 50° C., until no increase of colour is observed. The mass is thrown on ice and the dyestuff filtered off. It dyes wool in yellow shades which when chromed become bluish green and are very resistant to fulling, washing, and light.—J. C. C.

Anthracene derivatives; Process for preparing vat-dyeing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 235,094, March 18, 1910.

Vat dyestuffs are obtained by condensing together anthraquinone-mercaptans or anthraquinone disulphides or their derivatives and hydroxyanthraquinones or their derivatives by aid of sulphuric acid; the above substances may be replaced by substances which are converted into the mercaptans, disulphides, or hydroxy-compounds by means of the condensing agent.—T. F. B.

Indigo ; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 24,820, Oct. 25, 1910. Under Int. Conv., Oct. 25, 1909.

Indigo or its homologues or derivatives are obtained in finely subdivided forms, by oxidising the alkali salts of indoxyl or indoxylic acid or their homologues or derivatives, obtained according to Eng. Pats. 22,288 and 24,690 of 1910 (see Fr. Pat. 420,947 and Addition ; this J., 1911, 412). Example : One hundred parts of a presscake of indoxyl-alkali are dissolved in 2000 parts of water, and the solution is agitated with a current of air at ordinary temperatures, with or without addition of copper salts, sulphites, or other oxygen carriers. The indigo paste thus obtained by filtration or decantation, contains the indigo in a finely-divided state, showing a greenish colouration of great covering power when spread on paper. Before drying, starch, glue, saccharine substances, kaolin, aluminium hydroxide, chalk, or magnesia may be added to the paste to impart greater solidity to the dry product. The indigo may also be precipitated in presence of carbohydrates, vegetable glue, salts of fatty acids, resinates, kaolin, etc., to give the desired consistence to the dry product.—T. F. B.

Triphenylmethane dyestuffs ; Process for preparing acid chrome ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 234,805, March 6, 1910.

m-Aminobenzaldehyde is condensed with an aromatic hydroxy-carboxylic acid, the product is diazotised, the diazo compound converted by heating into the *m*-hydroxyleuco-carboxylic acid, and this is sulphonated and oxidised ; alternatively, the *m*-aminoleuco-carboxylic acid is diazotised and oxidised, the diazo compound converted to the hydroxy-compound, and this is finally sulphonated. —T. F. B.

Indigo ; Yellow-coloured derivatives of —— and process of making same. G. Engi and J. Fröhlich, Assignors to Soc. of Chem. Industry in Basle, Basle. U.S. Pat. 994,988, June 13, 1911.

When indigo is treated with one molecular proportion of a halide of an aromatic acid (*e.g.*, benzoyl chloride), in presence of a reducing agent, yellow and brownish yellow substances are produced ; they are insoluble in water, sparingly soluble in alcohol and petroleum spirit, and readily soluble in hot nitrobenzene, giving yellow solutions ; in fuming sulphuric acid they dissolve to brown solutions, which become yellow on diluting with water ; wool is dyed yellow shades from these diluted solutions. —T. F. B.

[Azo] Dyestuffs ; Production of ——. H. Levinstein, J. Baddiley and Levinstein, Ltd. Fr. Pat. 425,388, Jan. 30, 1911. Under Int. Conv., June 15, 1910.

Azo dyestuffs are prepared by combining diazo compounds with the glycine ethers of aminonaphtholsulphonic acids (this J., 1911, 738). Example 1 : The dyestuff from diazotised *o*-anisidine and the ethyl ether of the glycine of 1 : 8-aminonaphthol-3 : 6-disulphonic acid, combined in alkaline solution, dyes wool in clear violet shades which become redder and faster on chroming. Example 2 : Benzidine is tetrazotised and combined first with one mol. of salicylic acid and then with the ethyl ether of the glycine of 2 : 8-aminonaphthol-6-sulphonic acid. The product dyes cotton in brown shades. Example 3 : *p*-Aminoacetanilide is diazotised and combined with Cleve's acid, the product diazotised and combined with the ethyl ether of the glycine of 2-amino-5-naphthol-7-sulphonic-acid. The dyestuff may be modified by interposing a second mol. of Cleve's acid, thus giving rise to a trisazo compound. Example 4 : The intermediate compound obtained by combining diazotised 1 : 8-aminonaphthol-3 : 6-disulphonic acid with α-naphthylamine is diazotised and combined with the ethyl ether of 2-glycine-5-naphthol-7-sulphonic acid. The dyestuff dyes cotton in blue shades which are fast to light.—J. C. C.

Azo dyestuffs derived from halogenated naphthol sulphonic acid ; Manufacture of ——. H. Levinstein and Levinstein, Ltd. Fr. Pat. 425,389, Jan. 30, 1911. Under Int. Conv., June 23, 1910.

Dyestuffs which are extraordinarily fast to light and very fast to acids and alkalis are obtained by combining diazo compounds with 2-chloro-5-naphthol-7-sulphonic acid. Example 1 : The diazo compound from aminoazobenzenesulphonic acid when combined with the above acid furnishes a dyestuff which produces clear red shades on wool or cotton. Example 2 : α-Naphthylamine-3 : 6-disulphonic acid is diazotised and combined with *p*-xylidine and the product is diazotised and combined with the halogen acid. The dyestuff thus obtained dyes cotton in Bordeaux shades. Example 3 : 1 : 8-Aminonaphthol-3 : 6-disulphonic acid is diazotised and combined with α-naphthylamine. The product, when diazotised and combined as above gives rise to a dyestuff which produces blue shades on cotton. Example 4 : Metanilic acid is diazotised and combined with α-naphthylamine and the resulting amino-compound diazotised and combined as in the previous examples. The product dyes cotton in violet shades. The corresponding bromo-acid may also be used. —J. C. C.

Colouring matters of the anthracene series ; Manufacture of ——. Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 12.264, June 5, 1908. Addition to Eng. Pat. 10.324, May 2, 1906.

See Addition of May 29. 1908, to Fr. Pat. 365,920 of 1906 ; this J., 1908, 1107.—T. F. B.

Anthracene dyes ; Green —— and process of making the same. H. Wolff, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 995,936, June 20, 1911.

See Fr. Pat. 396,583 of 1908 ; this J., 1909, 596.—T. F. B.

Azo dyestuffs and their production. H. Levinstein, J. Baddiley, and Levinstein, Ltd., Blackley. Eng. Pat. 14,448, June 15, 1910.

See Fr. Pat. 425,388 of 1911 ; preceding.—T. F. B.

Azo dyestuffs ; Intermediate products for the manufacture of ——. and their production. H. Levinstein, J. Baddiley, and Levinstein, Ltd. Fr. Pat. 425,387, Jan. 30, 1911. Under Int. Conv., May 13, 1910.

See Eng. Pat. 11,877 of 1910 ; this J., 1911, 738.—T. F. B.

Triphenylmethane dyestuff ; Blue ——. A. Stock and F. Heim, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 995,494, June 20, 1911.

See Eng. Pat. 12,130 of 1910 ; this J., 1910, 1297.—T. F. B.

Sulphurised vat dye of the anthraquinone series. W. Herzberg and W. Bruck, Schöneberg, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 996,485. June 27, 1911.

See Fr. Pat. 420,530 of 1910 ; this J., 1911, 351.—T. F. B,

Yellow dyestuffs for wool ; Process for making ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 424,993, Jan. 18, 1911. Under Int. Conv., Sept. 23, 1910.

See Eng. Pat. 2233 of 1911 ; this J., 1911, 610.—T. F. B.

Polyazo dyestuffs for unmordanted cotton ; Process for making ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 425,090, Jan. 21, 1911. Under Int. Conv., March 19. 1910.

See Ger. Pat. 232,790 of 1910 ; this J., 1911, 611.—T. F. B.

Vat dyestuffs and process for producing them. Farbenfabr. vorm. F. Bayer und Co. Second Addition, dated Jan. 6, 1911, to Fr. Pat. 418,344, July 18, 1910. Under Int. Conv., Jan. 17, 1910.

See Eng. Pat. 2105 of 1910 ; this J., 1910, 1449.—T. F. B.

Vat dyestuffs and process for producing them. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 425,677, Feb. 6, 1911. Under Int. Conv., Feb. 18, 1910.

See Eng. Pat. 5670 of 1910 ; this J., 1911, 483.—T. F. B.

Sulphurised dyestuffs ; Process for producing brown vat-dyeing ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 425,411, Jan. 30, 1911.

See Eng. Pat. 1729 of 1911 ; this J., 1911, 612.—T. F. B.

Disazo dyestuffs especially suitable for the preparation of lakes ; Process for making ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 425,448, Jan. 31, 1911.

See Eng. Pat. 1730 of 1911 ; this J., 1911, 677.—T. F. B.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Cellulose ; Electrolytic decomposition of ——. R. Oertel. Chem.-Zeit., 1911, 35, 713.

The author has submitted cellulose to the action of the electric current in a neutral electrolyte of potassium chloride. With suitably chosen current strength and duration of treatment, varying with the dimensions of the bath and the electrodes, about two-thirds of the cellulose goes into solution. The remaining one-third is soluble in 10 per cent. sodium hydroxide ; the fibrous structure is still retained, though the fibres are not so strong as in the original cellulose. The electrolysis can also be conducted so that the residue forms with water a milky colloidal solution, which will pass through moderately fine filter paper. This solution is not changed on heating or on standing for a month, but a gel is precipitated by acids or alcohol which is flocculated on boiling. This precipitate is soluble in 10 per cent. sodium hydroxide and in strong ammonia. These phenomena are probably to be attributed to the formation of a new oxycellulose.—W. H. P.

Papermaking pulps ; The microscopy of certain [tropical] ——. T. F. Hanausek. Papierfabrikant, 1911, 9, (Fest- u. Auslandsheft), 38—43.

The author gives a description with microphotographs of the morphological characters of papermaking pulps prepared from certain tropical materials. The cellulose of *Albizzia moluccana*, a tree of tropical Asia, resembles the general type of leaf-wood pulps with certain characteristic differences. The fibres are short and thin-walled, and the papermaking value of the pulp is not very great. The cellulose of the Himalayan spruce (*Picea Morinda*) closely resembles that of European species. The phenomena observed when the fibres are attacked by cuprammonium solution are characteristic, also the occurrence of abundant strings of fairly well preserved parenchyma cells. This pulp appears to be equal in papermaking value to European spruce pulp. The author has examined pulp manufactured in Formosa from bamboo by the sulphite process. Some of the fibres showed the presence of enveloping sheaths, similar to those observed on Japanese kodzu fibres ; these sheaths are generally absent from bamboo fibres prepared by other processes. The cellulose components of sugar cane bagasse pulp are minutely described and illustrated. Lastly the author deals with rice straw pulp (see this J., 1911, 352) and points out that the field straw yields an inferior pulp to the paddy straw, owing to the greater abundance of non-fibrous cells in the former. Bagasse fibres are readily distinguished from straw pulp, but possess a certain resemblance to bamboo. Rice straw is characterised by buckle-shaped projections on the middle of the epidermal cells; small bristles from the leaf are also found.—J. F. B.

Parchment papers ; Influence of wood-cellulose on the strength of ——. C. Bartsch. Papierfabrikant, 1911, 9, (Fest- u. Auslandsheft), 23—24.

Parchment papers are no longer always prepared from a pure cotton-fibre paper ; many samples are met with which contain up to 45 per cent. of wood cellulose, generally soda wood pulp. The author has tested a number of these papers in order to ascertain whether the use of wood cellulose has any appreciable effect on their mechanical properties. The results however showed such wide variations from one sample to another, that it is impossible to draw any definite conclusions as to the influence of wood cellulose. Taking an average, it would appear that, whilst the tensile strength shows practically no diminution in the case of papers containing wood cellulose, the tensile elongation is in most cases sensibly lower than with pure cotton papers. The results for the folding and rubbing tests were most erratic. Incidentally it is remarked that the method proposed for the separation of the fibres of parchment papers prior to microscopic examination (see this J., 1911, 414) is equally applicable for the preparation of the fibres of "vulcanised fibre" for analysis. In the latter case, however, it is advisable to split up the thick board into its component layers by prolonged steeping in hot water or sodium hydroxide, and to operate on only a single layer in the manner described (*loc. cit.*)—J. F. B.

Soda cellulose ; "Pine oil" obtained in the manufacture of ——. Hilding. Papierfabrikant, 1911, 9, (Fest- u. Auslandsheft), 81—82.

In the digestion of pine wood (*P. sylvestris*) by the sulphite process a soap is skimmed off the surface of the black liquors and after decomposition by acids yields a thick oil which is recovered at certain Swedish pulp mills under the name of "fluid resin" or "*Taloel.*" The oil which separates on acidification is dark brown in colour, whilst matters derived from the lignin of the wood are precipitated as a granular sediment. After purification by washing, the oil deposits a copious mass of crystals. The author has submitted the oil to distillation under reduced pressure and an analysis of the distilled product by Twitchell's method gave numbers indicating 53·1 per cent. of fatty acids and 46·9 per cent. of resin acids ; it was free from phenolic constituents. The oily portion of the distillate was separated by pressure from the crystalline mass of resin acids and subjected to fractional distillation under a pressure of 15 mm. There were thus separated and identified : oleic and linolenic acids. In another series of distillations palmitic acid was also isolated ; this acid appears to be most abundant in the first fractions. An examination of the resin acids, after washing with light petroleum and crystallisation from alcohol, indicated that the product was a mixture ; it showed an acid value of 186·6, was dextro-rotatory and melted from 156° to 180° C. The fatty acids exist in the wood in the form of glycerides, and the ether-alcoholic extract of the sap-wood showed the reactions of glycerol ; the decomposition of these fats is held to account for the sharp acrolein odour of wood-tar. In the case of pine wood, fats are chiefly present in the sap-wood, whilst the heart-wood contains chiefly resins. Fats are only present in the winter, at which season most of the wood used for pulp manufacture is felled ; in the spring the fat is converted into starch. A crystalline substance which is very sparingly soluble in alcohol may be extracted by the direct treatment of the soap from the digestion liquors ; this substance is a phytosterol, m. pt. 133·5° C. Spruce wood contains less fat than pine wood ; it also probably contains a phytosterol. By the extraction with ether of the sap-wood of pine felled in the winter, the author obtained 0·3—1·5 per cent. of fats ; the quantity of phytosterol probably does not exceed 0·05 per cent.—J. F. B.

PATENTS.

Waterproofing fabrics; Method of ——. P. O. Keilholtz, Baltimore, Md. U.S. Pat. 994,931, June 13, 1911.

THE fabric is heated under a sufficient pressure to expel all moisture and contained air without injuring the material and is then immersed whilst hot in a bath of hot insulating fluid (which does not solidify at ordinary temperatures) and the whole is allowed to cool to a temperature at which the surface tension of the fluid and fabric reaches the maximum. The fabric is then removed from the bath. This process is specially applicable to the treatment of fabrics made of hygroscopic material to render them non-hygroscopic for electrical insulating purposes.—P. F. C.

Hair, animal hair, nails and other horn-like and gelatinous substances occurring in "schappe" silk and in silk waste in general; Process for destroying ——. C. Seignol. Second Addition, dated Mar. 21, 1910, to Fr. Pat. 416,063, July 28, 1909 (this J., 1910, 1371; 1911, 79).

ON account of its high sulphur content and slight alkalinity, fused or calcined sodium sulphide is the most suitable alkali sulphide for use in the process described in the principal patent.—P. F. C.

[*Cellulose acetate*] *Coverings for bottles, jars or other vessels.* The Viscose Development Co., Ltd., and J. R. Morford, London. Eng. Pat. 14,194, June 11, 1910.

A GLASS test-tube is dipped into a solution of cellulose acetate in glacial acetic acid, then raised, drained and afterwards inverted until the viscous solution has distributed itself evenly over the external surface of the tube. The tube is next plunged into water. This causes the solution to coagulate rapidly to a transparent film containing a large proportion of water of hydration and if the capsule thus formed is withdrawn from the tube, then drained from superfluous moisture and placed over the neck of the vessel to be sealed, it contracts by reason of the loss of its water of hydration and finally forms a tight transparent seal. The cellulose acetate can be replaced by any other cellulose ester which is soluble in a liquid perfectly miscible with water.—P. F. C.

Threads from cellulose; Production of ——. J. Hübner, Cheadle Hulme, Cheshire. Eng. Pat. 14,559, June 16 1910.

THE filtered cellulose solution is delivered through a pipe into an open vessel in which the level of the solution is kept constant. From this vessel it flows by gravity down a pipe to a spinning nozzle arranged in the upper part of a funnel open at the top, which is kept full to overflowing with a coagulating liquid. The newly formed threads pass down the funnel, out of the fine opening at the end of it, over tension rollers into coagulating and washing troughs and are finally wound on bobbins. The pipes delivering the cellulose solution to the nozzle and the coagulating liquor to the funnel are provided with stopcocks for regulating the flow. In order to avoid unnecessary friction, the supply pipes down which the cellulose solution flows are of a constant diameter which is approximately that of the cap of the spinning nozzle.—P. F. C.

Cellulose; Treatment of solutions of ——. Soc. anon. pour la Fabr. Soie de Chardonnet. Eng. Pat. 1436, Jan. 19, 1911. Under Int. Conv., Aug. 10, 1910.

THE double xanthate of cellulose and a base, such as sodium, known as viscose, is brought into "a molecular condition" suitable for spinning, by incorporating with it a coagulating substance, such as ammonium sulphate, in a small proportion, sufficient to bring it to the desired condition without causing coagulation.—B. N.

Cellulose esters; Preparation of solutions of ——. A. Wohl, Danzig-Langfuhr, Germany. Eng. Pat. 3139, Feb. 7, 1911. Under Int. Conv., Mar. 12, 1910.

FINELY divided acetyl-cellulose is stirred with methyl formate until it dissolves. The most suitable kinds of acetyl-cellulose for the purpose are those which are soluble in acetone; with these 20 per cent. solutions can be prepared.—P. F. C.

Acidylized-cellulose compounds; Process of producing dyed ——. E. Friedemann, Leverkusen, Germany, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 994,738, June 13, 1911.

A DYED cellulose compound is treated with an acidylizing agent. The treatment of dyed cotton with an acetylating agent is specifically claimed.—P. F. C.

Artificial tissues; Machine for the manufacture of ——. C. Baj, Lyon, Assignor to Comp. Franc. des Applications de la Cellulose, Paris. U.S. Pat. 995,652, June 20, 1911.

A SHEET of a suitable paste, reduced to the required width and thickness by passing it underneath an adjustable scraper, is delivered from a reservoir on to a rotating cylinder which is partly immersed in a coagulating bath. The tissue formed by the coagulation of the film of paste is stripped from the cylinder as soon as it leaves the bath and is led away. The surface of the cylinder successively passes beneath a spray washing device and a suction drying arrangement before it reaches the point at which it receives the sheet of paste.—P. F. C.

Tensile strength of paper, textile fabrics and the like; Apparatus for testing the ——. R. E. Wedgwood, London. Eng. Pat. 13,753, June 7, 1910.

THE piston of a hydraulic or an equivalent cylinder is joined to one of the clamping devices, or is arranged as part of the latter, for ascertaining the breaking stress or tensile strength of the material under test, this being obtained directly from a gauge communicating with the cylinder.—B. N.

Celluloid; Manufacture of non-inflammable materials similar to ——. Verein. Glanzstoff-Fabriken A.-G., Elberfeld, Germany. Eng. Pat. 29,246, Dec. 16, 1910. Under Int. Conv., Nov. 1, 1910.

SEE Fr. Pat. 423,774 of 1910; this J., 1911, 615.—T. F. B.

Cellulose; Process for strengthening ——. X. Eschalier, Villeurbanne, France. U.S. Pat. 995,852, June 20, 1911.

SEE Fr. Pat. 374,724 of 1906; this J., 1907, 821.—T. F. B.

Pyroxylin plastic and method of making same. L. Ach, Assignor to C. F. Boehringer und Söhne, Mannheim-Waldhof, Germany. U.S. Pat. 996,191, June 27, 1911.

SEE Ger. Pat. 214,962 of 1906; this J., 1909, 1270.—T.F.B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Silks; Augmentation of the affinity of dyestuffs for natural and artificial ——. A. Sansone. Rev. Gen. Mat. Col., 1911, **15**, 194—197.

IF natural silk of the *Bombyx mori* is treated in the cold for two or three minutes with 90 per cent. formic acid it rapidly swells, softens and becomes viscous. On washing it gradually returns to approximately its original condition but retains a greater elasticity and, in some cases, a higher lustre after drying. If the silk is allowed to contract during its immersion in the formic acid, a linear contraction amounting to 8—12 per cent. is produced; there is no loss in tensile strength except in the case of low quality schappe silks which are occasionally seriously weakened. Comparative dye trials showed that acid-treated silk has a markedly greater affinity for substantive dyestuffs and for metallic mordants than untreated material. This result was confirmed with acid-treated silk which had been subsequently neutralised with sodium carbonate solution, thus proving that the increased affinity is not produced by free formic acid remaining in the fibre but by a change in the physical nature of the silk. With basic and acid dyestuffs the difference is much less marked. Many artificial silks, viscose silk being prominent amongst them, show a similar change in dyeing properties after a formic acid treatment but an immersion of some hours is necessary to produce the maximum effect.—P. F. C.

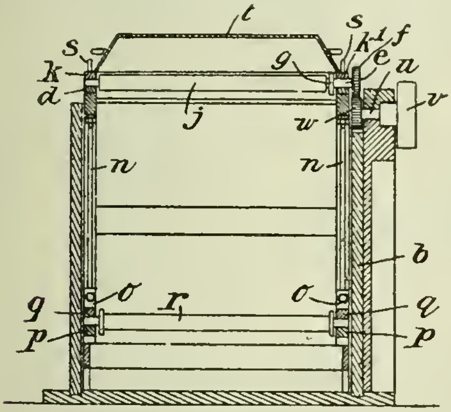
Pyranthrone vat; Colloido-chemical and other observations on the ——. R. Scholl. Ber., 1911, **44**, 1448—1452.

According to the Badische Anilin und Soda Fabrik, Pyranthrone (Indanthrene Gold-orange) gives a pale yellowish cherry-red vat with cold alkaline sodium hydrosulphite and a magenta-red one with a hot solution. Further the dyeings which are not soaped are always of a redder orange shade than those which are soaped. The author finds that both vats contain tetrahydropyranthrone, but that the cherry red colour of the cold vat is due to the presence of pyranthrone which is present in the colloidal condition and escapes reduction in the cold through being adsorbed by some of the magenta-red vat salt. The brightening of the shade of the dyeings in the boiling soap bath is due to oxidation of the dihydropyranthrone which produces the darker shade.—J. C. C.

Patents.

Dyeing and finishing frame. A. Steven, Newtownards, Ireland. Eng. Pat. 14,962, Dec. 15, 1910.

This apparatus comprises a rectangular frame which can be lowered into a vat, *b*. Along the upper side bars of the frame are arranged plates, *d*, provided with recesses which form the lower halves of bearings for the prolonged and reduced ends of a number of rollers, *j*, of square cross-section, the upper halves of the bearings being formed by sliding cover plates, *k*, k^1. One end of each roller, *j*, is connected by means of a rectangular socket or other suitable device with a small shaft, *e*, carrying a spur wheel, *f*, and all these wheels, *f*, are geared into each other. Brackets, *o*, working on slides, *n*, support bearings, *p*, *q*, for the ends of a lower set of circular rollers, *r*, arranged vertically underneath the rollers, *j*. In the side of the vat, *b*, a bearing is fitted supporting a shaft, *u*, which has a driven belt pulley, *v*, at its outer end and at its inner end a driving wheel, *w*, engaging with one of the spur wheels, *f*. The whole machine is provided with a cover, *t*. To work the apparatus each hank or web is placed round one upper and one lower roller and the rollers are then fastened down by the cover plates, k^1, *k* and *q*. The frame is then lowered into the vat and the driving wheel, *w*, engages with one of the wheels, *f*, causing all the upper rollers to rotate, and since the lower rollers are also free to rotate, the hanks are kept moving through the liquor contained in the vat. The machine can also be adapted to dye webs continuously.—P. F. C.



Dry dyeing; Method of ——. R. B. Ransford, London. From L. Cassella und Co., Frankfort-on-Maine, Germany. Eng. Pat. 22,876, Oct. 3, 1910.

The dyebath is prepared by dissolving acid dyestuffs in alcohol, then adding an aliphatic acid (such as highly concentrated acetic, formic or lactic acid) and introducing the solution into a bath of carbon tetrachloride. With certain dyestuffs, especially of the triphenylmethane series an addition of "benzine soap" is of advantage. With such a dyebath dry dyeings of good fastness to light can be obtained. Example—10 parts of Formyl Violet S4B are dissolved in 890 parts of alcohol, 100 parts of formic acid of 100 per cent. concentration are added and the clear solution thus obtained is poured into a mixture of 1950 parts of carbon tetrachloride and 50 parts of saponine. The goods to be dyed are worked in this bath for about 45 minutes at 30°—40° C., are then squeezed off and rinsed in carbon tetrachloride.—P. F. C.

Dyeing with vat dyestuffs. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 425,486, Jan. 25, 1911. Under Int. Conv., Feb. 28, 1910.

The addition of anthraquinone or one of its derivatives to the vat makes it easier to control by facilitating the reduction of the dyestuff. Specially good results are obtained by the addition of anthraquinone to fermentation vats.—P. F. C.

Resist effects in printing upon textile fabrics; Production of ——. The Calico Printers' Assoc., Ltd., Manchester, and E. Bentz, Dinting. Eng. Pat. 16,389, July 9, 1910.

Resist effects are obtained by first printing the bleached material with a resist paste consisting of a suitably thickened "Leukotrope" and subsequently applying to the printed fabric by padding, printing or any other known method, a colour mixture containing a suitable vat dyestuff together with such assistants as are commonly used for its fixation. The fabric is then steamed and finally submitted to the usual after-treatments. To obtain coloured resist effects suitable mordants, metallic oxides or colouring matters may be added to the resist paste. Or, as a modification of the process, the material, previously prepared with an alkaline β-naphthol solution, is printed with a "Leukotrope" resist paste to which has been added a suitable diazo solution, and is then treated with a colour mixture containing a vat dyestuff. The term "Leukotrope" is used to designate certain organic quaternary alkarylammonium compounds amongst which may be specified dimethylphenylbenzylammonium chloride (sold as Leukotrope O or Discharge Base I), and dimethylphenylbenzylammonium hydroxide disulphonate of soda (known as Leukotrope W or Indigo Base W) (see Fr. Pat. 414,937 of 1909; this J., 1910, 1247). Several recipes are given for the preparation of resist pastes and colour mixtures which give good results in practice.—P. F. C.

Dyeing half-woollen goods; Process of ——. M. Becke and A. Beil, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 995,431, June 20, 1911.

See Eng. Pat. 25,999 of 1909; this J., 1910, 1006.—T. F. B.

Dyeing; Process of ——. F. Binder, Mülhausen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 996,396, June 27, 1911.

See Eng. Pat. 14,272 of 1910; this J., 1911, 617.—T. F. B.

Black dyeings on the fibre which can be discharged; Process for producing ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 424,951, Jan. 17, 1911. Under Int. Conv., April 14, 1910.

See Eng. Pat. 2232 of 1911; this J., 1911, 680.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Alkali, etc., works; Forty-seventh annual report on —— by the Chief Inspector. Proceedings during the year 1910, *etc.* Feb. 23. 1911. pp. 115. Price 6d.

During the year, W. S. Curphey has succeeded R. Forbes Carpenter as Chief Inspector. He reports that the total number of works registered in the United Kingdom on December 31st, 1910, was 1434, a net increase of two as compared with 1909; this includes 168 works in Scotland. Of these, 79 are "alkali" works, 9 of which are in Scotland. A still further increase is noted in the number of works in which ammonium sulphate and chloride are manufactured. There was a decided fall in the acidity of the gases from all chimneys, due in great part to the lower acidity averages in the South and South-West of England and in the South Wales and Monmouthshire Districts, where the treatment of sulphide ores is largely carried on. There were no prosecutions during the year; in five cases, however, in which processes had not been registered through ignorance of the requirements, back fees have been claimed in lieu of penalties.

Alkali works showed increasing activity during the year, and, at its close, there appeared to be a good demand for the products of these works. There has also been a very marked increase in the activity of the cement industry since the early months of the year; all available plant has been fully occupied in the South-Eastern District, and the introduction and perfection of the most modern methods is considered to have placed this manufacture once more on a sound basis and in a position to compete successfully with foreign production. With the increase in the length of the rotary kiln, which has been almost doubled since its introduction, both production and combustion have improved, and the discharge from the chimneys, although of greater density, is no more objectionable than that from the older types of kiln plant. Tests of the escaping gases from two cement works showed these to contain a low proportion of acid constituents, with a high proportion of solids. The "dry" or "semi-dry" method of mixing is said to be gaining ground in the South-Eastern District.

Under the head of "Smelting Works," the patents of W. M. Martin for separating complex ores (this J., 1910, 825, 884) are referred to, as being in use at a works in Cornwall. S. E. Linder reports that sodium peroxide, in place of hydrogen peroxide, as an oxidiser for the determination of sulphur dioxide by acidimetric titration, especially where $N/10$ standard solutions have to be employed, has been found quite satisfactory; this substance, in dilute solution, has no effect on the sensitiveness of methyl orange, which is sometimes diminished by hydrogen peroxide, nor does it interfere, when neutralised, with the use of potassium chromate as indicator in titrating with silver nitrate.

There has been a large demand for sulphuric acid throughout the year; this is partly accounted for by the increased number of coke oven works provided with plant for the recovery of tar and ammonia and by the great activity which has prevailed in the tin-plate manufacture. The "intensive" system is being more widely adopted, and, under efficient supervision, the acidity of the escaping gases is kept well within the limit prescribed by law, varying but little from the ordinary practice. The importance of Gay Lussac towers of sufficient capacity is said to be more and more recognised as tending towards regular and economic working, and the "regulator" tower continues to give satisfaction, as also the use of fans to command a sufficient and constant draught. The two catalytic plants in No. 7 District (Eastern and South-Eastern) have been kept fully occupied during the year. The attention of manufacturers is directed to F. Raschig's communicaton to this Society on the chemistry of the lead chamber process (this J., 1911, 166), especially as concerns the possible loss of nitre as nitrous oxide and ammonia. The more stringent limit regarding the acidity of gases passing away from the overheat pan process for the concentration of sulphuric acid, which came into force during the year, in accordance with the Act of 1906, has been complied with. Different types of plant are preferred in different localities for concentrating this acid, according to the character of the acid to be concentrated and the quality required. The Kessler apparatus continues widely in use and in some cases has been modified so as to reduce the large volume of steam accompanying the gases and vapours to the scrubber, and to increase the time available in the scrubber and also the strength of acid obtained. In two new plants the vacuum is by air-jet exhaust in the outlet pipe from the scrubbers, in place of the steam-jet exhaust in front of the scrubbers, and satisfactory condensation is reported. Further extended use has been made of fused silica and of "tantiron" as materials in those plants where stepped series of vessels were employed through which the acid to be concentrated flowed in succession.

The Moritz-Milch type of mixing plant is in use in one manure works and is said to be on the eve of further adoption. The condenser designed by H. Alger, and referred to in last year's report (this J., 1910, 943), continues in use with fairly satisfactory results. There was a marked decrease in the importation of Peruvian guano and a considerable increase in that of sodium nitrate during 1910, the amounts in tons of manure materials for 1908, 1909, and 1910 being:—

	1910.	1909.	1908.
Guano	7,000	20,321	34,417
Mineral phosphates	455,500	451,807	530,177
Sodium nitrate	120,600	90,207	145,724

The exports of ammonium sulphate in 1910 amounted to 284,000 tons, as compared with an estimated home consumption (for all purposes) of 87,000 tons; the corresponding figures for 1909 were 264,000 and 87,000. The amount of ammonia recovered in the United Kingdom (expressed as tons of sulphate) was:—

	1910.	1909.	1908.
Gas works	167,820	164,276	165,218
Iron works	20,139	20,228	18,131
Shale works	59,113	57,048	53,628
Coke oven works	92,665	82,886	64,227
Producer-gas and carbonising works (bone and coal) ..	27,850	24,705	24,024
Total	367,587	349,143	325,228

The reduced increase, as compared with that between 1908 and 1909, is attributed to prolonged strikes which seriously interfered with the expansion which would otherwise have occurred from increased operations in coke oven works. Continued difficulty with regard to the disposal of effluent liquors from coke oven recovery plants by discharge into river courses (see Report for 1909; this J., 1910, 944) has furthered the introduction of a direct process for recovering ammonia from such gases; this consists in depriving the gases of tar and forcing them through sulphuric acid contained in a saturator, after which the gases are led away to be used as fuel in the usual way. Operating in this manner leads to the production of a comparatively small quantity of liquor which can be easily dealt with. A system of ammonia recovery similar in some respects to the above has been introduced into gasworks, the whole volume of gas produced being passed through acid in a saturator and the discharge of effluent liquor avoided, the virgin liquor resulting from the moisture in the coal and the acid liquor employed in the washer being the only water introduced into the process. Weak acid is employed, so that the illuminating power of the gas is unaffected, and, when the contents of the saturator reaches a strength of 40°—50° Tw., the liquor is run off and crystallised after concentrating by the aid of a steam coil; but, the conditions being different in the two classes of works, the recovery plant differs in detail. Advantages of the system are that hydrogen sulphide proceeds along with the crude coal gas to be dealt with in the purifying plant and that there is no necessity for storage and transference of the liquor, which prevents nuisance and loss of ammonia, the latter having been shown in the case of tanks which have a ventilating communication with the atmosphere to amount, through diffusion, in 24 hours, to as much as 3—5 per cent. of the whole quantity exposed. The necessity for bearing in mind this source of error in analytical work, even in the short time required for a direct titration of volatile ammonia, is also pointed out. Examples of this type of plant have been put into operation at small gasworks in Districts Nos. 5 (South Midland and Norfolk) and 6 (South and South-West of England), in the latter at a works where 5,000,000 cb. ft. of gas are made annually and 14 lb. of ammonia per ton of coal carbonised are said to be obtained. Although specially important for small works, the process seems quite suitable for those of much larger size. Continuous lime feed on the liquor stills has been adopted at several works and has resulted in better yields of sulphate, and a reduction in the amount of lime used. The substitution, at two works, of lime for sodium hydroxide has also been advantageous both as to yield and cost. In the "heap" form of oxide of iron purifier, which is now most widely adopted and is considered to have many advantages over the older forms of box or walled purifier, the extent of distributing area provided for the gases, after leaving the pipe conveying them to the purifier and before entering the oxide, must be properly adjusted; if it be too small, there is a tendency to create unnecessary resistance to the passage of the gases and to throw back pressure on the saturator, but, on the other hand, too large an area in proportion to the volume of the gases to be treated tends to local action in the purifier. In a recently erected Claus sulphur recovery plant, the kiln is placed above the main depositing chamber, into which the sulphur vapour passes directly downwards; this is considered a great improvement on the usual design, where the kiln is placed at the end of the chambers. A sheet-lead depositing chamber immediately next the kiln is strongly recommended in place of the usual brick chamber. A plant was erected in 1909 for eliminating hydrogen sulphide from crude coal gas in accordance with W. Feld's patent (this J., 1910, 352), but the process never got beyond the experimental stage and its operation has been discontinued.

Another plant for the mechanical production of bleach has been started in District No. 3A (Widnes, Runcorn, and Liverpool), the lime being hydrated and dealt with under cover until discharged into casks as finished "bleach"; all nuisance from dust is thus avoided.

Great activity prevailed throughout the year in the tin-plate flux works. The means recommended in previous reports (this J., 1909, 702) have been found capable of reducing the amount of escaping hydrochloric acid to well within the prescribed limit, and the great progress made during the year in reducing the escape of acid and metallic fume has proved incidentally of advantage to the manufacturer on account of the value of the recovered flue deposit. Examination of a number of samples of "thick metal" or "slime," the hard brittle material periodically removed from the bottoms of tinning sets, showed the presence of considerable amounts of iron (7—12 per cent.), but no zinc; the alloy being found at the bottoms of the pots, indicates that its separation is probably due to a process of incipient crystallisation.

An attempt to find an alternative for the method of combustion now practised for dealing with any small excess of hydrogen sulphide in those sulphide works in which absorption in lime purifiers is not suitable, led to an investigation by S. E. Linder on oxidation by means of manganese dioxide in presence of air (carbon dioxide being absent); the results show the great influence exerted by the base used to bring about the alkaline condition necessary for the re-oxidation of lower oxides of manganese suspended in water. In the presence of lime, there is little tendency for the manganese oxide to become inert through the formation of manganese sulphide, provided the amount of hydrogen sulphide entering the reaction vessel per minute is kept within a certain limit; if it exceed this figure, the oxide loses colour, but rapidly darkens again on reducing the supply of gas and increasing that of air. The gas would appear to react mainly with the higher oxides of manganese with the production of free sulphur and water :—$H_2S+MnO_2=H_2O+S+MnO$, and only in a secondary degree with the small amount of free lime present in solution. With sodium hydroxide as the base, on the other hand, it is impossible to prevent the formation of manganese sulphide, and revivification of this compound is slow; the conditions are also favourable to the formation of polysulphide and thiosulphate, so that sodium hydroxide is not admissible when free sulphur is the desired product.

The output of arsenious acid in Devon and Cornwall was 2837 tons as compared with 2865 tons in 1909. The question as to the best practicable means of preventing the escape of fume during the extraction of zinc from ores or residues by the distillation method is regarded as still in a condition of experiment. An examination of the deposit which forms on the front of the zinc furnace by the continuous passage of fume from the many retorts set in each furnace, showed the presence of a large proportion of chloride, probably as zinc oxychloride.

Attention is called to the importance of heating tar in properly constructed stills, to the extent required to remove the water and naphtha, before using it for road dressing, in order to avoid nuisance and damage from the volatile products and also serious pollution of water courses and streams.

In Scotland the number of works registered has decreased by one, as compared with the previous year. 70,640 tons of bones and phosphates were dissolved, as compared with 53,464 tons in 1909. The manufacture of sulphuric acid (including that by the contact process) has been active during the year, 132,168 tons of pyrites being burned, as compared with 116,395 tons in 1909. Two fatal accidents are reported at these works, one due to shunting operations and the other to an outburst of corrosive fume. The water-spray system of supplying moisture to sulphuric acid chambers has given satisfaction where it is in use. The attention of acid manufacturers is called to the advantages not only of regular tests of the exit gases, but of estimating separately the sulphuric and sulphurous anhydrides and oxides of nitrogen; valuable information is thus afforded at times of incipient disorganisation. The production of ammonium sulphate exceeded that for 1909 by 4205 tons, and the "direct" system of recovering ammonia from coke oven gases has been put into successful operation during the year. A marked improvement in the quality of the salt has been observed when the tar employed in skimming operations is inserted through the acid charge-hole in rear of the apron, instead of in front of the apron as usual; this seems to render the separation of arsenic sulphide more nearly complete. The heap system in place of box purifiers has not as yet made much progress in Scotland, and, in this connection, it is noted that a number of small box purifiers has been found superior to a few large ones. Under the head of tar distillation mention is made of a works "where the tar stills are gas fired and vertical in shape," the "man-hole being in the centre of the base of the still, instead of above as usual," and, from the point of view of safety and comfort in cleaning and facility of ventilation, it is considered desirable that this pattern should be more generally adopted. 170,793 tons of pitch were produced, as compared with 168,405 tons in 1909. The total shale mined in the United Kingdom during 1910 was 3,130,280 tons, and the yield of ammonium sulphate per ton of shale, 42·3 lb., the corresponding figures for 1909 being 2,967,017 and 43·1.—F. Sodn.

Acetic acid; The purification and properties of ——. W. R. Bousfield and T. M. Lowry. Chem. Soc. Proc., 1911, 27, 187—188.

Acetic acid may be purified by distilling from potassium permanganate, using a still-head to retain acids of higher boiling point, and then freezing to remove the water. The acetic acid was distilled in presence of a little water, but the quantity was not sufficient to carry over the higher homologues before the acetic acid as a minimum boiling mixture. The permanganate method of purification had the advantage that there was no real risk of producing any acetic anhydride; the acid was distilled while still moist, and was subsequently dried by freezing. The purified acid melts at 16·60° C., and has a density of 1·05148 at 18°/4°, and 1·04922 at 20°/4° C.; its maximum conductivity when mixed with water is $\kappa_{18} = 0{\cdot}001641_5$.

Ammonia synthesis under pressure; Rôle of iron as catalyst in ——. K. Jellinek. Z. anorg. Chem., 1911, **71**, 121—137.

Experiments were made on the production of ammonia by heating mixtures of nitrogen and hydrogen (1 : 3) in contact with wrought iron as catalyst at 870° C. and under a pressure of 30—60 atmos. The apparatus consisted of a steel cylinder enclosing an electrically heated tube of fireclay, packed round with magnesia, and an inner gas-tight reaction tube of porcelain. The iron was employed in the form of filings, turnings, or rods, and during each experiment the pressure was maintained constant for a time (several hours) and was then gradually reduced, without lowering the temperature; the ammonia in the issuing gas was absorbed by standard acid, the tube being finally rinsed out with the gas mixture at atmospheric pressure. The results, which are given in tabular form, show that most of the ammonia formed must be dissolved or adsorbed by the iron and is only slowly evolved as the pressure is reduced. Since the partial pressure of the ammonia remains fairly constant during this process, its concentration in the issuing gas increases as the total pressure falls, and it may far exceed the equilibrium if the gas be withdrawn from the heated region more rapidly than the conditions of equilibrium permit.—F. Sodn.

Ammonia; Action of the electric discharge on moist and dry ——. A. Besson. Comptes rend., 1911, **152**, 1850—1852.

By the action of the electric discharge, ammonia which had been dried by means of fused potash, was decomposed partly into nitrogen and hydrogen, and a very small quantity of a substance, having reducing properties, possibly hydrazine, was produced. With a mixture of ammonia and water vapour, hydroxylamine was formed. A mixture of ammonia and oxygen under the influence of the electric discharge did not yield any hydroxylamine, but considerable quantities of ammonium nitrite and nitrate were formed.—A. S.

Calcium fluoride; Plasticity of ——. R. Cohn. Z. angew. Chem., 1911, **24**, 1209.

Calcium fluoride, precipitated by the addition of calcium hydroxide or carbonate to a very dilute aqueous solution of hydrofluoric acid, and ground, after drying by exposure to the air or by gently heating, forms a plastic material with 20—25 per cent. (not more) of water, in a similar manner to barium sulphate (this J., 1911, 682).

A. Sbld.

Ferroso-ferric and ferrous oxides. S. Hilpert and J. Beyer. Ber., 1911, **44**, 1608—1619. (See this J., 1910, 1154.)

Attempts to obtain pure magnetic iron oxide and pure ferrous oxide by reducing ferric oxide with hydrogen or carbon monoxide having proved unsuccessful, a mixture of hydrogen and water vapour was tried. The hydrogen was passed through water contained in potash-bulbs which were immersed in a water-bath whose temperature was controlled by a thermostat. It was thus possible to maintain over the iron oxide a partial pressure of oxygen corresponding to every stage in the reduction of ferric oxide to metal. The iron oxide was contained in a porcelain boat and heated in a combustion tube, a copper spiral being placed in front of the boat. The products of the reduction were allowed to cool in a current of pure nitrogen, and were then weighed and the total and the ferrous iron determined by titration. Heating for two hours at 300°—400° C. with less than 4 per cent. of water vapour in the reducing gas always resulted in a mixture of oxides and metal, but with over 4 per cent. of water vapour the reduction stopped at the magnetic oxide. The best conditions for the preparation of the pure magnetic oxide are to have the water at 30° to 50° C. and the furnace at 400° C. 10 grms. of ferric oxide are wholly converted under these conditions in about 5 hours. When it was attempted to continue the reduction from this stage by decreasing the amount of water vapour, metallic iron began at once to be formed. By using higher temperatures it was found possible to obtain products containing high percentages of ferrous oxide, but that which most nearly approached pure ferrous oxide still contained 1·5 per cent. of ferric oxide. Attempts to produce pure ferrous oxide by heating reduced iron in atmospheres of pure water-vapour and of a mixture of hydrogen and water-vapour also failed. Comparative magnetic permeability tests were made by the ballistic method on the products of reduction having compositions intermediate between the magnetic oxide and ferrous oxide. In each case 5 grms. of the powder were taken, contained in a glass tube. The permeability was constant for samples containing up to 66 per cent. of ferrous oxide, then fell as the amount of ferrous oxide rose until with 82 per cent. it became nil. A mixture containing 10 per cent. of the magnetic oxide and 90 per cent. of alumina, however, gave almost the theoretical value, thus proving that the result obtained was not due to the powdered condition of the material. The authors consider that both the chemical and magnetisation tests point to the existence of solid solutions of ferrous oxide and the magnetic oxide.

—T. St.

Lead oxides; Action of potassium tartrate on ——. F. C. Krauskopf. J. Amer. Chem. Soc., 1911, **33**, 943—947.

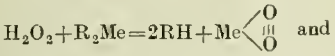
The solubility of litharge in solutions of normal alkali tartrates and the apparent insolubility of red lead and orange lead in the same solvents seemed to indicate a mode of determination of the amount of litharge in samples of red lead and orange lead. It was found, however, that both minium and lead dioxide are appreciably soluble in solutions of normal tartrates. When minium or lead dioxide dissolves in potassium tartrate solution no evolution of oxygen occurs. When lead dioxide dissolves, an oxidation of the tartrate occurs with concomitant precipitation of lead carbonate, while red lead dissolves without appreciable oxidation of the tartrate. Red lead is not reduced to litharge before dissolving.—R. C. P.

Lead acetate industry in Germany. Badermann. Z. angew. Chem., 1911, **24**, 1211—1212.

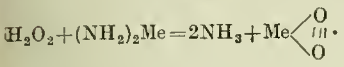
The German lead acetate industry is stated to be in a very depressed state, owing to the reduced demand for calico printing and dyeing due to the extended use of coal tar dyestuffs, and also to the competition in the British market of a new factory at Schiedam, Holland. The annual production of white acetate is estimated at 2600 metric tons. The selling price per 100 kilos. is given as M. 43—45 for home consumption, and M. 40—41 for export (21s. 5d.—22s. 5d. and 19s. 11d.—20s. 5d. per cwt. respectively) which barely covers the cost of production, the raw materials costing M. 34.6 (17s. 3d. per cwt.). The export of white acetate amounted in 1909 to 1677 metric tons, of which Great Britain took nearly a third; the imports (under a nominal duty of M. 1 per 100 kilos. or 6d. per cwt.) are now practically *nil.* The current price of brown acetate is given as M. 20—25 per 100 kilos. (9s. 11d.—12s. 5d. per cwt.); it is only made in small quantities and exported.—A. Sbld.

Zinc peroxite [peroxide] (moloxide, peroxidate), $ZnO_2\frac{1}{2}H_2O$, and a general method for the preparation of peroxites. E. Ebler and R. L. Krause. Z. anorg. Chem., 1911, **71**, 150—165.

Peroxites ("the true salts of hydrogen peroxide") of definite composition are obtained by the action of anhydrous ethereal hydrogen peroxide solution on the metal alkyl compounds or on the metal amides [Me=metal], in accordance with the equations :

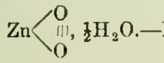


$$H_2O_2+R_2Me=2RH+Me\Big<\!\begin{array}{c}O\\ \vert\vert\vert\\ O\end{array}$$ and



$$H_2O_2+(NH_2)_2Me=2NH_3+Me\Big<\!\begin{array}{c}O\\ \vert\vert\vert\\ O\end{array}.$$

The method has been applied to the preparation of zinc peroxite as follows :—30 grms. of 30 per cent. hydrogen peroxide were shaken with 120 c.c. of ether and the ethereal extract was dried by means of anhydrous sodium sulphate ; the dry solution, containing 2·3 grms. of hydrogen peroxide, was quickly filtered and then added slowly to a solution of 5 grms. of zinc ethyl in 300 c.c. of dry ether, kept cool by ice, when a white precipitate of zinc peroxite was produced ; this was washed with dry ether, in absence of air, and dried *in vacuo* over sulphuric acid. The product, which evolves oxygen on heating, is hydrolysed very slowly by cold water, and yields hydrogen peroxide with dilute acids, has assigned to it the formula,



$$Zn\Big<\!\begin{array}{c}O\\ \vert\vert\vert\\ O\end{array}, \tfrac{1}{2}H_2O.$$

—F. Sodn.

Aluminium sulphide. W. Biltz and F. Caspari. Z. anorg. Chem., 1911, 71, 182—197.

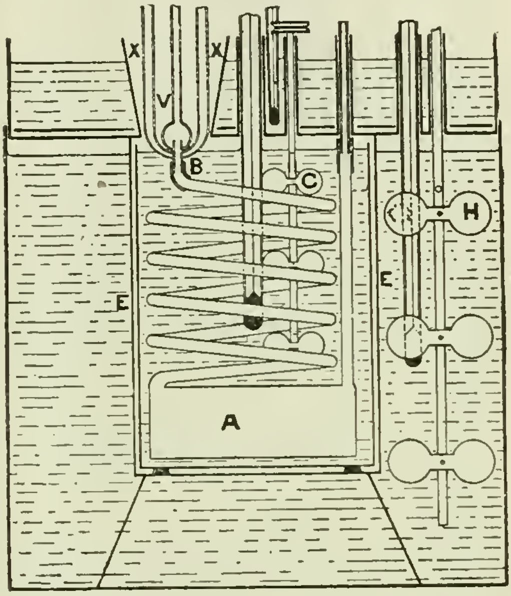
Aluminium sesquisulphide (Al_2S_3) may be prepared in a state of purity by subliming the crude product, obtained from aluminium and sulphur by the aluminothermic method (see Fonzès-Diacon, this J., 1900, 667). The pure substance forms a mass of white felted needles, resembling asbestos, m.pt. 1100° ± 10° C., and sp. gr. about 2·02 ; sublimation is observed at the melting point. It is readily hydrolysed by water, giving the oxide or hydrated oxide, but contact with a slightly moist medium leads to the formation of intermediate products composed of sesquisulphide and oxide. The crude sesquisulphide, obtained as above, contains a small amount of the monosulphide (AlS), and the proportion may be increased by very strong heating (*e.g.*, at 2100° C.). The sesquisulphide is isomorphous with alumina.—F. Sodn.

Rare earths ; The —— considered with special reference to the thorium industry. C. R. Böhm. Z. angew. Chem., 1911, 24, 1203—1209.

A lengthy summary of the literature of the rare earths is given (see this J., 1906, 495) and their uses and importance are discussed. Zirconia, which is now more easily obtained from the native Brazilian zirconia than from zircon (see this J., 1910, 150, 349, 491), is utilised in pottery, enamels, arc lighting, and in Röntgen ray therapeutics, and a great future for it is predicted. For incandescence gas lighting, however, it cannot displace thoria, as thorium nitrate gives the most coherent and resistant product. This is ascribed to its property of yielding a foam-like mass on heating, which can be increased by the addition of about 2 per cent. of sulphuric acid before evaporating the solution. The formation of a voluminous and finely divided ash serves as a ready technical test of the quality. Thorium nitrate is specially suitable for the production of mantles with cotton and ramie fibres, but its property of swelling renders it less suited for use with artificial silk ; in the latter case ammonia or other alkali is added to the impregnating liquid, or the impregnated material is treated with hydrogen peroxide. Ceria is the most easily obtained of the rare earths ; it constitutes about 50 per cent. of the considerable quantity of waste product arising in the thorium industry. Ceria is also utilised for incandescence lighting. Fair quantities of yttria from gadolinite and of zirconia from zircon were used in the manufacture of Nernst lamps prior to the introduction of the metallic filament lamps.
—A. Sbld.

Heat of evaporation as applied to water ; Determining ——. T. W. Richards and J. H. Mathews. J. Amer. Chem. Soc., 1911, 33, 863—888.

Previous methods of determining the heat of evaporation have proved unsatisfactory through loss of heat by radiation from the calorimeter during the considerable time required in conducting the determination. This is obviated by surrounding the calorimeter with an annular vessel containing dilute alkali, and raising its temperature to keep pace with that of the calorimeter by the addition, as requisite, of small portions of sulphuric acid. A specially constructed electric vapouriser generates steam, which is conducted through a worm cooled by water in the calorimeter ; and the water-values of the parts of the apparatus are carefully determined. The construction of the apparatus can be best understood from the annexed figure.



The vapouriser, V, is set within a large hole, X, X, in the cover. At B is attached the condenser, A, immersed in water contained in the calorimeter. Between the jacketing vessels, E and F, is dilute alkali, into which sulphuric acid is dropped. C is the stirrer within the calorimeter, H one in the outside vessel.

The heat of vapourisation of a true gram of water was found by this method to be 538·9 cal. $_{21}$° or 2·251 kilojoules per gram. A gram molecule therefore requires 9·707 cal. $_{21}$° or 40·54 kilojoules, when the vapourisation is conducted at 100° C. (1 cal. $_{21}$°=4·177 kilojoules).—R. C. P.

Hydrogen ; Production of —— from water-gas. A. Frank. J. Gasbeleucht., June 10, 1911.

The author has recommended (this J., 1911, 746) that plant for the production of pure hydrogen and other gases by cooling and liquefaction should be installed at gas-works. In addition to the applications of such gases previously given (*loc. cit.*) the following are also mentioned. Nitrogen would be useful as an inert gas in plant for storing and transporting inflammable liquids such as petroleum products. The oxyhydrogen flame is already used as a source of heat in the manufacture of quartz glass apparatus and this use is likely to develop considerably.—A. S.

Arsenic ; The allotropic varieties and the melting point of ——. P. Jolibois. Comptes rend., 1911, 152, 1767—1769.

Three allotropic forms of arsenic have been described by Engel (Comptes rend., 96, 497 and 1314) namely :—Yellow arsenic which is very unstable at ordinary temperatures ; the mirror-like variety obtained by cooling arsenic vapour ; and crystalline or grey arsenic which is the stable form of the metalloid. Having compared, by thermo-analytical methods, the behaviour of the mirror-like variety with that of chemically prepared arsenic (obtained by precipitating, with stannous chloride, a solution of arsenious anhydride in hydrochloric acid), the author confirms the observation of Engel that these two substances are identical. From experiments upon grey arsenic the author concludes that this variety of the metalloid is stable at all temperatures up to 850° C., its melting point—as determined by two different methods—being 850° C.±10°. Mirror-like arsenic is unstable at all temperatures and is transformed into the grey variety at about 280° C.—W. E. F. P.

Sulphur-phosphorus compounds. II. Syntheses with yellow phosphorus. J. Mai. Ber., 1911, **44**, 1725—1727. (See this J., 1911, 684.)

20 grms. of naphthalene were heated to 110° C. in an Erlenmeyer flask and a cold saturated, filtered solution of 3 grms. of phosphorus and 5·2 grms. of sulphur in carbon bisulphide was added. The temperature was then increased slowly to about 195° C., the flask being fitted with a reflux condenser. On cooling, tetraphosphorus heptasulphide, P_4S_7, crystallised out: it was washed repeatedly with carbon bisulphide and then with benzene and light petroleum spirit. The yield was 6—7 grms. Tetraphosphorus decasulphide, P_4S_{10}, was prepared in a similar manner, using 4 grms. of phosphorus, 13 grms. of sulphur, and 35 grms. of naphthalene. The naphthalene may be replaced by xylene. Attempts to prepare tetraphosphorus trisulphide, P_4S_3, in a similar manner proved unsuccessful.
—A. S.

Boron selenide; Preparation of —— from iron and manganese borides. J. Hoffmann. Chem.-Zeit., 1911, 35, 713.

If iron boride be treated with selenium vapour a porous mass similar to iron sulphide is formed and also a yellowish gray substance which is easily identified as boron selenide, since it reacts readily with water to give boric acid, hydrogen selenide and a red precipitate of selenium. The reaction of iron boride with dry hydrogen selenide is similar but requires a much higher temperature and can scarcely be carried out in glass vessels. Manganese boride reacts readily with selenium vapour. The product which is homogeneous yellow to yellowish green, reacts violently with water forming hydrogen selenide, boric acid, red selenium, and a residue very similar to manganese sulphide (probably impure manganese selenide). With hydrogen selenide the reaction is similar to that of iron boride. It is probable that the reaction of sulphur and selenium with iron and manganese borides (which are solid solutions, see this J., 1911, 627) is confined to borides with composition between Fe_2B and FeB, or with lower boron content than Mn_2B.—W. H. P.

Electrode potential in the electrolytic production of chlorine and alkali. Sacerdoti. *See* XI.

Orthophosphoric acid as a dehydrating catalytic agent. Part I. Condensation of acetone. Neogi. *See* XX.

Use of sodium chloride in alkalimetry. Feld. *See* XXIII.

Sodium nitrate production and consumption. W. Montgomery and Co. June 30, 1911. [T.R.]

The world's consumption of sodium nitrate for the twelve months ended June 30, 1911, was 2,331,000 tons against 2,242,000 in 1909—1910, an increase of 89,000 tons, or 4 per cent., of which quantity:—

Europe absorbed	1,575,000	tons against	1,530,000 tons
United Kingdom	129,000	,, ,,	118,000 ,,
United States	542,000	,, ,,	516,000 ,,
Other Countries	85,000	,, ,,	78,000 ,,

Production during the same period (estimating that for June at 4,650,000 quintals) was nominally 54,400,000 quintals against 53,046,000 for the preceding twelve months, but effectively, perhaps not more than 53,800,000 quintals, or 2,437,000 tons, for about this time the revision of stocks in Chili usually reveals the fact that local consumption and over-estimates from month to month accounts for 500,000 to 800,000 quintals. To-day the nominal stock in Chili is, on the above estimate of June production, 14,300,000 quintals against 13,000,000 at same date last year.

Shipments from South American ports during the twelve months, June 30, 1910, to June 30, 1911, were 2,314,000 tons, compared with 2,291,000 tons in 1909—1910.

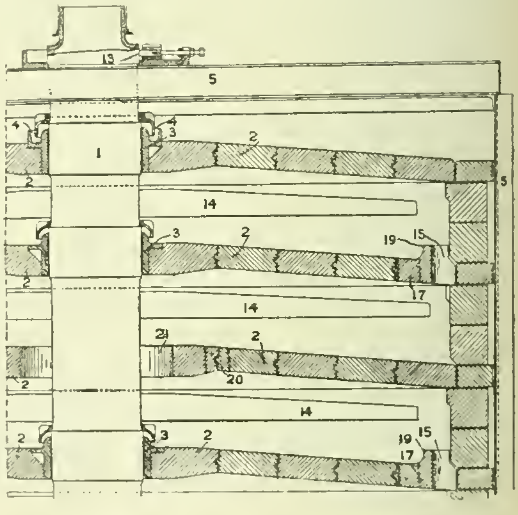
Canadian asbestos. Ch. of Comm. J., July, 1911. [T.R.]

Canada produces 82 per cent. of the world's supply of asbestos. The companies working asbestos quarries and factories in Canada are capitalized at $24,290,000. In 1880 only 380 tons of asbestos were produced in the Dominion, valued at $24,700; in 1909 the output was 63,300 tons, valued at $2,300,000. In 1909, 2,000 men were employed in the industry, and received wages amounting to $1,350,000. In the Black Lake quarries, in the Province of Quebec, there are 45,000,000 tons of asbestos rock in sight. The Russians are the only real rivals as regards extent of asbestos resources, but are heavily handicapped by the cost of transportation of £7 to £8 per ton from the Russian mines to London. The asbestos slate or shingle industry is being developed by the plants in Canada, and predictions are made that in a short time 75 per cent. of all the asbestos produced in the Canadian quarries will be used for asbestos shingles. The asbestos-slate business is only five years old, but during that time the demand for this article has increased enormously, and large factories are being established to supply the demand for this new roofing material.

Patents.

Pyrites roasting; Vertical rotatory furnaces for ——. J. Parent. Fr. Pat. 424,269, Dec. 13, 1910.

The furnace consists of a cylindrical metal casing, 5, divided into a number of superimposed chambers composed entirely of jointed refractory brickwork, 2, which slopes slightly towards the outside of the furnace. Down the centre of the furnace passes a hollow iron or steel axle, 1, which permits of internal cooling by air or water and to which arms, 14, with raking blades are attached so as to operate in each of the brickwork chambers. The material is charged into the apparatus at the top, where it is lit, and is caused to pass alternately to and from the centre,



falling through openings, 17 and 20, into the chamber immediately below at each change of direction. The present patent embodies five claims for improving the efficiency and durability of such a furnace. I. The temperature in the apparatus which is in the region of 800° C. renders friction joints liable to rapid corrosion: this is obviated by allowing about 5 mm. play at the part, 3, where the central rotating shaft passes through the brickwork; the shaft is sand-luted at the top, as shown at 4, and supported below on ball-bearings exterior to the furnace; it is maintained in a vertical position by adjustable rollers, 13, on the top of the furnace. II. The planes of contact on which the bearing balls rotate are arranged to allow the balls to rotate without lateral movement, so minimising friction; an opening is provided between the lower bearing faces for the escape of dust. III. To prevent the carrying forward of dust, the air travelling upwards against the descending mineral has separate openings, 15 and 21, provided for its passage from chamber to chamber, alternately at the axis and at the periphery, the mineral being kept from these and caused to pass through the openings, 17 and 20, by raised portions in the brickwork, 19. IV. The rake arms, 14, are not rigidly attached to the shaft, but are allowed a certain amount of play upwards which allows the rake teeth to mount over any hard fused pieces of mineral without breakage. V. The rake teeth are designed to turn over and forward the material to the openings through which it passes to the chamber below, and, as the material becomes exhausted, they cause the layer to increase in thickness which favours combustion by internal heating of the mass.—B. G. McL.

Phosphorus pentoxide and titanium compounds; Process of making ——. S. Peacock, Chicago, Assignor to American Cyanamid Co., New York. U.S. Pat. 995,897, June 20, 1911.

Titanium oxide is mixed with calcium phosphate or phosphate rock in such a ratio that sufficient calcium oxide will be present in the mixture to react chemically with all the titanium oxide, alumina, ferric oxide and silica that may be present. The mixture is heated to about 1500° C., in order to bring about the necessary reactions, and to drive off the phosphorus pentoxide liberated, the calcium titanate formed being also collected. The amounts suggested are: 2000 lb. of rock, and 692 lb. of titanium oxide.—W. C. H.

Di-ammonium phosphate; Process of making ——. S. Peacock, Chicago, Assignor to American Cyanamid Co., New York. U.S. Pat. 995,898, June 20, 1911.

Di-ammonium phosphate, $(NH_4)_2HPO_4$, substantially free from mono-ammonium phosphate, $NH_4H_2PO_4$, is produced by passing ammonia and phosphoric acid fumes into a suitable chamber, and causing them to react in the presence of water, which is maintained at a temperature too low to permit of the formation of the primary salt, and in suitably concentrating the solution thus produced under a pressure below that of the atmosphere. Any unabsorbed gases in the reaction chamber may be passed into a second chamber and there caused to react in the presence of water, and the solution thus formed may be passed into the first chamber and concentrated together with the solution already formed in that chamber.—W.C.H.

Silicon and pure alumina; Simultaneous manufacture of —— from the natural aluminium silicates. F. Laur. Fr. Pat. 425,277, March 31, 1910.

In the production of pure alumina for use in the manufacture of aluminium, it has hitherto been found necessary to employ a bauxite of very low silica content. In order to produce pure alumina from very silicious bauxites or from natural silicates, the white bauxite or kaolin may be crushed and mixed with coke, the amount of carbon employed being strictly limited to that necessary for the reduction of the silica (0·4 part of carbon for 1 of silica). The mixture is smelted in the electric furnace, when silicon will be separated and a slag of nearly pure alumina will be obtained. In order to free the latter from the last traces of silica, a small amount of powdered aluminium carbide (1 per cent. for each 1 per cent. of silica) may then be added whilst the liquid is stirred. A further quantity of silicon is liberated, and separated from the alumina, which may now be removed and pulverised. —C. A. W.

Oxygen; Preparing —— for use in respirators, life saving apparatus, recharging oxygen cylinders, and other purposes. J. Harger, Gatcacre, Lancs. Eng. Pat. 16,693, July 13, 1910.

Finely ground potassium chlorate (500 parts) is mixed with a finely-divided, precipitated catalytic agent such as recovered manganese dioxide or ferric oxide (62 parts), and lampblack (4 parts). The mixture is passed through a 70-mesh sieve and is then moulded, at a pressure of about one ton per sq. in., into rods, having one or more wires passing through them to conduct heat and to prevent the rod breaking up. A match head or igniter is attached to one end of the rod to start the combustion. Potassium ferrocyanide or ammonium bichromate may be substituted for the lampblack.—G. W. McD.

Oxygen and nitrogen from air; Process for obtaining —— by a chemical method. G. Kassner. Ger. Pat. 234,849, May 29, 1910.

In the production of oxygen and nitrogen from the air by means of such substances as calcium plumbate, alkali manganate, etc., which absorb oxygen at one temperature and evolve it again at a different temperature, claim is made for the use of reaction vessels (tubes, retorts, or the like) of not more than 50 mm. internal diameter and for heating these vessels in a liquid bath, *e.g.* in a bath of fused metal, alloy, paraffin, etc.—A. S.

Fractional distillation of liquefied air and like gaseous substances. G. Hildebrandt, Berlin. Eng. Pat. 15,999, July 5, 1910.

See Fr. Pat. 417,537 of 1910; this J., 1911, 86.—T. F. B.

Nitrogen compounds; Method of making ——. A. R. Frank, Halensee, Germany, Assignor to Soc. Gen. per la Cianamide, Rome. U.S. Pat. 996,011, June 20, 1911.

See Eng. Pat. 21,786 of 1907; this J., 1908, 898.—T. F. B.

Aluminium nitride; Process for the manufacture of ——. O. Serpek, Assignor to Soc. Générale des Nitrures, Paris. U.S. Pat. 996,032, June 20, 1911.

See Eng. Pat. 13,086 of 1910; this J., 1911, 421.—T. F. B.

Potassium and ammonium phosphates; Process for making primary ——. C. Klingbiel. Fr. Pat. 425,300, Jan. 27, 1911. Under Int. Conv., Jan. 29, 1910.

See Ger. Pat. 229,913 of 1910; this J., 1911, 438.—T. F. B.

Electrolysis of liquids [alkali chloride solutions]. Eng. Pat. 11,693. *See* XI.

VIII.—GLASS; CERAMICS.

Plasticity of calcium fluoride. Cohn. *See* VII.

Patents.

Furnaces for heating glass. V. H. Gregory, Chiswick, Middlesex. Eng. Pat. 14,206, June 11, 1910.

A triangular firebrick is fixed at the point where the gases enter the furnace. The stream of gas is thus divided into two portions; the main and upper portion, passing above the brick, takes its normal course against the underside of the pot, whilst the minor portion passes downwards and is directed to the outlet from the pot at the bottom of the furnace.—G. W. McD.

Vitrifiable substances; The fusing of ——. M. A. Demongeot, Paris. Eng. Pat. 20,414, Sept. 1, 1910.

Crystallised calcium carbonate (either as marble, Iceland spar or the like, or as artificially produced in chemical processes) is used as a support, on which vitrifiable, or previously vitrified, materials in a fine state of division (in powder, granules, paste or the like) may be fused together, provided that the materials contain sufficient fusible constituents (potassium or sodium carbonate, potassium nitrate or the like) to enable them to amalgamate and form a compact mass at a temperature below the critical temperature of decomposition of crystallised calcium carbonate.—W. C. H.

Frits of the composition of glass; Process for the preparation of ——. J. Kersten. Fr. Pat. 424,902, Jan. 16, 1911.

These frits for the manufacture of any kind of glass, and especially white glass, contain, in sufficient quantity, artificially produced alkali silicates as fluxes, which render the use of alkali carbonates or sulphates superfluous. The alkali silicate can be employed in the form of alkali metasilicate, and is produced artificially by the action of silica on solutions of alkali (obtained directly by any ordinary process from alkali chlorides) under pressure.—W. C. H.

White enamel. C. Rosenzweig, Vienna. U.S. Pat. 995,724, June 20, 1911.

An enamel composed of a glazing mass and a silica compound of a rare earth metal (*e.g.*, zirconium), which is freed from colouring admixtures and is white at the temperature at which it is caused to glow.—W. C. H.

Clay; Machine for grinding and mixing ——. L. Hinterschweiger. Fr. Pat. 424,892, Jan. 14, 1911.

See Eng. Pat. 1221 of 1911; this J., 1911, 805.—T. F. B.

Mica sheets; Process and apparatus for making ——. M. Meirowsky. Fr. Pat. 425,178, Jan. 24, 1911.

See Eng. Pat. 3874 of 1911; this J., 1911, 805.—T. F. B.

IX.—BUILDING MATERIALS.

Annual report on alkali, etc. works. See VII.

Patents.

Artificial stone; The manufacture of ——. E. E. Hippe, Copenhagen. Eng. Pat. 30,035, Dec. 24, 1910.

Artificial marble, granite, malachite, serpentine, Labrador stone, etc., is produced by moulding a mass of hydraulic or other cement on a specially prepared film or layer. The base of the mould is covered with a film of a solution of a salt of some heavy metal, *e.g.*, zinc, other than an alkaline earth metal. The film may be coloured or not, and upon it one or more coloured or uncoloured cements or moulding materials are put, which because they contain alkali or alkaline earth compounds react with the film of metal salt, and form insoluble compounds, which render the superficial structure of the moulded articles harder and denser, and in some cases aid in the production of special shades of colour. Strong size water, with a small amount of dissolved blood albumin is added to the cement and in some cases to the film of metal salt in order to retard the setting of the cement. Suitable sparkling granular materials, *e.g.*, black mica, pulverised mother of pearl, etc., or in some cases dry powdered mortar, are sprinkled on the film of metal salt before adding the mass of hydraulic material, to give the appearance of separate crystals. The mass may be kept in motion during the formation of a pattern, for instance by inclining the bottom of the mould.—W. C. H.

Wood; Process of impregnation of —— to assist its preservation. P. and G. Beaumartin. Fr. Pat. 424,949, Jan. 17, 1911.

Wood is first impregnated with a solution of copper sulphate, and then subjected to a second impregnation with a solution containing lime, in order to convert the copper sulphate into a less soluble salt possessing the same antiseptic properties, and having no acid reaction. For this second injection, lime water is used, which causes the formation of hydrated copper oxide in the interior of the beam, which is afterwards converted into carbonate by ground water containing carbon dioxide, and finally into bicarbonate. The same object may be attained by substituting a solution of calcium bicarbonate for lime water for the second impregnation.—W. C. H.

Wood for art cabinet making; Process of artificially colouring ——. Deutsche Werkstätten für Handwerkskunst Dresden, G. m. b. H. Fr. Pat. 425,085, Jan. 21, 1911.

The wood is embedded in a mixture of earth, lime and a compound from which ammonia is liberated by the lime. The embedding mixture is heated and kept moist, the temperature being raised from about 25° C. to 85° C. or more, and the treatment continued until the desired tint appears in the wood.—W. C. H.

Mortars; Process for increasing the impermeability of ——. A. W. Andernach. Fr. Pat. 425,286, Dec. 29, 1910.

The impermeability is increased by adding to the mortars materials consisting wholly or partly of grease. The admixtures may be completely or partially saponifiable. The claims also include the addition of disinfecting materials, such as picric acid to mortars.—W. C. H.

Cement clinkers; Cooling hot —— by liquids or gases. P. Jochum, Karlsruhe, Germany. Eng. Pat. 2347, Jan. 30, 1911.

The cement clinker is sprayed with water, and at the same time it is crushed between rollers which are cooled internally by water circulation. The clinker is thus very rapidly chilled with only a moderate addition of water and the resulting product is said to have improved hydraulic properties.—G. W. McD.

Cement; Process of cooling hot lumps of —— by means of liquid or gaseous fluids. Amme, Giesecke und Konegen Akt.-Ges. Fr. Pat. 424,878, Jan. 14, 1911. Under Int. Conv., Jan. 15, 1910.

The lumps of cement as they come from the kiln are ground, and artificially cooled during the grinding, either by contact of the ground material with the specially cooled wall of the grinding mill or conveyor, or by direct contact with liquid or gaseous fluids in the various parts of the plant.—W. C. H.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Electric smelting of iron ore at Trollhätten, Sweden; Experiments on the ——. Board of Trade J., June 29, 1911. [T.R.]

The report of the Swedish "Jernkontoret," or Iron and Steel Institute, for 1910 contains particulars of the result of the experiments made at Trollhätten in the smelting of iron ore by electricity provided at a cheap rate from the Government works. The plant cost £17,800. Smelting operations were commenced on 15th November, 1910. The results obtained show that the question of smelting iron ore by electricity is solved even from the economical stand-point, on condition that electricity is provided at low rates. Better results are to be expected if arrangements are made for a more effective circulation of gas, and it seems probable that this is feasible. The experiment has paid expenses. It is estimated that the smelting works cannot be a commercial success if the price exceeds the present rate of 40 kronor (£2 4s. 5d.) per kilowatt per annum. During the five months of operation 29 consignments of ore were used. The consumption of charcoal was 413 kilos. per ton of iron, and of electricity 1 kilowatt per year for 4 tons. The electric product was practically free from slag and oxide. Experiments have also been made with satisfactory results at the works of Fagersta, Eskilstuna, Hagfors, and Munkfors.

Mineral production of Germany in 1910. Board of Trade J., July 6, 1911. [T.R.]

The following provisional figures show the production of minerals and metals in the German Empire and Luxemburg in 1909 and 1910 :—

—	1909.		1910.	
	Quantity.	Value.	Quantity.	Value.
I. MINERALS—	Metric tons.	1,000 marks.	Metric tons.	1,000 marks.
Coal	148,788,059	1,519,222	152,827,777	1,526,689
Lignite	68,657,606	178,980	69,473,883	178,397
Asphaltum	77,537	727	81,186	627
Petroleum	143,244	10,118	145,168	10,146
Rock salt	1,369,805	6,242	1,424,064	6,424
Kainit	3,181,349	44,734	4,249,668	53,412
Other potash salts	3,860,685	36,921	4,062,004	37,958
Iron ore	25,504,464	97,981	28,709,654	106,803
Zinc ore	723,566	42,834	718,316	45,186
Lead ore	159,853	14,462	148,497	14,064
Copper ore	798,618	22,967	925,957	23,407
Silver ore and gold ore	7,510	724	6,646	640
Manganese ore	77,177	917	80,559	981
Pyrites	198,689	1,861	215,708	2,047
II. SALTS (VARIOUS)—				
Salt	648,751	18,507	669,959	19,293
Potassium chloride	624,994	68,259	741,560	72,988
Sodium sulphate	71,814	1,873	84,787	2,109
Potassium sulphate	68.539	10,817	84,583	12,562
Magnesium sulphate	53,812	904	57,359	941
Potassium-magnesium sulphate	38,723	3,004	37.439	2,807
Aluminium sulphate	56,096	3,483	*	*
III. PRODUCTS OF REDUCTION WORKS—				
Pig iron	12,644,916	691,564	14,793,604	802,853
Zinc	219,766	94,972	221,395	99,399
Lead in pigs, bars, etc.	167,918	43,991	157,851	41,340
Copper ingots	31,181	38,655	34,921	42,386
Sulphuric acid, distilled and undistilled	1,413,812	40,785	1,572,792	43,112
	Kilos.		Kilos.	
Silver	400,562	28,137	420,003	30,655
Gold	5,064	14,145	4,625	12,919
IV. PRODUCTS FROM PIG IRON—	Metric tons.		Metric tons.	
Castings, second fusion	2,388,815	423,257	2,460,425†	438,493†
Wrought iron and steel—				
a. Crude blooms, mill bars and cement steel	31,360	3,250	26,040	2,871
b. Finished wrought iron products	415,119	67,383	405,955†	58,709†
Cast iron and steel—				
a. Ingots, slabs, billets, etc.	2,774,327	237,346	2,743,440†	238,489†
b. Finished cast iron products	8,640,265	1,212,355	9,105,223†	1,289,685†

* Not yet available.

† Returns incomplete.

Mineral resources and industry of Bolivia. Board of Trade J., July 6, 1911. [T.R.]

Indications of gold are found all along the eastern slope of the Cordillera Real, and also in the beds of the rivers which flow east from this range. The annual production of gold in Bolivia may be reckoned at 17,460 ounces of bullion, valued at about 72,000*l*.

The richest silver region in the Republic lies in the west. In the north, south, and east the silver lodes are found near the summits of the Andean chain, running in an east to west direction. There is comparatively little silver in the north. The total production of silver during 1909 was valued at 54,472*l*., as compared with 941,523*l*. in 1902, and 1,474,495*l*. in 1895. This diminished output is attributed to the fall in the price of the metal, and the increase in the value of tin, which has been found in abundance close to the silver bearing areas and in a more easily worked condition. The owners of silver mines have consequently diverted their work and capital to tin production.

Copper is found widely dispersed over the highlands of Bolivia, and these formations extend into Peru. The richest copper region is in the province of Pacajes, which lies on the Altoplanicie, south-west of Lake Titicaca, and contains the copper deposits of Corocoro. The production of copper in Bolivia since 1885 has varied as follows :—1885, 1,518 met. tons ; 1900, 2,494 ; 1905, 4,552 ; 1909, 3,084 metric tons.

Tin is found principally on the higher peaks of the Cordillera Real overlooking the Amazon Basin. The average ore runs at from 5 to 10 per cent. High grade stream tin is also found and washed. In the majority of Bolivian tin-mining operations the only methods employed are crushing and washing in order to produce a concentrate of 55 to 65 per cent. tin. in which form the bulk of the metal is exported. Bolivia is now the second tin-producing country in the world, ranking after the Straits Settlements. The production has steadily increased, as is shown by the following figures of the production of concentrate :—

	Quintals.
1900	162,342
1905	269,120
1906	395,461
1907	313,237
1908	325,416
1909	355,664
1910 (first six months)	190,100

Quintal = 101·4 lb.

The principal beds of wolfram in Bolivia are found in the province of Caluyo, department of La Paz, the picked ore having the following composition : tungstic acid, 75 to 76 per cent. ; ferric oxide 10 to 20 per cent. ; manganese oxide, 15 to 4 per cent. The tungsten ores which are found in Bolivia in fair abundance, do not as a rule contain more than 56 per cent. of tungstic acid. Frequent fluctuations in the European market have subjected the owners of wolfram mines to so many losses in the past, that most of the mines are shut down.

The existence of petroleum in eastern Bolivia, on the foothills of the Cordillera Real, has been proved by the presence of pools of relatively pure oil, and also of pitch. These indications extend in the department of Santa Cruz to the village of Monte Agudo—a distance of some 300 miles. The oil-bearing belt throughout this length appears however to be comparatively narrow. Similar indications are reported in the Beni district.

Briquettes; Employment of steel and cast-iron turnings as —— for the cupola. E. A. Schott. Stahl. u. Eisen, 1911, **31**, 1044—1045.

THE tenacity of cylinder castings made from 70 per cent. of cast iron with 20 of briquettes made from cast-iron turnings and 10 of briquettes of steel turnings varied from 16·0 to 24·6 kilos. per sq. mm., and of those made from 70 per cent. of a rich silicon cast-iron with 30 of briquettes made from steel turnings varied from 16·5 to 29·6 kilos. per sq. mm.—A. H. C.

Cast iron; Corrosion of wrought and —— when heated in dry steam. F. Westhoff. Stahl u. Eisen, 1911, **31**, 1043.

SODIUM carbonate having been used in a boiler water was carried over into the steam pipes, and while those containing wet steam were uncorroded, those containing dry steam were attacked. The explanation is suggested that dissociation of the sodium carbonate took place in the dry steam, and the carbonic acid so formed was the cause of the corrosion, also that sodium hydroxide can attack iron under these circumstances.—A. H. C.

Rusting of irons; On the influence of surface on the ——. K. Arndt. Metallurgie, 1911, **8**, 353—358.

THE electrolytic theory of the cause of the rusting of iron is discussed in relation to the varieties of iron such as cast iron and the various machined products. Among other impurities graphitic grains form centres at which rusting starts. Fractures rust more readily than the outer surface, and it is suggested that a coating of silicates in the case of cast iron, and films of scale in rolled material act as a protecting layer; the rough surface of the fracture has a distinct accelerating effect on the rusting. It is generally concluded that smooth surfaces are more resistant than rough ones. The paper is illustrated by fifteen microphotographs.—A. H. C.

Steels; The influence of heat treatment on the tenacity and microstructure of hyper-eutectoid ——. A. Jung. Int. Z. Metallog., 1911, **1**, 209—255.

STEELS containing from 0·99 to 1·56 per cent. of carbon, 0·24 to 0·46 of manganese, 0·019 to 0·032 of silicon. 0·020 to 0·031 of phosphorus, and free from sulphur were heated in a specially designed carbon resistance furnace, and the alteration in the mechanical tests and microstructure observed after:—(1.) Hardening in water after heating for equal times at different temperatures. (2) Tempering at the most favourable temperature to give the best results and recording the time taken and its influence. (3) Quenching in oil and lead-tin baths of a temperature equal to that at which tempering took place. (4) Tempering of the steels hardened in water (*a*) at different temperatures for equal times, and (*b*) for different times at equal temperatures. (5) The influence of annealing. The mechanical tests, contraction of area, character of fracture, size of grain, and the hardness have also been determined in connection with certain special cases. The results are both tabulated and illustrated graphically, and it is concluded that:—(1) The temperatures to be employed in hardening hypereutectoid steels are restricted to a definite range which is lower and narrower the smaller the carbon content. (2) The ultimate strength increases to a maximum for a given carbon content as the temperature of quenching falls. (3) For equal quenching temperatures the ultimate strength increases with the carbon content. (4) The same quenching temperatures should be used for different media. (5) The greatest strength is attained by quenching in water and then tempering at 350° C. (6) By quenching in water and tempering, a comparative brittle material with high tenacity is obtained, while by quenching in a medium at the same temperature as that employed for tempering, a lower tenacity and greater toughness is obtained. (7) Different forms of heat treatment cannot be made to produce identical results; identity of results can only be obtained for any one property of steel. (8) The mechanical properties depend on the state of the carbon and also on the structure of the metal. (9) Martensitic structure gives the greatest hardness, troosto-sorbitic gives the highest tenacity, whilst pearlitic gives the greatest elongation. (10) It was not possible to detect any consistent influence of the carbon content on the mechanical properties of the specimens under the conditions employed.—A. H. C.

Steel; Solid non-metallic impurities ("sonims") in ——. H. D. Hibbard. Trans. Amer. Inst. Min. Eng., 1910, **41**, 803—822.

THE author discusses the solid non-metallic impurities of steel, for which he proposes the name "sonims"; and states that, in general, their effect on the quality of the steel, especially that made by oxidation processes (in converters or open-hearth furnaces) is not taken sufficiently into consideration. Silicon and phosphorus when present in small quantities as silicide or phosphide increase the tensile strength of the steel. Silicon may, however, be present as silica or silicates, and phosphorus possibly as phosphate; oxides of iron and manganese may also be present, all as solid impurities suspended in the molten metal. If a soft steel contain more than 0·01 per cent. of silicon, the latter will probably be present largely in the form of silica or silicates and may have a very injurious effect on the metal. An attempt to replace the final addition of ferromanganese to open-hearth steel by ferrosilicon gave ingots (carbon and silicon each about 0·3 per cent.) quite free from blowholes, but so "red short" that on reheating one and passing it through the blooming-mill, it broke into small fragments. In making steel from pig-iron and scrap in the acid open-hearth furnace it is advisable to allow the metal to remain for a time after melting before making the final addition of manganese. So long as manganese is present in the molten metal it is continually being oxidised, and the oxide combines with the silica to form a fusible silicate, which collects other solid impurities as it rises to the surface, and so cleans the metal; when the manganese is completely eliminated, however, any silica formed remains suspended in finely-divided particles in the bath. The effect of "sonims" is not proportional to their quantity, and micrographic rather than chemical methods are preferable in investigations concerning them. When present in microscopic or even smaller particles, they may be located largely along the contact surfaces of the grains formed when the steel solidifies, thus reducing greatly the tensile strength and ductility. In the basic open-hearth furnace the "sonims" may be eliminated by allowing time for the charge to "work" and by having a slag low in iron. The practice of adding a part of the manganese some time before tapping and the remainder immediately before or in the ladle is advantageous for the removal of "sonims," as also is, to a lesser degree, the addition of part of the scrap to the molten bath. The practically complete removal of "sonims" is possible in the case of steel made in crucible and electric furnaces and of acid open-hearth steel finished in the furnace. (See also Rosenhain, this J., 1909, 1133.)—A. S.

Manganese and silicon in the foundry. A. E. Outerbridge, jun. Amer. Foundrymen's Assoc., Pittsburgh Convention, 1911, 17—32.

THE author's remarks on manganese are mainly confined to the manufacture of chilled cast-iron car wheels, for which purpose only sufficient manganese (1 lb. of 80 per cent. alloy to 600 lb. of cast iron) is added to serve as a deoxidising and desulphurising flux; the metal is thus softened, greater ductility and strength being also obtained without injury to the chilled tread of the wheel. By the action of manganese a large proportion of the combined carbon in cast iron is changed into the graphitic form; and the author points out that since foundry irons contain scarcely more than traces of combined carbon, the use of manganese is not usually beneficial in these cases and may be very detrimental. Ferro-silicon is best adapted to the treatment of foundry iron which has become hard and brittle, such metal being thereby softened and strengthened. By the addition of silicon, pig-iron is softened and its chilling property is reduced.—W. E. F. P.

Titanium in iron and steel. C. V. Slocum. Amer. Foundrymen's Assoc., Pittsburgh Convention, 1911, 72—84.

The author advocates the use of titanium as a purifier for iron and steel in foundry practice. The titanium is used in the form of an iron alloy containing 10 per cent. of titanium, the amount employed being dependent upon the composition of the metal and the quality of the product required. Small amounts of the alloy—sometimes as little as 0·1 per cent.—are sufficient to remove impurities (oxides, occluded gases, etc.) not attacked by the usual fluxes; larger quantities considerably increase the transverse and tensile strength of the metal in addition. Having greater fluidity and homogeneity, finer grain and smaller shrinkage than the raw material, the treated metal produces sharper and sounder castings.—W. E. F. P.

Ferro-boron; Analysis of ——. G. Raulin. Monit. Scient., 1911, July, 434—438.

0·3 grm. of ferro-boron was dissolved in concentrated sulphuric acid and the residue, after fusion, shown to contain 58·0 per cent. of silicon and 41·5 of iron, corresponding approximately to the formula, $FeSi_3$. The boron was estimated by dissolving 0·4 grm. of the finely divided alloy in 3 to 4 c.c. of 66° B. sulphuric acid, heating the solution till fumes of sulphuric acid began to distil, and collecting the distillate in 20—25 c.c. of a solution of sodium hydroxide containing 20 grms. per litre. After cooling, 20 c.c. of pure methyl alcohol were added to the distillate, and after heating on the water bath and distilling nearly to dryness, then 15 c.c. more alcohol were added, and so on, to 4 or 5 distillations, the excess of alcohol was removed by heating the flask on the water bath and making the solution just acid with hydrochloric acid, adding an excess of 0·5 c.c. and rapidly distilling till the distillate measured 25 to 30 c.c. (If nitric acid be used for the solution of the alloy the nitrous acid produced so colours the distillate that accurate end reactions are impossible.) A mixture of 2 vols. of glycerin and 1 vol. of alcohol was now added, and the solution titrated by sodium hydroxide previously standardised by a similar titration against boric acid (H_3BO_3) dried over sulphuric acid, using phenolphthalein as the indicator. The other elements were estimated in the usual manner. The following analyses of two ferro-borons is given.

	A.	B.
Boron	10·25	14·15
Carbon	0·80	1·19
Silicon	1·46	0·43
Iron	86·45	78·87
Aluminium	0·21	1·69
Manganese	0·43	0·47
Calcium	0·33	2·81
Magnesium	—	0·01
Sulphur	traces	0·02
Phosphorus	0·16	0·10
	100·09	99·74

—A. H. C.

Alloys obtained in the electric furnace; Action of syrupy phosphoric acid upon various ——. M. Wunder and B. Janneret. Comptes rend., 1911, 152, 1770—1771.

By subjecting the finely-powdered products to the action of syrupy phosphoric acid (sp. gr. 1·75) at a temperature of 230° C. the following results were obtained:—*Silicon* (97 per cent.) was completely attacked in three hours with formation of a colourless liquid and a white, gelatinous precipitate. *Zirconium* dissolved in a few minutes to a clear, colourless liquid. *Tungsten* dissolved but with much greater difficulty than zirconium. *Ferro-silicon.*—Alloys containing 25, 50 and 90 per cent. of silicon were completely attacked, producing either clear solutions or syrupy liquids containing a white gelatinous precipitate. The time for complete reaction varied with the percentage of silicon present. *Ferro-titanium.*—Alloys containing 5 and 30 per cent. of titanium dissolved to a greenish, syrupy liquid in from 20 to 90 minutes. *Ferro-zirconium* dissolved to a clear, colourless liquid. *Ferro-vanadium* (containing 5 per cent. of vanadium) dissolved in about three hours to a slightly brownish liquid. *Silico-manganese* (containing 60 per cent. of silicon) dissolved to a clear liquid in 90 minutes. *Titanium nitride* dissolved to a blue syrupy liquid in about two hours, the reaction being accompanied by a strong evolution of gas. *Alloys of iron, silicon and aluminium* (containing 23 per cent. of aluminium) dissolved to a greenish, transparent, viscous liquid in three hours. *Boro-nickel* (containing 40 per cent. of boron) was completely attacked in three hours with formation of an apple-green precipitate and a greenish syrup. *Carborundum* was almost entirely disintegrated in three hours, with formation of a syrupy liquid and a white, gelatinous precipitate, the reaction being accompanied by a strong evolution of gas. The carbon present in the alloys remained wholly or partly in a flocculent condition in the syrupy liquid; the white, gelatinous precipitate obtained with certain of the silicon alloys was insoluble in water and in hydrochloric acid; no precipitate was produced by the addition of water, or water and hydrochloric acid, to any of the syrupy liquids obtained.—W. E. F. P.

Chromium; Determination of —— *in chrome-iron ore.* O. Nydegger. Z. angew. Chem., 1911, 24, 1163—1164.

0·5 grm. of powdered ore is fused with 5 grms. of borax flux in a platinum crucible until the melt is clear. (The borax flux is made by fusing together 1 part by weight of fused borax and 2 parts by weight of anhydrous sodium carbonate until frothing ceases. The flux is powdered and kept in a well stoppered bottle on account of its hygroscopic nature.) The contents of the crucible are dissolved in 300—400 c.c. of water and 4 c.c. of pure concentrated sulphuric acid, 0·2 grm. of potassium persulphate is then added, and the solution is heated for 30—40 minutes. Any chromic oxide is thus oxidised and the excess of persulphate decomposed. Also any manganese present is oxidised to the dioxide and is filtered off. The solution is now ready for titration. Standard ferrous solution, containing 50—100 grms. of Mohr's salt and 10—20 grms. of concentrated sulphuric acid per litre, is run in until the colour is almost pure bright blue, the end point being ascertained by spot tests with a 1 per cent. solution of potassium ferricyanide. The iron solution must be standardised the same day with 0·5 grm. of pure potassium bichromate dissolved in water with the addition of 1 c.c. of strong sulphuric acid, the solution being brought to about the same dilution as the test solution. A blank test must be made on each batch of borax flux.—T. St.

Pyrites residues; Investigation on the chlorinating-roasting of ——. Kothny. Metallurgie, 1911, 8, 389—399.

This investigation was undertaken in order to elucidate various points in the chemistry of the long utilised process of the chlorinating-roasting of pyrites residues. The composition of the residues was determined by first estimating the total copper, sulphur, and water soluble sulphate in the powdered material. A portion was then treated with a dilute solution of sodium sulphite and the iron and copper contents gave the amount of the sulphates of these metals, and by digesting a part of this sulphite solution with cold dilute nitric acid the whole of the copper oxide and forty-eight per cent. of the copper sulphide was extracted, from which the copper sulphide content was estimated. The difference between the total copper and that estimated gave the copper which was present in the roasted residues as chalcopyrite. By calculation from the above estimations the pyrites content was found, and tables are given of the analysis of five samples. The results of a number of experiments are given in which various mixtures were roasted at known temperatures, and it is concluded that in order to obtain the best yield of water soluble copper it is necessary:—1. That an intimate mixture of the materials be ensured by fine grinding; 2. That since the oxidation roasting of the pyrites and copper sulphide play an important part in the process, the surface of the material should be continually exposed by efficient rabbling; 3. There must be sufficient pyrites in the roast so that the whole of the copper may be converted into copper chloride, and in practice weathered pyrites may be added in the place of unchanged pyrites; 4. That 7 per cent. of sodium chloride must be added for every 4 per cent. of copper content; 5. That too long a heating of the roast is to be avoided; 6. 500° to 600° C. is the best temperature for the process.—A. H. C.

Copper ores rich in lead; Smelting of ——. R. Hesse. Metallurgie, 1911, **8**, 321—335, 365—375.

THE scheme is given of the usual method of extraction of copper from a typical ore containing 41 per cent. of copper, 23 of lead, 18 of sulphur, and 10·5 of iron, the copper being finally refined by electrolysis. A number of experiments are described in detail in which the raw ore, roasted ore, lead oxide, and ferric oxide in varying proportions were smelted in an electric furnace, equations being given for the reactions supposed to have taken place. It is concluded: 1. That the separation of metallic lead from copper lead ores by smelting roasted and unroasted ores is not possible. However, if the concentration of the oxides in the melt be sufficient to obtain free metal then a lead copper mixture separates. 2. The roasted ore, or mixtures of the roasted and unroasted ore, give on smelting with silica, if sufficient oxides be present, a black copper containing a little lead, while the lead and iron are removed as silicates. If the oxides be insufficient in amount then a black copper is obtained, but a slag very rich in copper and poor in lead. 3. If the lead and copper contents of the ore be below a certain amount then the above (2) cannot be profitably carried out and a previous concentration before smelting is necessary. 4. An electric or a reverberatory furnace can be used for smelting with equal advantage.—A. H. C.

Copper, nickel and cobalt ores; Investigation of ——. [*Separation of nickel from copper, cobalt, and iron.*] H. Pedersen. Metallurgie, 1911, **8**, 335.

A MIXTURE containing magnetic pyrites, nickel ore, and slag was digested with 20 c.c. of concentrated nitric acid and heated with sulphuric acid until fumes of sulphuric acid were evolved, the cooled solution was diluted with water and again evaporated to fuming. The residue was extracted with water and filtered from the slag, the solution precipitated by ammonium hydroxide, and the ferric hydroxide redissolved in dilute sulphuric acid and again precipitated, being finally estimated by titration. The solution containing the copper, nickel and cobalt was acidified with sulphuric acid, evaporated to 150 c.c. and after the addition of 5 c.c. of sulphuric acid the copper estimated by electrolysis. The nickel and cobalt solution was neutralised by ammonium hydroxide and 20 c.c. of excess added and the solution electrolysed. The nickel and cobalt on the cathode were dissolved in 40 c.c. of concentrated nitric acid, evaporated to dryness on the water bath, the nitrates destroyed by 1 c.c. of hydrochloric acid and again evaporated, redissolved in dilute hydrochloric acid, diluted to 150 c.c. and the nickel precipitated by the addition of 20 c.c. of a one per cent. solution of dimethylglyoxime in alcohol solution, followed by ammonium hydroxide, and the precipitate collected in a previously dried and weighed Gooch crucible. After drying for two hours at 110° to 120° C. the precipitate contains 20·31 per cent. of nickel.—A. H. C.

[*Ore concentration.*] *New use for eucalyptus oils.* R. T. Baker. Nature, June 29, 1911.

ACCORDING to a regulation passed recently by the Health Board of Australia (endorsing the B.P. standard), eucalyptus oils sold for therapeutic purposes must contain not less than 50 per cent. of eucalyptol. It has now been found that the so-called phellandrene oils excluded by this regulation give better results than any other oils examined as a reagent in the concentration of ores such as the "tailings" from Broken Hill ores. It is stated that a concentrate containing 47 per cent. of zinc, 10 of lead, and 15 oz. of silver, is obtained with a consumption of ½ lb. of eucalyptus oil per ton of concentrate, and that the demand for these phellandrene eucalyptus oils has increased enormously.—A. S.

Magnesium. Eng. and Mining J., 1911, **92**, 12. [T.R.]

THE consumption of magnesium in the United States in 1910 did not exceed that of the previous year, the total probably being valued at not more than $12,000. This metal, however, seems destined to have a much wider use in the near future, magnesium having been found to be of greater value in refining steel than aluminium, and also because of the great interest now being aroused by the remarkably light and strong alloys which are produced by the proper admixture of small amounts of zinc with magnesium. These alloys appear to be stronger than the aluminium alloys and have a specific gravity of about 1·8, as compared with 3 for the lightest commercial alloys of aluminium. They are already reported to be finding an extensive use in aeroplane manufacture.

The alloys of magnesium with from 2 to 4 per cent. of zinc can be wrought and rolled, and present the fracture of fine steel. Various degrees of hardness and corresponding coefficient of expansion can be obtained. The alloys can be readily cast and turned like brass or copper, without the use of soap or petroleum, and they resist the action of air and water.

In view of the fact that bulk for bulk magnesium can be manufactured for a less cost than aluminium, it is destined to become a strong competitor of the latter metal wherever its characteristics of great lightness are desirable.

Magnesium has been selling for about $1.25 per lb. in the United States, but it is expected that this price will be reduced to about 50c. in the near future.

Metals; Separation of —— *from aqueous solutions of their salts by hydrogen at high temperatures and pressures. II.* W. Ipatiew and W. Werkhowsky. Ber., 1911, **44**, 1755—1758.

IN the separation of copper from aqueous solutions of copper sulphate by the action of hydrogen at high temperatures and pressures (this J., 1909, 714), the basic copper sulphate and cuprous oxide which are also frequently produced are not formed as a phase of the main reaction, but are due to a secondary reaction (hydrolysis). If a sufficient quantity of sulphuric acid be added to the copper sulphate solution, they are not formed at all, and the separation of copper begins immediately. Starting with a neutral solution of copper sulphate at 90° C. and using hydrogen under a pressure of 25 atmospheres, only basic copper sulphate, $CuSO_4.2Cu(OH)_2$, separates in the first 10—15 hours; then cuprous oxide begins to be formed, until finally the precipitate consists entirely of cuprous oxide. After 40—50 hours crystals of copper begin to appear and the quantity of cuprous oxide diminishes gradually; and after 4—7 days, the precipitate consists entirely of copper. With higher pressures, similar phenomena are observed but the process is completed more quickly. At 100 atmospheres copper begins to separate after 15—20 hours, and more than 90 per cent. separates in 7 days; at 200 atmospheres complete separation of the copper takes place. With pressures of less than 25 atmospheres and temperatures above 90° C., the separation of the copper is retarded. Cuprous oxide is formed only at a sufficiently high temperature in presence of hydrogen. At 50° C. and 700 atm., no cuprous oxide is formed in 7 days, but at 60° C. and 600 atm., it is observed after 2 days.—A. S.

Spectra of combustion of hydrocarbons and of various metals. Meunier. *See* IIA.

Annual report on alkali, etc., works. *See* VII.

Patents.

Blast furnaces. E. Zohrab, Thurso, N.B., T. H. Evans, London, and T. E. Brown, Hanwell. Eng. Pat. 15,674, June 29, 1910.

Protuberances at the sulphur zone and recesses at the phosphorus zone are provided on the internal sides of the iron blast furnace so as to retard the passage of the ore, tuyères being placed at these regions in order to thoroughly treat the ore and completely remove the sulphur, phosphorus, and other impurities. Hydrogen or peat gas is used to heat the furnace and enters by a nozzle placed centrally in the ordinary water cooled tuyère, and which by injection draws in a supply of air from an air pipe controlled by a stop-cock, and provided with a gutter and drain pipe for the purpose of conducting away the moisture condensed in it and which air pipe may also be heated by gas jets fed from the waste gas supply.—A. H. C.

Iron and its alloys; Apparatus for manufacturing ——. M. Ruthenburg, Lockport, N.Y. U.S. Pat. 995,636, June 20, 1911.

The furnace comprises a cylindrical reduction chamber provided at the top with an ore-inlet and at the bottom with an inlet for deoxidising gas delivered from a producer in a heated condition. The gas inlet or distributing dome, which passes a little way up the centre of the furnace, is composed of two concentric tubes closed at the top. The gas is forced from this dome through radial tubes connecting the inner and outer walls, whilst a cooling medium is circulated through the intervening space. The comminuted ore, as it drops into the furnace, is passed between electrodes situated upon opposite sides of the inlet; it is therefore delivered to the chamber whilst charged with the heat of a fritting operation. Outlets are provided for the reduced metal and the waste gases.—C. A. W.

Armour-plates; Method of making ——. S. S. Wales, Munhall, Pa., Assignor to Carnegie Steel Co., Pittsburg, Pa. U.S. Pat. 996,544, June 27, 1911.

The back portion of a "fibred" steel plate is heated to a hardening temperature sufficient to convert it into a crystalline structure, whilst the face remains unaltered. The plate having been quenched, the hardened back portion is annealed at a temperature of about 450° to 750° C., the heat being applied to the back whilst the face and sides are protected. The plate is then cooled. Finally, the face portion is heated to above the recalescence point while the back is maintained below a hardening temperature; the surface is quenched and a face-hardened plate is obtained.—C. A. W.

Armour-plate; Method of making ——. L. H. Bowman, Munhall, Pa., Assignor to Carnegie Steel Co., Pittsburg, Pa. U.S. Pat. 996,558, June 27, 1911.

The back portion of a "fibred" steel plate is heated to a temperature above the recalescence point, the face portion being retained in an annealed or "fibred" condition. The plate having been quenched, the back portion, which is now crystalline, is converted to a strong fibrous structure by heating the face portion to the proper hardening temperature, above the recalescence point, whilst simultaneously the temperature at the back is not allowed to exceed that at which annealing takes place. The plate is again quenched and a face-hardened surface is obtained. —C. A. W.

Ferrochromium; [Electrical] Process of effecting reduction and producing ——. E. F. Price, Niagara Falls, N.Y., Assignor to Central Trust Co. of New York. U.S. Pat. 995,481, June 20, 1911.

The ferrochromium is produced by passing an electric current through a slag-resister, adjacent to a charge containing carbon and combined iron and chromium. The charge is thus heated to the temperature of reduction, and the resulting alloy is separated and maintained out of contact with the carbon in the charge by an intermediate layer of slag.—B. N.

Iron and chromium; Definite compound of —— *and its application to industrial purposes.* P. E. Dubois and G. G. Préher. Fr. Pat. 425,431, Jan. 31, 1911.

The claim relates to a definite alloy of iron and chromium, having the formula, Fe_2Cr, which is stated to be very resistant to the action of sea-water and of acids either concentrated or dilute, hot or cold, or in the state of vapour. It has a melting-point of about 1500° C., and may be obtained in the electric furnace or in the blast furnace. It is sufficiently malleable, it can be worked easily in the lathe and when necessary it can be welded autogenously. Finally, its resistance to shocks is said to be much greater than that of cast-iron and to approach more nearly that of steels containing 1·50 per cent. of carbon.—C. A. W.

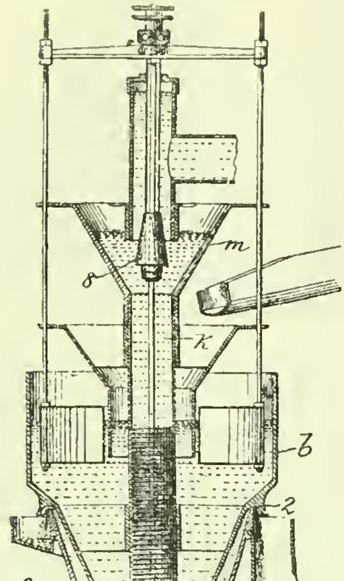
Metals; Process of, and gas-fired furnace for use in, the heating, annealing and hardening of ——. P. Schmidt und Desgraz Technisches Bureau, G. m. b. H., Hanover, Germany. Eng. Pat. 12,747, May 25, 1910. Under Int. Conv., Aug. 30, 1909.

The furnace is provided at one end with a combustion chamber and, in addition to the combustion passages above the hearth, with a series of passages arranged below the hearth so as to communicate with a separate uptake. Both uptakes are fitted with dampers. The gas, introduced at the top of the furnace, is carried through a conduit above the hearth to the other end, where it is mixed with the air necessary for combustion and swept into the combustion chamber. The products of combustion may then be conducted along the hearth to the uptake, as in the ordinary manner, or they may be carried into the passages below the hearth and so conducted to the other uptake, or the gas current may be divided so as to pass simultaneously through both passages. The hearth is constructed of perforated slabs, so as to form a continuous series of holes in which wires or chains may be heated.—C. A. W.

Metals of high melting point; Casting ——. A. L. J. Queneau, Philadelphia, U.S.A. Eng. Pat. 13,304, June 1, 1910. Under Int. Conv., June 19, 1909.

The casting metal (*e.g.*, brass, phosphor bronze, or manganese steel), maintained in a liquid condition by means of an electric current, is forced by means of compressed air into the mould placed above the crucible, the duct through which the metal is led being heated to a temperature higher than that of the bath. The apparatus comprises a stout metallic shell, which is connected with a source of current, and a graphite crucible, the latter being supported on a conducting pedestal—composed of magnesite, tar and graphite—which rests upon a metallic projection at the bottom of the shell. The space between the inner and outer vessels is filled with blocks of fireclay, a sufficient space being left around the crucible to permit the compressed air to find its way to the exterior. The other electrode is formed by the casting duct itself. It comprises a conducting tube, which depends from a recess in the cover and dips into the molten metal; the mould, provided at the bottom with a corresponding orifice, is then secured to the cover above the recess. The cover, insulated from the lower shell to which it is tightly bolted, then forms the corresponding terminal. The compressed air is admitted through an aperture in the top, a three-way cock being provided, by means of which the pressure may be released at the end of the operation. The conducting duct may be composed of magnetite, when iron or steel have to be cast, or of graphitised carbon, the proportion of graphite being calculated in order to give a sufficient electrical resistance. In this way, the duct is heated to a higher temperature than that of the surrounding bath, so that the metal within it remains fluid and continues to fill the mould as the casting is shrinking. —C. A. W.

Metalliferous ores; Apparatus for cleaning, separating, and classifying ——. G. H. Harris, Wadebridge. Eng. Pat. 16,443, July 9, 1910.



A SERIES of superimposed conical sections, *b*, *c*, *f* (see fig.), are adjusted vertically on a centrally arranged screwed water supply tube, *k*, in order to regulate the area of the discharge openings, 2, between them, and through which the lightest and the heavier particles leave the apparatus by the gutters, 6. A central rod, *g*, passes through the water supply tube, is attached to a float, *m*, in the top section and has mounted on it an inlet valve, 8, and an outlet valve, 15, which latter may be provided with propeller blades to be revolved by the issuing stream of water. Movements of the float automatically so adjust the entry and exit of the water that a constant level is maintained, the water passing down the central tube and up through the sections. The bottom section is provided with a grid consisting of two perforated plates, *s*, the opposing holes of which can be so adjusted by the rotation of one of the plates as to determine the size of the perforations and hence the size of the heaviest particles which leave the apparatus at the bottom valve.—A. H. C.

Furnace for melting metals. H. J. Mundy, Hull. Eng. Pat. 16,511, July 11, 1910.

A CYLINDRICAL furnace chamber provided with a hinged bottom and a cover is supported upon four telescopic columns above a well sunk in the ground. This well is extended on one side so as to form an aperture on the ground level through which air can be admitted to the perforated bottom of the chamber, when the latter is lowered into the well for use as a crucible furnace. The furnace may be used for melting iron, in which case it is worked as a cupola, or for melting metals such as brass in crucibles, the shaft portion being then lowered into the well at the bottom, so that it forms the crucible chamber. When the chamber is fixed in the upper position, for the melting of iron, the tuyères are introduced through apertures at the side, which also contains a tap-hole, whilst the perforated bottom is stopped with fire-clay. If, now, it be desired to melt brass, the slag is removed through the hinged bottom, the tuyère holes are stopped with fire-clay, the crucible is placed on top of a fresh supply of fuel and the chamber is lowered into the well. The heat remaining in the furnace should then be sufficient to ignite the fuel.—C. A. W.

Electroplating small articles. R. Blasberg, Solingen-Merscheid, Germany. Eng. Pat. 19,236, Aug. 16, 1910.

THE apparatus comprises a drum of non-conducting material, which is adjustable vertically in the bath-receptacle, the drum when rotating after adjustment in any position being kept under current by means of sliding contacts. The latter consist of metal cores passing through the trunnions of the drum, provided with metal discs, and with metal pins passing through the non-conducting sliding-frame of the drum, the pins being connected with the source of current at one end and at the other end pressing upon the discs either by their own weight or by the action of springs.—B. N.

Zinc and other manufactures; Process of, and means for, mechanically separating the useful from the waste products contained in the residues from ——. E. Dor-Delattre, Dorplein, Holland. Eng. Pat. 3078, Feb. 7, 1911. Under Int. Conv., Apr. 13, 1910.

IN the manufacture of zinc, that portion of the charge situated at the front end of the retort is usually insufficiently reduced. In order to separate this portion from the waste, during the clearance of the retort, an elongated receptacle is arranged in the pit below the furnace, into which the rich residue is allowed to fall. This receptacle is mounted on pivots and supported on rails inclined towards the furnace, so that it always tends to take up its correct position. When the front portion of the charge has been raked into it, the receptacle is drawn to the end of the pit, where its contents are deposited in a separate heap, the pivoted vessel being tipped automatically by chains which exert a tension on levers attached to the pivots. The waste products at the back of the retort having been cleared, the receptacle is allowed to glide back into its normal position below the mouth of the pit.—C. A. W.

Zinc oxide; Process for obtaining —— *from materials which contain metallic zinc or zinc oxide.* G. Wannschaff and J. Savelsberg, Papenburg on the Ems, Germany. Eng. Pat. 5577, March 6, 1911. Under Int. Conv., March 7, 1910.

THE material, such as galvanised iron waste, is treated in an iron vessel with an aqueous solution of zinc chloride heated to boiling. At the conclusion of the reaction, the solution is removed and allowed to cool, when a zinc oxychloride will be precipitated, the supernatant zinc chloride solution being employed in another extraction. The precipitate of oxychloride can then be extracted repeatedly with boiling water, a concentrated solution of zinc chloride being obtained in each case, until finally, when no more chloride is recoverable, the residue is treated with milk of lime or soda lye. The calcium chloride having then been washed out, a residue of pure zinc oxide remains.—C. A. W.

Zinc vapour; Method of and apparatus for condensing —— *to liquid metal.* C. Thierry, Paris, and J. Thomson, New York. U.S. Pat. 994,889, June 13, 1911.

THE zinc vapour is led through a number of condensing chambers, connected in series, the liquid metal as it forms being caused to flow by gravity from one chamber to another. In order to obtain the heat conditions necessary for the condensation to liquid, the chambers are enclosed in a casing possessing heat-insulating walls constructed to permit the admission and emission of air.—C. A. W.

Ores; Apparatus for, and method of smelting ——. H. M· Orahood, Exor. of J. W. Nesmith, Assignor to Colorado Iron Works Co., Denver, Colo. U.S. Pats. 995,365 and 995,366, June 13, 1911.

THE coarse ore is smelted in a stack furnace which resembles the ordinary type of blast furnace except that the hearth is extended on one side into a horizontal combustion chamber, into which the fuel is admitted under pressure, the heat being directed up the stack. In addition to the main blast supplied to the ore in the stack, supplementary tuyères are arranged at the base of the column, near the hearth. At the remote end of the combustion chamber an aperture is provided, through which the fine ore can be injected intermittingly in a horizontal stream, so that it remains suspended in "an atmosphere of combustion" and is thereby reduced.—C. A. W.

Metals; Apparatus for, and process of mixing ——. F. E. Canda, New York. U.S. Pat. 995,421, June 13, 1911.

The receptacle for the molten metal, which is provided with a tilting arrangement, consists of two communicating compartments—a main chamber at the top, in which the metal is received, and a crucible pit of smaller section at the bottom, in which metal can be melted electrically. For this purpose an electrode is supported in the centre, the other electrode being formed by the vessel itself. The lower pit, extending downwards from the floor of the upper chamber, has "an approximately angular section," one of the angles being situated in the plane in which the vessel is tilted.—C. A. W.

Precious metals; Apparatus for separating —— from associated materials. F. H. Prentiss, San Francisco, Cal., Assignor to American Exploration and Guaranty Co., Phoenix, Ariz. U.S. Pat. 995,718, June 20, 1911.

The material together with a thin film of mercury is allowed to run down the inner surface of a basket which rotates within an outer vessel. When the mixture reaches the limit of its movement over the surface, the mercury is separated from the material, passed through a conduit and conducted in an opposite direction through an exterior concentric passage until it reaches the inner surface once more, when the movement is repeated. The conduit connecting the inner surface with the exterior passage does not rotate with the basket, but means are provided by which the two may be oscillated together. By means of a second conduit, the mercury may be intercepted and diverted from the basket as it passes back through the outer passage.—C. A. W.

Gold; Extraction of —— from clay. J. J. W. H. van der Toorn. Fr. Pat. 424,843, Jan. 13, 1911.

The clay is kneaded into coherent blocks, which are subsequently dried and baked in a furnace. The bricks thus obtained are crushed and treated for the extraction of the gold in the usual way. Should the clay in the first place contain stones or small pieces of rock, it may be diluted with water and allowed to settle, when the deposit may be treated in a similar manner.—C. A. W.

Smelter fume products; Process of refining —— A. Roy, San Francisco, Cal., Assignor to W. A. Houts, Oakland, Cal. U.S. Pat. 996,146, June 27, 1911.

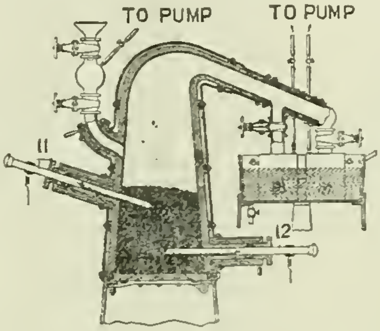
The product is washed with water so as to obtain an aqueous solution of zinc sulphate and arsenious oxide, which may then be treated with an alkali. Zinc hydroxide and arsenious acid are precipitated, and separated by a second extraction with water, the hydroxide being left as a residue. The arsenious acid is again precipitated from the solution by means of an alkali, whilst the residue of hydroxide is converted "by vapourisation and oxidation" into zinc oxide. The copper is recovered from the residual mass by solution and precipitation, and the ultimate residue, a lead product containing gold and silver, is treated in the ordinary manner.—C. A. W.

Metals; Process of producing —— from ores. R. P. Wheelock, Searchlight, Nev. U.S. Pat. 996,179, June 27, 1911.

A solution containing base metals in the form of soluble double cyanides is mixed with an acid, which precipitates the metals as simple cyanides. The precipitate is removed and heated with an acid, or in certain cases alone, the hydrocyanic acid evolved being absorbed in a solution of an alkali or alkaline-earth hydroxide.—C. A. W.

Metals; Fractional distillation of ——. C. G. Fink, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 996,474, June 27, 1911.

The sulphide compound of a volatile metal is heated in a partial vacuum with a reaction mixture which yields reducing gases, and a basic compound capable of combining with the sulphur at a high temperature to form a relatively stable body. More generally an antimony compound may be reduced in the presence of a material which will combine with the non-metallic element to form a slag more refractory than antimony. Thus, a mixture of antimony sulphide, lime and carbon may be heated to a temperature of 600° to 700° C. in what is practically a vacuum-still provided with adjustable electrodes, 11 and 12, plunged into the mixture. The gaseous products are removed, and finally the reduced antimony is distilled at a temperature of about 1300° C. in the attenuated atmosphere.—C. A. W.



Furnace; Electric melting and reduction ——. H. B. Lorentzen, Notodden, Norway. U.S. Pat. 996,492, June 27, 1911.

The furnace, which comprises a smelting chamber with upper and lower electrodes, is provided with a series of independent shafts or channels by means of which the ore is fed into the chamber through apertures surrounding the upper electrode. These channels ascend from the top of the chamber at a slight outward inclination, and then incline inwards, meeting in a common shaft at the top. In order to effect the combustion of carbon monoxide, an aperture for the admission of air is provided at the upper end of each channel. In this way the ore is subjected to a preliminary heating. The lower ends of the shafts are connected by walls so as to form a receptacle for carbon or other material, which can be passed into the smelting chamber through the gap surrounding the upper electrode.—C. A. W.

Ores; Process and apparatus for roasting ——. A. R. Wilfley, Denver, Colo., Assignor to J. Seep, Titusville, Pa. U.S. Pat. 996,548, June 27, 1911.

In order to produce "a magnetic roast," the ore is heated upon a revolving circular hearth and removed at a certain point in the circuit by means of a moist vapour blast, which is discharged across the hearth so that it comes into contact with the roasted material.—C. A. W.

Furnace for roasting ores. T. Edwards. Fr. Pat. 422,958, Oct. 31, 1910.

The furnace is composed of two or more elongated chambers, superposed but not communicating with one another. At one end of the furnace, these chambers communicate with separate fire-boxes, which are arranged one behind another so that the products of combustion passing from the first fire-box into the top chamber are carried over the second one. The separate grates are accessible from the same side of the furnace. Two shafts extending along the top of the furnace engage at intervals with vertical spindles, to which rakes are attached on each floor, those spindles near the fire-boxes being rotated more rapidly than the others, so that the feet of the corresponding rakes make a double number of revolutions. In this way the ore is advanced through the furnace. At this point also, the rakes are cooled with water, the spindles and arms being made hollow and fitted with interior partitions so as to provide separate passages for the entering and the emergent liquid. Apertures in the roof of the furnace, and on the floors of the chambers, permit the adjustment or the removal of the rakes. At the further end of the furnace, the chambers communicate with a common chimney through passages provided with registers. The ore, which may not be the same in each case, is fed on to the separate floors at this end. For this purpose, it is allowed to fall, as the bottom of the charging-bin is opened, on to screw-conveyors which carry it forward into a long trough. A second screw carries it to the end of this trough, and it is finally allowed to fall into a third conveyor opening directly into one of the chambers. All these conveyors are driven by means of chains from one of the shafts at the top of the furnace, the gears being so arranged that each screw rotates at a greater velocity than the one which feeds it. The ore as it reaches the other end of the furnace is discharged through vertical outlets. Each of these contains two flap-valves actuated by rods from one of the rake spindles, the mechanism being so contrived that when one set is opened the adjacent set remains closed. In this way, the formation of dust, which might be carried into the chimney, is prevented.—C. A. W.

Fine ores; Roasting of ——. W. Buddeus. Fr. Pat. 425,109, Jan. 16, 1911.

The furnace is intended for the roasting of fine ores or products poor in sulphur, which could not otherwise be treated without the application of external heat. It consists of two superposed cylinders, separated from one another by an intermediate piece containing a series of holes arranged around the circumference. Through these holes, flat bars can be pushed when required, so that the column of ore can practically be cut into two portions. Alternatively, a movable disc could be arranged to the same end. At the commencement, a layer of ore heated to the temperature of oxidation is placed on the porous bottom of the lower cylinder, and the furnace is then filled with the cold ore, mixed if necessary with a certain quantity of additional combustible, such as carbon or sulphur. Air under pressure is now admitted through the porous bottom. When the zone of oxidation has ascended above the intermediate piece, and the ore in the lower portion is cold, the bars are pushed into the holes and the lower cylinder is emptied through a door at the bottom. Finally, by withdrawing the bars, the heated material in the upper cylinder is allowed to fall into the lower one, the furnace is again replenished with cold ore and the operation is continued.—C. A. W.

Metals; Method and composition for the regeneration of —— which have been rendered useless. Metall-Regeno G. m. b. H. Fr. Pat. 425,080, Jan. 21, 1911.

The process is intended for the regeneration of certain metals which, by reason possibly of excessive heating, have become deficient in carbon. The metal, such as iron or steel, is heated to redness and powdered with an intimate mixture composed of a resin of the terpene group, 5 parts; bone-dust, 2 parts; crystallised copper sulphate, 1 part; borax, 1 part; and rock salt, 1 part.—C. A. W.

Alloys; Method and apparatus for the manufacture of —— with utilisation of components having a very high melting-point. Titan-Ges. m. b. H. Fr. Pat. 425,604, Feb. 6, 1911.

A reactive mixture, from which the metal or alloy of high melting-point is to be produced, is placed in a crucible supported above a second crucible. The upper receptacle is provided at the bottom with a small hole closed by a plate of some material fusible at the high temperature in question. The components of low melting point are melted in the lower crucible. As the reaction in the upper vessel goes forward, the metal or alloy collects at the bottom, melts the stopping plate and falls into the lower crucible. By this means, the heat losses are reduced to a minimum, so that a liquid alloy at very high temperature is obtained, from which the impurities can easily be separated.—C. A. W.

Electrolytic iron deposits; Manufacture of detachable ——. E. C. R. Marks, London. From Langbein-Pfanhauser-Werke A.-G., Leipzig-Sellerhausen, Germany. Eng. Pat. 25,092, Oct. 28, 1910.

See U.S. Pat. 987,318 of 1911; this J., 1911, 492.—T. F. B.

Steel; Process of producing high-grade —— from low grade material. W. R. Palmer, Assignor to F. A. Wilmot, Bridgeport, Conn. Reissue No. 13,264, June 27, 1911, of U.S. Pat. 924,925, June 15, 1909.

See this J., 1909, 798.—T. F. B.

Iron compounds; Method of treating finely-divided substances containing ——. T. C. King, Marion, Ala., Assignor to National Metallurgic Co., Jersey City, N.J. U.S. Pat. 995,542, June 20, 1911.

See Fr. Pat. 362,145 of 1906; this J., 1906, 642.—T. F. B.

Titaniferous iron ores; Treatment of ——. A. Sinding-Larsen, Christiania. U S. Pat. 995,576, June 20, 1911.

See Fr. Pat. 384,882 of 1907; this J., 1908, 509.—T. F. B.

Compounds of aluminium; Method of making fusible —— and recovering aluminium therefrom. L. R. Keogh, Assignor to C. A. Douglas, Ottawa. U.S. Pat. 996,094, June 27, 1911.

See Eng. Pat. 18,356 of 1908; this J., 1909, 1140.—T. F. B.

Tin scraps; Process of purifying —— preparatory to detinning the same. C. von der Linde, Crefeld, Germany. U.S. Pat. 996,380, June 27. 1911.

See Eng. Pat. 26,415 of 1910; this J., 1911, 554.—T. F. B.

Ores; Magnetic separation of ——. A. A. Lockwood, Assignor to Murex Magnetic Co., Ltd., London. U.S. Pat. 996,491, June 27, 1911.

See Eng. Pat. 13,009 of 1910; this J, 1911, 430.—T. F. B.

Metals; Processes and apparatus for electrolytic treatment of —— such as refining, separation, or plating. F. M. Köhler. Fr. Pat. 424,901, Jan. 16, 1911.

See Eng. Pat. 2364 of 1910; this J., 1911, 93.—T. F. B.

Ores and minerals; Process for separating the elements of ——. G. S. A. Appelqvist and E. O. E. Tydén. Fr. Pat. 425,344, Jan. 28, 1911. Under Int. Conv., Feb. 5 and June 18, 1910.

See Eng. Pat. 1211 of 1911; this J., 1911, 810.—T. F. B.

Drying devices, for use in drying high furnace blast. Eng. Pat. 23,262. *See* I.

Manufacture of fuel and ore briquettes. Fr. Pat. 425,227. *See* IIa.

XI.—ELECTRO-CHEMISTRY.

Storage cells; Treatment of sulphated ——. G. A. Perley. J. of Phys. Chem., 1911, 15, 489—507.

If a lead accumulator is neglected the final outcome is the formation of lead sulphate over the surface of the plates, while the capacity of the cell drops towards or to zero. Various methods of renovation have been proposed, and examined by the author, who concludes that: (1) A badly sulphated cell can be restored by charging at the normal rate in a sodium sulphate solution. (2) It is desirable, but not necessary, to use lead "dummies" outside the end plates. (3) The concentration of sodium sulphate may be varied within very wide limits, but 200 grms. of the crystallised salt per litre is recommended. (4) The sodium sulphate must meet the requirements as to purity which are laid down for battery acid. (6) The cost of electrical energy to restore a 40 ampère hour cell should not exceed 10 cents (5d.). (7) Since sodium sulphate is not deleterious to the cell, it is not necessary that the sulphate solution should be washed completely out of the pores of the plates. (8) It has been stated by others that a cell can be restored by charging at half the normal rate for a long time in the regular battery acid; but it seems probable that the time and electrical energy required would be excessive in the case of very badly sulphated cells. —R. C. P.

Electrode potentials in the electrolytic production of chlorine and alkali. R. Sacerdoti. Z. Elektrochem., 1911, **17**, 473—478.

The author has investigated the effect of raising the temperature on the potentials at the electrodes in the electrolysis of sodium chloride solutions, using platinum and iron as cathodes and platinum and magnetite as anodes, all highly polished. The relation between current density and potential is represented graphically in a series of curves for each electrode. The effect of temperature on the cathode curves is only very slight. The anode curves show that by a rise in temperature from 20° to 100° C. the anode potential corresponding to a given current density falls considerably (0·4 to 0·8 volt). The limiting value for the voltage across the cell is given by the two electrode potentials when the fall of potential in the electrolyte is assumed to be zero. With the aid of a diagram which shows the relation between electrode potential and temperature for different current densities at each electrode, the author shows that in practice the reduction in voltage due to increased temperature is never more than 0·5 to 0·75 volt, and that with high current densities the value is always very far removed from the reversible polarisation potential. In a strongly alkaline electrolyte the reversible anode potential is 1·3 volts and the reversible cathode potential—0·8, giving a difference of 2·1 volts for the cell.—W. H. P.

Electrolytic decomposition of cellulose. Oertel. *See* V.

Patents.

Electrolysis of liquids [*alkali chloride solutions*]. J. Billiter, Vienna. Eng. Pat. 11,693, May 11, 1910.

The cathodes are arranged in the form of strips, with covers permeable to the current for carrying away the evolved gas, each cover being adapted to enclose a cathode on all sides as in a sack. Thus the cathodes may be surrounded by membranes, in the form of tubes of asbestos fibre, so that the cathode product escapes by diffusion or "electro-diffusion." The membranes may be stretched over the electrodes by weighting with heavy bodies, or the cathodes may be rendered resilient by specially arranged springs, or by suitable auxiliary means, for the purpose of preventing the formation of detrimental alterations of shape or detrimental gas spaces. The electrolyte is guided through the intermediate spaces left open by the cathode surfaces from the top downwards, and consequently principally transversely to and over the whole cathode surface in as uniform a stream as possible, being finally discharged below the cathode through one or several openings suitably distributed in the bottom of the cell. The intermediate chambers between the single cathode elements are covered with impermeable strips, without interrupting the communication of liquids above and below the cathode surface, so as to make the circulation of the liquid agree as far as possible with the distribution of the current.—B. N.

Electrolytic process. R. J. McNitt, Niagara Falls, N.Y., Assignor to Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 995,476. June 20, 1911.

The fluid electrode is circulated from and to an electrolytic cell by reducing its density by charging it with the products of electrolysis, then removing the charged electrode by the difference in specific gravity between it and the incoming electrode substance. The products of electrolysis are extracted from the electrode, and the denser electrode thus produced is returned to the cell by the action of gravity.—B. N.

Insulating material; Electric ——. The British Thomson-Houston Co., Ltd. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 13,946, June 8, 1910.

The flexible insulation comprises a fibrous material coated or impregnated with an insulating substance containing a condensation product of phenols or aldehydes dissolved in alcohol, together with paraffin oil dissolved in amyl acetate.—B. N.

Aluminium and other wires; Process of insulation of —— *destined to the manufacture of electrical conductors, bobbins, etc.* Ges. für Elektrotechn. Ind. m. b. H. Fr. Pat. 425,532, Feb. 2, 1911. Under Int. Conv., June 28 and July 29, 1910.

The wire is passed, out of contact with solid bodies, through an electrolytic bath, in which an electrical tension is maintained higher than the counter-tension which is produced in the electrolyte at the surface of the aluminium. The wire is used as one of the electrodes.—B. N.

Insulator; Electric —— *and its process of preparation.* O. V. Thomas. Fr. Pat. 425,618, Feb. 6, 1911. Under Int. Conv., Dec. 2, 1910.

The material is composed of mica, rosin, rosin oil or a suitable mineral oil, preferably in equal proportions, with or without the addition of other mineral substances.—B. N.

Furnaces; Revolving electrical ——. O. Serpek, Paris. Eng. Pat. 29,299, Dec. 16, 1910. Under Int. Conv., Aug. 11, 1910.

The furnace is intended specially for the manufacture of aluminium nitride, and comprises resistances which are arranged diametrically through the casing of the furnace and connected externally with the source of current. The resistances may be brought into contact or separated, according as heating by resistances or arcs is desired. Inside the furnace, the resistances have a reduced section. —B. N.

Furnace; Electric —— *for treating gases.* H. Pauling, Gelsenkirchen, Germany. Eng. Pat. 3251, Feb. 8, 1911.

The surface of the wall on the inside of the furnace is subdivided into separate elements by channels, which penetrate to such a depth as to prevent the wall from acting as an electric conductor when heated by the electric flame. Each of the elements is wholly separated from the adjacent elements, to the depth of the channels. The latter may form a network, insulating the wall elements between its meshes, or they may be arranged transversely to the direction of the fall of potential.—B. N.

Voltaic arcs of great dimension; Production of ——. Badische Anilin und Soda-Fabrik. Fourth Addition, dated Jan. 26, 1911 (Under Int. Conv., Jan. 20, 1910), to Fr. Pat. 357,358, Aug. 30, 1905 (this J., 1906, 79).

The air traversing the tubular vessel receives a whirling movement, being introduced tangentially through several orifices distributed over the surface of the tube. By employing carbon electrodes containing illuminating bodies, the arcs formed may be utilised for illumination. With the exception of the points from which the arc springs, the electrodes are covered with metallic tubes, which may be cooled, and which are preferably furnished at the ends nearest the arc with edges in the form of a disc or a funnel. —B. N.

Gases; Electric purification of ——. Badische Anilin und Soda-Fabrik. Fr. Pat. 425,593, Feb. 4, 1911. Under Int. Conv., April 23, June 16, and July 7, 1910.

The gas is cleared of solid or liquid particles by providing a metal or carbon electrode suitable for the formation of a brush discharge, this electrode being in the form of a plate or disc, and its distance from the other electrode is regulated so that the intensity of the electric field at the edge of the brush electrode is on all sides approximately at the same value. Several such brush electrodes may be employed, and these, or the other electrodes, or both may be rotated. In addition to the above process, which may be employed for the electrification of the gas, an electric field may be produced for effecting the deposition of the suspended particles between two electrodes which do not produce brush discharges. These electrodes may be connected with the electrodes for producing the electrification of the gas, or the latter may be produced by an alternating current, and the deposition of the particles brought about by continuous current.—B. N.

Electrolyte for electrolytic cells. J. L. R. Hayden. Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 996,583, June 27, 1911.

See Eng. Pat. 15,792 of 1908; this J., 1909, 840.—T. F. B.

Method of waterproofing fabrics. U.S. Pat. 994,931. *See* XI.

XII.—FATS; OILS; WAXES.

Cottonseed products; Analysis of ——. Report by F. Paquin, E. L. Johnson, E. R. Barrow, F. N. Smalley, and R. C. Warren. Oil, Paint, and Drug Rep., June 12, 1911.

The chemists' committee of the Interstate Cottonseed Crushers Association meeting at Atlanta, Ga., on Aug. 22 and 23, 1910, have reported the following as the official methods to be used in making analyses of samples of the material traded upon under the rules of the Association. *Moisture.*—Dry 2 to 5 grms. of the cake or meal, etc., for three hours in a double walled oven containing a liquid boiling at such a temperature that the interior of the oven will be maintained at exactly 105° C., using a dish which can be covered as soon as it is removed from the oven. Cool to room temperature in a desiccator and weigh. *Oil.*—Extract 2 to 5 grms. for three hours in a short siphon Soxhlet apparatus, using petroleum ether boiling below 65° C. as the solvent. Evaporate until no traces of the ether remain and weigh as oil. *Nitrogen—Ammonia—Protein.*—(*a*) Digest 1·7034 grms. of the sample with approximately 0·7 grm. of mercuric oxide or 0·5 grm. of metallic mercury, 10 grms. of sodium or potassium sulphate and 25 c.c. of sulphuric acid (sp. gr. 1·84). Place the flask in an inclined position and heat below the boiling point of the acid for from 5 to 15 min. or until frothing has ceased. Increase the temperature and continue digestion until the liquid becomes colourless or nearly so, proceeding as in the regular Kjeldahl process except that no permanganate is added. (*b*) *Distillation.*—After cooling, transfer the contents of the flask to a distilling flask with about 300 c.c. of water, a few pieces of granulated zinc, pumice stone, or 0·5 grm. of zinc dust when found necessary to keep the solution from bumping, and add 25 c.c. of a 4 per cent. solution of potassium sulphide with shaking. Next add 60 c.c. of caustic soda solution of 1·5 sp. gr. or sufficient to make the reaction strongly alkaline, pouring down the side of the flask so that admixture does not at once take place with the acid solution. Connect the flask with a condenser of block tin, mix the contents by shaking and distil until all ammonia has passed over into the standard acid. At least 150 c.c. must be distilled over. Distil into an accurately measured quantity of $N/2$ sulphuric acid to which has been added 50 c.c. of distilled water. Titrate the distillate with $N/4$ caustic soda or ammonia, using cochineal as indicator. Nitrogen × 6·25 or ammonia × 5·147 = the per cent. of protein. *Total fatty acids—gravimetric method.*—Weigh 8 to 10 grms. of the mixed sample into a small extraction flask. Saponify with an alcoholic solution of sodium hydroxide on a steam bath and heat with occasional stirring until all the alcohol is driven off. Wash out the soap with about 400 c.c. of hot water into a beaker and digest on a water bath until the soap is dissolved. Acidify with dilute sulphuric acid and continue heating until the layer of fatty acids is clear. Cool and filter off the liquid from the cake of fatty acids, washing with cold water until no traces of free sulphuric acid are left. Allow the fatty acids to dry, most conveniently by standing overnight. Transfer the acids to a folded filter paper and place in a Soxhlet extraction apparatus and extract for three hours with petroleum ether boiling below 50° C. Dissolve the fatty acids adhering to the beaker in warm petroleum ether which is to be used for the extraction. Evaporate off the ether and dry till the weight remains constant. Time is saved by chilling the melted fatty acids in running water and dissolving the largest part of the dry fat cake in the beaker and on the filter in warm petroleum ether, allowing the solution to run into the tared flask and subsequently extracting the filter paper in the Soxhlet apparatus for 1½ hours as described. *Refining loss in crude cottonseed oil.*—*Apparatus required.* Scales, 1000 grms. capacity sensitive to 1 grm. Weights, 500 grms. to 1 grm. Seamless or enamelled iron cups, about 4½ in. diam. and 4 in. deep. Spoons, knives or spatulas for stirring, or preferably a mechanical agitator. Water bath with thermometers, suitably arranged to hold one or more of the test vessels. *Reagents.* Caustic soda solutions of 10°, 12°, 14°, 16°, 18°, and 20° B. at 60° F., made from a saturated solution of 77·5 per cent. caustic soda. The quantity of caustic soda to be used in refining "prime oil" must not exceed 1·097 per cent. of sodium hydroxide. The following are the corresponding quantities of the different strengths which can be used: 10° B. —16·8 per cent., 12° B. —13·7 per cent., 14° B. —11·6 per cent., 16° B. —10 per cent., 18° B. —8·7 per cent., 20° B. —7·6 per cent. A 16° B. solution contains 10·97 per cent. of sodium hydroxide. No oil shall be rejected unless tested with three or more lyes of strengths given above, nor shall any claim for excessive refining loss be established if it can be proved that the required colour can be obtained with smaller loss than that produced with the maximum amount of lye allowed. *Process.*—The dish in which the test is made is carefully tared, 500 grms. of the crude oil weighed in and heated to 85° F. The proper amount of lye of the desired strength is then added and the mixture stirred vigorously for 5 min. Heat is then applied and the temp. raised slowly, with constant stirring, to 110° F. The time from the addition of the lye till 100° F. is reached must be at least 15 min. but there is no objection to taking longer than this. Continue stirring gently until complete separation is obtained and the soap stock shows a tendency to settle. Allow to stand in a water bath at 125° F. for three hours (preferably over night). Cool in water until the soap stock has become hard and firm, then weigh to determine the loss by evaporation. The oil is decanted into a clean tared vessel, the soap stock drained therein for 20 min. and weighed. *Refining loss.*—Weight of crude oil less weight of refined oil = refining loss. Also, weight of soap stock less weight of caustic soda solution used plus the loss in evaporation = the refining loss. The two should agree within 0·5 per cent. *Hulls analysis.*—Pick out all the whole seed and uncut "meats" in the sample and calculate the percentage. Extract 5 grms. of the picked hulls for 3 hours in the Soxhlet apparatus using petroleum ether boiling below 65° C. Evaporate off the ether and weigh as oil. Report the percentage of oil in whole seed and uncut "meats," the percentage of oil in hulls and the percentage of total oil in the hulls using 0·2 as the factor to convert whole seed to oil. *Moisture in cake and meal.*—For the purpose of comparison this test should be made on all samples. *Samples.*—Containers for samples of meal and cake which are liable to lose moisture should have screw tops with a washer or gasket to make an airtight joint.—J. A.

Oils; Contribution to the examination of ——. H. Duperthuis. Mitt. Lebensmittelunters. u. Hyg., 1911, 2-65—79. Chem. Zentr., 1911, 1, 1889.

For the determination of the critical temperature of solution, the author recommends the use of a mixture of two solvents in one of which (isobutyl alcohol, amyl alcohol, acetone, petroleum spirit, or aniline) the oil is readily soluble, and in the other (ethyl alcohol) less readily soluble. Using a mixture of 1 vol. of aniline and 4 vols. of alcohol, the following values were obtained: Olive oil (6 samples), 35·7°—41·2° C.; arachis oil (3), 42·6°—43·4°; sesamé oil (2), 30·0° and 33·4°; poppyseed oil (1), 12·1°; walnut oil (4), 29·6°—33·1°; colza oil (1), 42·3; and cottonseed oil (1 sample), 26·2° C.

The volume of an oil does not increase proportionally with the temperature. For ordinary purposes, however the sp. gr. at 15° C. (dt) can be calculated from that (dt^1) observed at higher temperatures by means of the equation:

$$dt = dt^1 + 0{\cdot}000665(t^1 - t).$$

As the difference (t^1—t) decreases, the deviation of the calculated from the observed specific gravity increases. For $t^1 = 98°$ C. the sp. gr. at 15° C. can be calculated accurately to the third decimal place by means of the formula, Sp. gr. at 15° C. = sp. gr. at 98° C. + 0·0552.
—A. S.

Beeswax; Commercial analysis of —— *with special reference to East Indian and the so-called China beeswax.* G. Buchner. Z. öffentl. Chem., 1911, 17, 225—227.

On treating saponified pure beeswax (3·6 grms.), after evaporation of the alcohol, with about 250 c.c. of boiling water, clear solutions are obtained in the case of many varieties, whereas other kinds yield turbid solutions, or amorphous precipitates (East African, East Indian or Ghedda and "China" waxes). Waxes containing paraffin wax also yield turbid solutions, or, in the presence of more than about 15 per cent. of the adulterant, an oily layer which solidifies on cooling. Hence it is essential to identify the separated substance before reporting the wax as adulterated. For this purpose it is purified by repeatedly melting it in water, and is then dried and boiled for two hours with acetic anhydride under a reflux condenser. If the amount of the latter exceeds 30 per cent. this method of separation is sufficiently exact for commercial analyses. With regard to the influence of the completeness of the removal of the alcohol upon Weinwurm's test, the author's experiments have shown that the presence of a trace of alcohol retards the separation of the wax alcohols but promotes the separation of paraffin wax. Determinations of the glycerin in pure beeswax of different origin gave average results corresponding to 0·08 to 0·1 per cent. of glycerides.—C. A. M.

Japan wax; "Alcoholysis" of ——. E. Tassilly. Bull. Soc. Chim., 1911, 9, 608—615.

Applying the method of "alcoholysis" suggested by Haller (this J., 1906, 1159), the author has obtained from Japan wax, pelargonic acid and an acid having the formula, $C_{15}H_{30}O_2$, although a determination of the molecular weight by the cryoscopic method would indicate that this formula should be doubled. Traces of stearic and oleic acids were also found as well as the constituents already identified by Geitel and van der Wandt (this J., 1900, 356), Schaal (this J., 1908), and Matthes and Heintz this (J., 1910, 222).—J. A.

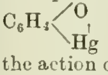
"Pine oil" obtained in the manufacture of soda cellulose. Hilding. *See* V.

Manuring the cacao tree and of the oil palm in Cameroon. Zeller. *See* XVI.

Fatty oils (Hydnocarpus, etc.) from plants of the family Flacourtiacea. Grimme. *See* XIXa.

Patents.

Soaps containing mercury compounds; Production of ——. Farbenfabriken vorm. F. Bayer und Co. Second Addition, dated Jan. 7, 1911 (Under Int. Conv., Jan. 22, 1910), to Fr. Pat. 402,740, May 5, 1909. (See this J., 1909, 1211; 1911, 222.)

Neutral soaps of potassium or sodium are mixed with mercury compounds derived from phenols, their homologues and substitution products, naphthol, etc. For example, 20 parts of ortho-phenylene mercuric oxide,  $C_6H_4\left\langle\begin{matrix}O\\ |\\ Hg\end{matrix}\right.$ in the form of its sodium salt, obtained by the action of 2 molecular proportions of sodium hydroxide on o-hydroxyphenylmercuric chloride, $C_6H_4(OH)HgCl$, are mixed with 1000 parts of neutral soap. The following compounds are also quoted as examples:—the abovementioned o-hydroxyphenylmercuric chloride and the isomeric *p*-compound; mercury diorthodihydroxydiphenyl, $Hg(C_6H_4{\cdot}OH)_2$; 1-hydroxy-2.4-dimercuric diacetate, $OH)C_6H_3(Hg{\cdot}O{\cdot}CO{\cdot}CH_3)_2$; and mercury diphenolate, $(C_6H_5{\cdot}O)_2Hg$.—E. W. L.

Albuminous substance containing soap. J. Morgenroth. Ger. Pat. 234,469, Oct. 6, 1909.

An aqueous solution of a soluble soap, which may also contain a small proportion of sodium chloride, is shaken for a long time with coagulated animal albumin, and the coagulum is then separated from the liquid.—A. S.

Fatty food compound. U.S. Pat. 995,777. *See* XIXa.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Kauri gum industry of New Zealand. Oil, Paint, and Drug Rep., July 3, 1911. [T.R.]

Owing to increased difficulty in obtaining the better grades of kauri gum in New Zealand, although the lower grades are still plentiful, the industry is gradually changing its aspect from the production of fine qualities for varnish to the production more of qualities suitable for making linoleum, but not for varnish. As most of the kauri gum used for varnish goes to the United States, while most of that used for linoleum goes to the United Kingdom and the Continent, the exports from New Zealand now show a tendency to shift from the United States to Europe. In 1910, for the first time (except in 1893) exports to the United States have been exceeded by shipments to Europe, the United States taking only 3839 tons, as against 4150 tons purchased by Europe. During the preceding year 5127 tons were exported to the United States, as against 3123 tons to Europe. As a general average, the United States in recent years has taken about two-thirds of the annual output of kauri gum in New Zealand. Over one half of New Zealand's total exports to the United States still consists of this gum, the exports during 1910 being valued at $1,271.891. It seems likely that the low grade deposits will last for many years, and as even the lowest grades now command good prices, the value of the quantity exported may not show any important diminution for some time. Varnish makers in the United States have been able to utilise inferior gum that had once been considered impossible to use; also, they have effected considerable saving in kauri gum by use of cheap substitutes, such as China wood oil.

Prices have recently declined from the high levels of 1907 and 1908, but are still high enough to prevent notable diminution in the number of diggers, which is over 3000.

The exports of kauri gum from January 1 to April 1, 1911, show a continuation of the tendency noticeable in 1910 of a decline in the trade with the United States and a gain in the trade with Europe. During the quarter the exports to America were 1017 tons, and to Europe 1174.

tons. The total, 2191 tons, shows improvement over the same quarter of last year, when 1518 tons were exported, this doubtless being due to lower prices creating a better export demand.

Turpentine and rosin production in the United States in 1910. U.S. Census Bureau Report. Board of Trade J., June 29, 1911. [T.R.]

The turpentine and rosin production of the United States in 1910, as compared with the previous year, was as follows :—

	1909.		1910.	
	Quantity.	Value	Quantity.	Value.
Turpentine	Barrels of 50 gals. 580,000	Dols. 12,654,000	Barrels of 50 gals. 555,000	Dols. 17,680,000
Rosin	Casks of 500 lb. 1,828,000	12,577,000	Casks of 500 lb. 1,906,000	18,255,000

The principal falling off in the production of turpentine was in the States of the Carolinas, Georgia, Alabama, and Louisiana, where there was also a diminution in the output of rosin. This was due to bad weather conditions and to lack of labour. The sharp rise in price of both articles is due to their increasing use in industry.

In 1910, 285,046 barrels of turpentine and 1,270,830 casks of rosin were exported.

"*Pine oil*" *obtained in the manufacture of soda cellulose.* Hilding. *See* V.

Patents.

Ink-written documents ; Preparation to be used in making copies of ——. D. Cameron, Edinburgh. Eng. Pat. 16,515, July 11, 1910.

For obtaining copies from documents written in ordinary ink the copying paper is moistened with a liquid containing tannic or gallic or other acid which, on coming in contact with the free ferrous salt in the ink, will produce a black or dark-coloured compound. In order to prevent spreading and blurring, a quantity of sodium sulphite or other alkaline substance is added to the liquid. Carbolic acid is also added as a preservative. For special use with logwood inks (as well as with ferrous inks) the liquid mixture may contain alum in place of sodium sulphite, the alum localising the reaction with the logwood.—E. W. L.

Paints ; Manufacture of anti-oxidising ——. W. Cline, Lancaster City, Pa., U.S.A. Eng. Pat. 17,796, July 26, 1910.

A paint intended to prevent oxidation of the surfaces to which it is applied contains as its principal ingredient "smoke carbon," obtained by precipitating, with a spray of water, the unconsumed or partly consumed products of combustion in a smoke stack, and driving off the moisture, but not the oils, etc., by heat. 2 lb. of the carbon are mixed with ¾ lb. of boiled oil, and then with a mixture of 1 quart of a suitable drier (*e.g.*, japan), and ½ gallon of a non-volatile solvent. 1 pint of varnish may be added instead of, or with, the boiled oil.—E. W. L.

Ultramarine blue [*and similar products*] ; *Manufacture of* ——. J. Luciani. Fr. Pat. 425,585, April 7, 1910.

The ultimate object of the invention is the better distribution of heat through the materials undergoing conversion (into ultramarine blue, etc.) and the consequent more complete and uniform transformation of those materials. The object is achieved by (1) lining the kilns with hollow bricks, fitting into one another so as to obviate the necessity of using jointing cement, and traversed by channels in such a way as to provide for a free circulation of air (when certain plugs are removed) through the lining from the outside to the inside of the kiln ; (2) placing the raw materials to be heated in vessels consisting of a (circular) base of refractory material and one or more concentric vertical tubes, the whole being surrounded by a sheet of paper or similar material. These vessels are stacked inside the kilns either on shelves or merely on top of one another in such a way as to permit of the free circulation of air amongst them.—E. W. L.

White-lead stack. A. J. Meier, Glendale, Mo. U.S. Pat. 996,041, June 20, 1911.

The stack comprises a bed of tan-bark, on a support, covered by a horizontal layer of tiles. The tiles have separate upper and lower series of openings in the corresponding faces, the openings of one series being in communication with, but out of alignment with, those of the other series, in order that heat may pass through to the corroding pots, but that the white lead may not fall through and mix with the tan-bark. The tiles are provided with over-lapping rabbets on their mutually adjacent edges, with a similar object.—E. W. L.

Lead oxides and white lead ; Process for the production of ——. H. C. Heide, London. From J. W. Bailey, Bayonne, N.J., U.S.A. Eng. Pat. 6273, March 12, 1910. Under Int. Conv., March 12, 1909.

See Fr. Pat. 413,507 of 1910 ; this J., 1910, 1120.—T. F. B.

Lead oxides and white lead ; Apparatus for the production of ——. H. C. Heide, London. From J. W. Bailey, Bayonne, N.J., U.S.A. Eng. Pat. 6274, March 12, 1910. Under Int. Conv., March 12, 1909.

See Fr. Pat. 413,508 of 1910 ; this J., 1910, 1120.—T. F. B.

Wood ; Apparatus for extracting products from ——. E. C. R. Marks, London. From The Southern Manufacturing Co., Pittsburg, U.S.A. Eng. Pat. 27,076, Nov. 21, 1910.

See U.S. Pat. 982,631 of 1911 ; this J., 1911, 295.—T.F.B.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Rubber mixings ; Rapid determination of fillers (*mineral matter, etc.*) *in* ——. Brüggemann. Gummi-Zeit., 1911, **25**, 1529—1530.

One grm. of the sample is extracted with acetone, the residue dried at 50°—60° C., and heated with 25 c.c. of petroleum (b.pt. 230°—260° C.) in a 100 c.c. Erlenmeyer flask. in a paraffin-wax bath, until the rubber has gone into solution. The flask is then nearly filled with benzene, and allowed to stand for 24 hours in order that the minerals and undissolved organic matter (cellulose, carbon, etc.) may settle out. The insoluble matter is filtered off through a weighed Gooch crucible, which has been prepared by forming in it, over the usual two thicknesses of filter-paper, a filter bed of kieselguhr (or "atmido") of about half the depth of the crucible. Filtration is complete in about 2 hours, a perfectly clear filtrate being obtained in one operation. The same filter can be employed again, after removing the surface to a depth of about 2 mm.
—E. W. L.

Rubber : Coefficient of expansion of ——. H. Bouasse. Caoutchouc et Guttapercha, 1911, **8**, 5286—5289.

The author points out that the thermodynamical reasoning, according to which a negative coefficient of expansion is possible for rubber, is sound except that it does not take hysteresis into account. The effect of change of temperature essentially depends on the previous history of the sample. When working with different samples, even if these are identical at the beginning of the operations, they will differ according to the treatment they receive. Thus it is necessary to define certain parameters possessing a meaning for different samples which have been deformed in various ways. For this object it is desirable that exhaustive studies should be made on a single definite sample.—H. E. P.

Rubber; Bromination of vulcanised ——. W. A. Caspari. Caoutchouc et Guttapercha, 1911, 8, 5289—5291.

Samples of washed Para and of good quality plantation rubber were mixed with 50 per cent. of sulphur. Portions were submitted to suitable cures, then finely divided, and extracted for two days with boiling acetone. In this way a series of samples of vulcanised rubber were obtained containing no free sulphur, and from 1·23 to 28·40 per cent. of combined sulphur. These samples were then brominated in carbon tetrachloride (with and without a small quantity of iodine) and in water, both cold and hot, according to the method of Hübener. The sulphur and bromine in the bromosulphides were estimated by the Carius method. It was found that on bromination the sulphur of vulcanisation is shared between the bromide and the liquid. In water the greater part passes into solution as sulphuric acid. In carbon tetrachloride the greater part remains in the bromosulphide (average 60 per cent. of the vulcanisation sulphur). Thus contrary to the opinion previously held, the sulphur of vulcanisation is attacked by bromine. The degree of bromination materially depends on the manner in which the operation has been conducted. The yield of bromide exceeds the calculated yield when the bromination is performed in water, which may be due to oxidation of the rubber, since these bromides contain from 5 to 60 per cent. of matter soluble in cold acetone. This soluble portion is a black resin which readily evolves hydrobromic acid at 60° C. The bromides from carbon tetrachloride do not contain more than 1 per cent. of matter soluble in acetone; in this case the amount of bromide found agrees well with the calculated value. It follows that for a reliable method of estimating rubber by bromination the conditions require sharp definition. —H. E. P.

Patents.

Caoutchouc and an intermediate product [*isoprene*]; *Synthetic manufacture of* ——. W. H. Perkin and C. Weizmann, Manchester, and F. E. Matthews and E. H. Strange, London. Eng. Pat. 5932, March 9, 1910.

See U.S. Pat. 991,453 of 1911; this J., 1911, 833. The isoprene is converted into caoutchouc by condensation and polymerisation.—T. F. B.

Caoutchouc or homologues thereof; Synthetic manufacture of —— *and intermediate products.* W. H. Perkin, Manchester, and F. E. Matthews and E. H. Strange, London. Eng. Pat. 5931, March 9, 1910.

(1). A mixture of a ketone and an α-halogen fatty ester is treated with zinc and then with water, giving compounds of the type of αββ-trimethyl-β-hydroxypropionic ester. (2). Compounds obtained as in (1) are dehydrated, yielding compounds of the type of trimethylacrylic ester. (3). Compounds obtained as in (2) are treated with a halogen, yielding compounds of the type of αβ-dibromotrimethylpropionic ester. (4). Isoprene or a homologue is obtained by hydrolysis of compounds obtained as in (3), when two molecules of halogen acid and one molecule of carbon dioxide are split off. (5). Caoutchouc or a homologue is obtained by a series of operations as (1) to (4) above, afterwards condensing and polymerising the isoprene or homologue thus obtained.—H. E. P.

Rubber or substances closely resembling rubber; Production of —— *and of ferments for such production.* A. G. Bloxam, London. From W. M. Callender, Guernsey. Eng. Pat. 6486, Mar. 15, 1910.

Rubber latex is subjected to the action of a proteolytic enzyme, active in neutral or slightly alkaline solution, such as bromelin. A current of air or oxygen may be passed, and glycerin and a suitable salt, such as ammonium persulphate, may be added. Rubber is obtained from coal tar by the action of the rubber ferment obtained as above.—H. E. P.

Isoprene; Production and polymerisation of —— [*to caoutchouc*]. A. Heinemann, London. Eng. Pats. (1) 14,040, June 10, and 24,236, Oct. 19, 1910; (2) 14,041, June 10, and 24,237, Oct. 19, 1910.

(1). Turpentine oil is depolymerised by passing the vapours over finely-divided and heated copper or silver, or through a heated structure of these metals. (2). Rubber is produced by treating isoprene with oxygen or ozone and heating the product till it becomes viscous.—H. E. P.

Rubber; Process of manufacturing cellular ——. H. Dogny and V. Henri. First Addition, dated Jan. 17, 1911, to Fr. Pat. 422,118, Jan. 11, 1910 (this J., 1911, 561).

The envelope of semi-vulcanised rubber, mentioned in the original patent (*loc. cit*), is dispensed with, the alternate perforated and unperforated sheets of unvulcanised rubber being built up and kept enclosed in a mould until the mass has been charged with air or gas under pressure, and is quite ready to be transferred to the mould in which it is to be vulcanised.—E. W. L.

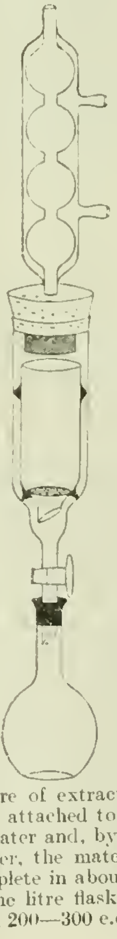
Rubber, ebonite, vulcanite, or similar substances; Manufacture of articles from old ——. H. H. Tarver. Fr. Pat. 424,961, Jan. 17, 1911. Under Int. Conv., Jan. 18, 1910.

See Eng. Pat. 1335 of 1910; this J., 1910, 1465.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

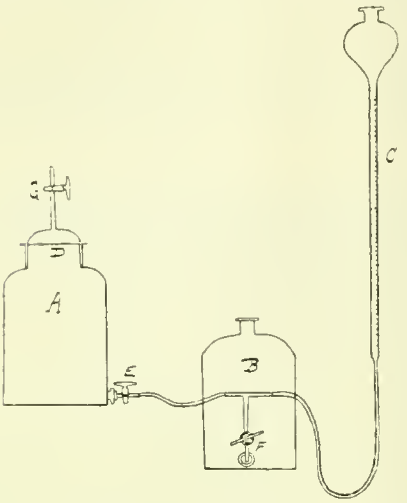
Extraction apparatus [*for tannin analysis*]; *The Grasser-Allen* ——. M. Auerbach. Collegium, 1911, 217—219.

The rule of the Internat. Assoc. Leather Trades Chemists, that one litre only of water shall be used in the extraction of tanning materials for analysis, causes considerable differences with various materials. In some cases, complete extraction with one litre is impossible, and the rule of returning the unextracted tannin as "difficultly soluble" leads to difficulties. This is most apparent where samples of tanning material are analysed for works control, before and after extraction. A material which has been well leached in the works will show practically no tannin by the present method of analysis, whilst it may actually contain appreciable quantities. A larger yield of tannin may thus be obtained from a material than is shown by its analysis. Koch's apparatus, which is used to the greatest extent on the Continent, is inconvenient and any concordance of results obtained with it is purely accidental. The sanction of the use of the Teas extractor complicates matters still further, as, with this apparatus, about 2 per cent. more tannin is usually found than with other extractors. The present apparatus (see fig.) is a combination of those devised by Teas and Grasser. The material is placed in the inner glass vessel and covered with cold water after closing the tap. After a time the water is removed to a graduated litre flask and replaced by water at a higher temperature and the operation repeated till the temperature of the water is about 50° C. and half a litre of extract has been obtained. A boiling-flask is then attached to the apparatus containing about 250 c.c. of water and, by opening the tap and using a reflux condenser, the material is further extracted. Extraction is complete in about one hour. The water is added to that in the litre flask and the last traces of tannin extracted with 200—300 c.c. of water.—D. J. L.



Voluminometer for untanned skin; A simple ——. J. T. Wood and D. J. Law. Collegium. 1911, 230—232.

The apparatus consists of the bottle, A, in which the skin is placed, connected by thick-walled rubber tubing, with the reservoir, B, and the burette, C. The bottle, A, is



closed by an accurately ground stopper, D, which is continued in a capillary tube closed by the tap, G. The bottle, A, and the burette, C, are filled with water and the level in C adjusted to the zero mark by opening the tap, F. The tap, F, is then closed and with G and E open the level of the water in A is caused to fall below the level of the stopper by lowering C. The stopper, D, is then removed and the piece of skin introduced. After replacing D, the bottle is filled completely up to G, by raising C, and, after closing G and E, the volume of the skin is indicated on the burette scale. By filling the apparatus with other liquids or solutions, their real swelling or contracting effect on skin may be observed. In this case, after adjusting the level to G, the tap is closed and by leaving E open the change of volume is indicated by the change of level of the liquid in the burette.—D. J. L.

Tannery effluents; Treatment of ——. J. A. S. Morrison. J. Amer. Leather, Chem. Assoc., 1911, 6, 326—342.

In respect to modes of treatment of their effluents, tanneries may be divided into two classes, those having access to the sewers and those which must treat their effluent to render it fit to discharge into a stream. In the second case the removal of solid matters is very important as the deposition on the bed or banks of a river of solids in a state of putrefaction has an undesirable effect. The determination of oxygen absorbed and albuminoid nitrogen are the most reliable tests of the putrescibility of an effluent. Of the waste liquors of a tannery the most objectionable are the soaks, spent liquors and old limes; other liquors are more easily treated. A tannery having a capacity of 1500 hides per week will probably run to waste 25,000 gallons of old tan liquors and 10,000 gallons of old limes: puers and wash waters will account for 75,000 gallons, whilst soaks add 40,000 gallons, making a total of about 150,000 gallons. As lime liquors and tan liquors are mutually precipitable, lime liquors should have separate drainage. If this is not the case, sludging of the drains may occur and precipitation and staining in lime pits may even occur through back-washes when running off old limes. A great part of the suspended animal matter is carried down with the lime-tannin precipitate and the proportions of liquors run into the tanks must be regulated to obtain maximum precipitation. Quiescent settling or continuous flow settling may be used. If full precipitation is not attained through continued excess of one liquor, the addition of precipitants is necessary. The best for this purpose is aluminium sulphate; the waste liquors being usually alkaline, aluminium hydroxide is precipitated. In extreme cases lime is added to render the liquors alkaline. Quiescent settling needs the greater attention but more exact and efficient treatment is obtained by this method and a smaller amount of sludge is produced. The amount of suspended solids varies with the flow of one or other waste liquor. An average sample of untreated effluent from a tannery at Burnley gave, on different days, the following figures:—

	Parts per 100,000.		
	Total.	Organic and volatile.	Ash.
Sample A, solids in suspension	324	308	16·0
,, ,, ,, solution ...	256	206	50·0
,, B solids in suspension	80	43	36·8
,, ,, ,, solution ...	84	26	57·2

After the treatment in precipitating tanks the effluent is more efficiently purified by filtration through the soil or by percolation through filter beds in a manner similar to that in use in sewage purification works. Little bacterial purification of tannery effluents has been attempted in England, but important pioneer work has been done in the United States. Some experiments described by H. W. Clark, chemist to the Massachusetts Board are quoted. A sheep-skin tannery (A) had 20,000—50,000 gallons of effluent daily. Attempts made to treat this on a sand filter 2 feet in depth, applying it at the rate of 25,000 gallons per acre per day reduced the oxygen figure from 61·25 to 7·92 parts per 100,000 but the filter soon became clogged by suspended matter. Admixture with old lime liquors effected the removal of 60 per cent. of the dissolved organic matter. The settled liquor was then run upon a sand filter four feet deep at the rate of 30,000 gallons per acre per day. By this treatment there was obtained, for two and a half years, a clear and colourless effluent containing much nitrates and a low oxygen absorbed figure. The nitrates were increased from 0·17 to 9·96 per 100,000. Albuminoid nitrogen decreased from 2·39 to 0·23 and oxygen absorbed from 46·66 to 1·79 parts per 100,000. Another tannery (B) was working cured skins and consequently naphthalene was present in the waste liquors; arsenic was also present, having been used in the limes. Precipitation and settling and filtration through 4·5 feet of sand produced a good effluent, but nitrification was considerably affected by the arsenic. Much of the arsenic was removed by the precipitation process, the amount decreasing from 8·54 to 1·67 parts of arsenious oxide per 100,000. The arsenic was almost entirely removed by passing through a coke filter, 2 feet in depth, which effect was attributed to the iron in the coke. The settled liquors were applied to this filter at the rate of 100,000 gallons per acre per day and afterwards through the sand filter. The oxygen absorbed figure was reduced from 40·50 to 10·57 by the coke-bed treatment and to 3·52 parts per 100,000 by the sand filter. The coke-bed treatment increased the nitrates to 0·12 part per 100,000, which figure was increased to 1·97 by the sand filter. Fowler (this J., 1911, 174 *et seq.*) has shown that effluents containing phenol and thiocyanates can be purified by bacterial filters, and there should be little difficulty in applying the method to the successful treatment of tannery effluents. The bacterial treatment would probably be best effected by the provision of two filters of carefully graduated coke breeze with a depth of 5—6 feet. The filter must be matured, which is best done by inoculation from a sewage filter. The liquid is best delivered by rotating distributors but it should be possible to distribute quite well by troughs laid on the top of the filter. The following limits for the purified effluent are desirable:—

	Parts per 100,000
Oxygen absorbed in 4 hours at 80° F.	below 2
Solids in suspension	below 10

The sludge has a good manurial value and is best treated, where the quantity is not sufficient to warrant the installation of a sludge-pressing plant, by running upon heaps of stable manure and intimate mixing, when good saleable manure is obtained.—D. J. L.

Diffusion of tannins through gelatin jelly. A. W. Hoppenstedt. J. Amer. Leather Chem. Assoc., 1911, **6**, 343—351.

Very little work has been done on the relative penetration of various tannins through hide. Youl and Griffith (this J., 1901, 426) have carried out some experiments on the subject, assuming that the amount of penetration was indicated by means of the determination of the hide-substance in leather during regular stages of the tanning. but this seems hardly justifiable, for the molecular and combining weights of the tannins should be considered. Five per cent. solutions of pure neutral gelatin were made and allowed to set in large test tubes and a similar set of tubes made up with the inclusion of 0·015 per cent. of ferric ammonium alum in the gelatin. The latter tubes were used so that the diffusion of all substances giving a reaction with iron might be observed, even though the substances themselves were colourless. Solutions of various tanning materials containing 4 grms. of tannin per litre were made and poured upon the surface of the gelatin, the height of the liquor in each one being identical and equivalent to that of the jelly below. Diffusion progresses steadily, and the various materials maintain their relative positions throughout. Sicilian sumac showed the greatest diffusion, followed closely by Virginian sumac, which in turn was followed closely by divi-divi, gambier, chestnut, myrobalans, and oak. Valonia and algarobilla came next, followed by hemlock and hemlock extract which were very nearly alike. Ordinary and clarified quebracho extract came next and showed a marked lack of diffusive power. Two mangrove barks showed hardly any diffusion at all. Diffusion in the pure gelatin and in the gelatin containing iron was practically the same. Of the seven main tanning materials used in the manufacture of sole leather, the order of rapidity of diffusion was as follows: chestnut, myrobalans, oak, valonia, hemlock, quebracho, and mangrove. The fluorescent substance of the oak extract showed very rapid diffusion. The lack of diffusivity of mangrove bark may bear some relation to Eitner's contention (Gerber, 1907, 780, 61) that mangrove is not a true tannin but more nearly allied to a vegetable colouring matter. It was supposed that clarified quebracho extract containing much sodium sulphate and sulphur compounds would diffuse more rapidly than the ordinary extract but the opposite was the case. The formation of darker-coloured layers or rings was noticed; these were also observed by Proctor and Law (this J., 1909, 297—299) in the diffusion of chromium salts through gelatin jelly and may be explained by the theory of Ostwald regarding the formation of layers of supersaturated solution (Allg. Chemie. 11. 778—780). All the blacks produced in the jelly, by both the catechol and pyrogallol tannins, were blue-blacks. All of the pyrogallol tannins diffused more or less rapidly, while this was the case with only two of the catechol tannins, namely, oak and gambier.—D. J. L.

Patents.

Hides and skins; Treatment [dyeing] of ——. M. C. Lamb, Blackheath, and J. W. H. Hall, Leeds. Eng. Pat. 13,432, June 2, 1910.

The skin is clamped taut to a frame and is caused to travel over a pipe fitted with nozzles through which the dyeing liquid is forced under pressure. The frame is moved by means of an endless chain situated above the skin, the chain and frame being provided with lugs which engage. Uniform spraying of the skin is effected by giving the pipe a reciprocating motion, and by staggering the nozzles. By means of a lever in the track of the frame, the spraying liquid is automatically turned on and shut off.—T. St.

Impervious leather; Process and machine for the production of a new ——. F. Cartaud. Fr. Pat. 425,279, March 31, 1910.

Flesh splits are coated with a very thin layer of caoutchouc applied in the form of a 10 per cent. solution in benzol (b. pt. 80°—120° C.). The coating is rendered opaque and coloured by pigments and while still plastic is rendered even or given an artificial grain by rolling. Vegetable-tanned splits are preferable when the appearance of the product is the first consideration, as with leathers for upholstery and book-binding, and for hat leathers. For boot-making, chrome-tanned leather is preferable. Splits of oil- or alum-tanned leather may also be employed. Vulcanisation is effected in the cold, by the application, with a brush, of a 3—5 per cent. solution of sulphur chloride in carbon bisulphide and drying in the air or at a gentle heat. The caoutchouc layer may be vulcanised hot by adding 5—10 per cent. of sulphur to the pigment used and, after drying, submitting the leather to a temperature of 130°—140° C. for 2 or 3 hours in an autoclave. The product thus obtained is less uniform than when cold vulcanised and the method can only be used with chrome leather. A machine for carrying out these operations is described.—D. J. L.

Milk; Treatment of skimmed —— *for the production of solid material [horn substitute] therefrom.* R. Koster and W. Goettler, Enfield, Middlesex. Eng. Pat. 6160, Mar. 11, 1911.

Skimmed or separated milk, coloured with an aniline dye or not (136 gallons) is warmed to a temperature of 70° to 100° F., the higher temperature being necessary only if the weather is cold or the treatment takes place in a cold room. Rennet (½ pint) is added, and the milk curdled. The whey is then removed, and the curd washed in two or three changes of cold and finally with hot water (80°—120° F.). The curd is allowed to cool and drain, and is then comminuted, placed in hot moulds (180° F.) and pressed (300 lb. per aq. in.). The articles thus prepared are hardened by means of formaldehyde or other hardening agent.—E. W. L.

Horn-like material; Preparation of a ——. A. Bartels. First Addition, dated Jan. 23, 1911, to Fr. Pat. 420,543, Sept. 19, 1910 (this J., 1911. 376).

Casein, in the form of powder, is kneaded with as little water as possible (about 20—42 parts of water to 100 parts of the mixture) under the simultaneous influence of high pressure and heat until a homogeneous mass is obtained. This is then pressed, with heating, into the form of slabs, rods, or moulded articles. The objects are hardened, in the usual way, with formaldehyde.—D. J. L.

Albuminous animal materials into non-inflammable plastic materials; Process for transforming ——. Soc. anon. franç. de Chim. Ind. Fr. Pat. 425,204, March 30, 1910.

The albuminous substance, in solution, alkaline or otherwise, is agglomerated by means of a suitable agglutinant and mixed with a colouring or oily material, according as the product is required coloured or translucent. A non-corrosive antiseptic is incorporated during the mixing and the antiseptic treatment is completed by impregnation of the mass with formaldehyde. For example, a mixture is made, in the cold, of 35 per cent. of casein, 5 per cent. of sodium carbonate, 20 per cent. of white gum and 20 per cent. of glue, and the colouring or oily matter is added to this. 20 per cent. of glue of good quality is next added, and the finely powdered mixture is dissolved in an 8 per cent. aqueous solution of zinc acetate or in a 10 per cent. solution of lead acetate. From 15 to 20 per cent. of resin oil warmed on the water bath with a small quantity of a non-corrosive antiseptic is added gradually to the homogeneous mass which is then dried under pressure in a suitable mould. The articles thus made are immersed in a 20 per cent. solution of formaldehyde till completely impregnated and allowed to dry for 8—10 days.—D. J. L.

Leather; Process for the treatment of chrome-tanned ——. R. W. Griffith, New York. U.S. Pat. 996,080, June 27, 1911.

See Eng. Pat. 24,508 of 1909; this J. 1910, 708.—T. F. B.

Skins; Process for deliming ——. C. H. Boehringer Sohn. Fr. Pat. 425,391, Jan. 30, 1911. Under Int. Conv., June 23, 1910.

See Eng. Pat. 3140 of 1911; this J., 1911, 638.—T. F. B.

XVI.—SOILS; FERTILISERS.

Manuring the cacao tree and of the oil palm in Cameroon. T. Zeller. Tropenpflanzer. 1911, **15**, 345—359.

The increasing exportation of cacao beans and palm nuts, which deprives the trees of valuable nutrients, renders artificial manuring of these crops necessary; this point has not yet received sufficient attention. The cacao tree particularly needs lime and potash, and the requirements per tree are nitrogen, 56 grms., potassium oxide 90 grms., phosphoric acid, 120 grms. For the oil palm the requirements per tree are nitrogen 128 grms., potassium oxide 306 grms., phosphoric acid 265 grms. In view of their high content of lime and potash, wood ashes are a suitable manure for the cacao tree. The investigation of several catch crops dug in to enrich the humus material in the soil showed that *Crotalaria* species, in particular *C. striata*, gave the greatest weight of dry material and nitrogen calculated on the basis of the crop obtained per square metre.—E. F. A.

Cyanamide; Decomposition of —— by fungi. H. Kappen. Centralbl. f. Bakt., 1910, **26**, 633. Biedermann's Zentr., 1911, **40**, 447.

Five different soil fungi are shown to decompose cyanamide, requiring for this purpose only very little organic nutriment. In some cases decomposition was observed without the addition of organic matter or visible growth of the fungus. Fungi vary in their resistance to cyanamide: two of those tested grew and decomposed cyanamide in 2 per cent. solution, others were killed in a 1 per cent. solution. Urea is formed by the fungi, the active enzyme being not identical with urease. It is further not an ectoenzyme since the filtered decomposing liquid is without action on fresh cyanamide solution. The organisms do not grow in nitrolime (crude calcium cyanamide) solution. Dicyanodiamide is useless as a source of nitrogen for the fungi investigated.—E. F. A.

Calcium cyanamide: Analysis of ——. A. Stutzer. Chem.-Zeit., 1911, **35**, 694.

Determinations of the total nitrogen in calcium cyanamide by the Kjeldahl method are found to agree closely with the results obtained with the salicylic acid process, contrary to Monnier's statement that the results given by the former method are about 1 per cent. low (this J., 1911, 821). Monnier's statement that 1·52 per cent. of nitrogen is wholly or partially derived from the carbon used in the process of manufacture (*loc. cit.*) is also stated to be erroneous, only 0·14 per cent. of such nitrogen being found. The reliability of Caro's method for determining the cyanamide-nitrogen is re-affirmed (see this J., 1910, 1218).—A. Sbld.

Manganese sulphate; Effect of —— on the growth of plants. Relations between the action of iron and of manganese in soils. G. Masoni. Staz. sperim. agrar. ital., 1911. **44**, 85—112. Chem. Zentr., 1911. **2**. 35—36.

From the results of experiments with lupins and wheat on soils to which definite quantities of manganese sulphate, ferrous sulphate, and sodium sulphate were added, the author concludes that the effect of manganese sulphate depends much more upon the SO_4 radical than upon the manganese. Indications were obtained that the action of manganese sulphate is impeded in presence of ferrous sulphate. In the soil manganese sulphate is converted into a compound (probably the carbonate) soluble only in acids.—A. S.

Lead arsenate insecticide; Adherence of ——. H. Astruc, A. Couvergne, and J. Mahoux. Comptes rend., 1911, **152**, 1860—1862.

The author prepared lead arsenate by the interaction of 200 grms. of anhydrous sodium arsenate and 600 grms. of crystallised lead acetate in aqueous solution and compared the adherence to glass and to leaves of plants of concentrated pastes of the same, freshly prepared and after keeping for periods of up to 20 days. The results are held to show that the age of the insecticide preparation has only a slight influence on its adherence to leaves of plants. Pastes which have been kept for five days adhere almost as well as when freshly prepared, and when kept for 20 days, the amount which adheres to the leaves after washing with water is about one-fourth less than the corresponding amount with freshly prepared pastes. With dried lead arsenate mixed to a paste just before use, the adherence is about three-quarters of the maximum obtained with freshly precipitated lead arsenate. The adherence is just as marked on glass as on the leaves of plants, and is thus a specific property of the precipitated lead arsenate. Only a very slight tendency of the particles of precipitated lead arsenate to become larger on keeping could be detected by microscopic examination.—A. S.

Annual report on alkali, etc., works. See VII.

Patents.

Fertilizer and process of making same. S. B. Newberry and H. N. Barrett, Baybridge, Ohio. U.S. Pat. 995,028, June 13, 1911.

Natural phosphate is ground and mixed with an amount of sulphuric acid approximately equivalent to the phosphate present. The mixture is calcined in an oxidising atmosphere at a temperature high enough to decompose the calcium sulphate formed, the calcined product finally being ground.—T. St.

Superphosphate; Process and apparatus for the continuous and automatic manufacture of —— in pits. E. Bracq-Laurent. Fr. Pat. 425,210, Dec. 15, 1910.

The mixture of phosphate and sulphuric acid is delivered from an incorporating machine into cylindrical pits with conical bottoms. These cylinders are rotated continuously and are also provided with rotating arms to keep the mixture thoroughly stirred. Whilst still hot the mixture passes into another vertical cylinder, below the first, which also rotates. Here the mixture remains for about 24 hours, during which it is slowly agitated by the rotating arms. A current of air assists the drying. The operations of filling and discharging the cylinders follow each other continuously and automatically.—G. W. McD.

Phosphates; Apparatus for the concentration of low-grade ——. C. Poupart. Fr. Pat. 425,516, Oct. 3, 1910. Under Int. Conv., June 20, 1910.

The mineral is pulverised and passes into an inclined tube where it meets with a water spray in sufficient amount to damp it thoroughly. It then falls into a drum provided with projecting blades and rotating at 800 revolutions per minute. Here the nodules are broken up and the moist material is then carried by a current of water over an inclined sieve to another drum also having projecting blades and rotating at 300 revolutions per minute, where it is transformed into a thick cream. By two jets of water the cream is forced through a sieve into a long tray containing water, in which is an endless rubber band travelling at the rate of 20—30 m. per minute. Before reaching the band the material has to fall through a layer of 8—10 cm. of water, and the finer and non-phosphatic portion is thus floated away. The band carries the concentrated material to a second and then to a third tray similarly arranged, from the last of which it passes away to be packed.—G. W. McD.

Superphosphates; Manufacture of ——. G. Cusatelli, Taranto, Italy. Eng. Pat. 18,523, Aug. 5, 1910. Under Int. Conv., June 8, 1910.

See Fr. Pat. 419,716 of 1910; this J., 1911, 228.—T. F. B.

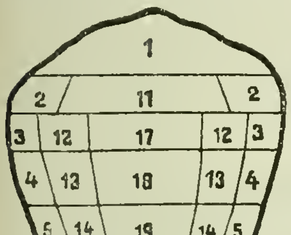
Manure from raw phosphates; Process of manufacturing ——. W. Palmaer, Stockholm. U.S. Pat. 995,894, June 20, 1911.

See Addition of March 4, 1907, to Fr. Pat. 326,917 of 1902; this J., 1907, 936.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Sugar beet; Distribution of sugar and non-sugar in the ——. A. Floderer and A. Herke. Österr.-Ungar. Zeits. Zuckerind. u. Landw., 1911, 40, 385—397.

Although a considerable amount of work has been done on this subject, which has an important bearing both on seed selection and on methods of sampling for analysis, the authors consider that it is all open to criticism, principally on account of an inadequate procedure in dividing the root. In now recommencing their investigation, large roots, uniform in size, both fresh and siloed, were divided into 19 pieces by making ten transverse sections, which again were subdivided into concentric rings, in the manner shown in the figure. 50 roots in all were used, and the respective pieces of these mixed together and analysed. As to sucrose, it was found that it is highest in the interior portion of the root, and that it accumulates most in that portion between the middle axis and the epidermis where tapering commences, in the following order, beginning with the highest content: 14, 15, 19, 13, 12, 18, 17, and 16; after which the sugar content decreases as follows: 11, 6, 8, 5, 4, 3, 7, 9, 2, 10, and 1. It was thus established that the highest amount of sugar occurs in the body of the root, the next highest in the tail, and the least amount in the crown. It was also found that the total dry substance content is practically constant throughout the whole of the root, scarcely varying at all with increase of sugar content; but that, as a consequence, the dry substance of the non-sugars decreases as the sugar content increases. Regarding the non-sugars, with fresh roots it was found that the soluble nitrogen content is smaller in the interior than in the exterior portions of the root, and that the amount of ash present is in inverse proportion to the sugar content. Both the potash and the magnesia were observed to decrease from the top downwards to the region where the greatest amount of sugar occurs, and then afterwards to increase. Between the sugar content and the contents of lime, soda and phosphoric acid it was, however, found impossible to establish any definite relationship.—J. P. O.



Beetroot juice; Process for the purification of ——. F. Rambousek. Z. Zuckerind. Bohm., 1911, 35, 587—591.

The diffusion juice flowing from the battery is passed through a de-pulper to remove the coarser particles of broken slices, pulp and root hairs and, after being heated to precipitate protein, is filtered through a sand filter to separate this along with the finer mechanical impurities. The juice is heated to 90° to 95° C., by passing it in a rapid stream through a heater, and filtered hot. During the heating the juice darkens through oxidation of the chromogen, but in this form the latter is more readily removed than in its original unoxidised condition. The filtered juice is much lighter in colour, is free from albumin, does not froth so much as the unfiltered juice, and less lime is required for its subsequent purification. It is next run into wooden tanks provided with stirring arms into which rods of tin are inserted, and is stirred along with wood charcoal and coke for 10 minutes. The charcoal and coke, by reason of their porosity, absorb colouring matters, and the wood charcoal removes odoriferous substances. The coke is treated before use with hydrochloric acid to remove sulphites. Wood is recommended for the tanks because the action of iron on the juice previous to addition of lime must be avoided otherwise the juice would be coloured a bluish violet. The tin is only slightly acted on and lasts a long time. Milk of lime is now added to the turbid juice in the proportion of 1·26 to 1·50 per cent. calculated on the juice; saturation to 0·06 alkalinity to phenolphthalein follows. The juice is then heated to 85° C. and filtered. Filtration is easy owing to the coke and charcoal rendering the cake open. The juice is saturated a second time, without the addition of lime, to 0·01 of alkalinity, heated to 85° C., and filtered. It is of advantage to boil the juice at this stage to decompose calcium bicarbonate. The third saturation is omitted. The juice is then sent to be concentrated, and the thick juice is sulphured until neutral to litmus. It is light coloured, boils well and yields a pale yellow massecuite. The washed or spun sugar is quite white. Including the cost of the coke and wood charcoal and taking account of the smaller quantity of lime required, the cost of purification is reduced to nearly half of that by the usual process where 3 per cent. of lime is used.—L. J. de W.

Beet seed; Experiments with decorticated ——. J. Gyárfás. Österr.-Ungar. Zeits. Zuckerind. u. Landw., 1911, 40, 398—413.

In carrying out experiments on the probable advantages of decorticating beet seed, two different kinds of seed, Schreiber's "Original" and Aderstedt's "Neuzucht," were used. During the operation of decortication by means of Kühne's machine, it was found that the loss was 25·6 and 38·5 per cent. respectively. By laboratory tests of the germinative energy, it was observed that decortication exerts on the whole an unfavourable effect, as the following figures indicate:—

	After 5th day.				After 12th day.			
	Schreiber.		Aderstedt.		Schreiber.		Aderstedt.	
	Seed-balls.	Sprouts.	Seed-balls.	Sprouts.	Seed-balls.	Sprouts.	Seed-balls.	Sprouts.
Undecorticated	63	128	57	120	67	139	58	124
Decorticated	64	135	39	76	70	146	42	84

Field trials showed that with decorticated seed the seedlings developed more rapidly, but that the roots had a greater tendency to "shooting." Similar experiments established that with decorticated seeds the crop was greater than with ordinary seeds, although no difference could be detected in the sugar content of the individual roots.—J. P. O.

Starch and dextrin ; Action of hydriodic acid upon ——. Oechsner de Coninck and Raynaud. Bull. Soc. Chim., 1911, **9**, 586—587.

The results of experiments show that when heated with dilute hydriodic acid dextrin is more readily hydrolysed than starch and that in both cases, the amount of sugar formed increases with the quantity of acid used.—J. A.

Patents.

Juice of sacchariferous plants ; Process for the extraction of ——. C. Steffen, Vienna. Eng. Pat. 4519, Feb. 22, 1911. Under Int. Conv., Feb. 26, 1910. (See Eng. Pat. 5439 of 1903 ; this J., 1903, 811.)

Comminuted sacchariferous plants as beetroots, sugar canes or the like are treated with heated crude juice until the mass has attained a temperature of 60° to 90° C., when it is pressed and separated into juice and residue, the latter being dried to form a nutrient fodder. According to the present invention, the press residues are submitted directly after their pressing and whilst still hot to a thorough lixiviation with water. The extract thus obtained is repeatedly used to treat fresh material, after which (either alone or with the pressed juice) it is submitted to the ordinary treatment for the extraction of sugar.

—L. J. de W.

Syrup [Sugar] ; Continuous conversion, at atmospheric pressure, of refinery —— *into large or small crystals.* P. Lagrange. Fr. Pat. 425,199, Jan. 25, 1911. Under Int. Conv., Jan. 26, and July 20, 1910.

The purified syrup is concentrated under atmospheric pressure until a temperature of 124° C. is attained. At this concentration, the massecuite will only contain 5—6 per cent. of water, and the temperature of crystallisation will be 110° C. The massecuite is then cooled to a point between 124° and 110° C., *e.g.*, to 120°—121° C. if large crystals are required, or to 115°—118° C. if small crystals are required. This cooling is effected in a battery of three cylindrical vessels maintained at the requisite temperature by steam coils. Massecuite is cooled in one of these vessels, whilst cooled massecuite is being discharged from another and fresh massecuite is being charged into the third. The cooled, still liquid massecuite is run into moulds to crystallise. The green syrup is removed from the crystallised sugar in an apparatus which comprises a cylindrical vessel provided with a conical bottom, and an internal perforated partition concentric with the wall of the vessel, the annular space between the partition and the wall communicating with the external air. The moulds are placed in the internal space bounded by the partition, and in contact with the partition, so that on exhausting the air from the internal space, through a pipe leading from the bottom of the vessel, the air that passes into the internal space through the holes in the partition, also passes through the slabs of sugar and removes the syrup therefrom. Owing to the resistance to the flow of air through the sugar, a partial vacuum is produced in the internal space, and this aids the removal of the syrup.—L. E.

Beetroots ; Treatment of waste portions of —— *and apparatus therefor.* J. E. Aubineau. Fr. Pat. 425,359, Jan. 28, 1911.

The material (rootlets, trimmings, etc.) is first washed in a vat and then passes to a trough in which it is subjected to a further washing process by a stream of water. The lower end of the shaft of an inclined screw conveyor is pivoted to a support in the side and near the bottom of the trough ; the screw does not extend to the lower end of the shaft, which is provided with stirring blades in its lower part, but the surface of the water in the trough covers the lower part of the screw. The material is stirred by the blades of the rotating shaft, and caught by the screw ; stones, etc., sink to the bottom of the trough, whilst light impurities float on the surface of the water, and are prevented by a barrier from being caught by the conveyor. The material passes from the top of the conveyor and slides over the inclined side of a hopper. An opening in this inclined side permits the material to fall through to a mill beneath, whilst, owing to their greater momentum, whole beetroots or large pieces which chance to be present in the material, "jump" the opening, and are then returned to the slicing machines. After the material has passed through the mill, it is macerated with 50 per cent. of warm or cold water or press water ; the temperature of the mixture is raised to 80°—85° C., maceration is continued for 30—40 minutes, and the mixture is then transferred to a hopper into which projects the lower end of an inclined rotary screw press and conveyor. The pitch of the screw of this press decreases towards the upper end ; the upper part of the case which envelops the screw is conical and perforated, and the upper end of the case is provided with an adjustable cone for regulating the pressure to which the mixture is subjected. The juice expressed from the mixture is then treated for the recovery of the sugar, whilst the residual pulp which is still rich in sugar may be used as cattle fodder.—L. E.

Starch ; Process of producing ——. J. J. Berrigan, Orange, N.J. U.S. Pat. 994,497, June 6, 1911.

A "starch milk" prepared from maize, is aerated in a centrifugal machine by means of fine jets of air ; the gluten is thus caused to float, and the starch is separated by centrifugal action.—W. P. S.

Starch ; Manufacture of potato ——. H. Benoist. Fr. Pat. 425,430, Jan. 31, 1911.

The potato pulp passes downwards through a series of superposed sieves of increasing fineness, the sieves being kept constantly agitated whilst a shower of water is directed on to the topmost sieve. The starch suspension thus obtained passes to a series of settling vessels. When a certain quantity of starch has been deposited, part of the starch is carried away with the waste water, and this is recovered by passing the water through a second series of settling vessels. Whilst the starch deposit is being removed from the first series of settling vessels, the starch suspension passes through the second series, the first series of vessels subsequently receiving the waste water from the second series and so on. The starch deposit is suspended in fresh water and passed through settling vessels a second and third time ; it is then suspended in water again and passed through a series of very fine sieves.—L. E.

Sugar-producing products and process of producing the same. G. B. McMullen, Chicago. Eng. Pat. 14,657, June 17, 1910.

See Fr. Pat. 417,317 of 1910 ; this J., 1911, 43.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Invertase action ; Inhibition of ——. A. Eriksson. Z. physiol. Chem., 1911, **72**, 313—338.

Invertase may be completely or partially taken up from its solutions by charcoal. When the latter is added to solutions containing enzyme and substrate, inversion is retarded. The inhibition is much more marked if the charcoal is mixed with the invertase solution and stored thus for some hours before addition of the substrate. The effect of storage of the mixture of enzyme and charcoal depends on its duration and on the temperature ; usually a maximum effect is attained after some hours. If then the charcoal is filtered off and the filtrate added to the substrate, inversion is less rapid than if the charcoal is allowed to remain in the mixture. The substrate is capable of re-activating a part of the enzyme taken up by the charcoal. Normal blood-serum has an inhibitive effect on invertase-action, and in this case also the order of mixing the three bodies, enzyme, substrate, and serum, is of importance, the inhibition being most marked when the serum and enzyme are mixed some time before addition of the sugar. Invertase solutions freed foom co-enzymes by dialysis, have, after heating to 100° C., a strong inhibitive action on inversion. That this effect is not due to substances formed only on heating is shown by the fact that a similar retardation is produced by invertase solutions from which the enzyme has been removed by shaking with charcoal, and which have been dialysed to remove co-enzymes. The substance or substances responsible for inhibition dialyse very slowly as compared with salts. The order of mixing does not in this case influence the result to the same extent as with charcoal and serum.—J. H. L.

Yeast-gum. H. Euler and A. Fodor. Z. physiol. Chem., 1911, **72**, 339—346.

Preparations of yeast-invertase, whether produced by extraction of the dried cells or from autolysed yeast, contain considerable quantities of a carbohydrate termed by Salkowski yeast-gum (see this J., 1894, 411). The authors consider that invertase may itself be a higher carbohydrate related to this gum, and they have therefore investigated the nature of the latter. Various methods of preparation were employed. The purest products were snow-white in colour, their rotatory power ranging from $[\alpha]_D=86{\cdot}88°$ to 89° (Salkowski found $[\alpha]_D=90{\cdot}1°$). A determination of the molecular weight indicated a value above 10,000. It has previously been shown that on hydrolysis dextrose and mannose are produced, the proportion of the respective hexoses being 1 : 2 according to Meigen and Spreng. The authors have determined the cupric-reducing power of the products of hydrolysis (reckoned as dextrose) and also the relative proportion of mannose formed, and from the results they calculate that the composition of the gum lies between the limits indicated by the formulæ :—

$$40C_6H_{12}O_6 \text{ (mannose)} + 30C_6H_{12}O_6 \text{ (dextrose)} — 69H_2O$$

and

$$40C_6H_{12}O_6 \text{ (mannose)} + 40C_6H_{12}O_6 \text{ (dextrose)}-79H_2O.$$

—J. H. L.

Furfural ; Reduction of —— by yeast during alcoholic fermentation. C. J. Lintner and H. J. v. Liebig. Z. physiol. Chem., 1911, **72**, 449—454.

The suggestion made by C. J. Lintner (this J., 1910, 776), that the disappearance of furfural during alcoholic fermentation is due to the formation of sulphur derivatives, appears to be incorrect. The aldehyde undergoes reduction to the corresponding furyl alcohol, and a second compound, not yet identified, is also formed. In the authors' experiments fermenting sucrose solutions were treated with 0·5 per cent. of furfural (larger amounts retard fermentation). The aldehyde was completely decomposed within four days, and on working up the products after fermentation had completed itself, an oil was obtained representing 70 per cent. of the furfural employed. This oil was found to consist chiefly of furyl alcohol, but it contained also about 30 per cent. of a substance crystallising in long needles melting at 50·5° C., and distilling with partial decomposition at 235° C. (under 720 mm. pressure).—J. H. L.

Beer ; Chemical behaviour and preservative action of sulphites in ——. J. L. Baker and F. E. Day. J. Inst. Brewing, 1911, **17**, 465—477.

It is a common practice to add sulphites to beer in order to increase the stability of the latter, but since the flavour of the beer is prejudicially affected thereby, it is evident that the preservative should be added in as small a quantity as possible. The authors show that in respect of the development of acidity, no advantage is gained by using large quantities of sulphite ; the maximum beneficial effect is attained by addition of sulphite in quantity corresponding to 50 parts of sulphur dioxide per 1,000,000, whereas the development of acidity appears to be favoured by addition of a considerable quantity of sulphite (corresponding to 100—200 parts of sulphur dioxide per 1,000,000), and is only retarded again by a very large amount of sulphite. When beer is treated with sulphite, the latter appears to combine slowly with certain constituents of the beer during the first few days after the addition. The combination is a stable one since it is not destroyed in acid solution at the normal temperature, though it is decomposed by successive treatment with alkali and acid. The authors show that calcium bisulphite combines with CO compounds present in commercial alcohol, and with maltose, and dextrin, to form substances which are not decomposed by cold hydrochloric acid. Since, in addition to alcohol, maltose and dextrin, beer contains proteins, hop extracts, and secondary products of fermentation, it is not surprising that a large proportion of the sulphite enters into combination : owing to their stability and inactivity, it is very unlikely that the substances so formed should have any antiseptic value. Since they appear to be hydrolysed by water and alkali, these substances may be unstable sulphonates or possibly sulphurous esters. It is most probable that the actual antiseptic value of sulphites is due to that part which remains uncombined or is released by the hydrolytic action of the water. It is also found that even small quantities of sulphites have a retarding effect on the secondary fermentation ; with large additions of sulphites, the retardation may be serious.—L. E.

Beer ; The solubility of carbon dioxide in ——. A. Findlay and Bucchok Shen. Chem. Soc. Proc. 1911, **27**, 189.

Previous experiments on the absorption of carbon dioxide by beer (Langer and Schultze, Z. ges. Brauw., 1879, 2, 369) have been interpreted as showing that beer dissolves more carbon dioxide than the corresponding water-alcohol solution ; and the supposed increase has been attributed to adsorption by the colloids present in beer (Emslander and Freundlich, Z. physik. Chem., 1904, **49**, 317 ; this J., 1904, 945). These conclusions, however, are not in harmony with experiments carried out by Findlay and Creighton (this J., 1910, 350), and the authors now show that carbon dioxide is, as a matter of fact, less soluble in beer than in the corresponding water-alcohol solution, and that the contrary conclusion reached by Langer and Schultze must be attributed to their having used beer supersaturated with carbon dioxide.

Cider making ; Principles and practice of ——. B. T. P. Barker. J. Inst. Brewing, 1911, **17**, 425—441.

Vintage apples may be classified as follows :—1. The sharp or sour class, in which the malic acid-content is above 0·45 per cent. 2. The sweet class, in which the content of malic acid is normally below 0·45, and that of tannin below 0·2 per cent. 3. The bitter-sweet class, in which the content of malic acid is normally below 0·45 and that of tannin is always above 0·2 per cent. except in abnormal seasons. The quality of the juice obtained from a given kind of apple varies both according to the nature of the soil and in different seasons. Attempts are now being made on Mendelian lines to improve the quality of cider fruit by raising new varieties containing suitable combinations of desired characters. The author proceeds to describe the manufacture of cider. Attempts to obtain a more regular type of fermentation by the use of selected yeasts have not led to very satisfactory results ; this is not surprising in view of the variation in quality of the different juices due to the miscellaneous character of the raw material employed. It is quite possible that if a more or less standard quality of juice could always be used, fermentation with pure cultures would give more satisfactory results than natural fermentation. There are usually from 6—12 different kinds of yeast naturally present in the juice ; some are not numerous and are soon crowded out. During the earlier stages of fermentation, yeasts of the *apiculatus* type appear to be most numerous, whilst *ellipsoideus* yeasts predominate at a later stage, and when the fermentation is finished and the cider has partly matured, a number of minute *torula*-like yeasts become conspicuous. Acetification is one of the most troublesome disorders of cider and ropiness is also of common occurrence, but the most characteristic cider disease is that known as "sickness." This disease is very liable to appear in sweet ciders during May and June. At present there is no satisfactory method of preventing the disorder in cask, but the cider may be rendered less liable to sickness by blending the sweet type of juice with juices which normally ferment more rapidly, or by using a comparatively large proportion of apples of the sharp class, or by bottling the cider at a very much earlier date than usual.—L. E.

Vinegar and vinegar essence; Chemical distinction of fermentation ——, with special reference to the content of formic acid. H. Fincke. Dtsch. Essigind., 1911, **15**, 145—148. Chem. Zentr., 1911, **1**, 1887.

By the method described previously (this J., 1911, 82, 235), the author could detect no formic acid in fourteen samples of vinegar and spirit vinegar. Three samples of vinegar containing pyridine contained 0·13—0·38 part of formic acid per 1000 parts of total acid, the proportion increasing with the quantity of pyridine present. Eight samples of wine vinegar contained per 1000 parts of total acid from 0·06 to 0·51 part of volatile acids capable of reducing mercuric chloride, but it has not yet been decided whether these consisted entirely of formic acid; the higher values were obtained with samples of high wine-content. Several undoubtedly genuine samples of fermentation vinegar were free from formic acid. In 21 samples of vinegar essence, the content of formic acid varied from 0·39 to 12·04 parts (mean 4·38 parts) per 1000 parts of total acid. The content of formic acid thus appears to afford a means of distinguishing fermentation vinegar from diluted vinegar essence, and of detecting addition of the latter to the former.—A. S.

Patents.

Beer and other alcoholic liquids; Manufacture of —— and apparatus therefor. J. C. Shears, Kingston-on-Thames, J. Speedy, and The Farringdon Works and H. Pontifex and Sons, Ltd., London. Eng. Pat. 12,915, May 27, 1910.

In the manufacture of beer and other alcoholic liquids, where the fermentation is effected in a closed vessel (see Eng. Pat. 18,645 of 1897; this J., 1898, 784) under pressure of the carbon dioxide evolved, the fermented liquid is passed from the fermenting vessel, by the pressure of the gas, direct through a chiller and filter to unsterilised or previously sterilised bottles or casks without allowing it to come into contact with the air. Claim is also made for an apparatus for moving the yeast-parachute up or down and consisting of a tubular extension of the parachute passing through a stuffing-box in the bottom of the fermenting vessel.—T. H. P.

Beer and method of preparing same. L. Wallerstein, New York. U.S. Pat. 995,820, June 20, 1911.

The cooled wort is treated with a preparation of malt, containing a proteolytic enzyme which is active in slightly acid media, and practically free from unstable albumins devoid of proteolytic action. The enzyme is added in such quantity and under such conditions, as to remain in the active state in the finished beer, and thus to render the latter chillproof and more stable at ordinary temperatures.—L. E.

Fermented beverages; Process of treating ——. L. Wallerstein, New York. U.S. Pat. 995,821, June 20, 1911.

The fermented beverage is heated to a temperature above 120° F., cooled to an extent sufficient to precipitate the albuminoids modified by heating, carbonated, freed from the precipitated albuminoids, bottled, and pasteurised. —L. E.

Lupulin; Preparation containing —— and method of making same (1). *Preparation for use in brewing* (2). L. Wallerstein, New York. U.S. Pats. 995,822 and 995,823, June 20, 1911.

(1) Lupulin, mixed with sugar, is ground until it is capable of yielding clear or opalescent solutions or pseudo-solutions of a yellowish colour with water. (2) A preparation containing water-soluble lupulin and a proteolytic enzyme active in slightly acid media, is added to beer or ale prior to bottling, in order to stabilise it.—L. E.

Beer or ale; Method of treating ——. L. Wallerstein, New York. U.S. Pats. 995,824—995,826, June 20, 1911.

The beer or ale is treated, prior to bottling, with a proteolytic enzyme derived from the gastric secretions of mammals, or with papain, or with bromelin, and is subsequently pasteurised.—L. E.

Alcohol-free drinks; Process for the manufacture of ——. C. R. and W. Wagner, Sonnenberg, Germany. Eng. Pat. 16,707, July 13, 1910. Under Int. Conv., July 13, 1909.

Alcohol-free drinks, containing the aromatic substances of the initial liquids, are prepared from wine, beer, or wine made from fruit and the like, by fractional distillation in vacuum vessels and separation of the alcohol carried over by fractional cooling as well as by absorption of the various fractions of the aromatic substances by suitable mixtures of liquids, and combining the latter with the residues of distillation. The various fractions, obtained by corresponding regulation of temperature and vacuum, are removed, directly after production, from the action of the vacuum. The fractional distillation is carried out in three stages, viz., (1) the more volatile, (2) the less volatile aromatic substances and (3) the alcohol being separated. The device for carrying out the process comprises a number of branch pipes, provided with three-way cocks, by means of which the absorption vessels as well as the cooler and separator may be connected with or disconnected from one or more distilling vessels and the air pump.
—L. J. de W.

Mash-tuns. P. L. Russell, Malton, Yorks. Eng. Pat. 18,665. Aug. 8, 1910.

A stirring apparatus for mash-tuns consists of a screw-threaded vertical shaft working in a fixed nut below the tun and provided with a fixed arm fitted with rakes. The shaft is rotated alternately in opposite directions, the fixed arm describing a helical path within the tun.—T. H. P.

Malt; Process and apparatus for drying ——. A. Lambert, London. Eng. Pat. 20,063, Aug. 29, 1910.

This process of drying and colouring malt consists in feeding the malt through zones of progressively increasing temperature, while causing fresh surfaces of the malt to be exposed. The apparatus comprises a jacketed hollow cylinder divided into separate compartments and furnished with helical conveying devices and stirrers.—T. H. P.

Malt; Process for separating —— into flour or meal, semolina and husks, and apparatus therefor. W. P. Thompson, Liverpool. From Mühlenbauanstalt und Maschinenfabr. vorm. Gebr. Seck und H. Krausemark, Dresden. Eng. Pat. 5346, March 3, 1911. (Compare this J., 1910, 587.)

The pure husk particles are removed, by the action of a continuously moving air-current, from the husks obtained by sifting, and, if desired, also from the semolina, and are then added to the other pure husks obtained after another grinding and sifting, either during or after such sifting. A coarse grinding roller mill is employed containing an apparatus for the uniform distribution of the compressed air used for separating the malt into meal, semolina and husks, this apparatus consisting of two similar pipes of different diameters which fit one into the other and are perforated, on opposite sides of the pipes, like a sieve over a portion of their periphery. By means of conveying walls, the outer pipe, at its perforated part, is formed into a nozzle having a slot extending over the whole length of the pipe, the compressed air escaping through this slot and being blown directly against the tailings (husks or semolina).—T. H. P.

Malting; Method of steeping grain for ——. W. H. Prinz, Oak Park, Ill., Assignor to G. A. Plamondon, Chicago, Ill., and G. Plamondon, Wheaton, Ill. U.S. Pat. 994,786, June 13, 1911.

The grain is subjected to the action of warm water until near the end of the steeping operation, then steeped in cold water and finally after-steeped.—T. H. P.

Saccharification and fermentation by Mucedinae; Rapid process of ——. Soc. Française "Amylo." First Addition, dated Jan. 28, 1911, to Fr. Pat. 423,336, Feb. 12, 1910 (this J., 1911, 642).

In view of the fact that the *Mucedinae* developed from the conidia growth, are very active, the must is kept for a shorter period in the aseptic vat used in the "Amylo" process, the fermentation being completed in open vats. There is no appreciable diminution in the yield of alcohol and considerable economy of expenses of the installation is effected.—L. E.

Fermentation processes; Method and apparatus for increasing the yield in —— wherein malt is employed. J. Grass. Fr. Pat. 424,875, Jan. 14, 1911.

In existing processes, the malt is added to the must at temperatures which are unfavourable to the diastatic action of the malt, and which do not permit of the dextrinisation of the malt starch, so that a large quantity of malt is required, and the malt starch is left in the residue. According to the present invention, the ground malt is mixed with cold or tepid water in a vessel provided with a perforated false bottom and a stirrer. The starch is deposited in the space below the false bottom from whence it is withdrawn through a cock, being subsequently introduced into the must at the optimum temperature of dextrinisation; this temperature suffices also to sterilise the added starch. The supernatant milky liquid containing the diastase of the malt is withdrawn through an outlet in the side of the vessel above the false bottom; it is then sterilised by addition of suitable antiseptics (or if preferred, sterilisation may be effected prior to the separation of the liquid and starch), and added to the must at the optimum temperature of saccharification. —L. E.

Alcoholic liquids; Process for the distillation of ——. E. Guillaume, Paris. U.S. Pat. 996,328, June 27, 1911.

See Eng. Pat. 5794 of 1902; this J., 1903, 223.—T. F. B

Machine for continuous extraction or washing. Fr. Pat. 424,978. *See* I.

Apparatus for the evaporation, concentration, desulphitation and distillation of liquids. Fr. Pat. 424,990. *See* I.

XIXa.—FOODS.

Bleached flour. F. T. Shutt. Report of the Dominion Chemist for the year ending March 31st, 1910. Dept. Agric., Central Expt. Farm, Ottawa, Canada. 1911.

With the object of obtaining precise information respecting the influence of nitrogen peroxide as a bleaching agent, a number of flours were examined before and after being submitted to the treatment, with the following results: *Moisture.*—In every case the bleached samples were the drier, the average difference being 0·66 per cent. *Ash.*—No difference was found. *Fat.*—Bleaching had no effect on the amount, although it was noticed that the fat from the bleached samples was invariably paler than that from the corresponding untreated flour. *Total and gliadin nitrogen.*—No difference could be detected. *Wet and dry gluten.*—Not only were the amounts of wet and dry gluten practically the same in both bleached and unbleached flours, but no difference could be observed in their resiliency and elasticity. *Nitrogen in nitrite-reacting material.*—Using the Griess-Ilosvay method, unbleached flours gave negative results, while 10 out of 11 bleached samples contained less than 0·5 part of nitrite-nitrogen per million. From a series of baking tests, the author concludes: (1) that flour free from nitrite-reacting material, baked in an electric oven, will yield bread free from nitrites; and (2) that flour containing considerable amounts of nitrite-nitrogen, when similarly baked, will give a bread which may or may not be free, but in any case will contain a considerably reduced quantity of nitrites. Contrasting the water-absorptive capacity of bleached and unbleached flours, by exposure in a thin layer on large watch glasses under variable conditions of atmospheric humidity, results were obtained indicating that the bleaching agent so affects the flour that it loses less moisture than the same sample untreated. Exposure, however, to a saturated atmosphere, by placing the watch glasses containing the flours over a vessel of water under a large bell jar, showed that the bleached flour absorbs a somewhat larger amount of moisture than the unbleached material. Considering, therefore, that the bleached flour was slightly drier, and its absorptive capacity somewhat greater than unbleached flour, it is concluded by the author that his results give some support to the contention that a slightly larger amount of bread could be obtained from the former than from the latter.—J. P. O

Milk; Determination of phosphorus in ——. C. Sloniewski. Bull. Soc. Chim. Belg., 1911, 25, 225—226.

The author has determined the total phosphoric acid in the ashes of numerous samples of milk, and finds that there is no appreciable loss of phosphorus if the incineration be carried out at a temperature below a dull red heat. He however prefers the oxidation process with nitric acid on account of its rapidity and simplicity. He expresses the opinion that milk contains more phosphorus than results recorded previously would lead one to believe, and points out that there appears to be a constant ratio between the quantities of phosphoric acid and ash, but not between the phosphoric acid and proteins of milk. This seems to indicate that casein does not contain phosphorus.—W. P. S.

Reduction enzymes. The reduction of nitrates by perhydridase [of milk] and aldehydes in the presence of water. A. Bach. Biochem. Zeits., 1911, 33, 282—290.

Fresh cows' milk accelerates the reduction of nitrates by aldehydes, so that, under suitable conditions, the formation of nitrites can be detected within two minutes after the commencement of the experiment; boiled milk in the presence of aldehydes, or fresh milk by itself, are without influence on the reduction of nitrates. The velocity of the reduction and the quantity of nitrite produced increase with the concentration of the aldehyde but to a less extent than the same, and this also holds for the concentration of the nitrate. With constant concentrations of aldehyde and nitrate, the amount of nitrate reduced during the first phases of the process is directly proportional to the concentration of the enzyme, but in the later phases small variations from this rule are observed. Besides the reduction of the nitrate, a decomposition of the nitrite formed takes place; both these processes proceed more rapidly as the temperature rises, the maximum being reached between 60° and 70° C. The acetic acid formed from acetaldehyde is without influence on the decomposition of the nitrite, as the latter process proceeds at the same rate in alkaline solution. When a mixture of fresh milk, acetaldehyde, and sodium nitrite is maintained at a temperature of 50° C., the quantity of nitrite decreases slowly, but this decrease is so small that it does not have any material effect on the results of experiments in which it is desired to follow the course of the reduction of nitrates under similar conditions. Formaldehyde yields less favourable results than acetaldehyde. By extracting calf's liver with a solution containing 2 per cent. of sodium fluoride and 1 per cent. of sodium bicarbonate, an extract may be obtained which, like the perhydridase of milk, accelerates the reduction of nitrates by acetaldehyde. —W. P. S.

Fatty oils (Hydnocarpus, etc.) from plants of the family Flacourtiacea. C. Grimme. Chem. Rev. Fett-Ind., 1911, **18**, 102—106, 131—133, 158—160.

In view of the recently reported cases of poisoning in Germany arising from the consumption of margarine which contained a proportion of marotti oil, the author has collected information regarding the known oils of the same group from the following sources:—Abderhalden, Biochem. Handlexikon, **3**, 134—136. Allen, Seif. Zeit., **37**, 1425. Brandis, Indian trees, 40—42. Dragendorf. Die Heilpflanzen, 448—449. Dymock. J. Pharm. Chim., 1905, April 1. Engler-Prantl, Die natürlichen Pflanzenfamilien, **3**, [6], 21—23. Greshoff, Pharm. Weekblad, **42**, 102—105. Hartwich, Die neuen Arzneidrogen, 168—169, 178, 242. Heckel, Ann. de l'Inst. coloniale de Mars., **98**, [2], 121—130. Hefter, Technologie der Fette und Oele, **2**, 684—687. Hirschsohn, Pharm. Zentralhalle, 1903, 627 *et seq.* de Jong, Rec. trav. chim. Pay-Bas, **28**, 24—41. Kosteletzki, Med.-pharm. Flora, **5**, 2003—2006. Lewkowitsch, Chem. Technol. Vol. II., 408. Litterscheid, Chem.-Zeit., **35**, 77. Moore and Tutin, Chem. Soc. Trans., **97**, 1285—1289; this J., 1910, 1034. Moss, Arch. Pharm., 1880, 224. Power and Barowcliff, Chem. Soc. Proc., **21**, 175; **23**, 70—71; Chem. Soc. Trans., **87**, 884—900; **91**, 557—578; this J., 1905, 741. Power and Gornall, Chem. Soc. Proc., **20**, 135—137; Chem. Soc. Trans., **85**, 838 *et seq.*; this J., 1904, 669. Power and Lees, Chem. Soc. Proc., **21**, 88—89; this J., 1905, 558. Reinsch, Chem.-Zeit., **35**, 77. Schaedler. Technologie der Fette und Oele, 807. Schindelmeiser, Ber. der pharm. Gesell., 1904, 164 *et seq.* Semler, Tropische Agrikultur, **2**, 527—528. Trimen, Flora of Ceylon, **1**, 75. Voigt, Jahresbericht d. Vereins für angew. Bot., **8** (1910). Watt, Dict. of the Economic Products of India, **4**, 192—195, 308—309. Wehmer, Die Pflanzenstoffe, 508—509. Wijs, Vetten, Olien en Wassen, 50—51. N. N. Pharm.-Zeit., 1883, 562. N. N. Pharm. Zeit., 1884, 589. Plücker, Zeit. Unters. Nahr. Genussm., **21**, 257—265. G. Desprez, Etude sur le Chaulmoogra, These. Univ. de Paris (Pharmacie); see this J., 1900, 1025. E. Collin. Ann. des Falsifications, **4**, 67—72.—J. A.

Egg-, serum-, and milk-albumin, and serum-globulin; Coagulation-temperatures of ——, in solutions containing ammonium sulphate. K. Micko. Z. Unters. Nahr. Genussm., 1911, **21**, 646—654.

By observing the temperatures of coagulation—both that of initial turbidity and that of formation of a flocculent precipitate—in two solutions of ammonium sulphate of different strengths, say half- and quarter-saturated for the albumins, and quarter- and eighth-saturated for the globulins, it is possible to identify the different albumins and separate them from one another. After salting out from their original solutions, the coagulation-temperatures are lowered, to extents varying with the different albumins: this effect is very slight in the case of egg-albumin, greater with serum-albumin, and very considerable with milk-albumin. A second salting out has very little further effect on the coagulation-temperature. The results of the investigation are embodied in a number of tables and diagrams.—J. T. D.

Salicylic acid; Determination of ——, in fruit juices. P. Vierhout. Z. Unters. Nahr. Genussm., 1911, **21**, 664—666.

In a stoppered separating funnel 50 c.c. of the juice are made acid to Congo red by about 15 drops of sulphuric acid, 50 c.c. of petroleum ether (b.p. 40°—60° C.) are added, and the whole well shaken. To the resulting emulsion 25 c.c. of 96 per cent. alcohol are added, the mixture is again shaken, and after settling, the upper layer is carefully siphoned off into a measuring cylinder. The treatment with petroleum ether and alcohol is repeated, the cylinder then filled with a mixture of two volumes of petroleum ether and 1 vol. of alcohol up to 200 c.c., the contents well mixed and allowed to stand, and 50 c.c. are then brought into a small flask containing a few grammes of anhydrous sodium sulphate. The flask is then corked, well shaken, and after two hours the contents are filtered through a dry filter into 50 c.c. of $N/10$ sodium hydroxide solution, the sodium sulphate and the flask being rinsed with a few c.c. of the petroleum ether and alcohol mixture, which is also passed through the filter. The sodium hydroxide is then titrated with $N/10$ acid, and the amount of salicylic acid calculated from the result.—J. T. D.

Analysis of cottonseed products. *See* XII.

Manuring the cacao tree and of the oil palm in Cameroon. Zeller *See* XVI.

Patents.

Milk; Process of condensing ——. J. C. Alexander, Roseburg, Oreg. U.S. Pat. 994,555, June 6, 1911.

The milk is placed in a closed vessel from which the air is exhausted; the vessel is surrounded by a jacket containing a freezing mixture, and when all the air has been removed from the milk, the latter is agitated by a stirring device. The water in the outer portions of the milk freezes whilst the other constituents of this portion of the milk mix with the unfrozen milk.—W. P. S.

Milk; Process of desiccating the solid content of ——. W. H. Swenarton. U.S. Pat. 995,303, June 13, 1911.

The milk is delivered on to a surface heated *in vacuo* to a temperature 5° C. above the boiling point of the milk, and after ten seconds or less is removed in the form of a coherent mass containing, when cool, 1·5—5·5 per cent. of moisture.—T. H. P.

Eggs; Process of preserving ——. A. G. C. Sterley, Hamburg. U.S. Pat. 995,198, June 13, 1911.

The eggs are dipped for a short time in a concentrated solution of benzoic acid (1 part) in alcohol (about 4 parts) and then withdrawn and the alcohol caused to evaporate immediately.—T. H. P.

Fatty food compounds; Making ——. J. H. Filbert, Baltimore, Md. U.S. Pat. 995,777, June 20, 1911.

The claim is for a fatty food composed of "oleo oil," neutral lard, cottonseed oil, salt and the following bodies extracted from milk, namely albumin, milk sugar and soluble salts. The mixture is made by churning the oil or lard with sterilised whey, chilling to harden the oil or lard, and then working the hardened mass to remove the watery part of the whey.—W. H. C.

Coffee; Preparation or treatment of ——. J. F. Meyer, L. Roselius, and K. H. Wimmer, Assignors to Kaffee-Handels-Akt.-Ges., Bremen, Germany. Reissues Nos. 13,261, 13,262, and 13,263, June 27, 1911, of U.S. Pat. 897,840, Sept. 1, 1908.

See Fr. Pat. 364,389 of 1906; this J., 1906, 903.—T. F. B.

Treatment of skimmed milk for the production of solid material [horn substitute] therefrom. Eng. Pat. 6160. *See* XV.

XIXb.—WATER PURIFICATION; SANITATION.

Nitric and nitrous acids; Method of detecting and determining ——, in water. J. Tillmans and W. Sutthoff. Z. anal. Chem., 1911, **50**, 473—495.

The diphenylamine method, in the presence of chlorides and by the use of appropriate concentrations of reagent, can be made to give constant results, so that both nitric and nitrous acids can be colourimetrically determined by it. The following details are given:—

Nitric acid.—To 100 c.c. of the water to be tested, 2 c.c. of saturated solution of pure sodium chloride are added; 1 c.c. is then delivered, by a pipette graduated in hundredths, into a test-tube. 4 c.c. of the diphenylamine reagent (see this J., 1911, 44) are carefully poured down the side, the mixture is vigorously shaken, and the tube cooled and then set aside for an hour. The blue tint gradually develops, attains its maximum in an hour, lasts one or two hours longer, then graually fades. For determination, five comparison solutions are made, by placing in a 100 c.c. flask 2 c.c. of saturated sodium chloride solution, adding 0·5, 1·0, 1·5, 2·0, and 2·5 c.c. respectively of solution of potassium nitrate containing 0·1872 grm. per litre (1 c.c.=0·1 mgrm. of N_2O_5), then 10 c.c. of glacial acetic acid, and making up to the mark with water. The acetic acid prevents the development of bacteria capable of reducing nitric acid, and renders the solutions absolutely stable. These comparison solutions are treated with the reagent along with the water, and the colours compared. Waters containing more than 2·5 mgrms. per litre give tints too deep for comparison, and must be diluted before treatment. With unknown waters, it is advisable to treat simultaneously the water in its natural state and two or three different dilutions. All reagents, and the distilled water used, must of course be free from nitrates; no filter-paper must be used, and the tubes must be protected from substances like chlorine or bromine, which react with diphenylamine. Any iron compounds in the water must be removed by precipitation with ammonia, subsidence, and decantation.

Nitrous acid.—The above procedure will include as nitric acid any nitrous acid present in the water. Nitrous acid may be separately determined by the method, however, for it reacts with solutions of diphenylamine too dilute to affect nitric acid, and reacts moreover in the absence of chlorides. The reagent is prepared as for nitric acid, using however 0·06 grm. of diphenylamine and 325 c.c. of the dilute sulphuric acid, or it can be made by diluting 500 c.c. of the sulphuric acid reagent with 200 c.c. of water. The five comparison solutions are made, by appropriately diluting a solution of sodium nitrite containing 0·1816 grm. in a litre (1 c.c.=0·1 mgrm. of N_2O_3), to contain 0·5 up to 2·5 mgrms. per litre of nitrous anhydride. The application of the test is similar to that in the case of nitric acid, but 5 c.c. of the water and 5 c.c. of the reagent are used, and the maximum depth of colour is reached in about 10 minutes and maintained for not much more than half-an-hour. Instead of determining the sum of nitrate and nitrite and the nitrite alone, thus talking the nitrate by difference, the nitrite may be destroyed and the nitrate then separately determined. This may be done either by adding to 100 c.c. of the water 5 drops of sulphuric acid and 0·2 grm. of urea, and allowing to stand overnight, or by adding to 100 c.c. of the water 5 c.c. of 10 per cent. ammonium chloride solution, concentrating on the water bath to 25 c.c., and again making up to 100 c.c. with distilled water.—J. T. D.

Sewage beds; Denitrifying bacteria of percolation ——. Lemoigne. Comptes. rend., 1911, **152**, 1873—1875.

It has been frequently shown that denitrification takes place in the biological purification of sewage, but it has been regarded as an accidental occurrence due to defective aeration of the bacteria bed. Since, however, Mazé (Ann. Inst. Pasteur, April, 1911) has shown that denitrification is a regular process of assimilation of nitrogen, the author endeavoured to ascertain whether denitrifying organisms play a part in the purification of sewage in a strongly aerated percolation bed. In every case among the dominant bacteria of the bed, a large number were found capable of rapidly destroying nitrates. The present paper is concerned with two of these organisms very similar to *Bac. subtilis*. They convert nitric-nitrogen into ammonia- and organic-nitrogen, without any formation of nitrous or nitric oxide or free nitrogen, and are specially active under conditions favouring aeration.—A. S.

Vanadium poisoning. Eng. and Mining J., 1911, **92**, 24. [T.R.]

Vanadiumism is a chronic intoxication caused by injection or absorption of some forms of vanadium. W. F. Dutton, M.D., in the "Journal" of the American Medical Association, states that the principle lesions are found in the lungs, kidneys, and gastro-intestinal tract. The lungs are highly congested; the kidneys reveal congestion due to continuous irritation; the gastro-intestinal tract shows evidence of irritation and inflammation.

Persons employed in establishments where the various salts of vanadium are produced, and more especially vanadium trioxide, suffer from chronic poisoning; labourers in reduction plants, who are exposed to the dust and fumes, are most susceptible. Accidental poisoning may come from using or wearing clothing dyed by vanadium chloride, trioxide, or pentoxide. Anæmia is an early symptom of vanadium poisoning. There is also a cough that is prominent and characteristic; it is dry, irritating, and paroxysmal, becoming so intense that hæmorrhages are frequent and severe, even causing death. The workers in the manufacture of the various products of vanadium are very susceptible to tuberculosis. Continuous exposure to the poison leads to fine tremors of the extremities, headache, neuroretinitis, amaurosis, vertigo, hysteria, and melancholia.

The prevention of vanadiumism is difficult in vanadium works, owing to the carelessness of the employees and employers. Means to allay and carry off the dust and fumes should be employed constantly. As an aid in recovery, active outdoor exercises are essential, while Turkish, Russian, or cabinet baths may be given to aid in the elimination of the poison.

Treatment of tannery effluents. Morrison. *See* XV.

Patents.

[*Insecticide*]. *Preparation consisting chiefly of polysulphide of alkali and alkaline earth metals; Process for the production of a stable, solid* ——. V. Lunda. Ger. Pat. 234,391, Dec. 25, 1909.

Solutions of polysulphides of alkali or alkaline earth metals are prepared in the usual manner by heating solutions of the corresponding bases with sulphur, and these solutions are converted into a nearly or completely dry product by evaporation and addition of a dehydrating agent. The mass is then pressed in moulds or heated rapidly to sintering, and may finally be coated with a layer of a substance which will protect it from the action of atmospheric moisture.—A. S.

Mercury derivatives substituted in the nucleus of halogen-, nitro-, or halogen-nitrophenols; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 234,851, March 25, 1910.

By heating halogen-, nitro-, or halogen-nitrophenols with mercuric oxide or its salts, or by heating the mercury salts of the above-named phenols, a new series of compounds is obtained, in which the mercury is attached to the benzene nucleus, the substituent groups being unaffected. The products are odourless, and are more powerful disinfectants than mercuric chloride.—T. F. B.

Sterilising apparatus for water supply systems. V. Henri, A. Helbronner, and M. von Recklinghausen. Fr. Pat. 425,184, Jan. 24, 1911. Under Int. Conv., Jan. 24, 1910.

See Eng. Pat. 1805 of 1910; this J., 1911, 305.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Cinchonine, quinine, and their isomerides; Absorption spectra of ——. J. J. Dobbie and A. Lauder. Chem. Soc. Trans., 1911, **99**, 1254—1261.

The authors have found that cinchonine and quinine and related compounds and derivatives exhibit two distinct series of absorption spectra, those of one series differing considerably from the spectra described previously

(Chem. Soc. Trans, 1903, **83**, 605). In the case of cinchonine the spectrum of the alkaloid in alcoholic solution and of the salts with 1 equivalent of acid to 1 equivalent of the base is practically the same as that of quinoline: the absorption band is neither well-defined nor persistent; with a layer 20 mm. thick of $N/5000$ solution it lies between 1/λ3220 and 1/λ3824. In the spectrum of the salts of the alkaloid with two equivalents of acid to one of base, on the other hand, the general absorption is greater and the absorption band is well defined and much more persistent: with a layer of 20 mm. of a $N/5000$ solution, the band lies between 1/λ3000 and 1/λ3488. This spectrum is practically identical with that of quinoline salts. Quinine exhibits analogous differences. In the spectrum of an alcoholic solution of the alkaloid and of solutions of salts containing one equivalent of acid to one of base, the principal band lies between 1/λ2938 and 1/λ3293; whilst in the spectrum of salts containing two equivalents of acid to one of base, the band lies between 1/λ2768 and 1/λ3468. The isomerides of cinchonine and quinine exhibit spectra indistinguishable from those of the respective alkaloids, but no conclusion as to the entire molecular structure of the isomerides can be drawn from this fact, for as shown above, the character of the spectra depends almost entirely on the quinoline part of the molecule. The difference between the two series of spectra is due to the nitrogen of the quinoline nucleus being trivalent in one case and quinquevalent in the other.—A. S.

Cocaine; Permanganate test for ——. F. J. Seiter. Amer. Journ. Pharm., June, 1911, 265. Pharm. J., 1911, **87**, 75.

The author criticises the various methods in use and now puts forward the following process as the most delicate:—To 1 c.c. of cocaine solution add one drop of 25 per cent. sulphuric acid and 1 c.c. of saturated potassium permanganate solution. After standing some time, a drop of the liquid is removed to a slide, a cover glass adjusted, excess of liquid removed, and a drop of water drawn under the cover glass by means of a piece of filter-paper placed on the opposite side. The slide is then examined under the microscope for the characteristic violet-red rectangular plates of cocaine permanganate. In this way the author has detected cocaine in 1 c.c. of solution which contained 0·00033 grm. of cocaine hydrochloride, equivalent to 1 in 3000. Other common natural alkaloids and cocaine substitutes, with the exception of α- and β-eucaine, when treated by the above test were instantly oxidised. The two eucaines reduce the permanganate very slowly. α-Eucaine yielded very small irregular masses of violet-red leafy crystals in 1 per cent. solutions. In high dilutions (1 : 6000) the crystals were better formed, and resembled those of ammonium magnesium phosphate. The limit for the formation of the α-eucaine permanganate crystals is 1 : 5000. β-Eucaine yielded violet-red globules, which did not crystallise on standing, in 1 per cent. solutions, but not with lesser concentrations. The crystals were examined under a magnification of eighty diameters in all cases, except the α-eucaine crystals, which required the use of a higher power.

Morphothebaine; Constitution of ——. *II. Synthesis of the tetramethoxyphenanthrene derived from morphothebaine.* R. Pschorr and G. Knöffler. Annalen, 1911, **382**, 50—61.

When the trimethoxyphenanthrene carboxylic acid obtained from morphothebaine is converted by Curtius' method into the corresponding amine, and the amino-group replaced by a methoxyl-group, 3,4,6,8-tetramethoxyphenanthrene is produced. The latter substance has now been synthesised, confirming the constitution of morphothebaine (Annalen, 1910, **373**, 55). Dimethoxybenzaldehyde and hippuric acid were condensed by the Perkin method to form the anhydride of benzoylaminodimethoxycinnamic acid, $C_{18}H_{15}O_4N$, m.pt. 182° C. When hydrolysed by sodium hydroxide in the presence of hydrogen peroxide, 2,4-dimethoxyphenylacetic acid, $C_{10}H_{12}O_4$, was obtained, melting at 113° C. The Perkin synthesis was again used to condense this substance with *vic. o*-nitrovanillin methyl ether. The nitro-acid was then reduced to (α)-2,4-dimethoxyphenyl-2-amino-3,4-dimethoxycinnamic acid, $C_{19}H_{21}O_6N$, m.pt. 207°—208° C. This was treated with nitric acid, whereby 3,4,6,8-tetramethoxyphenanthrene-9-carboxylic acid, $C_{19}H_{18}O_6$, was produced, melting at 226° C. (corr.). A by-product was formed in the same reaction. The carboxyl group was removed by heating with glacial acetic acid to 240° C. 3,4,6,8-Tetramethoxyphenanthrene, $C_{18}H_{18}O_4$, melts at 108° C., distils between 270° and 275° C. at 11 mm. as a light yellow oil, and is identical with that obtained from morphothebaine. During the heating with acetic acid, a lactone was produced, which after hydrolysis and treatment with methyl sulphate gave the methyl ester of 3,4,6,8-tetramethoxyphenanthrene carboxylic acid, m.pt. 136°—137° C.—F. Shdn.

Alkaloids; Solvent power of aqueous solutions of boric acid and glycerin for ——. E. Baroni and O. Borlinetto. Giorn. Farm. Chim., 1911, **60**, 193—195. Chem. Zentr., 1911, **2**, 93—94.

The author proposes as a solvent for alkaloids an aqueous solution containing 3 grms. of boric acid and 50 grms. of glycerin per 100 c.c. In obtaining the following results the alkaloid was mixed with the boric acid, and then the glycerin and water added.

The solubility increases with the content of boric acid in the solution. For instance solutions containing 7·65 and 15·3 per cent. of boric acid dissolve 20 and 40 per cent. respectively of quinine. For a 15 per cent. solution of veratrine 5 per cent. of boric acid is required.—A. S.

Solubility.	Codeine.	Atropine.	Cocaine.	Morphine	Strychnine.	Eserine.	Veratrine.
In water	1 : 60	1 : 200	1 : 704	1 : 1000	1 : 7000	traces.	traces
In glycerin-boric acid	per cent. 4	per cent. 10	per cent. 8	per cent. 5·5	per cent. 3·5	per cent. 7·5	per cent. 6

4 : 6-Dimethoxy-2-β-methylaminoethylbenzaldehyde; Synthesis of ——. A. H. Salway. Chem. Soc. Proc., 1911, **27**, 191.

4 : 6-Dimethoxy-2-β-methylaminoethylbenzaldehyde has been synthesised from β-5-hydroxy-3-methoxyphenylethylamine (this J., 1910, 897 and 371) according to a series of reactions similar to those employed by the author in the synthesis of cotarnine. The stages involved in this process are represented by the following scheme:—

$$C_6H_3(OH)(OCH_3)CH_2{\cdot}CH_2{\cdot}CO_2H \longrightarrow$$

β-5-Hydroxy-3-methoxyphenylpropionic acid.

$$C_6H_3(OCH_3)_2{\cdot}CH_2{\cdot}CH_2{\cdot}CO_2H \longrightarrow$$

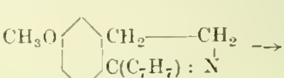
β-3 : 5-Dimethoxyphenylpropionic acid.

$$C_6H_3(OCH_3)_2{\cdot}CH_2{\cdot}CH{\cdot}_2CO{\cdot}NH_2 \longrightarrow$$

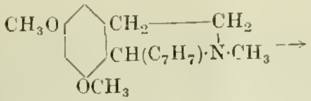
β-3 : 5-Dimethoxyphenylpropionamide.

$$C_6H_3(OCH_3)_3{\cdot}CH_2{\cdot}CH_2{\cdot}NH{\cdot}CO{\cdot}C_7H_7 \longrightarrow$$

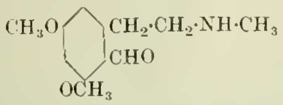
Phenylacetyl-β-3 : 5-dimethoxyphenylethylamide.



6 : 8-Dimethoxy-1-benzyl-3 : 4-dihydro*iso*quinoline.



6 : 8-Dimethoxy-2-methyl-1-benzyl-1 : 2 : 3 : 4-tetrahydro*iso*quinoline.



4 : 6-Dimethoxy-2-β-methylaminoethylbenzaldehyde.

4 : 6-*Dimethoxy-2-β-methylaminoethylbenzaldehyde* closely resembles cotarnine in its physiological action on the isolated uterus. On the other hand, it is considerably less toxic than the latter compound.

Ladanum or Labdanum. E. M. Holmes. Perfumery and Essen. Oil Record, 1911, 2, 132—133.

Labdanum, or more correctly Ladanum, is probably the oldest perfume of which any record exists. It is mentioned in the Scripture in Gen., ch. 37, v. 25, and in ch. 43, v. 11, under the Hebrew name Lôt, which is mistranslated as Myrrh.

Ladanum consists of a sticky, soft resinous matter exuded by the glandular hairs of a small shrub, a species of rock rose with purple flowers, which in Crete and Cyprus is the *Cistus Creticus*. It collects on the beards of the goats, and on the bells and fleeces of the sheep that browse upon the foliage. In Cyprus it is collected chiefly in the hilly district of Pyliria in the north-west of the island from Yallia to Levka, from the middle of May till the middle of July, when it is most abundant. The shepherds collect it either by scraping the fleeces, etc., with a wooden comb, or with a kind of rake with a double layer of stout strings attached like the teeth of a rake, which is used to draw gently over the foliage of the shrubs. The material so obtained is scraped off and made into masses. In Crete a similar instrument, called a ladanisterion, having slender leather thongs instead of strings, has been employed, certainly from the time of Dioscorides (A.D. 77), and probably earlier.

The production appears to have never been very large. About 20 or 30 years ago it was estimated at about 6000 lb. from Crete and 2800 lb. from Cyprus. It was exported chiefly to Turkey and was used, as it probably was in the earliest times, like frankincense and lignaloes, for the purpose of fumigation.

Ladanum is also made in Spain, but Spanish ladanum is practically unknown in European commerce. It is obtained from the foliage of another species, viz., *Cistus ladaniferus*, and by a different method, the twigs being boiled in water, and the resin that floats on the surface removed. At the present time a more modern and scientific process is used, the soft extract being quite as fragrant as the best Cretan product.

It is described by old writers on *materia medica* as occurring in commerce chiefly in two forms, viz., in the form of a soft extractiform mass usually enclosed in thin bladders, and a hard heavy kind in rolls as thick as the finger, curled into a flat coil about two inches in diameter. The former is known as natural ladanum, the latter as ladanum *in tortis*. An analysis of the soft, pure kind gave 86 per cent. of resin and volatile oil, 7 per cent. of watery extractive, and 6 per cent. of insoluble matter; and a Cretan specimen examined by E. Weiss in 1904 gave 2·9 per cent. of volatile oil, 53·69 per cent. of resin, and 23·6 per cent. of ash. The resin, soluble in alcohol, had an acid value of 6·352, an ester value of 98·93, and a saponification value of 162·45. Schimmel in their Report for 1893 state that old ladanum, presumably Cretan, yielded 0·91 per cent. of a golden coloured volatile oil of specific gravity 1·011 at 15°, having a penetrating odour like ambergris, and that after keeping a few months it deposited about 25 per cent. of crystals: these do not appear to have been thoroughly examined. The oil of Spanish ladanum is stated to have a specific gravity of 0·925. The inferior kind in coils was examined by Pelletier, who found it to give 72 per cent. of sand, 20 per cent. of resin, and 6 per cent. of gum with calcium malate, and 1·9 per cent. of wax. This kind probably consists of the residue left after melting and straining the ladanum. The advantage of ladanum as a perfume depends upon its peculiar but characteristic sweetness, and its extraordinary persistence, giving a lasting character to other perfumes, so that it may be classed with ambergris, musk, sandal, vetivert, and patchouli, but possesses a characteristic fragrance of its own. Its use in medicine seems to indicate that it possesses antiseptic properties like myrrh, the essential oil of which has recently been shown to be a powerful antiseptic. The physiological action of the oil of ladanum may be worth investigation.

Solanum dulcamara; The fruit of ——. B. R. Anderson. Chem. News, 1911, 104, 2—3.

Upon extraction with alcohol and water, the berries of woody night-shade (*Solanum dulcamara*) yielded 31·55 per cent. of a sugar, which appeared to be lævulose. The berries were then dried and extracted with ether, when an oil was obtained, amounting to 9·1569 per cent. After purifying, the oil was viscous and of an amber colour. It had the sp. gr. 0·9603, and an acid value of 306. Nitrogen is present in the berries to the extent of 0·934 per cent. Evidence was obtained of the presence of acetic, tartaric, and citric acids. The total alkaloid was 0·15 per cent., and appeared to be solanine.—F. Shdn.

Bupleurum fructicosum Linn.; Essential oil of ——. L. Francesconi and G. Sanna. Gaz. chim. ital., 1911, 41, 1., 395—414.

Bupleurum fructicosum, a plant belonging to the N.O *Umbelliferae*, grows abundantly in Sardinia, and according to Moris its fruit is used as a condiment, imparting to the food an aroma resembling that of fennel. The authors have examined the oil from plants, in various stages of development, from four different localities. The oil was obtained by distillation with steam, the yield varying greatly (from 0·5 to 4·4 per cent.), according to the origin of the plant, its stage of development, and to the parts of the plants used. The physical and chemical characters of the oil also varied considerably according to the factors mentioned. Sp. gr., 0·8257—0·8692 at 15° C.; optical rotation, +19·72° to +45·50°; refractive index, 1·4783—1·4862; saponification value, 5—14; after acetylation, 23·7—28·5. Apart from a small proportion of alcohols and esters, the oil consisted entirely of hydrocarbons. The effects of different factors on the yield and character of the oil are summed up as follows:—The amount of oil increases with the development of the plant; is greater in the flowers than in the leaves during the period of intense flowering; and in the same stage of flowering is greater in plants cultivated at higher altitudes. The specific gravity, optical rotation, and refractive index of the oil increase with the development of the plant up to a maximum at the commencement of flowering and then decrease. The ester content diminishes in the oil from the leaves as flowering progresses, and is greater in oils from plants grown at higher altitudes: it is greater in oil from the leaves than in that from the flowers, and diminishes with increase of the humidity of the atmosphere surrounding the growing plants. The sp. gr. varies directly and the optical rotation inversely with the ester content. The relative proportion of free alcohols is greater in the flowers than in the leaves, and in the latter increases at the expense of the combined alcohols as flowering progresses.—A. S.

Essential oils. H. Haensel. Geschäftsber., Oct., 1910—April, 1911. Chem. Zentr., 1911, 1, 1839.

Spanish myrtle oil was found to have the sp. gr. 0·9406 at 15° C., $\alpha_D = +23{\cdot}04°$, saponification value 128, after acetylation 159. The terpeneless oil prepared therefrom was a considerably finer product: it had the sp. gr. 0·9713 at 15° C., $\alpha_D = +25{\cdot}48°$, saponification value 195, after acetylation 234. A *peppermint oil* prepared from dried plants from The Palatinate (Bavaria) (yield 0·36 per cent.) had a light brown colour and a strong fine odour: sp. gr. 0·9076 at 22° C., acid value 3·73. ester value 33·6 (=9·36 per cent. of menthol esters), after acetylation 147·46 (=46·15 per cent. of total menthol): nothing separated from the oil on cooling to —14° C. A specimen of *Russian peppermint oil* of light yellow colour and fine odour also gave no deposit on cooling to —14° C. It had the sp. gr. 0·9031 at 20° C., acid value 1·87. ester value 22·4 (= 6·24 per cent. of menthol esters), after acetylation 141·2 (= 43·98 per cent. of total menthol). *Sumach bark oil.*—0·07 per cent. of a dark brown oil was obtained from the bark of *Rhus aromatica* by distillation with steam under pressure. It had a strong aromatic odour which changed on keeping and after some time resembled that of Russia leather. The oil had the sp. gr. 0·954 at 22° C.; it became viscous on cooling, and solidified completely at —15° C. It contained no constituents separable by means of bisulphite solution, but a mixture of palmitic acid and another acid, probably capric acid, and a phenolic compound. *Dead nettle flower oil.*—From the leafy flowering stalks of the white dead nettle (*Lamium album*) by distillation with steam under pressure, 0·537 per cent. of a brownish oil of pleasant odour was obtained, from which crystals separated at the ordinary temperature.—A. S.

Esterification of aromatic acids in the wet way; Catalytic ——. J. B. Senderens and J. Aboulenc. Comptes rend., 1911, **152**, 1855—1857.

VERY small proportions of sulphuric acid have no notable catalytic action on the production of ethyl benzoate from benzoic acid and ethyl alcohol. Good yields of the ester are obtained, however, by the use of larger quantities of sulphuric acid which then acts as a dehydrating agent. The toluic acids and salicylic acid behave in a similar manner to benzoic acid. With phenylacetic and phenylpropionic acids, on the other hand, good yields of the esters are obtained in presence of very small proportions of sulphuric acid, the results being quite similar to those obtained with the saturated fatty acids (this J., 1911, 830). —A. S.

Ethyl nitrite in spirit of nitrous ether; Simple determination of ——. O. Herting. Pharm. Zeit., May 27, 1911, 423. Pharm. J., 1911, **87**, 75.

THE ordinary method of determining the strength of spirit of nitrous ether, by measuring the nitric oxide formed by decomposing the ethyl nitrite, has the disadvantage that it requires a nitrometer, which the majority of ordinary pharmacists do not possess. Only simple apparatus is required for the following method:—Into a stoppered 100 c.c. flask put 10 c.c. of water, then 5 c.c. of a cold, saturated solution of potassium chlorate, 5 c.c. of the spirit of nitrous ether to be tested, and 5 c.c. of 10 per cent. nitric acid: stopper up and shake frequently during thirty minutes. Then add 10 c.c. of $N/10$ silver nitrate solution, shake well, and titrate back the excess of silver with $N/10$ ammonium thiocyanate, using iron alum as indicator; each c.c. of $N/10$ $AgNO_3$, represents 0·0255 of ethyl nitrite, $C_2H_5NO_2$, and from this figure and the specific gravity of the spirit, the percentage by weight of ethyl nitrite is readily found.

Boric acid esters. G. Cohn. Pharm. Zentralh., 1911, **52**, 479—485. Chem. Zentr., 1911, **1**, 1806—1807.

ALIPHATIC esters of boric acid can be readily prepared by treating a mixture of boric acid (previously fused and then finely powdered) and the alcohol with hydrochloric acid gas or concentrated sulphuric acid. As the boric esters show greater differences of boiling point than the corresponding alcohols, it is suggested that mixtures of alcohols, such as fermentation amyl alcohol, might be separated into their constituents by means of the boric esters. Higher alcohols, such as borneol, can also be converted into boric esters by the method described. Salicylic acid, when boiled for a long time with methyl borate is converted quantitatively into its methyl ester, but *p*-hydroxybenzoic acid when subjected to the same treatment remains unaltered. By the interaction of salicylic acid and methyl or ethyl borate in the cold, boron-trisalicylic acid $B(O.C_6H_4.CO_2H)_3$, is obtained. It crystallises in rhombic plates from benzene and in prisms from xylene, is insoluble in ether, benzene, petroleum spirit, acetone, and chloroform, but soluble in hot nitrobenzene. It decomposes on heating, and is immediately converted into boric and salicylic acids on treatment with water. Analogous compounds were prepared from boric ethyl or methyl ester and *o*-, *m*-, and *p*-cresotinic acids, α-and β-hydroxynaphthoic acids, and resorcylic acid. Gallic acid did not react in this manner, and tartaric and citric acids only very imperfectly. Salicylamide when warmed with the methyl, ethyl, propyl, or isobutyl ester of boric acid forms a compound which is readily soluble in cold methyl alcohol, but insoluble in benzene, acetone, and chloroform; it appears to have the composition, $B(O.C_6H_4.CO.NH_2)_2$.—A. S.

Acetanilide; Delicate test for ——. G. N. Watson. Amer. Journ. Pharm., June, 1911, 269. Pharm. J., 1911, **87**, 75.

WHEN acetanilide is heated along with boric acid over a naked flame until the boric acid melts, there is produced a yellow residue having a peculiar fragrant odour suggestive of sweet clover or arbutus. The yellow colour, however, is produced also by phenacetin. Antipyrine produces a pink colour, and naphthalene-like odour. Phenacetin produces an odour characteristic of itself, but more faint than that produced by acetanilide or antipyrine. With mixtures of the three antipyretic substances, the fragrant odour produced by the action of the acetanilide is sufficient to produce the characteristic odour, which is intensified by adding a few drops of water to the residue. This test suggests the use of acetanilide as a test for boric acid, the delicacy of which is worthy of investigation.

Acetamide; Preparation of ——. M. A. Rosanoff, L. Gulick and H. K. Larkin. J. Amer. Chem. Soc., 1911, **33**, 974—977.

THE yield of amides by treating esters with ammonia or by the distillation of the ammonium salts proving to be very unsatisfactory, resort was had to an excess of acetic acid as a catalytic agent. Dry ammonium acetate was prepared by neutralising glacial acetic acid with pulverised ammonium carbonate at about 50° C., allowing to cool, draining off the crystals, and pressing them out twice or three times with filter paper. 100 grms. of this ammonium acetate (corresponding to 75 grms. of acetic acid), and 113 grms. of glacial acetic acid, were boiled in a litre flask with reflux condenser for five hours. The product was rapidly distilled over with minimum loss and subjected to fractionation (again out of a litre flask), with the aid of a two-bulb Wurtz stillhead. This operation should be carried out as slowly as possible. Three fractions were collected separately: below 180° C.; 180°—213° C.; and above 213° C. The second fraction was slowly re-distilled with the Wurtz stillhead, and the portion passing over above 213° C. was added to a similar fraction obtained previously, the remainder being added to the first fraction of the previous distillation. The original was thus divided into a low-boiling and a high-boiling fraction. The former could again be neutralised with ammonium carbonate, and the resulting salt used for a new preparation. The high-boiling fraction, on solidification, was twice pressed out with filter paper. The dry crystals, practically pure acetamide, weighed over 60 grms., or 20 grms. more than the highest previous yield from the equivalent of acetic acid employed as ammonium acetate by Hofmann's method.—R. C. P.

Orthophosphoric acid as a dehydrating catalytic agent. Part I. Condensation of acetone in presence of phosphoric acid. P. Neogi. Chem. Soc. Trans., 1911, **99**, 1249—1252.

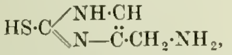
ON adding phosphoric acid (sp. gr. 1·75) to acetone, considerable heat is evolved, and on allowing the mixture to stand for several days, the acetone undergoes condensation, with formation of aromatic compounds. The latter, together with unchanged acetone and water, can be removed by distillation and the residual phosphoric acid (meta- and pyro-phosphoric acid), then used to effect the condensation of a further quantity of acetone; these operations can be repeated several times. Phosphoric acid has the advantage over sulphuric acid as a dehydrating agent of not charring the acetone to any large extent. The condensation products formed from acetone by means of phosphoric acid are mesitylene, mesityl oxide, phorone, and xylitone.—A. S.

New use for eucalyptus oils. Baker. *See* X.

PATENTS.

Therapeutic compound [*thiolaminomethylglyoxaline*]; *Manufacture of a new* ——. H. S. Wellcome, London, and F. L. Pyman, Dartford. Eng. Pat. 25,873, Nov. 7, 1910.

WHEN potassium thiocyanate and diaminoacetone dihydrochloride are warmed together in aqueous solution, a basic substance, 2-thiol-4 (or 5)-aminomethylglyoxaline,



is produced, which melts at 188° C. The hydrochloride darkens at 265° C., and the picrate melts at 237° C. The base and salts find application in medicine.—F. SHDN.

Physiologically active base [4 (*or* 5)-*β-aminoethylglyoxaline*]; *Manufacture of a* ——. H. S. Wellcome, London, and F. L. Pyman, Dartford. Eng. Pat. 28,538, Dec. 8, 1910.

BY treating 2-thiol-4 (or 5)-aminomethylglyoxaline (see preceding abstract) with hot dilute nitric acid, a new base, 4 (or 5)-hydroxymethylglyoxaline, $C_4H_6ON_2$, is produced, melting at 93°—94° C. Phosphorus pentachloride converts this into the hydrochloride of 4 (or 5)-chloromethylglyoxaline, m. pt. 144°—145° C. 4 (or 5)-Cyanomethylglyoxaline is made from the latter by means of potassium cyanide; it has the composition, $C_5H_5N_3$, and melts at 138°—140° C. The cyano-compound can be reduced to 4 (or 5)-β-aminoethylglyoxaline. This substance and its salts possess valuable physiological properties (see this J., 1910, 781).—F. SHDN.

Camphor; Method of producing transparent —— *in shaped pieces.* O. R. D. Witt, Hamburg, Germany. U.S. Pat. 995,510, June 20, 1911.

WHEN camphor is pressed in a vacuum of suitable degree, it can be formed into transparent pieces of any desired shape. —T. F. B.

Acetaldehyde and its condensation products and polymers; Process for making —— *from acetylene.* Chem. Fabr. Griesheim-Elektron. Fr. Pat. 425,057, Jan. 20, 1911. Under Int. Conv., Feb. 15, March 9, and Oct. 17, 1910.

A CURRENT of acetylene is passed into a solution of a mercuric salt in at least 45 per cent. sulphuric acid or in at least 25 per cent. phosphoric acid, at temperatures below 70° C., preferably at ordinary temperatures; the absorption at the strengths of acid named is greatest at 15°—25° C. When using lower strengths higher temperatures are required, and *vice versâ*; for instance, with 20 per cent. sulphuric acid a temperature about 30° C. is most suitable. The formation of higher condensation products, such as crotonic aldehyde, is greater the higher the concentration of acid used. It is thus possible, by varying the conditions of the absorption, to obtain products of any desired composition. The process can be stopped at intervals in order to separate the products by distillation, or a neutral salt (*e.g.*, sodium sulphate) may be added to the acid, which will cause the precipitation of the aldehyde. It is advisable to carry out the reaction in absence of air, preferably in an atmosphere of acetylene, and to keep the liquid well agitated during the process.—T. F. B.

Nicotine; Industrial synthesis of ——. J. A. A. Auzies. 425,370, Jan. 3, 1911.

THE vapour of butadiene of the formula, $CH_2:CH·CH:CH_2$, or of substances which produce this by condensation or decomposition (*e.g.*, amyl alcohol), is passed together with ammonia or methylamine, through a tube heated to redness, containing a mixture of a non-reducible oxide (thoria or alumina) and a powdered metal (copper or nickel); by this means pyrrol or methylpyrrol is produced. When the vapour of methylpyrrol is passed with hydrogen over finely divided nickel heated to 180°—190° C., it is entirely converted into 1-methylpyrrolidine by addition of four atoms of hydrogen. β-Chloropyridine is obtained by passing a mixture of pyrrol and chloroform vapours over thoria, alumina, or their chlorides, heated to about 450° C., hydrochloric acid being liberated. The condensation of 1-methylpyrrolidine with β-chloropyridine to form nicotine is effected by passing the vapours of the substances over thoria, alumina (or other catalytic oxides) or their chlorides or other salts, heated to 425°—450° C. The β-chloropyridine may be replaced by the corresponding bromo-, iodo-, or hydroxy-compound.—T. F. B.

β-γ-Dimethylbutadiene; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 425,582, Feb. 4, 1911. Under Int. Conv., Feb. 17 and May 30, 1910.

PINACONE can be converted into β-γ-dimethylbutadiene by distilling it with an acid sulphate or a salt of a di- or poly-sulphonic acid. *Example:* 500 kilos. of pinacone are distilled with 750 kilos. of acid potassium sulphate or of potassium pyrosulphate: the upper layer of the distillate is dried over calcium chloride and purified by fractionation, the dimethylbutadiene boiling at 68°—69° C.—T. F. B.

Chloral and an acid amide; Process for preparing a compound of ——. Chem. Fabr. Gedeon Richter. Ger. Pat. 234,741, June 7, 1910.

BY fusing together equal molecular proportions of chloral and bromo-isovalerylamide, a compound possessing powerful hypnotic properties is obtained.—T. F. B.

Hydrastinine salts; Process for preparing ——. H. Decker. Ger. Pat. 234,850, May 11, 1910.

FORMYLHOMOPIPERONYLAMINE is heated with phosphoric anhydride, with or without addition of indifferent solvents, and the 6·7-methylenedioxy-3·4-dihydro-isoquinoline thus obtained is converted into hydrastinine salts by methylation.—T. F. B.

Alkyl ethers of m-hydroxyhydrocinnamic acid and their salts; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 234.852. May 4, 1910.

ALKYL ethers of *m*-hydroxyhydrocinnamic acid (with the exception of the known methyl ether) are obtained (1) by treating *m*-hydroxyhydrocinnamic acid with alkylating agents; (2) by reducing the corresponding ethers of *m*-hydroxycinnamic acid; (3) by converting the alkyl derivatives of *m*-hydroxybenzaldehyde, *m*-hydroxybenzyl alcohol, or *m*-hydroxybenzylchloride into the hydrocinnamic acid derivatives in the usual manner; (4) by replacing the amino group in *m*-aminohydrocinnamic acid by alkyloxy groups other than the methoxy group, by aid of the diazo compound. The products are powerful antiseptics, and also possess antipyretic and antirheumatic properties.—T. F. B.

Yohimbine preparations and process of manufacturing same. F. Müller, Westend-Charlottenburg, Assignor to T. Teichgraeber, Berlin. U.S. Pat. 996.274, June 27, 1911.

SEE Eng. Pat. 14,576 of 1910; this J., 1911, 307.—T. F. B.

Acetylene tetrachloride; Process for making ——. Consortium f. Elektrochem. Industrie. Fr. Pat. 425,327, Nov. 8, 1910. Under Int. Conv., Nov. 9, 1909.

SEE U.S. Pat. 985,528 of 1911; this J., 1911, 446.—T. F. B.

Glycollic acid ; Process for the electrolytic production of ——. Deutsche Gold- und Silber-Scheide-Anstalt vorm. Rössler. Fr. Pat. 425,634, Jan. 6. 1911. Under Int. Conv., Oct. 1, 1910.

See Eng. Pat. 26,546 of 1910 ; this J., 1911, 833 —T. F. B

New use for eucalyptus oils. Baker. *See* X.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photohalides ; Studies on the ——. W. Reinders. Z. physik. Chem., 1911, **77**, 213—226.

When silver chloride is crystallised in diffused daylight from an ammoniacal solution, blue crystals are obtained, whilst red crystals are produced from hydrochloric acid solution and grey-black from mercurous nitrate solutions. The nature of the reducing agent used, and the presence of a colloid, have no influence on the general properties of the photohalides obtained from ammoniacal colloidal silver solutions. The crystalline photohalides are more sensitive to light than pure silver chloride. The photochlorides dissolve without residue in ammonia solution containing gelatin ; the blue crystals give red solutions, and the red crystals blue solutions. Silver chloride can absorb colloidal gold and also certain organic dyes, forming homogeneous crystals analogous to the photohalides : potassium, rubidium, and caesium alums can also be coloured by colloidal silver. (See also this J., 1911, 446.)—T. F. B.

Photohalides ; Studies on the ——. W. Reinders. Chem. Weekblad, 1911, **8**, 299—307. Chem. Zentr., 1911, **1**, 1782—1783.

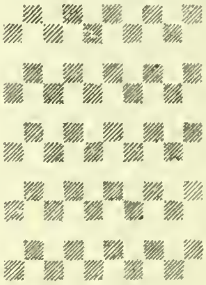
When silver chloride is crystallised from solutions containing gelatin, crystals of increased sensitiveness are obtained ; an increase is produced even when 1 mgrm. of gelatin is present in 10 litres of solution. Pink crystals are obtained from solutions containing considerable amounts of gelatin, and blue-violet crystals from those containing small amounts. Casein, albumin, and gum arabic also increase the sensitiveness of silver chloride, but sucrose and agar-agar have no effect. From concentrated dextrose solutions, rose-coloured crystals of increased sensitiveness are formed, whilst dilute dextrose solutions furnish the ordinary colourless crystals. In a series of comparative experiments, the sensitiveness was increased most by gelatin and albumin, less by casein and peptones, less still by pepsin and rennet, and imperceptibly by carbohydrates and sugars. The absorption of colloidal silver by silver chloride during rapid or slow crystallisation, can be prevented by adding gelatin or other colloids ; the amounts of silver and colloid absorbed by the silver chloride depend on the proportions in which these substances are present in the solution. The shade and intensity of the colour of the crystals, both before and after exposure to light, depends on the amount of colloidal silver absorbed. It would thus appear that the colours of the various photohalides are due, not to one or more distinct subhalides, but to the amount of finely divided silver which they contain.—T.F.B.

Images developed physically, after fixing, on an exposed gelatin-bromide plate. Effects of light and of X-rays singly or in succession. Chanoz. Comptes rend., 1911, **152**, 1832—1834.

The character of the image obtained by physical development, after fixing (see this J., 1911, 834), varies with the concentration of the fixing solution. Gelatin-bromide plates were exposed for periods of from 1 second to more than 2 hours to the light from an Auer lamp at a distance of 0·6 m., and parallel bands cut from the plates were fixed in solutions of sodium thiosulphate of different concentrations (from 0·33 to 33 grms. per 100 c.c.), and after washing, developed in the manner described previously. For a given exposure the opacity of the image diminished with a decrease in the concentration of the fixing solution. The relative opacity of the images corresponding to different periods of exposure was preserved when fixing solutions containing more than 1 grm. of sodium thiosulphate per 100 c.c. were used : as the exposure was prolonged the opacity increased to a maximum, then decreased, and subsequently again increased. When the fixing solution had a concentration of about 0·33 grm. per 100 c.c., however, the opacity appeared to increase continuously with the time of exposure. The author also compared the images produced (*a*) by physical development after fixing, and (*b*) by the ordinary method, on plates exposed to light and to X-rays singly and in succession. For light alone, and for X-rays alone, the changes in the opacities of the images *a* and *b* for different exposures were almost parallel. When the two sources of radiation were used in succession, however, the results obtained differed considerably. For images developed in the ordinary manner the order of exposure was of great importance ; as shown by Villard (Bull. Soc. franç. Phys., 1907), the image produced after exposing the plate first to light and then to X-rays represents the sum of the effects of the two exposures, and is quite different from that obtained after exposing first to X-rays and then to light, in which case the light effaces the effect of the X-rays. For images developed physically, after fixing, on the other hand, the effects produced by the two sources of radiation in succession, were quite similar whether the plate was exposed first to light and then to X rays or *vice-versa*.—A. S.

Patents.

Photographic colour screen-plates. H. W. H. Palmer, Tunbridge Wells. Eng. Pat. 8761, April 11, 1910.



The colours are printed mechanically on screen plates, films, etc., by successive impressions from a single block or other printing surface, on which the design shown in the figure is etched ; in this way, by moving the block downwards the width of one square, a three-colour screen is produced in which no two sides of adjacent squares of any one colour come next each other. —T. F. B.

Photographic paper. L. Günther, Heidelberg, Germany. Eng. Pat. 14,420, June 15, 1910.

A "duplex" paper, consisting of a support of thick tough paper carrying a thin silk or tissue-paper, is utilised for photographic purposes by coating the thin-paper surface with a suitable emulsion, and after the usual operations detaching the emulsion and thin paper from the support.—T. F. B.

Photographic collodio-bromide plate ; Instantaneous —— *and process of making it.* L. Enjolras. Fr. Pat. 424,906, March 24, 1910.

Collodio-bromide plates, papers, etc., possessing the same rapidity as gelatino-bromide products, may be prepared as follows :—50 grms. of cotton are nitrated for 10 minutes at 72° C. in a mixture of 1500 c.c. of sulphuric acid and 1000 c.c. of nitric acid (sp. gr. 1.4). 10 grms. of the nitro-cotton are dissolved in a solution of 25 grms. of silver nitrate in 750 grms. of alcohol and 250 grms. of ether, and the solution is run on to glass plates previously coated with an ammoniacal solution of albumin, and exposed to a temperature of 15° C. for 35 minutes. The plates are now immersed for 20 minutes in a solution of 120 grms. of potassium bromide, 5 grms. of gelatin, and 0·1 grm. of potassium iodide in one litre of water, at 15° C., and then transferred to a solution of 40 grms. of potassium bromide and 2 grms. of gelatin in one litre of water at 55° C.; the temperature of this bath is kept at 80° C. for 40 minutes, at 88° C. for 2 hours, and then at 50° C. for 7 hours. Finally the plates are immersed for an hour at 50° C. in a solution of 40 grms. of potassium bromide, 2 grms. of gelatin, and 6 c.c. of ammonia ("22°") in a litre of water, washed for 15 minutes in water at 30° C., and for 15 minutes at 15° C., and dried at 40° C. in a current of air.—T. F. B.

Polychrome screens for the photography of colours. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Fr. Pat. 425,586, April 7, 1910.

Screens of the type described in Fr. Pat. 339,223 of 1903 (see Eng. Pat. 22,988 of 1904 ; this J., 1905, 104) may be prepared by first coating the support with grains stained with all but one of the colours which are to constitute the screen, and finally filling in the spaces between these grains by means of grains stained with the colour omitted in the first place.—T. F. B.

Cinematograph films or bands. H. Danzer. First Addition, dated March 18, 1910, to Fr. Pat. 410,725, March 19, 1909 (see Eng. Pat. 3603 of 1910 ; this J., 1910, 978).

Cellulose films for use in cinematography are rendered waterproof by forming on their surface a layer of cellulose nitrate of low nitrogen content, *e.g.*, by treating them for a few minutes in a mixture of equal parts by weight of nitric acid of 38° B., and sulphuric acid of 66° B., at a temperature of 25° C. After washing, the films appear somewhat opaque, but may be rendered transparent by treatment with a suitable solvent of nitrocellulose, such as acetone : this treatment is insufficient to dissolve the layer of cellulose nitrate, but causes it to swell and become homogeneous.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Explosives; Fifteenth Annual Report of the Chief Inspector (E. A. Mann) of —— for Western Australia for the year 1910.

There were 44 Government reserves with a total area of 3205 acres, containing 72 magazines, inclusive of 5 Government buildings, with a total capacity of 1208½ tons. Outside the Government reserves there were 36 magazines with a capacity of 30½ tons. The above details do not include detonator magazines, which are treated as adjuncts to main magazines. The number of samples tested was 3440, inclusive of 1409 tests for gelignite and 1757 tests for fuse. The large increase (1438) in the number of samples tested was chiefly due to the increase in the number of fuse samples. Difficulties arose in complying with the burning speed regulations, especially with one particular brand of fuse. Very stringent steps had to be taken to enforce compliance with the regulations and considerable quantities of fuse were condemned and withdrawn from consumption. In view of the exceptionally heavy importation of explosives, the quantity which it was found necessary to condemn or destroy, on any grounds, was unprecedentedly small. Only three small parcels of a few pounds each were discovered at various times which were in such a condition as to render their destruction necessary, and none of the shipments arriving in the State had to be detained on the coast on account of chemical or physical deterioration, with the exception of the shipments of fuse already referred to. The importation figures were as follows :—

	1909.	1910.	Value.
	lb.	lb.	
Gelignite	2,378,100	3,657,108	£139,280
Dynamite	7,500	13,910	591
Blasting gelatin	370,500	296,500	15,790
Gelatin dynamite	310,250	326,900	14,702
Detonators (No.)	3,210,144	4,123,730	5,870
Fuse (coils)	498,900	4,489,324	10,723
Blasting powder	242,217	318,216	7,026
Sporting powder	575	1,135	142
Explosives N.E.I.	—	—	13,108
Fireworks	—	—	413
			£207,645

The increase in the value of the importations as compared with the previous year was £53,559, constituting a record figure for the State exceeding the highest previous figure by over £8000. The quantity and value of explosives and accessories imported into the States of the Commonwealth were as follows :—

Explosives.		Western Australia.	N.S. Wales.	Queensland.	Victoria.	South Australia.	Tasmania.
Nitroglycerin compounds	lb.	4,294,418	1,191,205	1,151,022	1,353,650	17,500	401,300
Blasting powder	lb.	318,216	1,149,325	450,300	257,500	—	118,075
Sporting powder	lb.	1,135	42,672	30,375	39,130	100	9,400
		4,613,769	2,383,202	1,661,697	1,650,280	17,600	528,775
		£	£	£	£	£	£
Fuse		10,723	2,180	3,630	1,539	100	—
Detonators		5,870	2,780	3,249	5,538	107	1,155
Explosives N.E.I.		13,521	21,950	4,249	60,303	3,865	1,537
		30,114	26,910	11,128	67,380	4,072	2,692
Total value of explosives enumerated above		£207,645	68,130	71,334	135,892	4,965	27,397

Western Australia takes 42·52 per cent. of the total Commonwealth importations of explosives.—G. W. McD.

Initial detonation. L. Wöhler. Z. angew. Chem., 1911, 24, 1111.

The use and advantages of the azides of the heavy metals—mercury, silver, lead and copper—are dealt with. If small quantities of lead azide (0·01 grm. per detonator charge) are added to mercury fulminate, it greatly increases the power and certainty of the latter as a detonating medium. The azides may also be advantageously used alone. During the preparation of lead azide there is, as compared with mercury fulminate, less liability to poisoning. It is non-hygroscopic, stable during storage and does not give rise to miss-fires. By allowing solutions of mercury or copper azides to crystallise slowly, large crystals are obtained which are less sensitive to shock than smaller crystals, though the detonating power remains unimpaired. The use of the basic azides has been studied, and also the influence of light upon the compounds.—G. W. McD.

Patents.

Noxious fumes resulting from the combustion of nitroglycerin explosives ; Method of, and apparatus for, reducing or neutralising the ——. E. Macaulay, Bulawayo, Rhodesia. Eng. Pat. 2820, Feb. 3, 1911.

A cardboard cylinder is divided by a wad into two compartments, one being filled with an alkali salt (ammonium chloride), the other with an alkaline earth oxide (calcium oxide) and a small amount of potassium permanganate. The ends of the cylinder are closed by wads, leaving, at one end, a space outside the wad for the reception of a cork split longitudinally and a wooden wedge, by means of which the cylinder may be expanded into the borehole. The whole of the cylinder and the wads are rendered damp-proof by being greased, and the cylinder is further enclosed in a waterproof sleeve, the lower end being tied, whilst the upper end, in which the wedge is inserted, is filled with earth and then tied up. —G. W. McD.

Safety explosives; Manufacture of ——. N. Ceipek, Vienna. Eng. Pats. 9742, April 21, 1911. (Addition to Eng. Pat. 7838, April 3, 1907; this J., 1907, 1296), and 9743, April 21, 1911.

(1). A MIXTURE of ammonium nitrate (88 parts), turmeric charcoal (6·25), and sandalwood charcoal (5·75 parts). Collodion cotton, gelatinised with trinitrotoluene, may also be added to the explosive. It is stated that the use of a mixture of turmeric charcoal and sandalwood charcoal increases the rate of combustion and the power of the explosive. (2). A mixture of ammonium nitrate (88 parts), carbonised turmeric powder (1·05), carbonised sandalwood (0·95), and nitrated turmeric powder (10 parts). By the addition of gelatinised collodion cotton, it is stated that the permanence, the explosive power, and the charging density of the compound are increased and its hygroscopic power diminished. The nitration of the curcuma root is carried out as follows: After extracting the colouring matter by boiling in water, the root is dried and ground and is then treated with a mixture of sulphuric and nitric acids. After draining off the acid the product of the reaction is washed in water and dried; it is said to be non-sensitive to blows or shock.—G. W. McD.

Safety-powder for blasting. G. M. Peters, Cincinnati, and M. F. Lindsley, Kings Mills, Ohio. U.S. Pat. 994,273, June 6, 1911.

A MIXTURE of ammonium nitrate, nitrocellulose, sodium chloride, calcium carbonate, and a solution of asphaltum in a nitro-hydrocarbon.—W. P. S.

Explosive compound. W. F. Hancock, Haliburton, Ontario. U.S. Pat. 995,134, June 13, 1911.

POTASSIUM chlorate, 16 parts; potassium nitrate, 12; brown sugar, 3; potassium bichromate, 3; sulphur, 6; charcoal, 1; and lampblack, 1 part.—A. S.

Explosive compound and process of manufacturing the same. D. M. Stirton, Cascade, British Columbia. U.S. Pat. 995,579, June 20, 1911.

RAW potatoes are cleaned and ground to a pulp and dried to about 50 per cent. of their original weight. Potassium chlorate (44 parts) is mixed with potato pulp (55 parts), and colouring matter (1 part). The mixture is granulated and dried, and coated with graphite.—G. W. McD.

Safety explosives; Method of manufacture of ——. A. Voigt. Fr. Pat. 425,550, Feb. 3, 1911.

THE following are given as examples of these explosives:—The sodium salts of mononitrophenol or sulphocresol (25 parts), sodium or potassium nitrate (65), and potassium perchlorate (10 parts). The sodium salts of mononitrophenol or sulphocresol (22·5 parts), potassium nitrate (45), potassium perchlorate (22·5), and ammonium nitrate (10 parts). The sodium salts of mononitrophenol or sulphocresol (25 parts), potassium nitrate (65), and trinitrotoluene (10 parts). The nitrates are dissolved in water and concentrated to the crystallising point before adding to the other ingredients. A greater density is thus obtained in the finished explosives, which are said to be very insensitive to shock and friction.—G. W. McD.

Explosives. J. Sayers, W. A. Wilson, and J. Thorburn, Ardeer, Scotland, Assignors to E. I. Du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pats. 995,187; 995,373; 995,374; 995,375 and 995,376, June 13, 1911.

SEE Eng. Pat. 26,239 of 1909; this J., 1911, 385. —G. W. McD.

XXIII.—ANALYTICAL PROCESSES.

Alkalimetry; Use of sodium thiosulphate in ——. W. Feld. Z. angew. Chem., 1911, **24**, 1161—1163.

THIOSULPHATES and polythionates react in solution with mercuric chloride with liberation of acid according to the following equations:—$Na_2S_2O_3 + 2HgCl_2 + H_2O = Hg_2Cl_2 + Na_2SO_4 + 2HCl + S$: $Na_2S_4O_6 + 2HgCl_2 + 2H_2O = Hg_2Cl_2 + Na_2SO_4 + H_2SO_4 + 2HCl + 2S$. When the mercuric chloride is in excess, as represented by these equations, the precipitate is white and the liberated acid may be titrated with alkali, using methyl orange as indicator, the end point being quite sharp. If the mercuric chloride is not in excess a black precipitate of mercuric sulphide is formed. (See this J., 1911, 357). The addition of ammonium chloride entirely prevents the precipitation of the mercury by the alkali, but it must be made immediately prior to the titration, otherwise the ammonium chloride interferes with the reaction between the mercuric chloride and the thiosulphate. As sodium thiosulphate is obtainable chemically pure and can also be quickly and accurately standardised against resublimed iodine, the above reaction forms an excellent method of standardising solutions of sodium hydroxide. About 0·5 grm. of thiosulphate, accurately weighed, is dissolved in water and the solution poured into 40 c.c. of a cold saturated (about 7 per cent.) solution of mercuric chloride. The mixture is warmed for about 20 minutes, cooled, and after the addition of 30 c.c. of 4-*N* ammonium chloride solution, is titrated with the solution of sodium hydroxide. Results are given proving the accuracy of the method. —T. St.

Nitrate-nitrogen; New method for the rapid determination of ——. A. Quartaroli. Staz. sperim. agrar. ital., 1911, **44**, 157—164. Chem. Zentr., 1911, 2, 49—50.

THE method is based upon the interaction of nitrates and anhydrous formic acid in accordance with the equation:—

$$2KNO_3 + 6H{\cdot}CO_2H = N_2O + 4CO_2 + 5H_2O + 2H{\cdot}CO_2K.$$

0·1—0·3 grm. of the nitrate are warmed with 5 c.c. of formic acid in a test-tube and the gas evolved is collected in a eudiometer tube over mercury. The volume of the gas is read before and after shaking with 2 c.c. of concentrated potassium hydroxide solution. The first reading gives the combined volume of carbon dioxide and nitrous oxide and the second that of nitrous oxide. The results are said to agree sufficiently well with those obtained by the Schulze-Tiemann method.—A. S.

Zirconium oxide; Behaviour of —— with hydrofluoric acid. E. Wedekind. Ber., 1911, **44**, 1753—1755.

IN the analysis of zirconium silicide, metallic zirconium containing silicon, and mixtures of zirconia and silica, a loss of zirconium may take place on evaporating with hydrofluoric acid in presence of sulphuric acid in order to remove the silica. Experiments have shown that when zirconium oxide is heated with hydrofluoric acid alone or in presence of a small quantity of sulphuric acid, a considerable loss takes place: practically the whole of the zirconia can be volatilised by repeating the operation several times. If, however, a considerable quantity of sulphuric acid be used, the loss by volatilisation can be entirely prevented, and with this precaution, silica can be satisfactorily separated from zirconia by the method In using the method, the quantities of sulphuric and hydrofluoric acids should be respectively at least 20 times and not more than 45 times the weight of the sample.

The method is however not suitable for the determination of the combined silicic acid in zirconium silicate (hyacinth). —A. S.

Determination of naphthalene in crude coal gas. Albrecht and Müller. *See* IIa.

Annual report on alkali, etc., works. *See* VII.

Occlusion in precipitates of barium sulphate. Johnston and Adams. *See* VII.

Determination of heat of evaporation of water. Richards and Mathews. *See* VII.

Determination of chromium in chrome iron ore. Nydegger. *See* X.

Analysis of ferroboron. Raulin. *See* X.

Analysis of cottonseed products. *See* XII.

Commercial analysis of beeswax, with special reference to East Indian and the so-called China beeswax. Buchner. *See* XII.

Determination of fillers [mineral matter, etc.] in rubber mixings. Brüggemann. *See* XIV.

Grasser-Allen extraction apparatus for tannin analysis. Auerbach. *See* XV.

Voluminometer for untanned skin. Wood and Law. *See* XV.

Analysis of calcium cyanamide. Stutzer. *See* XVI.

Chemical distinction of fermentation vinegar and vinegar essence. Fincke. *See* XVIII.

Determination of phosphorus in milk. Sloniewski. *See* XIXa.

Coagulation temperatures of egg-, serum-, and milk-albumin, and serum-globulin in solutions containing ammonium sulphate. Micko. *See* XIXa.

Determination of salicylic acid in fruit juices. Vierhout. *See* XIXa.

Detecting and determining nitric and nitrous acids in waters. Tillmans and Sutthoff. *See* XIXb.

Permanganate test for cocaine. Seiter. *See* XX.

Determining ethyl nitrite in spirit of nitrous ether. Herting. *See* XX.

Test for acetanilide. Watson. *See* XX.

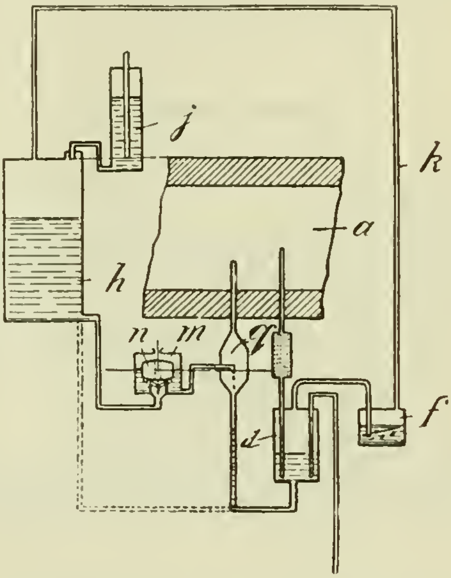
Patents.

Ignitable admixture in the air; Process and apparatus for ascertaining the proportions of ——. H. Breitbart, Duisburg-Beeck, Germany. Eng. Pat. 19,008, Aug. 12, 1910.

The apparatus consists of a double-walled, cylindrical vessel fitted with a piston, by means of which are drawn in simultaneously, the air to be tested, and the vapour of a measured volume of a suitable volatile liquid, such as benzene, ligroin, alcohol, etc. The amount of such vapour is too small to make an explosive mixture with a charge of pure air. In the bottom of the cylinder is a fire-clay fitting carrying platinum wires, which, heated from outside, serve to ignite the mixture in the interior of the vessel. A charge having been drawn in, the platinum wires are heated, and if no explosion occurs, the piston is screwed down, compressing the mixture. When an explosion occurs the gases operate a valve in the piston and escape through a safety device or silencer having internal rib or baffle plates, the valve at the same time causing a gong or other signal to actuate. The compression at the time of the explosion is indicated on a scale provided for the purpose. If the mixture does not explode on being thus compressed, the gases are allowed to escape by the valve being opened by a pin or bow suitably attached to the base of the cylinder.—T. St.

Analysis of gases; Apparatus for the automatic ——. A. Mertens. Ger. Pat. 234,983, July 7, 1910.

In an apparatus of the type shown on the figure, in which by means of a hydraulic pump device, the gas to be examined is alternately withdrawn from a flue, *a*, and forced through an absorbing liquid, the upper part of the closed vessel, *h*, containing the working liquid, is connected, on the one hand, with the absorption vessel, *f*, by the tube, *k*, and on the other, with the Mariotte bottle, *j*, in such a manner that the unabsorbed gas flows from *f* into the upper part of *h*, whilst a quantity of liquid corresponding with the volume of the absorbed gas flows from the Mariotte bottle into *h*. In the tube connection leading from *h* to the vessel, *d*, a chamber, *m*, may be interposed, in which the level is kept constant by means of the float, *n*. The chamber, *m*, communicates with *d* by way of the chamber, *q*, in which the same pressure in maintained as that prevailing in the flue, *a*, from which the gas to be analysed is withdrawn.—A. S.



XXIV.—MISCELLANEOUS ABSTRACTS.

Bamboo cane; Content and distribution of hydrocyanic acid in the ——. O. Walter, T. Krassnosselska, N. Maximow, and W. Maltschewski. Bull. Acad. St. Petersbourg, 1911, 397—426. Chem. Zentr., 1911, 1, 1864.

The authors have detected the presence of considerable quantities of hydrocyanic acid, loosely combined in the form of glucosides, in young Javan bamboo canes.—A. S.

Trade Report.

New German law as to working of patents. Board of Trade J., June 29, 1911.

A BILL to amend the law on the working of patents in Germany has been passed. In place of Article 11 of the Patent Law of April, 1891, the present law provides that "should a patentee refuse permission to an applicant for the use of the invention in return for reasonable compensation and guarantees, the right to use the invention may, if the grant of such permission is required in the public interest, be given to the applicant (compulsory licence). The right may be given in a limited form, and made dependent upon conditions.

"The patent may be revoked, in the absence of international agreements to the contrary effect, if the invention be worked exclusively or mainly outside the German Empire or the protected territories. The transfer of the patent to another is without effect in so far as the sole object is to avoid revocation.

"No decision shall be come to against a patentee under the above provisions until after three years from the notification of the grant of the patent."

The new law came into force on 1st July.

Books Received.

RUBBER. By PHILIP SCHIDROWITZ, Ph.D. Methuen and Co., Ltd., 36, Essex Street, London, W.C. 1911. Price 10s. 6d.

8vo volume, containing 298 pages of subject matter with 83 illustrations, and alphabetical indexes of subjects and names. The subject matter receives the following classification :—I. Historical. II. Production and consumption of rubber. III. General nature of the rubber industry. IV. Wild rubber. V. The plantation industry. VI. Preparation of rubbers other than Hevea on the plantation system. VII. Industrial rubbers. VIII. Rubber latices and coagulation. IX. Crude rubbers compared. "Tackiness," etc. X. Chemistry of crude rubber. XI. The theory of vulcanisation. XII. Manufacture of rubber goods. XIII. Substitutes and waste rubber disposal. XIV. Chemical, physical, and mechanical properties of vulcanised rubber. XV. Chemical analysis and physical examination of rubber. XVI. Mechanical tests. XVII. Contracts and Specifications.

FORTSCHRITTE IN DER GERBEREICHEMIE. Von Dr. FRANZ CH. NEUNER. (Wien). Theodor Steinkopf's Verlag. Dresden, Germany. 1911. Price M. 1.80.

8vo volume in pamphlet form, containing 49 pages of subject matter, a bibliographic list of references, and alphabetical indexes of authors' names, and of subjects. The subject matter is classified as follows :—I. Theory of the tanning process, etc. II. Investigations on the raw hide and its preservation. III. Softening. IV. De-liming, plumping, and pickling. V. Bacteriology of tanning and bating. VI. Vegetable tanning agents. VII. Analysis of tanning agents. VIII. Vegetable tanning. IX. Chrome-tanning and alum tanning. X. Leather analysis.

THE PRINCIPLES OF BLEACHING AND FINISHING OF COTTON. By S. R. TROTMAN, M.A., and E. L. THORP. Chas. Griffin and Co., Ltd., Exeter Street, Strand, London W.C. 1911. Price 16s. net.

8vo volume, containing 341 pages of subject matter, with 131 illustrations, and an alphabetical index of subjects. The matter is classified under the following heads :—I. Structure of cotton fibre. II. Constituents of cotton. III. Cotton testing. IV. Carbohydrates. V. Water. VI. Bacteria in bleaching. VII. Cotton piece goods. VIII. Steeping. IX. Transmission, impregnation, and plaiting of cloth. X. Alkali boiling. XI. Materials used in lye-boiling. XII. Soap. XIII. Soap-making. XIV. Organic solvents. XV. Kiers. XVI. Washing machines. XVII. Bleaching and bleaching powder. XVIII. Chemicking and souring apparatus. XIX. Sodium hypochlorite and electrolytic bleaching solutions. XX. Other bleaching agents. XXI. Souring or treatment with acids. XXII. Processes. XXIII. Coloured goods. XXIV. Stains and discolourations. XXV. Finishing and the materials used in finishing. XXVI. Mangling, drying, conditioning. XXVII. Stiffening. XXVIII. Auxiliary machines and processes. XXIX. Stenters. XXX. Beetling. XXXI. Calendering. XXXII. Combined finishing processes.

THE MANUFACTURE OF CHEMICAL MANURES. By J. FRITSCH. Translated from the French, with numerous notes, by DONALD GRANT. Scott, Greenwood and Son. 8, Broadway, Ludgate, London, E.C. 1911. Price 10s. 6d.

8vo volume, containing 332 pages of subject matter, with 69 illustrations, 108 tables, and an alphabetical index of subjects. The classification of the test is as follows :—I. Phosphoric acid. II. Principal phosphate deposits. III. Drying and enrichment of phosphates. IV. Historical review of superphosphate manufacture. V. Theory of manufacture of soluble phosphates. VI. Manufacture of superphosphates. VII. Crushing, sifting, drying, and storing of superphosphate. Retrogradation. VIII. Compound manures. IX. Manufacture of phosphoric acid, double superphosphates and various products. Manufacture of phosphorus in the electric furnace (Appendix). X. Manufacture of bone dust and of bone superphosphate (vitriolised bones). XI. Basic slag. XII. Nitrogenous manures. XIII. Manure from animal waste. XIV. Recovery of nitrogen from distillery spent wash. Cyanamide and nitrate of lime. XV. Nitrogenised phosphatic manures. XVI. Potassic manures. XVII. Transference and handling of raw materials and finished products.

THE CORROSION OF IRON AND STEEL. By J. NEWTON FRIEND. Ph.D., D.Sc. Longmans, Green and Co., 39, Paternoster Row, London. New York, Bombay, and Calcutta. 1911. Price 6s.

8vo volume, containing 289 pages of subject matter, with 63 illustrations, and alphabetical indexes of subjects and authors' names. The subject is treated under the following heads :—I. Iron. History and economic value. II. Action of air and water on iron. III. Action of steam. IV. Various theories of corrosion. V. Is acid essential in corrosion ? VI. Factors influencing rate of corrosion of iron exposed to natural forces. VII and VIII. Action of acids and alkalis. IX. Influence of aqueous solutions of single salts upon iron. X. Influence of aqueous solutions of two or more electrolytes on iron. XI. Actions of oils. XII. Passive state. XIII. Influence of chemical composition upon the corrodibility of iron. XIV. Electrical and galvanic action. XV. Relative rate of corrosion of iron and steel.

HANDBUCH DER MINERALCHEMIE. Herausgegeben von Prof. Dr. C. DOELTER. Vier Bände. Bd. I, (1). Theodor Steinkopff's Verlag. Dresden. 1911. Price M. 6.50.

LARGE 8vo volume, containing 160 pages of subject matter, with 14 illustrations, and forming part 1 of volume I of the entire work of four volumes. The subject matter of part 1 is classified as follows :—I. GENERAL INTRODUCTION. II. CARBON. Diamond. Graphite. Schungite. III. CARBONATES. Analytical methods. Chemical reactions for distinguishing the carbonates of the alkaline earths. The formation of the carbonates of calcium, magnesium, and iron. Analysis of sodium carbonate, etc.

SICHERHEITSEINRICHTUNGEN IN CHEMISCHEN BETRIEBEN. Von Dr. ING. KONRAD HARTMANN. Professor an der techn. Hochschule zu Berlin, etc. Otto Spamer's Verlag. Leipzig. 1911. Price M. 17.

LARGE 8vo volume, containing 304 pages of subject matter, with 254 illustrations, and an alphabetical index of subjects and authors. The text is arranged and classified under the following heads :—I. State regulations. Supervision of processes. II. The management. The workers. First aid in cases of accidents. III. General plan of operations and arrangements. IV. Special dangers. (i) Acids and other corrosive liquids. (ii) Poisonous substances. (iii) Substances dangerous as to fire or explosion. (iv.) Condensed and liquefied gases. V. Personal equipment of the workpeople.

Chrysotile-Asbestos. Its Occurrence, Exploitation, Milling, and Uses. By Fritz Cirkel. 2nd Edition. Department of Mines, Canada. No. 69.

The original work (see this J., 1905, 1261) has been enlarged to 302 pages, exclusive of the index. It now contains 66 full page plates, 88 illustrations in the text, and two maps.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

Patent Specifications may be purchased at the Sale Branch of the Patent Office, Quality Court, Chancery Lane, London, W.C., fifteen days after the date on which acceptance of the complete specification is advertised. The price is 8d. each.

I.—GENERAL PLANT; MACHINERY.

Applications.

15,439. Wilbuschewitsch. Preparing and regenerating catalysts. [Divided Appl. on No. 30,014, Dec. 24, 1910.]* July 3.

15,459. Wilton. Furnaces.* July 3.

15,686. Gobbe. Method and means for treating pulverulent substances. [Belg. Appl., July 8, 1910.]* July 5.

15.753. Faller. Apparatus for mixing comminuted solids and liquids and delivering them in the form of a jet.* July 6.

15,808. Wilbuschewitsch. Mixing device. [Divided Appl. on No. 30,014, Dec. 24, 1910.]* July 7.

15,964. Royston (General Reduction Gas and By-Products Co.). Methods and apparatus for treating materials.* July 10.

15,990. Dunn. Evaporating and concentrating apparatus. [U.S. Appl., July 18, 1910.]* July 10.

16,031. Smith. Classification of granular materials. July 11.

16,206. Tellier. *See under* XIX.

16,299. Marlow, and Pulsometer Eng. Co. Apparatus for drying, heating, or cooling. July 14.

Complete Specifications Accepted.

17,539 and 27,966 (1910). Clark. Pipes and launders for conveying abrasive or corrosive material. July 12.

17,595 (1910). Du Pont. Separating solids, particularly iron ores, by means of liquids. July 19.

17,618 (1910). Du Pont. Recovery of the separating liquid carried off by the solids in the separation of solids by liquids. July 19.

25,301 (1910). Johnson (Badische Anilin und Soda Fabrik). Spraying matter in suspension and spraying nozzles therefor. July 12.

26,526 (1910). Smith and Co. Apparatus for heating or cooling granular or like material. July 19.

7518 (1911). Bell Bros., and Johnson. Purifying steam generated by pouring molten slag into water. July 19.

7536 (1911). Smith, Mitchell, Askham, and Hey. Absorbers or separators for gases or vapours. July 19.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

15,617. Govan. Manufacture of spirit for motors and other uses. July 5.

15,837. Clarke and Campbell. Fuel. July 7.

15,939. Gunnill. Treatment of peat. July 10.

15,969. Mallet. Gasification of caking coal in closed gas producers. [Fr. Appl., Nov. 2, 1910.]* July 10.

16,027. Green. Gas-producers.* July 11.

16,125. Marriott. Synthetic Trinidad lake bitumen compounds. July 12.

16,168. Chadwick and Hollinshead. Working gas producers.* July 12.

16,230. Bloch. Regeneration of burnt-out electric lamps.* July 13.

16,308. Grote. Manufacture of metal filaments for electric lamps. July 14.

16,373. Pictet. Manufacture of a mixed gas. [Addition to No. 13,397 of 1911. Ger. Appl., July 16, 1910.]* July 15.

16,381. Clarke and Campbell. Retorts for the destructive distillation of fuel and like products. July 15.

Complete Specifications Accepted.

15,925, 18,578, and 18,720 (1910). Stuart-Bailey. Prevention of explosions in coal mines. July 12.

16,630 (1910). Woodall and Duckham. Vertical retorts for carbonising coal, etc. July 19.

16,981 (1910). Dixon. Apparatus for treating bituminous coal. July 19.

23,948 (1910). Stolte. Gas washer. July 12.

465 (1911). Hohle. Incandescent gas mantles. July 19.

1706 (1911). Deuts. Hüttenbau-Ges. Horizontal regenerative coke ovens or retort furnaces. July 12.

2581 (1911). Holmes and Co., and Holmes. Apparatus for washing and scrubbing gases. July 12.

11,851 (1911). Mertens. *See under* XXIII.

III.—TAR AND TAR PRODUCTS.

Complete Specifications Accepted.

21,401 (1910). Pollak. Manufacture of insoluble condensation products from phenols and formaldehyde. July 19.

26,432 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of an anthraquinone dicarboxylic acid and its anhydride. July 19.

1688 (1911). Tanne and Oberländer. Separation of solid hydrocarbons from naphtha residues and tars. July 19.

IV.—COLOURING MATTERS AND DYES.

Applications.

15,466. Hodgson, and Lord Mayor, Aldermen, and Citizens of Bradford. Manufacture of an organic base and colouring matters therefrom. July 3.

15,618. Levinstein, Baddiley, and Levinstein, Ltd. Manufacture of azo dyestuffs. [Addition to No. 15,069 of 1910.] July 5.

15,809. Act.-Ges. f. Anilinfabr. Manufacture of vat dyestuffs of the anthraquinone series. [Ger. Appl., Aug. 11, 1910.]* July 7.

15,979. Soc. of Chem. Industry in Basle, and others. Manufacture of sulphurised vat dyestuffs of the anthracene series. [Addition to No. 20,094 of 1908.]* July 10.

Complete Specifications Accepted.

15,070 (1910). Levinstein, Baddiley, and Levinstein, Ltd. Manufacture of intermediate products for making azo dyestuffs. July 19.

20,338 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. July 12.

21,200 (1910). Newton (Bayer und Co.). Manufacture of an azo dyestuff. July 19.

27,046 (1910). Newton (Bayer und Co.). Manufacture of thiazolesulphonic acids. July 19.

30,284 (1910). Bayer und Co. Manufacture of dyestuffs which are derivatives of diaminodiphenylurea or -thiourea. July 12.

12,009 (1911). Meister, Lucius, und Brüning. Manufacture of a monoazo dyestuff for preparing violet lakes. July 12.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

16,000. Peters and Cullum. Treatment of cellulose. July 10.

16,278. Matthews. *See under* XIV.

Complete Specifications Accepted.

16,629 (1910). Pawlikowski. Manufacture or treatment of artificial silk, horsehair, etc. July 19.

29,087 (1910). Stanley. Manufacture of wood pulp. July 12.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

16,001. Peters and Cullum. Waterproofing linen, cotton, silk, straw, etc. July 10.

16,071. Frohlich. Dyeing and scouring or washing machines. [U.S. Appl., July 16, 1910.]* July 11.

Complete Specifications Accepted.

15,785 (1910). Halliwell. Finishing, conditioning, or damping yarns or threads. July 12.

16,206 (1910). Goetz. Apparatus for dyeing, bleaching, mordanting, and otherwise treating wool, cotton, and other fibrous substances. July 19.

17,020 (1910). Moulding and Watson. Cleaning, strengthening, and conditioning yarns. July 12.

28,329 (1910). Hahn. Mercerising cotton in the form of skeins. July 19.

29,997 (1910). Scheitlin. *See under* VII.

VII.—ACIDS: ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

15,432. Elektrochem. Werke. Production of solutions of nitrogen pentoxide in monohydrate of nitric acid. [Ger. Appl., July 16, 1910.]* July 3.

15,439. Wilbuschewitsch. *See under* I.

15,593. Firman. Production of potash and phosphoric acid.* July 4.

15,948. Imray (Meister, Lucius, und Brüning) Manufacture of nitric acid. July 10.

15,984. Ashcroft. Manufacture of carbonate or bicarbonate of sodium or potassium and ammonium salts or ammonia. July 10.

16,129. Schulz A.-G., and Gruber. *See under* VIII.

16,152. Bradley. Electrolytic preparation of sulphuric acid. July 12.

16,207. Boult (Sparre). Conversion of lower oxides of nitrogen to higher oxides of nitrogen.* July 13.

Complete Specifications Accepted.

15,973 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia. July 12.

15,991 (1910). Bernstein. Manufacture of cuprammonium solution. July 12.

16,275 (1910). Aluminium-Industrie A.-G. Manufacture of hydrocyanic acid. July 12.

16,454 (1910). Freeth and Cocksedge. Manufacture of ammonium nitrate. July 19.

16,455 (1910). Freeth and Cocksedge. Manufacture of ammonium nitrate from ammonium bicarbonate and sodium nitrate. July 12.

16,615 (1910). Heylandt-Ges. Method of liquefying hydrogen. July 19.

17,628 (1910). Harger. Manufacture of oxygen. July 12.

20,875 (1910). Henss. Manufacture of ammonium sulphate. July 19.

24,817 (1910). Bollo and Cadenaccio. Production of peroxides and oxides or hydrated oxides of barium, strontium, potassium, and sodium, from the carbonates. July 12.

29,997 (1910). Scheitlin. Rendering alkali peroxides harmless for use in the laundry, bleaching, etc. July 19.

534 (1911). Goldschmidt and Goldschmidt. Manufacture and use of ferrosoferric oxide. July 19.

7103 (1911). British Thomson-Houston Co. (General Electric Co.). Manufacture of boron compounds. July 12.

VIII.—GLASS; CERAMICS.

Application.

16,129. Schulz A.-G., and Gruber. Deferrisation of silicated alumina, kaolin, etc.* July 12.

IX.—BUILDING MATERIALS.

Complete Specification Accepted.

11,509 (1910). Brand. Artificial stone. July 12.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

15,586. British Thomson-Houston Co. (General Electric Co.). Treatment of refractory metals. July 4.

15,740. Duke. Metallic alloy.* July 6.

15,824. Härdén, and Electric Furnaces and Smelters, Ltd. Production of metals from their ores. July 7.

15,849. McKeehnic and Beasley. Wet extraction of copper and other non-ferrous metals from ores, mattes, etc. July 8.

15,850. McKechnie and Beasley. Treatment of nickel-copper mattes. July 8.

15,959. Lowy and Muller. Production of electro-deposits. [Austrian Appl., June 1, 1911.]* July 10.

15,995. Dewar. Metallurgical treatment of oxidised ores of copper or products containing copper. July 10.

16,294. Michelin. Process for coating iron and steel.* July 14.

Complete Specifications Accepted.

8031 (1910). British Thomson-Houston Co. (General Electric Co.). Tungsten and its manufacture. July 12.

11,832 (1910). Simpson. Purification and alloying of metals. July 19.

11,869 (1910). Stock. Bessemer converters. July 19.

17,595 (1910). Du Pont. *See under* I.

20,337 (1910). Cowing. Production of alloys and separation of metals. July 19.

20,989 (1910). Johnson (McNitt). Separation of alkali metals from alloys or combinations with other metals. July 12.

28,030 (1910). Ruthenburg. Extraction of antimony from ores. July 19.

XI.—ELECTRO-CHEMISTRY.

Complete Specification Accepted.

13,731 (1911). Soc. Anon. Electrométallurgique. Supplying electric furnaces with triphase currents. July 19.

XII.—FATS; OILS; WAXES.

Applications.

15,440. Wilbuschewitsch. Oxidation of oils, fats, fatty acids, fish oils, etc. [Divided Appl. on No. 30,014, Dec. 24, 1910.]* July 3.

15,803. Budde. Recovery of waxes, oils, fats, and resinous substances from organic materials. July 7.

15,961. Schneider. Treatment of oil seed.* July 10.

16,119. Desfossés. Candles.* July 12.

Complete Specification Accepted.

7726 (1910). Testrup. Treatment of oils, fats, and the like. July 12.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

15,803. Budde. *See under* XII.

15,886. Continental-Caoutchouc und Gutta-Percha-Comp. Protective paints for metal surfaces. [Ger. Appl., July 22, 1910.]* July 8.

16,155. Cavarly. Buckles for use in making white lead, etc.* July 12.

16,224. Linoleum Manufacturing Co., and Godfrey. Manufacture of linoleum. July 13.

16,277. Matthews. Manufacture of varnishes and paints. July 14.

Complete Specification Accepted.

7722 (1910). Child. Manufacture of printing ink and the like. July 12.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

15,945. Marks (Düsseldorfer Celluloid-Fabr.). Manufacture of plastic products resembling gutta-percha, etc.* July 10.

16,217. Rowbotham and Kassner. Extraction of rubber and other juices from parts of rubber plants and trees and from crude rubber. July 13.

16,278. Matthews. Manufacture of articles such as are usually made from hard rubber, celluloid, vulcanite, ebonite, etc. July 14.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

15,561. Bué. Utilisation of leather waste. [Belg. Appl., July 26, 1910.]* July 4.

15,761. Reidel. Artificial leather.* July 6.

Complete Specification Accepted.

8318 (1911). Bartels. Manufacture of artificial horn from casein. July 19.

XVII.—SUGARS; STARCHES; GUMS.

Application.

16,284. Hervey. Manufacture of dextrine.* July 14.

Complete Specification Accepted.

133 (1911). Bebien. Apparatus for dissolving sugar and filtering the syrup obtained. July 12.

XVIII.—FERMENTATION INDUSTRIES.

Application.

16,153. Kluge. Process for denaturing alcohol.* July 12.

Complete Specifications Accepted.

16,194 (1910). Palmer, and Fraser and Co. Apparatus for collecting carbon dioxide from fermentation baths and compressing same. July 19.

16,744 (1910). Wooldridge. Brewing. July 12.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

15,430. Darnall. Purification of water and sewage.* July 3.

15,611. Coplans. Apparatus for purifying water and other liquids. July 5.

16,206. Tellier. Desiccation in a vacuum of meats and other substances containing water or absorbable liquids. [Fr. Appl., July 15, 1910.]* July 13.

Complete Specifications Accepted.

18,985 (1910). Adams. Screening apparatus for removing solids from sewage, etc. July 19.

12,333 (1911). Bloxam (Ahrndsen). Process for sterilising liquids, particularly milk. July 19.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

15.438. Imray (Meister, Lucius, und Brüning). Manufacture of arseno-compounds. July 3.

15,671. Sefton-Jones (Von Wülfing). Preparations containing formic aldehyde.* July 5.

Complete Specifications Accepted.

29,073 (1910). Johnson (Chem. Fabr. Griesheim-Elektron). Manufacture from acetylene of acetaldehyde and condensation and polymerisation products thereof. July 19.

7204 (1911). Meister, Lucius, und Bruning. Manufacture of salts of dimethylphenylbenzylammoniumdisulphonic acid. July 12.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

15,775. Bamber. Production of gapless granular three-colour screens for colour photography. July 7.

XXII.—EXPLOSIVES; MATCHES.

Complete Specifications Accepted.

21,071 (1910). Lanfrey. Explosive. July 12.

26,334 (1910). Nitroglycerin Aktiebolaget. Explosive. July 12.

3879 (1911). Mallet. Increasing the efficiency of explosive charges. July 19.

XXIII.—ANALYTICAL PROCESSES.

Complete Specifications Accepted.

8582 and 17,146 (1910). Turquand and Gray. Apparatus for detecting dangerous gases. July 12.

27,990 (1910). Schroeder. Apparatus for indicating the presence of fire-damp or other combustible gases. July 19.

11,851 (1911). Mertens. Automatic gas analyser. July 12.

Journal of the Society of Chemical Industry

No. 15, Vol. XXX. AUGUST 15, 1911. No. 15, Vol. XXX.

New York Section.

Meeting held at the Chemists' Club, on Friday, February 24th, 1911.

DR. CHARLES F. McKENNA IN THE CHAIR.

A NEW TREATMENT OF WATER BY MEANS OF ALUMINIUM PLATES FOR PREVENTING SCALE IN BOILERS WITHOUT THE USE OF CHEMICALS.

(Abstract.)

BY THOMAS R. DUGGAN, F.I.C., F.C.S.

It is not quite known why, in the generation of steam, certain salts of calcium and magnesium form hard crusts or scale. All engineers try to minimize this evil, knowing that ⅛ inch thickness of scale means a loss of about 20 per cent., ¼ inch equals a loss of 40 per cent., and ⅜ inch of scale a loss of about 50 per cent. of heat.

After many trials, Brandes has discovered an apparatus —"The Luminator"—which so changes water allowed to flow over it, that when used in steam boilers little scale is deposited, old scale is softened and detached from the plates, and the precipitable salts are deposited as a powder. I should hesitate to offer this for serious consideration were there not men of repute and integrity who have proved it in practice, as well as several plants working successfully in this country.

The treatment consists in allowing water to run down an aluminium plate of special dimensions, with corrugations of a particular size, according to the character of the water to be treated. It is only necessary to brush the channels well to keep them clean.

Storage tanks and mains, if far from the boiler, must be coated with a non-conducting composition—any bituminous varnish will do—and the water must reach the boiler as soon after treatment as possible. In any case, to get the maximum effect, the water must be used within 7 days of its treatment; hence storage tanks should not be too large.

Where water is passing continuously night and day, it may be found necessary to give the apparatus rest on about one day per week, as the plates under certain conditions become inert. This only happens under very unfavourable conditions, and in most cases may be neglected altogether.

The theory of the action of the "Luminator" is that, by the passage of water over the metal channels at certain speeds, a current of electricity is induced, the water being negative and plates positive, and a kind of ionization of the salts takes place, which makes them fall out in an amorphous form; at the same time aluminium is by friction and electrical action abraded from the surface as colloidal aluminium, which after a time is changed in the water.

The best results are obtained when the "Luminator" is facing either north or south and exposed to direct light; in the dark the apparatus almost ceases to work.

The action within a steam generator is somewhat obscure, but in all probability the colloidal aluminium acts as a series of nuclei or active centres for the evolution of carbon dioxide and the crystallisation of salts, while the aluminium particles also combine with the dissolved oxygen of the water, and so deoxidise it. As corrosion of boiler plates is supposed to be caused by the presence of free oxygen in the water, this action should diminish the corrosion of boilers; such is found in practice to be the case. For instance—a boiler which was usually red with ferric oxide at the steam and water line, a belt of about 12 inches wide, became purple black like new plates after using water treated by this process. This action is not confined to the steam and water junction, but goes on all over the boiler until it becomes coated with a smooth adherent semi-metallic coating of magnetic oxide of iron, which seems to prevent centres of crystallisation upon the plates and precipitates the salts as a powder.

Discussion.

Mr. W. A. Converse said that it seemed to be generally agreed that the change effected by the "Luminator" was physical and not chemical. The water, before and after treatment, showed no difference upon analysis, but, upon boiling, was said to show considerable difference in precipitation. He had himself examined samples before and after treatment and could not find any difference. The amount of material precipitated when boiled under atmospheric conditions was identical; and so were the solid substance remaining in solution; and the same was true when boiled at 80 lb. pressure. The only difference was a very slight reduction in the alkalinity, one grain in a gallon of water.

Mr. F. B. Herreshof said that an experiment was tried with a feed water heater made in Boston some fifteen or twenty years ago. It had a coil with a large surface exposed, so that the temperature of the feed was brought up to nearly 300° F. It was assumed that sulphate of lime would separate out at about 300° F., and it was claimed by the makers that all the carbonate would separate out. There were about five grains to the gallon of carbonate, as well as sulphate, and analysis showed that none of the carbonate was separated. Thus, at even that high temperature, the presence of carbonic acid which could not get away kept the calcium carbonate in solution; but calcium sulphate, if present in large enough amount, separated out. In a steam boiler the conditions were different, because the steam evolved swept away the carbonic acid as fast as it was disengaged from the bicarbonate; and the insoluble carbonate of lime, probably at first a fine powder, began to crystallise and form scale on parts of the boiler. Calcium sulphate was soluble in four hundred parts of cold water; but at high temperatures, such as 300° F., it probably became dehydrated to a certain extent—at any rate it deposited on the tubes and parts of the boiler that became heated. The flues and crowns of boilers were hotter than the water, and it was there that calcium sulphate became attached as a very hard scale. How was this electric influence on a small scale to prevent calcium bicarbonate from decomposing at that temperature; or the carbonic acid from being swept out by the steam? How could it prevent calcium sulphate from decomposing when heated to a high temperature and forming scale?

Mr. Jerome Alexander said that the fact that metals dissolved in water in the colloidal condition had long been known. It was common practice to put water in copper vessels in order to get rid of bacteria; and even before Pasteur elaborated his germ theory of disease, the French chemist, Duclaux, having had his attention drawn to the fact that bacteria would not grow in silver vessels, said that in some way the silver must go into solution; and from experiments made he inferred that silver was a great and potent germicide. In this particular case, aluminium and its compounds, whatever they might be, acted substantially as protective colloids. The various reactions described by Mr. Herreshof actually did occur, but in the presence of the aluminium or alumina compounds, the insoluble products separated as colloids and remained in suspension so that they passed out of the boiler when the boiler was blown off. He had never heard of a metal acting as a protective colloid, and he doubted if the metal aluminium could so act. Possibly aluminium oxide might and so prevent precipitation. There appeared to be no doubt as to the facts stated by Mr. Duggan, and therefore one could only search for the most reasonable explanation of them. It looked as if the aluminium compounds, of whatever nature they might be, did act as protective colloidal substances.

Dr. Ferris said that it was a common practice in the west to put zinc slugs in boilers, particularly tubular ones, where the heat was principally in the flues, to prevent the formation of scale. The precipitate remained in powder form and could be blown out very easily. But the zinc slugs in time dissolved. In an eighty horse power boiler two or three zinc slugs of 25 lb. each would dissappear in a month.

Mr. T. R. Duggan, in reply, said that a litre of water was run through the Luminator apparatus ten times, and another litre of the same water was run over an enamelled plate the same number of times. Both samples were then heated to 80° C. for ten or fifteen minutes. The experiment showed a loss of 20 per cent. of temporary hardness in the water run through the Luminator, while the other lost about three per cent. Aeration had nothing to do with it. There was no limit to the hardness which could be treated in the apparatus, but for such hard waters as reached, say, 80 grains per gallon on Clark's scale, an apparatus some twenty feet long would be needed. The loss in weight of the aluminium was impossible to measure, it was so infinitesimal. The apparatus shown was designed to pass a thousand gallons of water per hour, and would last three or four years, running night and day. A boiler using the Luminator should be blown off frequently, more especially in the first stages of its use, because old scale came off so rapidly that it accumulated at the bottom and, if permitted to remain there, might result in burning the boiler. There was one case where that happened; the boiler was never blown off, and at the end of a fortnight it gave way. It was extraordinary what an effect the treatment had upon foaming. In every case where these machines had been used, foaming practically ceased. Alkali waters were easily treated, but acid waters gave trouble everywhere. Waters containing ferrous sulphate could be treated, but ferrous carbonate would deposit on the aluminium plates, so they had to be continually cleaned, making it almost impossible to treat such waters. Milk, when passed through the apparatus, was found to keep an extraordinarily long time; whereas the same milk, not passed through it, coagulated and became sour quickly. The corrugations had no function except to increase the surface of the plate. If the water could be spread over one flat surface or plate to a certain depth, uniformly, the one plate would be sufficient; but in practice it was impossible to obtain that; so corrugations were used and they had to be of different dimensions for different apparatus. If the water contained traces of nitrates and nitrites, they were decomposed. In a large factory in Europe a two per cent. solution of magnesium bicarbonate had to be converted into carbonate. They were applying the Luminator for that purpose. They used one very much longer and larger than the one exhibited, but achieved the desired result. In the case of salt water, there must be constant blow-offs. The process would not decrease the amount of salt in the water. A certain amount of it was beneficial rather than otherwise; but sea water, for instance, could not be treated to any advantage. Zinc slugs were used in Great Britain many years ago, in marine boilers particularly, but for some unknown reason had been abandoned within the last ten years.

Meeting held at Rumford Hall, 50, East 41st Street, on Friday, May 19th, 1911.

DR. CHARLES F. McKENNA IN THE CHAIR.

METHODS FOR THE UTILISATION OF WOOD WASTE.

BY GEORGE WALKER.

Starting with logging operations in the forest, there is a vast amount of waste in the shape of branches, tops and roots of trees. The stumps of the resinous wood trees contain considerable quantities of resinous matter, and some attempts have already been made to utilise them by destructive distillation and by extraction with steam and solvents. This has been attempted in some of the western and southern states, more especially the latter, where the stumps are much richer in resin. The waste of the saw-mill consists of slabs, edging and saw-dust which it has been proposed to submit to destructive distillation. There are, however, many obstacles to any profitable employment of such waste in this way. Such waste constitutes the poorest parts of the tree so far as the yield of distillation products, such as methyl alcohol, acetic acid, and tar is concerned, and the residual charcoal is for the most part in such a fine state of division and the mills so distant from a market that it seems impracticable to utilise it excepting for fuel in the carbonisation of fresh quantities of wood. In the case of the mills, sawing hard woods such as oak, beech, birch, etc., the yield of distillation products need not, with the proper apparatus, be less than that obtained by the wood distillers of New York and Pennsylvania, who use almost exclusively beech, birch, and maple wood.

The distiller of saw-mill waste would, however, be heavily handicapped by the unsaleability of his charcoal, which is the most important source of profit to the ordinary wood distiller, amounting to about $2.40 for each cord of wood distilled, and yielding sufficient revenue to almost pay for the wood.

In the case of the soft woods the handicap becomes still heavier owing to the fact that such wood yields less than half the quantities of acetic acid and methyl alcohol obtained by the ordinary wood distiller. A comparison of the two methods shows that whereas the ordinary wood distiller obtains a total value of about $8.10 per cord of wood distilled, the distiller of saw-mill waste would only obtain a total value of $2.85, and the expense for labour, etc., in both cases would be about the same.

It is contended that some turpentine can be obtained from mill waste. This is only true as regards the waste obtained in sawing long-leaf yellow pine, and only then in exceptional cases, viz., in the case of mills using the wood of trees which have been boxed for turpentine, and on the logs which have the so-called "box faces," or that portion of the trunk on which the oleo-resin has collected and hardened after the turpentine extractor has abandoned it. The utilisation of the saw-dust, however, deserves some attention.

A small saw-mill town in Canada needed light, and as wood-gas was attracting some attention at the time, the owner of the mill, sawing 120,000 feet of lumber per day, and producing large quantities of saw-dust and other waste wood, thought some of it could be utilised for making gas. I undertook to do this and erected a plant for the purpose. The plant consisted of two benches, of five retorts each, capable of distilling ten tons of saw-dust per day. The retorts were of cast iron, 1½ ins. thick, 12 ft. long, and 12 ins. in diameter, and provided with Archimedean screws having flights of cast iron on a 2½ in. shaft. The saw-dust was delivered to the screw in the retort from a hopper at the front end, from which the saw-dust was passed through vertical 6 inch pipes by means of screw conveyors. The rate of speed of the main screw was regulated so that a thin layer of saw-dust continually passed along the bottom of the retort from front to rear, and was carbonised on its passage and delivered at the rear-end into a main provided with a screw conveyor by which it was delivered to an air-tight sheet iron car. There was a vapour main common to all the retorts at the rear end, and from this main the vapours and gases were passed to a condenser. The system was provided with a gas exhauster and scrubber, and the pressure in the retorts was maintained by this means as near zero as possible. The saw-dust used was made from Canadian pine and was dried in a special steam drier before being delivered to the retorts. As the object of the plant was the production of illuminating gas, but little attention was paid to the residual products, which were insignificant in quantity and not worth the expense of refining. I think some similar process might be used for mill waste by passing all the waste wood through a "hog," and carbonising it, as the process can be carried on automatically with a minimum of labour. I found that the dry saw-dust contained sufficient resinous matter to bind the particles together, when warmed and powerfully compressed, and a compressor was erected for this purpose and a considerable quantity of briquettes made, which seemed when first made of good quality, but unfortunately there was not sufficient resinous matter in the saw-dust to exclude moisture, and the hygroscopic nature of the dry saw-dust soon led to swelling and crumbling of the briquettes made.

It must be remembered that the slabs, edgings and saw-dust are derived from that part of the tree poorest in resinous matter, and in the case of the saw-dust, nearly all of the turpentine it contained while in the tree evaporates whilst in process through the mill in consequence of its fine state of division.

In ordinary wood distillation, when wood is slowly distilled, there is a point when a temperature of 275° C. has been reached when the flow of volatile products through the condenser almost ceases and the exit pipes connecting the retorts with the condensers, commence to cool. Before reaching this point nearly all the acetic acid and methyl alcohol have distilled over, but very little tar, and if the distillation be then stopped and the retort cooled and opened, the wood will be found of a dark red colour and containing nearly all the tar.

Some time between the years 1870 and 1880, a process was carried on in New York by the late Dr. Squibb, wherein advantage was taken of the fact just described, for the production of a red charcoal which he termed "tinder wood." The wood used was oak brought down the river in boats and split into ordinary kindling wood size and then distilled in a special oven until the point was reached at which the wood was converted into red charcoal. This red charcoal was then placed in paper bags and sold for kindling wood, and the acetic acid and methyl alcohol refined by the ordinary methods. It proved an excellent material for kindling fires, but domestic prejudices destroyed the industry. Besides pyroligneous acid, methyl alcohol, and charcoal, there is produced by the distillation of wood a quantity of tar, amounting in the case of the hard woods to about seven per cent. of the weight of the wood or about 25 gallons per cord. This tar is not utilised at present for any other purpose known to me except for fuel for the retorts of steam boilers, and for the recovery of the wood alcohol which it contains, but it may be further distilled and products of value obtained from it.

In the wood distilling plants this tar is distilled by means of direct or indirect steam for the recovery of methyl alcohol, and a considerable quantity of light oil distils over with the methyl alcohol, the tar remaining in the still being called "steamed tar" by the wood distillers. I have distilled this steamed tar in large cast iron stills containing about 2500 gallons each and have produced therefrom about 30 per cent. of heavy oil having a specific gravity of 1·020 to 1·060 and a boiling point of 200° to 300° C. and a residue of about 60 per cent. of pitch suitable for making briquettes of artificial fuel, when mixed with 90 to 92 per cent. of coal-dust and compressed. The heavy oil may be sold as a wood preservative either by itself or mixed with dead oil of coal tar, or it may be treated with caustic soda and sulphuric acid for the production of pure wood creosote. The oil coming over at the end of the tar distillation contains a large percentage of wood paraffin which, when the oil is used for preserving timber, enters the pores of the wood and becomes a wax-like solid on cooling, thoroughly preventing the access of water to the wood and at the same time preventing decay.

This oil containing paraffin, has a great advantage over coal tar oils containing naphthalene inasmuch as the paraffin is not volatile as the naphthalene is. A curious thing connected with the distillation of wood tar is its liability to boil over near the end of its distillation. In this respect wood tar behaves in an entirely different manner from coal tar, the former always boiling over, if at all, at the end of the distillation, whilst the latter boils over, if at all, at the beginning. At least 500,000 barrels of wood tar are produced annually by the wood distillers of the United States. This could be collected at some central refinery and there used for the purpose I have described, and might form the basis for a large and profitable industry. The light oil produced from the tar by steaming, is a reddish brown liquid and has a sp. gr. of 0·920 to 0·960. When distilled with steam and purified by treatment with caustic alkali, it is an almost colourless liquid of about 0·880 specific gravity and has a very penetrating odour. In its purified condition, it is a powerful solvent and mixes with nearly all oils. I discovered in 1898 that this oil is an excellent solvent for pyroxylin and during the past year I have purchased from the wood distillers about 100,000 gallons of it for this purpose.

In the Northern States the waste of wood has been caused by the methods of the saw-mill man, but in the Southern States the greatest waste is due to the operations of the turpentine extractor, supplemented by the operations of the long-nosed pig of the farmer which has a fondness for the roots of the young yellow pines. What is known as the naval stores industry commenced about 1845 in North Carolina and for some years was confined to the manufacture of pine tar and gum turpentine, the latter being exported to England and used there for making resin and turpentine oil. In about 1850 the people of North Carolina commenced making turpentine oil and resin, and instead of exporting the gum alone, exported resin and turpentine oil. Since that time the industry has progressed with great rapidity and last year the products amounted in value to at least $40,000,000, requiring for their production the destruction of 1,500,000 acres of virgin forest.

This rapid destruction of forest has caused a scarcity of trees suitable for the industry, and there has consequently been a large increase in prices.

The unscientific methods of the turpentine extractor, mean destruction of the tree in from four to five years, and unless the turpentine is produced in connection with, or near, a saw-mill, the trees are blown down and very soon decay and become useless for timber.

After the tree has been apparently killed by the turpentine extractor, the bark and sap-wood rapidly decay in that warm moist climate, but a resinous central portion remains which is called "light wood" because it burns with a luminous flame and has been and is now used as lighting material. The method of the formation of "light wood" is unknown, but it seems certain that the resinous matter by some natural process concentrates in the centre of the tree after it is apparently dead.

The light wood formed as described, is very rich in oleo-resin, in some cases amounting to 40 per cent. of the weight of the wood. When this wood is destructively distilled, it yields considerable quantities of an oil resembling that produced by the destructive distillation of resin, besides a quantity of oil of turpentine, also small quantities of acetic acid and methyl alcohol and a large quantity of uncondensable gas of high illuminating power. The relative quantities of these products depends upon the method of heating the retorts, and the rapidity of the distillation. Uncondensable gases are formed largely from the resinous matter at the expense of the oils.

I have been distilling this wood for several years in South Carolina in steel cylindrical retorts having a capacity of about one cord each. As the plant is too far from a charcoal market to admit of this material being profitably transported, it is used for fuel, together with the uncondensable gases, for the distillation of another charge of wood. At the commencement of the distillation a small fire is made under the retort and live steam admitted to the wood in its interior. The action of steam and fire is continued until all the oil of turpentine has distilled over when the steam is shut off, and the heavier oil distilled over at a higher temperature. At the end of the distillation steam is injected into the charcoal in the retort after the water surrounding the condenser has been run out. By this means the heavy oily matter remaining in the condenser which would contaminate the turpentine oils and render their subsequent refining more difficult, is blown out and at the same time the steam serves to quench any fire which might occur in the charcoal when being drawn from the retort. The distillation is supplemented by the action of a steam jet exhauster which connects with the end of the condenser and serves to produce a partial vacuum in the retort and eliminates pressure of vapour in the retorts and consequent loss of condensable products by decomposition All the uncondensable gases are passed through the exhauster and are pushed by it through a series of fine copper screens in an upright cast-iron cylinder or scrubber whereby the globules of tar enclosing the gas are broken up and the tar removed, the gas in its purified condition being then conducted to the retort furnaces and burned for fuel.

The heavy oils produced by the distillation of the wood are distilled in cast iron stills, a residue of elastic glossy black pitch amounting to about 25 per cent. of the weight of the oil remaining in the still. The distillate from this operation consists of a light oil resembling turpentine, but having a specific gravity of about 0·880, and an oil heavier than water containing about 20 per cent. of creosote and a large quantity of wood paraffin.

As is well known, there is a process in use in the south which consists in grinding or "hogging" the light wood or stumps and then submitting the ground wood to the action of live steam in closed vessels, whereby the turpentine oil is carried over by the steam into a condenser and afterwards refined and sold as wood turpentine.

In 1905 it occurred to me that the resin contained in the light wood after the extraction of the turpentine by steam could be recovered by a process of extraction with a volatile solvent based on the principle of the well-known Soxhlet extractor, and after a series of experiments in the laboratory and with an experimental apparatus constructed on a working scale to determine yields and costs, I devised and constructed a plant at Conway, South Carolina, to carry out my process. In this process the finely divided light wood is subjected to the action of live steam in large steel cylinders for the extraction of the turpentine, and the wood, minus the turpentine, treated with a volatile solvent for the recovery of the rosin. This apparatus is now producing rosin at the rate of about 200 barrels per week and a considerable quantity of turpentine. As this process produces about five times as much rosin and turpentine in 12 hours as the same quantity of wood produces in four years by the old method of "boxing" the trees, it is probable that in the near future this method of making rosin and turpentine will supersede the old one.

Of course the future of such an industry depends upon the quantity of raw material (light wood) to be obtained. Light wood, as I have before stated, is the *débris* or waste of the naval stores industry, but in spite of the fact that considerable quantities of light wood are used for railroad ties, it is considered by competent observers that there is enough of this waste material remaining in the Southern States to supply the wants of the world in rosin and turpentine for many years. After the extraction of rosin and turpentine from the "light wood," the extracted wood forms an excellent material for the manufacture of wood pulp. Probably at some future time the lumber, naval stores, and wood pulp industries will be carried on together and this will be accomplished by the acquisition of a yellow pine forest, the annual growth of which will be sufficient to provide for the needs of a saw-mill, an extraction and a wood pulp plant.

This forest could be placed in charge of an experienced forester and the supply continually renewed. An estimate of the area of the forest required would be based on the fact that twenty-five years are required for the tree to reach its proper size, and the number of cords of "light wood" can be closely approximated. The conversion of the trees into light wood after being felled, requires a period of from 5 to 10 years, and light wood produced in this way from the "untapped" trees, would have several advantages. The trees could be cut close to the ground and the heavy resinous butts which are often rejected by the lumbermen on account of the difficulties encountered in sawing them, would all be utilised.

By the method described, the light wood produced would be free from decayed and partially burnt material and would contain more resinous matter than the light wood now available and would produce more turpentine and lighter coloured rosin. It would also save an enormous quantity of wood now destroyed in the ordinary process of "turpentining" and would, I think, place the naval stores, the lumber, and the wood pulp industries on a permanent basis.

UTILISING WASTE WOOD BY DESTRUCTIVE DISTILLATION.

BY JAMES LAWRENCE AND JAMES C. LAWRENCE.

(This J., 1911, 728—730).

ERRATUM.

On p. 729, col. 2, in Mr. George Walker's remark in the course of discussion that "about 500,000 barrels of pine tar were produced annually," *for* "pine tar" *read* "hard wood tar."

Communications.

A PRELIMINARY NOTE ON THE USE OF NICKEL HYDROXIDE IN TANNIN ESTIMATION.

BY PURAN SINGH, F.S.C., ETC.

(Forest Chemist to the Government of India).

While working recently on the manufacture and the decolourisation of tannin extracts, it was observed that freshly prepared nickel hydroxide added in small quantities effectively decolourised the tan-liquors at the expense of some of the tannin strength of the extracts, as is generally the case with all processes of decolourising tannin extracts. These experiments, on the other hand, indicated the possibility of the use of nickel hydroxide as a substitute for hide powder in the hide powder process of tannin estimation.

In the hide powder process, as the hide powder is not a constant substance of a definite composition, unless the prescribed conditions are rigidly adhered to, the results obtained by different chemists vary considerably. There are other objections against the use of hide powder which are too well known to be detailed here. Though the hide powder process is now universally adopted, it is in many respects unsatisfactory. It would, therefore, be a considerable improvement on the process of tannin estimation as adopted by the International Association of Leather Trade Chemists, if some suitable substitute of a definite composition could be found for hide powder.

The preliminary experiments of the writer have shown that nickel hydroxide can serve as a good substitute for hide powder. Thirty-seven specimens of different Indian tanning materials were examined, and it will be seen from the tables given below that the figures for tannin and non-tannin as determined by hide powder and by nickel hydroxide are in fair agreement. A more detailed communication on the subject will follow.

The extraction of the materials and the determination of total soluble solids were done as in the hide powder process. Nickel hydroxide was used for detannising the liquors, side by side with the chromed hide powder. The conditions for the determination of tannin by hide powder as prescribed by the International Association of Leather Trade Chemists were observed as closely as possible.

Detannisation with nickel hydroxide was done as follows:—

100 c.c. of the optically clear tannin liquor was shaken in a 250 c.c. flask with about 100 c.c. of a paste-like mass of freshly prepared nickel hydroxide* (washed free of alkali and sulphate), made by suspending nickel hydroxide in distilled water. After thorough shaking, the mixture is made up to 250 c.c. and filtered. The filtrate is quite clear and gives no tannin reaction. Should it happen that, owing to insufficient quantity of nickel hydroxide added, the filtrate shows tannin reaction, the operation must be repeated on a fresh quantity of the tan liquor using a greater quantity of the reagent. 50 c.c.

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* Nickel hydroxide is precipitated from nickel sulphate solution by caustic soda as an apple-green precipitate. It is thoroughly washed with distilled water till it is free from alkali and sulphate. The washing may preferably be done by repeated shaking of the precipitate with distilled water in a bottle and decanting the supernatant water by means of a siphon. Nickel hydroxide in the form of a pasty mass is best kept in a stoppered bottle. The contents of the bottle are shaken before use.

of this clear tannin-free filtrate is evaporated, dried and weighed. The non-tannin is then calculated on 100 c.c. of the original liquor used.

The action of the nickel hydroxide was tried on solutions of glucose, cane-sugar, tannic acid (B.P. pure), gallic acid and their mixtures of known strength with the following results :—

	Dry material in 100 c.c.	
	In original solution.	In filtrate from nickel hydroxide.
Cane sugar	4·1316	4·123
Glucose	1·3912	1·380
Tannic acid	0·8332	0·037
Gallic acid	0·7876	0·248
Tannic acid and cane sugar	0·4166 tannin 2·0658 sugar	2·03
Tannic acid and glucose	0·4166 tannin 0·6956 glucose	0·7010
Tannic acid and gallic acid	0·4166 tannin 0·3938 gallic	0·16

The above figures indicate that nickel hydroxide can be used with advantage on all tanning materials.

The tannin in Indian oak, mangrove, *acacia*, and *terminalia* barks and in myrabolams has been estimated both by nickel hydroxide and hide powder with the results tabulated below.

These results naturally suggest :—

1. The investigations into the nature of the action of nickel hydroxide on tannic and gallic acids and the properties of resulting compounds.
2. The manufacture of pure tannic acid from tannin compounds of nickel.
3. The possibility of tanning leather by means of tannin compounds of nickel.
4. The decolourisation and concentration of tannin extracts by means of nickel hydroxide.

Upon these the writer is working and hopes to revert to the subject in a future communication.

COKING INDUSTRY OF SOUTH YORKSHIRE AND DERBYSHIRE

BY PROF. L. T. O'SHEA.

The manufacture of coke has been an extensive industry in South Yorkshire for many years, owing to the fact that most of the seams north of the Don yield coking coals. Before the year 1899 the coals were coked chiefly in

Name of the material.	Moisture.	Non-tannin percentage.			Tannin percentage.	
		Total soluble solids.	By hide powder.	By nickel hydroxide.	By hide powder.	By nickel hydroxide.
Mangrove barks from Andamans.	per cent.					
(1) *Rhizophora mucronata* (bark from old trees)	8·84	45·88	8·01	9·7	37·87	36·18
(2) Do. (,, ,, young ,,)	7·43	31·92	7·83	9·2	24·09	22·72
(3) *Rhizophora conjugata* (,, ,, old ,,)	8·47	44·40	9·62	9·30	34·78	35·10
The same repeated	—	43·28	—	9·2	—	34·08
(4) Do. (bark from young trees)	8·34	40·00	12·26	12·50	27·74	27·50
The same repeated	—	39·92	—	12·3	—	27·62
(5) *Bruguiera gymnorrhiza* (bark from old trees)	9·24	45·48	8·2	8·00	37·28	37·48
(6) Do. (,, ,, young ,,)	8·35	40·72	10·09	9·50	30·63	31·22
The same repeated	—	38·76	—	7·30	—	31·46
(7) *Ceriops Candolleana* (bark from old trees)	8·20	45·56	12·16	11·90	33·40	33·66
(8) Do. (,, ,, young ,,)	7·95	33·80	8·31	9·80	25·49	24·00
The same repeated	—	33·56	—	9·7	—	23·86
(9) A sample of Mangrove bark kept in stores for 2 years (species *Rhizophora mucronata*)	10·31	32·12	8·7	8·7	23·42	23·42
(10) Mangrove Tannin extract made by the writer at Rangoon	13·43	85·80	15·6	16·3	70·20	69·50
Myrabolam from Bombay.						
(11) Powder of the pulp of air-dried *Terminalia Chebula* fruits half ripe collected in October, 1910	9·12	62·08	19·80	18·10	42·28	43·98
(12) Do. nearly ripe collected in Oct., '10	9·06	60·00	19·90	18·40	41·10	41·60
(13) Do. quite ripe do. do.	9·61	63·96	16·41	15·95	47·55	48·01
(14) Do. half ripe collected in Jan., 1911	8·59	66·64	19·28	16·80	47·36	49·84
(15) Do. nearly ripe do. do.	8·59	65·00	19·32	18·50	45·68	46·50
(16) Do. perfectly ripe do. do.	9·30	63·94	16·64	13·55	47·30	50·39
(17) Do. half ripe collected in March, 1911	9·26	67·16	15·80	14·20	51·36	52·96
(18) Do. quite ripe do. do.	9·00	65·88	16·18	16·00	49·70	49·88
(19) Do. quite ripe and dried on the tree March, 1911	8·75	66·88	15·19	15·20	51·69	51·68
Indian Oaks.						
(20) *Quercus incana* bark from Chakrata	7·69	22·54	6·79	6·52	15·75	16·02
(21) Do. ,, ,, Naini Tal	20·94	17·50	6·98	6·28	12·12	11·22
(22) *Quercus dilatata* ,, ,, Chakrata	7·20	12·01	4·58	4·26	7·43	7·75
(23) *Quercus lineata* ,, ,, Darjeeling	8·76	20·64	6·22	6·68	14·42	13·96
(24) *Quercus pachyphylla*, bark do.	9·38	24·88	5·84	5·20	19·04	19·68
(25) *Quercus semicarpifolia*, bark do.	7·4	17·15	6·86	6·64	10·29	10·51
(26) *Castanopsis hystrix*, bark do.	7·7	13·28	5·05	3·72	8·23	9·56
Terminalia barks.						
(27) *Terminalia tomentosa*	5·39	17·87	6·98	5·87	10·89	12·05
(28) *Terminalia belerica* without corky layer	8·82	22·96	17·01	14·72	5·95	8·24
(29) Do. do. with corky layer	6·19	20·53	13·77	9·80	6·76	10·73
(30) *Terminalu Chebula* bark	7·45	22·28	8·49	5·80	13·79	16·45
Miscellaneous barks.						
(31) *Shorca Robusta* bark stripped green from a standing tree and air dried	7·88	27·36	10·68	9·12	16·68	18·24
(32) A sample of *Shorea Robusta* bark kept in stores for 3 years	7·42	17·26	7·99	8·00	9·27	9·26
(33) *Acacia arabica* bark kept in stores for 6 months	8·43	21·47	10·09	8·80	11·38	12·67
(34) *Acacia pinnata* bark kept in stores for do.	9·23	15·55	9·43	6·8	6·12	8·75
(35) Powder of *Acacia arabica* pods with seeds kept in stores for 6 months	8·43	36·88	19·92	13·62	16·96	23·26
(36) *Cassia auriculata* bark kept in stores for 6 mths	8·32	26·48	9·16	7·6	17·32	18·88
(37) *Cassia Fistula* bark kept in stores for 6 mths	7·41	17·95	9·66	7·0	8·29	10·95

beehive ovens, and, except in a few isolated instances, the recovery of by-products from coke-ovens was not attempted. A noticeable instance of this exception is the successful recovery of by-products from coal coked in the beehive oven by Messrs. Newton, Chambers & Co., at the Thorncliffe Coal and Iron Works. This firm for many years has recovered ammonium sulphate, and illuminating and lubricating oils, from coal coked in their patent beehive oven and is well known for the manufacture of the disinfectant "Izal" from the products of the distillation of the tar oils. The manufacture of coke in the modern retort or closed oven with by-product recovery in South Yorkshire practically dates from the year 1900, when the first battery of 35 ovens was started at the Wharncliffe Silkstone Collieries by Messrs. Simon-Carvès. Since that year considerable progress has been made in South Yorkshire and North Derbyshire. The development of the industry is interesting, not only from the point of view of its rapid growth, but also as affording an example of the improvements and modifications in oven construction which have closely followed one another as manufacturers and oven constructors have gained experience of the conditions necessary for successful working of the plant.

The following figures, taken from the Mines and Quarries General Report, Part III, "Output" for 1909 shows the extent of the industry in Yorkshire and Derbyshire.

The quantity of coke manufactured at coke ovens in 1909:—

United Kingdom	10,240,093 tons.
Yorkshire	2,684,102 ,,
Derbyshire	234,825 ,,

With the exception of Durham, in which county 5,335,790 tons of coke were produced in 1909, Yorkshire is the largest coke-producing county in the United Kingdom.

The following figures, kindly supplied by the various firms of oven constructors, show the extent of the by-product recovery industry in these counties:—

	Yorkshire.		Derbyshire.	
	No. of Batteries.	No. of Ovens.	No. of Batteries.	No. of Ovens.
Simon-Carvès ...	20 (*a*)	729 (*a*)	0	0
Simplex	1	44	2	150
Semet-Solvay ...	3	92	0	0
Koppers	8 (*b*)	317 (*b*)	0	0
Huessener	1	30	2	100
Mackey-Seymour	1	32	0	0
Otto Hilgenstock	5 (*c*)	325 (*c*)	1	60
Coppée	0	0	2 (*d*)	117 (*d*)

(*a*) Including 4 under construction, consisting of 94 ovens.
(*b*) ,, 2 ,, ,, ,, 65 ,,
(*c*) ,, 2 ,, ,, ,, 100 ,,
(*d*) ,, 1 ,, ,, ,, 50 ,,

The number and kind of oven, whether by-product or not, in use in 1909, are shown by the following figures, taken from the report above mentioned:—

Kind of Oven.	Yorkshire.	Derbyshire.
Beehive	3802	302
Simon-Carvès	709	0
Semet-Solvay	125	0
Coppée	50	67
Koppers	72	36
Otto Hilgenstock	325	60
Simplex	44	150
Huessener	25	34
Collins	45	0
Mackey-Seymour	32	0
Other kinds	74	0
Total	5303	649

Coking Coals.

South Yorkshire Coalfields.—Most of the coal seams north of the Don are coking coals, and amongst the seams which are used in South Yorkshire for coking, either alone or mixed with coal from other seams, are the Tinsley Thin, High Hazels or Kents Thick, Barnsley Bed, Swallow Wood, Fenton, Parkgate, Thorncliffe Thin, Silkstone, Whinmoor, and Soft Bed or Coking Coal.

Amongst the Yorkshire coals the most important and perhaps the most generally used for coking are those from the Barnsley, Parkgate, and Silkstone seams.

Derbyshire Coalfields.—This coalfield is co-extensive with the South Yorkshire coalfield, and in its northern area furnishes many excellent coking coals, though south of Ilkeston the coals appear to lose their coking properties.

Amongst the coking coals of North Derbyshire are those from the following seams:—High Hazels, Top Hards, Waterloo, Deep Softs, Deep Hards, Piper, Tupton, Three-quarter, and Black Shale.

Correlation of the Seams.—It is generally accepted that the following seams in the two counties correspond with one another. Barnsley Bed and Top Hards, Parkgate and Deep Hards, Silkstone and Black Shale, but the correlation of the other seams presents some difficulties.

Approximate analyses of some of the Yorkshire and Derbyshire coals are given in the following table:—

	Volatile matter.	Fixed carbon.	Ash.	Moisture.	Sulphur.
Yorkshire.					
High Hazels	35·32	63·11	1·57	—	2·49
Barnsley	30·97	64·65	4·38	—	1·94
Swallow Wood ..	30·44	63·69	5·86	—	2·64
Parkgate	30·56	65·59	3·84	—	2·18
Thorncliffe Thin	35·52	63·98	0·50	—	—
Silkstone	32·29	65·08	2·36	—	—
Whinmoor	32·95	60·83	4·60	1·62	—
Derbyshire.					
Waterloo	34·17	53·38	3·89	7·94	—
Deep Softs	35·27	55·50	3·55	5·68	—
Deep Hards	33·48	56·95	5·18	4·39	—
Piper	34·78	55·35	5·94	3·93	—
Tupton	34·17	58·89	3·38	3·56	—
Black Shale	36·12	55·11	6·29	2·48	—

It will be seen from the analyses that the proportion of volatile matter obtained from the Yorkshire and Derbyshire coals is very high. The substances recovered from them are ammonium sulphate, tar, benzol, and gases.

The yield of products generally obtained is:—

Ammonium sulphate, 22 to 35 lbs. per ton of coal.
Tar, about 5 per cent.
65% benzol, from 2·25 to 2·5 gallons per ton.
Gases, 10,000 to 11,500 c. ft. per ton.

The Coking Slack.

The coal generally used is the small coal or slack that is separated from the larger coal in the process of screening which the coal undergoes directly it is drawn from the pit. In cases, however, where the quantity of slack made is insufficient, some of the larger coal is crushed and sent to the coke ovens. Sometimes dry slack is used for coking purposes. Washing the slack is generally resorted to where it is required for use in by-product ovens. This, by removing the mechanically mixed dirt, greatly improves the quality of the coke and reduces the quantity of ash and sulphur in it.

Coal Washing.

The process of coal washing has been greatly developed owing to the necessity of using washed slack in the by-product oven, and the washery is now considered a necessary adjunct to the coking plant. There are various forms of washers; those most frequently used are: (*a*) Trough washer; of which the Elliott and Blackett washers are examples; (*b*) Jig washer, such as the Humboldt, Lührig, and Baum. In some of the jig washers such as the Humboldt and Lührig the coal is sized before washing, whilst in others, such as the Baum, sizing takes place after washing. Large plants capable of dealing with any quantity up to 500 tons a day may be seen working in many of the collieries in the district.

Coking in Beehive Ovens.

The manufacture of coke in Beehive ovens is more extensively practised in South Yorkshire than in Derbyshire. In the former county, 3802 beehive ovens were in use in 1909, and in the latter there were 302. The ovens are dome shaped chambers, about 13 feet in diameter and 7 to 8 feet high in the centre. They are built in batteries in two rows, back to back, with a common flue running the whole length of the battery. In front of each oven is a doorway which, during the coking process, is closed with bricks well covered with "daub," whilst in the crown of the dome is an opening or hopper used for charging purposes. Each oven is connected with the central flue by means of a port through which the waste gases pass into the flue, and from it are conducted under boilers where they are used for generating steam. The ovens are charged with a layer of slack (usually washed) 2 ft. 3 in. to 2 ft. 6 in. thick, and air is admitted through a small opening left in the bricked-up doorway. The heat retained in the masonry soon causes the coal to distil and the gases take fire in the dome of the oven. When the gases are well alight the hoppers at the top of the ovens are closed with dampers, and the coking of the coal proceeds slowly from the top downwards. The coking time varies from 72 to 96 hours, and when complete the coke is quenched inside the oven by breaking down the upper part of the doors, and discharging copious quantities of water on the red hot mass. After quenching, the coke is raked out by hand or by means of mechanical rakers, on to platforms in front of the batteries.

The chief qualities of coke produced are: Blast Furnace Coke, Steel Smelting Coke, and Foundry Coke.

By-Product Ovens.

Retort ovens without recovery of by-products were in use in Yorkshire more than thirty years ago, but for various reasons the process fell into disuse until the year 1899. During this period the only successful plant was the beehive open recovery plant of Messrs. Newton, Chambers & Co.

In the Chambers oven heated air is admitted into the dome of the oven and the by-products are drawnd own through the coking mass and removed from the oven by means of exhausting fans. Ammonia liquor, and tar oils are condensed, whilst the gases are used for generating steam. A special feature of this plant is the use of certain of the tar oils as fuel for steam generation. Ammonium sulphate is manufactured from the ammonia liquor. The tar oils contain higher phenols and paraffin wax, but no anthracene or phenol: they are worked up into lubricating and illuminating oils, and are used in the preparation of the disinfectant "Izal."

In 1899 the construction of the first retort oven by-product plant in this district was commenced at the Wharncliffe Silkstone Collieries, and in 1900 a battery of 35 Simon-Carvès ovens with recovery plant was started. This may be looked upon as the pioneer plant, and in comparison with the more modern plants serves as an illustration of the great advances that have been made in oven construction.

The retort coke oven is a closed chamber heated externally by gases burning in flues that surround the oven. Retort ovens may be divided into horizontal flued ovens and vertical flued ovens, and these again into regenerative ovens in which the air for combustion in the combustion flues is preheated, and waste heat ovens, in which no means are taken to preheat the air.

In the early days of oven construction the horizontal flued ovens were generally preferred. The tendency of recent years has been to adopt vertical flued ovens, although there are certain well-known instances of horizontal flued ovens. Examples of the vertical flued ovens in this district are the Simon-Carvès, Koppers, Otto Hilgenstock and Coppée, whilst the Semet-Solvay and Huessener are horizontal flued ovens.

One of the most striking improvements in oven construction is the distribution of the air supply as well as the supply of gas to each combustion flue. The first ovens on this principle to be erected in this district were the Koppers ovens; other examples are the Simon-Carvès (Poetter patent). The dimensions of the ovens are generally:—

Length	30 feet
Height	6 to 8 feet.
Width	15 to 22 inches.

Both ends of the oven-chamber are open and closed with doors during the coking process. The ovens are built in batteries of from thirty-five to fifty ovens in a battery.

The slack is charged into the red-hot oven by hand through charging holes in the crown of the oven, or mechanically, after it has been compressed into the form of a cake through the doors. The doors and charging holes are closed, and well luted with puddled clay. The decomposition of the coal begins at once, and the coking proceeds slowly from the sides of the oven towards the centre. The volatile products are removed from the ovens by means of exhausters through stand-pipes in the roof, which connect with mains that convey the products to the by-product recovery plant. The exhausters are usually placed between the coolers and the ammonia scrubbers. The coking time varies from thirty-six to forty-five hours. When the charge is completely coked, the oven is drawn by opening the doors and pushing the coke out on to a platform, where it is quenched by discharging on to the red-hot mass copious volumes of water. This may be carried out by hand, or by means of mechanical quenchers. As soon as the oven is discharged the doors are closed, and the oven filled with a fresh charge of slack.

Recovery of By-Products.

The Old Process.—The old process for the recovery of by-products consists in:—

(1) Cooling the gases for condensation of tar and ammonia liquor.
(2) Water washing to recover ammonia from the cooled gases.
(3) Creosote washing for benzol recovery.

The general arrangement of the plants used is based on those used in gas works, and present no novel features. No steps are taken to purify the gases after the removal of the by-products, unless the gases are to be used in gas engines, then usually filtration, and, occasionally, oxide of iron purification is resorted to.

The tar is separated from the condensed ammonia liquor, and sold without further treatment. The composition of the tar produced in retort ovens resembles that produced in gas retorts. It is rich in naphthalene, carbolic acid and anthracene, and its sp. gr. varies from 1·1 to 1·2.

The ammonia liquor is distilled in continuous stills of the Coffey type, with steam and lime, and the gases passed into sulphuric acid in the usual way.

The benzol is recovered from the creosote oil by distillation, and the process may be intermittent or continuous.

The treatment and disposal of the effluent from the ammonia stills is a most important question in by-product plants in this district owing to the restrictions imposed by the various Rivers Boards on the discharge of the effluent from the stills into streams, and several methods are used for its disposal, of which the following are the most generally adopted:—

(1.) The liquor flows into settling tanks, and the clear but dark-coloured liquor flows away into the stream.

(2.) Where disused workings are available it is allowed to flow into them without preliminary treatment.

(3.) It is pumped on to spoil heaps that are on fire, and there gradually evaporates.

(4.) After passing through settling tanks it is used to quench the coke.

(5.) It is evaporated by spraying the liquor into a furnace heated with solid fuel or waste gases from the coke ovens.

In 1900, according to Dr. Maclean Wilson, there were 24 batteries of ovens with sulphate plants; in 23 cases the effluent was disposed of as follows:—

(1.) Discharged into streams or sewers ..	2
(2.) Discharged into disused workings ..	6
(3.) Pumped on to spoil heaps	6
(4.) Used for coke quenching	8
(5.) Evaporated	1

The cost of chemical purification has up to now prevented the use of chemical processes in coke works, whilst the bacteriological treatment of sewage has not yet been adopted in this district.

Direct Sulphate of Ammonium Process.

The problem of doing away with the effluent from ammonia stills, or at least confining the quantity to the smallest limit, would appear, in some measure, to have found a solution in the recovery of sulphate directly from the gases. The process originated with F. Brunck, of Dortmund, who passed the gases coming from the coke ovens at a temperature of 70° C. into saturators containing sulphuric acid. The process failed through the imperfect condensation of tar. It has, however, since been perfected, and direct recovery processes are now recommended by the various oven construction firms.

The processes now adopted are all based on Brunck's original plan, namely, to pass the gases into the saturator at a temperature above their dewpoint (60° to 70° C.), and so avoid the condensation of the moisture they contain.

The processes may be divided into two classes :—

(1.) The gases are cooled to 15° C. to condense the tar, and subsequently heated to 70° C., after which they pass through the saturator maintained at about 100° C. The initial cooling causes the condensation of ammonia liquor, which is distilled with lime, and the ammonia liberated passes into the saturator. The effluent from the still is reduced at least 50 per cent. by this process. H. Koppers was the first to introduce this method successfully, and there are at least two other plants designed to work on similar lines. In Yorkshire, one Koppers direct recovery plant is in work at the Corton Wood Collieries.

(2.) In the second class, the gases do not undergo any special cooling beyond that which takes place in the mains conveying them to the by-product plant. To this class belongs the Otto process, in which the tar is removed by a tar spray, and the Simon-Carvès, in which the tar is mechanically removed. After removal of the tar, the gases, at 70° C., charged with the moisture that they originally contain, pass through the saturator, the temperature of which is about 100° C.

For these processes it is claimed that no effluent, or at least only a very small quantity, is produced, and that quite harmless.

In these processes benzol cannot be recovered unless the gases are cooled after passing the saturator. If the benzol is recovered then an effluent is produced, but it is claimed that the effluent that separates is innocuous, as it is free from the cyanides, thiocyanates, and tar compounds.

The Feld and Burkheiser Processes.

The latest advance in ammonium sulphate production is to use the sulphur in the gases for the production of ammonium sulphate. There are two such processes.

(1.) The Feld process.—In this process the sulphuretted hydrogen is fixed as ferrous sulphide, which, by treatment with sulphur dioxide, is converted into ferrous thiosulphate. This is converted into ammonium thiosulphate, which is subsequently oxidized to sulphate.

(2.) The Burkheiser process.—In this the sulphur compounds are removed by oxide of iron purifiers, and subsequently converted into sulphur dioxide by oxidation. The sulphur dioxide is combined with the ammonia, and Burkheiser salt, a mixture of ammonium sulphate and sulphite, is produced.

There is a Feld plant under construction at the Hardwick Colliery, in Derbyshire, and one, if not two, Burkheiser plants under construction in the district.

The Gases.—The gases that come from the by-product plant are primarily used for oven heating ; with the Yorkshire and Derbyshire coals from thirty to fifty per cent. of the gas produced is required for this purpose. The remainder is surplus gas. In most of the plants in this district this surplus is used for raising steam, but at a few collieries it is used for the generation of power in internal combustion motors. The amount of gas available for this purpose is from 5000 to 7000 cubic feet per ton of coal carbonized. The composition of the gas is similar to that of illuminating gas, and its calorific power varies from 450 to 600 B.T.U. per cubic joot, according to the quantity of nitrogen it contains.

At the Wharncliffe Silkstone Collieries considerable developments have taken place in the use of gas for power generation. The plant consists of two Stockport four-cycle engines of 200 h.p. each, one Crossley four cycle-engine of about 70 h.p., one Robey four-cycle engine of 300 h.p., and one Robey two-cycle engine of 300 h.p., or a total of 1120 h.p. These engines are entirely run on the gas from a battery of Simon-Carvès ovens.

At the Thorncliffe Iron Works and Collieries, engines amounting to 500 h.p. are driven with gases from a battery of Kopper ovens, and at Mitchells' Main, gases from a battery of Simon-Carvès ovens are used to generate 500 h.p., in 250 sets. Gas engines may be running on coke oven gases at other collieries in the district, but on this point the author has no definite information. (See also Short, this J. 1910, 921—928.)

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows :—

English.—8*d.* each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT ; MACHINERY.

Patents.

Raising or forcing liquids ; Methods of —— and apparatus therefor. H. A. Humphrey, London. Eng. Pat. 15,820, July 1, 1910.

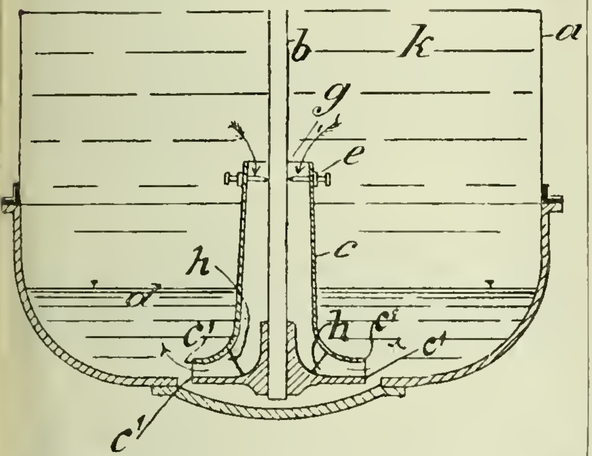
For more rapid working in internal combustion pumps, as described in Eng. Pats. 20,736 of 1906 and 18,594, 18,595, 19,341 and 25,638 of 1907 (this J., 1908, 436 ; see also this J., 1910, 75, and 1911, 524), the gaseous combustible mixture is forced into the explosion chamber under pressure. The fresh combustible charge is introduced into an air vessel placed at the end of the discharge pipe remote from the explosion chamber, and is compressed therein during the outward flow of liquid. Part of the compressed charge flows into a reservoir from which it is allowed to pass into the explosion chamber at the desired moment, whilst the remainder serves to effect the return stroke of the column of liquid which cannot in this case be brought about by the head of liquid in the delivery main, as a non-return valve is introduced at the foot thereof just beyond the air vessel. The compressed charge may either be introduced into the explosion chamber whilst the outward flow of liquid is still in progress, thus assisting in the outward propulsion of liquid, or it may be introduced during the return flow of liquid, after the products of explosion have been expelled.—H. H.

Drying organic matter and substances containing the same; Method of and apparatus for ——. J. Grossmann, Manchester. Eng. Pat. 16,953, July 16, 1910.

The apparatus is similar to that described in Eng. Pats. 19,922 of 1906 and 28,516 of 1909 (this J., 1907, 1077, and 1911, 237), and is applicable to drying organic substances without decomposing them. The machine comprises a cylindrical or conical vessel fitted internally with revolving shaft and paddles, and with fixed stirrers, and is heated externally by furnace gases in such a way that the greatest heat is applied where the material contains most moisture, and so that the material is not allowed to remain in contact with the shell at any point long enough to be decomposed. The gases after heating the dryer externally, may be led back through the interior in the opposite direction to the travel of the material. The dried material, if of no value for other purposes, may be used by itself or with other fuel for heating the dryer.—A. T. L.

Mixing apparatus or stirrers for liquids. C. Still, Recklinghausen, Prussia. Eng. Pat. 22,861, Oct. 3, 1910.

The stirrer, which is more particularly intended for mixing liquids of different specific gravity, operates on the principle of a centrifugal pump. A vertical shaft b, journalled at the upper end in the cover of the containing vessel a, and operated by gearing from above, has an attachment at the free lower end as shown in the diagram. The lighter liquid k, of which there is a considerable layer above the point e, passes downwards through the opening g, and is thrown out laterally between the lips c^1, into the heavier liquid d, by the centrifugal action caused by the blades h. In dispensing with the lower bearing and placing the upper one well above the liquid, chemical action between the liquid and the bearing metal is avoided.—B. G. McL.



Solutions or their filtrates; Apparatus for making ——. A. Pye-Smith, London. Eng. Pat. 6865, Mar. 18, 1911.

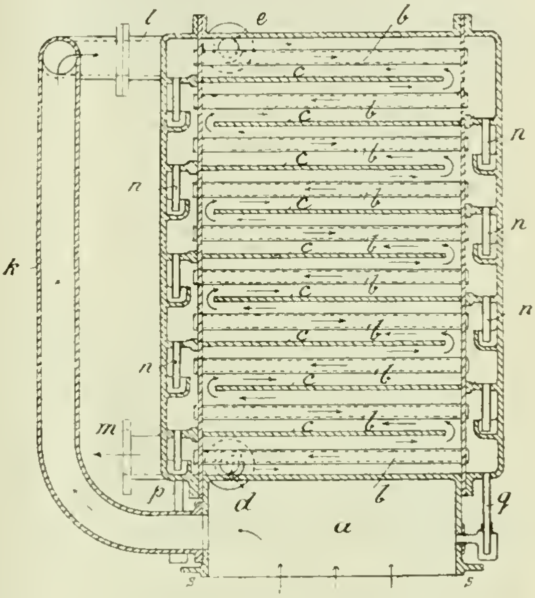
The patent involves the combination of several devices arranged on a framework beneath an elevated platform. The agitation necessary for bringing about the solution is effected in three or more vessels of approximately cubical shape, mounted diagonally on shafts capable of being rotated by means of friction pulleys; a screw device for elevating one end of the shaft causes engagement or disengagement with the friction pulley; mechanical internal agitators are entirely dispensed with in these vessels. The contents are discharged into a vat having a mechanical stirrer driven from the same shaft and from thence passed through vacuum filters. Holes are provided in the platform for charging the ingredients into the cubical vessels.—B. G. McL.

Extracts from vegetable substances; Process of obtaining valuable ——. W. Anderson, Govan, and J. Meikle, Glasgow. Eng. Pat. 23,148, Oct. 6, 1910.

The material is treated in the revolving basket of a centrifugal machine, which is preferably under-driven by a turbine directly attached to the supporting spindle. The turbine is operated by the vapour of the solvent to be used for the extraction; the exhaust from the turbine passes into the centrifugal through the spindle casing, here it heats and condenses on the material, the extract being simultaneously withdrawn through a filter-cloth if desired. —B. G. McL.

Reflux condensers. C. Still, Germany. Eng. Pat. 3269, Feb. 8, 1911.

The apparatus, which is intended to bring about a sharply defined dephlegmation of vapours is shown in the diagram. The main body of the condenser rests on the still to which it is jointed by the flange s; the vapours pass from the collecting chamber a, upwards through the pipe k, and enter the condenser by two branch pipes l, where they are caused to pass alternately backwards and forwards through each set of tubes b, these sets each consisting of horizontal layers of about twelve tubes, the uncondensed vapour escaping through two tubes m. The condensing water enters the condenser at d, and is caused to travel upwards in a direction contrary to that of the vapour by means of the baffle-plates c, finally emerging at e. This mode of operation, by reason of the fact that the hot vapours first meet the warm condensing water, tends to preserve through the condenser a more uniform difference of temperature between the vapour and the condensing water, and it is claimed that a better utilisation of the cooling surfaces takes place and that the purity of the resulting products is favourably influenced. The condensates formed, are immediately removed from contact with the vapour and flow through the pipes n, into the dip seals in the next lowest chamber finally passing by the pipes p, and q, into dip seals which communicate with the still; this prevents the possibility of the current of vapours again taking up portions of the condensed products. —B. G. McL.

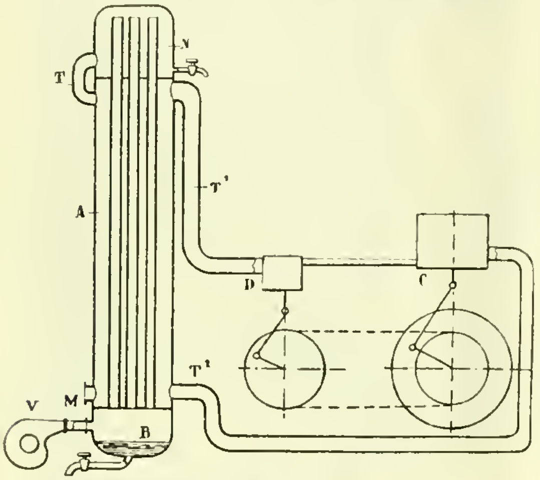


Distilling vessels. P. Porges, L. Singer, and L. Steinschneider, Austria. Eng. Pat. 29,145, Dec. 15, 1910. Under Int. Conv., July 26, 1910.

Stills of large capacity for work under high vacuum have to be constructed of thick plates. These lower the rapidity of heat transference and tend to produce overheating of the material lying on the plates: stills made of thin plates used in conjunction with external stiffening rings, soon become useless when employed for such substances as heavy petroleum oils, owing to the attack of the hot fire gases on these rings, whilst internal rings produce similar overheating effects. The still of the present inventors is in the form of a Cornish boiler; the fire-flue may be made of thin metal without stiffening rings whilst the shell is supported by internal strengthening rings where it is in contact with comparatively cold gases. To facilitate removal of the material these rings may be caused to bridge across the lowermost part of the shell, or this part may be supported externally by short arc-shaped pieces; internal cross stays may also be employed. —B. G. McL.

Volatile liquids; Recovery of ——. Soc. l'Air Liquide (Soc. Anon. Pour l'Etude et l'Exploitation des Procédés G. Claude). Fr. Pat. 425,992, April 20, 1910.

The air, laden with the vapour it is desired to recover, is delivered by the fan, V, into the lower part of the heat interchanging apparatus, A, and passes up the tubes to the upper end N, whence it returns downwards over the exterior of the tubes to the outlet, M. Air is compressed by the compressor, C, and after cooling is expanded in the motor, D, and thereby refrigerated. The cold air passes through the pipe, T¹, into the upper part of the casing, A, and cools the air passing upwards within the tubes. The vapour is condensed and partly collects in the reservoir, B, and is partly scrubbed out of the air as it passes through the chamber, N, which is filled with layers of metallic gauze. The air which returns through T, is quite cold, and assists in the cooling of the incoming, vapour-laden air. The power supplied by the motor, D, is used to help to work the compressor, C, which draws its supply of air from the lower part of A, through the pipe, T².—W. H. C.



Filtering apparatus. D. Smith, Leeds. Eng. Pats. 25,225, Oct. 31, 1910, and 29,964, Dec. 24, 1910.

The claim is for a filtering system comprising a tank constructed of concrete or other suitable material across which a series of double lattice-work hurdles or frames are placed, in a vertical position, at intervals. Straw or other similar material is placed in the frames, and the liquid to be purified passes through them successively in a horizontal direction.—W. H. C.

Extraction and like apparatus for use with inflammable liquids. C. Martini, Berlin. Eng. Pat. 14,707, June 18, 1910.

In order to prevent the formation of explosive mixtures of the inflammable liquid and air, the apparatus is filled with a protecting gas. The claim is for means of ensuring that this is always done, and to this end, the manhole cover of the top of the vessel is attached by links or other suitable arrangement to the valve supplying the gas, in such wise, that, when the cover is closed, the gas-supply valve is open. Further, the valves of the supply mains for the protective gas and for inflammable liquid and the clutch of the agitating gear, are all interlocked in such a manner, that neither the liquid supply can be opened, nor the agitator be started, until the valve on the protective gas main is opened.—W. H. C.

Double-walled vacuum vessels. A. Monasch, Berlin. Eng. Pat. 5725, March 7, 1911.

Small flattened rolls of metallic gauze are introduced at intervals into the space between the double walls of vacuum vessels. They serve as supports and enable the vessels better to resist shock and pressure.—W. H. C.

Subjecting gases or vapours to the action of liquids; Apparatus for ——. C. H. Fowler and E. A. Medley, Great Crosby, Lancs. Eng. Pat. 17,696, July 26, 1910.

The claims relate to improvements in the apparatus described in Eng. Pats. 22,282 of 1902 (this J., 1903, 1121) and 27,391 of 1907 (this J., 1908, 1196). The circulation of the gases between the discs is prevented by arranging the latter close together, with solid centres, round the shaft. The liquid is projected in the form of jets between the discs, from nozzles which pass through the outer casing and terminate near the periphery of the discs.—W. H. C.

Porous objects; Manufacture of ——. Graf B. Schwerin Germany. Fr. Pat. 426,072, Feb. 15, 1911.

Porous diaphragms, etc., suitable for chemical or electrical purposes, are made by shaping finely-powdered carborundum, either without an agglutinant or with one that is unstable, and firing it in an inert or reducing atmosphere. —H. H. S.

Rotary kiln. T. A. Edison, Orange, N.J. U.S. Pat. 996,070, June 27, 1911.

The kiln consists of a rotating tube, of which the lower end contains a combustion zone. The upper end is of enlarged diameter and consists of a number of sections each containing longitudinal partitions so that the passages in each section are out of line with those in adjacent sections.—A. T. L.

[*Drying*] *Kiln.* F. D. Willey, Assignor to Chicago Varnish Co., Chicago, Ill. U.S. Pat. 996,442, June 27, 1911.

The kiln comprises a drying chamber provided in its upper portion with steam pipes. Air is admitted at the top of the chamber and is directed against the steam pipes by deflecting plates which extend from the walls of the chamber towards the centre above the steam pipes. The air passes downwards to discharge channels leading from the upper part of the chamber below the steam pipes. A guard or shield beneath the steam pipes consists of two rows of strips of asbestos-coated "duck," the strips in the upper row being opposite the spaces in the lower row. —A. T. L.

Filters; Apparatus for cleaning air or gas ——. P. Kestner, Lille, France. U.S. Pat. 996,860, July 4, 1911.

See Eng. Pat. 2870 of 1906; this J., 1907, 246.—T. F. B.

Drying method. K. Reyscher, Bielefeld, Germany. U.S. Pat. 997,092, July 4, 1911.

See Eng. Pat. 21,191 of 1910; this J., 1911, 792.—T. F. B.

Separating solids from liquids; Apparatus for ——. H. G. Nichols, Ymir, British Columbia. U.S. Pat. 996,877, July 4, 1911.

See Fr. Pat. 389,706 of 1908; this J., 1908, 1008.—T.F.B.

Separating and classifying granular or powdered materials, Process and apparatus for ——. J. S. Fasting. Fr. Pat. 426,317, Feb. 21, 1911.

See Eng. Pat. 4410 of 1911; this J., 1911, 792.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Quantity of dust needed to spread an explosion. Coal-dust explosions. G. S. Rice. Dept. of Interior. U.S. Bureau of Mines, 1911. Miners' Circular 3.

In certain tests at the mining experiment station at Pittsburg the bituminous coal dust used was so fine that it passed through a 200-mesh sieve (one with 200 openings in the length of an inch), and floated easily on a strong air current. This dust spread an explosion when there was only 0·32 ounce of it suspended in each cubic foot of air, or 1 pound in 500 cubic feet of air.

To burn completely 0·12 ounce of the dust used at Pittsburg for the tests mentioned, would take all the oxygen in a cubic foot of air, and to burn a pound of it would require all the oxygen in 133 cubic feet of air.

Firewood; Philippine ——. A. J. Cox. Philipp. J. Sci., 1911, 6, 1—19.

The chief woods used for fuel in the Philippines are the *Rhizophoraceae*, the consumption being at least 200,000 cubic metres annually. Wood which has been simply air-dried, contains more moisture than wood that has been dried in an oven and then exposed to the air. The best seasoned wood retains in the Philippine climate, 12·5 to 13 per cent. of moisture reckoned on the dry weight, the latter being the only constant basis on which to compute moisture and ash. The available heating value of the combustible matter in 17 varieties of woods used as fuel, varies between 4284 and 4596 calories, the average being 4418 calories. Similar values were obtained for several barks. The percentage of ash for five varieties varied between 0·61 and 2·26, and analyses of these ashes were made. The sp. gr. of 19 varieties were also determined, the lightest being "Tambu tambu" (0·5668—0·5954) and the heaviest "Bacauan" (1·071—1·002). Comparative tables are given showing the approximate fuel value of North American and Philippine woods, the better being those with high sp. gr. (0·75 and over). Of the latter, "Pototan" (*Bruguiera gymnorhiza* Lam.), "Bacauan" (*Rhizophora mucronata* Lam.), "Catutan" (*Bruguiera* sp.), and "Tangal" (*Ceriops tagal* (Perr.) C. B. Rob.), give the highest values. The available heating value of a fuel may be calculated from the following expression, the calories being equal to

$$4418 \times \left(\frac{100-(\%\text{ water} + \%\text{ ash})}{100}\right) - 6 \times \text{per cent. water.}$$

The volatile constituents of the wood of the mangrove ash are large, and may condense as clinker on the furnace walls, or any object being heated.—F. Shdn.

Brown-coal briquettes; Spontaneous ignition of ——. F. W. Hinrichsen and S. Taczak. Mitt. aus dem Königlichen Materialprüfungsamt zu Gross-Lichterfelde West, 1911, 29, 220—247.

Fresh briquettes were stored under various conditions in the open and also in closed rooms which could be heated by steam-pipes if desired, and the temperature at various parts of the heap was observed daily for a period of one or two months. In no case was spontaneous ignition brought about, and there was no considerable rise in temperature unless the briquettes were stacked closely without air spaces. If the briquettes are stacked loosely with air spaces between them, to a height of 3 to 4 meters, in a closed store or in the open, or if they are shot into the store without being stacked, there is practically no danger of spontaneous ignition, whether dry or kept moist. The briquettes should be quite cold before storing.—A. T. L.

Japanese petroleum oils; Optical and other properties of ——. M. A. Rakusin. Petroleum, 1911, 6, 1068—1052.

Out of 10 oils examined, only one was polarimetrically inactive. It had a sp. gr. of 0·7877 at 15° C., and was a remarkable example of an inactive oil derived from a great depth (2100 feet). This oil was derived from Amaze in the district of Higachyama. It was of an orange-yellow colour, showed manifest dichroism, and had a sp. gr. of 0·7877 at 15° C. When examined in a 200 mm. tube it showed merely a tendency towards dextro-rotation. There were no data from oils of the same district to determine whether it was a primary oil or had been modified by filtration.—C. A. M.

Mineral oils of high boiling point; Chemical composition of ——. J. Marcusson. Chem.-Zeit., 1911, 35, 729—731; 742—744.

The constituents to which mineral machine oils chiefly owe their lubricating power are those not reacting with formaldehyde and sulphuric acid. The cyclic unsaturated hydrocarbons reacting with these reagents to form sparingly soluble "formolites" (see this J., 1904, 1082; 1911, 201) have a higher specific gravity and refractive index but are more fluid than the original oils. In applying the test to viscous oils, 27 grms. of the sample are dissolved in 50 c.c. of "normal benzine" (petroleum spirit) and the solution treated, without shaking, with 30 c.c. of concentrated sulphuric acid, after which the mixture is cooled in ice-water and treated, little by little, with constant shaking and cooling, with 15 c.c. of 40 per cent. formaldehyde solution. The contents of the flask are now transferred to a litre flask containing 200 c.c. of ice-water, the acid liquid neutralised with ammonia, and the precipitate collected, drained, washed free from ammonia, and dried at 105° C. until constant in weight. Russian machine oils yielded from 10 to 24 per cent. of formolite, whilst American oils yielded from 30 to 33 per cent. As a rule American oils are also richer in unsaturated hydrocarbons which combine with iodine. Thus, 11 samples of American oils gave iodine values ranging from 6·1 to 15·3, as against iodine values of 3·3 to 5·6 in the case of four Russian oils. The iodine absorption is due not only to unsaturated alicyclic hydrocarbons, but also to aliphatic olefines. On the other hand, Russian oils contain a larger proportion of hydrocarbons that resist the action of fuming nitric acid than American oils do.—C. A. M.

Heating value of fuels. Rules of the French Coke Committee. Gas World, July, 1911, 55, 111—112.

The Central Coke Committee of France, in view of the confusion occasioned by variations in the methods adopted to specify heating value, have issued a circular containing the definitions and methods to which they will adhere.

(*a*) Starting with a fuel which has been dried at 110° C. (=240° Fahr.), find the gross heating value in calories per kilogram, the water from the combustion being supposed to be cooled to freezing point; this is the absolute heating power of the *dried* fuel, or the absolute heating power, simply. Suppose this be 6882 cals. per kilogram.

(*b*) Let a fuel containing 12 per cent. of water be given, dry it at 110° C.; the absolute heating value of the *dried* residue is, again, 6882 cals. per kilogram. Then the heating value of the original wet fuel is only 6056 cals. per kilogram. This is termed the absolute heating power of the crude damp fuel.

(*c*) Let a fuel containing 12 per cent. of moisture, 13 of ash, and 75 of combustible matter be given, and let its absolute heating power (*a*, above) be 6882, or its absolute heating power when damp (*b*, above) be 6056; then the heating power per kilogram of the combustible material (excluding moisture and ash) is 8075 cals. per kilogram. Term this the absolute heating power of the pure combustible. This is of importance in reference to deterioration through exposure to wet. If the moisture rise to 22 per cent. instead of 12, the heating power wet (*b*, above) falls from 6056 to 5368.

(*d*) The laboratory bomb test gives a figure which assumes that the water formed has cooled to 0° C. and has given up all its heat. This is not the practical result of burning the coal as fuel; steam or water vapour carries off heat units. Each gramme of steam or water vapour at 100° C. carries off 0·637 cal., whether it owe its origin to the original moisture or to the combustion of hydrogen.

On deducting this, we arrive, from the absolute heating power (*a*, above), at the net heating power—the useful heating power of the combustible.

(*e*) Given a coal containing 12 per cent. of moisture, 13 per cent. of ash, and 75 per cent. of combustible matter, and assuming this latter contain 1 per cent. of hydrogen, then on burning 1 kilogram of this there would be evaporated 0·12 kilogram of water, and 0·0675 kilogram of water vapour produced by combustion; in all 0·1875 kilogram water vapour at 0·637 cal. per gramme $= 187{\cdot}5 \times 0{\cdot}637$ cals. = 119 cals., and the heating value of the wet fuel (*b*, above) is 5937, instead of 6056. This is the useful heating power of the crude damp material. This is the most useful of all the values. The water vapour produced by the combustion may cause the practical value of the fuel to be as much as 8 per cent. less than that given by Mahler's bomb (*b*, above).

The thermal efficiency of any apparatus is the ratio between the number of calories utilised and the number given by the fuel, in a given period of time. The latter number is the product of the weight of the fuel into its heating value. This heating value may be the absolute (*a*, above), in which case we have the "absolute thermal efficiency." The Coke Committee announce their intention of using, in all specifications, the useful heating power (*e*, above) in stating this ratio, which will then be called the useful thermal efficiency.

Detecting mineral and rosin oils in other oils. Outerbridge. *See* XII.

PATENTS.

Coke ovens; Construction of ——, to make them proof against the action of alkalies. W. Greaves, N. Alfreton. Eng. Pat. 12,210, May 18, 1910.

To render the oven walls proof against the action of volatile sodium and potassium compounds, such as sodium and potassium chloride, which are contained in certain kinds of coal, the walls are built entirely of, or are lined with, bricks made of calcined magnesite. The finely ground calcined magnesite may be mixed with a binding agent such as raw china-clay or bauxite. An average analysis of suitable bricks is: Silica, 4·96; alumina, 2·85; iron oxide, 0·84; lime, 1·67; and magnesia, 89·34 per cent.—A. T. L.

Gas-producer. B. M. Aslakson, Salem, Ohio. U.S. Pat. 996,603, July 4, 1911.

The producer is of the underfeed type and is provided with a tapered screw extending horizontally through the lower part of the fuel chamber for delivering the fuel at the bottom of the fuel column. An annular air-supply chamber of rectangular cross-section surrounds the fuel column somewhat above the fuel feeding device, and air is admitted at points all round the fuel column through orifices in the vertical wall and also in the top of the air chamber.—A. T. L.

Gas producers. W. Jones, Middlesbrough, Yorks. Eng. Pat. 17,048, July 18, 1910.

The producer, which is supported on skeleton columns above a water-trough having a central conical ash-deflector, is supplied with steam and air from an annular chamber at the base of the firebrick lining. This chamber has its outer wall inclined and extended downwards into the water trough. The inner wall of the chamber has a number of tuyère openings spaced evenly around it, and doors are provided in the outer wall, each door giving access to two adjacent tuyère openings. A transverse partition is arranged in the annular chamber across the steam and air inlet so as to distribute the blast equally among the tuyère openings. The annular chamber is made in segments, and the joints rest upon the supporting columns of the producer.—A. T. L.

Gas producers. T. W. S. Hutchins, Stockton-on-Tees, Durham. Eng. Pat. 2138, Jan. 27, 1911.

In a producer of the kind in which the "blow" is upwards and the "make" downwards, such as is described in Eng. Pat. 12,467 of 1906 (this J., 1907, 861), the periodic change from "make" to "blow" is effected automatically by a double-beat steam-valve controlled by a water motor which works an oscillating lever. In one position of the valve, the steam is directed through a superheating coil and into the top of the producer for the "make" period, and in the other position the steam passes to an ejector nozzle in the chimney so as to aid the draught for the "blow" period, and steam is also admitted to a cylinder so as to open the chimney valve. The air valves at the bottom of the producer, which open automatically during the "blow" period, are balanced by weights instead of by springs. The chimney valve is a lift-valve, and its stem is protected by its guiding sleeve when the valve is open. To facilitate the removal of ashes or clinker from the centre of the hearth, there is a central opening to which is fitted a cast-iron tube dipping into water in a sump. —A. T. L.

Water-gas apparatus. J. C. Stelfox, London. Eng. Pat. 29,709, Dec. 21, 1910.

In order to prevent a back-flow of gas into the air main on opening the blast-valves at a time when the pressure in the air main is lower than the pressure of gas in the generator, the blast-valves are locked in their closed position until the blast-pressure is in any desired excess of the gas pressure. For this purpose a locking lever is controlled by the difference in the pressures acting on two diaphragms, one subject to the pressure of the air and the other to that of the gas.—A. T. L.

Gas calorimeters. A. Macklow-Smith, Westminster, London. Eng. Pat. 25,336, Nov. 1, 1910.

The patent relates to gas calorimeters of the continuous-flow type, in which the gas burnt is displaced from a closed vessel by the water which has run through the calorimeter so that the volume of gas burnt is equal to the volume of water heated. The invention consists in connecting the drain-cock of the gas-reservoir and the gas-supply cock of the same so that both are opened and closed together for refilling the reservoir with gas.—A. T. L.

Coke ovens or retort furnaces; Horizontal regenerative ——. Deutsche-Hüttenbau-Ges., Düsseldorf, Germany. Eng. Pat. 1706, Jan. 23, 1911. Under Int. Conv., Jan. 31, 1910.

See Fr. Pat. 425,133 of 1911; this J., 1911, 882.—T. F. B.

Naphtha residues and tars: Process for separating solid hydrocarbons from ——. J. Tanne, Rosniatow, Galicia, and G. Oberländer, Berlin. Eng. Pat. 23,125, Oct. 6. 1910. Under Int. Conv., Oct. 7, 1909.

See Addition of Oct. 6, 1910, to Fr. Pat. 409,516 of 1909; this J., 1911, 409.—T. F. B.

Gas-washer. A. Stolte, Zweibrücken in Pfalz, Germany. Eng. Pat. 23,948, Oct. 15, 1910.

See U.S. Pat. 988,908 of 1911; this J., 1911, 529.—T. F. B.

Gas-producer. R. V. Farnham, Skelmorlie. U.S. Pat. 996,628, July 4, 1911.

See Fr. Pat. 423,670 of 1910; this J., 1911, 675.—T. F. B.

Process to recover ammonium sulphate direct from coke oven or retort gas. Eng. Pat. 5667. *See* VII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Incandescence mantles prepared with artificial silk; Contributions to the chemistry of ——. F. Wirth, Chem.-Zeit., 1911, 35, 752—753.

Artificial silk mantles though dearer than those made with ramie have in a comparatively short time met with an extensive use owing to their toughness and elasticity, also on account of the reduced consumption of gas required. The ash skeleton is free from thick particles, and has a large surface, consequently all the thoria and ceria is available for the emission of light. The author reviews the usual fixing processes whereby the thorium and cerium nitrates with which the fabric has been impregnated are converted into amorphous hydroxide or peroxide; stress is laid on the necessity of fixing the incandescence substances in an amorphous or colloidal state, otherwise the skeleton will lack coherence. The employment of amorphous salts such as thorium phosphite and subphosphate, the double oxalate of thorium and ammonium, cerium tartrate, etc, without a fixing bath, is suggested; also the use of salts easily hydrolysable on steaming or moderate heating such as the acetates or thiosulphates. (See also this J., 1907, 863, 1272; 1908, 15, 742, 848, 932; 1909, 973; 1910, 13; 1911, 76, 609.)—A. Sbld.

The gas lighting of railway carriages. Times Eng. Suppl., July 19, 1911.

Gas lighting was adapted for use in railway carriages about 1880 by Julius Pintsch, and gradually became the standard illuminant. Even to-day, 15 or 16 years since the successful application of electricity to train lighting, 75 to 80 per cent. of the carriages on the railways of the United Kingdom are illuminated by gas.

For a number of years the incandescent mantle was thought to be unsuited to railway carriage requirements. At first upright mantles were tried in France, and even now that form of burner is in use on the Paris, Lyons, and Mediterranean Railway. But just as incandescent lighting was being introduced by the railways of this country, inverted burners came into vogue, and proved an instant success. With them, however, it is found desirable to increase the gas pressure at the nipple from 2 in. to from 8 in. to 20 in., practice varying somewhat on different railways. By utilising the gas in this way it is found possible under ordinary conditions to obtain a light of 30 c.p. from 0·6 cb. ft. per hour, or, if desired, 50 c.p. from 1 cb. ft. per hour. The former is considered ample for illuminating a compartment in the majority of instances, although one or two railways seem to prefer the larger unit.

The new incandescent burners, using some 0·625 cb. ft. of gas per hour each and giving 30 c.p., as compared with two old flat-flame burners using 2 cb. ft. per hour and only giving some 16 c.p., were very welcome, not only from the point of view of increased illumination, but from considerations of economy, for oil gas costs anything from 9s. to 12s. per 1,000 cb. ft. to deliver compressed to the coaches.

The costly oil gas has been used because of its higher candle power when used in burners of the flat-flame type. Incandescent burners, however, require a gas of high heating power, which coal gas possesses, and there is reason to believe that it may be satisfactorily substituted for the more expensive oil gas. The latter has a higher calorific value and less is required—say, 0·6 cb. ft. per hour as against 0·9 to 1 cb. ft. of coal gas; but the difference in price—coal gas 2s. 6d. to 3s. per 1000 cb. ft. as against oil gas at about 10s. or more—leaves room for a very substantial saving.

Patents.

Separating tar from distillation gases by means of tar, gas liquor containing tar or a mixture of the two; Process and apparatus for ——. C. Otto and Co., G. m. b. H. Second Addition, dated Feb. 16, 1911, to Fr. Pat. 390,470, May 22, 1908 (this J., 1908, 1052).

In order to obtain the best results with the method described in the original patent it has been found that it does not do to have the injectors too large. Several smaller injectors are used, grouped together so that part or all may be used as desired. In order to equalise the pressures, the tar used to work the injectors is pumped into a box from which it is distributed to the injectors, which also draw the gases from a box common to all the ejectors and into which the hot gases are conducted from the ovens.—W. H. C.

Incandescent lighting bodies: Process of making ——. O. Wiederhold, Jersey City, N.J. U.S. Pat. 996,182, June 27, 1911.

A mixture of thorium and cerium nitrates is reduced to oxide by heating and is made into a paste with a hardening fluid consisting of a mixture of thorium nitrate solution with cerium nitrate. The paste is highly compressed and then baked.—A. T. L.

Incandescence gas mantles of artificial or natural celluloses. J. L. A. Grand. Fr. Pat. 426,156, Feb. 11, 1911.

Two single artificial silk yarns, one having a right-handed and the other a left-handed twist, are slightly twisted together so as to give a double yarn of such strength and structure that it can be woven into the tube form without frequent breakages on account of the friction of the weaving process. The tube of fabric thus prepared is treated with ether to which a little carbon bisulphide has been added in order to remove all grease, and is then immersed until thoroughly saturated in a solution of thorium-cerium nitrate in distilled water (99 per cent. of thorium nitrate and 1 per cent. of cerium nitrate). The fabric is next drained, dried and then denitrated by treating it with alcohol (95°) to which has been added a quantity of hydrofluoric acid. This mixture precipitates salts of thorium and cerium in a very insoluble and viscous condition and also renders soluble any deleterious substances contained in the fabric and thus facilitates their removal during a subsequent washing operation. To convert a suitable length of tube fabric into the shape required for an inverted mantle the tube is flattened out and at one end the opposite sides are fastened together by an arc-shaped stitching. The tube is then opened, flattened again in a plane at right angles to the first folding and the arc-stitching is repeated.—P. F. C.

Electric incandescence bodies; Process for producing ——. J. Krannichfeldt, Köln-on-the-Rhine, Germany. Eng. Pat. 26,045, Nov. 9, 1910.

A thin layer of a metal such as platinum, vanadium, or tungsten is deposited electrolytically together with an inert substance such as graphite or diamond dust, and the layer is drawn from the cathode as a thin sheet which is cut into thin strips for use as lamp filaments. If desired, a layer of a metal such as copper, nickel or silver, which is readily drawn from the cathode, is first deposited, and this layer is afterwards removed from the sheet of metal and inert material which is to form the filaments.—A. T. L.

Tungsten; Preparation of —— *for incandescence lamp filaments.* Cie. Fr. pour l'Exploitation des Procédés Thomson-Houston. Fr. Pat. 426,299, Feb. 21, 1911.

In obtaining filaments of tungsten which will remain ductile in use, the powdered tungsten used is prepared by the reduction of pure tungsten oxide, WO_3, in a fused silica tube heated to 1100°—1300° C., a current of pure dry hydrogen being passed through the oxide. The tube is about 1·5 m. long and 40 mm. diameter. Reduction takes place slowly, the process lasting 5 to 15 hours, and several intermediate oxides, viz., a blue, a brown and a black oxide, are formed. Towards the end of the process, a fresh supply of dry hydrogen is circulated through the tube. The tungsten is produced in powdered form, but in relatively large particles. A similar form of tungsten powder can be obtained by heating the oxide in a closed crucible to 1000° C. for 5 hours, and then reducing it. The powdered tungsten is compressed under very high pressure into rods 15 cm. long and 6 mm. diameter. The rods are heated to 1200° C. in hydrogen for 10 mins. to 1 hour, and are then heated to whiteness by the passage of an electric current in an atmosphere of hydrogen, so as to volatilise all impurities. The rods are then hammered and drawn into filaments by the process described in Fr. Pat. 421,012, Oct. 1, 1910, and finally the filaments are heated to 1000° C. in a current of pure dry hydrogen to remove oxide or other impurities which may have been formed on the surface.—A. T. L.

Tungsten and the manufacture thereof. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 8031, April 2, 1910.

See Fr. Pat. 426,299 of 1911 ; preceding.—T. F. B.

Photometer ; Selenium ——. Ges. für Elektrotechnische Industrie m. b. H. Fr. Pat. 425,854, Jan. 16, 1911. Under Int. Conv., Jan. 17, Jan. 29, and July 27, 1910.

The patent relates to the type of photometer in which a rotating mirror, mounted obliquely to its axis of rotation, directs the light alternately from each of the two sources which are to be compared on to a selenium element through which a continuous current is passed, this element being connected in series with two windings producing a magnetic field of constant direction, and in which a small coil, through which an alternating current is passed synchronising with the alternations of the light falling on the selenium element, is suspended in this magnetic field so as to oscillate about the zero point when the lights are of equal intensity. In order to increase the sensitiveness of the instrument by using stronger currents, and at the same time to prevent the rapid oscillations of the needle, the field due to the continuous current passing through the selenium element is weakened by separate opposed windings or by a permanent magnet. In one arrangement the mirror, which has reflecting surfaces at both back and front, is mounted between two selenium elements. These elements are in independent circuits having opposed windings so that the variations of the field due to the two elements are in the same sense. The same effect may also be obtained using two separate mirrors. In another arrangement the selenium element is in the primary circuit of a transformer, and the secondary circuit contains two windings for producing the field in which the coil, through which the alternating current is passed, is suspended. When the two lights are of equal intensity, there is no current in the secondary of the transformer and the needle of the suspended coil is at the zero position.—A. T. L.

III.—TAR AND TAR PRODUCTS

Rosin ; Quantitative determination of —— in admixture with coal-tar residues. Holde and F. Meister. Chem.-Zeit., 1911, **35**, 793—794.

Coal-tar residues (treated with sulphur to withstand atmospheric influences) are often used with an admixture of rosin for building purposes in place of natural asphalt. The following method is given for determining the amount of rosin contained :—10—20 grms. of the product (2·5—5 grms. suffice if the rosin exceed 4 per cent.) are extracted by boiling with 200 c.c. of ether under a reflux condenser, the mixture is filtered, the insoluble residue washed three times with ether and the washings added to the filtrate, which is then thoroughly shaken with successive lots of 30 c.c. of *N*/10 sodium hydroxide until the aqueous layer appears colourless (six portions usually suffice). The saponified solutions thus obtained are united, shaken with two portions of 50 c.c. of ether, and the united ethereal extracts are then shaken with 30 c.c. of *N*/10 sodium hydroxide. The united alkaline extracts are then decomposed in a separating funnel by dilute sulphuric acid in presence of ether. The mixture is thoroughly extracted with ether and the resulting ethereal solution, after addition of some concentrated sodium sulphate solution, is washed free from mineral acid and filtered. The filtrate is evaporated to 100 c.c. and heated with 0·5 grm. of dry animal charcoal for 10 minutes on the water-bath ; the mixture then filtered and the charcoal washed with ether. The filtrate and washings are evaporated on the water-bath and the residue is heated for 5 mins. at 105° C., cooled and weighed. To the weight found 8 per cent. is added, on account of the proportion of rosin insoluble in *N*/10 sodium hydroxide. The results are stated to be sufficiently accurate for all practical purposes.—A. Sbld.

Patents.

Dichloronaphthalenes ; Process for preparing a mixture of 1·4- and 1·5- ——. Badische Anilin und Soda Fabrik. Ger. Pat. 234,912, March 20, 1910.

Naphthalene is treated with the amount of chlorine necessary to convert it into a dichloro-derivative, in presence of a suitable catalytic agent ; the reaction is preferably carried out at a low temperature, and a solvent or diluent may be added. The resulting mixture of 1·4- and 1·5-dichloronaphthalenes is separated from the isomeric and other compounds either by taking advantage of the differences in solubility or volatility, or by treating the product with sulphuric acid of such concentration that the two desired compounds will be unaffected, whilst the isomerides and other by-products will be sulphonated. —T. F. B.

Symmetrical trinitrobenzene from halogenated trinitrobenzene ; Process for preparing ——. J. Meyer. Ger. Pat. 234,726, July 18, 1909.

Halogen derivatives of symmetrical trinitrobenzene ($hal : NO_2 : NO_2 : NO_2 = 1 : 2 : 4 : 6$) are converted into symmetrical trinitrobenzene by treatment with metals in neutral solution. Methyl, ethyl, or amyl alcohol, acetone, ether, or benzene may be used as solvents, and copper, zinc, brass, iron, aluminium, or magnesium as metals. It is advantageous to use finely divided metals, and also to use a solvent containing a small proportion of water. —T. F. B.

Condensation product from phenol and formaldehyde ; Process for obtaining a stable, light-coloured ——. H. Kunisch. Fr. Pat. 426,568, Feb. 25, 1911.

A product which is only very slightly coloured, is obtained by the condensation of phenol and formaldehyde in presence of ammonia and hydrogen sulphide, with or without addition of carbon bisulphide. *Example*—15—45 c.c. of carbon bisulphide is added to 0·5 kilo. of melted crystallised phenol, ¼ to ⅜ litre of water saturated with hydrogen sulphide is added, then 0·5 kilo. of 40 per cent. formaldehyde, and finally ⅛ kilo. of pure, 24 per cent. ammonia solution. The mixture is heated for one to two hours at 140° C., allowed to cool, and the upper aqueous layer separated ; the lower layer is heated for twelve hours at 100°—110° C., and when cool is broken up and heated in suitable moulds to a temperature of 150°—200° C., and submitted to a pressure of 150—300 atmospheres. The hydrogen sulphide may be replaced by thiophenol or other substances which evolve hydrogen sulphide under the conditions of the reaction. It is also advantageous to add to the mixture a metallic oxide or sulphide, preferably zinc oxide, in the proportion of 5—20 grms. per kilo. of phenol : in this case the ammonia and hydrogen sulphide may be omitted, though better results are obtained when they are used. (Compare Eng. Pat. 21,566 of 1908 ; this J., 1909, 374.)—T. F. B.

Chloro-alkarylsulphochlorides ; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 234,913, April 16, 1910.

By the action of chlorine on alkarylsulphochlorides, with aid of heat, and with or without addition of phosphorus compounds, chloro-alkarylsulphochlorides may be obtained, providing the conditions of the reaction be so regulated as to avoid, as far as possible, the destruction of the sulphochloride group.—T. F. B.

Orthonitrobenzaldehyde ; Manufacture of ——. J. Koetschet, Lyons, and A. Barbier, St. Fons, Assignors to Soc. Chim. des Usines du Rhône, ancien. Gilliard, P. Monnet et Cartier, Lyons, France. U.S. Pat. 997,301, July 11, 1911.

See Fr. Pat. 421,922 of 1910 ; this J., 1911, 610.—T. F. B.

Aniline; New nitro derivative of —— [tetranitro-aniline] and process for producing it. B. J. Flürscheim. Fr. Pat. 425,706, Feb. 8, 1911. Under Int. Conv., Feb. 9, 1910.

See Eng. Pats. 3224, 4701, 9477, and 11,478 of 1910; this J., 1911, 275.—T. F. B.

Phenylglycine salts; Process for producing ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 426,123, Feb. 16, 1911.

See Eng. Pat. 3980 of 1911; this J., 1911, 884.—T. F. B.

Separating tar from distillation gases by means of tar, gas liquor containing tar, etc. Fr. Pat. 390,470. *See* 11.

Reflux condensers. Eng. Pat. 3269. *See* I.

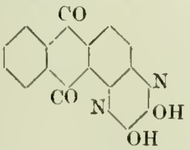
IV.—COLOURING MATTERS AND DYES.

Colouring matters; The bleaching of —— by light. P. Krais. Zeits. angew. Chem., 1911, **24**, 1302—1304.

Having found that the ordinary methods of stating the intensity of sunlight give no correct idea of the bleaching effect on dyestuffs, the author proposes to use a standard for this purpose prepared in the form of test papers from a dyestuff comparatively easily acted upon by light and which is not discoloured during the bleaching. To 200 grms. of white China clay previously wetted out with 200 c.c. of water, there is added 400 c.c. of a solution of Victoria blue R. (A. G. für Anilinfabrikation, Berlin) containing exactly 1 grm. of dye per litre, the mixture being shaken till homogeneous. The colourless liquid is removed on a suction filter and the coloured clay, after being air-dried in the dark, is finely powdered. Of this material 50 grms. are stirred up with 35 c.c. of water and added to 45 c.c. of a solution of gum arabic, prepared by dissolving 50 grms. of the gum in 250 c.c. of water, the solution being passed through a fine linen cloth. The colour thus prepared is spread with a brush over wood-free, unsized paper, smoothed with a softening brush and air-dried in the dark. By exposing strips of this paper the author has found that the bleaching effect of the light is constant during the middle hours of the day so that by preparing standard bleachings it is possible to state the resistance of a colouring matter to light in terms of "bleaching hours."—J. A.

Indanthrene; Degradation of —— to dihydroxypyrazinoanthraquinone and its behaviour towards benzoyl chloride and sodium alcoholate. R. Scholl and S. Edlbacher. Ber., 1911, **44**, 1727—1737.

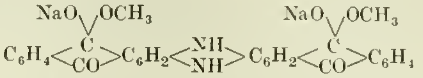
The constitution of indanthrene has hitherto been arrived at by means of synthetical methods of preparation, and the authors have now confirmed it by a study of its oxidation of indanthrene by chromic acid in glacial acetic acid solution. Under these conditions indanthrene is oxidised to dihydroxypyrazinoanthraquinone



and the constitution of this has been proved by its synthesis from 1 : 2-diaminoanthraquinone and oxalic acid.

Earlier experiments on the benzoylation of indanthrene were without success, but it is now found that a dibenzoyl derivative, in which the benzoyl groups are attached to the iminic nitrogen atoms, is obtained by boiling the dyestuff with 70 parts of benzoyl chloride for an hour. It forms red needles and is hydrolysed by either sulphuric acid or alcoholic potash.

With sodium methoxide, indanthrene forms an additive compound of the formula



$$C_6H_4<\overset{\overset{NaO\diagdown\diagup OCH_3}{C}}{\underset{CO}{}}>C_6H_2<\overset{NH}{\underset{NH}{}}>C_6H_2<\overset{\overset{NaO\diagdown\diagup OCH_3}{C}}{\underset{CO}{}}>C_6H_4$$

and the authors find that anthraquinoneazine also forms a similar additive compound with the same reagent. —J. C. C.

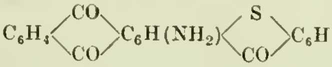
Patents.

Acid dyes of the anthracene series; Process of making ——. M. Iljinsky, Assignor to R. Wedekind und Co., m. b. H., Uerdingen, Germany. U. S. Pat. 996,487, June 27, 1911.

Anthraflavin derivatives, formed by sulphonating and nitrating anthraflavic acid, are condensed with aromatic amines in the presence of condensing agents and the products are separated into dyestuffs soluble in water and alkalis, and a residue insoluble in alkali. Special mention is made of the condensation of nitrated derivatives of dichloranthraflavin-sulphonic acid with aromatic amines in the presence of sulphur and sodium sulphide.—P. F. C.

Anthraquinone series; Production of vat dyestuffs containing sulphur of the ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 425,742, Feb. 6, 1911. Under Int. Conv. March 5, 1910.

When the 4-aminoanthraquinonyl-1-thiosalicylic acids (prepared by condensing 1 : 4-chloroaminoanthraquinone with thiosalicylic acid) are treated with dehydrating agents, vat dyestuffs are obtained which belong to the group of the anthraquinone-thioxanthones, for example :—



$$C_6H_4<\overset{CO}{\underset{CO}{}}>C_6H(NH_2)<\overset{S}{\underset{CO}{}}>C_6H_4$$

Example : 8 parts of 4-aminoanthraquinonyl-1-thiosalicylic acid are stirred with 100 c.c. (*sic*) of chlorosulphonic acid at 0° C. for one hour. The mass is then gradually warmed to 15—20° C. and stirred for 6—8 hours. The dyestuff is obtained by throwing the whole into ice-water and gives a reddish blue vat from which cotton is dyed in fast blue shades.—J. C. C.

1-Diazo-2-naphthol-4-sulphonic acid; Preparation of bromo-derivatives of —— and of orthohydroxyazo-dyestuffs from them. Fabrique de Prod. Chim. ci-dev. Sandoz. Fr. Pat. 425,837, Feb. 10, 1911. Under Int. Conv., Dec. 21 and 23, 1910.

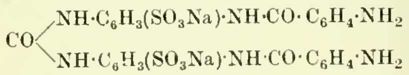
A monobromo-1-diazo-2-naphthol-4-sulphonic acid is obtained by warming with bromine a solution of 1-diazo-2-naphthol-4-sulphonic acid in chlorosulphonic acid or in concentrated or slightly fuming sulphuric acid, in the latter case with the addition of iodine as a catalyst. The new diazo compound, when combined with 1-phenyl-3-methyl-5-pyrazolone, dyes wool from an acid bath in orange shades which turn to reddish blue on chroming. The dyestuff similarly prepared with the use of β-naphthol, dyes wool in violet brown shades which on chroming become deep blue.—J. C. C.

Aminoanthraquinonecarboxylic acids; Production of new —— and their substitution products and dyestuffs derived from them. Badische Anilin und Soda Fabrik. Fr. Pat. 425,859, Jan. 19, 1911. Under Int. Conv., June 7, and Sept. 21, 1910; Jan. 4, 1911; additional patent Aug. 17, 1910.

1-Amino- or 1-arylamino-anthraquinone-2-carboxylic acids are obtained by treating the anthraquinone-2-carboxylic acids substituted negatively in the 1-position with ammonia or primary or secondary amines preferably in the presence of copper or its compounds and of agents capable of fixing mineral acids. New dyestuffs suitable for manufacturing pigments are prepared by allowing the chlorides of the above acids to remain at a moderate temperature or by heating them with an indifferent solvent or by treating them with reducing agents. When the amino-derivatives of diarylketone-o-carboxylic acids have been condensed in the first instance with halogenated anthraquinone-2-carboxylic acids the products are converted into dyestuffs by treating them with dehydrating agents.—J. C. C.

Diazotisable products and their intermediate products; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 426,201, Feb. 18, 1911. Under Int. Conv., March 14, 1910.

Compounds which can be diazotised and developed in substance or on the fibre are obtained by condensing the chlorides or bromides of nitrocarboxylic acids with aromatic sulphonic or carboxylic acids containing an amino-group and then reducing the nitro-derivative thus obtained. Example: 75 parts of diaminodiphenylurea disulphonic acid (sodium salt) are mixed with 800 parts of warm water and 20 parts of sodium carbonate, and 50 parts of *p*-nitrobenzoyl chloride are then added to the solution. Reduction is now effected by the addition of 200 parts of finely divided iron and 100 parts of acetic acid. After removal of iron the acid of composition—

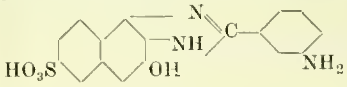


$$CO\begin{cases} NH{\cdot}C_6H_3(SO_3Na){\cdot}NH{\cdot}CO{\cdot}C_6H_4{\cdot}NH_2 \\ NH{\cdot}C_6H_3(SO_3Na){\cdot}NH{\cdot}CO{\cdot}C_6H_4{\cdot}NH_2 \end{cases}$$

is precipitated from the filtrate by means of salt. The substance is absorbed by the fibre, and when diazotised on the fibre and treated with β-naphthol gives a red colour fast to washing and light. When developed with phenylmethylpyrazolone a yellow colour is produced.—J. C. C.

Azo dyestuffs from aminophenylnaphthimidazole [hydr]oxysulphonic acid; Manufacture of ——. R. B. Ransford, London. From L. Cassella und Co., Frankfort on Maine, Germany. Eng. Pat. 15,646, June 29, 1910.

By condensing *m*-aminobenzaldehyde-bisulphite with 1·2-diamino-3-naphthol-6-sulphonic acid (obtained by reducing azo dyestuffs of 2·3-aminonaphthol-6-sulphonic acid), an aminophenylnaphthimidazole hydroxysulphonic acid of the formula—



is produced. When this acid is combined with diazotised aniline, sulphanilic acid, etc., or with tetrazo compounds, products are obtained which dye cotton orange-yellow to red shades; by diazotising these on the fibre and developing with β-naphthol, the shades are slightly modified and become fast to washing. (Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 1675 and 21,175 of 1905, 12,421 of 1906, and 6814 of 1907; see this J., 1905, 963; 1906, 978 and 1143; 1907, 1003.)—T. F. B.

Vat dyestuff; Process for preparing a grey-brown ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 235,811, Jan. 25, 1910.

By condensing acenaphthenequinone with β-naphthindoxyl (Ger. Pat. 216,639; this J., 1910, 16), a dyestuff is obtained which dyes wool and cotton greyish-brown shades from alkaline hydrosulphite vats.—T. F. B.

Condensation products and colouring matters of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 15,649, June 29, 1910.

See Fr. Pat. 424,814 of 1911; this J., 1911, 739.—T. F. B.

Colouring matters of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 20,338, Aug. 31, 1910.

See Fr. Pat. 420,267 of 1910; this J., 1911, 350.—T. F. B.

Azo dyestuffs derived from halogenated naphtholsulphonic acids; Manufacture of ——. H. Levinstein, and Levinstein, Ltd., Blackley. Eng. Pat. 15,069, June 23, 1910.

See Fr. Pat. 425,389 of 1911; this J., 1911, 886.—T. F. B.

Azo dyestuffs; Production of yellow to orange-red ——. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 426,102, April 23, 1910.

See Eng. Pat. 9968 of 1910; this J., 1911, 612.—T. F. B.

Tetra-trisazo dye. W. Herzberg, Schöneberg, and W. Lange, Treptow, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 997,061, July 4, 1911.

See Ger. Pat. 232,790 of 1910; this J., 1911, 611.—T. F. B.

Vat [indigo] dyestuffs; Manufacture of reddish-blue to violet-blue ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 24,886, Oct. 26, 1910. Under Int. Conv., Jan. 24, 1910.

See Fr. Pat. 421,096 of 1910; this J., 1911, 413.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Marine fibre. A. G. Green and G. H. Frank. J. Soc. Dyers and Col., 1911, 27, 169—170.

This fibre is obtained by dredging from the shallow seas of Spencer Gulf, South Australia, and can be put upon the London market at £5 per ton. Chemically, it is a hydrated lignocellulose giving the typical reactions of lignin, and microscopically it strongly resembles New Zealand flax fibre (*Phormium tenax*). From these facts it is certain that the fibre is not of marine origin but is produced by the natural retting of a land plant which has been submerged through an incursion of the sea. On account of its lignified character the behaviour of the fibre towards dyestuffs is peculiar. It can easily be dyed with basic dyestuffs without a mordant and gives fairly good results with certain acid dyestuffs which have residual basic properties. For salt and sulphide dyestuffs it has very little affinity and for ordinary acid dyestuffs none at all. The fibre is brittle and not very strong.—P. F. C.

Cellulose; The acetylation of cotton ——. C. G. Schwalbe. Z. angew. Chem., 1911, 24, 1256—1260. (See also this J., 1910, 415.)

The author has already shown that in every process for the preparation of cellulose acetates, hydrocellulose is produced, and has suggested that hydrolysis of the cellulose is an essential and primary stage in its acetylation. In further investigation of this subject, the author has now shown that if the acetylated products be separated from the undissolved cotton after the first 5—10 minutes of the reaction (acetylation with a mixture of acetic anhydride, acetic acid and sulphuric acid), these acetylated products have a considerable reducing action on Fehling's solution. Curiously the undissolved cotton separated at the same time has practically no reducing action, and must be regarded as virtually unattacked. This circumstance is due to the very different velocities of acetylation of cellulose and hydrocellulose: experiments conducted under identical conditions showed that after 5 minutes' treatment with the acetylating reagent, cellulose was converted only to the extent of 16 per cent. into soluble esters, whilst hydrocellulose was converted to the extent of 74 per cent., and further, that from a mixture of cellulose and hydrocellulose the whole of the hydrocellulose had been converted. The formation of acetylated products having a cupric-reducing power, is characteristic of the early stages of acetylation; at a later stage the products have no action on Fehling's solution, but in the last stages of complete acetylation the products are again found to reduce strongly. This intermediate non-reducing stage occurs not only in the acetylation of cellulose, but also in the acetylation of hydrocellulose. The author considers that he has now definitely proved that in the acetylation of cotton, the cellulose is first converted into hydrocellulose, and that the latter then becomes acetylated very rapidly. Incidentally it is remarked that the conversion of cellulose into hydrocellulose takes place far more rapidly in the ordinary acetylating mixture (a perfectly anhydrous medium) than in 97—98 per cent. glacial acetic acid containing an equal amount of sulphuric acid.—J. F. B.

Paper; The sizing of —— with rosin compounds. J. S. Remington, D. A. Bowack and P. Davidson. Papierfabrikant, 1911, **9**, 787—790, 819—823.

The authors have prepared and studied the properties of the aluminium resinates precipitated by the action of aluminium sulphate on a solution of neutral rosin soap. They regard these compounds as being the true sizing agents of engine sized papers, and attribute to the free resin acids a very subordinate part. Neutral aluminium resinate is obtained by precipitating a neutral or "brown" rosin size with the equivalent quantity of alum. The air-dried substance contains 4·56 per cent. of aluminium oxide, whereas pure aluminium abietate, $Al_2(C_{44}H_{62}O_5)_3$, would contain 4·94 per cent. The dry compound dissolves very readily in cold benzene and chloroform, but is only moderately and often partially soluble in certain other media, notably ether and alcohol. It melts at 135°—140° C. Practically no free resin acids are precipitated under the above conditions, nor even when the alum is used in excess. It is found, however, that solvents such as ether and alcohol split up the dry neutral aluminium resinate into a soluble portion poor in aluminium oxide and an insoluble richer in that base. The residue which is insoluble in ether is of variable composition containing 6—10 per cent. of aluminium oxide; it has no definite melting point, but softens and darkens above 300° C.; it does not give the Liebermann-Storch reaction, it is but slightly affected by mineral acids and insoluble in ordinary solvents, but chloroform converts it into a jelly. This dissociation into acid and basic aluminium resinates may take place during the drying of the precipitate, since the fresh, hydrated aluminium resinate is perfectly soluble in cold ether or alcohol. If the clear solution be digested in the hot, a flocculent precipitate gradually separates out, which appears to be identical with the insoluble portion of the dried aluminium resinate. It is known that when ordinary sized papers are extracted directly with ether, only a portion of the rosin is extracted, varying according to the proportion of free rosin in the size used. The papers after extraction, as a rule, are not completely unsized, which fact is an argument against the theory of free rosin sizing, and a further quantity of rosin may be extracted after acidification. Determinations with commercial sized papers showed that the proportion of directly extracted rosin to total extract ranged from 66 to 90 per cent.—J. F. B.

Paper pulp; Reactions between dyestuffs, loading and sizing materials in ——. L. Kollmann. Papierfabrikant, 1911, **9**, 845—851.

The soluble dyestuffs used for colouring the fibres of paper pulp are capable of reacting not only with the cellulose fibres, but also to a greater or less extent with the mineral loading and the sizing materials. The author has studied these reciprocal affinities separately, since their recognition is an important factor in the utilisation of the materials to the best advantage. On adding solutions of various dyestuffs to suspensions of mineral loading matters, the author determined the quantity of colouring matter absorbed by the mineral before the supernatant liquor became coloured. Thus, china clay, which may be regarded as possessing acid functions, absorbs an appreciable quantity of basic dyestuff, but shows no affinity towards acid dyestuffs; magnesia on the other hand, being basic, absorbs acid dyestuffs, but not basic. Substantive dyestuffs are absorbed by both, but more strongly by magnesia than by china clay. Many dyestuffs, particularly valuable for colouring paper pulp, give precipitates when treated with alum or with rosin size; the precipitation is seldom quantitative, but such dyestuffs are prized because they give nearly clear backwaters. In this case the dyestuff should be allowed to act first on the fibres of the pulp before the alum or the size is added to complete their fixation. When a mixture of dyestuff and rosin size in solution is precipitated by alum, or a mixture of dyestuff and alum is precipitated by rosin size, a coloured precipitate is always obtained, and the liquid is more or less decolorised. Only basic dyestuffs give a precipitate directly with rosin size. Precipitated free rosin is only coloured by basic dyestuffs, whereas precipitated aluminium resinate is coloured more strongly by acid dyestuffs; the precipitate produced by calcium salts (hard water) with rosin size shows a stronger affinity for basic dyestuffs. In no case could the individual components of a heterogeneous precipitate of rosin size be separately identified by their dyeing affinities under the microscope. The dried precipitates showed practically the same behaviour towards the various dyestuffs as the hydrated precipitates. Hot drying in certain cases adversely affects the shade or intensity of the dyestuff in the paper, basic dyestuffs being generally more sensitive than acid.—J. F. B.

Paper specialities. H. Postl. Papierfabrikant, 1911, **9**, 853—855.

Japanese papers.—Genuine Japanese papers are not made of rags, but only of freshly prepared native bast fibres. The treatment which the fibres receive in the process of preparation is very gentle, both chemically and mechanically; the bast is merely steeped in dilute alkali, and cleaned by hand, the beating operation is also entirely conducted by hand with wooden mallets, the hollander engine is not employed. Thus the fibres obtained retain all their natural qualities and strength, and since bleaching chemicals are not used, the Japanese papers are renowned for their great strength, they also have a silky gloss and feel and possess excellent printing qualities. Attempts to utilise the native Japanese fibres in Europe have led to no satisfactory results.

Dutch tobacco paper.—The qualities demanded for these papers are: light and permanent colour, extremely good resistance to crumpling and creasing, complete absence of holes or porous thin patches through which the aroma and moisture of the tobacco might escape. The paper is made from cotton and linen rags mixed with waste paper of best quality. The web is run on a machine with two wet presses, and is cut into sheets by a special machine placed in front of the last wet press. The moist sheets are taken off by hand and dried in lofts; sizing and plate-glazing are effected as in hand-made papers.

Imitation hand-made cardboard.—This is used for covers for pamphlets, etc., and must have deckle edges and a pronounced grain. Tinted boards in fast colours are best made from coloured rags, preferably cotton, in order to obtain the desired thickness. When produced on the cylinder machine, strips of waxed cloth are attached to the wire to define the deckle edges. Each sheet passes through the press between two marking felts, which impress on the board the desired grain. Drying is effected by slightly heated cylinders, or better, in the air. Generally engine-sizing suffices, but in some cases the boards are tub-sized.

Imitation parchment paper.—Formerly the characteristic appearance of imitation parchment papers was obtained by the use of paraffin, stearin, starch preparations, glucose, etc., but now the same result is produced by the selection of a strong, well boiled sulphite pulp, suitably treated in the hollander. Generally the knives of the beater roll are of bronze, and the bed plate is composed of hardened cast steel ribs or basalt lava. Sometimes both roll and plate are of lava. The wire of the paper machine should be very long, with several suction boxes. The drying cylinders should be of ample capacity and so designed that not more than 100 kilos. of paper are dried in 24 hours per 1 sq. m. of cylinder surface. Slow drying is essential to give a strong and flat paper.—J. F. B.

Use of sulphite cellulose waste lyes on sewage fields. Stutzer. *See* XIXb.

PATENTS.

Vegetable fibres; Process for the preparation of ——. F. Kreissl and C. Seibert. Fr. Pat. 425,955, Feb. 11, 1911. Under Int. Conv., Feb. 16, 1910.

The separation of the useful fibres from the woody portions of stems is effected in the following manner:—The entire stems are steeped in cold water for 24 hours and are then boiled for half-an-hour with a soda lye of 8 per cent. concentration. The boiled stems are removed from the boiler and washed with jets of hot water under high pressure. They are next boiled again with 8 per cent. soda lye for 5 minutes under a pressure of 15 atmospheres and again subjected to jets of hot water. The action of the jets of water opens up the fibrous portions of the plants, and forcibly removes the softened ligneous tissues. A subsequent digestion for 3 minutes with an 8 per cent. lye under a pressure of 10 atmospheres is frequently required. The spent lye contains matters suitable for the preparation of a gum and the short fibres of the ligneous portions may be collected for paper-making.—J. F. B.

Fibre-producing process and resulting fibre material. V. Drewsen, New York. U.S. Pat. 996,225, June 27, 1911.

A vegetable material, such as wood chips, is boiled under pressure in a liquid obtained by adding about 10 per cent. of quicklime and 2—4 per cent. of sulphur to water. After this process the fibre is washed, disintegrated, boiled with an aqueous solution of sodium carbonate to remove all traces of sulphur and finally washed.—P. F. C.

Tulle fabrics; Mercerising and otherwise treating ——. L. Arnould and H. David et Cie. Fr. Pat. 426,060, April 21, 1910, and H. David et Cie. Fr. Pat. 426,414, May 2, 1910.

Tulle fabrics are mercerised and then schreinered or otherwise finished; if desired the material may also be filled. As the fabric is not strong enough to allow of it being mercerised in the ordinary manner on a stenter mercerising machine under tension, it is previously folded lengthwise so as to bring the selvedges together and temporary lists are then sewn on to the folded piece. In this form the fabric can be submitted to the mercerising process under tension without being damaged. Instead of folding one piece lengthwise, two or more superposed pieces (which must be of the same width) may have their selvedges sewn together and then be provided with two strong temporary lists.—P. F. C.

Silk hanks; Apparatus for treating —— with froth from soap or other solution. Färberei und Appreturges. vorm. A. Clavel und F. Lindenmeyer. First Addition, dated April 15, 1910, to Fr. Pat. 387,796, Feb. 19, 1908 (this J., 1908, 854).

In order that the hanks may be washed whilst still on the reels without diluting the soap solution in the vat below, a number of inclined gutters are placed across the vat immediately under the hanks on the reels, so that the water flows down the hanks into the gutters and away at the side of the vat. An arrangement is also provided for keeping the reels raised during the operations of putting on and taking off the hanks. This consists of a curved lever fixed to the bearing at the driven end of each reel. The reel is driven by a worm-shaft operating on a pinion-wheel attached to the reel. When the lever is depressed, the free end of the reel is raised, whilst the pinion articulates on the worm, and a hook on the end of the curved lever engages with a hook on the side of the vat holding the reel in the raised position. The front side of the vat is divided into two portions, the upper being counter-balanced and capable of being raised when two tiers of reels are being operated simultaneously.—J. F. B.

Liquid soap for "boiling off" silk or other textiles. E. Calliat. Fr. Pat. 426,065, April 21, 1910.

The specification relates to a liquid soap suitable for "boiling off" silk and for other uses in preparing and dyeing textiles. It possesses great penetrating power and preserves the softness of the fibre. The soap is prepared by mixing in the cold 100 parts of oleic acid, 40 parts of methylated spirit and 40 parts of an alkaline lye of 32° Bé.—J. F. B.

Tallow for finishing natural and artificial silks and other textiles; A soluble, liquid ——. E. Calliat. Fr. Pat. 426,217, April 23, 1910.

A liquid soluble soap for finishing textiles, particularly artificial silk, is prepared by melting 100 parts of tallow and then adding 40 parts of methylated spirits and 40 parts of an alkaline lye of 32° Bé., mixing the ingredients well and allowing to cool.—J. F. B.

Drying machines for fabrics, etc. Dexter Engineering Co. Fr. Pat. 425,986, Feb. 13, 1911. Under Int. Conv. Feb. 19, 1910.

In drying machines consisting of a number of steam-heated cylinders with steam entering through the axis at one side and condensed water escaping through the axis at the other side, the hot condensed water still containing a little steam passes into a discharge pipe which is bent so as to retain a water-seal and thus to separate the residual steam from the hot water. This separated steam is conducted to the axis of the first drying cylinder of the series which is not in connection with the main steam supply of the machine.—J. F. B.

Drying machines [*textile fabrics*]. Dexter Engineering Co. Fr. Pat. 425,985, Feb. 13, 1911. Under Int. Conv., Feb. 17, 1910.

In drying machines consisting of rows of steam-heated cylinders over which the fabric to be dried passes as a continuous web, each cylinder is provided, at the opposite end to that at which the steam enters, with a water-sealed steam and water separator. These traps prevent the escape of uncondensed steam from the cylinders, whilst providing for the free discharge of the condensed waters. The traps are in connection with a system of branch pipes so arranged that all the steam emanating from the condensed waters discharged from the cylinders, as well as all the steam which may have escaped from the cylinders with the water, is conducted through a range of radiating pipes situated below the lower tier of drying cylinders, close to the fabric which is being dried. Thus the heat of the waste steam is utilised to assist the drying operation. —J. F. B.

Cellulose esters of fatty acids; Manufacture of artificial silk from ——. Chem. Fab. von Heyden. Fr. Pat. 426,436, Jan. 26, 1911.

In spinning artificial threads from ordinary solutions of cellulose esters, the coagulating liquid forms a shell of solid cellulose ester which is not readily penetrated, so that the interior of the thread remains fluid for a considerable time. This defect is remedied if the solution of the ester be previously mixed with a certain proportion of a liquid which is not a solvent of the ester, but which is miscible with the solvent. For instance solutions of cellulose acetate in acetic or formic acid should be diluted slightly with water, and solutions in chloroform, acetone, etc., should be diluted with alcohol, to such an extent that the solution ready for spinning is in a condition bordering on incipient coagulation. It is found that solutions of a cellulose acetate which contains 55—59 per cent. of combined acetic acid give better results than solutions of the full triacetate.—J. F. B.

Cellulose cuprammonium solutions; Process for preparing —— by means of basic copper sulphate. Hanauer Kunstseidefabrik. Ger. Pat. 235,219, Jan. 21, 1909.

Basic copper sulphate of the formula, $7CuO,2SO_3+6H_2O$, prepared by precipitating hot copper sulphate solutions by means of ammonia or sodium carbonate solutions, may be used as a solvent for cellulose. Five mols. of the cellulose and seven mols. of the basic sulphate are treated with an amount of ammonia insufficient to dissolve the copper salt. Concentrated cellulose solutions may be obtained by this means, whereas the solutions obtained by dissolving basic copper sulphate (precipitated by potash) in ammonia, have only a low solvent power for cellulose. —T. F. B.

Viscose; Process for preparing purified ——. F. Becker. Ger. Pat. 234,861, Aug. 16, 1910.

Solutions of increased stability are obtained by the dialysis of crude viscose against water or an alkali solution. The products are suitable for working up into artificial silk, horsehair, films, etc.—T. F. B.

Agglomeration of pulverulent materials, minerals, coal, etc. A. Nicolle. Fr. Pat. 425,991, April 20, 1910.

The residual liquors of the sulphite paper process contain bodies, chiefly calcium lignosulphonate, which are useful as agglomerants. The chief objection to their use is that the briquettes made with such residues will not stand exposure to the atmosphere without disintegrating. It has been found that salts of chromium, iron, cerium and other metals of that group have the property of rendering these lignosulphonate bodies insoluble. Formerly the waste liquors were evaporated to dryness at a considerable cost, but according to the process claimed this is not necessary. The waste liquor is evaporated to a syrupy consistency only and from ten to twenty-five per cent. of one of the above mentioned salts is added. Briquettes formed with this mixture are said to be able to resist atmospheric influences. If preferred the briquettes may be first made with the concentrated liquor and then afterwards passed through a bath containing about ten per cent. of one of the salts alluded to dissolved in water. —W. H. C.

Wood pulp; Manufacture of ——. J. C. W. Stanley, Santa Cruz, California. Eng. Pat. 29,087, Dec. 14, 1910. Under Int. Conv., Dec. 14, 1909.

The refuse from lumber mills such as outside slabs and short ends is sawn into boards about 4 feet long and 4 inches thick and reduced to small splinters in a "hog" breaking machine. These splinters are placed on the false bottom of an iron tank and treated for 8 hours at 200° F. with a solution of sodium hydroxide of 10° B., the tank being provided near the top with a perforated plate to prevent the wood from floating. The soaked wood and the liquor are then transferred to a large digester mounted on trunnion bearings and the operation is completed by boiling the wood in the liquor for a further 8 hours under 80 pounds pressure. The digester is then opened and inverted so as to discharge its contents into a pit where slow cooling is caused to take place until a temperature of 100° F. is reached. The mass is then raised by elevators and placed in a revolving wire cage where most of the liquor is strained from the fibrous matter and the latter is then crushed, washed and transferred to a pulp press. —P. F. C.

Paper pulp; Apparatus for treating old paper for the production of ——. A. van Hemelryk, Hal, Belgium. Eng. Pat. 433, Jan. 6, 1911.

A triturating machine is described for reducing waste paper and the like to pulp, to prepare it for re-manufacture into paper. The machine consists of a single conical body or receptacle which increases in diameter from the inlet end to the discharge end, whilst the kneading arms fixed on the shaft also increase in size in proportion to the amount of trituration which the material has undergone. The discharge orifice is situated a little above the lowest part of the body at the wide end of the cone and has a movable plate, whereby the discharge of the pulped material may be partially or entirely checked, in order to control the degree of trituration obtained. A small door is provided at the lowest part of the body to facilitate the washing out of the apparatus.—J. F. B.

Mechanical wood pulp; Process for the production of ——. G. C. Howard, Seattle. Assignor to Howard Pulp Process Co., Everett, Wash. U.S. Pat. 997,064, July 4, 1911.

Mechanical wood pulp is prepared by treating a mass of fibre-bundles in a tube-mill containing balls heavier than the individual fibre-bundles and of diameter larger than the length of these bundles. The reduced bundles are then similarly treated with lighter balls having a diameter equal to the length of the bundles, lastly the mass is treated with still smaller balls having a diameter less than the length of the bundles. At any stage of the process the fibre-bundles may be treated with a chemical solvent in order to reduce the cohesion of the fibres.—J. F. B.

Cellulose esters; Solutions of —— *and their production.* A. Wohl. Fr. Pat. 425,900, Feb. 6, 1911. Under Int. Conv., March 12, 1910.

See Eng. Pat. 3139 of 1911; this J., 1911, 888.—T. F. B.

Hair; Treatment of —— *for felting or like purposes.* B. Ronjat, Paris. Eng. Pat. 23,074, Oct. 5, 1910. Under Int. Conv., Oct. 27, 1909.

See U.S. Pat. 993,461 of 1911; this J., 1911, 798.—T.F.B.

Plastic bodies [*paper, etc.*]; *Manufacture of* —— *and moulded articles therefrom.* J. Y. Johnson, London. From Bakelite-Ges. m. b. H., Berlin. Eng. Pat. 28,155, Dec. 3, 1910.

See Fr. Pat. 424,459 of 1910; this J., 1911, 741.—T. F. B.

Utilisation of peat. Fr. Pat. 426,311. *See* XVI.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Ingrain colours; Resistance of —— *against re-solution.* W. P. Dreaper and A. Wilson, J. Soc. Dyers and Col., 1911, 27, 170—171.

In order to determine the influence of the temperature of dyeing of ingrain colours on the fastness of the shades obtained, samples of silk were dyed to the same depth of shade with the pure sodium salt of the sulphonic acid of Primuline base at 100° C. and 15° C. The dyed samples were then diazotised, developed with β-naphthol and subjected to the action of sodium oleate solution (1 per cent.) at 95° C. for one hour. It was found that the sample dyed at 15° C. lost 67 per cent. of colour by re-solution, whilst the sample dyed at 100° C. lost only 17 per cent. When R salt was used as the developer, the loss of colour after 10 minutes' soaping at 95° C. was 12 per cent. on the sample dyed at 100° C. and 94 per cent. on that dyed at the lower temperature. Samples dyed at 100° C. and 15° C. and then developed with β-naphthylamine, and afterwards soaped, lost 4 and 95 per cent. respectively. Similar but less pronounced results were obtained on dyeing cotton instead of silk. It was also proved that the use of a developer of a basic nature has a good influence on the fastness to soaping of the shades obtained. For example, a dyeing developed with β-naphthylamine and a comparable dyeing developed with R salt lost 7 per cent. and 26 per cent. of the colour respectively on soaping under similar conditions.—P. F. C.

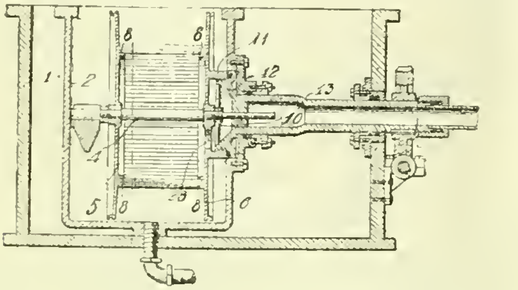
White effect on fabrics to produce figured styles; Printing an opaque ——. J. Heilmann et Cie., A. Lipp and M. Battegay. Bull. Soc. Ind. Mulhouse, 1911, **81**, 137—138.

A preparation containing viscose, a solution of an aluminate and a solution of a silicate is printed on to the material. The coagulation of the viscose and the precipitation of the insoluble aluminium silicates are then simultaneously produced by drying or by a short steaming. The insoluble soaps which are precipitated on the fibre in the process described in Ger. Pat. 231,643 of 1910 were found to have too low melting points and have therefore been replaced by aluminium silicates.—P. F. C.

Patents.

Dyeing-machine. J. M. Payne, Phœnix, Ala. U.S. Pat. 996,514, June 27, 1911.

The apparatus comprises an outer tank, 1, and an inner tank, 2, within which is a reel, 8, mounted on a shaft, 4. The reel consists of two flanged discs, 5 and 6, having notches, spaced apart, in which bars or slats are fitted. The disc, 6, has a projecting annular flange, 11, on the inside of which a screw thread is cut. A rotatable nozzle, 13, extends through the walls of the tanks at one side, and is enlarged at the end, this enlarged portion, 12, having an external screw thread which engages with the screw thread on the inside of the flange, 11. A "spider," 10, disposed in the mouth of the nozzle, carries one end of the shaft, 4, and an opening, 28, provides communication between the interior of the reel and the nozzle.—A. S.



Vat dyestuffs; Dyeing with ——. Farbwerke vorm. Meister, Lucius, und Brüning. First and Second Additions, dated Jan. 31 and Feb. 1, 1911, respectively to Fr. Pat. 425,486, Jan. 25, 1911. Under Int. Conv., March 15 and April 2, 1910, respectively.

In the process described in the principal patent (this J., 1911, 889) the anthraquinone can be replaced by a large number of other compounds, all of them characterised by the property of being more easily reduced than the vat dyestuff employed, whilst their reduction products are more readily re-oxidised. Amongst such compounds are the quinones of the benzene and naphthalene series, the nitrosonaphthenes, the indophenols and their sulphonic acids, isatin, indirubin and certain colours of the triphenylmethane series such as Cetopaline. Moreover the catalytic effect of these substances (including anthraquinone) is effective not only with dyestuffs of the indigoid class, but with all other vat dyestuffs such as those derived from anthracene, benzanthrene, benzanthrenequinoline, etc. The process is also applicable to dyeing with sulphide dyestuffs.—P. F. C.

Dry scouring and vat-dyeing of wool; System applicable to the ——. G. Mezzera. Fr. Pat. 426,456, Feb. 3, 1911. Under Int. Conv. Feb. 8, 1910.

This apparatus comprises a hydroextractor which is provided with an air-tight cover, two reservoirs, one for the treating liquor and one for hot air, an aspirating device, a circulating pump and suitable pipe connections which are fitted where necessary with stopcocks. Both reservoirs are provided with closed steam coils for heating their contents. The wool is packed into the cage of the hydroextractor and by means of the pump the treating liquor is circulated through it for about 15 minutes and then returned to the reservoir. The excess of liquor contained in the wool is next expelled by starting the hydroextractor and also allowed to run back into the tank. The material is finally dried by drawing a current of hot air through it by means of the aspirator.—P. F. C.

Oxidation brown; Production of —— *with white and coloured effects.* Badische Anilin- und Soda-Fabrik. Second Addition, dated Feb. 15, 1911, to Fr. Pat. 357,472, Sept. 4, 1905. Under Int. Conv., Oct. 20, 1910 (this J., 1910, 19).

A brown shade resembling manganese bistre and of good fastness to soaping, bleaching and to light can be obtained if, in the process described in the principal patent and its first addition, the paraphenylenediamine or its homologues is replaced by a derivative containing an electro-negative group in the nucleus, notably by nitroparaphenylenediamine. Example: A padding liquor for a deep shade is obtained by mixing a cooled solution of 450 grms. of nitroparaphenylenediamine in 6270 c.c. of water and 550 c.c. of formic acid, with a solution containing 340 grms. of sodium chlorate and 480 grms. of ammonium chloride in 1260 c.c. of water and finally adding 450 c.c. of a 1 per cent. solution of ammonium vanadate. Discharge effects can be obtained by printing the padded and dried fabric with a reserve containing sulphites and hydrosulphites or sulphoxylates and (if coloured effects are desired) a suitable sulphide or basic dyestuff.—P. F. C.

Printing colours for fabrics; Preparation of ——. S. Wechsler. Fr. Pat. 425,777, Feb. 9, 1911.

The dried and powdered dyestuff is intimately mixed with "varnish" and glycerin and to the mixture a preparation commercially known as "hygrol" is added. "Hygrol" contains about 50 per cent. of glycerin, 1 per cent. of an alkaline salt, 2 per cent. of tartar, 17 per cent. of rosin oil and 30 per cent. of "varnish." A typical printing colour prepared according to this process contains 7 parts of powdered Diamine Blue, 12—16 parts of glycerin, 7—9 parts of "varnish" and 70—80 parts of "hygrol."
—P. F. C.

Printing carpet yarns. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 11,420, May 11, 1911. Under Int. Conv., June 4, 1910.

In drum printing machines of the ordinary type, for printing carpet yarns, the plain narrow vulcanite roller is replaced by a metallic roller having its periphery pitted by engraving. After the roller has taken up the printing colour, the excess is removed by scrapers which are fitted parallel and on either side of the roller. The process is particularly applicable to the printing of discharge colours on dyed carpet yarns.—P. F. C.

Drying proofed and like fabrics or materials; Apparatus for ——. J. Spenle, Salford. Eng. Pat. 14,645, June 17, 1910.

Proofed fabrics containing volatile solvents are dried by passing them through a chamber containing in its lower part a horizontal steam chest or other heating device for drying the fabric and in its upper part a cooling device for condensing and collecting the volatilised solvent. In order to prevent the escape of the vapour through the entry and exit openings of this chamber, cooled solvent-free air is withdrawn through an outlet in the roof by a fan and (preferably after warming it) is delivered to two horizontal slotted pipes which are arranged at the entry and exit openings and discharge the air on to the fabric and again into the chamber. The outlet and the two slotted pipes are so proportioned as to ensure that there shall be no tendency for air to enter the chamber from without nor for vapour to escape through the entry and exit openings from within. If desired, the cooling devices for condensing the solvent may be arranged in the outlet leading from the upper part of the chamber to the fan.
—P. F. C.

Reducing agents [*for printing, etc.*]; *Manufacture of* ——. A. Ashworth, Bury. U.S. Pat. 997,534, July 11, 1911.

See Eng. Pat. 17,734 of 1908; this J., 1909, 88.—T. F. B.

Dyeing yarn; Method of ——. J. C. Hebden, Providence, R.I., and F. H. Daniell, Franklin, N.H. U.S. Pat. 996,761, July 4, 1911.

See Fr. Pat. 408,424 of 1909; this J., 1910, 623.—T. F. B.

Brown shades by oxidation on the fibre; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 426,431, Jan. 19, 1911. Under Int. Conv., Jan. 26, 1910.

See Eng. Pat. 14,272 of 1910; this J., 1911, 617.—T. F. B.

Brown shades on textile fibres; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 425,831, Feb. 10, 1911. Under Int. Conv., Feb. 28, 1910.

See Eng. Pat. 12,140 of 1910; this J., 1911, 280.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Colloidal silicic acid; Preparation of ——. E. Ebler and M. Fellner. Ber., 1911, 44, 1915—1918.

The methods previously described for the production of colloidal silicic acid (sol or gel) are not capable of producing a product which leaves no residue with hydrofluoric acid, except at considerable expense. By slowly distilling purified silicon tetrachloride into pure distilled water, with shaking, a solution is obtained from which it is possible to remove the hydrochloric acid very thoroughly by dialysis with parchment, after which the sol can be concentrated till it contains as much as 9 per cent. of silica without precipitation. The authors have prepared from distilled water of conductivity $6{\cdot}2 \times 10^{-6}$ a sol the conductivity of which is only $1{\cdot}7 \times 10^{-5}$.—W. H. P.

Silicate and carbonate rocks; Analysis of ——. W. F. Hillebrand. U.S. Geol. Survey, Bull. 422, 1910.

Compared with Bulletin 305 (see also this J., 1908, 813) of which the present is a revision, the following changes have been made. The preparation of the sample is modified to preclude moisture and oxidation during grinding, by carrying on the process in absolute alcohol which is afterwards dried off, or in an inert gas. If all the portions of the air-dried powder necessary for analysis be weighed out successively, the error caused by keeping the powder in a weighing tube for days with consequent admission of air at every opening of the tube, is eliminated. The chapters on water have been re-arranged and are introduced by a section on the rôle of hydrogen in minerals. Modifications in the colorimetric method for the estimation of titanium have been necessitated by Merwin's discovery (Amer. J. Sci., 1909, 28, 199) that alkali salts bleach the hydrogen peroxide colour. For this a blank may be done, or Merwin's corrections applied. If the titanium exceed 0·02 grm. in 100 c.c. of 5 per cent. sulphuric acid, no correction is required; but for amounts between 0·002—0·01 grm., the titanium found is too low by approximately 0·0004 grm. The best methods for titanium are the colorimetric and, in absence of zirconium, the Gooch, which consists essentially in freeing the titania precipitated by ammonia from alumina by at once adding acetic acid in large excess and boiling for some minutes, and subsequently precipitating from a sulphuric acid solution by sodium acetate. Steiger's method for determining fluorine by its bleaching effect on the titanium hydrogen peroxide colour, is, of course, also affected by Merwin's discovery. Merwin's modification of Steiger is described in full. The chapter on sulphur is supplemented by a section on the errors involved in the determination of sulphur as barium sulphate. These vary so much in individual cases that general directions to meet all conditions cannot be given.

Stress is laid on the necessity of complete analyses, owing to the largely increased list of elements now known to enter into the normal composition of rocks. Titania, zirconia, manganese, phosphorus, lithium are almost universally distributed in rocks. H. S. Washington (U.S. Geol. Survey, Professional Papers 14 and 28), has sifted the data accumulated in the thousands of analyses published since 1869, and has assigned to each analysis a certain value on a scale of 5.—H. H. S.

Carbon dioxide; Reactions of —— *with carbon bisulphide and hydrogen sulphide under the influence of heat.* R. Meyer and S. Schuster. Ber., 1911, 44, 1931—1944.

The general method of experiment was to pass mixed gases through a combustion tube heated to dull or bright redness, and to determine the composition of the issuing gases by means of suitable absorbents, etc. The conditions of experiment were varied considerably, the tube at times being empty and at others packed with pumice, copper, copper oxide, quicklime, or platinised quartz; the gases were sometimes moist and sometimes dry: the velocity of the gaseous current was varied between wide limits: the proportions of the reacting gases were altered. *Carbon dioxide and sulphur dioxide.* At most only small quantities of carbon monoxide were formed. *Carbon dioxide and carbon bisulphide.* Carbon dioxide was charged with carbon bisulphide vapour by passing it through a wash-bottle containing the liquid. The mixed gases were then passed through concentrated sulphuric acid in order to remove water vapour. Carbon monoxide was formed in varying amounts according to the conditions. Platinised quartz, a high temperature and heating the carbon bisulphide in the wash-bottle (thus increasing the proportions of this substance) were all favourable to the production of carbon monoxide. As much as 40·7 per cent. of the carbon dioxide was in one case reduced to the monoxide. *Carbon dioxide and hydrogen sulphide.* The hydrogen sulphide was prepared by dropping dilute sulphuric acid into a concentrated solution of sodium sulphide, in order to obtain it free from hydrogen. The gases were mixed in about equal proportions and dried before passing through the combustion tube. Carbon monoxide and hydrogen were always formed, the action being greater in presence of platinised quartz. The reaction is probably expressed by the equations: $CO_2 + H_2S \rightleftarrows CO + H_2O + S$ and $CO + H_2O \rightleftarrows CO_2 + H_2$. *Carbon monoxide, water- and sulphur-vapour.* This experiment was undertaken to confirm the supposed reversibility of the action $CO_2 + H_2S \rightleftarrows CO + H_2O + S$. 1 litre of carbon monoxide was passed through heated water and then through the combustion tube, in which was a boat containing sulphur. The carbon dioxide and hydrogen sulphide formed, were absorbed in potash bulbs. The gain in weight due to carbon dioxide was equivalent to a volume of 302 c.c. The unabsorbed gas, consisting chiefly of carbon monoxide, was found to contain 3·3 per cent. of hydrogen. This no doubt was the result of the secondary action $CO + H_2O = CO_2 + H_2$. *Carbon dioxide, carbon bisulphide and water vapour.* 450 c.c. of carbon dioxide were passed through carbon bisulphide heated to 40° C., and then through water heated to 80°—85° C. By passing the mixture through the combustion tube, 24·2 c.c. of carbon monoxide, 89 c.c. of hydrogen sulphide and free sulphur were formed. The following reactions probably take place: (1) $CO_2 + CS_2 \rightleftarrows 2CO + S_2$. (2) $CO + S + H_2O \rightleftarrows CO_2 + H_2S$, (3) $CO + S \rightleftarrows COS$ and (4) $H_2S \rightleftarrows H_2 + S$. *Carbon monoxide and sulphur vapour.* The action $2CO + S_2 = CO_2 + CS_2$ took place completely, the issuing gases being wholly absorbed by alcoholic potash solution. *Carbon dioxide, carbon bisulphide and sulphur vapour.* 2·6 per cent. of the carbon dioxide was converted to carbon monoxide. When sulphur vapour was omitted (see above), over 10 per cent. of the carbon dioxide was reduced under similar conditions. *Carbon dioxide and hydrogen* gave rise to very small quantities only of carbon monoxide. *Carbon monoxide and water vapour.* When the tube was filled with platinised quartz, 213 c.c. of the resulting gas contained 22·4 c.c. of hydrogen. *Carbon monoxide and hydrogen sulphide.* For these experiments hydrogen sulphide free from carbon dioxide and hydrogen was obtained from precipitated zinc sulphide. In one experiment in which equal volumes of the two gases were mixed, over 11 per cent. of the final gas was hydrogen. The action is represented thus: $CO + H_2S \rightarrow COS + H_2 \rightarrow CO + S + H_2$. *Sulphuretted hydrogen* passed alone through the tube gave traces of free hydrogen. When the tube was packed with platinised quartz, dissociation was more pronounced, but remained very limited in extent.—T. St.

Potassium nitrite; Some properties of ——. E. Donath. Chem. Zeit., 1911, **35**, 773—774.

In order to determine the amounts of potassium nitrite, potassium nitrate, and potassium hydroxide present in a mixture, Fischer proposed concentrating the solution till the nitrate crystallised out, neutralising the free alkali in the mother liquor with acetic acid, and then mixing the liquid with 90 per cent. alcohol. The liquid separates into two layers, the lower of which is an aqueous solution of the nitrite, and the upper a dilute alcoholic solution of potassium acetate. The author has further found that after shaking an almost saturated solution of potassium nitrite with an equal volume of 96 per cent. alcohol, the mixture separates into a lower aqueous layer containing 71·9 per cent., and an upper alcoholic layer containing 6·9 per cent. of potassium nitrite. If, however, methyl alcohol be substituted for spirits of wine, the nitrite is precipitated as a well crystallised deposit, and can thus be separated from potassium hydroxide, which is not separated from aqueous solutions by methyl alcohol. The cloudiness produced by the addition of methyl alcohol to concentrated aqueous solutions of commercial potassium hydroxide is due to the separation of salts, and does not occur with chemically pure potassium hydroxide. On the other hand, concentrated solutions of sodium hydroxide are precipitated by methyl alcohol, which can be easily distilled from alkaline solutions. Sodium nitrite behaves quite differently; its concentrated solution does not separate into layers on addition of spirits of wine, neither is it precipitated by methyl alcohol.
—W. C. H.

Rare earths; Stearate separation of ——. C. W. Stoddart and C. W. Hill. J. Amer. Chem. Soc., 1911, **33**, 1076—1090.

The authors separate rare earth mixtures by adding a hot alcoholic solution of potassium stearate to a cold neutral solution of the earthy nitrates, drop by drop in quantities sufficient for the precipitation of only a fractional portion of the earths present. During precipitation the solution is agitated rapidly by means of a mechanical stirrer. The precipitate formed is easily filtered and washed. In dealing with the yttrium earths from monazite it is possible to prepare practically pure yttrium in a relatively small number of fractionations, though there is a brief pause in the process of separation at that stage when a fraction of the atomic weight, about 102, is obtained. When the method is applied to the yttrium earths from gadolinite, a rapid separation is noted without any pause at the fraction of atomic weight 102. The yttrium earth stearates are soluble in anhydrous compounds of relatively high boiling point (*e.g.*, carbon tetrachloride, xylene, etc.), but there is no evidence of differential extraction by these solvents. The gadolinium earths from monazite and gadolinite are also capable of separation by this method. From the monazite earths the authors have obtained europium, gadolinium, and samarium in a comparatively pure state. Incidentally, during the work on the gadolinium earths, the applicability of the stearate method to the members of the cerium group was established.—W. H. P.

Uranium salts; Reaction of ——. J. A. Siemssen, Chem.-Zeit., 1911, **35**, 742.

The precipitated ethylene diamine salt (this J., 1911, 283) is soluble not, as previously stated, in an excess of the reagent, but in an excess of the solution of the uranium compound. For a quantitative determination of uranium the precipitate is washed with cold water, and ignited in a platinum crucible, and the residue heated over the blowpipe until constant in weight, and weighed as U_3O_8. To prevent the precipitate becoming gelatinous, the ethylene diamine solution should not be diluted below 10 per cent.—C. A. M.

Thorium; Carbonates of ——. E. Chauvenet. Comptes rend, 1911, **153**, 66—68.

Thorium hydroxide at ordinary pressure absorbs carbon dioxide to form the basic carbonate, $CO_4Th,ThO_2,4H_2O$. At 30—40 atmospheres pressure it takes up more carbon dioxide, and forms the normal carbonate, $CO_4Th,2H_2O$. Anhydrous thoria which has been heated to redness is without action on carbon dioxide; but if it has not been heated beyond 430° C., it absorbs it, slowly at 1 atmosphere, more rapidly at 30 atmospheres, the compound, $CO_4Th,6ThO_2$, being formed. The precipitate formed from a solution of thorium salt by addition of sodium carbonate has the formula, $CO_4Th,8H_2O$, and dried *in vacuo*, leaves the substance, $CO_4Th,2H_2O$. When heated, it loses carbon dioxide and water, and becomes gradually more basic, till at 300° C. it is converted into the hydrated oxide $(ThO_2)_4H_2O$, which gives up its water at 430° C.
—J. T. D.

Actinium emanation; Transformation of the ——. H. Geiger. Phil. Mag., 1911, **21**, 201—204.

The experiments show that the actinium emanation consists of two products, each of which emits α rays. The first has a period of 4 seconds and emits α rays of a range of 5·7 cm.; the second has a period of 1/500 second or thereabout, and the range of its α rays is 6·5 cm.—it carries a positive charge, and is probably a solid.—J. T. D.

Carbon bitelluride, CTe_2. A. Stock and H. Blumenthal. Ber., 1911, **44**, 1832—1838.

When an arc is formed between electrodes of tellurium (or tellurium cathodes and graphite anodes) immersed in cooled carbon bisulphide, the tellurium is first vapourised, then, for the most part, is condensed by the carbon bisulphide to a fine black powder. Some, however, passes into solution, the carbon bisulphide becoming coloured yellow to brown-red. The yellow solution under the action of light is decomposed, a black precipitate separating out. Also, when the solution is evaporated, a residue consisting of tellurium, sulphur and carbon is left. Owing to the extremely unstable nature of the dissolved compound, efforts to ascertain its composition were for a long time unsuccessful. It was found however that by heating the solution in an exhausted sealed tube for 48 hours at about 175° C., a grey-black precipitate separated, leaving nearly pure carbon bisulphide. The precipitate was freed from carbon bisulphide and then gradually heated in a Jena tube sealed at one end. The open end was connected with a U-tube cooled in liquid air, and beyond this with a mercury air-pump. The heating was carried on till a temperature of 600° C. had been reached. In the U-tube there condensed a little carbon bisulphide. In the Jena tube three products separated according to their volatility. Furthest from the heated portion was a slight sublimate of tellurium dioxide and sulphur. Next was a thick ring of crystalline tellurium, and lastly there was the unvolatilised residue consisting of carbon with a little tellurium. The weights of carbon and tellurium corresponded to the formula, CTe_2. Carbon bitelluride is extremely unstable, readily resolving into its elements, the tellurium in the black form. This, however, quickly passes, with evolution of heat, into the metallic grey form. Owing to instability and sensitiveness to light, carbon bitelluride can only be prepared in subdued artificial light. It has an insupportable acrid odour. Very dilute solutions smell of garlic. Carbon bitelluride appears very similar to carbon biselenide, which has as yet been only obtained in very dilute solutions.—T. St.

Nitrous oxide; Analysis of ——. W. R. Smith and E. D. Leman. J. Amer. Chem. Soc., 1911, **33**, 1116—1117.

Difficulties have been observed in the analysis of nitrous oxide as supplied in cylinders in the liquid state, owing to the progressive variation in composition of the gas as it is removed. A cylinder whose true content was 1·4 per cent. of oxygen, 5·2 of nitrogen, and 93·4 of nitrous oxide gave 2·9 of oxygen, 11·2 of nitrogen, and 85·9 of nitrous oxide when nearly full, and 0·7 of oxygen, 1·6 of nitrogen, and 97·7 of nitrous oxide when nearly empty. A fair sample, however, can be obtained by inverting the cylinder and taking the sample from the bottom of the liquid. In this way an analysis of 1·1 per cent. of oxygen and 3·1 of nitrogen was obtained from a cylinder of true content, 1·0 per cent. of oxygen and 3·3 per cent. of nitrogen. —W. H. P.

The Cheshire salt trade. Times, July 25, 1911.

The brine authorities within the Cheshire salt area held a conference at Northwich on July 24 relative to the locking up of brine lands and the removal from Northwich of brine for an undertaking by which 150,000 tons of salt per annum are to be produced, and to ask the President of the Local Government Board immediately to confer with the Local Authorities, the County Council, the Salt Union, and Brunner, Mond, and Co., with a view to an amicable settlement. The conference expressed the opinion that a Bill should be promoted forthwith restricting the removal of brine beyond three miles, and preventing brine lands being locked up.

Sulphur in Sicily. Foreign Off. Ann. Series, No. 4737.

An account is given of the working of the Sicilian Sulphur Combine (Consorzio Obbligatorio) for the year August 1, 1909, to July 31, 1910, the figures showing that the production was rather under than above the demand, and that the amount of stocks and liabilities on warrants show improvement. There has been a reduction in the output of sulphur, from an average of 505,518 metric tons per annum during the years 1897–1906 to the present figures of 396,664 metric tons for 1909–10. The heavy existing stocks (July 31, 1910, 596,128 metric tons) still unsold show that the crisis would only be aggravated by any return to former figures. It is not considered likely that the average annual output will again exceed 400,000 tons per annum, as no important new sulphur-deposits have been discovered, and some of the old ones are worked out. The profit-and-loss account of the Consorzio for the year 1909–10 shows 411,532*l.* gross profits and 279,281*l.* expenses and losses.

Behaviour of carbon dioxide and certain gaseous mixtures in the high pressure arc. Muthmann and Schaidhauf. *See* XI.

Chemistry of anaesthetics. II. Examination of commercial oxygen. Baskerville and Stevenson. *See* XX.

Patents.

Nitric oxide and nitrogen peroxide; Manufacture of pure ——. Farbwerke vorm. Meister, Lucius und Brüning, Hoechst on Maine, Germany. Eng. Pat. 10,522, May 1, 1911. Under Int. Conv., Oct. 31, 1910.

Nitric oxide of 99—100 per cent. strength is obtained at the cathode by the electrolysis of dilute nitric acid containing a certain amount of nitrogen peroxide or nitrous acid. The best results are obtained by using nitric acid of not more than 40 per cent. strength, which contains 1 per cent. or less of nitrogen peroxide or nitrous acid, and by maintaining the temperature at or below 40°—50° C. The cathode may be made of carbon, graphite, gold, or platinum; the nitric oxide which is evolved may be dried by means of concentrated sulphuric acid, and may be converted into pure nitrogen peroxide by adding to it the corresponding quantity of pure, dry oxygen or air.—O. R.

Phosphorus pentoxide and calcium silicate; Process of making ——. S. Peacock, Chicago, Ill. Assignor to American Cyanamid Company, New York. U.S. Pat. 997,086, July 4, 1911.

Calcium phosphate is mixed with crude silica, iron oxide, and alumina in such proportions that sufficient calcium oxide will be present in the mixture to combine with substantially all of the silica, iron oxide, and alumina. The mixture is heated, in thin layers, in a non-reducing atmosphere to a temperature sufficient to volatilize the phosphorus pentoxide.—G. W. McD.

Brine; Treatment of ——. The Salt Union, Ltd., Liverpool, G. W. Malcolm, Davenham, Cheshire, and F. T. Munton, Winsford, Cheshire. Eng. Pat. 13,415, June 2, 1910.

In the manufacture of salt from brine by the vacuum process, sufficient brine is electrolysed to yield an amount of sodium hydroxide equivalent to the amounts of magnesium and calcium salts present in the quantity of brine to be treated. The sodium hydroxide is partially carbonated, and the alkaline liquid is mixed with the raw brine, the mixture allowed to settle, and the purified brine decanted off and evaporated. Evaporation takes place in vacuum pans, heated by means of exhaust steam from non-condensing engines, which drive the generators of the current used for electrolysis.—O. R.

Potassium salts from felspar; Process of obtaining ——. F. Thompson, Newark, Del. U.S. Pat. 995,105, June 13, 1911.

A mixture of 5 parts of finely powdered felspathic rock, 5 parts of an alkali bisulphate, and 1·8 parts of an alkali chloride, is heated to a bright red heat, cooled, and leached with water, and potassium and sodium sulphates are separated from the resulting solution.—O. R.

Ammonium sulphate direct from coke-oven or retort gas; Process to recover ——. R. Fabry, Sheffield. Eng. Pat. 5667, Mar. 7, 1911.

The zinc sulphide, which is precipitated when coal gas is washed with zinc sulphate solution with formation of ammonium sulphate and zinc sulphide (Eng. Pat. 4473 of 1910; this J., 1910, 1203), is subsequently converted into zinc sulphate by means of sulphuric acid. The hydrogen sulphide, which is evolved, is burnt with a suitable quantity of air, and the products of combustion are converted into sulphuric acid, preferably by the contact process.—O. R.

Ammonium nitrate; Manufacture of —— *and compounding it with other salts for agricultural purposes.* J. Price, London. Eng. Pat. 5657, Mar. 7, 1910.

Air, steam, and oxygen are mixed, subjected to a temperature of 2000°—3000° C. in a suitable furnace, and suddenly cooled under pressure with the formation of ammonium nitrate; or, air and steam only may be used in the furnace, and hydrogen peroxide added in the cooling chamber. The temperature of the latter may vary from —40° to —120° C., and the pressure, which is simultaneously applied, may be from 30 to 2 atmospheres respectively. The ammonium nitrate may be compounded with a suitable phosphate, sulphate or carbonate, either in the dry state or in the presence of water, the mixture in the latter case being finally evaporated in a vacuum.—O. R.

Ammonium sulphate; Machine for the dust-free drying and grinding of ——. J. Vorraber, Köln-Lindenthal, Germany. Eng. Pat. 14,638, June 17, 1910. Under Int. Conv., Dec. 9, 1909.

The machine consists essentially of a double-walled, rotating drum, surrounded by a casing. The walls are connected to each other by means of a series of radially arranged tubes, which serve for the passage of hot gases from a burner, whereby the drum is heated both externally and internally. Ammonium sulphate, which has been crushed and ground by means of rollers, is conducted into the hollow space enclosed between the walls of the drum, and is distributed by means of ribs projecting from the walls of the drying chamber. The dried product is conveyed to the end of the drum, where it passes between two revolving grinding-rings, which are adjustable and serve to pulverise and deliver the material out of contact with air. The heated gases, which flow through the drum, are sucked off by means of a fan.—O. R.

Arsenical vapours; Apparatus for treating ——. J. F. Peck, Providence, R.I., Assignor to G. O. Draper, New York. U.S. Pat. 996,516, June 27, 1911.

The vapours are drawn by suction through a thick creamy milk of lime in a series of vessels, so that the arsenic in the vapours is absorbed.—A. T. L.

Lead oxide ; Manufacture of ——. G. V. Barton, Liverpool. Eng. Pats. 13,600 and 27,867, June 4, and Nov. 30, 1910.

The lead melting-pot described in Eng. Pats. 13,458 of 1908 and 4465 of 1909 (this J., 1909, 992 and 1910, 87) is provided with means for subjecting the material, after it has left the pot, to the action of jets of highly heated air under pressure. This may be done by means of concentric flues, the inner one serving for the passage of the lead oxides and the outer one for the admission of air, highly heated in a supplementary furnace. A series of pockets or depressions are fitted into the neck, which connects the melting-pot with the central flue, and serve to intercept unoxidised lead, which is collected periodically. The material passes from the central flue into a water-jacketed chamber fitted with a screw conveyor, whereby it is rapidly cooled and the finished product is delivered in the desired state of oxidation. The delivery chamber communicates with a smaller collecting chamber, and the latter with a water-sprayed receiver, these last two chambers serving to collect any small particles of lead oxide, which may be still present in the air blast.—O. R.

Potassium bitartrate ; Process for the extraction and recovery, in the state of —— *of the total tartaric acid contained in lees, crude tartars, and tartaric material generally.* Cantoni, Chantems et Cie and E. Degrange. Fr. Pat. 426,714, Feb. 25, 1911.

The material is successively treated with a solution containing a limited quantity of an alkali salt (such as sodium carbonate), or a mixture of alkalis, and with one or more acids (such as hydrochloric acid), so as to obtain two liquids ; or, separate portions are treated with acid and alkali respectively. Oxalic acid, equivalent to any calcium present, is then added to the acid solution and potassium chloride or other potassium salt to the alkali solution, the reagents being added in such proportions that, by mixing the two solutions, all the calcium present is precipitated as oxalate and the tartaric acid as potassium bitartrate. The latter is then separated from the precipitate by solution in hot water containing a little oxalic acid. It is claimed that a saving of 50 per cent. in reagents is effected, as compared with the usual treatment by acids or alkalis alone. Carbon dioxide constitutes a valuable by-product in the process. The oxalic acid is recovered and used again.—F. Sodn.

Ferrated alkali silicate ; Impts. in —— *by addition of borax.* Bessler, Waechter and Co., Ltd.. and T. Rouse, London. Eng. Pat. 21,563, Sept. 16, 1910. Addition to Eng. Pat. 2440 of 1910 (this J., 1911, 283).

About 1 per cent. of ferric oxide and ½ per cent. of calcined borax are added to the materials used in the preparation of an alkali silicate, thereby improving the properties of the product, when used as binding material for briquetting powdered fuel, ores, and the like.—O. R.

Potassium chlorate ; Process and apparatus for the transformation of potassium chloride into ——. Prod. Chimiques Electroniques. Fr. Pat. 426,117, Feb. 16, 1911.

A solution of potassium chloride is submitted to the influence of chemically active rays, in the presence of free oxygen. Suitable apparatus consists of two or more communicating superposed spherical vessels of cast-iron with athermanous lining, each of which is provided with a lamp, disposed axially, and a window through which the intensity of the light may be observed. These spheres are filled from an upper reservoir with a solution of potassium chloride, and oxygen or air, admitted below, is made to bubble through the solution. The uppermost sphere communicates by a vertical tube, provided with observation windows, with an upper receiver into which the liquid rises as the transformation proceeds, owing to an accompanying increase of volume. At the completion of the process, which is ascertained by observing the volume and by examining a sample of the liquid, the solution is slowly replaced by a further supply of chloride. —F. Sodn.

Perborate ; Process for the manufacture of mixtures containing a ——. Saccharin Fabrik. Aktienges., vorm. Fahlberg, List und Co. Fr. Pat. 425,958, Feb. 11, 1911. Under Int. Conv., Feb. 12, 1910.

Crystallised sodium perborate is mixed with an acid salt of sulphobenzoic acid, preferably in equivalent proportions, for example, 10 kilos. of the former to 14·6 kilos. of acid sodium sulphobenzoate. The resulting mixture is stable and is decomposed by water, giving hydrogen peroxide, boric acid, and sodium sulphobenzoate, 12 grms. of the above mixture, for instance, dissolved in 100 c.c. of water, giving a 1 per cent. solution of hydrogen peroxide.—F. Sodn.

Perborate mixture yielding hydrogen peroxide ; Stable ——. A. Klages and F. Sommer, Salbke-Westerhüsen on Elbe, Germany. U.S. Pat. 996,773, July 4, 1911.

See Fr. Pat. 425,958 of 1911 ; preceding.—T. F. B.

Cyano-compounds [alkali cyanides and cyanamides] and other analogous compounds ; Process for the production of ——. "The Nitrogen Co." États-Unis d'Amerique. Fr. Pat. 425,699, Oct. 14, 1910.

Barium or other suitable metal, such as lithium, strontium, or manganese, preferably liberated *in situ* by electrolysis, is made to react in a bath of molten salts (chiefly alkali cyanide), with carbon or a compound (such as a hydrocarbon) from which carbon is liberated under the conditions of the process, and nitrogen, or a compound furnishing such (*e.g.*, ammonia), is brought into contact with the carbide thus formed, so as to give a cyanide (barium cyanide), which is then decomposed by an alkali metal, preferably produced by electrolysis in the same bath, forming alkali cyanide and the original metal (barium). The process may be carried out as follows :— Two electrolytic cells of refractory material communicate at the bottom ; they contain as electrolytes, at the start, molten barium chloride, with a small proportion of sodium chloride, and melted sodium cyanide, preferably with some barium cyanide added, respectively, the electrolytes floating on the surface of molten lead or other heavy metal, which separates the two cells, but is kept circulated between them. There are carbon anodes in the first cell, and a cathode of iron, nickel, or carbon in the second. Under the influence of the current, barium and sodium are liberated at the surface of the lead (cathode) in the primary cell, and the alloy thus formed passes into the secondary cell, where it constitutes the anode ; barium cyanide is here produced by the action of the discharged anions, and this reacts with the sodium liberated at the cathode to give sodium cyanide and barium ; the barium then combines with carbon, which is introduced into this cell, giving barium carbide, and the finely divided carbide is converted into cyanide by taking up nitrogen which also is passed into the molten electrolyte. The barium cyanide again interacts with sodium to give sodium cyanide and barium, so that a further supply of barium salt is not required after a sufficient proportion has been introduced. In the absence of free carbon in the secondary cell, the barium reacts with sodium cyanide to form sodium cyanamide (which may be prepared thus), but this is reconverted into cyanide, as soon as carbon is added. When a sufficient quantity of sodium cyanide has been produced, the current of nitrogen is stopped and, after all barium cyanide has been decomposed, the suspended barium carbide and carbon are allowed to settle and the molten cyanide is withdrawn ; or, the barium cyanide may finally be allowed to accumulate, so that a mixture of sodium and barium cyanides is obtained.—F. Sodn.

Hydrocyanic acid ; Process for the manufacture of ——. Aluminium-Industrie Akt.-Ges., Neuhausen, Switzerland. Eng. Pat. 16,275, July 7, 1910. Under Int. Conv., Sept. 24, 1909.

See Fr. Pat. 417,794 of 1910 ; this J., 1911, 26.—T. F. B.

Spraying of matter in suspension and spraying nozzles therefor [absorbing nitrous gases]. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 25,301, Oct. 31, 1910.

See Addition of Nov. 9, 1910, to Fr. Pat. 412,788 of 1910; this J., 1911, 684.—T. F. B.

Ammonia; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 15,973, July 4, 1910.

See Fr. Pat. 418,287 of 1910; this J., 1911, 85. Reference is directed in pursuance of Sect. 8, Sub-sect. 2, of the Patents and Designs Act, 1907, to Eng. Pat. 14,023 of 1910.—T. F. B.

Cuprammonium solution; Process of making ——. H. Bernstein, Philadelphia, U.S.A. Eng. Pat. 15,991, July 5, 1910.

See U.S. Pats. 965,273 and 965,557 of 1910; this J., 1910, 1105.—T. F. B.

Ammonium sulphite or sulphate from gases; Process for the preparation of ——. K. Burkheiser, Aachen, Prussia. Eng. Pat. 15,877, July 2, 1910. Under Int. Conv., July 2, 1909.

See Addition of July 1, 1910, to Fr. Pat. 394,926 of 1908; this J., 1911, 13.—T. F. B.

Ammonium sulphite and sulphate from coke-oven gases; Process for making ——. Chem. Industrie Akt.-Ges., and F. Wolf. Fr. Pat. 426,272, Jan. 25, 1911.

See U.S. Pat. 994,435 of 1911; this J., 1911, 803.—T. F. B.

Ammonia from peat; Process for obtaining ——. P. Mason and The Sulphate of Ammonia Co., Ltd. Fr. Pat. 426,125, Feb. 16, 1911.

See Eng. Pat. 15,285 of 1910; this J., 1911, 620.—T. F. B.

Hydrosulphites; Process for making anhydrous ——. Chem. Fabr. von Heyden A.-G. Fr. Pat. 426,465, Feb. 8, 1911.

See Eng. Pats. 16,540 and 28,773 of 1910; this J., 1910, 1204; 1911, 747.—T. F. B.

Alkali metals; Separation of —— from alloys or combinations thereof with other metals. G. W. Johnson, London. From R. J. McNitt, Niagara Falls, U.S.A. Eng. Pat. 20,989, Sept. 8, 1910.

See Fr. Pat. 420,288 of 1910; this J., 1911, 369.—T. F. B.

Alkali silicate; Manufacture of a ferrated and borated ——. T. Rouse, and Bessler, Waechter, and Co., Ltd. Fr. Pat. 425,853, Jan. 16, 1911. Under Int. Conv., Jan. 31, and Sept. 16, 1910.

See Eng. Pats. 2440 and 21,563 of 1910; this J., 1911, 283, and preceding.—T. F. B.

Carbonates of barium, strontium, potassium, and sodium; Process of treating the —— to obtain the respective peroxides and oxides or hydrated oxides. V. Bollo and E. Cadenaccio, Genoa, Italy. Eng. Pat. 24,817, Oct. 25, 1910. Under Int. Conv., Oct. 27, 1909.

See Fr. Pat. 420,470 of 1910; this J., 1911, 361.—T. F. B.

Refractory materials; Treatment of —— and apparatus therefor. E. Weintraub, Lynn, Mass., Assignor to General Electric Co., New York. U.S. Pats. 997,879, 997,880, and 997,881, July 11, 1911.

See Eng. Pat. 1197 of 1907; this J., 1908, 226.—T. F. B.

VIII.—GLASS; CERAMICS.

Ceramic products; Content of phosphoric acid in ——. A. Indra. Chem. Zeit. 1911, 35, 774.

The analyses of a series of refractory clays of various kinds have shown a content of phosphoric acid, ranging from 0·023 up to 0·109 per cent. of P_2O_5. It is highly probable that phosphoric acid is present in all clays, and consequently in ceramic products. This is in agreement with a recent observation of K. Endell, that although phosphoric acid, which is present in most eruptive rocks as apatite, is removed in the process of kaolinisation, kaolin from Adolfshütte contained 0·12 per cent. of P_2O_5. From a technical point of view, the amount of phosphoric acid is generally unimportant, but should not be overlooked for example, in the case of materials to be used for lining furnaces for certain operations in the metallurgy of iron.—W. C. H.

Patents.

Ceramic refractory material of high electric resistance; Manufacture of ——. H. Körber and A. Diltsch, Austria. Fr. Pat. 425,977, Feb. 13, 1911.

A mixture is made of 1—2 parts by weight of powdered magnesium or aluminium, 5 of magnesia, 3—4 of waterglass or other silicate, and 3 of quartz. Artificial stones prepared thus are said to offer a resistance of 10 megohms at red heat, to be unchanged at 1800° C., and to be quite non-conducting at ordinary temperatures.—H. H. S.

Covering for unfired pottery to prevent efflorescence. M. Perkiewicz, Germany. Fr. Pat. 426,285, Feb. 20, 1911.

The pottery is treated with a solution of glue and a mixture of phenol and formaldehyde which will condense to phenol aldehyde. This on treatment with another solution, of copper sulphate, barium nitrate or weak oxalic acid, forms a resinous skin on the brick or other body which prevents the efflorescence of soluble salts from the body.—H. H. S.

IX.—BUILDING MATERIALS.

Clays; The behaviour of certain —— towards water. E. Donath. Chem.-Zeit, 1911, 35, 774.

When dry clay, the pores of which are filled with air, is sprinkled with water, the mass falls to pieces, and owing to the escape of the air the finest particles are floated upwards, and the cohesion of the mass destroyed, especially at those points where foreign admixtures are present. This phenomenon was shown very distinctly by some carbonaceous clays, belonging to the chalk formation, obtained from a Moravian mine. The amount of combustible (carbon) substance ranged from 20 to 50 per cent. and the residue on ignition varied between 33 and 71 per cent. The disintegrating effect of water was most noticeable with a clay giving 60 per cent. of mineral matter. When these clays, either in lumps or in powder, were enclosed in a moist atmosphere, they gradually absorbed water up to 12 per cent. No deformation of the mass took place, and a crack could be seen only here and there, until about 5 per cent. of water was dropped on the lumps from a burette, when cracks began to show. With an addition of rather more than 8 per cent. of water the lumps fell to pieces after some time to a thick paste. The cohesion of these clays is very much diminished by the enclosed particles of coal. This property, possessed by certain carbonaceous clays, of at once falling to pieces under the action of larger quantities of water is quite characteristic, and affords a means of separating the actual coal from the clay, since, as far as is known, no coal shows the same property under the action of relatively small amounts of water.—W. C. H.

Reinforced concrete; Resistance of —— to explosives. Eng. and Mining Jour. 1911, **92**, 105.

The extraordinary resistance of reinforced concrete to violent shocks was demonstrated in France during the investigations on coaldust explosions, in the Liévin gallery. More recently, at the factory of the Prest-O-Lite Company, Indianapolis, U.S.A., two gas-storage drums exploded, the shock of the explosion cracking the walls of a building 100 feet away. The actual building, constructed of reinforced concrete, in which the explosion occurred, remained however practically undamaged, except for a hole in the roof, the size of the drum base.—C. A. W.

Patents.

Cement; Manufacture of very silicious artificial ——. C. Candlot. Fr. Pat. 425,868, Jan. 21, 1911.

Very silicious materials are usually avoided in the manufacture of Portland cement because of the high temperature required in the firing. This difficulty is overcome by the addition of a flux such as fluorspar or oxide of iron. A small quantity of alumina as clay or bauxite is also added.—H. H. S.

Firebricks and the like; Manufacture of ——. K. A. Mankau, St. Petersburg. Eng. Pat. 14,981, June 22, 1910.

See Fr. Pat. 417,293 of 1910; this J., 1911, 29.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Chromium steels. Portevin. Comptes rend., 1911, **153**, 64—66.

Guillet (this J., 1904, 373, 867) found that chrome steels with 0·1 per cent. of carbon and 7 to 22 per cent. of chromium were martensitic. The author shows that in this state they are not really stable, and that by extremely slow cooling from 1300° C. they can be brought into a state similar, in structure and in hardness, to that of ordinary steels of the same carbon content. If in this state they are subjected to annealing in the ordinary practical acceptation of the term the effect is that of quenching—they become martensitic and increase considerably in hardness.—J. T. D.

Vanadium in vanadium and chrome-vanadium steels; Determination of ——. J. R. Cain. J. Ind. Eng. Chem., 1911, **3**, 476—481.

An investigation of the sources of error in the methods commonly used for the determination of vanadium in steels has been made at the Bureau of Standards (U.S.A.). These sources of error are described in detail and a new method is proposed. 2—4 grms. of the steel are dissolved in 40—60 c.c. of 10 per cent. (by vol.) sulphuric acid in a covered 300 c.c. Erlenmeyer flask. The insoluble matter is filtered off, washed two or three times with water, ignited, and fused with potassium bisulphate, the aqueous solution of the fusion being added to the main solution. Hydrochloric acid may be used instead of sulphuric acid if the steel will not dissolve readily in the latter. The solution is nearly neutralised with sodium carbonate solution, and finely powdered cadmium carbonate is added, in small portions, at intervals of 4 or 5 mins., the solution being boiled vigorously in between and the flask kept well covered: about 15—20 mins. boiling is usually sufficient, and a gram or two of cadmium carbonate should be left undissolved at the end. The precipitate, which contains the whole of the vanadium and chromium and a small quantity of iron, is allowed to settle, filtered off rapidly, washed twice with hot water, and dissolved with the minimum quantity of nearly boiling 10 per cent. sulphuric acid, the solution being collected in the flask in which precipitation was effected. (When hydrochloric acid is used for dissolving the sample, the carbonate precipitate must be dissolved in sulphuric acid and the precipitation repeated.) The solution is boiled, cooled, nearly neutralised with ammonia, and the cadmium precipitated by passing a rapid current of hydrogen sulphide for a few minutes through the boiling solution. The precipitate is filtered off, washed with hot water, and the filtrate concentrated to 60—70 c.c. and electrolysed with a current of 5—6 ampères at 6—7 volts, using a mercury cathode; the iron and chromium are deposited on the cathode. When the solution is free from iron (ferricyanide test) and chromium (no colour or turbidity on treating 3—4 c.c. with a few drops of hydrogen peroxide, boiling till the brown colour due to vanadium peroxide disappears, and adding ammonia), it is removed and the cathode washed two or three times with 25—30 c.c. of water, with the current passing. (The test portion of the electrolyte should be acidified with sulphuric acid before returning it to the electrolytic bath.) After adding 2 or 3 c.c. of sulphuric acid (1 : 1 by vol.) the solution is heated to 70°—80° C., and permanganate added till a strong pink colour is produced. Sulphur dioxide is then passed into the boiling solution for a few minutes, the excess of sulphur dioxide is removed by a current of carbon dioxide, the solution is filtered through asbestos (not paper) or a Munroe crucible, cooled to 70°—80° C., and titrated with *N*/50 permanganate. The adaptation of the method to the determination of chromium in steels is being worked out.—A. S.

Vanadium poisoning. Lees. *See* XIXb.

Titanium; For malleable iron. C. H. Gale, Pittsburgh, Pa. Proc. Amer. Foundryman's Association; 1911, 271.

In view of the well-known efficiency of titanium for deoxidising metals, a ferro-titanium alloy was added to open-hearth "malleable." No definite conclusions were arrived at as to the effect of titanium added to the metal in the ladle, but when added to the bath of molten metal in the furnace, about 30 to 45 minutes before tapping, an improvement in the quality of the product, as shown by transverse and tensile tests, was noticed. The titanium was in the proportion of 0·03 and 0·06 per cent. respectively for two series of tests. No titanium remained in the finished metal. For heavy work, by adding titanium the silicon might be lowered and still produce strong soft castings, as it is found that graphite separates out more readily after purification of the metal by means of titanium. Added in the furnace, titanium prevents oxidation, even though the charge undergoes a prolonged heating.
—R. W. N.

Rust; Contribution to the knowledge of ——. E. Donath and A. Indra. Chem.-Zeit., 1911, **35**, 773.

In connection with the rusting of iron embedded in concrete, as a preliminary, the authors have investigated the chemical constitution of four samples of rust. 1. From a steel bomb which had contained sulphurous acid and had been exposed for some time to fumes of sulphurous acid. 2. Rust scale from the outer surface of a boiler which had been exposed for a long time to the atmosphere, and rust from malleable iron. 3. Rust scale from the cast iron base of a machine, which had also been exposed for some time to the atmosphere. 4. Rust from strong wire netting. The specimens were carefully removed from the articles by a brush. It must of course be admitted, that in rusting, not only is pure iron itself converted into rust, but that the other constituents, such as silicon, manganese, etc., undergo a chemical change, and the resulting products of these constituents must appear in the rust. The percentage compositions of the four specimens were :—

	1.	2.	3.	4.
Moisture	4.41	1·74	2·35	1·60
Combined water	12·21	7·53	6·23	1·55
Carbon dioxide	0 83	0·25	0·65	0·93
Silica	0·49	0·46	3·32	0·84
Phosphoric acid (P_2O_5)	0·46	0·08	0·43	0·23
Sulphuric acid, reckoned as SO_3	2·72	0·06	0·18	0·07
Ammonia	1·07	0·02	0·06	0·02
Ferrous oxide	2·23	2·79	6·04	1·03
Ferric oxide	74·52	86·45	78·56	92·94
Manganic oxide (Mn_2O_3)	0·23	0·33	1·69	0·41
Graphite	?	?	0·49	?

With cast iron it is highly probable that the graphite exists as such in the rust, but it is not clear what happens to the non-graphitic carbon. In the case of No. 1, the sulphur dioxide in the atmosphere surrounding the bomb doubtless influenced the formation of the rust, a point which is confirmed by the relatively large amount of sulphuric acid combined with the ammonia, as ammonium sulphate, and with iron as 0·42 per cent. of ferrous sulphate. Distinct amounts of sulphuric acid indeed appear in all the samples. The sulphur in iron is present as sulphide and on rusting is oxidised to iron sulphate, which, together with the feebly acid nature of the ferric hydroxide serves to fix traces of ammonia in the atmosphere, and thus accounts for the ammonia content in the rust. As carbon dioxide is present in all these analyses, its influence on the formation of rust cannot be ignored, even if the assumption that its presence is a necessary factor in the process is rejected. The state of oxidation of the manganese is not certain, but there is no doubt that relatively large amounts of ferrous oxide are present, since when dissolved in hydrochloric acid and diluted with water, the rusts gave a rich blue precipitate with potassium ferricyanide.—W. C. H.

Zinc vapour; Condensation of —— from electric furnaces. F. T. Snyder. Trans. Amer. Electrochem. Soc., 1911, **19**, 317—331.

In the electric smelting of zinc it is practicable and convenient to deliver zinc vapour to a condenser at a rate 300—400 times greater than that at which it is delivered to the standard retort condenser, and the designing and construction of efficient condensers of large capacity has thus become an important question. The author discusses the problem in detail on the basis of the data furnished by the retort condenser which is an efficient apparatus for its particular purpose. The result arrived at is that for a large condenser designed on the basis of the proportions of the retort condenser, it is necessary to provide 1 sq. cm. of clay cooling surface (or an equivalent amount of some other material) for each 0·4 grm. of zinc vapour to be condensed to the molten metal per hour; to arrange the thickness of the material of this cooling surface and the temperature conditions at the other or non-condensing side of the material so that 0·21 kilo.-calories of heat will flow through each sq. cm. of the surface per hour when the average temperature of the condensing surface is 725° C.; and to arrange the volume inside the condenser so that the product of the average longitudinal velocity of the gases in cm. per second and the average distance through which the zinc vapour has to diffuse to the condensing surface (corrected to the standard temperature of 864° C., at which the normal mixture of equal volumes of zinc vapour and carbon monoxide condenses) in cm. is 9·5. In many large zinc condensers which have been built or proposed, means of applying heat are provided, but this should be unnecessary in a properly designed condenser.—A. S.

Tin; Distillation of —— in vacuo. E. Tiede and F. Fischer. Ber., 1911, **44**, 1711—1717.

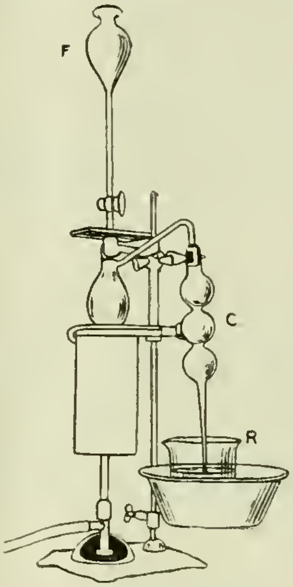
Tin, although it melts at 230° C., has a very high boiling-point, and its distillation is a very difficult matter. The authors have succeeded in causing the distillation of several grams by heating it electrically in a small magnesia or porcelain tube. The heating coil of platinum wire is wrapped round the tube and the whole placed in an exhausted glass vessel whose outer walls are well cooled by flowing water. The first product of the distillation is a yellow deposit which gradually darkens and becomes nearly black. The yellow powder, which is found with all varieties of tin, appears to possess all the properties of stannous sulphide. If the tin be prepared under special conditions so as to be quite free from sulphur, only a black distillate is obtained of pure tin, but in the air of the laboratory this soon becomes contaminated with sulphide.—W. H. P.

Non-ferrous metals; Melting —— in an electric furnace. C. A. Weeks. Met. and Chem. Eng., 1911, **9**, 363—365.

In order to prevent the volatilisation of the molten metals, the author designed a furnace of the arc type, in which the heat is transferred to the metal by radiation from the arc, together with some reflection and conduction from the walls and roof of the furnace. The furnace is entirely enclosed, and the atmosphere is neutral (see U.S. Pat. 949,511; this J., 1910, 363). The efficiency of the furnace for melting copper, bronze and brass, and for refining zinc dross, is demonstrated by the author, and figures showing the cost of working compared with those of direct oil-fired and coke-heated furnaces are given.—T. St.

Arsenic and antimony; Determination of —— in anode and cathode copper. E. F. Kern and Ching Yu Wen. Met. and Chem. Eng., 1911, **9**, 365—367.

10—30 grms. of copper are dissolved in concentrated nitric acid and 1 grm. of ferrous sulphate added. After driving off nitrous fumes the solution is diluted to 400—500 c.c., warmed, and excess of strong ammonium hydroxide added. The precipitate is filtered off, washed with hot dilute ammonia solution, dissolved in 20 c.c. of concentrated nitric acid, and the solution evaporated to fuming with 10 c.c. of sulphuric acid. After cooling, about 5 c.c. of a 10 per cent. solution of hypophosphorous acid, or 6 c.c. of a 20 per cent. solution of potassium hypophosphite are added (provided the solution does not contain more than 0·3 grm. of arsenic). The solution is again heated until all the excess of the hypophosphorous acid or potassium hypophosphite is destroyed. To ensure this, fumes of sulphuric anhydride should be caused to be evolved freely for at least half an hour. After cooling, the solution is transferred to the distillation flask, the beaker being rinsed twice with only 10 c.c. of water, and the solution is then raised slowly to the boil in order to expel any sulphurous acid gas that may be present in the solution. After allowing to cool, 40 c.c. of concentrated hydrochloric acid are added, and the distillation flask is adjusted as shown in the diagram. The beaker, R, contains 250 c.c. of water, and the tip of the condenser, C, is immersed to a depth of about ½ inch. The tube of the funnel F is filled with concentrated hydrochloric acid, and 80 c.c. are then poured into the bulb. The solution in the flask is brought to the boil very slowly and then the acid is allowed to run in at such a rate (three drops in two seconds) that the volume in the flask remains approximately constant. When the acid in the funnel, F, is nearly exhausted, the distillation is complete. The distillate is nearly neutralised with 30 per cent. potassium hydroxide solution and the neutralisation completed (after cooling the solution) with a saturated solution of sodium bicarbonate, the addition of an excess of 70—80 c.c. being necessary. The neutralised solution is then titrated with $N/10$ iodine solution. *Antimony.* The solution remaining in the distillation flask is transferred to a beaker, diluted to about 400 c.c., warmed, and saturated with hydrogen sulphide. After washing with hydrogen sulphide solution, the precipitate and paper are treated for an hour at room temperature with 40 c.c. of a 10 per cent. solution of potassium sulphide. The filtered solution is acidified with dilute sulphuric acid



and the precipitated antimony sulphide filtered. Precipitate and paper are then treated with 40 c.c. of concentrated hydrochloric acid and 1 grm. of potassium chlorate is added little by little. After complete solution of the antimony sulphide, free chlorine is expelled, and the cellulose fibre is filtered off and washed with hot dilute hydrochloric acid. The filtrate is evaporated to 50 c.c., 20 c.c. of concentrated hydrochloric acid added, and the solution diluted to 600—700 c.c. 3 grms. of potassium iodide are then added, and the solution titrated with $N/10$ solution of sodium thiosulphate, starch being used as indicator. The thiosulphate is run in very slowly until the blue colour disappears for at least one minute.—T. St.

Electroplating ; Some unsolved problems in ——. G. B. Hogaboom. Trans. Amer. Electrochem. Soc., 1911, **19**, 53—58.

Mainly owing to the great development of the automobile industry, one of the chief needs of the electroplating industry is an acid electrolyte from which a satisfactory heavy deposit of brass could be obtained. At present brass is deposited from a cyanide solution, but the process is slow and the deposit is frequently unsatisfactory on account of "spotting out"—a discolouration which appears on the work in spots after polishing and lacquering. For the deposition of tin the electrolyte prescribed by Roseleur in 1854 is still most generally used, and there is a demand for an electrolyte capable of giving a heavy deposit and of being replenished by the anode. No satisfactory electrolytes have yet been devised for the plating of aluminium with gold, silver, copper, or brass, so that the deposit will stand burnishing and not peel off in time. Other unsolved problems mentioned are : a method of removing a deposit of nickel from another metal without affecting the latter ; an electrolyte for the removal of fire-scale from brass, and one that could be used in place of immersion in acid for producing a bright or matt surface ; a method of cleaning metals in which the grease is saponified by the electrolyte ; a method of producing a heavy deposit of lead on the inside of iron pipes to prevent rapid corrosion ; a method of coating electro-galvanised iron or steel with decorative metals without destroying the protective action of the zinc coating ; an alkaline nickel-silver electrolyte to be worked with a low voltage ; a method of etching steel without destroying a resistance film of gelatin ; a method of obtaining a heavy deposit of platinum ; and an alkaline substance capable of acting as a substitute for potassium cyanide.—A. S.

Radium ; Method of investigating the quantity of —— *in rocks and minerals.* J. Joly. Phil. Mag., 1911, **21**, 134—150.

The finely ground rock or mineral is mixed with four times its weight of potassium and sodium carbonates, and fused in a platinum crucible which is bedded in magnesia and heated by a platinum resistance wire. The crucible rests on asbestos on a thick iron disc, and a silica shade, resting in an annular groove in the disc and mercury-sealed, confines the gases evolved, which can only escape through a hole in the disc provided for the purpose, and are collected, after drying, in a strong rubber bag of some 600 c.c. capacity. When the fusion is complete, the gases in the furnace are washed through into the bag by a stream of air, and the whole of the contents of the bag is then admitted into the exhausted electroscope. The temperature reached is about 1150° C., but the decomposition is practically complete about 900° C. The electroscope is calibrated by fusing a rock specimen, alone and with some admixed uraninite, the difference giving the effect of the uraninite, and enabling the instrument to be calibrated. With basic rocks, addition of a little boric acid increases the liveliness of the effervescence and the ease of escape of the emanation. Rocks may also be fused with borax glass instead of the alkali carbonates. The results obtained by this method are always a little higher than those obtained by the solution method ; and the fusion method is preferable as involving fewer materials and less manipulation. It would probably be desirable to use it in treating the residues from the evaporation of natural waters.—J. T. D.

Sulphuryl chloride ; Action of —— *on certain metals.* H. B. North, Bull. Soc. Chim., 1911, **9**, 646—649.

When gold, platinum or iron is treated, in the form of powder, with excess of sulphuryl chloride, no action occurs at ordinary temperatures, but on heating in a sealed tube to about 160° C. the metals dissolve, and on cooling, crystals of the chlorides ($AuCl_3$, $PtCl_4$ or $FeCl_3$) separate. In the case of gold (for example) the reaction probably proceeds thus :—$2Au + 3SO_2Cl_2 = 2AuCl_3 + 3SO_2$. Sulphuryl chloride is without action on silver, zinc or cadmium even at 300° C. Mercury is readily attacked, with formation of the bichloride.—J. H. L.

Copper heated in a vacuum ; The extraction of gases from ——. M. Guichard. Comptes rend., 1911, **153**, 104—107.

If copper be heated in a vacuum, a considerable evolution of gas takes place at first, but after a time it decreases, and remains fairly constant for many hours. For example, a copper wire heated for seven hours at 630° C. evolved 8·5 c.c. of gas, and during the next hour 0·078 c.c., whilst during the following 14 hours the evolution only amounted to 0·022 c.c. per hour. If the copper is now allowed to cool and again heated, a further evolution results. The gas only appears to be removed from the superficial layer of the copper. It is not possible to remove the gas rapidly from melted copper by aid of a vacuum, owing to the increased solubility of the gases. It is stated that gases from different kinds of copper contained from 33 to 75 per cent. of carbon dioxide and from 9 to 12 per cent. of carbon monoxide, the remainder consisting of hydrogen and nitrogen.—T. F. B.

Aluminium ; Some observations on the laboratory production of ——. H. K. Richardson. Trans. Amer. Electrochem. Soc., 1911, **19**, 159—170.

The author describes some laboratory experiments on the electrolytic production of aluminium in a furnace of the form described by Winteler (Borchers-Solomon, "Electric furnaces," p. 210). It consisted of a box, 360 mm. by 180 mm. by 110 mm. high, of wrought iron plate bolted to angle iron on all edges. The bottom was covered by a plate of artificial graphite, 2·2 cm. thick, which acted as cathode. The carbon anode was of square cross-section, 10·16 × 10·16 cm., and for melting the charge at the start, a piece of carbon, 1·27 cm. thick, was inserted between the electrode and the bottom plate (compare Neuman and Olsen, Met. and Chem. Eng., 1910, **8**, 185). Partitions of asbestos board were placed on each side of the anode at a distance of 5·08 cm., the spaces between these partitions and the walls of the furnace being filled with sand. The experiments indicate that the best results are obtained by using a mixture of 85 per cent. of natural cryolite and 15 per cent. of alumina, with a current density of 3 ampères per sq. cm. of anode surface. Irregular working may be caused (*a*) by production of a gaseous film around the anode, which opens the circuit, (*b*) by non-wetting of the anode, and consequent production of numerous small arcs between electrode and electrolyte. The former may be remedied by opening or closing the circuit quickly, or by tapping the electrode ; and the latter by addition of alumina or cryolite to the bath. A summary of the results obtained is given in the following table :—

Charge.			Volts.	Ampères	Average anode current density	Ampère efficiency
Alumina	Cryolite	Weight				
per cent.	per cent.	kilos.			amp. per sq. cm.	per cent.
20	80	4	17·0	150	2·62	50·3
			8·1	320	2·76	75·8
15	85	4	17·0	160	2·49	93·0
			5·8	400	2·98	73·6

The electrolyte was at a bright cherry red heat, corresponding to a temperature of 900°—1000° C.

In discussion, J. W. Richards pointed out that in practice the temperature has to be kept sufficiently high to prevent the aluminium rising to the surface of the bath. The current efficiency obtained is usually 75—80 per cent., the loss being probably due to re-solution of aluminium in the fused electrolyte.—A. S.

Phellandrene process for extracting copper in New South Wales. Chem. and Drug., July 29, 1911.

This process was first used at Broken Hill, in New South Wales, but its use is extending widely. The crushed and ground ore is mixed with water into a cream, and 4 lb. of oil of eucalyptus containing phellandrene is added to each ton of ore; the copper is collected by the phellandrene and this floats to the top of the magma. The oil is removed by distillation. The oils of eucalyptus containing phellandrene appear to be the only oils suitable for the purpose, and their use in the extraction of copper has enhanced the value of these oils considerably. Inquiries for oils yielding phellandrene are now being made all over the eastern States of Australia, and an increased production of these oils has resulted. Labour conditions are, however, a great drawback to the eucalyptus oil industry, as they are to other industries.

Patents.

Concentrating-amalgamators. R. Luckenbach, Colwyn, Pennsylvania, U.S.A. Eng. Pat. 3124, Feb. 7, 1911.

A new form of amalgamating pan is described with continuous discharge of the gangue slime into an annular launder. Also some special forms of "deflecting agitators" (mullers).—B. M. V.

Armour plates; Manufacture of ——. Vickers, Sons and Maxim, Ltd., Sheffield, and J. L. Benthall, Chesterfield. Eng. Pat. 6664, March 16, 1910.

The invention consists mainly in rendering the back portion of the plate less pervious to capped projectiles. The plate is "cemented" on both sides if of low or medium carbon content, or on the side which will form the face, if of high carbon content. After heat treatment by known methods (reference is made to Eng. Pat. 4328 of 1893) and machining, the plate is hardened on each side in succession, the back portion first. An intermediate low heat may be applied to plates of high carbon content between the two final hardenings.—B. M. V.

Alloys. A. L. Brooke and R. D. Mackintosh, Mortlake. Eng. Pat. 14,192, June 11, 1910. (Addition to Eng. Pat. 15,389, July 1, 1909.)

In the preparation of nickel, aluminium and magnesium alloys nickel oxide is reduced to the metallic state under charcoal, and alloyed with aluminium in a crucible. A small quantity of zinc chloride and metallic zinc are then added before incorporating the magnesium. The latter can be melted with the other components under carbon and argol, or charcoal, fluorspar, and sodium chloride. Or the reduced nickel and the aluminium may be melted in separate crucibles and poured into another, heated, crucible, and the alloy cast into ingots which are subsequently melted up with magnesium under a layer of carbon and argol.—R. W. N.

Steel for armour plates; Manufacture of ——, guns and other steel articles. W. Beardmore, Glasgow. Eng. Pat. 14,955, June 21, 1910.

The patentee claims steel for armour plate containing carbon, 0·15 to 0·25; molybdenum, 1·00 to 2·00; nickel, 5·00 to 6·00; tungsten, 0·25 to 1·00; and manganese not over 0·50 per cent., for the purpose of obtaining a glass hard surface on a steel of low carbon content by simple cementation, though the inventor does not propose to dispense with the usual differential heat treatment.—B. M. V.

Crucible furnaces. W. Buess, Hanover. Eng. Pat. 17,238, July 20. 1910.

The furnace is an improved form of tilting gas- or oil-fired crucible furnace adapted to completely discharge the contents of a broken crucible without stopping the heating, through a hole (which may be normally closed) at the bottom of the main body of the furnace, situate directly opposite the burner-hole. The bottom of the furnace consists of a detachable cooling chamber which may be cooled by passing the compressed air through it on its way to the fuel jet.—B. M. V.

Iron and steel; Manufacture of ——. A. Boucher. Prilly, Switzerland. Eng. Pat. 29,830, Dec. 22, 1910. Under Int. Conv., Nov. 7, 1910.

A process for obtaining ordinary or "special" steels by mixing by simple fusion in any suitable furnace, of chemically pure iron and chemically pure alloying materials. For the electrolytic manufacture of pure iron reference is made to Eng. Pat. 28,746 of 1910 (this J., 1911, 752).—B. M. V.

Slag-Wool; Manufacture of ——. G. A. Herdman, Coatham. Eng. Pat. 23,817. Oct. 14, 1910.

Instead of blowing the wool straight into the usual "house" or chamber, it is blown into a rotary perforated cylinder extending through the "house." "Shot" are thus screened off and scattering and loss of the slag-wool minimised.—B. M. V.

Aluminium and alloys of aluminium; Solder for ——. N. J. A. Bourgade. Fr. Pat. 425,912, April 18, 1910.

The solder, which may be used without cleansing agent or solvent for oxide, is composed of an alloy of tin (1 part) and zinc (2 parts), to which cadmium is added in the proportion of 5 per cent. of the weight. These proportions may be varied.—C. A. W.

Aluminium alloys. B. J. Smart, Woolwich. Eng. Pats. 14,940, June 21, 1910, and 9227 of 1911; date of appl., June 21, 1910.

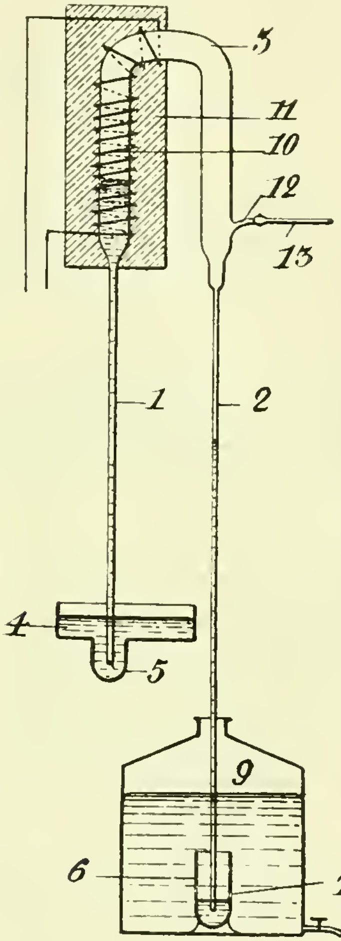
(1) This patent refers to alloys similar to those described under (2), but containing from 10 to 20 per cent. of copper and zinc together, the copper being less than five per cent., with between 0·1 and 1·0 per cent. of magnesium. (2) The patent relates to an alloy of aluminium with not less than five per cent. of copper and zinc together and from 0·1 to 2·0 of magnesium, the alloy having a low specific gravity and yet a high tensile strength with more or less ductility. The aluminium is melted and the zinc and copper added, the melt being either allowed to solidify or else poured into a cold crucible in order to allow of the escape of occluded gases. It is then just melted, the magnesium added, and after casting in suitable moulds forged at a temperature of 400° C. and then annealed at 450° C. for five hours. Aluminium of high purity is preferable, but commercial aluminium may be used.—A. H. C.

Blast-furnace or cupola provided with an arrangement for electrical refining. A. Helfenstein. Fr. Pat. 426,694, March 1, 1911. Under Int. Conv., March 10, 1910.

The masonry in which the crucible of the furnace or cupola is constructed is enlarged towards either side so as to form an extension, which is traversed by a covered channel communicating, at the further end, with a covered refining chamber, and in the centre, with the hearth or crucible. The masonry of the two chambers forms an integral part of the furnace structure, and each is provided with an interior prolongation which forms an open hearth in front of the casting-hole. A group of electrodes, formed by units of the same polarity, is suspended in the interior of each chamber so that it can be raised or lowered; whilst the necessary path for the current is completed by the metal in the channels. In this way, the two refining chambers are electrically connected by means of the molten bath, of insignificant resistance, as it forms in the crucible of the furnace. In practice, the metal formed in the furnace falls into the crucible and runs through the channels on either side, until the level in the chambers has risen sufficiently to come into contact with the electrodes. The molten metal in either chamber is then refined electrically, and possibly converted into steel, after the necessary materials have been added, until finally it is allowed to pass through the overflow on to the cooling-hearth already mentioned.—C. A. W.

Mercury; Apparatus for the distillation of ——. L. Dunoyer. Fr. Pat. 426,036, Feb. 14, 1911.

IN its simplest form, the apparatus (Fig. 1) comprises two barometric tubes, 1 and 2, connected at the top by an inverted U-tube, 3, of large diameter. The tube on the left dips into a flat-bottomed cup, 4, the extremity fitting into an extension thereof, 5, which always remains filled with mercury, in the bottom of the vessel. Similarly, the tube, 2, on the right, of greater length, dips into a receiving vessel, 9, fitted with a tap, 8, at the bottom, the admission of air to the apparatus at this point being prevented by a smaller interior receptacle, 6, which surrounds the extremity of the vertical tube. This receptacle is kept partly filled with pure mercury, 7, which runs through a hole at the side into the outer vessel as the distillation proceeds. The left hand branch, 3, of the U-tube at the top is surrounded by a spiral, 10, through which an electric current can be passed, the whole branch being then covered with some heat-retaining material. In order to start the apparatus, the mercury to be distilled is placed in the cup on the left, a small amount of the pure metal is poured into the inner receptacle on the right, and the apparatus is connected with a water-dropping vacuum pump through a side-piece, 12, attached to the right-hand branch of the U-tube. When the air has been removed as far as possible by this means, the side-piece, 13, is sealed in a flame, and the heating current is passed through the coil. The particles of mercury as they condense and drop down the right-hand tube should then complete the vacuum, whilst the enlarged portion at the top of the apparatus is sufficient to prevent any mercury from being carried over mechanically into the receiver. The apparatus is quite continuous, since the cup on the left can always be kept filled with mercury, but, if desired, the heating current may be cut off automatically by means of an interruptor as the metal reaches the bottom of the vessel. Finally, by modifying the arrangements so as to obtain a vacuum in the two receptacles, the apparatus may be considerably shortened, but in this case each limb must be provided with a stop-valve in order to prevent the metal from rushing back when air is admitted to one side or the other.—C. A. W.



Furnace; Muffle roasting —— *for ore.* H. M. Ridge. Fr. Pat. 426,647, Feb. 28, 1911. Under Int. Conv., July 1, 1910.

THE roasting furnace, of the horizontal type, is provided in the ordinary manner with vertical spindles which engage with an endless screw extending along the top. These spindles serve to rotate agitators which sweep over the several floors, the zones of action being adjusted so that they alternately cut one another considerably or scarcely at all. In this, however, lies the essential point in the construction of the furnace—the heating gases from the grate at one end are not allowed to come into contact with the ores, but are passed through flues extending below the bottom floor to the end of the furnace, whence they are carried back through similar flues beneath the second floor. Thence they pass into the atmosphere or into a third flue extending either above or below the top muffle. The spindles, at the top of the furnace, rotate in cups filled with water, whilst, at the points where they pass across the flues, they are insulated by means of refractory bricks or other non-conducting material. By this means the escape of gases is prevented. The ore, introduced at the top of the furnace, at one end, is transported to the other extremity, where it drops through an aperture into the second muffle and passes back in a reverse direction. In this way, it is transported to the lowest floor of the furnace.—C. A. W.

Electric furnace; Induction ——. J. H. Reid. Fr. Pat. 425,720, Feb. 8, 1911.

THE essential feature in this furnace is an upright induction coil which may be lowered successively into a series of hemispherical hearths arranged side by side. It is there rotated continuously about a vertical axis, so that the charge is subjected to a uniform agitation, until, finally, at the conclusion of the operation, the coil is raised and transported to the next hearth. The coil is composed of three windings—a primary, which is connected to the exterior source of current, a secondary circuit, closed on itself, and a tertiary circuit joined at the extremities to two plates on the outside of the coil. These plates, which serve to lead a portion of the current into the charge, are composed of some material electrically conducting only at a high temperature, such as a mixture of graphite and dolomite. It is evident that the current induced in the secondary circuit, which might however be suppressed, will induce a current of still higher amperage in the tertiary one. The coil is suspended in the charge from a vertical shaft which can be rotated by means of a system of gear-wheels driven by an overhead motor. Into one of these gear-wheels the top of the shaft is fitted loosely, so that a ridge extending down the side passes through a notch cut on the inner circumference of the wheel. By this means, a continuous rotation of the coil is obtained, even whilst it is being raised from the charge. The shaft itself is suspended by means of a swivel-hook and a chain which passes over a pulley and is connected to a winch driven when necessary by the motor. The whole arrangement of motor and winch is supported upon a truck which can be moved on rails over the series of hearths.—C. A. W.

Furnaces; Crucible and melting-pot ——. L. F. Tooth, London. Eng. Pat. 30,287, Dec. 30, 1910.

THE furnace is heated by a tangentially directed burner. The products of combustion, after encircling the crucible, pass outwards and downwards through flueways constructed in the wall of the furnace to an annular flue surrounding the lower part of the central chamber, and thence to another annular flue surrounding the upper part of the central chamber. From the last-mentioned flue the gases pass to the chimney. By this means the wall of the furnace is equally heated throughout, and rapidity of heating is attained.—R. W. N.

Furnaces; Mechanical ore roasting ——. J. Harris, Sheffield. Eng. Pat. 23,331, Oct. 8, 1910.

The furnace is divided into vertical sections with an arrangement of flues and dampers in order that any one section may be allowed to cool down and be repaired without stopping the whole furnace, and then be reheated by passing the gases from the other sections into it. The lower girder tie rods can also be situated in an air channel to be kept cool, and a dust chamber is provided beneath the lowest tier of the furnace. A false floor is also placed at a short distance above the arched floor of the lowest tier and so supported as to provide a zig-zag passage in order to supply the auxiliary heat necessary to completely remove the sulphur from some ores.—A. H. C.

Dry ore separation; Process for ——. W. W. Bonson, Dubuque, Iowa, U.S.A. Eng. Pat. 29,971, Dec. 24, 1910.

The dry ore is delivered upon a moving meshed surface, air being blown through the mesh from below forces a portion of the gangue from the ore which is then moved to another position on the surface. The lighter portion is suitably deflected in a different direction from that in which the ore is moving, whilst the heavier portion is deflected to another part of the surface where it is retained until all the lighter material is on the top when the latter is deflected to another part of the surface and can be removed.—A. H. C.

Air for use in metallurgy; Treatment of —— to maintain constant humidity. J. B. Miles. Fr. Pat. 425,759, Feb. 7, 1911. Under Int. Conv., Feb. 12, 1910.

See U.S. Pat. 971,297 of 1910; this J., 1910, 1210.—T.F.B.

Furnaces; Electric —— and the manufacture of steel. G. Massip, Paris. Eng. Pat. 22,777, Oct. 1, 1910. Under Int. Conv., Oct. 2, 1909.

See Fr. Pat. 424,337 of 1910; this J., 1911, 753.—T. F. B.

[Zinc] ores; Process and apparatus for reducing ——. H. H. Hughes. Fr. Pat. 425,941, Feb. 11, 1911. Under Int. Conv., Feb. 11, 1910.

See U.S. Pats. 980,640 and 980,641 of 1911; this J., 1911, 135.—T. F. B.

Sulphide ores; Process for roasting ——. C. W. Renwick. Fr. Pat. 426,149, Jan. 17, 1911.

See U.S. Pat. 981,880 of 1911; this J., 1911, 220.—T.F.B.

Residues from the manufacture of zinc and the like; Process and apparatus for separating mechanically the useful from the useless parts of ——. E. Dor-Delattre. Fr. Pat. 425,987, Feb. 13, 1911. Under Int. Conv., April 13, 1910.

See Eng. Pat. 3078 of 1911; this J., 1911, 902.—T. F. B.

Aluminium; Process for producing alloys of —— with other metals. J. G. and W. F. Mellen. Fr. Pat. 425,719, Feb. 8, 1911. Under Int. Conv., Feb. 14, 1910.

See U.S. Pat. 982,218 of 1911; this J., 1911, 220.—T. F. B.

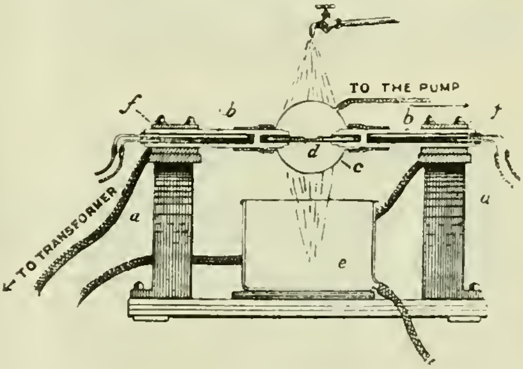
XI.—ELECTRO-CHEMISTRY.

High pressure arc; Behaviour of carbon dioxide and certain gaseous mixtures in the ——. W. Muthmann and A. Schaidhauf. Z. Elektrochem., 1911, **17**, 497—503.

Using the same apparatus as that described by Muthmann and Hofer (this J., 1903, 303) the authors have investigated the behaviour of carbon dioxide on being submitted to the action of the high tension discharge. It is found that with platinum electrodes the dissociation of the carbon dioxide is subject to a strong catalytic influence which causes the amount of carbon monoxide observed to be much less than the amount in the case of silver and gold electrodes, which do not show any catalytic effect. The dissociation of the carbon dioxide is most considerable when the electrodes are near together (2 mm.). At greater distances the dissociation decreases and the catalytic effect of the platinum is less marked. Combination of a platinum electrode with a silver or gold electrode, leads to values intermediate between those for two platinum and for two silver (or gold) electrodes. When the figures for the dissociation are used with a view to finding the temperature of the discharge it is found that recombination has taken place to such an extent as to make the numbers from 400° to 600° C. too low. Mixtures of nitrogen and carbon dioxide under the action of the discharge give the same yields of nitric oxide as mixtures of nitrogen and oxygen. Nitrogen and methane form hydrogen cyanide and hydrogen steadily up to the point of decomposition of the methane, when the separation of carbon interrupts the action.—W. H. P.

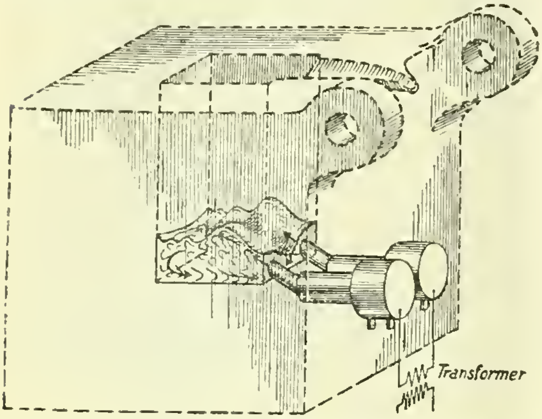
Electric furnace with tungsten resistance suitable for chemical purposes. F. Fischer and E. Tiede. Ber., 1911, **44**, 1717—1720.

The method of electric heating used by the authors in the distillation of tin (see page 959) is defective, since the tin vapour attacks and destroys the platinum winding fairly rapidly. To avoid this the authors have devised the furnace illustrated, in which the heating substance, *d*, is a tube of metallic tungsten. The copper tubes, *b*, *b*, act as leads, being cooled at the outer ends with running water as shown. The tin placed in a small crucible which can be fixed at the middle of the tungsten tube, is very readily volatilised when heated in this way and condenses on the walls of the glass bulb.—W. H. P.



Electric furnaces for molten materials. C. Hering. Met. and Chem. Eng., 1911, **9**, 371—373.

The author discusses the ideal features of a commercial electric furnace for molten charges, and the best means of approximating to them. He is of opinion that such approximation is obtainable more completely with resistance than with arc furnaces. A furnace of the resistance type designed by the author is shown in the diagram. Circulation of the molten charge is brought about by means of the "pinch phenomenon," which depends for its action on the fact that when an electric current of suitable amount is passed lengthwise through a column of a liquid conductor confined in a submerged hole or tube, the liquid will be ejected from the middle of this tube quite forcibly and at the same time will be sucked in around its circumference. In the figure, the heaters or resisters are the short small tubes in which this electromagnetic force acts, and in which all the heat is generated. The arrows show the circulation approximately. The electrodes, preferably made of the same metal, are the larger embedded cylinders, and are provided at their outer ends with water-cooled terminals, to which the leads from the transformer are attached. The direction of this squirting action is independent of the direction of the current, hence either direct or alternating currents may be used. —T. St.



Electrical heating as a means of prevention of superheating of liquids. Mathews. *See* XXIII.

Rapid determination of silver and cadmium, by means of a gauze cathode and stationary anode. Benner and Ross. *See* XXIII.

Patents.

Accumulator plates; Electric ——. J. Apoznanski, Moscow. Eng. Pat. 27,176, Nov. 22, 1910.

Highly porous composition plates for electric accumulators are made by drying the plates, filled with paste, at a high temperature between acid-proof cover plates, so as to utilise the generation of gas at the raised temperature for producing innumerable pores, and at the same time hardening the plates.—B. N.

Galvanic cells; Liquid excitant for ——. Soc. des Établissements Sage, Bine & Cie. Fr. Pat. 426,182, April 25, 1910.

In order to form a depolarising liquid excitant for galvanic cells, particularly those of the two-fluid type, it is proposed to add, to a mixture of nitric and sulphuric acids more or less diluted, certain radio-active salts such as those of radium, polonium, actinium, uranium or thorium. Naturally, only traces of these salts are employed, and the same effect could be produced by using larger quantities of certain salts which possess a special "radio-magnetic activity," such as those of cobalt, nickel, and thallium. By the use of these radio-active salts, it is claimed that the energy-capacity of the cell is increased to a remarkable degree, that there is a total absence of all polarisation and finally that the current is produced with absolute constancy until the cell is completely exhausted. As an example, the liquid may be composed of distilled water (1000 c.c.), sulphuric acid (200 c.c.), nitric acid (100 c.c.) and an appreciable trace of radium, polonium or actinium, or one to two grams of the remaining metals. The nature of the salt employed, halide, nitrate or sulphate, is immaterial so long as it is readily soluble; whilst in certain cases other acids, organic or inorganic, such as acetic acid or hydrochloric acid, may be added. Moreover, the emanations from the cell, which in any case are very small, may be totally suppressed by the addition of bases such as zinc oxide, alkalies such as potash or oxidising agents such as hydrogen peroxide. In a two-fluid cell, the excitant is placed in the vessel containing the positive plate.—C. A. W.

Electric arcs [for gas reactions]; Method of and apparatus for deviating ——. J. J. Thoresen, Christiania, and F. Tharaldsen, Meraker, Norway. U.S. Pat. 996,951, July 4, 1911.

See Fr. Pat. 352,556 of 1905; this J., 1905, 976.—T. F. B.

Furnace; Electric ——. *Treatment of refractory materials.* E. Weintraub, Lynn, Mass., Assignor to General Electric Co., New York. U.S. Pats. 997,882 and 997,883, July 11, 1911.

See Eng. Pat. 21,667 of 1906; this J., 1907, 1148.—T. F. B.

Furnace; Electric —— *for treating gases.* H. Pauling. Fr. Pat. 425,725, Feb. 8, 1911.

See Eng. Pat. 3251 of 1911; this J., 1911, 905.—T. F. B.

Furnace; Electric ——. G. von Schatzl. Fr. Pat. 426,074, Feb. 15, 1911.

See Eng. Pat. 3533 of 1911; this J., 1911, 810.—T. F. B.

Endothermic reactions in gases; Process for effecting ——. Elektrochem. Werke G. m. b. H. Fr. Pat. 426,306, Feb. 21, 1911. Under Int. Conv., March 2, 1910.

See Eng. Pat. 5281 of 1911; this J., 1911, 812.—T. F. B.

Electrolytic reduction of organic bodies [unsaturated fatty acids, etc.]. Eng. Pat. 18,969. *See* XX.

Treatment of brine. Eng. Pat. 13,415. *See* VII.

Porous objects; Manufacture of ——. Fr. Pat. 426,072. *See* I.

XII.—FATS; OILS; WAXES.

Copra; Analysis of ——. Chem.-Zeit., 1911, 35,, 755.

The following method is recommended by the Association of German Oil Mills for the determination of the oil in copra:—One half of each piece in the sample is taken and finely ground in a mill. 10 grms. of the powder, placed in a filter paper thimble (which is closed with cotton wool) are extracted with petroleum ether (b. p. 60° C.) for 4 hours at a temperature not exceeding 75° C. in a Soxhlet apparatus, the highest part of the siphon tube of which should be at most 1 cm. above the upper edge of the thimble. The thimble is then taken out, squeezed, and dried in the water oven. The dried contents are ground in a mortar with coarse quartz sand, the mixture placed in the thimble and extracted in the Soxhlet for 2 hours. This operation requires repeating if the copra was not originally very finely ground. The extracted oil, after evaporation of the solvent is dried at 105°—106° C.; and weighed.—A. Sbld.

Mineral oil and rosin oil; Detection of —— *in other oils [Examination of core oils].* A. E. Outerbridge, jun. Reprint from Proc. Amer. Soc. for Testing Materials, Philadelphia, 1911, 11, 1—14.

The presence of traces of mineral oil or rosin oil in linseed or other oils may be detected by the green fluorescence given by the former and the blue fluorescence given by the latter, when exposed to a source of ultra-violet light (preferably the ordinary enclosed electric arc-light) and examined against a black background. In this way the author states that he has detected 0·1 per cent. of mineral oil in an otherwise non-fluorescent oil. No trace of fluorescence is shown by linseed, cottonseed, maize, soya bean, tung, or pure strained lard oil, but commercial samples of lard oil showed some slight fluorescence, and it is suggested that a method of determining oleic acid (to which the fluorescence is attributed) may be based upon this fact. Samples of "de-bloomed" mineral oil, quite free from "bloom" when examined in sunlight or the light from an ordinary arc-light, all became highly fluorescent when examined in ultra-violet rays, and it was found possible to determine their proportion when mixed with vegetable oils.—C. A. M.

Niger seed and poppy oils. L. Vuaflart. Ann. Falsificat., 1911, 4, 330.

A sample of niger seed oil prepared in the vicinity of Arras gave the following analytical values: Sp. gr., 0·923; solidifying point, – 6° C., iodine value, 128·5; and butyrorefractometer reading at 25° C., 71·3. It did not yield any insoluble bromide, but gave the arachidic acid reaction. The principal difference between niger seed and poppy seed oils is the solidification point. Thus a sample sold as poppy seed oil solidifying at –11° C. and the acidity of which (3·17) was not sufficient materially to raise the solidifying point, was reported to contain niger seed oil. Its iodine value was 130·6, and its butyrorefractometer reading at 25° C. was 72·1.—C. A. M.

Fat distillation [*Pitches*]*; The composition and examination of residues from ——.* J. Marcusson. Zeits. angew. Chem., 1911, 24, 1297—1302.

In determining the saponification value of the various fat pitches the best results are obtained by dissolving 5 grms. in 25 c.c. of thiophene-free benzol and boiling this solution for an hour under a reflux condenser with 25 c.c. of N. alcoholic potash. After cooling, 200 c.c. of 96 per cent. alcohol are added to throw the dark-coloured pitchy matter out of solution. Without filtering this off, 3 c.c. each of a 1 per cent. phenolphthalein solution and a 3 per cent. alcoholic solution of Alkali Blue 6B, are added and the excess of alkali titrated with $N/2$ hydrochloric acid. By using the two indicators together, and in the quantities given, the neutral point in the titration is sharply indicated by the change in colour from red to green. The saponification value of various fat-pitches has never been found to be below 33 and in many cases exceeds 100, whereas that of petroleum pitch does not exceed 21. The *acid value* of fat pitches is best determined by dissolving 20 grms. in 80 c.c. of ether, precipitating with 80 c.c. of neutralized alcohol, filtering and titrating the filtrate, using alkali blue as indicator. 200 c.c. of petroleum spirit (b. p. 80° C.) are added to a solution of 10 grms. of the pitch in 15 c.c. of benzole. The precipitate is sucked dry on a vacuum filter and the filtrate shaken up 3 times with concentrated sulphuric acid in 15 c.c. portions. The last traces of mineral acid are removed by washing with water and alcoholic potash (made from 50 per cent. alcohol). On evaporating off the petroleum spirit the asphalt-free oily portion of the pitch is obtained. Stearine pitch contains from 3·3 to 11·8 per cent. of this, wool-fat pitch from 15·4 to 40 per cent., whilst petroleum pitch contains from 40 to 60 per cent. (all these figures referring to the samples examined by the author). It is recommended to determine the iodine and saponification values of these liquid portions as they are found to vary with the different varieties of pitch. The refractive index should also be determined since at 15° C. this does not exceed 1·510 in the case of stearine pitch, whilst that of the liquid separated from petroleum pitch varies from 1·516 to 1·545. Petroleum pitch may also be detected in fat pitch by the fact that the former gives with mercuric bromide a compound which is insoluble in ether, whilst the latter does not. The test is carried out by dissolving 10 grms. of the pitch in 25 c.c. of hot benzole, adding to the solution 30 c.c. of $N/2$ alcoholic potash, shaking for a little and then rapidly diluting with 200 c.c. of 96 per cent. alcohol. After standing for a little, the liquid portion, which should be alkaline to phenolphthalein, is poured off and the pitchy residue in the flask washed with a little alcohol. This is then freed from alcohol by heating on a water bath and is afterwards dried at 105° C. When dry it is heated with 100 c.c. of dry ether under a reflux condenser and after cooling the solution is transferred to a large size test-tube being filtered if necessary from any asphaltene which may be present. 20 c.c. of a 2 per cent. solution of mercuric bromide in ether is then added and the mixture allowed to stand overnight. If a precipitate has formed this is filtered off, washed with ether, and dissolved from the filter with warm benzole. On evaporating the solvent, if more than 10 per cent. of the petroleum product is present in the original pitch, the mercuric bromide double compound is obtained as a dark-brown to black brittle mass.—J. A.

Butter, margarine, etc.; Application of miscibility curves to the analysis of ——. E. Louïse. Ann. Falsificat., 1911, 4, 302—305.

In applying his method (this J., 1907, 932; 1909, 892; 1910, 438; 1911, 556) to the analysis of butter, etc., the author uses a cylindrical bath containing concentric chambers, the outer of which is closed, with the exception of two small openings for the escape of vapour and the introduction of a thermometer. This chamber is charged with heavy lubricating oil ("valvoline"), whilst the inner chamber is filled with ordinary petroleum oil. Ten grms. of the melted and dried fat and 10 c.c. of the "typical" petroleum oil are placed in a large test tube, which is closed with a cork through which passes a thermometer, and is placed in the inner chamber. The "typical" petroleum oil should be such that when 20 c.c. thereof are mixed with 10 c.c. of absolute alcohol the turbidity temperature is 4·9° C., and with 5 c.c. of alcohol, 4·0° C. Increasing quantities of aniline are then introduced into the tube, the turbidity temperatures determined and the miscibility curves plotted. Five c.c. of the aniline should give a reading of 69° C. when mixed with 10 c.c. of the typical petroleum oil, and 10 c.c. a reading of 72° C. All the samples of butter fat thus examined gave curves of the same form, approximating to each other, and differing at the most divergent point by only 2° C. Twelve samples of margarine gave curves considerably higher (about 8° C.), whilst "vegetaline" gave curves about 4° C. lower than those of butter. Samples of different animal fats gave curves slightly higher than those of margarine.—C. A. M.

Cochineal "fat" and the presence of linolic acid therein. R. Huerre. J. Pharm. Chim., 1011, 4, 56—65.

From 1 kilo. of "silvery" cochineal, yields of 76, 80 and 77 grms. respectively of fat were obtained by extraction with ether, in which cochineal wax is practically insoluble. The characters of the fat were: m. pt., 32° C.: iodine value, 48—52 (mean, 50·53); acid value, 89; iodine value of total fatty acids, 45·90; iodine value of free fatty acids, 44; glycerides, 8 per cent.; unsaponifiable matter, 3 per cent. (See Liebermann, this J., 1885, 585.) The fatty acids appear to consist of 35 per cent. of oleic acid, 8 per cent. of linolic acid, and 57 per cent. of myristic acid. The oleic acid was isolated by means of its lead salt. The linolic acid was identified by means of the tetrahydroxystearic acid (m. pt. 171°—173° C.) obtained by oxidation with alkaline permanganate. No satisfactory separation of oleic and linolic acids could be obtained by the methods of Farnsteiner (this J., 1899, 500) or of Haller (this J., 1906, 1159).—A. S.

Detection of palm fat in butter by Ewer's method. Nockmann. *See* XIXa.

Detection of cocoanut oil in butter by Fendler's method. Hepner. *See* XIXa.

Analysis of margarine. Cribb and Richards. *See* XIXa

Determining cocoanut oil and butter in butter and margarine. Revis and Bolton. *See* XIXa.

Cottonseed products for 1910. Oil, Paint and Drug Reporter, July 10, 1911.

The United States Bureau of the Census has just published a bulletin on cotton production in the United States, together with the statistics of cottonseed products for 1910. The tables cover mainly the investigations of the last census for the year 1909.

The comparative results for the past five years on these items of cottonseed production and cottonseed products for each year are given by the bulletin as follows :—

Cottonseed.

Year.	Produced.	Manufactured.	
		Quantity.	Value per ton.
	(tons)	(tons)	$
1910	5,175,000	4,106,000	27·40
1909	4,462,000	3,269,000	27·70
1908	5,904,000	3,670,000	15·60
1907	4,952,000	2,565,000	17·60
1906	5,913,000	3,844,000	13·80

Total Value of Products.

1910	$142,710,000
1909	105,720,000
1908	86,090,000
1907	65,980,000
1906	94,380,000

Cottonseed Products.

	Oil.		
	Quantity.	Value.	
		Total.	Per gal.
	(galls.)	$	(cts.)
1910	167,970,000	80,430,000	48
1909	131,000,000	55,230,000	42
1908	146,790,000	44,090,000	30
1907	103,050,000	33,390,000	32
1906	153,760,000	43,050,000	28

Cake and Meal.

	Quantity.	Value.	
		Total.	Per ton.
	(tons).	$	$
1910	1,792,000	44,660,000	24·92
1909	1,326,000	35,910,000	27·08
1908	1,492,000	33,580,000	22·51
1907	1,043,000	23,300,000	22·34
1906	1,786,000	39,140,000	21·91

Exports.

The aggregate volume of exports of cottonseed for 1910 is given at 9,653 tons, valued at $339,439 ; of oil, 23,550,468 gallons, valued at $13,186,692 ; of meal and cake, 369,719 tons, valued at $10,122,274. Germany took of the total exports of cottonseed more than 6,000 tons, or about two-thirds of the total exportation. Of cottonseed oil, the Netherlands took nearly 5,000,000 gallons, or about one-fourth of the total, the United Kingdom coming next with 3,668,000 gallons. Of meal and cake, Denmark took 132,000 tons and Germany 126,000 tons. These two countries took approximately two-thirds of the total exports.

Formerly a very large percentage of the cottonseed products manufactured in the United States was exported, but an increasing domestic demand has caused a decline year by year in the proportions exported. In 1899, 50 per cent. of the oil produced was exported, while in 1909 the ratio was less than 20 per cent.

Patents.

Fatty matter and fibrin ; Utilisation of animal material containing ——. J. Giband and O. Bang. Fr. Pat. 426,278, Feb. 11, 1911.

Animal material, consisting of slaughter-house offal, accidentally killed and slaughtered animals, fish offal, fish, cetaceous animals, or other animals containing fatty matter and fibrin, is freed from the largest bones, crushed up, and soaked in water. About one per cent. of hydrochloric acid (of 33 per cent. strength) or caustic soda (of 0·5 per cent.), but preferably the former, is added, and the mixture is heated for several hours at 40°—50° C., at the end of which time all is extracted except the bones, nerves and tendons, and some membranes. At this stage the temperature is raised to 70°—80° C., and the mass is then filtered through a sieve, and centrifugalised. Three separate layers are formed, the inner one consisting of fatty matter, the middle of fibrin, and the outer of solids. On saturating the solution of the fibrin with soda, the fibrin is precipitated, and when dried forms an amorphous, translucent mass, having some resemblance to casein. The nerves and tendons are used for the manufacture of glue.—E. W. L.

Fats, oils, and fish oils ; Method and apparatus for converting —— *by the catalytic method into analogous products of higher melting point.* M. Wilbuschewitz. Fr. Pat. 426,343, Dec. 30, 1910.

The fat, etc., is intimately mixed with the catalytic agent and heated under pressure in autoclaves. The intimate mixture referred to is effected by pumps or injectors, in the autoclaves, through which in a direction opposite to that of the injected mixture, a current of hydrogen circulates. The latter may either be introduced in such a manner that when the reduction has already begun in the upper part of the autoclave it disperses in the form of spray, the oily mixture accumulating in the bottom of the apparatus, so that it can be pumped into other autoclaves where the process is repeated until the desired melting point is reached ; or the hydrogen may be introduced into the last autoclave, and the reduction continued in the succeeding autoclaves with the aid of a reduction valve and with a corresponding diminution in the pressure. Special types of apparatus for carrying out the process are claimed. The catalytic agent may be prepared by dissolving iron, copper, nickel, etc., in an acid and mixing the solution with about twice its quantity of a solid inorganic substance. The metallic salt is then converted into its carbonate, which is ignited to obtain the oxide, and this is, in turn, reduced with hydrogen to obtain the metal enveloping the particles of inorganic substance. Claim is also made for an apparatus in which the catalytic agent is thus prepared. For regenerating the catalytic agent the oil is extracted from the mixture, the last traces of oil in the residue saponified, the fatty acids separated, and the metallic salt again converted into carbonate and oxide and reduced. By pushing the catalytic reduction of the fats by this process very far material suitable for the manufacture of soap and candles is obtained, whilst with a less pronounced action the products may be employed as butter substitutes or medicinal fats. If oxidising gases, *e.g.*, ozone, be used, in place of hydrogen, oxidised oils are obtained, whilst the process may also be utilised in the manufacture of aerated oils.—C. A. M.

Emulsions ; Manufacture of solid —— *[for treatment of roads, preservation of wood, etc.]* Kaliwerke Aschersleben. Fr. Pat. 425,838, Feb. 10, 1911. Under Int. Conv., Feb. 23, 1910.

Chemical compounds capable of combining with water of crystallisation (*e.g.*, hygroscopic salts such as calcium chloride, magnesium chloride, or the double chloride, tachydrite, in the partially or completely dehydrated condition) are mixed with such a quantity of an aqueous emulsion of coal tar, fats, resins, etc., that the amount of water present does not exceed that capable of being absorbed by the hygroscopic salts, etc. A suitable emulsion for the impregnation of wood is obtained by incorporating calcined zinc chloride or other suitable salt with the requisite quantity of emulsion of a preservative oil. Glue or other substances not precipitated by salts may also be used as the emulsifying agent for oils, resins, etc., in this process.—C. A. M.

Soaps and cleansing compositions; Organic chloro-compound ——. G. Koller, London. Eng. Pat. 15,288, June 25, 1910.

The soap, or composition of which soap forms an integral part, is incorporated with chlorinated hydrocarbon solvents, such as tetrachloroethane, pentachloroethane, dichloroethylene, trichloroethylene and perchloroethylene, by means of alcohols, or phenols, or both, which are soluble in both water and the chloro-compounds. The latter may also be incorporated with the raw materials during the process of manufacture of the soap or composition.—B. N.

Soaps; Manufacture of detergent solid or semi-solid ——. Soc. Anon. Belge pour la Fabrication des Savons et Produits Chimiques. Fr. Pat. 426,356, Feb. 22, 1911.

A mixture of olive oil, caustic potash and water is boiled and allowed to stand, and then incorporated with the product obtained by boiling together cocoanut oil, caustic potash and water. An addition of powdered pumice stone and of suitable alkaline salts is also made.—C. A. M.

Soap; Processes of manufacturing ——. C. Joehlinger, Brussels. Eng. Pat. 4586, Feb. 23, 1911.

See Fr. Pat. 426,356 of 1911; preceding.—T. F. B.

Soap from oil-cake, chestnuts, acorns, and all fruits or seeds containing fats. H. Olive. Fr. Pat. 426,532, Feb. 24, 1911.

Oil-cakes, chestnuts, etc., are boiled with a lye of caustic soda or potash to which has been added ordinary salt and boric acid, and the solid matter then pressed. The resulting alkaline liquid is mixed with *e.g.*, arachis oil and borax, and boiled for about 2 hours, after which fresh caustic lye is added, followed, after some hours' boiling, by cocoanut oil, and the manufacture completed as in the case of ordinary soaps.—C. A. M.

Detergent compound for toilet purposes. F. D. Thorne. Fr. Pat. 426,329, Feb. 21, 1911.

See Eng. Pat. 3880 of 1911; this J., 1911, 814.—T. F. B.

Electrolytic reduction of organic bodies [unsaturated fatty acids, etc.]. Eng. Pat. 18,969. *See* XX.

Soluble liquid tallow for finishing natural and artificial silks, etc. Fr. Pat. 426,217. *See* V.

Substitute for boiled linseed oil in varnishes, etc. Eng. Pat. 1980. *See* XIII.

Liquid soap for "boiling off" silk, etc. Fr. Pat. 426,065. *See* V.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Pigment; Adaptability of [zinc-lead] ores to manufacture of ——. Evans W. Buskett. Min. and Eng. World. July 8, 1911, 57—58.

An ore which carries 30 per cent. lead and zinc combined, will cover the fixed charges of manufacture into pigment and provide a small profit, but poorer ores will not do so unless they carry sufficient silver and gold. Cadmium, antimony, bismuth and arsenic are commonly considered objectionable, but a small percentage of these impurities may be removed by roasting.

After some general remarks as to choice of site, etc., the author describes the plant at Coffeyville, Kansas.

At first, the ore used contained about one-third lead and two-thirds zinc (giving about equal proportions of zinc oxide and lead sulphate in the pigment), but it was found desirable to increase the proportion of lead to about equal to that of zinc.

After crushing to pass a ¼-inch screen the ore is roasted to 1 per cent. to 3 per cent. sulphur; anything over 3 per cent. creates an unpleasant atmosphere for the bag-men.

The next operation is "blowing-up" or "burning" in furnaces of 18 hearths, each 6 ft. by 12 ft., in which the blast enters under grates of perforated iron plates, the holes being ⅛ in. at top and ¾ in. at bottom. The furnace is charged first with a layer of coal. When this is burning freely, a charge of about equal parts of ore and coal is fed in.

The fume passes up a tower common to the 18 hearths to a combustion chamber where it is freed from carbon and other impurities by oxidation and from dirt by gravity. Then follows 500 ft. of sheet-steel cooling pipe and another settling chamber from which the fume is driven by a fan, into bags. The following table summarises the principal costs:—

	Per day.
Salaries	$29.00
Wages for power	12.85
,, ,, ore crushing	8.75
,, ,, roasting	15.00
,, ,, distribution	3.00
,, ,, furnaces	49.50
,, ,, bag-room	23.50
,, ,, coal crushing	4.50
50 barrels at 35 cents	17.50
Bags	10.00
30 tons ore, 35 per cent., at 35 cents per unit	367.50
30 tons coal, at $2	60.00
Gas and water	10.00
Total	$611.10

Production will average 20,000 lb. of pigment which at 4½ cents per lb., realizes $900.00 leaving a profit over charges as above, of $288.90 on 30 tons of ore treated. —B. M. V.

Limewashing in factories and workshops. Special exception where certain washable water paints are used. Home Office Circular, No. 616, 1911.

In pursuance of section 1 (4) of the Factory and Workshop Act, 1901, the Home Secretary grants to all factories and parts of factories which have been painted with at least two coats of a washable water paint as defined below, and are repainted with at least one coat of such paint once in every three years, a special exception that the provisions in subsection (3) of the said section with respect to limewashing shall not apply thereto. The exception is subject to certain provisos.

In this Order a washable water paint means a washable paint which when finished for use contains—

(i) at least half its weight of solid pigment containing not less than twenty-five parts by weight of zinc sulphide as zinc white (lithopone) in each hundred parts by weight of solid pigment; and

(ii) at least ten parts by weight of oil and varnish to each hundred parts by weight of solid pigment.

Rosin; Quantitative determination of —— *in admixture with coal-tar residues.* Holde and Meister. *See* III.

Patents.

Boiled linseed oil in varnishes, etc.; Substitute for ——. T. L. Leishman, Edinburgh. Eng. Pat. 1980, Jan. 26, 1911.

A mixture of tung oil, boiled Soya bean oil and a fish or other equivalent non-drying oil is used. Further ingredients may be glue, gum tragasol or the like, in water. The composition may be used as a paint, varnish, etc. A hard composition may be used in water-proofing, linoleum manufacture, etc.—H. E. P.

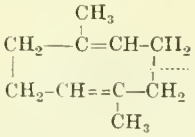
Iron compounds [magnetic oxide pigment]; Preparation of —. J. T. Carrick (E. S. Hutchinson and R. G. Ralston, Exors.), Assignors to J. L. Cameron, Exor. of B. S. Pattison. U.S. Pat. 997,237, July 4, 1911.

SEE Eng. Pat. 12,106 of 1909: this J., 1910, 1168.—T. F. B.

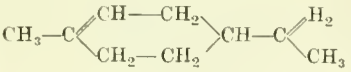
XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Dimethyldipentene. A product of the action of heat on a dimethylcaoutchouc. A. H. Richard. Comptes rend., 1911, **153**, 116—120.

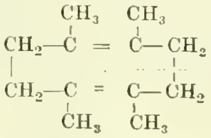
IT was found that on prolonged exposure to diffused daylight 2-3-dimethyl-1-3-butadiene, which is a methylisoprene, yields the viscous dimeric product previously described by Couturier and Lebedew. This product is transformed, even in the dark, into a white substance which melts at about 175° C. and possesses many properties in common with caoutchouc. This homocaoutchouc begins to decompose when heated above 200° C. On dry distillation it is completely converted into volatile liquids which are all polymerides of the hydrocarbon C_6H_{10}, about 50 per cent. of the product consisting of a homoterpene $C_{12}H_{20}$. This homoterpene boils at about 205° C. and has a density of 0·872 at 0° C. It is a colourless liquid of terpene-like odour, volatile in steam, soluble in ordinary organic solvents though only sparingly in 95 per cent. alcohol, optically inactive, and easily polymerised. It is resinised by nitric and sulphuric acids, gives an intense red colour with acetic anhydride and sulphuric acid, and in acetic acid solution at 0° C., it takes up 4 atoms of bromine without liberation of hydrobromic acid. The nitrosochloride hydrochloride, $C_{12}H_{20}{\cdot}NOCl{\cdot}HCl$, is a yellow powder which decomposes at about 160° C. Since Harries has shown that paracaoutchouc, which is a polymerisation product of isoprene, is a polymeride of the complex—



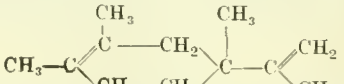
and since on heating, para-caoutchouc yields the dipentene



the homocaoutchouc obtained by the polymerisation of methylisoprene should be a dimethylcaoutchouc derived from the complex,



and, on heating, this compound should yield the 2-4-dimethyldipentene—



This formula is borne out by the molecular refractions of the homoterpene described above. This homoterpene yields a dihydroderivative boiling at 93°—95° C. under 20 mm. pressure, and of density 0·860 at 0° C.—L. E.

PATENTS.

Erythrene, its homologues [e.g., isoprene] and derivatives; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 425,967, Feb. 11, 1911. Under Int. Conv., March 11, 1910.

ERYTHRENE, its homologues and derivatives, are obtained by heating to temperatures above 500° C. cyclohexanol or its homologues or derivatives, with or without the aid of substances which facilitate decomposition. *Example.*—Cyclohexanol is allowed to fall, drop by drop, into an iron tube heated to 600° C.; decomposition occurs immediately, with evolution of gas, which is condensed or absorbed by means of bromine. Good yields of erythrene are obtained in this way. Isoprene is obtained by similarly treating o-methylcyclohexanol.—T. F. B.

Isoprene from terpenic hydrocarbons; Process for producing ——. Badische Anilin und Soda Fabrik. Fr. Pat. 425,885, Jan. 28, 1911. Under Int. Conv., Sept. 3, 1910.

IT is stated that increased yields of isoprene are produced from terpenic hydrocarbons by heating the vapours in a rarified or inert atmosphere. The heating is effected by means of a metal wire heated by an electric current. The apparatus may consist of a vertical iron tube, containing a platinum spiral heated to dull redness, which does not touch the walls of the tube; the upper end of the tube is connected with the flask containing the hydrocarbon, whilst the lower end communicates with a series of condensing flasks, the last of which is connected with a vacuum pump. The tube is surrounded by a jacket filled with hot water. The tube is first filled with nitrogen or evacuated to a pressure of 20 mm., and the hydrocarbon vapours are then passed over the heated spiral, together with a slow stream of nitrogen; the first condensing flask collects a quantity of unaltered hydrocarbons, which can be again utilised, whilst the isoprene condenses in the other flasks.—T. F. B.

Rubber and like trees; Treatment of latex of ——. R. Rankin, Hamilton. Eng. Pat. 10,056, Apr. 25, 1910.

THE latex is poured into a coagulating medium which coats or seals the globules, preventing access of air. Ethyl alcohol, or methylated spirit is used for this purpose. —H. E. P.

Caoutchouc; Industrial manufacture of ——. G. Reynaud. First Addition, dated Apr. 23, 1910, to Fr. Pat. 419,860 of 1909. (This J., 1911, 226.)

BY the modified process, described in the present addition, the conversion of turpentine oil into a rubbery product can be carried out entirely in the cold. About 1 kilo. of natural rubber (or rubber manufactured according to the present or other process) in the form of sheet or crepe, is soaked in turpentine oil (5 to 6 kilos.) until the whole of the latter is absorbed by the rubber. The mass is then plunged into sulphuric acid (60° Bé. diluted with 4 to 5 times its own volume of water) and allowed to soak for 12, 18, or 24 hours, until it is completely impregnated with the acid. It is then transferred to a rather stronger acid (60° Bé. diluted with 2 or 3 times its own volume of water). This is followed by a third bath of stronger acid still (60° Bé. diluted with once or twice its own volume of water), and finally the mass is soaked in acid of 60°—66° Bé. until it is completely transformed (12 to 15 days, for example). In the case of 63° Bé. acid the final soaking may occupy a month or more. The product is washed with water or dilute alkali, when it is found to possess all the properties of rubber.—E. W. L.

Rubber; Purification of natural and reclaimed ——, *and other materials soluble in hydrocarbons, by dialysis.* H. Debauge. Fr. Pat. 426,457, Feb. 3, 1911.

RESINS, sulphur and other soluble impurities are separated from natural raw rubber or from reclaimed rubber, etc., by dialysing a solution of the rubber, etc., in benzene, toluene, xylene, petrol, carbon bisulphide, carbon tetrachloride, terpenes, etc., against the pure solvent using, as semi-permeable membrane, a sheet of vulcanised rubber, swollen by the solvent, and supported between two sheets of fabric, or a septum of other material such as paper, parchment, ebonite, pig's bladder.—E. W. L.

Caoutchouc; Production of products similar to vulcanised ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 6642, March 16, 1911. Under Int. Conv., April 6, 1910.

It has been found that the caoutchouc-like substances prepared by the polymerisation of erythrene and similar hydrocarbons, their homologues and analogues, (Eng. Pats. 15,254 and 25,850 of 1910, and 6540 of 1911; this J., 1910, 1215 and following), can be vulcanised by the methods used for vulcanising natural caoutchouc, substances being obtained equal to, and some even better than, vulcanised natural caoutchouc. The claims are for such vulcanised products and their preparation.—E. W. L.

Caoutchouc; Manufacture of substances similar to ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 25,850, Nov. 7, 1910. Under Int. Conv., Dec. 27, 1909.

See Fr. Pat. 422,955 of 1910; this J., 1911, 637.—T. F. B.

India-rubber, gutta-percha, balata, and the like; Apparatus for removing foreign matter from ——. M. M. Dessau, London. U.S. Pat. 997,047, July 4, 1911.

See Eng. Pat. 13,201 of 1910; this J., 1911, 499.—T. F. B.

Isoprene; Manufacture of ——. O. Silberrad. Fr. Pat. 426,007, Feb. 13, 1911. Under Int. Conv., Feb. 18, 1910.

See Eng. Pat. 4001 of 1910; this J., 1911, 445.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Mangrove swamps of the Philippines; Economic possibilities of ——. [*Source of tanning materials.*] R. R. Williams. Philipp. J. Sci., 1911, 6, 45—61.

A number of data, both analytical and general, are given regarding the principal trees of the Philippine swamps. These include the diameter of the trees, value of the bark, and the percentages therein of insoluble and soluble matter and tannin. Only the "bacauan" (*Rhizophora mucronata* and *R. conjugata*) and the "pototan" (*Rruguiera gymnorhiza* and *B. eriopetala*) can be depended upon to give a satisfactory supply of bark. The manufacture of cutch from these barks appears likely to prove profitable, judging from the author's experiments.—F. Shdn.

Analysis of oakwood extract. J. Jedlicka and K. Dlouhy. Collegium, 1911, 253—258.

Zeuthen's method.—Paessler has stated, on the work of the German analysis-commission (Collegium, Nos. 362, 374 and 407) that the concordance of results by this method, obtained by different analysts, is, for the most part, better than that by the official method. Much importance, however, has not been ascribed to the point as to whether the percentage of non-tans obtained by this method is the same as that by the shake method. The German commission found that, with chestnut extract, the non-tans were always higher by Zeuthen's method than by the shake method using either Vienna or American hide-powder. With oakwood extract (Collegium, 407, 161) seven analyses by Zeuthen's method showed on an average 0·7 per cent. higher non-tans while five analyses showed on an average 1·1 per cent. lower. The differences lay between —1·2 per cent. and + 1·2 per cent. with a range of 2·4 per cent. The authors have always found higher non-tans in oakwood extract by Zeuthen's method and from the mean of 87 analyses of this material find 0·8 per cent. higher non-tans with a corresponding lowering in the percentage of tannin. On this account they consider it inadvisable to accept Zeuthen's modification as guarantee analysis of oakwood extract as the tannin-percentage, as shown by analysis, fell about 2 per cent. on the introduction of the shake method and by Zeuthen's method a still lower percentage would be shown. When the shake method was substituted for the filter-bell great difficulty was experienced in convincing the consumers that no change in the quality of the extract had taken place. *Estimation of insoluble matter.*—Paessler and Veit state that the insoluble matter consists only of difficultly soluble tannin. It was thought that inorganic material might accumulate in the precipitated matter, but investigations of its ash compared with that of the clear solution showed that this was not the case. By dissolving the difficultly soluble matter, however, in hot water and analysing in the usual manner it was found to contain considerable quantities of non-tans. One sample showed 81·7 per cent. tannin and 18·3 per cent. non-tan. From several analyses it was found that, with oak-wood liquors of densities between 1·5° and 8° Bé, the material which separates out contains only about 80 per cent. tannin. The tannin-figure is probably still lower than this as the further insoluble matter was added to the tannin found by analysis and the authors have reason to believe that this contains considerable quantities of non-tans. *Incineration of the extract.*—The direct evaporation and ashing of the extract may lead to loss by spurting and complete ashing requires much time. The process is hastened by evaporating the extract, drying, powdering finely and ashing a known weight of the dried material. *Abnormally high non-tans.*—A rise in temperature of the laboratory, after a cold and dull period, to a temperature of 28°—30° C., resulted in an increase of non-tans, found in the Mitrovitz oakwood extract, of more than 2 per cent. The non-tan solutions became bright yellow instead of the usual pale yellow colour and still gave no clouding with salted gelatin solution. By cooling all the water used in the operations to 18°—20° C. normal figures were again obtained as were also when the weather became cool again. Whether the sample of hide-powder was unusually prone to become decomposed or if there were other reasons could not be ascertained. No such variation in the absorption of a sample of hide-powder had been met with before, although the laboratory reached a temperature of 30°—35° C. many times during the summer.—D. J. L.

Acid in chrome leather; Determination of ——. G. Grasser. Collegium, 1911, 247—248.

The author criticises the recent method proposed by Fahrion for determining the presence of free acid in chrome leather (this J., 1911, 818). Fahrion's method depends on estimating the ratio of $Cr_2O_3 : SO_3$ and it is assumed that the chromium salt which is effective in tanning is the basic $Cr(OH)SO_4$. Our knowledge of this question is very defective, as other basic chromium salts are utilised in tanning. The author thinks that Fahrion's method may give valuable results where sulphuric acid only has been used in the tanning bath, but he prefers his own method (this J., 1910, 1216) for the direct and rapid determination of the acid content.—J. R. B.

Disinfection of skins against anthrax; A harmless method for ——. A. Schattenfroh. Collegium, 1911, 248—251.

Most of the materials which have been proposed for the disinfection of hides against anthrax, have been found unsuitable, because of the injurious action of the material itself on the gelatinous matter of the hide. The author, therefore, turns his attention to materials which are at present in common use in the tannery and his method is a modification of the pickling process. A series of experiments showed that a 2 per cent. solution of hydrochloric acid at a temperature of 20° to 22° C. was sufficient to destroy the most resistant anthrax spores in less than 24 hours. At 40° C. a 1 per cent. solution of hydrochloric acid killed the spores in 2 to 3 hours. To reduce the swelling caused by this concentration of acid, considerable quantities of salt were added, as in the ordinary pickling process. For the disinfection of goat and sheep skins a pickle of 1 per cent. of hydrochloric acid and 8 per cent. of common salt is prepared. The skins are carefully entered at a temperature of 40° C. and left for 6 hours, or. a pickle of 2 per cent. of hydro-

chloric acid and 10 per cent. of common salt is made and the skins left in for two days at 20°—22° C. Either of these two methods will disinfect against anthrax.
—J. R. B

PATENTS.

Plastic substances [from glue]; Process of manufacturing and moulding articles therefrom. P. R. Zierow, Berlin, and Kämmer und Reinhardt, Waltershausen, Germany. Eng. Pat. 7325, Mar. 23, 1911.

One kilo. of glue or gelatin is soaked in water (about 1 kilo.) for about 2 hours and then heated to about 60° C. 300 to 500 grms. of pulverised (crystalline) gypsum, 25 grms. of magnesium oxide and 300 to 500 grms. of water are then added and the mixture again heated to about 60° C. 250 to 400 grms. of glycerine, and 50 to 75 grms. of wax or wax-like substance (stearine, paraffin-wax, spermaceti, ceresin, earth-wax) in a warmed state are next incorporated with the mass, together with any desired suitable colouring matter. Articles may be prepared by moulding this mass while still warm, the finished articles being immersed in a "tanning solution" (formaldehyde, magnesium sulphate) to render them insoluble, or the tanning agent may be added to the warm mass before moulding. The "untanned" mass may also be moulded into the form of plates, etc., and placed on the market in that form, for subsequent re-melting and moulding. Vegetable fibres (*e.g.* cotton, hemp or wood-pulp), finely divided, may replace a portion of the gypsum (up to one-half).
—E. W. L.

Artificial leather or leather board; Manufacture of ——. Hide-Ite Leather Co. Fr. Pat. 425,846, Jan. 7, 1911.

See U.S. Pat. 981,591 and Eng. Pat. 491 of 1911; this J., 1911, 143 and 759.—T. F. B.

Tanning process. O. H. Nowak, Chicago, Assignor to Dermiforma Co. of America. U.S. Pat. 996,509, June 27, 1911.

See Fr. Pat. 360,854 of 1905; this J., 1906, 647.—T. F. B.

XVI.—SOILS; FERTILISERS.

Soil; Chemical nature of the organic nitrogen in the ——. S. L. Jodidi. J. Amer. Chem. Soc., 1911, **33**, 1226—1241.

Methods are described for extracting the bulk of the nitrogen present in the soil and separating this into ammoniacal, acid amide, diamino acid, and monoamino-acid (by difference) nitrogen. Practically all the nitrogen described as amide and diamino-acid nitrogen actually consists of these bodies, whilst from 40 to 92 per cent. of the monoamino-acid nitrogen, calculated by difference, belongs to this class of compound. The proportion of the total nitrogen extracted from the various plots of soil examined, by boiling with hydrochloric acid, was 76 per cent. on the average, the balance remaining insoluble. The soluble nitrogen is present as ammonia, 1·22 to 1·97 per cent.; as amide nitrogen, 25·4 to 33; as diamino-acid nitrogen, 12·2 to 13; and as monoamino-acid nitrogen from 22·2 to 55·6 per cent., the residue consisting of other types of nitrogen compounds. Extraction with water dissolves only a very small proportion of the total nitrogen, 2·92 to 7·88 per cent., so that the soluble acid amides and amino-acids are present in the soil in some kind of insoluble combination rather than in the free state. The organic nitrogen formed in the soil from comparatively fresh organic materials consists almost entirely of acid amides, mono- and di-amino acids and differs markedly from that formed from comparatively old organic material, which contains a considerable percentage of compounds belonging to other than these classes.—E. F. A.

Cyanamide; Detection and determination of —— in fertilisers. L. Vuaflart. Ann. Falsificat., 1911, **4**, 321—324.

Calcium cyanamide may be detected in fertilisers by its odour, its alkaline reaction, abundant ash rich in calcium, the black residue left on treatment with water, and the yellow precipitate (insoluble in ammonia, but soluble in nitric acid) obtained on adding silver nitrate to its aqueous solution. The nitrogen may be quantitatively determined either by the soda-lime or Kjeldahl method. Dicyanamide is determined by treating 100 c.c. of the solution from 2 grms. in 250 c.c. with silver nitrate, and 20 c.c. of 10 per cent. potassium hydroxide solution, instead of ammonia, the precipitate then containing the whole of the nitrogen of the cyanamide and dicyanamide. This nitrogen is determined by Kjeldahl's method, and the difference between the results and that found for the cyanamide gives the dicyanamide nitrogen.—C. A. M.

Volumetric determination of phosphoric acid. Rosin. *See* XXIII.

Mussel mud as a fertiliser. Oil, Paint and Drug Reporter, July 10, 1911.

The use of mussel mud as a fertiliser is referred to in a brief report from the U.S. Consul at Charlottetown, Prince Edward Island, Canada, as follows:—

In most of the bays indenting the shores of Prince Edward Island are found extensive deposits of mussel mud, organic remains of oysters, mussels, clams and crustaceæ. The shells, usually more or less intact, are found imbedded in dense deposits of a mudlike substance, and this combination is a fertiliser of high value. It supplies lime and organic matter, besides small quantities of phosphates and alkalies. The shells decay slowly year by year, throwing off a film of fertilising stuffs. The deposits around Prince Edward Island vary from 5 to 25 feet in depth.

PATENTS.

Peat; Utilisation of —— [Nitrogenous manure, etc., from ——]. P. Variot. Fr. Pat., 426,311, Feb. 21, 1911.

The peat is moistened with water and reduced to a pulp in a disintegrator, from which it is led into backs or vats provided with stirrers which keep the peat in suspension and allow mineral, earthy and calcareous matters to settle. The cellulose is extracted from the purified pulp by known chemical and mechanical processes, and the liquid, which contains the nitrogen of the original peat, is run into decanting backs or basins, and dried for direct use as manure. The separated cellulose is treated in any desired way to produce paper-pulp, plastic materials, glucose, etc.
—E. W. L.

Emulsions of mineral hydrocarbons. [Insecticide. Vines.] G. Galabert. Fr. Pat. 425,694, April 11, 1910.

Ten kilos. of rosin and four kilos. of glue or gelatin are dissolved in 24 litres of petroleum or other hydrocarbon and 4 litres of nitrobenzene by the aid of a water bath. After cooling 1·5 kilos. of hydrochloric acid, 0·5 kilos. of lime and 36 litres of water are added. When well mixed a further addition of 4 kilos. each of sodium and potassium sulphide and 18 litres of carbon bisulphide is made. The mixture is employed as an insecticide especially for vines.
—W. H. C.

XVII.—SUGARS; STARCHES; GUMS.

White sugar; Harloff's "acid thin-juice" process of making ——. J. J. Hazewinkel. Archief Suikerind. Nederl.-Ind. (Java). 1911, **19**, 123—139. Intern. Sugar J., 1911, **13**, 395—396.

The raw cane juice is treated by the double carbonatation process so that the final alkalinity is due only to potassium and sodium salts, and not to calcium salts, after which sulphitation follows. When carrying out the first carbonatation, the alkalinity which should be observed is 0·05 per cent. of calcium oxide, using phenolphthalein as indicator, *i.e.*, the maximum alkalinity at which the liquor can readily be passed through the presses. The second carbonatation is effected at 60°—65° C., and is continued until the juice no longer produces a precipitate on boiling, or on saturating with carbon dioxide. After filtering, the clear juice is sulphured, until on testing it isfound that 100 c.c. are neutralised by about 48 c.c. of $N/100$ sodium hydroxide, using phenolphthalein, which limit must not be exceeded, otherwise loss by inversion, and corrosion of the boilers as the result of feeding with acid condensed water, is endangered. After evaporation, the syrup is filtered, and again sulphured, but this time very slightly, graining and curing being finally carried out in the usual way. The author has found that no inversion occurs when juices, sulphured in the prescribed manner, are concentrated to syrup, or when the syrup is boiled to massecuite. Examination of the condensed water from the effects in which the sulphured juice had been boiled showed that there was only a slight acidity, with such a small sulphurous acid content that no danger of boiler corrosion from this source could be anticipated. As advantages of the Harloff process, it is stated that: (1) a better quality of sugar is obtained, and all is recovered as a superior first product; (2) on account of the decreased viscosity of the syrups, due to the sulphitation treatment ,boiling and crystallisation are considerably improved; (3) economy in the amount of sulphur is effected, about 15 per cent. less sulphur being required, as compared with the ordinary procedure; and (4) boiling in the effect is facilitated, on account of the evolution of sulphur dioxide, and gases from the decomposition of organic acids.—J. P. O.

Sucrose and its decomposition-products; Behaviour of —— on heating. J. E. Duschsky. Z. Ver. deutsch. Zucker-Ind., 1911, 581—608.

As a preliminary step in the investigation of the partial decomposition undergone by sucrose during the concentration of factory-juices, the author has studied the effect of prolonged heating on the optical rotation and cupric-reducing power of solutions of dextrose and lævulose. The rotation of dextrose solutions of 50 per cent. concentration diminishes, on heating to 120° C. or over, to an extent depending on the temperature and time of heating. Owing to darkening of the solution the decomposition cannot be followed polarimetrically beyond a certain point. The maximum fall in rotation observed by the authors was the result of heating for 12 hours at 135° C., and amounted to about 15 per cent. Reduction or increase of the pressure under which the heating is carried out has no appreciable effect. In presence of traces (0·05 per cent.) of lactic or acetic acid, not only is the fall in rotation much less, but at first a distinct rise takes place, which is followed on further heating by a fall to the original value and beyond. A similar rise in rotation is produced on heating dextrose with less than an equal weight of water; thus the polarisation of a mixture of 5 grms. of dextrose and 1 grm. of water increases by more than three per cent. after heating for 4 hours at 130° C., and in presence of a trace of lactic acid the increase is still greater. It appears therefore that a high concentration of dextrose and the presence of traces of acid have a protective action on the sugar, and favour the formation of products of high rotatory power, which, however, are unstable, decomposing into inactive products sooner or later on continued heating. Alkalis, even in traces, accelerate the fall in rotatory power. Potassium chloride is without influence, but sodium acetate acts as a weak alkali owing to partial hydrolysis. In all the experiments with dextrose the cupric-reducing power was found to diminish somewhat, but to a relatively smaller extent than the rotatory power. Lævulose decomposes on heating much more readily than dextrose. When mixed with 1/10 of its weight of water no appreciable change in the rotatory power takes place in 7 hours at 60° C., under atmospheric pressure; after 8 hours at 80° C. a fall of 4 per cent. occurs, and after 9 hours at 100° C. a fall of 20 per cent. At higher temperatures and pressures the fall is more rapid; diminution of pressure, on the other hand, causes retardation, possibly owing to cooling. In less concentrated solutions (*e.g.*, 50 per cent.) the lævulose decomposes less rapidly. Traces of lactic or acetic acid retard the fall in rotatory power, but in no case was an increase observed as in the case of dextrose. The products of decomposition of lævulose are probably optically inactive and have little, if any, cupric-reducing power.—J. H. L.

Sugar refineries; Danger of fire in ——. F. J. T. Stewart. Amer. Sugar Ind., Beet Sugar Gaz., 1911, **13**, 276.

Reporting to the New York Board of Fire Underwriters on the recent fire in a sugar refinery at Brooklyn, U.S.A., the author states that the risk attending the pulverisation of sugar, and the need for conducting this in a separate building, or in a section cut off by a 12-inch fire wall without direct opening to other buildings, is clearly shown. Whichever method be adopted, the outer wall of the building should preferably be made of some light material, such as plaster on wire lath, or terracotta blocks, so that the force of any explosion may be vented outwards. No dust room should be used. Dust from granulators and pulverisers should be kept down by spraying in an enclosed chamber of incombustible material, thus eliminating the danger of the dust room and dust tubes. All pulverising mills should be equipped with magnets and some form of explosion preventer. The location of the machinery and conveyors should be such as to necessitate as few door openings as possible, and stair and elevators should be enclosed in a suitable manner. A bad feature of the plant was the wooden sugar bins passing through the sixth floor. When these burned, they not only made large openings in the floor, but the burning sugar flowed over the floors, adding to the intensity of the fire. These bins should be replaced by a structure of incombustible material.—J. P. O.

Sugar; Effect of feed water containing —— on boilers. F. P. Pillhardt. Centr. Zuckerind., 1911, **19**, 1119—1120.

It sometimes happens in the sugar factory that the boiler feed water condensed from the vapours of the multiple effect contains sugar. When the amount of sugar is small, as indicated by the characteristic dark colour of the water in the gauge glasses, and by frothing on blowing off, the corrosive action of the resulting acid decomposition products of sugar may be obviated by the addition of caustic soda. Since a large excess of this re-agent in the boilers causes inconvenience from foaming, the amount to be used should be controlled by titration with $N/10$ sodium hydroxide solution, using rosolic acid as indicator and only a slight excess of caustic alkali added to the feed water, so that 100 c.c. are equivalent to 10 c.c. of $N/10$ acid. If, however, a large amount of sugar has entered the boilers, either as the result of entrainment during evaporation or of a defective or imperfectly "beaded" tube, treatment with caustic soda is useless. Then, in addition to the acid decomposition products of sucrose, amorphous carbon is precipitated, forming a non-conducting layer on the tubes, hindering the interchange of heat, and, unless the boiler is put out of use, often finally causing an explosion. It is also pointed out that not only are the acid decomposition products of sucrose active in causing corrosion, but that the caramel bodies, caramelan, caramelen, and caramelin, have also been proved to be of influence.—J. P. O.

Beet pulp; Preservation of —— by the lactic ferment. E. Malpeaux. La Betterave, 1911, **20**, 340—344.

On examining the influence of inoculation with "Lactopulpe" (see this J., 1909, 1027) upon the quality of beet cossettes, it was found that, while on the whole there is but little difference in composition as the result of the treatment, a slight loss in the amount of dry substance is noticeable, the cellulose, carbohydrate, nitrogen, and ash contents all decreasing. Experiments on the large scale have shown that the repulsive smell, observable in the neighbourhood of the silos, which is often the cause of complaint, is suppressed by the inoculation, giving place to an odour resembling that of fresh cossettes. It was also found that it is even possible to feed lambs with the preserved pulp with fully satisfactory results, and that the practice of inoculating the pulp in the silos can be carried out by the farmer without any difficulty.—J. P. O.

Carbohydrates [*sorbose*]; *Photochemical synthesis of* ——. *I. Formation of sorbose.* G. Inghilleri. Z. physiol. Chem., 1911, **71**, 105—109.

A SEALED glass tube containing 200 c.c. of 40 per cent. formaldehyde solution, and 12 grms. of oxalic acid was exposed to sunlight for several months. No apparent change occurred, but on opening the tube a large amount of gas escaped (probably carbon dioxide) and the liquid which smelt strongly of formic acid, contained a hexose sugar having the characters of optically inactive sorbose. The quantity of sugar obtained is not stated, but it must have been at least several grms.—J. H. L.

Caramel; Preparation of ——. J. J. Hazewinkel. Archief Suikerind. Nederl.-Ind., **18**, 519—546.

IN Java it is found necessary to darken the raw sugar made for export to certain countries, in which the Customs duty is levied on a basis of colour. In so doing, a kind of crude caramel is used, which the author now finds on analysis to be, so far as colour and composition are concerned, for the greater part unchanged molasses. With the object of improving the mode of manufacturing this caramel, the author has carried out a series of experiments, using a molasses containing 30·6 per cent. of sucrose and 32·4 per cent. of reducing sugars, and was able to establish the fact that the maximum amount of colour is produced by heating the molasses to 120°—130° C., for 5 to 10 hours. The finished product should be neutralised.—J. P. O.

Cane juices; Correlation between the contents of sugar and potash of ——. H. C. Prinsen-Geerligs. Bull. Assoc. Chim. Sucr., 1911, **28**, 1036—1040.

THE author has repeatedly observed that although the quantity of final molasses produced from a given weight of cane is subject to wide variations according to the quotient of purity of the juice, the composition of the molasses, and notably its content of potash, do not vary much. A juice of purity 75 may, for example, furnish, for a given weight of dry solids, 2·5 times as much molasses as a juice of purity 90, and yet the composition of the molasses may be almost identical. The chief constituents of cane molasses are reducing sugars and their decomposition products, and salts, of which (apart from the lime introduced during manufacture) those of potash are most important. It appears therefore that the amount of potassium salts in cane juices is closely related, not to the total solids, but to the reducing sugars present. Possibly potassium salts retard the disappearance of reducing sugars, during the ripening of the cane. The author has attempted to determine whether the disappearance of reducing sugars during ripening is accompanied by a corresponding diminution in the quantity of potassium salts present, but all the evidence goes to show that the potash-content of the cane remains fairly constant during growth. A large number of analyses have been made of juices from various factories, noted for working certain types of cane. The results justify the conclusion that juices which contain a high content of sugar, and possess a high quotient of purity, are, on the whole, characterised by a low content of potassium salts, and *vice versa*. Certain varieties of cane are able to extract more potash from the soil than others under the same conditions; and those which extract most, furnish juices of low sugar-content, and low purity. The author does not recommend the reduction of potash-manure, for this is essential for the growth of the cane, but he points out that in selecting new varieties of cane for cultivation, from a number of seedlings, those should be chosen which contain a low content of potash.—J. H. L.

"*Sugar sand*" *from maple sap; a source of malic acid.* Warren. *See* XX.

PATENTS.

Diffusion vessel [*Sugar*]; *Vertical* —— *with a discharging contrivance serving for the passage of the liquid.* W. Bock. Fr. Pat. 426,024, Feb. 14, 1911.

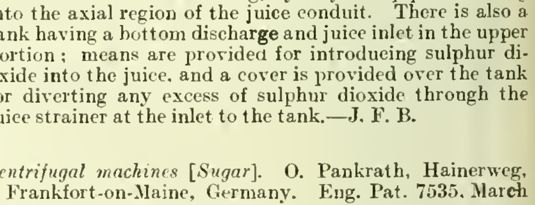
THE lower part of a vertical diffusion vessel is traversed by a vertical hollow shaft which is provided with spiral blades, and is perforated in its upper part. Each of the blades attached to the upper part of the shaft consists of an upper perforated plate and a lower plate, with a space between the two. Hence, liquid entering at the top of the diffusion vessel traverses the beetroot slices or other material under treatment and then passes, *via* the upper blades and the shaft, away from the bottom of the vessel. When diffusion is complete, the introduction of liquid is stopped, and a considerable part of the liquid retained by the material is driven out of the vessel by compressed air. An outlet at the bottom of the vessel is then opened and the shaft is rotated, the material thus being discharged. The lower part of the diffusion vessel is double-walled, the inner wall being perforated so that juice, expressed from the material during discharge, can pass away to another outlet. If desired, the liquid may be made to pass through the vessel in the opposite direction, or again, the apparatus may be used for continuous diffusion. In another form of apparatus a spiral, which may be mounted on the above-mentioned shaft or on a special shaft, is used for charging the diffusion vessel.—L. E.

Cane juice; Apparatus for treating ——. E. W. Deming. New York. U.S. Pat. 996,911, July 4, 1911.

THE apparatus consists of a closed conduit for juice arranged in proximity to a casing in which a continuous circulation of milk of lime is maintained, and a valve connecting the juice conduit with the casing, by way of a pipe extending into the axial region of the juice conduit. There is also a tank having a bottom discharge and juice inlet in the upper portion; means are provided for introducing sulphur dioxide into the juice, and a cover is provided over the tank for diverting any excess of sulphur dioxide through the juice strainer at the inlet to the tank.—J. F. B.

Centrifugal machines [*Sugar*]. O. Pankrath, Hainerweg, Frankfort-on-Maine, Germany. Eng. Pat. 7535, March 25, 1911.

THE machine is intended more particularly for the separation of sugar syrup from the massecuite, and is provided with means whereby it can be discharged periodically.



The apparatus comprises a revolving conical drum, *a*, with sieve, *b*, and discharge orifices, *B*, for the liquor The drum is supported by bolts, *f*, secured to a rotating disc, *c*. The bolts, *f*, also carry a ring, *g*, which closes the bottom of the drum excepting for an annular discharge orifice, *i*, and a series of rings h h^1, which distribute the massecuite and take a part of its weight. The annular orifice, *i*, is closed by a ring, *k*, which is held up against the drum, *a*, by a spring, *m*, and is lowered by a hand-lever, *n*, to discharge the granular sugar at intervals. In this arrangement the drum is charged intermittently. To permit of a continuous flow of the massecuite, there may be an outer drum, inclined oppositely to the drum, *a*, or there may be a series of oppositely inclined drums, each drum or set of drums having closing rings such as *k*. The flow of massecuite into the inner drum need not then be interrupted whilst the sugar is being discharged from the outermost drum.—A. T. L.

Purifying solutions [sugar juice, etc.]; Process and apparatus for ——. F. Tiemann, Berlin. U.S. Pat. 997,477. July 11, 1911.

SEE Addition of Dec. 23, 1909, to Fr. Pat. 395,752 of 1908; this J., 1910, 969.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Fermentation; Mechanism of alcoholic ——. A. Lebedeff. Comptes rend., 1911, **153**, 136—139. (See this J., 1910, 1264).

THE author's more recent work has led him to conform to Young's view (this J., 1909, 1322; 1911, 705) that the phosphoric acid ester formed in alcoholic fermentation has the formula $C_6H_{10}O_4(H_2PO_4)_2$. He has not succeeded in obtaining an ester by treating dihydroxyacetone with dried yeast or zymin. He now shows, however, that if the yeast juice (60 c.c.) prepared by his method (this J., 1911, 147) be allowed to act on dihydroxyacetone (3 grms.) in presence of monosodium phosphate (1 grm.) and disodium phosphate (2 grms.), the product, on treatment with phenylhydrazine, yields the same compound $C_{24}H_{31}N_6O_7P$, as that obtained from the product of fermentation of sucrose. (*See* Young, this J., 1911, 705.) Again, the barium salts of the esters formed in the fermentation of sucrose and of dihydroxyacetone are both found to correspond to the formula $C_6H_{10}O_4(PO_4Ba)_2$. The products of fermentation of dextrose, lævulose and mannose all yield the same osazone (or phenylhydrazine salt thereof) and from the author's present work it may be concluded that whatever fermentable sugar be employed, the same phosphoric acid ester is produced initially. In conclusion, the author represents the mechanism of alcoholic fermentation as follows:—

$$C_6H_{12}O_6 = 2C_3H_6O_3$$
$$2C_3H_6O_3 + 2RHPO_4 = 2C_3H_5O_2RPO_4 + 2H_2O$$
$$2C_3H_5O_2RPO_4 = C_6H_{10}O_4(RPO_4)_2$$
$$C_6H_{10}O_4(RPO_4)_2 + H_2O = C_2H_5OH + CO_2 + C_3H_5O_2RPO_4 + RHPO_4$$
or
$$C_6H_{10}O_4(RPO_4)_2 + 2H_2O = 2C_2H_5OH + 2CO_2 + 2RHPO_4.$$

—L. E.

Yeast-enzymes; Behaviour of —— *in the free state and combined with protoplasm.* H. Euler and S. Kullberg. Svenska Vet. Akad. Arkiv. f. Kemi, 1911, **4**, No. 13; Z. physiol. Chem., 1911, **73**, 85—100.

CONSIDERABLE differences have been observed, between the zymase, maltase and invertase of yeast, as regards their activity, solubility and behaviour towards antiseptics. These differences are summarised by the authors, who attempt to correlate them by means of the following working hypothesis. The enzymes of yeast are originally constituents of the protoplasm, with which they may remain combined during the life of the cell, or from which they may separate and exist free within the cell. In the latter case they are relatively easily extractable and occur in relatively large amounts within the cells; in the former case they can be obtained free only after the protoplasm has been killed, *e.g.*, by drying or by mechanical means. Yeast-enzymes when freed from living protoplasm are not, in general, sensitive towards antiseptics. Zymase occurs in living yeast bound with the protoplasm. In this condition its activity is almost, but not quite, destroyed by antiseptics, or by cooling for half an hour to the temperature of liquid air. After carefully drying the yeast, about 1/30—1/10 of its fermentative activity remains, and this residual zymase may be partially extracted by water. The activity of zymase solutions obtained by Buchner's method is scarcely affected by antiseptics; that of dried yeast is, however, considerably depressed by toluene, but not so much as in the case of living yeast. The maltase of living yeast is not extracted by water, and its activity is destroyed by chloroform and greatly diminished by toluene and thymol. The maltase of dried yeast is, on the other hand, partially extractable, and less sensitive towards antiseptics. Invertase occurs in the free state in yeast cells to a greater extent than the other enzymes, and extracts of considerable activity may be obtained from fresh yeast at 50° C. On drying the yeast, about half the invertase is destroyed, that which remains being more readily extracted than the invertase of living yeast. The invertase of *Monilia candida* differs from that of yeasts, in that, like zymase and maltase, it is more intimately bound with the protoplasm of the cells. It is also much more sensitive towards chloroform.

—J. H. L.

Amylases. III. Preparation and properties of pancreatic amylase. H. C. Sherman and M. D. Schlesinger. J. Amer. Chem. Soc., 1911, **33**, 1195—1204.

BY means of a process involving extraction of the dry pancreas powder with 50 per cent. alcohol, precipitation by alcohol-ether, solution in a little water and precipitation by alcohol and subsequent purification by dialysis in 50 per cent. alcohol, preparations were obtained having diastatic powers up to 3480 (Sherman, Kendall, and Clark, this J., 1910, 1173) corresponding to over 5000 on the Lintner scale. Six independent preparations showed diastatic activities of 3310, 3670, 3540, 3570, 3720, 3320 (reckoned on the dry substances) indicating that the procedure followed yields a fairly definite result, more particularly in view of the well established fact that the more highly enzymes are purified the more sensitive they become to external conditions. The amylase was obtained as a friable colourless powder or as brittle, easily pulverised, slightly yellowish scales readily soluble in water to a clear colourless solution. This coagulates on heating, the coagulum giving a blue violet biuret reaction and the filtrate a rose pink biuret colouration and a flocculent precipitate with alcohol. The enzyme showed typical xanthoprotein, tryptophane, biuret and Millon's reactions, in this respect closely resembling Osborne's malt diastase which, however, only had an activity of 600° Lintner. The pancreatic diastase as here prepared, acting on soluble starch at 40° C., formed 6000 times its weight of maltose in 20 minutes and 211,000 times its weight in 30 hours. It digested 400,000 times its weight of starch to the erythrodextrin stage in less than 22 hours and to products giving no reaction with iodine in 48 hours.

—E. F. A.

Zymase; Nature of ——. A. Lebedeff. Bull. Soc. Chim., 1911, **9**, 672—682.

THE author has investigated the action of solutions of zymase, prepared by the maceration method (see this J., 1911, 147), on sugar. When the concentrations of sugar and enzyme are varied by diluting with water, the quantity of carbon dioxide produced depends chiefly on the dilution of the zymase-extract and to only a small extent on the concentration of the sugar. This appears to indicate that the action of the zymase is not purely catalytic, but the explanation is to be found in the varying concentration of the co-enzymes present in the extract. When boiled extract is used for diluting, instead of water, the activity of the zymase, for a given concentration of sugar, is nearly proportional to the amount of co-enzyme present. The author concludes that the zymase present in maceration-juice is a typical enzyme. The quantity of sugar fermented is nearly proportional to the quantity of co-enzyme present, provided the latter exceeds a certain amount. The great activity of zymase solutions prepared by maceration is due to their large content of co-enzymes. It seems probable that the still greater activity of living yeast is to be attributed, not to a high content of zymase, but to the continuous re-formation of co-enzymes in an organic form, as fast as they are destroyed in the course of fermentation.—J. H. L.

Patents.

Starchy and nitrogenous materials in breweries and distilleries; Saccharification of ——. J. Ducreux. Fr. Pat. 425,714, Feb. 8, 1911.

According to this invention the cooked materials employed in breweries and distilleries are saccharified by means of a mixture of soluble or modified starch and dextrin, separately prepared from other starchy materials mashed with the necessary ferments. The materials employed for preparing the diastatic mash may consist of wheat starch, wheat flour, the meals of various cereals, tubers or legumes. Such material is stirred with hot water to a paste at a suitable temperature until the mash is homogeneous and of suitable consistence. It is cooled to a lower temperature without interrupting the mixing, and the ferment, malt, soluble enzyme or culture of organised ferment as the case may be, is worked in under suitable conditions. It is claimed that various flavours may be produced according to the material used in the diastatic mash, also that under these conditions the conversion of the constituents of the main mash is more complete than usual; the quantity of brewery or distillery mash is augmented by the products of the materials employed in preparing the diastatic mash.—J. F. B.

Fermented beverages; Production of etherified and clarified ——. E. W. Kuhn, London. Eng. Pat. 9777, April 21, 1910.

A wort is prepared containing a predetermined limited proportion of glucose, *e.g.*, sufficient to produce 2 per cent. of alcohol; this is fermented with a selected type of yeast suitable for the kind of beverage to be prepared; fermentation is conducted in closed vessels at atmospheric pressure. The fermented liquor is then sterilised under high pressure, cooled and inoculated with cultures of bacteria or mycodermæ suitable for producing the organic acids from which the typical "ethers" or bouquets are formed. These cultures are allowed to act under sterile conditions in closed vessels under pressure on a liquid which does not contain sufficient alcohol to inhibit their development. After the "ethers" are formed the liquor is transferred to a jacketed cooling tank under a counter-pressure of filtered, sterilised air. The tank is sealed and a sufficient quantity of glucose and yeast is introduced to produce the quantity of alcohol and carbonic acid desired in the finished beverage, *e.g.*, a further 2 per cent. of alcohol, the liquor is fermented under pressure, then cooled in order to clarify it and cause it to absorb the carbon dioxide formed.—J. F. B.

Malting and manufacture of beer; Process of ——. H. Dufour. Fr. Pat. 426,215, Feb. 18, 1911.

The germination is effected in a horizontal cylinder the lower part of which is surrounded by a trough. The cylinder is made to rotate slowly, and is cooled to the desired degree by a stream of water (or other means) which flows over its exterior surface and collects in the trough. The mashing is effected in two stages, in the first of which part of the malt is mashed by a diffusion process. The wort thus obtained is boiled with or without hops and is then used as mashing liquor for the remainder of the malt, whereby enzyme action is restricted and solution of husk constituents is retarded. The mashing process is effected in a cylinder similar to that used for malting save that part of the cylindrical surface is perforated and serves as a false bottom; the mashing liquor is introduced into the trough in which the cylinder rotates and passes thence into the cylinder.—L. E.

Alcohol; Manufacture of ——. A. E. V. Castro, Merida, Mexico. U.S. Pat. 996,400, June 27, 1911.

The fresh cold juice of agaves is mixed with scraped raw potatoes, coarse brown sugar, ground Indian corn, and down of the pinuela plant. The mixture is allowed to ferment for 4 or 6 hours, and is then distilled.—A. T. L.

Malt: Process and mill for separating —— *into meal, semolina, and bran.* Mühlenbauanstalt u. Maschinenfabr. vorm. Gebr. Seck. Fr. Pat. 426,478, Feb. 15, 1911.

See Eng. Pat. 5346 of 1911; this J., 1911, 916.—T. F. B.

Wines, spirits, and liqueurs; Process and apparatus for the artificial ageing of ——. A. Jarraud, Cognac, France. Eng. Pat. 19,024, Aug. 12, 1910.

See Fr. Pat. 419,143 of 1910; this J., 1911, 104.—T. F. B.

Reflux condensers. Eng. Pat. 3269. *See* I.

XIXa.—FOODS.

Chicken meat; Effect of low temperatures on ground ——. H. W. Houghton. J. Ind. Eng. Chem., 1911, 3, 497—506.

The author studied the chemical changes which take place in ground chicken meat (separated from skin, loose adipose tissue, and bones) when placed in cold storage for periods up to 5 months at from − 6° to + 6° C., in air and in an atmosphere of carbon dioxide. The light meat and dark meat were kept separate and experiments were also made with chicken fat (prepared by pressing the adipose tissue of the viscera) and chicken meat fat (prepared by extracting the dried meat with anhydrous ether). It was observed that after cold storage the meat was much less firm than fresh chicken meat and possessed a slight characteristic odour. The ammonia-nitrogen increased slightly during storage, especially in the case of the light meat. The water-soluble nitrogen compounds, total solids, and organic extractive matter increased decidedly in the light meat and decreased slightly in the dark meat. The coagulable nitrogen compounds decreased in both kinds of meat during the first 30 days and then increased, but not to the original value. The amino-acids increased in both kinds of meat. The proteoses and peptones increased in the light meat and decreased in the dark meat. During the first 90 days of storage the soluble phosphorus compounds increased in both the dark meat and light meat, more markedly in the former. The meat after cold storage contained a little volatile sulphur, but none was present in the fresh meat. No appreciable change due to storage could be detected in chicken fat, but in the chicken meat fat the iodine value increased and the refractive index slightly decreased. The changes produced in the meat by cold storage were prevented to a certain extent by maintaining an atmosphere of carbon dioxide in the storage chamber, probably owing to retardation of bacterial action. In this atmosphere there was an increased production of proteoses, peptones, and amino-acids, probably owing to enzymic action during the first 30 days when the temperature was about 12°—13° C. The chicken meat was examined for the presence of enzymes, and peroxydase, catalase, a protease similar to trypsin, invertase, and a nitrate-reducing enzyme were detected, but no oxydase, lipase, or diastase. (See also Hepburn, this J., 1911, 826.)—A. S.

Palm fats in butter; Detection of —— *by Ewer's method.* E. Nockmann. Z. Unters. Nahr. Genussm., 1911, 21, 754—757.

Results of experiments carried out by the author show that Ewer's method (this J., 1910, 712) yields untrustworthy results when applied to butter obtained from cows which have been fed on beetroot leaves. Whilst Ewer considers that all butters which give a "difference value" of less than 9 must contain palm kernel oil or cocoanut oil, five out of seven butters obtained from cows on beetroot leaves yielded "difference values" of from 7·8 to 8·95.—W. P. S.

Cocoanut oil in butter; Detection of —— *by Fendler's method.* A. Hepner. Z. Unters. Nahr. Genussm., 1911, 21, 758—760.

Experiments carried out by the author show that the composition of butter fat is altered when the cows are fed on beetroot leaves and that such butter yields results when examined by Fendler's "B" method (volume of the ethyl esters, b. p. 240°—300° C., distilling from 50 grms. of the mixed ethyl esters of the fat) which may lead to the conclusion that the butter contains from 10 to 15 per cent. of cocoanut oil.—W. P. S.

Cocoanut oil and butter in butter and margarine ; Methods of determining ——. C. Revis and E. R. Bolton. Analyst, 1911, **36**, 333—340.

Of various methods examined a combination of the Reichert-Meissl, Polenske, and Kirschner methods was found to yield the most satisfactory results, particularly in the case of margarines containing both butter fat and cocoanut oil. As, however, the results are dependent on the conditions under which the methods are carried out, the details of procedure are given as follows : Five grms. of the fat are saponified with sodium hydroxide and glycerol in the usual way and the soap is dissolved in 100 c.c. of recently boiled water ; after the addition of 0·1 grm. of powdered pumice (sieved through butter-muslin) and 40 c.c. of dilute sulphuric acid, the mixture is distilled, the actual distillation being commenced when the insoluble fatty acids have melted, and 110 c.c. of distillate are collected in from 19 to 21 minutes. The distillate is now cooled to 12° C., mixed, filtered, and 100 c.c. of the filtrate are titrated with $N/10$ barium hydroxide solution, using phenolphthalein as indicator ; the result is multiplied by 1·1 in order to obtain the Reichert-Meissl value of the sample. The condenser, receiver, and filter are then washed with 18 c.c. of cold water, and the volatile insoluble acids are next dissolved in neutral alcohol and titrated with $N/10$ barium hydroxide solution ; this gives the Polenske value. When the latter value exceeds by 0·5 c.c. the figure corresponding with the Reichert-Meissl, as shown in the subjoined table, the presence of cocoanut or palm kernel oils is indicated :—

Reichert-Meissl values.	Polenske values.	Reichert-Meissl values.	Polenske values.
32	3·5	27	2·4
31	3·2	26	2·0
30	3·0	25	1·8
29	2·9	24	1·7
28	2·7	23	1·6

To the 100 c.c. of neutralised distillate obtained as described above is added 0·5 grm. of powdered silver sulphate, and the mixture is placed aside for 1 hour and shaken occasionally. The mixture is then filtered, 100 c.c. of the filtrate are transferred to a flask, 35 c.c. of water and 10 c.c. of dilute sulphuric acid are added, and the whole is distilled, a piece of aluminium wire being added to prevent "bumping." One hundred and ten c.c. of distillate are collected and 100 c.c. are titrated, the number of c.c. of $N/10$ barium hydroxide required being calculated to the Kirschner value by the following formula :— $K=\frac{x\times 121\times(100+y)}{10,000}$, where x is the titration value and y the number of c.c. of $N/10$ alkali required to neutralise 100 c.c. of the Reichert-Meissl distillate. The Kirschner value is of importance in the case of cocoanut oil-butter mixtures, and this importance is enhanced when the cocoanut oil is introduced into the butter as the constituent of a margarine. This is due to the fact that the Kirschner value is practically a measure of the butyric acid content of the mixture. Results of analyses of numerous samples of mixtures are given.—W. P. S.

Margarine ; Notes on the analysis of ——. C. H. Cribb and P. A. E. Richards. Analyst, 1911, **36**, 327—333.

Whilst the proportion of cocoanut oil to butter in mixtures of the same can be calculated approximately from the Wollny and Polenske values of the sample of fat, the results leave room for improvement, and the authors show that more satisfactory results are obtained if the Wollny and Polenske values be corrected as described below. In the first place the volatile soluble acids have to be corrected (*a*) for the proportion of soluble volatile acids due to the cocoanut oil, and (*b*) for the proportion of the insoluble volatile acids derived from the cocoanut oil becoming dissolved owing to the fact that while the volume of the distillate remains constant the volatile "insoluble" acids diminish directly with the cocoanut oil. In the second place the insoluble volatile acids have (*c*) to be increased by the amount that has been deducted from the soluble volatile acids, and (*d*) to be diminished by the amount of insoluble volatile acids due to the butter fat present.

(*a*) From the volatile insoluble acids is deducted a number of c.c. equivalent to one-tenth of the volatile soluble figure, the remainder being then calculated into cocoanut oil, assuming that 17·5 c.c. corresponds with 100 per cent. of cocoanut oil. From the percentage thus obtained the soluble volatile acid figure for the cocoanut oil is calculated and the result deducted from the total volatile soluble figure. The remainder, subject possibly to further correction, represents in c.c. the volatile soluble acids due to the butter present.

(*b*) As the result of various experiments, the authors find that 0·8 c.c. should be deducted from the soluble acids and added to the insoluble acids, in order to correct for the solubility of the so-called insoluble acids derived from the cocoanut oil. This figure is largely dependent on the temperature at which the distillate is filtered ; the authors have adopted a temperature of 15° C., instead of 12° C. If this correction be made, it is necessary to alter the figure for the cocoanut oil insoluble acids, on which the calculation of the percentage of cocoanut oil is ultimately based, from 17·5 c.c. to 18·3 c.c.

The presence of a third constituent in the fatty mixture affects the complexity of the problem ; it contributes a quantity of soluble and insoluble volatile fatty acids and the presence of its non-volatile fatty acids exercises a retentive effect on the distillation of the volatile. Although a satisfactory method for correcting the figures obtained for the combined effect of the retention of volatile acids and the variation in the ratio between the water and the quantity of acids distilled, has not yet been obtained, the addition of 1·9 c.c. to the insoluble volatile acids, and a corresponding reduction of the same amount from the soluble volatile acids, is said to give fairly accurate results.—W. P. S.

Carbonated beverages ; Effect of environment of —— *on bacteria.* C. C. Young and N. P. Sherwood. J. Ind. Eng. Chem., 1911, 3, 495—497.

Comparative experiments in which the contents of some of the test-bottles were inoculated with 48-hour broth cultures of *Bac. typhosus*, *B. coli communis*, and *B. prodigiosus*, and the number of bacteria determined both in the infected samples and in control samples after periods of 4, 28, 80, and 244 hours after bottling, showed that although the reduction in the number of organisms on standing was more marked in carbonated than in uncarbonated liquids, especially in the case of *B. typhosus*, in no case was the whole of the organisms destroyed. *B. prodigiosus* and *B. coli* appeared to be somewhat more resistant than *B. typhosus*. It is evident that sterilisation is not effected by the action of the carbon dioxide under pressure, and only water free from bacterial contamination should be used for the manufacture of carbonated beverages.—A. S.

Millers and pure flour ; "Improvers" condemned. Times, July 18, 1911.

At a meeting of millers held on July 17 to discuss what action should be taken to compel millers to manufacture flour only on certain proposed lines and free from bleaching or chemicals, the chairman said that 180 firms had sent letters stating that they were in favour of legislation making it compulsory upon millers to sell only pure flour. The Local Government Board assumed that the English farmer's weak wheat could be utilised by the aid of "improvers" to make flour and show a loaf equal in appearance to one baked from flour manufactured from strong wheat. At present English wheat was noted for its colour and its flavour. The ability of other countries to make their flours appear more valuable than they really were, and to imitate English flavour, would not compensate the farmer for millers being allowed to use flour "improvers" for native wheat. If legislative action were not taken to compel the sale of pure flour millers would have to ask the Government to prohibit the import of treated flour. A committee was appointed to ask for an interview with the President of the Local Government Board.

Butter, margarine, etc.; Miscibility curves applied to the analysis of ——. E. Louïse. *See* XII.

Patents.

Coffee substitutes; Apparatus for preparing ——. O. Gaebel, Breslau, Germany. U.S. Pat. 995,956, June 20, 1911.

An apparatus for preparing coffee substitutes from malt in a continuous operation consists of a saccharifying chamber, a drying chamber, a cleaning device, a roasting chamber, a glazing chamber, and a second drying chamber. These parts of the apparatus are in connection with each other, and suitable means are provided for moving the material through the chambers and from one chamber to another.—W. P. S.

Milk powder; Process of manufacturing a soluble, sterilised, and stable ——. Soc. Mignot et Plumey. Fr. Pat. 426,282, Feb. 20, 1911.

Milk is first concentrated by passing it through an evaporating apparatus, the milk entering the apparatus at a temperature of 85° C. and leaving it three minutes later, after having lost from 50 to 60 per cent. of its water, at a temperature of 100° C. The concentrated milk is then conducted to a vessel from which it is transferred by means of a roller on to the surface of a rotating drum. Boiling water is conducted through the interior of the drum, and the rate of rotation of the drum is so adjusted that the film of milk on its surface is dried completely before the drum has made a complete rotation. A scraper is provided for removing the dried milk, and the drum is partially surrounded by a jacket connected with a chimney in order to accelerate the evaporation.—W. P. S.

Desiccating milk. C. H. Campbell, New York. U.S. Pat. 996,832, July 4, 1911.

The milk is heated to a temperature below the coagulating point of the albumin. The concentration is only carried to such a point that the milk can still be injected, in the form of a fine spray, into a vacuum at a lower temperature. The temperature of the milk is thereby lowered and a quick evaporation is effected, whereby the tendency of the fine globules to coalesce is substantially diminished and a spongy material results which is finally heated to drive off the remaining moisture.—G. W. McD.

Chocolate; Manufacture of a cooked, digestible —— containing all the nutritive constituents of cocoa and capable of being used with water or milk without further cooking. L. M. Dardenne. Fr. Pat. 426,491, May 4, 1911.

Cocoa is mixed with milk or water at a temperature of from 40° to 50° C., this part of the operation being carried out in an open vessel, the lower part of which is surrounded by a water-bath. The mixture is then boiled for about 25 minutes, the temperature of the water-bath being raised (under pressure) for this purpose, and evaporated down at a lower temperature. The mixture is next cooled rapidly to 4° C., and, when cold, the mass is powdered, or it may be pressed into moulds.—W. P. S.

Assimilable food product from bran. A. Lumière. Fr. Pat. 426,416, May 2, 1910.

Wheat bran is extracted first with cold water and then with hot water, the extracts being evaporated so as to produce a dry powder. Sugar, yolk of egg, milk, cocoa, or the like, may be added to the powder or to the aqueous extracts before the latter are evaporated.—W. P. S.

Alimentary product from the flour of germinated cereals. A. Lumière. Fr. Pat. 426,417, May 2, 1910.

Germinated grains are heated to a temperature of 100°—140° C., in order to destroy the diastase, and then ground to form a flour.—W. P. S.

Fruit; Process of preparing concentrated juices and extracts of ——. O. Volz. First Addition, dated Feb. 17, 1911, to Fr. Pat. 362,247, Jan. 8, 1906 (this J., 1906, 652).

After the extraction of the aromatic substances by means of suitable solvents as described in the original specification (*loc. cit.*), the fruits, etc., are subjected to pressure and the juice obtained is concentrated, whilst the pressed residue is dried and extracted with water or with a mixture of water and alcohol. This extract is mixed with the portion obtained by pressure, and the concentrated mixture is added to the aromatic constituents extracted by the solvents mentioned.—W. P. S.

XIXB—WATER PURIFICATION; SANITATION.

Sulphite cellulose waste lyes; Use of —— on sewage fields. Stutzer. Wochenbl. Papierfab. 1911, 42, 2685—2688. (See also this J., 1911, 18).

Near the town of Königsberg are two sulphite wood pulp mills, one above and the other below the town. In 1910, the former received permission, on certain conditions, to discharge its waste lyes into the town sewers. The chief conditions were: acidity not to exceed 0·6 grm. per litre, temperature not to exceed 40° C. and the flow to be regulated to a constant average. These conditions were framed from the point of view of minimising the corrosion of iron pipes, etc. Little regard was paid to the fact that the sewage waters were partially utilised some miles away for the irrigation of fields, although at times the greater portion found its way direct to the sea. During the year 1910, several troubles were experienced as the result of the inclusion of the sulphite lyes in the town drainage: in the town, rain-water pipes, etc., were corroded by the fumes of sulphur dioxide rising from the drains, and in the sewage fields the rye crops were severely injured. Investigation showed that the degree of acidity permitted, was far too high, and although the discharge of lye from the mill was regular, the quantity of town sewage was so variable that at certain times, especially in the early morning, the dilution of the lye was insufficient. Vegetation is far more susceptible to the action of acid than iron pipes, in fact the noxious effect of waste sulphite lyes on vegetation is probably entirely due to their acidity. In the year 1911, under the author's advice, the pulp mill undertook to increase the proportion of lime added to the waste lyes, so that their acidity, calculated as sulphuric acid, was reduced to 0·2 grm. per litre; further, the discharge from the mill was conducted for a long distance around the outside of the town before joining the main sewer, and in its course received a very much larger quantity of surface drainage water than before. These alterations were entirely successful; at the sewage fields the acidity never exceeded 0·06 grm. per litre, and sometimes the sewage was even slightly alkaline; the proportion of sulphite lye present was also reduced to a maximum of 23 parts per 1000, as compared with over 100 parts per 1000 previously. Not only was the rye unharmed by the presence of the lyes, but a beneficial effect was apparently produced owing to the organic matter thus introduced into the sewage.—J. F. B.

Sewage disposal investigations; Report on ——. *Studies of the Philadelphia Bureau of Surveys.* Scient. Amer., 1911, 72, 11.

Philadelphia is required by statute to submit to the State Department of Health on or before January 1st, 1912, a comprehensive plan for the collection and disposal of sewage of the various drainage districts of the city. During the year 1908 Mr. George R. Stearns, director of the Department of Public Works, and Mr. George S. Webster, Chief Engineer of the Bureau of Surveys, visited the sewage disposal works of the principal cities of Europe and also inspected a large number of plants at home. Upon their return Dr. Rudolph Hering was engaged in an advisory capacity, and a division of the Bureau of Surveys, known as the Sewage Disposal Division, was organised under the supervision of Mr. George E. Datesman, principal assistant engineer. A sewage testing station was established near the Spring Garden pumping station of the Bureau of Water, and experimental work was begun on March 23rd, 1909, under the immediate direction of Mr. W. L. Stevenson, assistant engineer in charge, and continued until May 15th, 1910.

The report is intended as a progress report; some of its conclusions are summarized in the following paragraphs.

Fine screening, through metal cloth containing 35 meshes per inch, removed one-third of the suspended matter in the crude sewage as applied, prevented the formation of scum in subsequent sedimentation tanks and prevented the clogging of the nozzle orifices on the sprinkling filter beds.

Experiments on horizontal flow sedimentation showed that three and one-half hours' nominal flow through a baffled tank removed two-thirds of the suspended solids in the crude sewage and that increased storage did not produce a proportionate improvement in the efficiency of the tank. Between periods of three and one-half to six hours' flow the influent was not deoxidized nor rendered offensive when sprayed upon sprinkling filters. To prevent septic action the tanks required sludging and washing out every six weeks.

In the studies of vertical-flow sedimentation the Imhoff tank was used, and by the substantial separation of the sewage flow from the digesting sludge it was found possible to keep the sewage fresh and eliminate offensive odours either in the effluent, the sludge, or the gas developed.

In operating the slate contact bed it was found that the best results were accomplished when the bed was filled twice a day or at a rate of 2,000,000 gallons per acre daily. Crude sewage applied deposited three-fourths of the suspended solids. The conclusion was reached that where slates are not a waste product the construction of beds of this material would be costly.

The sprinkling filters were found to produce the best results with fixed sprinkler nozzles when the film of sewage was made to travel constantly back and forth over the media without a resting period. The superiority of a uniform over an irregular rate of operation was established. The maximum rate obtained with exposed filters was 2,500,000 gallons per acre per day, but in winter the stability of the effluent deteriorated. With a filter protected from the weather and receiving fine screened and settled sewage uniformly distributed over its surface the maximum rate was 3,100,000,000 gallons per acre per day. The effluent was found to be stable practically all of the time.

In studying various kinds of filtering media it was found that trap and gravel maintained their initial size, while limestone and slag disintegrated to a slight extent. The smooth surface of the gravel stone was not as well adapted to the formation of a bacterial jelly as rougher media and the extreme roughness of slag caused it to retain the deposited solid, so that clogging soon ruined the bed. In the uncovered filters, operating at 2,500,000 gallons per acre daily, the best results were obtained with trap media from 1 to 3 inches in size. Under the more favourable conditions of fine screens and settled sewage distributed at a rate of 3,100,000 gallons per acre per day media ¾ to 1½-inch size produced an excellent effluent.

Filters of less depth than 6 feet were not satisfactory, but with depths greater than 6 feet a satisfactory effluent was obtained, operating at rates between 2,500,000 and 3,000,000 gallons per acre daily. Additional depth over 6½ feet did not seem to be economical.

At rates between 2,500,000 and 3,000,000 gallons per acre per day media composed of stones uniform in size completely unloaded the solids stored in the interstices, whereas stones of great diversity in size became badly clogged, but did not unload. Ice caused no trouble in operation.

Fungus growths on the filter surface were completely removed by an application of calcium hypochlorite dissolved in water without interfering with the biological action of the bed.

It was found impossible to operate the Hamburg and the intermittent sand filters at rates high enough to be economical for the conditions in Philadelphia.

Crude sewage, passed through a fine-mesh screen or satisfactorily settled to remove solids larger than about 1/25 inch and disinfected with calcium hypochlorite to yield six parts per million of available chlorine was added to river water in proportions up to one to ten, and its purification accomplished without offence to sight or smell, or without depleting the dissolved oxygen of the river water below fifty per cent. saturation.

In the studies of sludge it was found that horizontal flow in sedimentation tanks produced sludge, 88 per cent. moisture, at an average rate of 5 cubic yards per 1,000,000 gallons. An Emscher tank with 4½-foot vertical flow produced sludge, 82·6 per cent. moisture, at an average rate of 0·9 cubic yard per 1,000,000 gallons of sewage. The placing of sludge from a sedimentation tank in a water-tight uncovered tank for digestion did not prove successful. In the sludge bed tests fine sand or sawdust over a coarse drainage floor proved more efficient for reducing moisture in the sludge than a plain earth lagoon. Wet sludge from a sedimentation tank applied 6 inches deep in winter weather under cover dried to a consistency fit to remove in six days, and under the same conditions but not under cover in twelve days. Based upon small size tests in winter weather, Imhoff tank sludge, 12 inches deep upon a sand bed, dried to a consistency fit to remove in twelve days during freezing weather. When equal weights of rice coal and wet sludge were mixed and placed on sludge beds the mixture was fit to remove in one day and was successfully burned.

Vanadium poisoning. G. E. Lees, Eng. and Mining Jour., 1911, **92**, 99—100. (See also this J., 1911, 919.)

In the absence of any evidence from different countries where the ores are mined, the author fails to find that there is any such disease as "vanadiumism" arising from external contact with vanadium compounds, and this conclusion he reaches after five years' experience in the treatment of vanadium ores. Although the workmen are exposed both to the ore-dust and to the various intermediate compounds arising in the preparation of the alloys, not one has ever exhibited symptoms which could be attributed to contact with vanadium compounds. Nor can the absence of reliable evidence be attributed to the fact that the metal has only recently entered the industrial field.—C. A. W.

Limewashing in factories and workshops. Special exception when certain washable water paints are used. See XIII.

Disinfection of skins against anthrax; A harmless method for ——. A. Schattenfroh. *See* XV.

Patents.

Refuse destructors and like furnaces. W. Piernay, Stettin, Germany. Eng. Pat. 3755, Feb. 14, 1911.

A clinker cutter is used in the form of a carriage, the upper surface of the leading edge being inclined at an acute angle to the guides of the carriage. The cutter is placed between the slidable bed of the furnace and the lower end of the water-cooled iron shell forming the combustion shaft. When the cutter is moved it separates the lower end of the core of clinker.—G. W. McD.

Sewage; Process for the treatment of ——. J. L. F. Garrigou. First Addition, dated March 30, 1910, to Fr. Pat. 419,703, Nov. 2, 1909 (this J., 1911, 237).

The solution of ammonium sulphate obtained from the sewage as described in the original specification (*loc. cit.*) is placed in leaden vessels surrounded by a freezing mixture. When the greater part of the solution has been frozen, the liquid portion containing the ammonium sulphate is run off through a central tube and conducted to evaporating pans, whilst the ice is employed for cooling a fresh portion of the solution.—W. P. S.

Liquids; Apparatus for the sterilisation of —— [by ultra-violet rays]. V. Henri, A. Helbronner, and M. von Recklinghausen. Fr. Pat. 424,369, March 12, 1910.

Several forms of apparatus are described. In one form, the lamp is movably suspended in a quartz chamber from which the air is exhausted, the liquid to be treated being directed against the sides of this chamber. The outlet pipe for the liquid is provided with a valve which is operated by the flow of the liquid and regulates the working of the lamp. The lamp may be removed vertically or horizontally from the lamp chamber. The liquid may also be passed through a tube containing an inner quartz tube in which is situated the lamp, or it may be circulated through a chamber containing a quartz tube in which an arc lamp is fitted. Means are also described for passing a current of water over the inner surface of the tube surrounding the mercury lamp.—W. P. S.

Liquids; Apparatus for the treatment of —— by ultra-violet rays. V. Henri, A. Helbronner, and M. von Recklinghausen. Fr. Pat. 425,406, Jan. 30, 1911. Under Int. Conv., Jan. 31, 1910.

Lamps emitting ultra-violet rays are fitted inside quartz tubes extending from side to side of a closed chamber through which the liquid to be treated is passed. In another form of the apparatus the liquid is circulated through quartz tubes arranged in a chamber in which is situated a suitable lamp.—W. P. S.

Liquids; Apparatus for sterilising —— by means of ultra-violet rays. Banque du Radium. Fr. Pat. 426,297, April 29, 1910.

An arc lamp, or other lamp capable of emitting ultra-violet rays, is fitted at the top of a vessel into which the liquid to be sterilised is admitted. The supply pipe for the liquid is provided with a valve which is operated by an electro-magnet in circuit with the lamp: when the lamp is working, the valve is opened and the liquid is admitted into the lower portion of the vessel where, as it rises in the vessel, it is submitted to the action of the rays. The liquid leaves the vessel through a central overflow pipe which contains a metal sieve. Should the electric current be interrupted, the valve is closed and its movement at the same time opens up communication between the vessel and a small drainage pipe so that the vessel is emptied and stagnant liquid does not collect when the lamp is not working.—W. P. S.

Water; Apparatus for sterilising —— by means of ultra-violet rays. T. Nogier. Fr. Pat. 426,606, May 6, 1910.

A circular tube is provided at intervals with partition plates or screens which alternately direct the current of water passing through the tube from the centre of the periphery and *vice versa*. Quartz mercury lamps are situated in the tube between the partition plates and means are provided for introducing or removing the lamps without interfering with the flow of the water.—W. P. S.

Nitrogen from waste waters, etc.; Process for the recovery of —— by precipitation of soluble nitrogenous matters. H. L. A. M. Watrigant. Fr. Pat. 424,980, March 26, 1910.

Waste waters, such as the effluents from malt houses, starch factories, etc., are treated with tannin and with a solution containing aluminium sulphate, ferric chloride, magnesium chloride, or the like. These two treatments may be made successively, the precipitates being either mixed or kept apart, or simultaneously. The precipitates obtained are pressed and dried, or they may be mixed with plaster, peat, sawdust, etc.—W. P. S.

Water supply systems; Apparatus for destroying bacteria in ——. V. Henri and A. Helbronner, Paris, and M. von Recklinghausen, Bas-Meudon, France. Eng. Pat. 2424, Jan. 31, 1910.

See Fr. Pat. 425,406 of 1911; preceding.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Distribution of a substance [acetic acid] between two solvents [water and ether]; Influence of dissolved salts on ——. N. de Kolossovsky. Bull. Soc. Chim., 1911, **9**, 632—635.

The author has studied the influence of various salts on the ratio of distribution of acetic acid between water and ether. If p and p^1 are the weights of acetic acid in 100 c.c. of the aqueous and ethereal layers respectively, then in the absence of salts, and at 18° C., the ratio of distribution (p/p^1) changes from 2·05 to 1·01 as the quantity of acetic acid present ($p+p^1$) is increased from 0·5 to 60 grms. The effect of most salts is to lower the ratio, the lowering being, *ceteris paribus*, less marked when the concentration of acetic acid is high. If the amount of acid ($p+p^1$) is kept constant, the lowering of the ratio is within certain limits proportional to the concentration of the salt present, but when the latter exceeds a certain amount the ratio is affected to a relatively smaller extent. A study of various salts shows that their influence on the ratio of distribution may be referred additively to the positive and negative ions, and the following moduli show this influence in the case of a number of common ions at a concentration of $N/1$:—$NO_3=+0{\cdot}03$, $I=-0{\cdot}03$, $ClO_3=-0{\cdot}10$, $Br=-0{\cdot}14$, $Cl=-0{\cdot}16$, $\frac{1}{2}SO_4=-0{\cdot}18$, $K=0{\cdot}00$, $Na=-0{\cdot}13$, $\frac{1}{2}Ba=-0{\cdot}14$ and $\frac{1}{2}Mg=-0{\cdot}23$. The change in the ratio of distribution produced by a salt at a concentration of n grm.-equivalents per litre, is therefore $n(M+M_1)$, M and M_1 being the moduli of the positive and negative ions as given above. These moduli cannot be applied when n is much greater than 1 or when the concentration of acetic acid is very high.—J. H. L.

Hydromorphine. L. Oldenberg. Ber., 1911, **44**, 1829—1831.

By the use of colloidal palladium saturated with hydrogen, as suggested by Paal, the reduction of morphine takes place quite readily. 0·1 grm. of palladium dissolved in 10 c.c. of water and saturated with hydrogen, sufficed to reduce 10 grms. of morphine hydrochloride dissolved in 250 c.c. of water. The palladium was separated by ultra-filtration through collodion. On adding the calculated amount of sodium carbonate to the solution, the hydromorphine separated in fine, almost colourless needles. From solution in hot acetone or hot chloroform, hydromorphine crystallises in somewhat large prisms. It melts at 155°—157° C. and contains one molecule of water. The formula is $C_{17}H_{21}NO_3,H_2O$, and it is probable that the two additional hydrogen atoms attach themselves to the morphine molecule at the isolated double bond in the isoquinoline nucleus, between the carbon atoms 11 and 12. Hydromorphine hydrochloride was obtained in microscopic crystals, easily soluble in water and apparently without water of crystallisation. The sulphate could not be obtained in crystalline form. Hydromorphine does not appear to have greater narcotic properties than morphine.—T. St.

Nicotine; Determination of ——. G. Bertrand and Javillier. Ann. Chim. Analyt., 1911, **16**, 251—256.

The fresh or fermented tobacco is extracted on the water bath with ten times its weight of 0·5 per cent. hydrochloric acid for 15—20 minutes, and the liquid drawn off. This is repeated four times, or more, if necessary. If tobacco-juice is being used, 5 grms. should be diluted to 100 c.c. and acidified by adding 1 c.c. of 10 per cent. hydrochloric acid. A solution of silicotungstic acid or its potassium salt (10—20 per cent. solution) is added to the slightly acid liquid to precipitate the nicotine. After 24 hours the precipitate is collected and washed in dilute hydrochloric acid. The precipitate can be decomposed with magnesia, the nicotine distilled off in a current of steam, and the distillate titrated. The presence of ammonia does not affect the accuracy of the results provided that the liquid to be precipitated by the silicotungstate does not contain more than 0·5 grm. of ammonium chloride in 25 c.c. If the precipitate be ignited, a mixture of silica and tungstic oxide is left behind, the weight of which when multiplied by 0·1139 gives the corresponding weight of nicotine. If the presence of pyridine or other bases in the original extract be suspected, the nicotine precipitate can be decomposed with alkali, the nicotine extracted with chloroform and the optical rotation determined.—F. Shdn.

Nicotine ; Determination of —— in the presence of pyridine bases. L. Surre. Ann. Falsificat., 1911, **4**, 331—334.

The method is based upon the fact that nicotine has a high lævorotation (—161° 55′ at 20° C. for a sodium flame), whereas pyridine bases are inactive and do not affect the nicotine reading, which in aqueous solutions of 1 to 8 per cent. is proportional to the concentration. If 50 c.c. of a solution of nicotine or a nicotine salt (up to 8 per cent.) be distilled with 1 grm. of calcined magnesia, water, and at least 2 grms. of powdered pumice stone, almost the whole of the alkaloid passes over in the first 150 c.c., whilst the residue will be found in the second 150 c.c. On the other hand, the whole of any pyridine bases present will be found in the first 150 c.c. The amount of nicotine in grms. per litre in the first distillate may then be calculated from the rotation, A, observed in a 200 mm. tube at 20° C., by means of the formula $N = A \times 18{\cdot}57$. The traces of nicotine in the second distillate are now titrated with $N/10$ sulphuric acid and the amount in grms. per litre calculated by means of the formula :—

$$N = n \times 0{\cdot}0162 \times \frac{150}{100} \times 20 = n \times 0{\cdot}486 \text{ where } n \text{ represents}$$

the number of c.c. of acid, and 162 the molecular weight of the alkaloid. The error does not exceed 0·5 to 0·7 grm. per litre. For the titration of the second distillate a solution of 0·1 grm. of Luteol in 50 c.c. of 90 per cent. alcohol is used as indicator. Speaking generally a commercial nicotine extract with an acid reaction usually contains nicotine, a little pyridine and a large proportion of pyridine bases, whilst there are " synthetical nicotines" upon the market which do not contain a trace of alkaloid. In some of these the pyridine bases have been rendered soluble by conversion into sulphates, and the preparations are thus rendered very acid and give an abundant precipitate of sulphate. In such cases only 25 c.c. of the sample should be distilled with 2 grms. of calcined magnesia and at least 4 grms. of powdered pumice stone.—C. A. M.

Terpin ; Examination of ——. M. Bourdet. J. Pharm. Chim., 1911, **4**, 69—70.

According to the French Codex the determination of water in terpin is made by drying either at 100° C. or *in vacuo*. The author points out that only the latter method gives accurate results, for at 100° C. a slight loss due to formation of terpineol occurs, whilst if the temperature rises to 105° C. (the m.pt. of anhydrous terpin) there may be a further loss due to volatilisation.—A. S.

Carvone ; Hydrogenation of ——. G. Vavon. Comptes rend., 1911, **153**, 68—71.

By the use of platinum black as a catalyst, carvone can be successively converted into carvotanacetone, tetrahydrocarvone, and carvomenthol. By similar means acetone, methylethylketone, acetophenone, benzophenone, cyclohexanone, valeric aldehyde, œnanthol, benzaldehyde, vanillin, piperonal, and anisic aldehyde have all been converted into the corresponding alcohols.—J. T. D.

Glycerophosphoric acid ; Velocity of hydrolysis of ——. F. Malengreau and G. Prigent. Z. physiol. Chem., 1911, **73**, 68—84.

The hydrolysis of glycerophosphoric acid in dilute solutions at 100° C., is a unimolecular reaction. It is retarded by addition of acids, to an extent depending on the increased concentration of hydrogen ions. Indeed, the partial neutralisation of its own acidity greatly increases the velocity of hydrolysis, the velocity-constant of the mono-sodium salt being double that of the free acid. On the other hand a certain acidity is necessary for hydrolysis, for the disodium salt is scarcely decomposed by water. the reaction is very sensitive towards changes of temperaure ; a fall of 2°, from 100° C. to 98° C., alters the velocity considerably. The phosphoric acid set free during hydrolysis has no disturbing influence on the course of the reaction, for the hydrogen atom replaced by the glyceryl radicle is alcoholic in function, and its liberation does not affect the concentration of hydrogen ions in the solution. Salts do not influence the reaction except insofar as they may affect the concentration of hydrogen ions.—J. H. L.

Phenylarsinic acid derivatives ; Quinine esters of ——. K. J. Oechslin. Philipp. J. Sci., 1911, **6**, 23—34.

Quinine esters of phenylarsinic acids were made with the object of their being used in the treatment of "surra." Benzoarsinic acid, $CO_2H.C_6H_4.AsO_3H_2$, was prepared from *p*-aminophenylarsinic acid and the product treated with phosphorus pentachloride. The phosphorus oxychloride was distilled from this *in vacuô*, the residue dissolved in chloroform and a solution of quinine in chloroform added. The quinine derivative was then purified by adding cold water, warming gently, neutralising with sodium hydroxide and precipitating with sodium carbonate. The excess of quinine was removed by dissolving in alcohol and precipitating with ether. The product still contained some chlorine. Benzoarsinic acid was treated with phosphorus trichloride, and the product of the reaction treated further with phosphorus pentachloride in chloroform. Quinine in the same solvent was added when the quinine ester of benzodichlorarsin, $C_{20}H_{23}N_2O.\ CO_2.\ C_6H_4.\ AsCl_2$, was produced. This substance is exceedingly toxic for trypanosomata as well as the cells of the host. It was oxidised to the corresponding arsinious acid by means of hydrogen peroxide, when a substance was obtained free from chlorine and soluble in excess of alkali. By a similar series of reactions the diquinine ester of di-*p*-benzoarsinic acid was prepared. It has the composition $(C_6H_4CO)_2 : (C_{20}H_{23}N_2O_2)_2 : AsO_2H$, is a fine white powder and is soluble in dilute hydrochloric acid, but insoluble in sodium carbonate solution. Phenylglycinarsinic acid was prepared from *p*-aminophenylarsinic acid and chloracetic acid. This was treated with acetyl chloride and acetylphenylglycinarsinic acid resulted, a substance which is readily converted into phenylglycinarsinic acid on warming or standing in excess of ammonia. It is insoluble in concentrated hydrochloric acid. The quinine ester is a white powder, soluble in dilute acids and alkalis, the latter causing the separation of quinine when added in excess and after standing.—F. Shdn.

Salicylic acid ; Detection of ——. H. C. Sherman and A. Gross. J. Ind. Eng. Chem., 1911, **3**, 492—495.

The detection of salicylic acid by means of Millon's reagent is rendered much more delicate by heating the mixture. The limit of delicacy is at a dilution of about 1 : 2,000,000 if 20 c.c. of the solution be treated with 2 drops of Millon's reagent and heated on the boiling water bath for 45 mins., a blank test being made for comparison. A large number of other substances in addition to salicylic acid, however, also give reactions with Millon's reagent, and this reaction, and that with ferric chloride are not so useful for identifying small quantities of salicylic acid as Jorissen's test (Bull. Acad. Roy. Sci. Belg., III., 3, 259 ; compare this J., 1910, 230). When carried out in the following manner, Jorissen's test is stated to be considerably more delicate than the ferric chloride reaction. The solution to be tested is treated with 4—5 drops of a 10 per cent. solution of sodium or potassium nitrite. 4—5 drops of 50 per cent. acetic acid, and 1 drop of a 1 per cent. solution of copper sulphate, the liquid being shaken after the addition of each reagent. After heating in a boiling water bath for 45 mins., and cooling, the colour is examined against a white background, a blank test being carried out in a similar manner. In this way 0·005 to 0·01 mgrm. of salicylic acid in aqueous solution can be detected: faint but perceptible reactions are obtained with 5—8 c.c. of a 1 : 1,000,000 solution, and with 18—25 c.c. of a 1 : 3,500,000 solution. The ferric chloride and Jorissen reactions may be applied to the same solution of salicylic acid, the liquid, after the addition of ferric chloride, being diluted until the violet colour disappears and then submitted to the Jorissen test. Benzoic, cinnamic, and tartaric acids, maltol, isomaltol, orcinol, arbutin, resorcinol, and phlorizin do not respond to the Jorissen test. A 1 : 100,000 solution of phenol gives the same colour as a 1 : 1,000,000 solution of salicylic acid. With the Millon reagent phenol can be detected at a dilution of about 1 : 2,000,000. With saligenin the limit of delicacy of the ferric chloride reaction is between 1 : 10,000 and 1 : 20,000; in the Jorissen test saligenin gives a red colour at 1 : 10,000, a yellowish tint at 1 : 100,000, and no reaction at 1 : 1,000,000. 2-Hydroxyisophthalic acid gives the Jorissen reaction up to a dilution of 1 : 100,000, but is easily distinguished from salicylic acid by the colour it gives with ferric chloride. Methyl-ethyl acetoacetate gives neither the Millon nor the Jorissen reaction at a dilution of 1 : 1000.—A. S.

Digitalis leaves; Further observations as to the physiological tests of ——. Focke. Arch. Pharm., 1911, **249**, 323—328.

In continuation of previous work (Arch. Pharm., 1910, **248**, 345) tests have been made with extracts of varying strength from digitalis leaves. If an aqueous infusion of 1 per cent. strength be prepared about 80 per cent. of the active constituents are extracted. If the residue after preparing this infusion is washed out, only a further 5 per cent. of active constituent is thereby removed. If a 10 per cent. aqueous infusion is made, the water being in contact with the drug for 30 minutes, and filtered through linen and pressed, the infusion contains 74 per cent. of active constituent. It is not considered advisable, however, to prepare dilute extracts in order to remove as much as possible of the active matter and subsequently concentrate by evaporation. The 10 per cent. extract as prepared by the author is regarded as the more satisfactory.—F. Shdn.

Maple sap; "Sugar sand" from ——*; a source of malic acid.* W. H. Warren. J. Amer. Chem. Soc., 1911, **33**, 1205—1210.

When the sap of the sugar-maple tree is evaporated a variable quantity of a sandy substance appears, partly in the pan, but mostly in the syrup, from which it is removed by straining. Different samples probably vary somewhat in composition from year to year but the general composition is shown by the following analysis: silica, 7·74; phosphoric acid, 0·05; ferric oxide, 0·39; calcium, 17·16; magnesium, 0·03; moisture, 2·6; malic acid, 51·48; invert sugar, 2·31; sucrose, 3·46; matter soluble in ether, 0·37; carbon dioxide, 0·66; extraneous organic matter, 2·35; undetermined, 11·14 per cent. To obtain malic acid from this "sugar sand," acid calcium malate, $Ca(C_4H_5O_5)$, $6H_2O$, is first prepared by precipitating half of the calcium from the "sand" with oxalic acid and evaporating the filtrate till it crystallises. Subsequently this salt is decomposed quantitatively by oxalic acid.
—E. F. A.

Strychnine hypophosphite. D. B. Dott. Rept. Brit. Pharm. Conf., 1911, 6. Pharm. J., 1911, **87**, 173.

The ordinary books of reference do not describe the hypophosphite of strychnine. It crystallises with the composition indicated by $B \cdot H_3PO_2 \cdot 3H_2O$, all the water of crystallisation being lost at 100° C. It is one of the most soluble of the strychnine salts, being dissolved by 3·3 parts of water at ordinary temperature.

Arsenates of strychnine. D. B. Dott. Rept. Brit. Pharm. Conf., 1911, 5. Pharm. J., 1911, **87**, 173.

The salt $B_2 \cdot H_3AsO_4$ seems to exist, but it is sparingly soluble and apparently partly decomposed in presence of water. There are, however, two well-defined salts, both fairly soluble in water. In the first place we have the generally recognised acid salt $B \cdot H_3AsO_4 \cdot 2H_2O$. The water is not wholly lost in the water-bath, but the salt is anhydrous at 120° C., probably three-quarters of the water is driven off under 100°, and the remainder at the higher temperature. The solubility in water at ordinary temperature was found to be 1 in 34. The second acid salt does not appear to be so generally known. It has the composition $B \cdot (H_3AsO_4)_2 \cdot H_2O$, and is soluble in 16¾ parts of water at ordinary temperature. This tendency to form extra-acid salts like potassium "quadroxalate" is exhibited in other alkaloids, notably in the case of quinine. Though it has the advantage of greater solubility, the proportion of strychnine is, of course, much less.

Sodium ethylate solution. H. Finnemore. Rept. Brit. Pharm. Conf., 1911, 8. Pharm. J., 1911, **87**, 174.

Solution of sodium ethylate is used in medicine as a caustic to a somewhat limited extent. According to the official description, it is a colourless liquid, becoming brown by keeping. As it is only employed occasionally, it usually happens that when required, the stock is dark brown in colour, and, although its medicinal properties are not affected by this colouration, yet the preparation is then unsightly and the user is apt to assume that deterioration has accompanied this change. The change of colour is due to the action of the alkali on the acetaldehyde, which may be shown to be always present in small quantity in commercial absolute alcohol. Various methods were tried to get rid of this impurity, and the most successful was found to be that of Hewitt, who used sodium phenyl hydrazine sulphonate to remove the objectionable aldehydic constituents of whisky (this J., 1902, 96).

The alcohol was boiled for one hour with the reagent mentioned, and distilled. The distillate contained no aldehyde, but when kept for some time aldehyde gradually reformed, and the solution of sodium ethylate made therefrom became discoloured. In using sodium ethylate for its hydrolytic effect in experiments on another subject, the writer observed the great depth of colour of the resulting solution when this was used, as compared with the absence of colour when sodium methylate was employed. The use of pure methyl alcohol in place of ethyl alcohol in such a caustic solution was therefore suggested, and a sample of solution of sodium methylate shows no trace of discolouration after two years.

Examination of commercial oxygen. Chemistry of anaesthetics. II. C. Baskerville and R. Stevenson. J. Ind. Eng. Chem., 1911, **3**, 471—476.

After a bibliographic review of the methods of preparation and analysis, the authors recommend the following standards of purity for oxygen to be used in medicine. The gas, which after drying, should contain at least 94 per cent. of oxygen, should be free from liquid and solid impurities and should be neutral towards moist litmus paper. When 2 litres of the gas are passed slowly through an aqueous solution of barium hydroxide, not more than an opalescence should be produced. When 5 litres of gas are passed slowly through sodium hydroxide solution, over heated copper oxide, and then through barium hydroxide solution, no turbidity should be produced. Seven samples of "C.P." oxygen examined by the authors, contained from 92·82 to 99·23 per cent. of oxygen, and were all suitable for medicinal use.—A. S.

Essential oils; Some ——. Roure-Bertrand fils. Wiss. u. ind. Ber. von Roure-Bertrand fils, 1911, [3], 3, 23—26. Chem. Zentr., 1911, 2, 139.

Inula viscosa oil is a mobile, light brown liquid having a very powerful odour resembling simultaneously the odours of hyssop and eucalyptus; its chief constituent appears to be cineol. It has the sp. gr. 0·9436 at 15° C.; optical rotation — 24°; is soluble in 1 vol. or more of 80 per cent. alcohol. with separation of paraffins, and gives a turbid solution with 10 vols. of 70 per cent. alcohol. *Essential oils from Syria.*—Origanum oil—a straw-yellow liquid from which a transparent camphor separated on prolonged standing. Sp. gr., 0·9309 at 15° C.: optical rotation. + 1° 6′; soluble in 1⅕ vol. or more of 80 per cent. alcohol. Laurel oil, probably from *Laurus nobilis* L.—sp. gr., 0·9161 at 15° C.; optical rotation. —14° 20′; soluble in 1 vol. or more of 80 per cent. alcohol. Sage oil.—sp. gr., 0·9843 at 15° C.; optical rotation, — 6° 8′; soluble in 1 vol. or more of 80 per cent., and in 1·5 vols. or more of 70 per cent. alcohol. Colourless thyme oil—sp. gr., 0·9120 at 15° C.; optical rotation, —0° 56′; soluble in 1¼ vols. or more of 80 per cent. alcohol; content of thymol and carvacrol, 43 per cent. Neroli oil—sp. gr., 0·8758 at 15° C.; optical rotation. + 1° 6′; soluble in 1 vol. of 80 per cent. alcohol, further addition of alcohol causing fluorescence and separation of paraffins; saponification value, 51·5; esters (as linalyl acetate). 18 per cent. Petitgrain oil—sp. gr., 0·8857 at 15° C.; optical rotation. —3° 24′; soluble in 1¼ vols. or more of 70 per cent. alcohol; saponification value, 77·4; esters (as linalyl acetate), 27·1 per cent. —A. S.

Algerian rue oils. Roure-Bertrand fils. Wiss. u. ind. Ber. von Roure-Bertrand fils, 1911, [3], **3**, 22—23. Chem. Zentr., 1911, **2**, 139.

An oil from *Ruta montana*, known as "*essence figeable*" (congealing oil) contained 90 per cent. of methyl-nonyl ketone. It solidified completely at 10° C., was soluble in 2¼ vols. or more of 70 per cent. alcohol, and was slightly dextro-rotatory (0° 42′ in a 100 mm. tube): it had the sp. gr. 0·8307 at 15° C. An oil from *Ruta bracteosa* remained liquid at —1°, had the consistence of butter at —5°, and did not solidify completely even at —15° C. It had the sp. gr. 0·8410 at 15° C.; optical rotation, —4° 12′; and contained about 90 per cent. of ketones. It was soluble in 2 vols. of 70 per cent. alcohol, but with larger quantities of alcohol, a faint blue fluorescence began to appear and separation of paraffins began.—A. S.

Odorous constituents; Relation of the —— of certain plants to plant metabolism. F. Rabak. J. Amer. Chem. Soc., 1911, **33**, 1242—1247.

The esters, which are the odorous constituents of plant oils, are not manifestly affected during fructification. There does, however, appear to be a period during growth when under favourable conditions some of the basic constituents of plants are transformed into esters and the corresponding alcohols. As growth proceeds there is a steady development of the ester compounds: the amount of free alcohols bears but little relationship to that of their corresponding esters. Both the amount and the composition of plant oils varies from one season to another: thus oil of erigen (*Erigeron canadensis*) contained in 1904, 37·8 per cent. of esters and no free alcohols, but in 1905 it had 13·6 per cent. of esters and 8·7 per cent. of free alcohols. During drying, probably owing also to the action of enzymes and oxydases contained in the plant, there is a partial decomposition of the esters into alcohols. It is considered that the odorous constituents are simply products of excretion and of no further use to the plant other than as a possible means of protection against insect pests. In the case of peppermint, bergamot, mint, and wormwood, the yield of oil and its ester and alcohol content are compared in three stages of growth, namely before, during, and after flowering. The amount of ester was greatest as a rule after flowering; the amount of free alcohol showed very little variation. In no instance was a decided consumption of the ester or alcoholic constituents observed.—E. F. A.

Opium and Drug Act of Canada. Board of Trade J., July 27, 1911.

The "Opium and Drug Act," which was assented to on May 19, 1911, prohibits the improper use of opium and other drugs in the Dominion of Canada.

Under this Act it is provided, *inter alia*, that every person who, without lawful or reasonable excuse, imports, manufactures, sells, offers for sale, has in his possession, or takes or carries from any place in Canada to any other place in Canada, any drug for other than scientific or medicinal purposes, shall be guilty of a criminal offence, and shall be liable, upon summary conviction, to a fine not exceeding 500 dollars and costs, or to imprisonment for a term not exceeding one year, or to both fine and imprisonment.

The possession of opium prepared, or being prepared, for smoking is illegal, as is also the exportation of drugs to any country which prohibits the entry of such drug.

It is laid down in the Act that the term "drug" means and includes:—

Cocaine or any salts or compounds thereof.
Morphine ,, ,, ,,
Eucaine ,, ,, ,,
Opium, or
Any substance which may be added to the above list under the authority of the above-mentioned Act.

The Act repeals Cap. 50 of the Statutes of 1908.

Analysis of nitrous oxide. Smith and Leman. *See* VII.

Patents.

Aldehyde suitable for use as a perfume, from the tar of coniferous woods; Process for obtaining an ——. F. Müller. Ger. Pat. 234.794. Oct. 1. 1909.

The fraction of the tar from the wood of coniferous trees, boiling between 150° and 200° C., contains the aldehyde in question. which can be isolated by the ordinary means. It is sparingly soluble in water. but dissolves readily in alcohol, its solutions having a very pleasant odour. As a perfume it may be used in solution alone or mixed with other odorous substances.—T. F. B.

Nitrophenylnitromethanes, their homologues and derivatives; Process for preparing ——. Soc. Chim. des Usines du Rhône. Fr. Pat. 426,635, Feb. 27, 1911.

The nitrophenylnitromethanes. $NO_2.C_6H_4.CH_2.NO_2$, their homologues and derivatives, are readily obtained by treating the corresponding nitrotoluenes with highly or moderately concentrated nitric acid, the water formed during the reaction being eliminated. *Example.* Nitric acid of 40°—45° B. is gradually added to o-nitrotoluene heated to 110°—120° C., the temperature being kept at this point, in order to remove the water formed: at the end of the reaction the product is washed with water, and freed from nitrobenzoic acid and nitrobenzaldehyde by treatment with sodium carbonate or bisulphite. The *o*-nitrophenylnitromethane is then separated from the unchanged nitrotoluene by prolonged extraction with caustic soda; it is then obtained in a state of purity (m. pt. 67° C.) by precipitation with acid. The same result may be produced by keeping an excess of nitrotoluene during the reaction. By use of other nitrotoluenes the following products are produced:—*p*-Nitrophenylnitromethane. m. pt. 91° C.; *p*-chloro-*o*-nitrophenylnitromethane. m. pt. 112° C.; *p*-bromo-*o*-nitrophenylnitromethane. m. pt. 113·5° C.; o-chloro-o-nitrophenylnitromethane. m. pt. 82° C.; 3-methyl-6-nitrophenylnitromethane, m. pt. 86·5° C.; 3-methyl-2-nitrophenylnitromethane, m. pt. 64° C.—T. F. B.

Guaiacolsulphonic acid and its salts; Process for preparing ——. H. Auge et Cie. Fr. Pat. 426,419, Jan. 4, 1911.

Guaiacol is treated for several hours with sulphuric acid containing 30 per cent. of anhydride: a highly coloured product is obtained, which is diluted with water, and barium carbonate is added to the solution; the precipitated barium sulphate is separated from the solution of barium guaiacol-*o*-sulphonate, which is then mixed with the calculated quantity of sulphuric acid and filtered. The solution of guaiacol-o-sulphonic acid is concentrated in a vacuum to a syrup, from which the salts of the acid may be obtained in the usual manner.—T. F. B.

Dimethylphenylbenzylammoniumdisulphonic acid; Process for preparing a ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pats. 234,915, March 23, 1910, and 234,916, Aug. 31, 1910.

The methylbenzylanilinedisulphonic acid, obtained by heating methylbenzylaniline or its monosulphonic acid with fuming sulphuric acid (Ger. Pat. 69,777), is converted into a dimethylphenylbenzylammoniumdisulphonic acid, valuable for use in textile printing, by treating its salts (1) with a methyl halogenide or dimethyl sulphate or (2) with methyl esters of sulphonic acids, preferably in presence of substances which will combine with acids.—T. F. B.

Dimethylphenylbenzylammonium disulphonic acid; Manufacture of salts of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 7204, March 22, 1911. Under Int. Conv., March 22, 1910.

See Ger. Pat. 234,915 of 1910; preceding.—T. F. B.

Reduction of organic bodies [unsaturated fatty acids, etc.]; The electrolytic ——. H. Higgins, Wallasey. From E. Higgins, Philadelphia. Eng. Pat. 18,969, Aug. 12, 1910.

In the electrolytic reduction of unsaturated fatty acids or their esters or salts, or other organic compounds, it is proposed to employ, in the cathode compartment of the cell, a catalyst composed of or containing the oxide or hydroxide of nickel or cobalt or a mixture of these. The oxide or hydroxide may be mixed with or deposited on kieselguhr, pumice, or other porous inert material, and the whole formed into a coherent mass by pressure, with or without the addition of a binding agent; or the catalyst may be mixed, either alone or together with an inert binding material, with a body, such as cane sugar solution, which when roasted in a non-oxidising atmosphere, yields a porous mass of carbon containing the oxide or hydroxide.—T. F. B.

Therapeutical preparations containing formic aldehyde. J. A. von Wülfing, Berlin. Eng. Pat. 29,907, Dec. 23, 1910. Addition to Eng. Pat. 2682, Feb. 3, 1906 (see this J., 1906, 1067).

Compounds analogous to those described in the principal patent are obtained by combining formaldehyde with cane sugar (sucrose) or monoses; at least five mols. of formaldehyde are combined with one mol. of sucrose or two mols. of a monose in aqueous solution. When glucose is used, a dry product may be produced by adding to the thick concentrated syrup several times its weight of a biose, especially lactose, and then completely drying at 70° C. The product from sucrose contains 30·5 per cent. of formaldehyde, that from galactose and the thick syrup from glucose about 30 per cent., and the fructose compound about 22 per cent.—T. F. B.

Acetylene tetrachloride; Process for producing ——. A. G. Bloxam, London. From G. Ornstein, Berlin. Eng. Pat. 2375, Jan. 30, 1911.

See Fr. Pat. 420,489 of 1910; this J., 1911, 307.—T. F. B.

Menthylated oil of wintergreen and the process of producing same. A. W. Mathys, London. From Blieberger, Weber, and Co., New York. Eng. Pat. 28,378, Dec. 6, 1910.

See U.S. Pat. 979,416 of 1910; this J., 1911, 239.—T. F. B.

Nitro-hydroxyarylarsinic acids; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 426,711, March 1, 1911. Under Int. Conv., May 24, 1910.

See Eng. Pat. 5595 of 1911; this J., 1911, 768.—T. F. B.

Reflux condensers. Eng. Pat. 3269. *See* I.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Ammonium persulphate as a reducer; The action of ——. J. W. Dodgson. Phot. J., 1911, **51**, 265—268.

Whilst solutions of ammonium persulphate have no action on paper or gelatin alone, yet in presence of finely divided silver both these substances are oxidised, carbon dioxide being evolved. Films of gelatin containing reduced silver are acted upon by the persulphate in the same manner. The ammonium persulphate probably converts the silver into silver persulphate, which reacts with water, forming silver peroxide.—T. F. B.

Photographic images; The development of —— after fixation. A. and L. Lumière and A. Seyewetz. Comptes rend., 1911, **153**, 102—104.

When it is desired to develop the photographic image after fixation, by the method first described by Neuhauss, it is necessary to increase the normal exposure twenty times. However, if the fixing bath be diluted, the exposure necessary becomes much less; when using a 2 per cent. solution of sodium thiosulphate, four times the normal exposure suffices for slow plates, and six times for rapid plates. Slow plates of fine grain may also be fixed in saturated solutions of sodium sulphite, but this method is of little use for rapid plates, as the fixation becomes too slow. Among the various silver salts tested for the physical development, the double sulphite of silver and sodium gave the best results; the following formula is recommended:—(A) Silver nitrate, 75 grms.; anhydrous sodium sulphite, 180 grms.; water, 1000 c.c.; (B) *p*-phenylenediamine, 20 grms.; anhydrous sodium sulphite, 20 grms.; water, 1000 c.c.; for use, mix 5 parts of A with one of B. The *p*-phenylenediamine may be replaced by the same quantity of metol, quinol, or pyrogallol; these act more rapidly than *p*-phenylenediamine, but deposit more silver on the image in the form of fog. Variations in the speed of development, produced by altering the strength of the developer, modify the colour of the image. Amongst the other metals whose sulphites are soluble in excess of sodium sulphite, mercury alone has given useful results; in some respects, mercury gives better results than silver, the image being less dichroic and more opaque; also, with prolonged development the images show less tendency to fog. On the other hand, the mercury solutions develop slowly, giving images with strong contrasts, especially in cases of under-exposure. The solution which gives the best results is composed as follows:—(A) Mercuric bromide, 9 grms.; anhydrous sodium sulphite, 180 grms.; water, 1000 c.c.; (B) metol, 20 grms.; anhydrous sodium sulphite, 20 grms.; water, 1000 c.c. Five parts of A are mixed with one of B.
—T. F. B.

Patents.

Photographic plates which avoid halation; Process for the manufacture of ——. A. Herzka, Dresden, Saxony. Eng. Pat. 16,421, July 9, 1910.

In making anti-halation plates, which have a layer of coloured gelatin between the emulsion and the support, it is proposed to distribute the coating on both sides of the support (*e.g.*, by dipping the glass plate in a suitably coloured gelatin solution, which may also contain a hardening agent), and after drying and hardening, to coat one side of the plate with emulsion. It is claimed that by this means the thickness of the coatings on either side of the support can be reduced to less than half that of the single coating; it is also stated that the coloured layer is so thin as to be readily removed during development.
—T. F. B.

Polychrome screen for colour photography; and its production. O. S. Dawson, C. L. Finlay, and The Thames Colour Plate, Ltd. Fr. Pat. 426,498, Feb. 18, 1911. Under Int. Conv., Feb. 19, 1910.

See Eng. Pat. 4208 of 1910; this J., 1911, 308.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Limit-charges of explosives; Experiments on the influence of the section of the galleries on variations in the ——. V. Watteyne and J. Bolle. Annales des Mines, Belgium, 1911, **16**, 289—319.

The main gallery at the Frameries is constructed of wood and has an elliptical section of 2 sq. m., a length of 30 m. and it has observation windows and safety valves. It is open at one end and closed at the other by a brick structure in which a steel cannon is placed with a bore hole 50 mm. in diameter and 500 mm. deep. The cannon is relined when the diameter of the bore hole exceeds 62 mm. The charging density of the explosive varies from 0·4 to 0·6, *i.e.*, taking the sectional area of the bore hole as unity the sectional area occupied by the explosive varies between the figures given. The explosive mixture in the gallery contains from 7·75 to 8·25 per cent. of firedamp. The coal dust used has a volatile matter of from 20 to 22 per cent., and is fine enough to pass through a sieve of 1280 meshes to the sq. cm. Coal dust is spread near the cannon in quantities varying from 75 to 100 grms. per cb. m. of the gallery. No tamping is used and the explosive is fired with an electric detonator. Experiments are carried out at 20° to 30° C. The limit-charge (*charge limite*), *i.e.*, the maximum weight of the explosive which is considered to be safe in practice, in a single shot, is determined as follows:—A weight of the explosive is initially used which ignites a mixture of either firedamp and air, or coal dust and air. In successive experiments the weight of the explosive is diminished each time by 50 grms. until a point is reached at which the explosive does not, in a series of 10 consecutive shots, ignite either mixture. This amount is the *charge-limite* for that particular explosive under actual mining conditions. A large number of factors have an influence on the *charge-limite*. Slight variations in the composition of the explosive, the state of purification of certain ingredients, such as trinitrotoluene, and the moisture content of the finished explosive, exert a very considerable influence. The fineness of division of the ingredients is also of importance, as, in the case of Carbonite, it has been shown that the *charge-limite* was increased from 250 grms. to 900 grms. by using the ingredients in a finer state of division and mixing them more intimately. Paraffined paper wrappers, in the case of ammonium carbonite, have been shown to reduce the *charge-limite* from 550 grms. to 400 grms. Very considerable variations in the composition of the firedamp used at various times have had no influence, provided that the content of methane in the mixture is kept at about 8 per cent. Increasing the amount of coal dust, beyond the 100 grms. mentioned above, has had no influence. Variations in temperature, in the case of firedamp mixtures, has had no influence, but, on the other hand, in the case of coal dust mixtures ignitions occur more readily if there is a considerable difference between the temperature of the mixture in the gallery and the external air, and also when the air is dry. Variations in the barometric pressure have had no influence. Very conflicting results have been obtained as to the influence of the charging density in the bore hole, and the authors prefer to leave this question still open. The French Commission have concluded that maximum security was obtained with maximum charging density, but in their experiments the explosive was tamped, whereas, in the Belgian experiments the explosive was not tamped. In Belgium all permitted explosives the *charge-limite* of which gives an expansion in Trauzl block, superior to the equivalent of 175 grms. of Dynamite No. 1, are classified as "S.G.P.," and grouped as follows:—

(1) *Wetterdynamites* containing a high proportion of nitroglycerin and hydrated salts. There are three explosives in this group and the one selected for trial was *Antigrisouteuse V.*, composed as follows: Nitroglycerin (44 parts) sodium sulphate (44 parts), and carbohydrates (cellulose) (12 parts). (2) *Carbonites* containing 25 per cent. of nitroglycerin and 20 to 34 per cent. of potassium or sodium nitrate, and a high proportion of carbohydrates. The non-freezing variety contains trinitrotoluene. There are seven explosives in this group and the one selected for trial was *Kohlencarbonite*, composed as follows: Nitroglycerin (25 parts), potassium nitrate (34 parts), barium nitrate (1 part), carbohydrates (39·5 parts), and sodium carbonate (0·5 part). (3) *Gelatin Dynamites.* There is only one explosive in this group containing: Nitroglycerin (25 parts), collodion cotton (1 part), trinitrotoluene (12 parts), ammonium nitrate (20 parts), potassium perchlorate (6 parts), carbohydrates (39 parts), and ammonium sulphate (7 parts). (4a) Ammonium nitrate explosives. There are four explosives in this group and the one selected for trial was *Fractorite D*, containing: Nitroglycerin (4 parts), ammonium nitrate (75 parts), sodium nitrate (10 parts), ammonium oxalate (7 parts), and carbohydrates (4 parts). (4b) Ammonium nitrate explosives with the addition of nitro derivatives of the aromatic compounds. There are seven explosives in this group and the one selected for trial was *Favier* 3 *bis*, containing the following: Trinitrotoluene (8·5 pars), ammonium nitrate (60 parts), potassium nitrate (11 parts), potassium permanganate (0·5 part), carbohydrates (6 parts), aluminium sulphate (5 parts), ammonium chloride (4 parts), and barium carbonate (5 parts). (5) Chlorate explosives. There are three explosives in this group and the one selected for trial was *Yonckite* 10 *bis.*, containing the following: Trinitrotoluene (10 parts), ammonium nitrate (30 parts), sodium nitrate (15 parts), ammonium perchlorate (25 parts), and sodium chloride (20 parts).

To investigate the influence of the section of the gallery on the *charge-limite*, two circular tubes were placed inside the main elliptical gallery, the one having a sectional area of 0·95 sq. m. and the other 0·28 sq. m. The explosive was, as usual, fired from a cannon into firedamp and air mixtures, and coal dust and air mixtures contained in these tubes and the outer tube. In all cases comparative experiments were carried out in the three tubes using three ranges of charging density. (1) Minimum charging density of 0·18 to 0·40. (2) Mean charging density of 0·41 to 0·60 (this is the density which is used for the official tests for determining the *charge-limite* in the large tube). (3) Maximum density of 0·61 to 0·80. The results of the experiments with mean charging density are tabulated below, where the official *charge-limite* is taken as unity:—

	Firedamp mixture.			Coal dust mixture.		
	Sectional area of gallery. sq.-metres.			Sectional area of gallery. sq.-metres.		
	0·28	0·95	2	0·28	0·95	2
	Relative charge-limite.			*Relative charge-limite.*		
1. Wetterdynamites	0·46	0·46	1	>1	>1	>1
2. Carbonites	0·72	0·94	1	0·06	0·28	>1
3. Gelatin dynamites	0·56	0·81	1	0·50	>1	>1
4a. Ammonium nitrate explosives	0·36	0·79	1	0·21	0·43	>1
4b. Ammonium nitrate explosives with addition of nitro derivatives of aromatic compounds	0·33	0·80	1	0·87	>1	>1
5. Chlorate explosives	0·06	0·67	1	0·61	>1	>1

The authors' conclusions are as follows:—The *charge-limite* decreases with the section of the gallery. The extent of the reduction varies very much according to the type of explosive used and whether experiments are carried out in coal dust mixtures or firedamp mixtures. Wetterdynamites gave no ignition with coal dust mixtures in any of the galleries, whereas in the firedamp mixtures there was a very considerable reduction in both middle and small galleries. In the case of the Carbonites there was a very marked reduction in the *charge-limite* in the coal dust mixtures in the galleries of smaller section, but in the case of the firedamp mixtures the reduction in the *charge-limite* was not very marked. Gelatin Dynamite behaves in very much the same manner in the various galleries with both mixtures, and the diminution of the *charge-limite* in the Ammonium nitrate group is more marked in the case of the coal dust mixtures than in that of the firedamp mixtures. The reverse of this is true for the chlorate explosives. The following general law may be taken as true: "All things being otherwise equal, when an explosive is detonated in a mortar in contact with explosive mixtures of either coal dust and air, or firedamp and air, the charge which will ignite the mixture diminishes with the section of the gallery in which the experiments are carried out." The facility of ignition of combustible mixtures increases with pressure. When an explosive is detonated in a space occupied by gas it produces high compression, at the instant of explosion, dependent on the nature of the explosive, and irrespective of the space in which it is detonated. The explosion produces a wave disturbance which is propagated by a series of successive compressions and expansions which, however, are not the same in all cases. In a confined space the mechanism of the propagation is influenced by the superposition of direct and reflected waves from the sides, which give rise to very high compressions and the development of high temperatures. These effects are still more marked when obstacles which give rise to reflected waves are close to the centre of the explosion, and, consequently, a gallery of small section brings about a reduction of the *charge-limite.* A necessary factor of security is that the gases produced by the explosion should be able to expand rapidly and thus produce a rapid fall in the temperature. Overcharging the explosive retards the rapidity of cooling to a very considerable extent, and a restricted space also acts in the same direction as an increase in the charge, and, consequently, brings about a reduction of the *charge-limite.* Despite the fact that at the Frameries Testing Station experimental work is carried out in a manner approximating as closely as possible to actual practice, the results of the present investigation show that much requires to be done before one can be satisfied that this view is actually well founded. The authors do not lay much stress upon the marked diminution of the *charge-limite* of certain explosives when fired in the small gallery of 0·28 sq. m., since it is extremely improbable that, in actual practice, work would ever be carried out under similar conditions. In the case, however, of the middle gallery with a section of 0·98 sq. m. it is considered to be possible that, on occasions, these conditions might be reproduced. The stemming of the explosive introduces a very considerable increase of safety, which appears to be more marked in the explosives "S.G.P." than in others.—G. W. McD.

Glycerin for explosives. Oil, Paint and Drug Reporter. July 10, 1911.

THE U.S. Consul at Durban, Natal, reports that the use of whale oil glycerin as an ingredient of the explosives manufactured at Umbogintwini has been abandoned. When the increasing scarcity of the article in Europe made it apparent that the firm would have to find some source for supplementing their supplies of glycerin it was decided to treat the whale oil produced at Bluff for the purpose. A plant was built adjoining the whale factory at a cost of £20,000, and a considerable staff has for some months been employed.

In addition to their supplies from the Bluff, the firm had continued importing glycerin from Europe, and were using the imported material in the proportion of nine parts to one of the local glycerin. The result has been to prove that whale-oil glycerin—at any rate, that produced under the resources which are possible there—is unsatisfactory for explosives manufacture. The reason is apparently that the animal oil contains elements transmitted to the glycerin which render it when nitrated, chemically unstable.

PATENTS.

Explosives. O. Silberrad, Buckhurst Hill, Essex. Eng. Pat. 7625, March 29, 1910.

THE invention consists in the detonation of high explosives intended for the filling of shells, by the employment of an intermediate charge of powdered picric acid, trinitrotoluene, trinitrobenzene, etc., acting in conjunction with an initial detonator, such as mercury fulminate. It has been found that these explosives, in the powdered condition, can be detonated by a much smaller charge of fulminate than when cast, and that this detonation can be readily transmitted to similar explosives in a cast condition. The fuse consists essentially of a detonating fulminate cap separated only by a layer of cartridge paper from the powdered picric acid, trinitrotoluene, etc., contained in the magazine of the fuse.—G. W. McD.

Explosive. A. C. Lanfrey, Baccarat, France. Eng. Pat. 21,071, Sept. 10, 1910. Under Int. Conv., Sept. 10, 1909.

A MIXTURE of potassium nitrate (5½ parts), picric acid (3), calcium carbonate (1½), powdered carbon (1), and ammonia (1 part).—G. W. McD.

Smokeless powder; Process for the manufacture of ——. C. Claessen. Fr. Pat. 426,437, Jan. 23, 1911.

THE explosive is rolled into sheets which are cut up into strips of such length and breadth as are required for the tube being manufactured. These strips are wound round a mandril and the free ends are joined together by heat and pressure. Another method proposed is that strips of explosive should be wound in helical form on a mandril, joined together by heat and pressure, and then forced through a die to the required diameter.—G. W. McD.

Explosive. Nitroglycerin Aktiebolaget, Stockholm. Eng. Pat. 26,334, Nov. 12, 1910. Under Int. Conv., Nov. 26, 1909.

SEE Fr. Pat. 422,727 of 1910; this J., 1911, 573.—T. F. B.

Explosives; Manufacture of ——. B. J. Flürscheim. Fr. Pat. 425,996, Feb. 13, 1911. Under Int. Conv., Feb. 17, 1910.

SEE Eng. Pats. 3907, 4700, 5338, and 10,433 of 1910; this J., 1911, 385.—T. F. B.

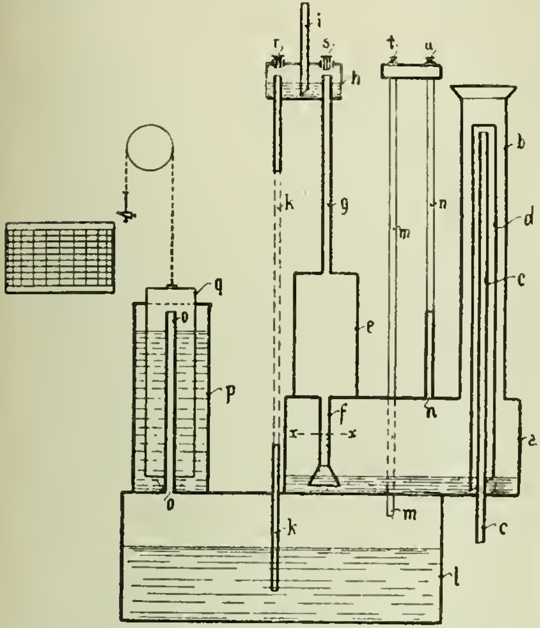
XXIII.—ANALYTICAL PROCESSES.

Gases; The methods of the United States Steel Corporation for the technical sampling and analysis of ——. J. M. Camp. Met. and Chem. Eng., 1911, **9**, 302—306, 356—361.

WITH the object of making comparable the results of gas analyses obtained at the various laboratories of the U.S. Steel Corporation, standard methods of sampling and analysis have been drawn up. In this paper these methods are described with detailed manipulative instructions. Carbon dioxide is absorbed by potassium hydroxide solution, and "illuminants" by fuming sulphuric acid. Methane, hydrogen and carbon monoxide are determined by exploding after addition of oxygen. (A mixture of oxygen and nitrogen, containing 35—45 per cent. of oxygen is used.) In the analysis of gases in which the proportion of oxygen is very small, such as blast-furnace gas and producer gas, the oxygen is absorbed by stick phosphorus, but in other cases such as flue gas, oxygen is determined by exploding after addition of hydrogen. —T. St.

Gas; Apparatus for analysing ——. Erste Süddeutsche Manometerbau-Anstalt und Federtriebwerk-Fabrik, J. C. Eckardt. Fr. Pat. 426,725, March 2, 1911.

THE apparatus works as follows:—A water syphon is used as a means of automatically emptying and filling the apparatus. The water enters by the tube *b*, and fills the receptacle, *a*, and in rising, closes the opening of the tube *n*. The water then rises in *o*, until it reaches the upper end of the tube *c*, within the tube *d*. The water then commences to syphon out and as vessel, *a*, is gradually emptied, the gas to be tested enters by the tube *i* through the liquid seal in *h*, and by tube *g* into the measuring vessel, *e*. As soon as the water in *a* reaches the lowest level of the syphon, a definite volume of gas is enclosed in the measuring vessel *e*, and in the tubes, *f* and *g*. As the water again rises in *a*, this volume of gas is forced over through the seal *h* and by tube *k* into the vessel *l* containing the absorbing liquid, and the volume of gas unabsorbed by this liquid is registered, on a revolving drum, by the rising of the bell *q*. As soon as the water, descending in the vessel *a*, falls below the opening of tube *n*, the excess of gas in the bell, *q*, can escape by tube, *m*, which communicates with *n*, and the open air through vessel, *a*, and tube, *b*, thus leaving the whole system at atmospheric pressure again ready for fresh determinations.—G. W. McD.



Calcium, barium, and strontium ; Separation [*and detection*] *of* ——. E. Birnbrauer. Chem.-Zeit., 1911, **35**, 755.

The carbonates of the earths obtained in the usual way by precipitation with ammonium carbonate, or by fusion with alkali carbonates, are dissolved in dilute nitric acid and the solution evaporated to dryness. Calcium nitrate is extracted by digesting the residue 3 times with a mixture of ether and alcohol (1 : 1) at a gentle heat on the water bath and washing twice on the filter with the same solvent. The insoluble portion is dissolved in hot water, acetic acid, ammonium acetate and then ammonium bichromate are added and the mixture heated to the boil; the precipitated barium chromate is filtered off, and strontium tested for by heating the filtrate to the boil with an equal volume of ammonium sulphate solution (1 : 2).—A. Sbld.

Silver and cadmium ; Rapid determination of —— *by means of a gauze cathode and stationary anode.* R. C. Benner and W. H. Ross. J. Amer. Chem. Soc., 1911, **33**, 1106—1112. (See also this J., 1911, 449, 574.)

The authors obtain satisfactory results for the rapid electrolytic determination of silver, using a potassium cyanide electrolyte. It is advisable not to deposit too much silver on a given electrode since after a certain amount has been deposited, the remainder separates in a rather spongy form. The most suitable electrolyte for quantities of silver up to 0·3 grm. is 8 grms. of potassium cyanide in 60 c.c., with a little potassium hydroxide to prevent the cyanide from becoming coloured. Cadmium can be determined in the same way and under similar conditions except that the washing must be conducted before the current is broken, cadmium being somewhat soluble in potassium cyanide solution. No electrolyte has been found in either case which will replace the potassium cyanide.—W. H. P.

Phosphoric acid ; Volumetric determination of ——. J. Rosin. J. Amer. Chem. Soc., 1911, **33**, 1099—1104.

The author quotes the data of experiments which show that the reaction between silver nitrate and disodium phosphate is most conveniently represented by the equation: $3Na_2HPO_4 + 6AgNO_3 = 2Ag_3PO_4 + 6NaNO_3 + H_3PO_4$. The volumetric method based on this is conducted as follows. The solution of phosphoric acid neutralised to phenolphthalein with sodium hydroxide (free from chloride) is treated with an excess of *N*/10 silver nitrate and well shaken. Zinc oxide is now added until the solution is neutral to litmus paper. The solution is filtered and the excess of silver determined in an aliquot portion of the filtrate by Volhard's method. It is necessary to add at least a 30 per cent. excess of acetic acid, while a great excess of zinc oxide is to be avoided as it will precipitate some silver especially if allowed to stand long in contact with the solution. For this reason it is wise to filter as soon as possible. In this way the author has obtained results with sodium and ammonium phosphates deviating from the gravimetric figures by only about 3 parts per 1000. He has also investigated the action of silver nitrate on precipitated phosphates and finds that, in general, phosphates soluble in acetic acid are transposed to silver phosphate more or less readily, while those insoluble in acetic acid are not so transposed. In the case of calcium phosphate this method is easily available for analysis. If after shaking with excess of silver nitrate the liquid is found to be acid, zinc oxide is added as above, and the excess of silver determinated after filtration. The method is available in the presence of sulphates, nitrates, chlorides (after a correction has been applied), but not in the presence of more than traces of iron or aluminium.—W. H. P.

Phosphoric acid ; Colourimetric determination of ——. J. Pouget and D. Chouchak. Bull. Soc. Chim., 1911, **9**, 649—651.

Details of this method for the determination of small quantities of phosphoric acid have already been published (see this J., 1909, 261). For the preparation of the reagent the acid sodium molybdate of commerce, $Na_6Mo_7O_{24}.22H_2O$, not the normal salt, should be used. To ensure the right composition of the reagent, however, the following method of preparation is recommended. Two solutions, A and B, are prepared, A by dissolving 95 grms. of molybdic acid and 30 grms. of dry sodium carbonate in 500—600 c.c. of hot water, cooling, adding 200 c.c. of pure nitric acid of 36 per cent., filtering and making up to 1 litre, and B by dissolving 2 grms. of neutral sulphate of strychnine in 90 c.c. of hot water, cooling and diluting to 100 c.c. One c.c. of B is mixed with 10 c.c. of A shortly before use, and the mixture filtered. To obtain the maximum of accuracy with the method, two tests should be carried out with 0·2 and 0·3 mgrms. of phosphoric acid respectively, to serve as standards, the one most resembling in tint the actual experimental solution being used for the colourimetric comparison. For the preparation of standard solutions of phosphoric acid the authors recommend mono-potassium phosphate.—J. H. L.

Electrical heating as a means of prevention of superheating of liquids. J. H. Mathews. Trans. Amer. Electrochem. Soc., 1911, **19**, 81—90.

In making molecular weight determinations by the ebullioscopic method, superheating of the liquid can be largely prevented by direct electrical heating. The author uses a large vertical coil (about 20 cm. in length unwound) of large diameter surrounding the bulb of the thermometer in the liquid. Two strands of No. 26 (0·38 mm.) platinum wire twisted together, through which a current of 10—14 ampères is passed, are generally used. but wires of other metals (*e.g.*, "Ni-chrome" or "Advance" resistance wires) may be employed. The ends of the coil are sealed into narrow glass tubes which extend through the cork stopper of the boiling tube. The use of a large free coil of wire and of heavier currents is found to be preferable to the method of Beckmann (this J., 1908, 1132). Bubbles of vapour rising from the heating coil do not come in contact with the thermometer, and a more efficient stirring of the liquid is produced than when the coil is disposed below the thermometer. The boiling tube has a flattened end, so that the coil may extend practically to the bottom. Experiments with German silver wire and ribbon (smooth and roughened) showed that the degree of superheating depends much more upon the condition of the surface than upon the nature of the wire. It is less with a roughened surface, owing to the greater number of bubbles produced. German silver wire roughened by scratching with a file was as effective as platinum wire, whereas smooth German silver wire was considerably inferior (compare Bailey, J. Amer. Chem. Soc., 1911, **33**, 447).—A. S.

Analysis of silicate and carbonate rocks. Hillebrand. *See* VII.

Reaction of uranium salts. Siemssen. *See* VII.

Analysis of nitrous oxide. Smith and Seman. *See* VII.

Determination of vanadium in vanadium and chrome-vanadium steels. J. R. Cain. *See* X.

Method of investigating the quantity of radium in rocks and minerals. Joly. *See* X.

Rosin; Quantitative determination of —— in admixture with coal tar residues, etc. Holde and Meister. *See* III.

Detecting mineral and rosin oils in other oils. Outerbridge. *See* XII.

Analysis of copra. *See* XII.

Use in analysis of caoutchouc nitrosites. Gottlob. *See* XIV.

Determination of acid in chrome leather. Grasser. *See* XV.

Cyanamide; Detection and determination of —— in fertilisers. Vuaflart. *See* XVI.

Detection of palm fats in butter by Ewer's method. Nockmann. *See* XIXa.

Detection of cocoanut oil in butter by Fendler's method. Hepner. *See* XIXa.

Margarine; Analysis of ——. Cribb and Richards. *See* XIXa.

Determining cocoanut oil and butter in butter and margarine. Revis and Bolton. *See* XIXa.

Determination of nicotine in presence of pyridine bases. Surre. *See* XX.

Chemistry of anæsthetics. II. Examination of commercial oxygen. Baskerville and Stevenson. *See* XX.

Examination of terpin. Bourdet. *See* XX.

Detection of salicylic acid. Sherman and Gross. *See* XX.

Patents.

Gases; Apparatus for the continuous determination of solids or liquids in —— by means of a mark produced on a suitable surface. E. K. H. Borchers. Fr. Pat. 426,426, Jan. 11, 1911. Under Int. Conv., Jan. 13, 1910.

See Ger. Pat. 225,625 of 1910; this J., 1910, 1477.—T. F. B.

Gas analyser; Automatic ——. A. Mertens, Cruybeke, Belgium. Eng. Pat. 11,851, May 16, 1911. Under Int. Conv., May 18, 1910.

See Ger. Pat. 234,983 of 1910; this J., 1911, 927.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Light; Chemical action of ——. II. G. Inghilleri. Z. physiol. Chem., 1911, **73**, 144—151.

Tubes containing formaldehyde and water were exposed to light for a year. The liquid product yielded a distillate containing a considerable quantity of methyl alcohol, and a yellow syrupy residue probably containing methylenitan or a similar product. In this photo-synthesis, as well as in that of sorbose (see reference below), and in others recorded by Berthelot and by Stoklasa, traces of alkali dissolved from the glass tubes, probably act catalytically. Mixtures of formaldehyde solution and methyl alcohol were found to contain, after exposure to light for five months, formic acid and small quantities of methyl formate. In order to determine whether a mixture of glycerol and oxalic acid yields the same products under the influence of light as it does on heating (*viz.*, allyl alcohol, acrolein, allyl formate and formic acid) the author exposed tubes containing 60 grms. of glycerol and 20 grms. of oxalic acid dissolved in a little water. The liquid product contained formic acid, a few grms. of butyric acid and some mono-, and possibly di- and tri-butyrin. (See also carbohydrate synthesis, under XVII.)—J. H. L.

Peroxydase properties; Specific nature of various compounds of iron in respect of their ——. J. Wolff and E. de Stoecklin. Comptes rend., 1911, **153**, 139—141.

Colin and Sénéchal (this J., 1911, 838) have recently questioned the view that different compounds of iron possess specific peroxydase properties of widely different kinds (see Wolff, this J., 1908, 474, 772; Wolff and de Stoecklin, this J., 1908, 772; de Stoecklin and Vulquin, this J., 1909, 678). The accuracy of this view, however, is borne out by the author's further experiments. Thus, whereas a trace of iron ferrocyanide alone suffices to produce crystals of quinhydrone from quinol in presence of hydrogen peroxide, iron thiocyanate only effects this in presence of a large excess of potassium thiocyanate. Again, whereas iron ferrocyanide readily forms purpurogallin from pyrogallol in presence of hydrogen peroxide, iron thiocyanate does not effect this transformation to any appreciable extent even in presence of a large excess of potassium thiocyanate. It is also shown that potassium thiocyanate does not accelerate the oxidation of hydriodic acid by hydrogen peroxide, and that if an iron salt such as the nitrate, sulphate, chloride, or acetate exerts a catalytic action on this oxidation process, the catalytic action is much increased by addition of a small quantity of alkali thiocyanate, and this catalytic action nearly attains a maximum when the iron salt and thiocyanate are present in proportions corresponding to the formula $FeK_3(CNS)_6$; moreover it is found that within the limits of the experiments, the acceleration of the catalytic action of iron nitrate is not due to the persulphate formed by the interaction of the thiocyanate and hydrogen peroxide.—L. E.

U.S. shipping rules for dangerous articles. Oil, Paint and Drug Reporter, July 10, 1911.

The Interstate Commerce Commission has promulgated new regulations for the transport of dangerous articles other than explosives which were adopted at the hearing on June 2 subject to final revision of proofs. These rules become effective on and after October 1 next, except as otherwise specified. Copies of the rules can be procured now. Some of the salient features are as follows:—

The following are *forbidden articles*—

(*a*) Outside packages containing, in the same compartment, interior packages the mixture of whose contents would be liable to cause a dangerous evolution of heat, gas or corrosive materials.

(*b*) Cylinders containing gases capable of combining chemically.

(*c*) Packages containing a dangerous article in a leaking condition or in such an insecure condition as to make leakage probable during transit.

(*d*) Cotton waste or rags oily with linseed oil (new).

Inflammable liquids include any liquid which gives off inflammable vapours (as determined by flash point from Tagliabue's Open Cup Tester, as used for test of burning oils) at or below a temperature of 80° F.

When *dangerous articles* requiring the red labels are shipped in the same outside package with dangerous articles requiring yellow or white labels, the outside package must be labelled with the red label only. The shipping order description for such package must give (1) the name of the inflammable liquid present in the largest quantity; and also (2) the name of that article whether dangerous or not, that is subject to the highest rate in the freight classification and tariff under which the shipment is transported. If several dangerous articles requiring the same label are packed together, the shipping order description must give (1) the name of the article in greatest quantity, and (2) the name of that article, whether dangerous or not, that is subject to the highest rate in the freight classification and tariff under which the shipment is transported.

Labels must be of diamond shape, with each diagonal (not sides) five and three-quarters inches long. The colour is red for inflammable liquids and compressed inflammable gases, yellow for inflammable solids and oxidising materials, light green for non-inflammable compressed gases, and white for corrosive liquids.

Rules for Packing Inflammable Liquids.

All inflammable liquids in group 2 must be shipped in well-stoppered glass or earthenware vessels of not exceeding one gallon capacity, cushioned in wooden barrels or boxes; or in metal cans of capacity not exceeding ten gallons or boxes (not jacketed or crated); or in well-stoppered carboys, cushioned and boxed; or in strong tight wooden barrels thoroughly coated on the interior, that must be carefully inspected and re-coopered when necessary; or in iron or steel barrels; or in tank cars, provided the vapour tension of the inflammable liquid corresponding to a temperature of 100° F. does not exceed ten pounds per square inch.

Liquefied petroleum gas in the condensation of which pressure is used must be weathered after condensation by storage for not less than twenty-four hours in well-ventilated reservoirs. It must not be shipped in tank cars unless its vapour tension corresponding to a temperature of 100° F. does not exceed ten pounds per square inch, or unless it has been thoroughly blended with a heavier liquid to form a mixture whose vapour tension corresponding to a temperature of 100° F. does not exceed ten pounds per square inch.

The commission has not deemed it best at this time to prohibit the use of good wooden barrels in shipping inflammable liquids with a flash point below 20° F. It is, however, expected that their use for that purpose will be gradually discontinued and that within a reasonable time metal barrels will come into general use for such shipments.

Packages containing inflammable liquids must not be entirely filled. Sufficient interior space must be left vacant at charging or filling temperature of 70° F. to permit expansion of liquid and vapour, and to prevent distortion of containers when heated to a temperature of 120° F. In barrels, or smaller packages, this vacant space must not be less than 5 per cent. of the capacity of the container (2 per cent. for paints, varnishes, dryers or removers, when flash point is now lower than 20° F.) and in tank cars not less than 2 per cent., inclusive of the dome.

1834. Nitrocellulose, nitrostarch, picric acid or trinitrotoluol, uniformly wet with not less than twenty pounds of water to eighty pounds of dry material must be placed in waterproof containers, securely packed in a strong and tight box, keg or barrel and marked "*Wet Nitrocellulose—20 per cent. water,*" or "*Wet Nitrostarch—20 per cent water,*" or "*Wet Picric Acid—20 per cent. water,*" or "*Wet Tri-nitrotoluol—20 per cent. water.*"

A car placarded "Inflammable," or known to contain inflammable liquids, must not be entered with a lighted lantern, torch or other fire until both car doors have been opened and sufficient time allowed for ventilation and escape of any vapours. The presence of these vapours will generally be indicated by characteristic odours. Packages protected by white and yellow labels, respectively, must not be loaded in the same car or stored together.

Packages protected by labels must be loaded so that they cannot fall to the car floor and so that other packages of freight cannot fall on them.

Iron or Steel Barrels or Drums for Inflammable Liquids and Mixed (Nitrating) Acids.

1. An iron or steel barrel or drum with a capacity of from fifty to fifty-five gallons must have a minimum weight in the black, exclusive of the weight of rolling hoops, of seventy pounds and a minimum thickness of metal in any part of the completed barrel must not be less than that of full No. 16 gauge, United States standard. When the capacity of the drum or barrel is less than thirty gallons the minimum thickness of metal must not be less than No. 18 gauge, United States standard.

2. An iron or steel barrel or drum with a capacity of from 100 to 110 gallons must have a minimum weight in the black, exclusive of the rolling hoops, of not less than 130 pounds, and the minimum thickness of metal in any part of the completed barrel or drum must not be less than that of full No. 14 gauge, United States standard.

3. Each barrel or drum must stand without leaking a manufacturer's test under water, by interior compressed air, at a pressure of not less than fifteen pounds per square inch, sustained for not less than two minutes, and the type of barrel or drum must be capable of standing, without any serious permanent deformation and without leaking, a hydrostatic test pressure of not less than forty pounds per sq. in., sustained for not less than five minutes.

4. When filled with water to 98 per cent. of its capacity the type of barrel or drum must also be capable of standing without leakage a test drop on its chime from a height of four feet upon a solid concrete foundation.

5. Bungs and other openings must be provided with secure closing devices that will not permit leakage through them. Threaded metal plugs must be close fitting. Gaskets must be made of lead, leather, or other suitable material. Wooden plugs must be covered with a suitable coating and must have a driving fit into a tapered hole.

6. The method of manufacturing the barrel or drum and the materials used must be well adapted to producing a uniform product. Leaks in a new barrel or drum must not be stopped by soldering, but must be repaired by the method used in constructing the barrel or drum.

Education of Engineers. Times Eng. Suppl., July 5, 1911.

The most significant result of the Conference on Education and Training of Engineers, held at the Institution of Civil Engineers, is that it confirms the acceptance of the general principles laid down upon the question in 1903 by the special committee of the Institution. Those principles are opposed to early specialisation in engineering subjects for the average civil engineer, they support the establishment of a definite standard of school work to be attained to by all candidates for the engineering profession, and they indicate the advantages of imparting to such candidates a general knowledge of natural philosophy rather than elaborate instruction in a single department of science.

Patent.

Chemical elements; A cabinet for containing classified ——. A. A. Beadle. Dawlish, South Devonshire. Eng. Pat. 26,389. Nov. 14, 1910.

A cabinet containing six shelves each divided into 20 sections and having placed upon the background a chart of the elements based upon a modification of the periodic law.—G. W. McD.

Books Received.

NITROCELLULOSE INDUSTRY. A compendium of the history, chemistry, manufacture, commercial application and analysis of nitrates, acetates, and xanthates of cellulose as applied to the peaceful arts, with a chapter on gun cotton, smokeless powder, and explosive cellulose nitrates. By EDWARD CHAUNCEY WORDEN, Ph.C., M.A. In two volumes, vols. I and II. Constable and Co., Ltd. London. 1911. Price 42s.

THE entire work consists of Vol. I. containing 565 pages of subject matter, and Vol. II. 598 pages, with 324 illustrations, indexes of patents, names of authors, etc., and subjects. There is a frontispiece in each volume, engraving of Schönbein in Vol. I., and of J. W. Hyatt, the discoverer of celluloid, in Vol. II. The text is subdivided and systematised under the following heads:—I. Cellulose. II. Cellulose nitrates. III. Nitration of cellulose. IV. Solvents and non-solvents. V. Fusel oil and the amyl alcohols. VI. Amyl acetate. VII. Natural, artificial, and synthetic camphor. Camphor substitutes. VIII. Paint and varnish removers. Turpentine substitutes. IX. Pyroxylin solutions. X. Pyroxylin lacquers, enamels, and bronzing fluids. XI. Imitation leather and fur. Waterproofing of textiles. XII. Pyroxylin-coated enamel and patent leathers. XIII. Artificial filaments. XIV. Celluloid and the pyroxylin plastics. XV. Celloidin and the cellulose nitrates in microscopy. XVI. Collodion and the cellulose nitrates in pharmacy and medicine. XVII. Cellulose nitrates in photography. Emulsions, films, and processes. XVIII. Guncotton, smokeless powder, and the explosive cellulose nitrates. XIX. Cellulose acetates. XX. Viscose and the cellulose xanthates. XXI. Denatured ethyl alcohol. APPENDIX (i) Transportation of explosives and inflammable materials. (ii). Transportation of smokeless powder for cannon and small arms. (iii), Flash point of inflammable liquids. (iv), Inflammable liquids, placarding for transportation.

*New Books.

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Anweisung f. die chemische Untersuchung v. Fleisch u. Fetten. 8°. Berlin, Selbstverlag des deutschen Apotheker Vereins. 1911. 50 Pf.

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Bericht der Versuchsstation f. Zuckerindustrie in Prag f. d. J. 1910. XV. (X, 182 S. m. Fig. u. 5 Tab.) Lex. 8°. Prag (F. Řivnáč). 1911. M. 3.

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Biechele, Dr. M.: Anleitung zur Erkennung u. Prüfung aller im Arzneibuch f. das Deutsche Reich. 5 Ausg., aufgenommenen Arzneimittel m. Erläuterung der bei der Prüfung der chemischen Präparate sich abspielenden chemischen Prozesse. Zugleich e. Leitfaden bei Apothekenvisitationen f. Apotheker u. Ärzte. 13, vielfach abgeänd. Aufl. (IV. 612 S.) kl. 8°. Berlin, J. Springer. 1911. Cloth M. 6.60.

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Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

Patent Specifications may be purchased at the Sale Branch of the Patent Office, Quality Court, Chancery Lane, London, W.C., fifteen days after the date on which acceptance of the complete specification is advertised. The price is 8d. each.

I.—GENERAL PLANT; MACHINERY.

Applications.

16,394. Renshaw. Machine for drying granular chemicals, salt, etc. July 17.

16,535. Dymond (Mabee). Process of evaporating liquids.* July 18.

16,713. Wilton. Apparatus for pumping air or gases and purifying or washing them. July 20.

16,731. Adam and Testrup. Effecting chemical conversions. July 20.

16,732. Boys. *See under* XXIII.

16,958. Rigby and Testrup. Removal of moisture from peat or other substances. July 24.

17,269. Neumann. Apparatus for discharging viscid liquids or pasty materials.* July 28.

17,283. Koerver. Method and apparatus for raising and forcing liquids. July 28.

17,355. Moseiski. Apparatus for absorbing dilute gases by liquids.* July 28.

Complete Specifications Accepted.

11,938 (1910). Neff and Brandes. Treatment of liquids. July 26.

14,276 (1910). Yost. Clinkering, roasting, calcining, or otherwise treating materials. July 26.

17,420 (1910). Wildbore (Haggenmiller) Hearth floor for calcining or agglomerating furnaces. Aug. 2.

17,602 (1910). Du Pont. Process and apparatus for recovery of separating liquid carried off by separated solids in the separation of solids by means of liquids. Aug. 2.

19,992 (1910). Elliott. Apparatus for purifying fumes and gases. July 26.

22,433 (1910). Theisen. Apparatus for purifying, cooling, and mixing gases. July 26.

27,075 (1910). Hagemeister. Apparatus for heating large quantities of air so as to obtain a high degree of pressure. Aug. 2.

29,581 (1910). Tiemann. Compressing precipitates in settling vessels. July 26.

608 (1911). Drage. Filtering machines. (Feb. 21, 1910.) Aug. 2.

4489 (1911). Imray (Spiegel). Apparatus for removing nebular particles from gases. Aug. 2.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

16,512. Royston (Rickie). Gas producers. July 18.

16,709. Otto und Co. Supply of gas to the flues of coke ovens. [Ger. Appl., Aug. 8, 1910.]* July 20.

16,825. Dempster and Sons, Ltd., and Toogood. Gas retorts. July 22.

16,899. Roberts. Liquid for the treatment of coal, coke and other fuel and its manufacture. July 24.

16,931. Burke. Process for producing light hydrocarbons. July 24.

16,958. Rigby and Testrup. *See under* I.

16,987. Higgins and Marcussen. Method of producing an hydrocarbon spirit. July 25.

17,043. Stackard. Combustion of pulverulent fuel. July 25.

17,220. Generation of water gas. July 27.

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*Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding lists can be obtained.

17.368. Koller. Gas-producers utilising brown coal and lignite. (Addition to 7330 of 1911.) [Hungarian Appl. July 30, 1910.]* July 28.

COMPLETE SPECIFICATIONS ACCEPTED.

14,640 (1910). Franke. Plant for making peat briquettes. July 26.

17,043 (1910) and 4047 (1911). Lewis and True. Manufacture of gas in retorts. July 26.

17,469 (1910). Eisner. Manufacture of filaments for incandescing electric lamps. July 26.

18,199 (1910). Carr and Nairne. Apparatus for testing the illuminating power of gas. July 26.

22,303 (1910). Di Legge. Means for indicating the presence or escape of gases. Aug. 2.

24,256 (1910). Pictet. Continuous manufacture of hydrogen and soot from acetylene or a mixture of acetylene with other hydrocarbons. July 26.

28,711 (1910). White and White. Gas generating plant. (Addition to 10,357 of 1910.) Aug. 2.

28,922 (1910). Senior and Livens. Suction gas-producing plant. Aug. 2.

3518 (1911). Bleichert und Co. Quenching coke. July 26.

6924 (1911). Stettiner Chamotte Fab. A.-G. vorm. Didier. Coke ovens, retort furnaces and the like. (Sept. 12, 1910.) Aug. 2.

III.—TAR AND TAR PRODUCTS.

APPLICATION.

17.291. Johnson (Badische Anilin und Soda Fabrik.) Manufacture of chlorinated hydrocarbons. July 28.

COMPLETE SPECIFICATION ACCEPTED.

6076 (1911). Soc. Chim. des Usines du Rhône. Manufacture of nitrophenylnitromethanes and their homologues and derivatives. July 26.

IV.—COLOURING MATTERS AND DYES.

APPLICATIONS.

17.045. Imray (Meister. Lucius and Brüning). Manufacture of preparations suitable for making an indigo-vat. [Addition to 18.761 of 1910.] July 25.

17,123. Bloxam (A.-G. für Anilin Fabrikation). Manufacture of new indophenols and of new sulphur dyestuffs derived therefrom. July 26.

17,129. Newton (F. Bayer und Co.). New dyestuffs of the triphenylmethane series and intermediate products for use therein. July 26.

17.139. (Johnson (Badische Anilin und Soda Fabrik). New condensation products of the anthraquinone series. July 26.

17.200. Newton (F. Bayer und Co.). Manufacture of di- and polyoxybenzene compounds. July 27.

COMPLETE SPECIFICATIONS ACCEPTED.

9539 (1910). Newton (Bayer und Co.). Manufacture of vat dyestuffs. July 26.

15,068 (1910). Levinstein, Baddiley, and Levinstein, Ltd. Manufacture of azo-dyestuffs. (Dec. 21, 1910.) Aug. 2.

19,545 (1910). Newton (Bayer und Co.). Manufacture of azo dyestuffs. July 26.

21,202 (1910). Newton (Bayer und Co.). Manufacture of azo dyestuffs. July 26.

24,682 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of condensation products of gallocyanines and derivatives thereof. Aug. 2.

7422 (1911). Farb. vorm. F. Bayer und Co. Manufacture of new disazo-dyestuffs (June 15, 1910). Aug. 2.

V. FIBRES; TEXTILES; CELLULOSE; PAPER.

APPLICATIONS.

16,671. Woosnam (Brug.). Paper pulp refiners.* July 20.

16,720. Hartogs. Manufacture of artificial thread. [Ger. Appl., Aug. 18, 1910.]* July 20.

17,097. Chambers and Hammond. Apparatus for screening and removing flocks, fibres, and other suspended matters from liquids. July 26.

17,146. Meygret. *See under* VI.

17,341. Burney, Scruby, and Young. *See under* XXI.

COMPLETE SPECIFICATIONS ACCEPTED.

17,460 (1910). Harger. Balloon envelopes and the like, to prevent diffusion of gases. Aug. 2.

20,560 (1910). Milne. Treating bamboo preparatory to making it into pulp. Aug. 2.

22,499 (1910). Parker. Multiple-colour paper and pulp machines. July 26.

25,986 (1910). Guadagni. Production of artificial silk. July 26.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

APPLICATIONS.

16,557. Johnson and Newton. Means for rendering fabrics and the like non-inflammable.* July 18.

17,146. Meygret. Bleaching vegetable fibres, pulps, and the like.* July 26.

COMPLETE SPECIFICATIONS ACCEPTED.

17,089 (1910). Pawlikowski. Machines for drying and otherwise treating textile materials with fluids. July 26.

27,038 (1910). Johnson (Badische Anilin und Soda Fabrik). Production of discharge effects on fibre, and pastes to be used therein. [Addition to 30,505 of 1909.] Aug. 2.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

APPLICATIONS.

16,426. Elektrochem. Werke. Electrolytic production of ammonium nitrate. [Ger. Appl., July 16, 1910.]* July 17.

16,449. Chem. Fabr. Griesheim-Elektron, and Grünstein. Manufacture of acetic acid. July 17.

16,629. Collett and Eckardt. Production of ammonium sulphate. [Divided Appl. on No. 21,237 of 1910.]* July 19.

16,866. Taraud and Truchot. Recovery of nitrous products in making sulphuric acid by the chamber process. [Addition to No. 9461 of 1911. Fr. Appl., Aug. 20, 1910.]* July 22.

17,017. Pape. Process for desulphuration of zinc sulphate.* July 25.

17,047. Ges. für Chemische Industrie in Basel. Apparatus for electrolysis of fused alkali chlorides. [Addition to 18,300 of 1910. Ger. Appl., Dec. 22, 1909.]* July 25.

17,157. Girod and Graflich. von Landsberg-Velen and Gemen'sche Chem. Fabrik, Berg-und Huttenwerke G. m. b. H. Process for manufacturing light coloured sulphuric acid, free from arsenic and iron, by the lead chamber process. [Ger. Appl., Aug. 13, 1910.]* July 26.

17,158. Girod and Graflich von Landsberg-Velen and Gemen'sche Chem. Fabrik, Berg- und Huttenwerke, G. m. b. H. Concentrating sulphuric acid. [Ger. Appl., Aug. 13, 1910.]* July 26.

COMPLETE SPECIFICATIONS ACCEPTED.

29,282 (1910). Schlaugk. Preventing the decomposition of aqueous solutions of hydrogen peroxide. July 26.

29,485 (1910). Withers (Blum). *See under* X.

30,185 (1910). Thomann. Manufacture of a hard and dense composition comprising an alkaline peroxide in unalterable form. Aug. 2.

61 (1911). Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia. Aug. 2.

153 (1911). Jaubert. Method and apparatus for preparing hydrogen. (Jan. 14. 1910.) Aug. 2.

401 (1911). Saubermann. Process for generating hydrogen. Aug. 2.

2304 (1911). Klingbiel. Process for manufacture of phosphates of potash and ammonia (Jan. 29, 1910.) Aug. 2.

5713 (1911). Collett and Eckardt. Production of graphite, etc., in the manufacture of ammonia. (Mar. 10, 1910.) Aug. 2.

10,759 (1911). Gewerkschaft des Steinkohlenbergwerks Lothringen and Uhde. Process for producing ammonium nitrate. Aug. 2.

11,640 (1911). Cons. f. Elektrochem. Industrie. Generation of hydrogen from silicon and alkali solutions. July 26.

12,008 (1911). Klages, Sommer, and Saccharinfabr. vorm. Fahlberg, List, und Co. Product for yielding hydrogen peroxide. July 26.

VIII.—GLASS; CERAMICS.

Applications.

16,877. Thompson. Melting pot of a glass furnace. July 24.

17,270. Colin. Process for enamelling objects of cast iron and particularly kitchen utensils.* July 28.

Complete Specification Accepted.

1859 (1911). Kersten. Method for preparing constituent mixtures for the manufacture of glass. Aug. 2.

IX.—BUILDING MATERIALS.

Applications.

16,433. Newton (Bayer und Co.). Process for preserving wood. July 17.

16,960. British Thomson-Houston Co. Purification of asbestos (General Electric Co.). July 24.

16,997. Hutchinson. Corsistometer for testing bituminous road materials. (W. W. Crosby.) July 25.

17,226. Ehlers and Rommel. Artificial stone composition. July 27.

17,230. Brownfield and Beech. Composition for use in making fire-resisting bricks and tiles. July 28.

Complete Specification Accepted.

27,494 (1910). Howells. Utilisation of waste material for making concrete, etc. July 26.

X.—METALS: METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

16,583. Harris. Mechanical ore-roasting furnace. July 19.

16,601. Hatton. Manufacture of ingot iron and steel. July 19.

16,821. Zavelberg. Extraction of easily oxidisable metals from their ores.* July 22.

16,824. Browett. Treatment of metals or metalliferous ores or materials. July 22.

16,946. Gitsham. Plant for recovering gold and silver from antimonial, arsenical, and other gold-bearing ores. July 24.

16,957. Helsingborgs Koppaverks Aktiebolag. Chloridising and roasting ores. [Addition to 23,108 of 1909. Swedish Appl., July 26, 1910.]* July 24.

17,010. Island. Separating precious metals from ores. [Addition to 13,488 of 1910.]* July 25.

17,150. Rosenberg. Cleaning surfaces of articles made of silver and other metals.* July 26.

17,179. Stobie. Manufacture of electric steel. July 27.

17,256. Eckford. Manufacture of lead oxide. July 28.

17,287. Schwalb, jun. Process and furnaces for the extraction of iron, etc., from ores, waste products, etc.* July 28.

17,357. Cowper-Coles. Process for removing scale and oxide from iron and steel surfaces. July 28.

Complete Specifications Accepted.

17,587 (1910). Beauchamp. Extraction of zinc oxide from ores and tailings. July 26.

17,647 (1910). Heskett. Manufacture of steel. Aug. 2.

17,785 (1910). Dick. Treatment of siliceous zinc ores. Aug. 2.

18,010 (1910). Cinille. Process and apparatus for the manufacture of hard steels direct from cast iron. Aug. 2.

18,452 (1910). Baker. Treatment of ores. Aug. 2.

21,206 (1910). Harden, and Electric Furnaces and Smelters, Ltd. Reduction of metals from their ores by reduction. July 26.

27,020 (1910). Johnson. Manufacture of gold, aluminium, silver, and silver bronze leaf. Aug. 2.

29,376 (1910). Weiss. Treatment of metal to produce sound castings. July 26.

30,295 (1910). Dellwik-Fleischer Wassergas-Ges. Gas heated smelting or heating furnaces. July 26.

41 (1911). Naulty and Scanlin. Copper alloys and process of making them. July 26.

XI.—ELECTRO-CHEMISTRY.

Applications.

16,426. Elektrochem. Werke. *See under* VII.

16,636. Johnson (Badische Anilin und Soda Fabrik). Production of long stable electric arcs for the treatment of gases. July 19.

16,902. Chem. Fabrik Buckau. Manufacture of magnetite electrodes. [Ger. Appl., July 22, 1910.]* July 24.

17,060. British Thomson-Houston Co. (Gen. Electric Co.). Electric Furnaces. July 25.

17,132. Pape. Manufacture of electric accumulator electrodes and means for use therein. (Addition to 905 of 1911.) July 26.

17,362. Cowper-Coles. Electro-galvanising. July 28.

Complete Specifications Accepted.

17,650 (1910). Helfenstein. Electric furnace with a receptacle for the charge arranged on the furnace chamber. (July 27, 1909.) Aug. 2.

3648 (1911). Weintraub. Electrolytic meters (Feb. 14, 1910.) Aug. 2.

8901 (1911). Stassano. Electric furnace. July 26.

9633 (1911). Imray (Shawinigan Carbide Co.). Electrodes for electric furnaces. Aug. 2.

XII.—FATS; OILS; WAXES.

Applications.

17,002. May. Solid oil-containing medicines. July 25.

17,114. Mellalieu and Taylor. Compound for removing paint, grease and stains from textile materials, cleaning paint, and useful as a detergent. July 27.

Complete Specifications Accepted.

4241 (1911). Harrison (Naamlooze Vennootschap "Lux"). *See under* XIX.

5188 (1911). Paal. Process for the reduction of fats and unsaturated fatty acids (Aug. 5, 1910). Aug. 2.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Application.

16,974. Pope. Pigments. July 25.

Complete Specifications Accepted.

17,770 (1910). Ramage. Lead pigments and method of making same. July 26.

29,485 (1910). Withers (Blum). Manufacture of zinc white oxide. July 26.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

16,539. Thame. Treatment of raw rubber. July 18.

17,124. Hiestrich Nachf. Extraction of india-rubber. (Addition to 10,216 of 1911.) [Ger. Appl., Dec. 20, 1910.]* July 26.

17,125. Hiestrich Nachf. Extraction of india-rubber. (Addition to 10,216 of 1911.) [Ger. Appl., Dec. 20, 1910.]* July 26.

17,248. Schnidelmeiser. Synthetic caoutchouc. July 28.

Complete Specifications Accepted.

9219 (1910). Hodgkinson. Treatment of isoprene to manufacture rubber or a substance resembling rubber. July 26.

24,325 (1910). Bertrams Ltd., Gillespie, and Matthew. Apparatus for coagulating rubber latex by smoke. Aug. 2.

25,201 (1910). Reynaud. Manufacture of india-rubber. July 26.

26,870 (1910). Shaw and Cooke. Smoking and coagulating rubber latex. July 26.

6540 (1911). Farb. vorm. F. Bayer and Co. Process for producing artificial caoutchouc. (Mar. 31, 1910. Addition to 17.734 of 1910). Aug. 2.

8987 (1911). Howard. Production of soft resilient rubber. July 26.

9600 (1911). Bridge. Machines for washing, macerating, crepeing, and similarly treating india-rubber. Aug. 2.

XV.—LEATHER: BONE: HORN: GLUE.

Applications.

16.527. Redlich. Clarification of tanning extract liquors, especially quebracho extract liquors.* July 18.

16,810. Hartmann. Hardening and waterproofing animal skins.* July 21.

16,904. Johnston. Production of pliant and vulcanisable leather and manufacture of casings for pneumatic tyres, boots and shoes therefrom. [Australian Appl., Feb. 2, 1911.]* July 24.

Complete Specification Accepted.

12,845 (1910). Heuschkel. Manufacture of artificial marble from leather in which tannic acid is obtained as a by-product. Aug. 2.

XVI.—SOILS; FERTILISERS.

Complete Specification Accepted.

12,844 (1910). Heuschkel. Manufacture of artificial manure. Aug. 2.

XVII.—SUGARS; STARCHES; GUMS.

Applications.

17,031. Adam. Reduction of hydrogenisation of sugars. July 25.

17,221. Colking and Kynoch, Ltd. *See under* XXII.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

17,275. Friedberger. Manufacturing fermentation lactic acid. [Divided Appl. on 2507 of 1911.] July 28.

17,322. Skinner. Means for cooling beer. July 28.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

16,431. Petzholdt. Manufacture of cocoa. [Ger. Appl., Oct. 26, 1910.]* July 17.

16,688. Hewitt. Method of softening water and preventing deposition of scale in boilers. July 20.

16,746. Stacey. Manufacture or treatment of flour. July 21.

16,781. Uhde. Combustion of refuse.* July 21.

17,097. Chambers and Hammond. *See under* V.

17,215. York. Water purification plants. July 27.

17,305. Von Vangel. Manufacture of foodstuffs. July 28.

Complete Specifications Accepted.

17,871 (1910). Richter und Richter. Draining and utilising slime of any kind; particularly from sewage. July 26.

24,162 (1910). Mollinger. Preservative treatment of milk. Aug. 2.

4241 (1911). Harrison (Naamlooze Vennootschap "Lux"). Preservation of butter, fat, etc. July 26.

14,720 (1911). Kwilecki. Apparatus for determining the amount of albumin in liquids. (Feb. 24, 1911.) Aug. 2.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

17,018. Immendorf and Kappen. Urea.* July 25.

17,259. Fairweather (E. I. du Pont de Nemours Powder Co.). Method of producing butylene glycol.* July 28.

Complete Specifications Accepted.

29,559 (1910). Kalle und Co. Manufacture of therapeutic preparations. July 26.

568 (1911). Bart. Manufacture of organic derivatives of arsenic acid. (Jan. 7, 1910.) Aug. 2.

9359 (1911). Meister, Lucius, und Brüning. Manufacture of a dimethylphenylbenzylammonium disulphonic acid. July 26.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

16,672. Ward. Process of toning photographic prints. July 20.

17,015. Forbes. Colour photography. July 25.

17,341. Burney, Scruby, and Young. Substances suitable for the production of non-inflammable cinematograph films. July 28.

Complete Specifications Accepted.

24,378 (1910). Triepel. Method of toning photographic prints. Aug. 2.

8153 (1911). Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Manufacture of polychrome photographic screens. July 26.

XXII.—EXPLOSIVES; MATCHES.

Applications.

16,673. Fairweather (Dynamit A.-G. vorm. A. Nobel und Co.). Process of casting explosive charges.* July 20.

17,113. Venot and Chasseigne. Paste for lucifer match igniting tips.* July 26.

17,138. Flürscheim. Explosives. (Addition to 3907 of 1910.) July 26.

17,209. Touaceli. Illuminating torches. (Italian Appl., July 28, 1910.] July 27.

17,221. Cocking and Kynoch, Ltd. Nitration of sugars. July 27.

Complete Specifications Accepted.

29,989 (1910). Paul. Process for producing sulphur phosphides rich in sulphur and suitable for producing non-poisonous priming materials. Aug. 2.

2682 (1911). Ely Bros., Ltd., and Goodwin. Detonating compositious for rim-fire cartridges, percussion caps, detonators, etc. July 26.

XXIII.—ANALYTICAL PROCESSES.

Applications.

16,732. Boys. Examination or treatment of liquid films. July 20.

16,857. Holzapfel. Gas detecting apparatus. July 22.

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New York Section.

THE ANALYSIS OF SHELLAC.

BY A. C. LANGMUIR AND F. S. WHITE.

(This J., 1911, 788.)

Errata.

Col. 2, line 1, *for* " 50° C." *read* " 50° F."
Col. 2, line 7, *for* " weighted " *read* " weighed."
Col. 2, line 15, *for* " 6·849 " *read* " 6·812."

Communications.

THE IRON AND STEEL INDUSTRIES OF SHEFFIELD.

Y J. O. ARNOLD, D.MET., AND A. McWILLIAM, M.MET., A.R.S.M., UNIVERSITY OF SHEFFIELD.

(See this J. 1911, 861.)

A patient search for records of the very first beginnings f the iron and steel industries in Sheffield and its neighbourhood produces little in the way of facts, and leaves he impression that, either through the different ideas of elative importance prevailing in those early days, the ndustry did not obtain the honour of record, or, more robably, from the secrecy with which it would be conducted, after a fashion the heritage of which remained ntil quite recently, records were not sought for, and in act were even avoided. Proximity to beds of coal can ardly have had much influence, as, so far as is known, harcoal was the fuel used until a comparatively recent late. Coal seems to have been worked in the neighbourhood for six or seven centuries, but not to have been ecorded as applied to the manufacture of iron and steel ntil the time of Dud Dudley, about 1619.

The iron ores of the district have been worked from ancient times, but they consist of clay ironstone, a ferrous carbonate with clay, and usually contain considerable quantities of phosphorus. Although pig iron made from hese ores, and containing about 0·6 per cent. phosphorus, s excellent for foundry purposes and for making into the highest qualities of wrought iron to be used as such, one can hardly conceive of these being used to make blades that would win such a wide reputation, for an amount of phosphorus that allows of an excellent wrought iron being made would have a very harmful influence when present to the same extent in high-tempered steel. Thus, there seems hardly any doubt that, whilst local ores would be used for making best quality iron, for the making of the highest qualities and tempers of steel the iron used would of necessity be imported either from other countries—Russia, Styria, or Sweden, as to-day—or from other districts, of which Sussex and the Forest of Dean have been suggested. Why should the people who imported iron from Scandinavia, Spain, or Russia, bring it up to Sheffield? Probably the ordinary iron trade centred round here owing to the supplies of iron ore outcropping in the district near Kimberworth, etc., where the ore has been worked evidently down till water was reached, then the pit abandoned and the seam worked elsewhere till water again stopped proceedings, and so on for hundreds of workings. Not all the points mentioned, however, are satisfying as a complete cause for the high-tempered steel trade centreing in and around Sheffield, even attracted as it would be by the ordinary iron trade; but the balance is supplied by the rather extraordinary position of the city, for one of its chief characteristic features is that it has five small rivers, with a considerable fall per mile, meeting practically within the bounds of the city. The Loxley and the Rivelin meet at Hillsborough, one and a half miles to the north-west, and in another half-mile join with the Don. To the south-west, the Porter and Sheaf meet close to the city and soon unite with the Don which flows through the city. Each stream is supplied by the drainage from the surrounding moors with sufficient water to develop the necessary power all the year round, and the form and slope of the river beds are such that serviceable dams for water power are easily made at small expense. Standing on the Bole Hills, where the Sheffielder goes for invigorating breezes and a magnificent view, a regular chain of these dams with their attendant forges or grinding wheels may still be seen. A considerable number of men are still busily engaged at the forges and wheels in working hours, forging and grinding table blades and pocket knives, grinding scythe blades and other similar work. Mr. Thomas Winder in a recent lecture gave very convincing evidence that the name Sheffield was really an altered form of the old name " Escafeld," found by him in Domesday Book and other ancient records, and meaning the " Field of Waters." That the carboniferous sandstones of the district yielded most excellent grindstones, and that refractory materials were abundant, must also have had considerable influence.

The name Bole Hills is of metallurgical origin, for it indicates a position where furnaces or boles were built so that they would receive the full force of the prevalent winds which would act instead of blast, and hundreds of visits to the spot, even on the calmest of days in town, leave the impression that there would be very few unproductive times for lack of breeze. If the idea of the Bole Hills be correct, it may take us back to pre-historic times. It is well to remember that the Ancient Britons could hardly have been such savages as generally represented, for there is good evidence that they were well acquainted with the manufacture of iron, at least for weapons. Hunter's " Hallamshire " says that in the midst of a mass of scoria near Bradfield some Roman coins were found, and that many other remains of scoriæ are found in the parish of Sheffield where no tradition is known as to an iron works having existed there. The Domesday makes no mention of Sheffield iron works, but in 1160 the monks of Kirkstead had " pretty extensive " iron works at Kimberworth, two works for smelting the ore and two for forming the iron into bars. Chaucer in " The Reve's Tale," 1386, in describing the Miller of the time of King Edward III., says: " A Shefeld thwytel bare he in his hose." The project of rendering the Don navigable was early discussed, and a petition granted in 1442 to make tow paths.

That foreign iron was used in Sheffield more than 300 years ago is shown by the following extract from the accounts of the Church Burgesses for 1557:—" Paid to Robert More for one stone and quarter of Danske Yron XXIId. Paid to ye same Robt. for X lib. of Spanysche Yron . . XV." It is of considerable interest that " 100 " of Spanish iron cost 14s., whilst " 100 " of Danish iron (probably of Swedish manufacture) cost 12s. retail. Peter Bales, 1590, in the " Writing Schoolmaster " recommends Sheffield razors and penknives for quill cutting, etc. In Hunter's " Hallamshire," p. 165, it is stated that previous to 1615, Sheffield workmen could only make armour for the common soldier; the knights' armour was always brought from abroad. The statement is in accord with the ideas developed in the present account, namely, that there was a considerable volume of trade in ordinary wrought iron of excellent quality, made from local ores and fuel, and a smaller trade in highly-tempered goods, such as knives, razors, etc., made from imported iron. Any armour manufactured here would then have been of good wrought iron, perhaps manipulated in the making so as to be slightly steely, as is often done at the present time, whilst such large, highly-tempered work as knights' armour was possibly made in Spain. Scott, in writing "Ivanhoe," evidently had this idea, for in describing the siege of Torquilstone (near Conisbro') he says: "Thrice did Locksley bend his shaft against De Bracy and thrice did his arrow bound back from the knight's armour of proof. 'Curse on thy Spanish steel coat,' said Locksley. 'Had English smith forged it, these arrows had gone through an as if it had been silk or sendal.'" Probably the opening scene of "Ivanhoe" was near Woodhouse, about 5 miles east of Sheffield, and until quite recently wrought iron works, known as the Rotherwood Iron Works, were in operation at Woodhouse Mill.

There is evidence that shear steel, then called German steel, was first manufactured in England by "one Crowley, a Newcastle man," about 1730.

The operation of making converted bar or blister steel consists essentially in packing bars of Swedish or other equally pure charcoal wrought iron in charcoal and heating them out of contact with air for several days, the time varying according to the amount of carbon desired in the steel. The carbon, which penetrates the iron either as carbon or some carbonaceous gas, acts upon the highly basic ferrous silicate of the cinder always present in wrought iron, reduces the oxides and liberates carbon monoxide gas, which, being under pressure, raises the plastic steel in blisters which give the name to the product. Blister steel is made into shear steel, so called because the material was in high repute for the manufacture of shears for cutting cloth; the mark with which such steel is still branded being a rude representation of a pair of shears.

Up to 1740, steel articles would be made from blister steel or from shear steel, or from natural or puddled steel.

The next important step in the development of the steel industry seems to have been due to the fact that Benjamin Huntsman, a clockmaker of Doncaster, found great difficulty in obtaining from blister steel a material sufficiently regular in temper for his use. He started experimenting and, in 1740, discovered the process of melting the broken pieces of blister steel in crucibles and pouring the molten material into cast-iron ingot moulds, thus making ingots of crucible cast steel. In reference to this Dr. Percy states: "Formerly, so far as I am aware, steel was never melted and cast after its production; and in only one case, Wootz, ever molten during its production." Huntsman seems to have been able to make sound ingots and steel with small quantities of material other than iron and carbon by double-melting, that is, breaking up the ingots and re-melting them. He did further experimental work at Handsworth, and finally removed to Attercliffe, both now parts of Sheffield, and the process is still carried on by his descendants on the same site as the firm of Benjamin Huntsman, the present head of the firm being the fifth in direct succession.

In an article on "the Iron Trades in 1750," it is stated that out of 12,000 tons of iron used in Sheffield annually, 4,000 tons were imported from Sweden.

A steel cementing furnace was started by the Cutlers' Company in 1759. The iron used came from Hull.

Lardner, in his "Cyclopedia," says that it is remarkable that a town that used to import from Styria now sends to Austrian forges steel of its own converting.

At this time there would be the ordinary cast iron and wrought iron trades, the manufacture of shear steel, crucible steel and the articles made from these several varieties of materials.

Probably the most revolutionary introduction into the steel trade of Sheffield was due to the invention of the Pneumatic or Bessemer Process by the late Sir Henry Bessemer in 1856. This process consisted in melting in the cupola, pig iron of suitable composition with its 7 per cent. or so of impurities, pouring the molten metal into a Bessemer converter, and oxidising the impurities by means of a blast of air forced through the molten iron. This method differs essentially from preceding methods of purifying pig iron in the fact that the metal, during the whole process of purification, is kept in the molten condition. As the impurities become less and less, the melting point of the metal increases, but the extra heat required still to maintain the bath in its molten condition is supplied partly by the oxidation of the carbon and manganese, but in the English Bessemer process mainly by the silicon contained in the original pig iron. In the older processes the temperature was not kept so high, and consequently, when the material came to a certain degree of purity, it "came to nature," that is, it changed from the molten state into a pasty condition, and was afterwards balled up and forged into wrought iron. In the molten state, however, the steel can dissolve oxide of iron, and it was found that after the removal of the original impurities was effected, the material was "red-short," *i.e.*, could not be forged at a red heat without cracking. It required the addition of manganese to remove the new impurity oxygen, an invention previously patented by Mushet, although the patent had been allowed to lapse. The combination of these ideas resulted in the highly-successful Bessemer process, and in 1856 Henry Bessemer and Partners founded the firm of Henry Bessemer & Co., in Sheffield.

Soon after, the invention of the Siemens furnace on the regenerative principle, which had already been foreshadowed by Stirling, started the now well-known Siemens-Martin or Open-hearth process. These two methods of manufacture, the Bessemer and Open-hearth with acid or silica linings, were strong competitors in connection with the manufacture of structural steels and special steels for the general heavy trades, which now also became centred in Sheffield. At one time Sheffield had a large output of railway materials, such as rails, tyres and axles, but the continued decrease in the price of rails ultimately compelled Sheffield to relinquish the trade in favour of coast towns where expenses of transit could be kept to a minimum, and the Sheffield district retained again only the special qualities of those steels, such as those used for tyres, axles, etc.

Gradually the Open-hearth process is ousting the Bessemer, and one after another the Bessemer Converters are being put out of action and replaced by Open-hearth furnaces, until now very few of the former remain in Sheffield. At one time, only acid steel was made, but one of the recent developments in the district is the gradual erection of Basic Open-hearth furnaces, so as to utilise phosphoric pig iron in the manufacture of certain varieties of steels; but for such materials as guns, projectiles, etc., the acid process only is used. With an acid lining, only carbon, silicon and manganese are removed, sulphur and phosphorus are not touched, whilst, with a basic lining, carbon, silicon, manganese and phosphorus may be removed, and in certain circumstances a small portion of the sulphur. Desulphurising processes were also developed, and Mr. E. J. Saniter, the inventor of one of the best known of these, who was last year awarded the Bessemer Gold Medal of the Iron and Steel Institute, is now with the local firm of Steel, Peech & Tozer.

While these great developments were taking place in the manufacture of structural steel, guns, projectiles, armour plates, large crank shafts and the general heavy lines, the crucible steel trade was not by any means stagnant. Threatened with extinction as it was then, and has been annually since, it supported the old adage of flourishing more and more. The increase in the manufacture of the other types of steel merely necessitated the manufacture of much more crucible steel with which to work upon it with chisels, turning tools, drills, etc. Not only did the output of crucible steel increase in quantity, but new varieties were introduced. Mushet, in 1858, discovered his self-hardening tool steel, which not only became sufficiently hard by merely cooling in air, but could be run at much higher speeds at work without softening or losing its temper. His steel contained 8 or 9 per cent. of tungsten and 1 to 2 per cent. each of manganese and carbon and some chromium. About 1900, the Americans showed the world that more could be done with this type of steel than had been done formerly, but almost immediately Sheffield repelled the invasion of this apparently formidable rival and, producing a still better type of high-speed steel, as the latest arrival was called, carried the war into the enemy's camp with most marked success. The Sheffield steel contained anything from 10 to 20 per cent. of tungsten with 2 to 6 per cent. of chromium, very much lower carbon than formerly, and it is hardened from about 1300° C. Still more recently, in 1908, another improved high-speed steel was produced in Sheffield, by means of the addition of one or other of the rare elements, a modification which it is said produces a steel that lasts four times as long as the previous best high-speed steel, a result which caused very considerable sensation throughout the metallurgical world.

In the History of the Cutlers' Company it is stated that "In 1379 a Poll Tax was levied. Out of 354 adult males, 312 could not pay more than 4d., 37 paid 6d., 3 paid 1s., 2 paid more than 1s. Not one of these is described as a cutler. Smiths, cordwainers, coopers and wrights there were, but only 6 cutlers are mentioned in all the surrounding villages."

Passing from 1379 to 1911, the City of Sheffield has now about 400 works engaged in the manufacture of steel and steel articles. It is also the greatest Armoury the world has ever seen; three of its firms have shipyards on the coast, and each firm is capable of turning out a battleship complete. Thomas Firth & Sons, Ltd., are associated with John Brown & Co., Ltd., whose shipyard is at Clydebank, where the "Lusitania" was built. Cammell, Laird & Co., Ltd., have a building station at Birkenhead, and Vickers, Ltd., from their Barrow Yard recently launched the "Vanguard," a battleship of the Dreadnought type, built with an expedition which created a world's record in construction.

THE SILVER INDUSTRY OF SHEFFIELD.

BY ERNEST A. SMITH, A.R.S.M.

(Deputy Assay Master, Sheffield Assay Office).

(See this J. 1911, 861.)

The manufacture of sterling silver wares and of silver-plated wares is a branch of Sheffield trade of considerable mportance. It shares with cutlery the honour of being a staple industry of the city, and has taken a great and increasing part in building up Sheffield's fame. From the beginning the silver trade has been intimately connected with the cutlery trade. The origin dates from the middle of the eighteenth century, and can be traced as an off-shoot of the older industry, the manufacture of cutlery, for which the city has so long been famous.

The silver industry began when the art of "silver-plating" was invented in the year 1742 by an ingenious mechanic, Thomas Bolsover, who was a member of the Cutlers' Company. When repairing the handle of a knife, composed partly of silver and partly of copper, he accidentally fused he metals, causing them to adhere to one another, and his accident suggested to Bolsover the possibility of a process of coating copper with silver so as to present the appearance of silver, and thus obtain a substitute for olid silver ware which should be less expensive but not an mitation. Bolsover succeeded in carrying out his idea, and manufactured small articles in plated silver. This was he starting point of a very important industry, namely, he manufacture of the celebrated *Sheffield Plate*, which lourished for a hundred years, and then had to give place o the process of silver-plating by electro-deposition, known as electro-plating. This process was introduced n 1840, and thenceforward plating by Bolsover's process declined. and by about 1850 had almost died out.

The silver-plating process pursued in the manufacure of old Sheffield Plate consisted in taking an ingot of copper slightly alloyed with brass, and a thinner ingot of silver finer than standard, and placing them in close ontact after their surfaces had been scraped clean and ven. The silver was then protected by a thin sheet of opper and a sheet of iron outside that. The whole was ightly bound together with iron wire, and the edges brushed with a solution of borax to prevent oxidation in he subsequent heating. The ingot was next very careully heated in a reverberatory furnace until the silver began to fuse and was seen to flow at the edges. It was then quickly removed from the furnace, gradually cooled, and when cold cleaned in an acid solution, after which it was scoured with sand and water and rolled out to the desired thickness. For the purposes of manufacture it was cut up and hammered into the required shape by skilled workmen, or stamped in dies, the edges and parts being soldered together at a moderate heat, and finally burnished by hand. In the early days of silver-plating the manufacture of buttons and buckles was an immense industry, and Bolsover at once established a factory in Baker's Hill for the production of these and other small articles, such as snuff-boxes, etc. He experienced great difficulty in regard to labour, and at first he, and others who followed him, had to accept the services of itinerant tinkers and such workmen as they could induce to come from London and other places—men who speedily realised their importance and exacted their own terms.

For the first fifty years the copper was plated with silver upon one side only, but Bolsover's apprentice, Joseph Hancock, improved upon the process and plated both sides, at the same time extending its application to large articles, such as tankards, coffee-pots, etc. Tin was at first applied to hide the raw edges of the copper, or brass, but in 1784 George Cadman, in partnership with Samuel Roberts, substituted solid silver edges and mounts, thus not only hiding an obvious disfigurement, but also protecting the parts most exposed to wear. The earliest forms of Sheffield Plate are generally plain and simple in design, but later the designs were pierced like the silver-pierced work of about the middle of the eighteenth century. As a general rule, Sheffield Plate simply reproduced the patterns of solid silver in use at the time.

The Old Sheffield Plate, which, as stated above, represents the earliest form of silver-plating, was exceedingly durable. At the present time it is much sought after by collectors, and when genuine usually commands a high price. Several fine examples of Sheffield Plate may be seen in the Weston Park Museum.

Electro-plating.—The method now used was discovered in 1840 by a surgeon, Mr. John Wright, a native of Lincolnshire, who was for some time assistant to Dr. Shearman, of Rotherham, but afterwards practised in Attercliffe, and subsequently removed to Birmingham.

Dr. Wright appears to have been a great experimentalist, and Dr. H. Clifton Sorby has recorded the fact that in his early days he and Dr. Wright used to meet and experiment at the laboratory of Mr. Lucas, who was the scientific chemist at the silver refinery at Attercliffe.

Dr. Percy, the famous metallurgist, states (in his "Metallurgy of Silver," page 115) that "Mr. Wright informed him that he (*i.e.*, Mr. Wright) was led to this invention from reading the following passage in Scheele's memoir on Prussian Blue"* :—"It is remarkable that our colouring matter [hydrocyanic acid] after it has united with the alkali, or with the lime, forms a menstruum, capable not only of dissolving metallic calces, but also of constituting a triple salt, which is not decomposed by the aërial acid as happens with the *lixivium sanguinis* [*i.e.*, aqueous solution of cyanide of potassium] and the precipitating liquor, when exposed to the free access of air. Iron is not the only metal which has the property of fixing the colouring matter. The same quality belongs likewise to gold, silver, copper, and probably to several other metallic calces; for if, after these calces have been precipitated, a sufficient quantity of precipitating liquor be added, in order to re-dissolve them, the solution remains clear in the open air, and in this the aërial acid does not precipitate the metallic calx."

A patent was granted for the use of cyanide of potassium in electro-plating to Messrs. George Richards Elkington and Henry Elkington in 1840, Mr. Wright having sold his invention to those gentlemen on condition of receiving one shilling per ounce of silver deposited. The patent ought legally to have been taken out in the name of the inventor.

The process was first introduced into Sheffield in 1843 by the late Mr. John Harrison, of Norfolk Works, Scotland Street, who, being impressed with its merits, obtained from Messrs. Elkington a licence to use the process, and sent Mr. George Walker (whom he engaged as an operative plater) to be instructed at Messrs. Elkington's Works at Birmingham.

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* Chemical Essays Translated by Dr. Beddoes, London, 1780, p. 405.

On the 1st July, 1843, Mr. Harrison advertised in the "Sheffield Independent" that he had commenced the business of electro-plating, etc., with Elkington's patent. Mr. Walker ultimately commenced electro-plating on his own account in 1845, and was the founder of the firm of Messrs. Walker & Hall, now carrying on the trade in Sheffield. In the early days of electro-plating the electric current was generated by means of a series of small electric batteries, but subsequently "magneto"-electric machines were introduced. One of the first machines in use was patented by Mr. Woolrich, and a "licence to use Mr. Woolrich's patent process of magneto-plating for the term of five years" was granted in 1845 to the late Mr. William Carr Hutton, the founder of the Sheffield branch of Messrs. William Hutton and Sons.

Within recent years great improvements have been made in electrical plant as applied to electro-plating, dynamos having now taken the place of the old apparatus. The base metal now used on which to deposit the silver is called "German silver" or "nickel silver," and is an alloy of copper, nickel, and zinc, grayish-white in colour, and much harder than copper. It is rolled cold into sheets and afterwards manipulated by stamping into dies, spinning on lathes, hammering by hand, etc., the parts and edges being soldered together by means of a gas and air blowpipe. It is then "buffed" (polished smooth) with sand and oil upon leather wheels making 2500 to 3000 revolutions per minute, and finally thoroughly cleansed. The articles thus prepared are immersed in a vessel or tank containing a solution of the double cyanide of silver and potassium, in which are also hung plates of silver to be deposited upon the articles. The electric current, generated by a dynamo, is then passed through the solution, travelling from a rod from which are suspended the silver plates to one from which hang the articles to be plated, and thus is deposited upon the latter a silver coating of any desired thickness. After removal from the vat the articles (the silver coating of which at first is white) are treated with the scratch-brush lathe, and subsequently polished, or burnished with steel tools. The final polishing is accomplished in a similar manner to "buffing," lime and rouge being used instead of sand, and the plate is finally burnished with steel tools, the latter method giving employment to large numbers of women and girls.

One of the fundamental differences between the old and new plating processes is that, whereas in *Old Sheffield Plate* the base metal had to be covered with silver before it was wrought into shape (an article thus consisting of a number of separately-plated pieces joined together and liable to show their individuality after use), an electro-plated one is first completely made up in the base metal (German silver), after which it receives in all parts a covering of silver of uniform thickness, which is renewable as often as required.

Another base "metal" used for electro-plate is Britannia metal, which is an alloy of tin, antimony, and copper, and is principally used in the manufacture of teapots, jugs, spoons, etc. This alloy was introduced about 1769 by James Vickers, of Garden Walk, Sheffield. Subsequently Mr. James Dixon, the founder of the well-known Sheffield firm of silversmiths, James Dixon & Sons, of Cornish Place, very largely developed the trade in Britannia metal. The manufacture of wares in Britannia metal largely superseded that of pewter ware, in which previously there had been a very important English trade.

Close-plating.—Another method of silver plating, known as "close-plating," was also extensively employed in former times, and appears to have been introduced into Sheffield by W. C. Hutton in 1832.

Although now superseded by electro-plating, it is still carried on in Sheffield to a limited extent. It was generally used on steel articles, almost all the old snuffers being of steel, close-plated; it was also largely used for fruit knives and forks. The process consists of first making the article perfectly smooth and clean, and then tinning it by dipping it into melted tin. A foil of pure silver beaten thin and cut to the size of the object was then placed upon it and fitted as perfectly and closely as possible. When the silver foil had been closed upon the steel in every part by careful hammering, a heated soldering iron was passed over the whole of the surface, by which operation the tin again melted and formed a kind of solder between the steel and the silver foil. The surface was then polished with a steel burnisher. By this process the finished knife has a good cutting edge, and is not acted upon by the acid of the fruit and will last a lifetime.

Sterling Silver.—It is but natural to expect that manufacturers of plated goods would now and again see openings for supplying their customers with silver ones and thus combined trades would arise. The exact date of the introduction of the silversmith is a little uncertain, but probably this would be about 1760, since it is stated in Hunter's "Hallamshire" that prior to that date Henry Tudor and Thomas Leader, both of whom had been apprenticed in London, came to Sheffield to make snuff boxes and small silver articles that were struck in dies. By the year 1773 the silver industry appears to have grown to some importance, as a petition of several artificers in silver plate in the town and neighbourhood of Sheffield, was in that year presented to Parliament, setting forth that "a manufacture had of late years begun within the town and neighbourhood, and was then a very considerable trade, very likely to increase," and asking that an Assay Office should be established in Sheffield (see below). From that time the industry has gradually increased until it has attained its present important position.

In connection with the manufacture of silver wares the quality of the metal to be used has been fixed by law for centuries. It is well known that silver or gold, when pure, is almost as soft as lead, and articles made of either would be quite unequal to the wear of everyday life. To remedy this defect it is necessary that some other metal should be added to impart a certain amount of hardness, and copper is almost universally employed for this purpose.

By a law passed in 1300, in the reign of Edward I., it is enacted that the legal standard of silver ware should be 925 parts of silver per 1000. This alloy is known as "standard" or "sterling" silver. Another legal standard for silver wares also exists, viz., 959 parts of silver per 1,000, known as Britannia silver, but as it is much softer than standard silver it is seldom used. The actual preparation and melting of the standard silver is usually effected in small wind furnaces with natural draught, the crucible being made of a mixture of graphite and fireclay. Many of the larger firms prepare their own alloy, but standard silver is also supplied to the trade by local smelting companies and refiners, several of which have been in existence for over 100 years.

Standard silver is very malleable and ductile, and is well adapted to casting. Owing to its malleability, it lends itself with great facility to the design of the artist and the craftsman. It can be readily shaped into vessels of various kinds by means of the hammer, or raised by the process of stamping into objects of almost any desired shape. For the manufacture of silver knife blades, etc., the metal is forged by hammering in a manner similar to that employed for the manufacture of steel blades, by which treatment it acquires a considerable degree of hardness and toughness, and its resistance to wear is thereby materially increased. Many beautiful examples of the silversmith's art have been produced by Sheffield firms.

The growth of the silver trade in recent years may perhaps be best indicated by the fact that whereas in the year 1810 the weight of silver marked at the Sheffield Assay Office was under 60,000 ounces—and in 1860 only amounted to about 85,000—at the present time approximately 1,500,000 ounces (46 tons) of silver pass annually through the Office. This does not, however, represent the total weight of silver articles manufactured at Sheffield, as a considerable weight is sent to London and elsewhere for hall-marking to meet the wishes of customers. It is interesting, also, to note that about nine-tenths of the increase shown by these figures has taken place within the last 20 years. At the present time there are between 150 to 200 firms in Sheffield manufacturing wares in sterling silver, electro-plate and Britannia metal.

The importance of the silver industry to Sheffield may be gathered when it is stated that, so far as can be computed roughly, something like 10,000 persons are employed in the various factories or as out-workers. Some firms do everything on their own premises, others have a certain proportion of their work done by out-workers, and in some cases a firm procures its goods in the rough and only finishes them. The nature of the silver-plating trade allows of the employment of a comparatively large number of women and girls.

Gold wares are also manufactured in Sheffield, and although the number produced annually is comparatively small, the trade is gradually increasing.

Assay Office.—The importance of the silver industry is also emphasised by the fact that Sheffield is one of the four cities in England at which an Office now exists, authorised by Act of Parliament, for the assaying and hall-marking of gold and silver ware. With certain exceptions all gold and silver articles manufactured must be submitted for assay and hall-marking before being exposed for sale.

At the date of the birth of the Silver Trade in Sheffield, offices authorised to assay and mark silver and gold wares existed at London, Chester, Exeter, and Newcastle-on-Tyne.

The establishment of an Assay Office at Sheffield in 1773 was consequent upon a petition to Parliament on the 1st of February in that year.

The Act reciting that the silversmiths and plate-workers in Sheffield were under great difficulties and hardships in the exercise of their trades, for want of assayers in convenient places to assay and "touch" their plate, appointed Sheffield to have an Assay Office for assaying and marking wrought plate, and incorporated a company entitled "Guardians of the Standard of Wrought Plate within the town of Sheffield," with perpetual succession, and power to use a Common Seal. The Guardians appointed by the Act were noblemen and others resident in or within twenty miles of Sheffield. They are thirty in number, and it is enacted that of these a certain proportion (at the present time not more than one-third, nor less than one-fifth) shall be plate-workers. No time was lost after the Act was passed before the Company proceeded to business. They met on the 5th July, 1773, under the presidency of the Earl of Effingham, and appointed officers, etc. The principal officers are four Wardens, the Assay Master, and a Law Clerk. The regulations of the Office are similar to those in force at Birmingham, and are much more precise than those of London.

The distinctive City Mark struck upon all wares assayed in Sheffield is a Crown for silver, and a York Rose for gold.

The Assay Office, which is situated in Leopold Street, is equipped with thoroughly up-to-date appliances. Prior to 1903 all silver assays were made by the old cupellation method, but in that year the Volhard (sulphocyanide) volumetric method was introduced.

Power to assay and hall-mark gold wares was granted to the Assay Office authorities in 1904. The method employed for the assay of gold wares is similar in principle to that universally adopted for the assay of ordinary gold bullion, and involves cupellation to remove the base oxidisable metals, and inquartation with subsequent parting in nitric acid to separate the gold.

The wares sent for hall-marking are carefully scraped so as to obtain fair samples of the metal of which they are made, and the samples are subsequently assayed. The Acts provide for the marking, with the authorised marks, known as hall marks, such wares as, on trial, are found to be of silver or gold of standard quality, and the breaking up of any found to be worse than standard.

It speaks well for the various Sheffield firms which supply standard silver to the trade, that the average quantity of silver which has failed "to pass the Hall" within the past ten years is below one half-ounce per ten thousand ounces assayed and hall-marked.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

English.—8*d.* each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1*s.* each, to the Secretary of the Society.

French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs Bourgeois, Paris (3e.).

German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Air; Humidifying of —— in factories, workshops and the like. D. M. Bright, Portadown, Ireland. Eng. Pat. 14,238, Dec. 13, 1910.

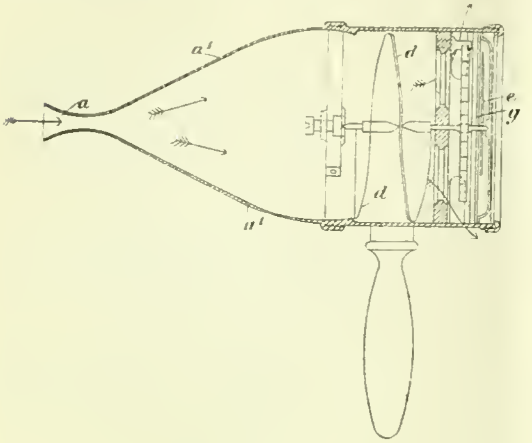
The air is caused to pass under pressure down a central tube which is capable of being raised or lowered; the walls of this tube are widened out at the lower end, which acts as a valve, the seat of which is formed by the inner wall of a chamber surrounding the air tube. Water is supplied to this chamber and flows out through the annular opening between the valve and its seat. The air passing from the central tube is caused to impinge upon and atomise the issuing water, the quantity of which may be regulated by raising or lowering the air tube by suitable mechanism.—B. G. McL.

Pipes and launders suitable for conveying abrasive or corrosive material. J. L. Clark, Johannesburg, Transvaal. Eng. Pats. 17,539, July 23, 1910, and 27,966, Dec. 1, 1910.

The pipes are formed by rolling together sheets of dried wood pulp on a mandrel. The sheets are first waterproofed with a solution of bitumen, then dried and whilst being formed into pipes on the mandrel, they are covered and impregnated with an abrasion-resisting material such as sand, cement, emery, etc., mixed with bitumen or other suitable agglomerant.—W. H. C.

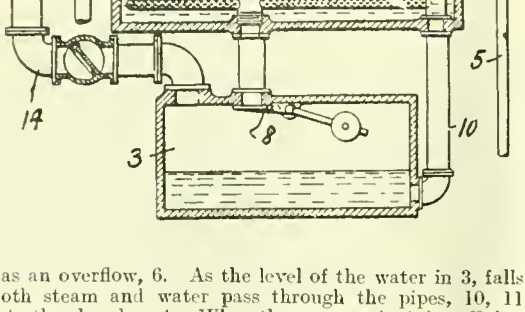
Measuring the velocity of flow or the pressure of air, steam, gas or other fluid; Instruments for ——. W. A. Lyall, Ambergate, and J. Davis and Son, Ltd., Derby. Eng. Pat. 16,215, July 7, 1910.

The apparatus consists of a trumpet-shaped vessel of the form shown in the figure. The air or other gaseous fluid to be measured enters through the conical mouthpiece, *a*, and owing to the gradually increasing cross-section of the part, a^1, the velocity head with which the fluid enters is changed into pressure head and acts upon the helical vane, *d*, causing it to rotate. The amount of rotation produced is proportional to the pressure, and hence to the velocity. The spindle on which the vane, *d*, is mounted, carries a pointer, *e*, which indicates the velocity on a dial, *g*.—W. H. C.



Steam regenerative accumulators. F. Hodgkinson, Edgewood Park, Pa., U.S.A. Eng. Pat. 26,157, Nov. 10, 1910. Under Int. Conv., Nov. 11, 1909.

Exhaust or surplus steam enters the lower chamber, 3, through the valved pipe, 14, and drives some of the water in 3, through the pipes, 10, 11, into the delivery chamber, 4, which is supplied with water through the pipe, 5, and has an overflow, 6. As the level of the water in 3, falls, both steam and water pass through the pipes, 10, 11, into the chamber, 4. When the pressure in 4, is sufficient to overcome that of the weighted valve, 8, the latter opens and water returns from 4 to 3. The water carried forward into 4 is proportional to the exhaust steam. As the demand for steam increases on the low-pressure system, the heat stored up in 4, evaporates water and the low-pressure steam thus produced leaves the chamber, 4, through the pipe, 12.—W. H. C.



Separating-liquid carried off by separated solids in the separation of solids by means of [volatilisable] liquids; Process and apparatus for the recovery of ——. F. I. Du Pont, Wilmington, Del., U.S.A. Eng. Pat. 17,618, July 25, 1910.

The material from which the volatile liquid is to be removed is fed laterally into a stationary sloping cylinder, the lower end of which extends beyond the heating chamber and is water-cooled by an external jacket, means being provided for removal of the condensed liquid. At the other end the cylinder is jointed to another cylinder which is capable of being rotated by means of a shaft, the connection from which closes its upper end, while lateral holes leading into a vertical discharge pipe are provided for the removal of the treated material. In this latter cylinder are fixed projecting blades in the form of a broken worm-conveyor which extends as an unbroken worm-conveyor down into the stationary cylinder to a point below the charging pipe. The whole of the rotating cylinder and a part of the stationary cylinder are enclosed in a heating chamber provided with gas-burners below the cylinder and a chimney. The material to be treated is fed in through the charging pipe and is drawn upwards through the cylinders by the rotating worm gear. The vapour driven off being heavier than air, travels in the reverse direction and is recovered in the condenser, the vertical discharge pipe for the solids at the upper end acting as a vapour trap.—B. G. McL.

Heating or cooling granular or like materials. F. L. Smidth and Co., Copenhagen. Eng. Pat. 26,526, Nov. 15, 1910. Under Int. Conv., June 15, 1910.

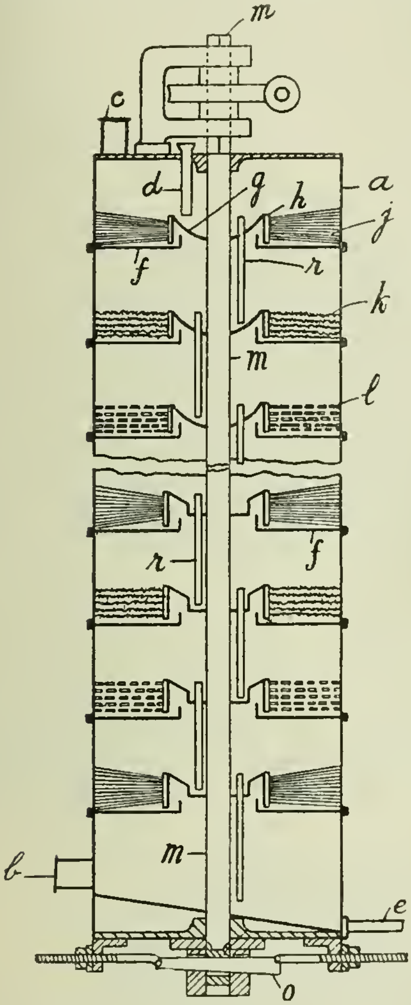
Several horizontal jacketed drums are spaced round a central axis by which they are rotated within an outer casing. The material is fed into one end of each of the drums from a feed chamber and the heating or cooling medium is caused to pass in an opposite direction through the annular space between each drum and its jacket. A centrally disposed drum is provided into which the heat interchanging-medium first passes and from which it is distributed to the jackets.—W. H. C.

Heat transferring apparatus. M. F. Chambers and C. F. E. Skilton, Cork. Eng. Pat. 5251, March 2, 1911.

The claim is for a method of regulating the supply of steam to a multitubular heating coil without altering the valve on the main steam supply. The upper ends of the tubes are connected by short pipes with a cylindrical steam-distributing chamber, itself connected with the steam supply main. The ends of the connecting pipes are arranged in pairs in a spiral round the cylindrical chamber and a non-rotatory hollow cylinder is arranged within the cylindrical steam chamber so that it can be moved upwards or downwards by a screwed rod which passes through a stuffing-box at the top of the outer cylinder. When it is desired to supply steam to all the tubes, the inner cylinder is raised to the highest position. In order to reduce the heating power of the apparatus, the inner cylinder is lowered to a greater or less degree, closing the openings to successive pairs of connecting pipes. As the steam passes through the hollow inner cylinder there is no throttling of the supply to those pipes that remain open. The lower ends of the heating tubes are connected with an annular exhaust pipe. Each pipe is provided with a ball-valve which closes when the steam is shut off and prevents steam entering from the exhaust.—W. H. C.

Absorbers or separators for gases or vapours of the bubble scrubber type. J. Smith, H. L. Mitchell, and W. H. Askham, Ravensthorpe, and H. Hey, Dewsbury. Eng. Pat. 7536, March 25, 1911.

A cylindrical casing, *a*, is divided into a number of compartments by the partitions, *f*, and is provided with a central shaft, *m*, driven from above and provided with a height-adjusting device, *o*, below. A number of bells, *h*, having saucer-shaped tops, *g*, are attached to the shaft and rotated with it, so that the lower edges of the bells dip into the liquid in the trays, *f*, which have upturned edges. Overflows, *r*, are provided for the passage of the liquid from shelf to shelf. The vertical sides, *h*, of the bells, *g*, are provided with annular layers of bristles, *j*, wire gauze, *k*, or perforated plates, *l*, so that a larger surface of liquid may be exposed to the gas. The apparatus is particularly suitable for the recovery of benzene from a mixture of that substance with air. The mixture enters at *b*, passes up the central opening in the partitions, *f*, under the edge of the bells and bubbles up through the liquid in the trays. It then passes through the bristles, gauze, or perforated plates, and the air, deprived of the benzene, escapes through *c*. The absorbing liquid enters through *d*, flows downwards from shelf to shelf and is discharged through *e*.—W. H. C.



Condensers or other thermal interchangers; Tube for ——, and process of producing the same. J. Ely, Summit, N.J., Assignor to J. B. Roache, Brooklyn, N.Y. U.S. Pat. 997,281, July 11, 1911.

The tubes are of metal, and are protected by being covered internally and externally with a film of rubber. The tubes are treated with a solution of rubber and the film left behind after the evaporation of the solvent is vulcanised and forms a hard, firmly-adhering coat.—W. H. C.

Kiln; Rotary ——. J. S. Fasting, Frederiksberg, Denmark, Assignor to F. L. Smidth and Co., New York. U.S. Pat. 997,381, July 11, 1911.

The end of a rotary kiln is provided with a movable closure or door. Both the end of the kiln and the closure are surrounded by an air chamber which is supplied with air under pressure.—W. H. C.

Evaporating fluids; Process of ——. F. P. Bergh, H. J. Loebinger, and H. C. Neuberger, Assignors to General Reduction Co., New York. U.S. Pat. 997,950, July 18, 1911.

Fluids containing solid, viscid or oily materials in solution or suspension are evaporated by subjecting them in the form of a spray to the action of a current of a vaporising gas of lower specific gravity than that of the atomised fluid. The stream of gas is passed below the layer of sprayed fluid, while the mixture of gas and evaporated fluid is led off from above said layer.—H. H.

Evaporation; Process of ——. C. R. Mabee, Detroit, Mich., Assignor to S. A. Griggs, Walkerville, Canada. U.S. Pat. 998,020, July 18, 1911.

Air is forced through holes formed in hollow stirrers rotating in the liquid, which is contained in a cylindrical tank or drum.—H. H.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal; The escape of gas from ——. H. C. Porter and F. K. Ovitz. U.S. Bureau of Mines, 1911, Technical Paper No. 2, 1—14.

Laboratory experiments made with certain American bituminous and semi-bituminous coals from dangerous mines, showed that these coals liberate methane not only during mining, but also during a long period afterwards. Taking the volume of the coal as unity, about $\frac{1}{4}$ vol. of methane escaped during crushing, and $\frac{1}{2}$ to $1\frac{1}{2}$ vols. on continued exposure to air. The escape of methane was at first rapid, but ceased after 3 to 18 months. The reduction of the calorific value of the coal owing to the loss of methane was very small. Such coals absorbed oxygen over a prolonged period at varying rates, without an equivalent formation of carbon dioxide. The well-known influence of atmospheric pressure on the liberation of inflammable gases in mines is probably due to the presence of reservoirs of these gases in the stratified rocks, and not to the presence of gases in the substance of the coal itself.—A. T. L.

Lignite; Briquetting tests of ——. C. L. Wright. U.S. Bureau of Mines, Bull. No. 14, 1911, pp. 62.

The tests were carried out with the object of ascertaining 1. The possibility of briquetting American lignites without the addition of a binder. 2. The suitability of the German brown-coal briquette presses for briquetting American lignites. 3. The percentage of moisture needed in the briquette material to give the best briquettes. 4. The approximate commercial cost of briquetting lignites. 5. The weathering qualities of briquettes as compared with raw lignites. Two presses were used; an English machine making briquettes of an average weight of 3·75 lb. and employing a pressure of 2500 lb. per sq. in. and a German machine making briquettes of 1 lb. in weight under a pressure of 20,000 lb. per sq. in. The briquettes made were subjected to physical tests to determine their power of withstanding shock and also to a weathering test; a series of photographs is given showing the appearance of the briquettes at various stages during this test, which extended to 286 days. The quantity of matter soluble in carbon bisulphide, the natural binder in the lignite, was found to form a reliable criterion as to the briquetting power of the lignite. The following conclusions are drawn: 1. Lignites containing less than 1·4 per cent. of matter soluble in carbon bisulphide (calculated to a moisture-free basis) have not been briquetted with the German machine, nor with any other machine without the addition of a binder. 2. Lignites containing 1·4 to 1·5 per cent. of matter soluble in carbon bisulphide are difficult to briquette, and further tests are needed to determine whether entirely satisfactory briquettes can be made from them with the German machine. 3. The few lignites tested that contained more than 1·5 per cent. of matter soluble in carbon bisulphide were briquetted with the German machine without binder. 4. The percentage of moisture that the dried lignite must contain to give satisfactory briquettes with the German machine is, within limits, inversely proportional to the percentage of matter soluble in carbon bisulphide. Hence, if two lignites have the same ash content the one that is richer in bitumen may be dried more and will give briquettes of higher heat value (because of the lower moisture content) than the other. Further tests are being carried out with the use of artificial binding agents, notably sulphite pitch (see this J., 1906, 1115, and 1908, 466 and 915). The briquettes should prove a satisfactory domestic fuel as they ignite readily, produce a hot fire and burn freely till consumed, the loss through the bars being from 6 to 8 per cent.; little poking is necessary and the small amount of smoke produced is light yellow and of an inoffensive nature.—B. G. McL.

Foundry coke; Proposed standard methods for determining the constituents of ——. H. E. Diller, Sec. Committee American Foundrymen's Association, 1911, July, 559—562.

SETS out detailed methods regarding:—Sampling from car, etc., preparation of sample, and determination of moisture, volatile matter, ash and fixed carbon, sulphur, and phosphorus. The paper is too detailed to admit of abstracting, and is issued as a series of recommendations on which discussion is invited.—B. M. V.

Producer-gas; Essential factors in the formation of ——. J. K. Clement, L. H. Adams, and C. N. Haskins. U.S. Bureau of Mines, Bull. No. 7, 1911, 1—58.

A DETAILED investigation into the reactions taking place in the gas producer and the conditions which influence them. The processes consist of: 1. The distillation of the volatile hydrocarbons from the freshly fired fuel at relatively low temperatures. 2. The combustion of the fuel with formation of carbon dioxide. 3. The formation of carbon monoxide and hydrogen, the essential constituents of producer gas, in accordance with the equations: $CO_2+C=2CO$; $H_2O+C=CO+H_2$. The conditions of equilibrium between carbon, carbon monoxide and carbon dioxide for various temperatures have been studied by Boudouard (see this J., 1899, 498 and 742).

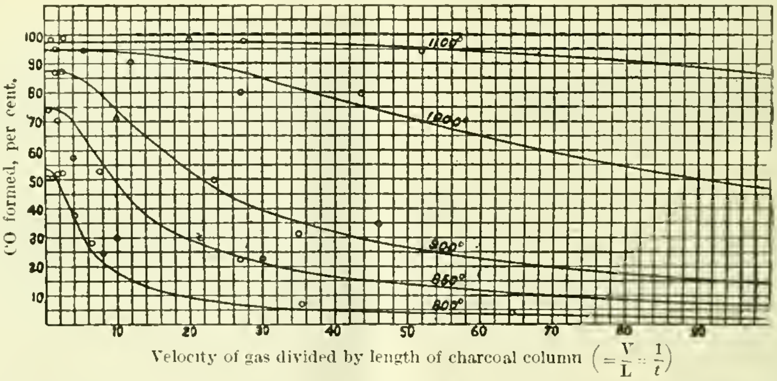


FIGURE 1.—Variation of percentage of CO formed from CO_2 and charcoal with change of gas velocity.

Starting with carbon and carbon dioxide quite a considerable length of time, especially at the lower temperatures, is necessary for equilibrium to be established and this being the case the authors point out that Boudouard's figures do not represent the conditions which will obtain in producer practice and they have made a series of investigations in which carbon dioxide is caused to pass through a layer of carbon at definite temperatures with varied and definite velocities. The tests were carried out using a glazed porcelain tube filled with carbon, heated in an electric furnace which could be maintained at within one to two degrees centigrade of the desired temperature, the actual temperature of the carbon layer being measured by means of a thermo-couple the error of which did not exceed five degrees below 1100° C. nor ten to fifteen degrees between 1100° and 1300° C. The velocity of the gas was determined by the dimensions of the tube, the weight and density of the carbon, the temperature, and the volume of gas passed through the tube per minute. The experiments were conducted at temperatures ranging from 700° to 1300° C., using charcoal, coke, and anthracite; the results obtained are shown diagramatically in figures 1, 2 and 3. A large number of experiments were made at 700° C., but the results were too erratic to admit of mathematical treatment. The attainment of the condition of equilibrium requires a considerably greater length of time of contact between the gas and the fuel in the cases of coke and anthracite than with charcoal. With very low velocities—that is, when the time of contact is sufficient for the reaction to reach equilibrium—the percentage of carbon monoxide formed is practically the same with each of the three forms of carbon. The effect of the differences in the reaction velocities becomes more appreciable as the rate of flow of gas increases. An unaccountable disagreement in the figures obtained for equilibrium conditions for carbon monoxide and carbon dioxide exists between those obtained by the authors and the figures of Boudouard, the latter's figures for carbon monoxide being higher in every case. These investigations confirm the observation that a very high temperature is necessary for the production of carbon monoxide from carbon dioxide and carbon; the considerations which argue against working the fuel bed of the gas producer at extremely high temperatures, *i.e.*, above 1300° C. are the tendency to clinker formation and the lowered efficiency due to the gases leaving the producer at a high temperature. The results have also a direct bearing on the formation of carbon monoxide in boiler operations and show that with a hot thick fuel bed the formation of a small amount of carbon monoxide is inevitable. In order that this carbon monoxide may be burned to carbon dioxide, it is necessary that in some way sufficient air be added to the hot gases as they leave the top of the fuel bed. A detailed mathematical treatment of the figures obtained is given with the following conclusions: 1. The differential equation for the velocity of the incomplete reaction, $CO_2+C\rightleftharpoons 2CO$, has been solved for the velocities in either direction, and it has been shown that the method is applicable to other cases. 2. Close agreement has been found with the values calculated from van't Hoff's laws of the variation of equilibrium constants and coefficients of reaction velocity with temperature. 3. It is probable that velocity of chemical combination and not diffusion is the determining factor in the speed of the reaction. 4. It is possible to compute the percentage of carbon monoxide which is formed at any temperature and for any time of contact. A similar series of investigations on the reactions taking place between superheated steam and carbon were carried out, he methods employed being substantially the same as in he previous experiments. In addition to the reactions : $_2O+C=CO+H_2$ and $2H_2O+C=CO_2+2H_2$, the former f which predominates at higher temperatures, a certain mount of methane (about 2 per cent. with very slow gas elocity) is produced by reduction which may take place ccording to one or more of the equations : $C+2H_2=$ H_4 : $CO+3H_2=CH_4+H_2O$: $CO_2+4H_2=CH_4+2H_2O$: $C+2H_2O=CH_4+CO_2$. The work of Mayer, Henseling nd v. Altmeyer (J. Gasbeleucht., 1909, 52, 166, 194, 38, 326) proves that with the aid of a catalyser these eactions can take place between 200° and 500° C. and t higher temperatures they may take place without a atalyser. Harries (J. Gasbeleucht., 1894, 82) found hat with zero velocity a temperature of 1100° C. will be equired for the decomposition of water vapour to become ractically complete. The authors find that below 200° C. the percentage of water decomposed falls ery rapidly with increase in gas velocity until a contact ime of one second is reached ; further increase in gas elocity beyond this point reduces the percentage of xed gases formed slowly. At this temperature less than ne-fifth of the water vapour is decomposed under producer onditions where the gas velocity is over one foot per econd. Charcoal has a greater decomposing power han coke at the same velocity. At 1300° C. with a ontact time of 2 seconds, and at 1400° C. with a contact ime of 0·5 second, the decomposition of the aqueous apour is nearly complete. The variation of the omposition of the gas with velocity at temperatures from 900° to 1200° C. is shown graphically in a series of charts, one for each temperature ; from these it will be observed that the curves for hydrogen and carbon monoxide have the same general form as the curve for the total fixed gases. From these curves deductions are made showing how, for any given temperature the predominance of reaction according to any one of the equations may take place. The two sets of investigations lead to substantially the same conclusion, namely, that for a high rate of gasification conjointly with a high percentage of carbon monoxide and a low percentage of carbon dioxide and water vapour a high temperature in the fuel bed is necessary ; the higher the temperature the better will be the quality of the gas and the greater the capacity of the producer ; the use of large amounts of steam is inconsistent with the realisation of high temperature, and is therefore to be avoided. These conclusions substantially bear out the results obtained by Bone and Wheeler in actual practice (this J., 1907, 674 and 1908, 1008). The fusible nature of the ash of many fuels causes formation of clinker with its attendant difficulties when the producer is operated at high temperatures ; this is usually obviated by lowering the temperature by means of an excess of steam with consequent loss of capacity. The enormous increase in the rate of gasification with rise in temperature, as shown in the experiments described points to the possibility of operating a producer at very high temperatures—1500° C. or more, by providing for the removal of the slag in a liquid state after the manner of blast furnace practice.—B. G. McL.

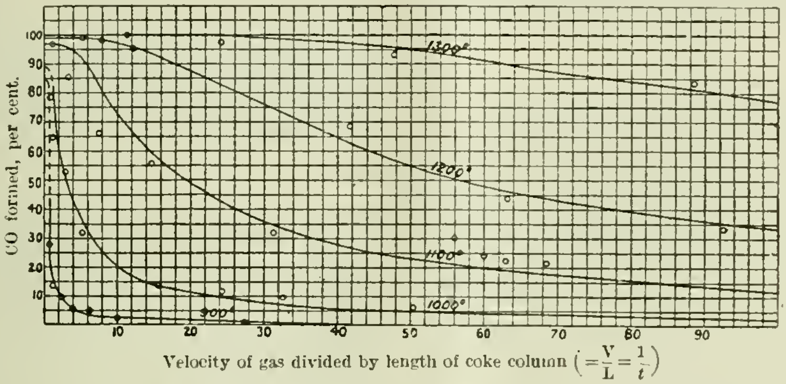


Figure 2.—Variation of percentage of CO formed from CO_2 and coke with change of gas velocity.

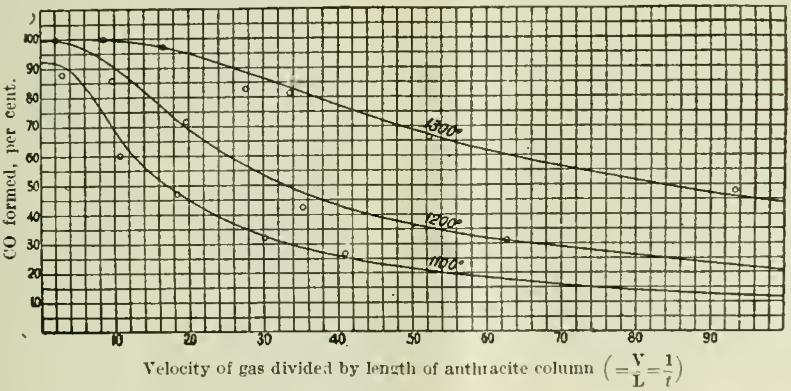


Figure 3.—Variation of percentage of CO formed from CO_2 and anthracite with change of gas velocity.

Contamination of gas in gas-holders. L. Chevalet. J. Gas Lighting, 1911, 114, 920—921.

The lower algæ capable of reducing sulphates of calcium and magnesium with formation of hydrogen sulphide, known as the "thiogenes" belong to the following species: *Oscillaria*, *Ulothrix* and *Beggiatoa*, the last named of which are in nearly all the Enghien sulphur waters, which fact appears to corroborate the statement of Planchud that the hydrogen sulphide in mineral waters is produced biologically from the various mineral sulphates by reduction. The pollution of the gas by hydrogen sulphide in the holder at the Melun gas works on the Seine during the flood of January, 1910, was due to the presence of these algæ. Minute quantities of carbolic acid, such as might be obtained by causing the water to wash the tar previous to its admission to the gas-holder are found to inhibit the action of these algæ.—B. G. McL.

Contamination of gas in holders by hydrogen sulphide evolved from the water in the tank by bacterial processes. J. G. Taplay. Gas World, 1911, 55, 105—107.

The author has already referred to the existence of bacteria capable of producing hydrogen sulphide (see this J., 1904, 929). The pollution of gas in the gas holder by hydrogen sulphide observed some years ago by a London gas company was investigated, and it was found as a preliminary that there was more than sufficient oxygen dissolved in the water immediately to oxidise any hydrogen sulphide which might be formed by the possible decomposition of traces of carbon bisulphide by water; that hydrogen sulphide was only formed in waters containing sulphates of calcium and magnesium; and that in the presence of such usual constituents of coal gas as benzene, naphtha, ethylene, acetylene, methane and pyrrol usually present in coal gas, no hydrogen sulphide was produced in sterile solutions of these sulphates. On examining the inner walls of the gas holder a black slimy mass was found below the water level; this was identified as the remains of the so-called "iron organisms" named *Chlamydothrix* by Migula, who found that the water in which these organisms live and grow holds in solution an organic compound of iron, which is decomposed by the *Chlamydothrix*, the organic carbon being absorbed by them while the iron is set free as hydrated ferric oxide. The micro-organisms found in the gas-holder-tank water were the *Bacillus fluorescens liquifaciens*, two varieties of the *Streptococcus pyogenes*, the *Bacillus coli communis*, and one of the varieties of the *Bacillus proteus*, together with several moulds. In the water accompanying the "iron-organisms" the *Bacillus coli communis* and the *Bacillus proteus* were found. Of all these only the *Bacillus coli communis* is capable of yielding sulphuretted hydrogen, its activity being markedly increased by the presence of the *Bacillus proteus*. The "iron-organisms" which contain cellulose and albuminous matter appear to serve as food for the bacilli, and for the production of hydrogen sulphide: all three factors, namely the bacilli, the food, and the metallic sulphates, must be present, together with hydrogen sulphide, a gas composed chiefly of methane, ammonia, volatile fatty acids, indole, methyl sulphydrate, aldehydes, and other complex organic bodies are also produced. Copper sulphate added to the gas-holder tank water in the proportion of one part in 10,000 parts of water was found to be the most suitable substance for inhibiting the action of the bacilli.—B. G. McL.

Patents.

Coal mines; Prevention of explosions in ——. C. Stuart-Bailey, Lancaster. Eng. Pat. 15,925, July 4, 1910.

Packages of finely divided anhydrous powder such as chalk dust contained in bags formed of waterproof and incombustible material are arranged at various points of the working galleries in such a manner that they are burst by the initial explosion or the operation of tamping and the powder scattered into the mine, thus preventing further explosion due to coal dust.—H. H.

Grading comminuted material such as small coal; Apparatus for ——. W. Reid, Burnbank, Lanark. Eng. Pat. 23,960, Oct. 17, 1910.

The material is fed by means of a screen shoot on to a series of screen tables of increasing mesh over which it is drawn by a scraping conveyer and at the same time subjected to the flushing action of a number of jets of water. The various grades of material passing through the screen tables are collected by hoppers beneath.—H. H.

Washing coal and other granular material; Machines for ——. R. S. Benson, Middleton-St. George, Durham, and Head Wrightson and Co., Ltd., Thornaby-on-Tees, Yorks. Eng. Pat. 24,269, Oct. 19, 1910.

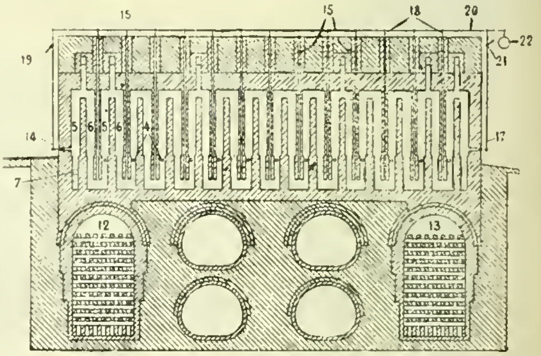
The claim is for improvements in the coal washing machine described in Eng. Pat. 21,253 of 1909 and consists in providing an adjustable sill at the lower end of the trough of the washer and a deck at the upper end having a greater inclination than the trough. The lower end of the deck, or of its upwardly inclined extension, is serrated, in order to force the water to scour the coal more thoroughly.—W. H. C.

Coke-ovens; Charging of ——. W. Hiby, Wakefield. Eng. Pat. 18,922, Aug. 11, 1910.

The charge of compressed coal is pushed into the oven on a "peel" having side plates to support the charge. The charge is of such a length that it is stopped by the end door of the oven before the whole charge is introduced. The continued motion of the charging ram forces the coal to completely fill the coal space without leaving a slope at the ends. The side walls of the peel of the charging machine, and the peel itself, are withdrawn, while the end wall remains in position to keep the coal in place. Finally the end door is withdrawn a short way, and the oven door is introduced from above or at the side and when in position the end of the peel is withdrawn.—W. H. C.

Coke-ovens; Horizontal or inclined, regenerative ——. R. Fabry, Sheffield. Eng. Pat. 3197, Feb. 8, 1911.

The oven has vertical heating flues, 5, 6, and longitudinal regenerators, 12, 13. The gas for heating is supplied by the main, 22, and first enters the flues through the pipe, 14, mixing with air from the regenerators, 12, which passes through the sole flue under one oven and thence through the port, 7, into the first vertical flue, 5. The mixture burns and passes upward and then returns down the flue, 6. Near the lower part of the first flue, 6, a portion of the products of combustion is withdrawn through an opening not shown in the figure into the neat adjacent sole flue. As the gases reach the bottom of the flue, 6, a fresh supply of gas is introduced through the conduit, 15, and meets with another supply of air through the aperture, 4. The gases continue their zig-zag path to the far end of the oven, a portion of the products of combustion being withdrawn and fresh gas and air supplied at the lowest points. At the far end the residue of the products of combustion passes into the sole flue and together with the portions previously withdrawn passes away through the regenerator, 13, to the stack.—W. H. C.



oke-oven. G. E. Behr, Jnr., Brooklyn, N.Y. U.S. Pat. 996,829, July 4, 1911.

HE claim is for a coke-oven with openings in the top or charging the coal and having the side wall on one ide constructed with horizontal heating flues and on the ther side with gas-withdrawal flues. The latter are rovided with a series of openings so that the gas which s driven off by the radiated heat from the heating flues n the opposite wall is withdrawn at once in a direction t right angles to the radiating wall. The gases conequently only pass through layers of coal that are at a ower temperature than that of the coal from which they ave been generated.—W. H. C.

ertical retorts for carbonising coal or the like. H. W. Woodhall, Dorset, and A. M. Duckham, Little Bookham, Surrey. Eng. Pat. 16,630, July 12, 1910.

HE brickwork forming the heating flues and the retorts s formed with special bricks and so bonded together as to orm one construction, which is free to move and expand ithin the surrounding brick casing, which supports nd protects the retorts and flues.—W. H. C.

ituminous coal; Apparatus for the treatment [partial carbonisation] of ——. W. Dixon, Glasgow. Eng. Pat. 16,981, July 16, 1910.

MPROVEMENTS are claimed in the apparatus described n Eng. Pat. 10,804 of 1907 (this J., 1908, 619) for the artial carbonisation of coal in order to render it smokeless n burning. The upper part of the retort, in which the oal is heated, is made in the shape of an inverted truncated one, the middle portion, in which the carbonised coal is ooled, is cylindrical, and the lower discharge portion is urved, and water-sealed. The upper portion of the etort is of such size that the contents, when carbonised, ust fill the middle portion, which has the same capacity s the lower portion. Pipes are arranged, passing through e wall of the retort, so that steam can be injected into the oal either immediately above, or below, the middle section, s desired.—W. H. C.

oal; Process of obtaining ammonia from ——. H. L. Doherty, New York. U.S. Pat. 997,908, July 11, 1911.

HE process consists in coking the coal by direct contact ith a gas flame, passing the volatile products through e hot coke, and drawing off the volatile products from e hot coke together with steam formed by the quenching the coke. By this means, ammonia is obtained both om the nitrogenous volatile matter and from the nitrogen hich normally remains in the coke. The ammonia is parated from the gases by treatment with an absorbing quid, which may take the form of spray.—A. T. L.

oal; Apparatus for coking —— *and producing gas.* H. L. Doherty, New York. U.S. Pat. 997,941, July 11, 1911. (Compare preceding abstract.)

HE apparatus comprises a closed coking chamber, ranged above a quenching chamber provided with a scharge orifice for the coke. The fuel column is conuous, so that as coke is withdrawn at the bottom, the t coke from the coking chamber descends into the enching chamber which is provided with suitable ater-sprayers. The charge in the coking chamber is ated from above by the flames from downwardly inclined rners which are fed with air and gas under pressure. as outlets are provided at the middle of the height of the king chamber.—A. T. L.

ashing and scrubbing gases; Apparatus for ——. W. C. Holmes and Co., Ltd., and E. D. Holmes, Huddersfield, Yorks. Eng. Pat. 2581, Feb. 1, 1911.

IS apparatus for washing and scrubbing gas for moval of ammonia, benzol, naphthalene, cyanides, ., with such suspended matter as tar, comprises a vertical cylindrical casing divided by horizontal partitions having central openings with upturned edges, into a number of compartments in each of which rotates a ring-shaped brush dipping into washing liquid contained in the annular channels formed by such edges. The bristles of the brushes are inclined so as to cause the liquid to rise to the roots of the bristles, and spiral baffles are arranged within the compartments to further agitate the liquid. The gases to be washed, pass vertically upwards against a descending current of washing liquid which flows over the upturned edges of the partitions on to imperforate plates at the backs of the brushes, which deflect the liquid to the periphery of the compartment below. The brushes are all mounted on a single vertical shaft passing centrally through the apparatus, and in a modification they are replaced by wire bristles attached radially to this shaft, the liquid being led to the centre and passing outwards by centrifugal force.—H. H.

Evaporator for petroleum oils or other liquids. M. J. Trumble, Assignor to Trumble Refining Co., Los Angeles, Cal. U.S. Pat. 996,736, July 4, 1911.

The liquid to be evaporated is fed into the upper part of a chamber having vertical walls and heated externally by suitable means. The liquid is caused to spread over the vertical walls in a thin film by conical spreaders, and the vapours given off are withdrawn through openings in a central vapour pipe having horizontal discharge pipes passing through the walls of the evaporator and through the heating jacket to a collecting main without.—W. H. C.

Apparatus for the detection of dangerous gases. Eng. Pats. 8582 and 17,146. *See* XXIII.

Apparatus for indicating the presence of fire-damp or other combustible gases. Eng. Pat. 27,990. *See* XXIII.

Apparatus for manufacturing gas and lime. U.S. Pat. 997,982. *See* VII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Photometric flame standard; Corrections for the effects of atmospheric conditions on ——. W. J. A. Butterfield, J. S. Haldane, and A. P. Trotter. Internat. Photometr. Commission, Zürich, July, 1911.

The authors have investigated the effect of varying the pressure, humidity, and vitiation (deficiency of oxygen and excess of carbon dioxide) of the atmosphere on the luminous intensity of photometric flames. The corrections are expressed as follows. Let A be the accepted normal percentage of aqueous vapour in the air, a = the prevailing percentage of aqueous vapour in the air when the lamp is in use, C and c, the normal and prevailing percentages of carbon dioxide, and P and p the accepted normal and prevailing pressures. Then the actual light (I′) is given in terms of the light under normal conditions (I) with sufficient accuracy by the following equations.

For the Harcourt pentane lamp:—

$$I' = \frac{100-\left(\frac{a-A}{0{\cdot}16}+\frac{c-C}{0{\cdot}035}-\frac{p-P}{12{\cdot}5}\right)}{00} I$$

For the Hefner amylacetate lamp:—

$$I' = \frac{100-\left(\frac{a-A}{0{\cdot}16}+\frac{c-C}{0{\cdot}045}-\frac{p-P}{25}\right)}{100} I$$

A smaller number of experiments on a No. 2 "Metropolitan" Argand, a Bray "$\frac{G}{L}$ 5 ft. $\frac{15}{10}$" slit flat-flame burner, and on the parliamentary standard spermaceti candle gave the following less decisive results, which.

however, indicate that for ordinary gas testing purposes the corrections are inconsiderable, and practically unnecessary.

	One per cent. decrease of light is caused approximately by the following changes from normal.		
	Pressure.	Aqueous vapour.	Vitiation expressed by per cent. of carbon dioxide.
		per cent.	per cent.
Argand	−25 mm.	+0·20	+0·03
Flat-flame	− 5 mm.	+0·11	+0·035
Spermaceti candle	−20 mm.	+0·50	+0·04

In other circumstances, *e.g.*, testing of electric lamps with a flame standard, corrections are called for.—W. H. P.

III.—TAR AND TAR PRODUCTS.

Benzylamines and hexahydrobenzylamine (aminomethylcylohexane): New method of preparation of ——. P. Sabatier and A. Mailhe. Comptes rend., 1911, **153**, 160—162.

Benzylamine and dibenzylamine, together with a very small proportion of tribenzylamine, are formed when a mixture of benzyl alcohol vapour and ammonia is passed over thoria heated to 300°—350° C., the greater part of the alcohol being converted. When the operation is carried out at about 330° C., benzylamine is the chief product, when conducted at 370°—380°, dibenzylamine predominates, but in the latter case the alcohol is partly decomposed in other ways also. A resinous hydrocarbon is gradually deposited on the thoria necessitating the regeneration of the catalyser from time to time, by heating to dull redness, in the air. Vapours of benzylamine, obtained as above when passed over nickel at 170°—180° C., are partly decomposed into ammonia and toluene, but a notable proportion of hexahydrobenzylamine is formed, identical with that obtained by the reduction of an alcoholic solution of hexahydrobenzonitrile by metallic sodium. —A. Sbld.

IV.—COLOURING MATTERS AND DYES.

Aniline black. V. R. Willstätter and C. Cramer. Ber., 1911, **44**, 2162—2171.

The authors have repeated Green and Woodhead's work (this J., 1910, 1295) on Aniline Black, and are not in accordance with it. They find that the leucoemeraldine of these authors, which is a pale brown amorphous body, can be reduced to a colourless leuco-base by means of phenylhydrazine and conclude that Green and Woodhead's product has a quinonoid structure. The various stages of Aniline Black are given as follows:—The leuco-bases of the groups $C_{48}H_{42}N_8$ and $C_{48}H_{41}ON_7$ are produced from all preparations of Aniline Black by treatment with phenylhydrazine at 150° C. Singly quinonoid preparations are best prepared from trebly quinonoid black by the action of phenylhydrazine at 100° C. or of titanium trichloride in the cold. The doubly quinonoid stage is easy to obtain by the oxidation of the leuco-base or the singly quinonoid substance by the air. The oxidation of aniline salt by bichromate, persulphate, chlorate and other agents leads, in the absence of excess of aniline salt, to the pure trebly quinonoid Aniline Black, the well known emeraldine, $C_{48}H_{36}N_8$. By further oxidation, best with hydrogen peroxide, quadruply quinonoid Aniline Black. Oxidation Black or nigraniline, $C_{48}H_{34}N_8$ is formed. On ultimate oxidation with bichromate or persulphate, the quadruply quinonoid black containing oxygen is obtained of the formula, $C_{48}H_{33}ON_7$. This is dull black and stable towards sulphurous acid.—J. C. C.

Flavanthrene; New synthesis of ——. E. Benesch. Monatsh. f. Chem., 1911, **32**, 447—456. (See also this J., 1903, 1240; 1907, 679; 1910, 808.)

Flavanthrene has been obtained, in minute quantity, by the following series of reactions: 2-Methoxyanthraquinone is converted successively into the 1-nitro and 1-amino-derivative. The latter compound is diazotised and converted into 1-iodo-2-methoxyanthraquinone, which on heating with copper powder is converted into 2 : 2′-dimethoxy-1 : 1′-dianthraquinonyl, yielding 2 : 2′-dihydroxy-1 : 1′-dianthraquinonyl on saponification. Both these compounds yield very small quantities of flavanthrene when heated with concentrated ammonia in sealed tubes to 270° C. The isomeric 2 : 2′-dimethoxy-3 : 3′-dianthraquinonyl derived similarly from the 3-nitro-2-methoxyanthraquinone formed along with the above 1-nitro-compound, does not yield a trace of flavanthrene, when heated with ammonia.—A. Sbld.

Patents.

Dyestuffs which are derivatives of diaminodiphenylurea or thiourea; Production of new ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 30,284, Dec. 30, 1910. Under Int. Conv., April 20, 1910.

p-Aminobenzeneazo-1-amino-8-naphtholsulphonic acids can be converted into ureas by treating them with phosgene in alkaline solution. The dyestuffs thus obtained dye cotton in brown shades which when developed on the fibre with diazotised nitraniline yield green shades fast to light and washing. Similar dyestuffs are produced by treating with phosgene one mol. of the above acids and one mol. of any other *p*-aminobenzeneazo-aryl-sulphonic or carboxylic acids of the benzene or naphthalene series. Example 1: 46 parts of the acid sodium salt of *p*-aminobenzeneazo-1-amino-8-naphthol-4 : 6-disulphonic acid obtained by combining *p*-nitrodiazobenzene chloride with 1-amino-8-naphthol-4 : 6-disulphonic acid in acid solution and reducing the monoazo-compound with sodium sulphide, are dissolved together with 34·5 parts of sodium carbonate in 3450 parts of hot water. A current of phosgene is then passed through until the reaction is complete, when the solution is heated to 75° C. and the urea salted out, filtered off and pressed. Example 2: 23 parts of the aminoazo-compound obtained by combining 1 mol. of *p*-nitrodiazobenzene chloride with 1 mol. of 1-amino-8-naphthol-3 : 6-disulphonic acid in acid solution and subsequent reduction with sodium sulphide, and 14·4 parts of the sodium salt of *p*-aminobenzeneazosalicylic acid are dissolved as above and treated with phosgene. The urea is isolated as in the preceding example.—J. C. C.

Monoazo dyestuff particularly adapted for the preparation of violet colour lakes; Manufacture of a ——. Farbwerbe vorm. Meister, Lucius, und Brüning, Hoechst-on-the-Maine, Germany. Eng. Pat. 12,099, May 18, 1911. Under Int. Conv., Dec. 2, 1910.

Diazotised 1-naphthylamine-2-sulphonic acid is combined with 2-naphthol-3-carboxylic acid in alkaline solution. The product in the form of a 20 per cent. paste is converted into the calcium salt with the addition of turkey-red oil or the lake may be made from the above materials in one operation. It possesses a beautiful violet tint and is fast. —J. C. C.

Vat dyestuffs; Halogenated ——. G. Engi and J. Fröhlich, Basel, Assignors to Soc. Chem. Ind. in Basel, Switzerland. U.S. Pat. 997,766, July 11, 1911.

Yellow vat dyestuffs are obtained by treating the condensation product of indigo and benzoyl chloride with a halogenating agent.—J. C. C.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

he textile fibre industry of Brazil. J. Royal Soc. Arts, 1911, **59**, 920—921. [T.R.]

ITH the world's source of cotton supply in the main nited to the United States, and in view of the reputed ilures to develop the cotton-growing industry in India ıd Africa on a very large scale, it would seem that Brazil ill, within the next generation, witness an extension of ; cotton industry, and when such a time comes its cottor- aring trees will have their share of attention in this spect. There are indigenous to Brazil, and growing wild certain regions, two species of trees of interest to the mmercial world because of their possibilities as producers cotton fibre. The first tree (" Barraguda," from having barrel-shaped trunk) grows to from twenty-five to irty-five feet in height, tapering from the great bulge the trunk to a very slender one, from which branches rm about twelve feet above the ground. The pods in hich the cotton grows are from five to eight inches long, ıd two to four inches in diameter. The fibre is coarse ıd white, long, and strong, and while too coarse r use in textiles of any degree of fineness, it would, it is id, lend itself to the fabrication of blankets, cotton twine, ıd a variety of other materials. The second tree (" Im- russu ") produces a much finer cotton, of a brownish lour, which is exceedingly light, but not long enough spin well, and resembles eiderdown. It is so light and ıffy that the entire contents of a pod can be blown free om the outer enclosure or hull. It is a remarkably rong fibre, and a strip half an inch in width will, without ıy preparation, sustain a weight of fifty to a hundred ounds. The tree, which has a peculiar and characteristic ırk, has its habitat in central Bahia and northern Minas eraes, being most abundant in the latter State, and is ılled " imbirussu."

aw cotton ; Some constituents of ——. E. Knecht. Textile Inst. J., 1911, **2**, 22—29.

AW Egyptian cotton-sliver was exhaustively extracted ith benzene, yielding 0·47 per cent. of crude cotton wax aving the appearance and consistence of bees-wax (see this ., 1911, 813). On treatment with petroleum spirit the crude ax was resolved into two constituents : cotton wax A, to ıe amount of about 70 per cent., soluble in the spirit ; and otton wax B, insoluble in petroleum. Cotton wax A has a ale colour, it melts at 66°—67° C. and consists for the most art of a true wax, containing besides, some free fatty acids, nall proportions of glycerides and some hydrocarbons. otton wax B is a dark green, granular but plastic sub- ance, melting at 68° C., and containing very little free ıtty acid. The Egyptian cotton deprived of wax yielded on ĸtraction with alcohol 0·68 per cent. of a solid extract, morphous, very hygroscopic and of a very rich brown olour. Aqueous extraction, which followed, gave 1·46 er cent. of a brown hygroscopic substance similar to the lcoholic extract. Ammonia (25 c.c. of strong ammonia er litre) extracted 0·48 per cent. Formic acid at similar ilution extracted 0·46 per cent. of matter which was ıainly mineral. Texas cotton yielded 0·55 per cent. of rude wax soluble in benzene ; the alcoholic extract mounted to 0·90 per cent. and contained 1·07 per cent. f nitrogen ; it reduced Fehling's solution strongly ; the queous extract was 1·61 per cent., ammoniacal extract ·39 per cent., formic acid extract 0·72 per cent. The xhausted Texas cotton was digested with cold dilute ydrochloric acid and yielded a further 0·43 per cent. f extract. Bengal cotton yielded only 0·38 per cent. of rude wax. Spinning trials were conducted on the large cale with Egyptian cotton deprived of its wax. The de- axed material behaved very badly in the drawing and pinning processes, giving an excessive amount of waste, regular results and showing a tendency to adhere to the ollers. Finer counts gave great trouble and breakages ere extremely frequent. In the loom, used as warp, he de-waxed thread was also troublesome on account of reaks. The yarn spun from the de-waxed cotton was 4·5—27 per cent. weaker than the ordinary yarn. On he other hand, the extraction of the wax from ordinary yarn after spinning increased the strength by 13 per cent. ; the addition of 2 per cent. of paraffin wax to this extracted yarn decreased its strength again by 33 per cent. J. Hübner has conducted dyeing experiments with the cloth manufactured from the de-waxed raw Eygptian cotton. Substantive dyestuffs gave lighter shades on the extracted cotton than on the ordinary. Methylene Blue and certain other dyestuffs on the other hand dyed darker shades on the extracted cotton.—J. F. B.

Cotton goods ; The sizing of —— *in relation to subsequent processes.* F. Whowell. Textile Inst. J., 1911, **2**, 43—53.

Certain of the ingredients employed for sizing warp yarns exert very injurious effects upon the cloth in some of the subsequent processes through which it is required to pass, *e.g.*, singeing, bleaching, dyeing and printing. It is known that a moist atmosphere and a certain amount of moisture in the yarn are practically essential to ensure good results in the weaving. Under humid conditions, sized warps are very liable to develop mildew whilst standing in the weaving sheds or rolled up on the weavers' beams. The sizer therefore incorporates a small amount of zinc chloride with his size, which acts at the same time as an antiseptic and as a deliquescent. Other chlorides are also frequently employed as deliquescent agents, *e.g.*, magnesium and calcium chlorides. All these chlorides tend to dissociate when heated above a certain temperature, and cloths containing them are liable to become tendered after passing through the singeing process. The heat of the singeing machine liberates hydrochloric acid which destroys the fibres of the cloth. The damaged parts are often irregularly distributed over the cloth, and they betray themselves in the form of small or large holes with clean-cut edges, distinct from the frayed edges of mechanically damaged parts. Another objectionable substance often used in sizing is paraffin wax, the object being to lubricate the sized threads for the weaving process. Tallow is the proper substance to employ for this purpose, but paraffin is used either consciously because it is cheaper or unconsciously in the form of adulterated tallow. Paraffin wax and similar unsaponifiable substances are not emulsified in the boiling processes to which the goods are subjected preparatory to bleaching or dyeing. The wax is simply loosened, floats to the top of the kier and settles on the goods in the form of patches producing grey, water-resistant stains which cannot be bleached or dyed. Sometimes the wax remains evenly distributed over the cloth without forming patches, in which case the fibres remain absolutely resistant to the calendering operation and the cloth finishes up quite limp. Mineral oil stains derived from the lubricating oil of the loom or other machinery are likewise objectionable, and it has been clearly demonstrated that mineral oil stains resist all known processes of bleaching, but it would appear that a mixture of vegetable and mineral oils is not so harmful. In the discussion of the paper, P. Bean pointed out that the use of deliquescent chlorides is not confined to the object of facilitating the weaving operations. Magnesium and calcium chlorides are used illegitimately for the object of increasing the weight ; these chlorides increase the weight of the cloth not merely by the excess of moisture they attract, but also by enabling the cloth to carry more " filling." Heavily weighted grey cloths are sent to the bleacher with instructions to finish " to loom weight," and the bleacher first has to take out all the " filling " and then replace it to an equivalent weight when finishing the cloth. In extreme cases as much as 50 to 60 per cent. of added weight is demanded, and it is impossible to attain such results without the use of deliquescent chlorides. Even the smallest proportion of magnesium chloride is dangerous if the cloth has to be singed. " Yorkshire grease " has been mentioned as a substitute for tallow, but this is not always safe.—J. F. B.

Silk weighting ; Theory of ——. P. Heermann. Chem.-Zeit., 1911, **34**, 829—830.

A statement by Sisley, in support of the impregnation theory of silk weighting, that when dried silk is used, the concentration of the stannic chloride bath used remains unaltered (Chem.-Zeit., 1911, 621), is shown to be incorrect, and the author re-affirms his former opinion that the impregnation theory is quite untenable (this J., 1904, 820). The "ionic" theory is again stated to be in accord with all the observed facts. In the weighting of silk by stannic chloride it is shown that only one-half of the stannic oxide fixed is directly adsorbed by the fibre, the remaining and mechanically adhering mordant solution, is fixed on washing the fabric ; the reduction in the concentration of the bath is found to be only about half the amount of tin fixed on the fibre. The author also re-affirms the correctness of his observations on the tin-phosphate process (see this J., 1905, 1224).—A. SELD.

Pine fibre [paper yarns] for textile manufacturing. C. P. Hellberg. Textile Inst. J., 1911, 2, 33—41.

OF the processes which have been worked for the manufacture of textile yarns from half-manufactured (moist and unfinished) paper, Türk's process by which "Licella" yarn was made at Waldhof, Germany, has been abandoned. Kron's process, for producing "Silvalin" yarn, is still being worked at Hämmern, but not under very satisfactory conditions. The manufacture of yarn from finished paper is being carried out under Claviez's patent in Saxony and Austria, the product being sold as "Xylolin." The author's observations go to show that finished paper is the only suitable starting point for the manufacture of yarn on the large scale, but that Claviez's process is too cumbersome and laborious to form the basis of a large industry for a low-priced article. The author has introduced machinery which greatly simplifies the manufacturing process. Particularly his slitting, dividing and reeling machine for producing the narrow strips of paper on bobbins from a reel of 19¼ inches in width has done much to solve the economic problems of the industry. By his process, the strips are damped as they are unreeled for spinning, and the bobbins may therefore be stored for any length of time. The strips are twisted on a modification of a ring spinning machine. Yarn is produced from the original reel of paper according to the new process in nine operations, as compared with 102 operations on the old plan. Of commercial grades of paper Swedish "Kraftpaper" undoubtedly gives the best and strongest yarns, but improved results are to be expected from paper made specially for the purpose. A concern formed to undertake the manufacture of paper yarns in Sweden should control its own spruce forest, and manufacture the pulp and paper to be used ; it is estimated that if spinning were begun at the rate of 5000 tons per year, yarn could be produced at prices ranging from 1⅜d. to 2½d. per lb., according to count. There is a large outlet for fabrics composed wholly or partly of paper yarn, to relieve the constantly increasing demand for jute and coarse cottons, thus cheapening these fibres for finer manufacturing purposes. Paper fabrics are admirably adapted for carpet and upholstery work, also for packing purposes, especially for packing wool.—J. F. B.

Cellulose and formic acid ; The interaction of ——. C. F. Cross and E. J. Bevan. Chem. Soc. Trans., 1911, 99, 1450—1456.

THE authors have examined the products of the action of formic acid on modified cellulose, with or without the intervention of a catalytic agent (this J., 1910, 417). The viscous solution may be precipitated by water or allowed to evaporate on a glass surface to a transparent film. The precipitated substance when washed and dried in the air is soluble in pyridine and nitrobenzene ; it is also soluble in a 20 per cent. solution of potassium or ammonium thiocyanate. It retains 8—9 per cent. of moisture and yields on saponification numbers corresponding to cellulose diformate, but on analysis, to cellulose monoformate. On storage for 4 months in a closed bottle, it is found to contain free formic acid and if the product be then distilled with water, formic acid to the amount of one molecule, calculated to cellulose diformate, is obtained. The authors therefore conclude that this product is a monoformate of a modified cellulose, and that the second molecule of acid found on saponification is really derived from the cellulose by the action of the alkali ; moreover this second molecule of acid is not all formic acid, but includes a certain amount of acetic acid. The original product on acetylation yields a diacetyl-monoformate. The cellulose residue obtained by the saponification of the original formate shows signs of profound constitutional modification ; it contains an unusually high percentage of hydrogen, and on acetylation gives an abnormally high yield of acetylated product containing more than the usual three molecules of combined acetic acid characteristic of the normal cellulose triacetate. An examination of the film prepared by drying down the formic acid solution of the original reaction product showed that it was essentially a modified cellulose insoluble in pyridine and retaining 13—16 per cent. of hygroscopic moisture. On prolonged boiling with aqueous alcoholic sodium hydroxide a progressive splitting off of acid products was observed. When cellulose is treated with formic acid in presence of a catalyst (zinc chloride or phosphoric acid) it gradually forms a viscous solution ; on pouring into water a certain proportion of modified cellulose products remains in solution ; the aggregate gain in weight of the insoluble and soluble products is relatively low, and the insoluble product shows on saponification higher acid values than correspond to its elementary composition regarded as an ester. The authors have studied, for the sake of analogy, the condensation products of formic acid with polyhydroxy compounds of the aromatic series. Resorcinol reacts with formic acid in presence of hydrochloric acid yielding an intensely crimson coloured body which has been characterised as dihydroxybenzhydrol, $OH{\cdot}CH[C_6H_3(OH)_2]_2$; this particular type of condensation appears only to take place in the para position with respect to a hydroxyl group, since quinol does not react.—J. F. B.

Rosin sizing ; Use of magnesium sulphate as a precipitating agent in ——. Pauli. Wochenbl. f. Papierfab., 1911, 42, 2791—2792.

THE author has made experiments on an industrial scale with a solution of Kieserite (magnesium sulphate) as a substitute for aluminium sulphate in engine sizing. The author has confirmed in the paper mill the conclusions arrived at in the laboratory by Frohberg (this J. 1911, 414) in his study of the reactions of the solutions themselves. Magnesium sulphate, whether used alone or in partial substitution for aluminium sulphate, has no sizing value. When a mixture is used the effects obtained are for all practical purposes merely those due to the quantity of aluminium sulphate present in the mixture.—J. F. B.

Xanthogenic esters of cellulose and starch. Ost, Westhoff and Gessner. *See* XVII.

Celluloid industry of Japan. Bd. of Tr. J., Aug. 3, 1911. [T.R.]

HITHERTO there have been no celluloid factories actually working in Japan. In 1908, however, two companies were formed and began the erection of factories with a daily capacity of one and three tons of celluloid respectively. Negotiations with a view to amalgamating the two companies have so far proved abortive. Both factories have been completed recently, and the manufacture of celluloid is to be begun at once.

Celluloid requires for its manufacture macerated tissue paper of fine quality, nitric and sulphuric acids, camphor, and rectified alcohol. Of these ingredients, camphor is produced at present only in Formosa, Southern Japan, South China and the Dutch Indies, and 75 per cent. of the world's supply is grown within the Japanese Empire. Up to the present Japanese consumers of camphor have enjoyed no advantage in price over those in other countries ; the two celluloid companies, however, have succeeded in obtaining supplies of camphor at a price slightly below that at which the article is exported.

With regard to other materials, though paper-making takes a high place among native industries, Japanese paper makers have not hitherto turned out the fine tissue per made from cotton fibre which alone is suitable for luloid manufacture. A large paper mill at Osaka is king attempts in this direction, however, and, while paper does not, it is stated, as yet equal imported sue paper, constant improvement is being effected.

Nitric acid of at least 95 per cent. being necessary, ereas the best nitric acid of Japanese manufacture es not exceed 93 per cent., the new companies are ting steps to manufacture this material. It has been und possible to obtain in Japan alcohol sufficiently pure celluloid manufacture. Sulphuric acid is readily obtainle in the country.

The output of celluloid limited by the available pply of camphor. At present there are in existence y 14 celluloid factories, of which two are in the United tes, seven in Germany, three in the United Kingdom, l two in France. The erection of two additional factories Japan, therefore, with an estimated daily output of r tons, is a feature of importance to the industry.

mports into Japan of raw celluloid, in rod and sheet m, amounted in 1909 to 239 tons of a value of 60,353*l*., l in 1910 to 270 tons, valued at 65,363*l*. Deducting ne 70 tons re-exported to China and other Eastern ntries in the form of celluloid wares, the domestic nand is found to be about 200 tons, of a value of some 000*l*. per annum. Allowing a margin for the expansion the demand in consequence of the manufacture of the icle in the country, thus saving import duties, there nains a surplus, if the factories work to their full acity, of at least 1,000 tons per annum of a value of ne 200,000*l*.

The demand for celluloid in the East is as yet comatively small. The total imports into China of raw luloid do not exceed 8,000*l*. annually, and those of luloid wares amount to perhaps some 12,000*l*. Of the celluloid half the quantity comes from Germany, ich country also does a good business in small wares. quiries as to the prospects of selling celluloid in India ve not met with encouraging replies. It is to the ited States that the Japanese manufacturers look the bulk of their export trade. They hold that the nand in that country is very great, and is by no means t by the domestic output.

The price of celluloid imported into Japan averages out 2s. 5d. per lb. It is claimed that the Japanese tories will be able to produce celluloid at an average ce for all qualities of about 1s. 10d. per lb., thus enabling m to compete on favourable terms in foreign markets. s probable that in view of the difficulties involved in the cess and of the lack of properly trained labour, this re is unduly low. Much, however, depends upon the ce at which the factories are able to purchase supplies of nphor.

Patents.

tificial silk, horsehair, etc.; Manufacture [lustreing] f ——. R. Pawlikowski, Görlitz, Germany. Eng. Pat. 16,629, July 12, 1910.

the manufacture of artificial silk an additional lustre y be imparted to the threads by stretching them whilst l moist and allowing them to dry under tension. According to this invention, the stretching process takes place the bobbins to which the silk is transferred for the rpose of treatment with acid, whereby they become ner and non-gelatinous. The threads are wound on the bbins, treated with acid and washed, and the diameter the bobbins is then increased so as to produce a tension der which the threads are dried. The periphery of the bbins is made up of separate bars of glass or other acidisting material. In one form of bobbin these bars supported by the interposition of solid or pneumatic bber rings between the bars and the body of the bobbin. e rubber rings are placed under compression during winding-on of the threads, and the compression is bsequently removed, forcing the bars outwards. In other form, the ends of the bobbin-bodies on which the rs rest are wedge-shaped and rigid rings are forced tween the bars and wedges after the threads are wound .—J. F. B.

Fibrous materials; Treatment of ——. W. A. Dickinson, Mitcham. U.S. Pat. 998,237, July 18, 1911.

The invention relates to the manufacture of artificial hair by treating vegetable husks or fibres with an alkaline solution to remove resinous matters and toughen the fibres, then bleaching one portion of the fibres and dyeing the other portion, mixing and drying these fibres and treating the mixed fibres with a polishing material. The fibres are then carded and brushed to remove superfluous polishing material and to give them a lustrous finish. The carded fibres are twisted into ropes, the ropes are steeped in water and dried to give the fibres a permanent set and are finally loosened and unravelled to produce artificial hair.—J. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Electrolytic production of bleaching liquors. Foerster. *See* VII.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Nitric acid; Method for the determination of ——. G. Romijn. Z. anal. Chem., 1911, 50, 566—570.

The method, which involves the reduction of nitrate to nitrite, is carried out as follows: 5 c.c. of a solution made by dissolving ammonium sulphate (100 grms.) in 100 c.c. of ammonia (sp. gr. 0·96) and diluting to 300 c.c. is made up to 100 c.c. with the nitrate solution to be examined (which should contain not more than 400 mgrms. of nitrate ion per litre). 200 mgrms. of a mixture of equal weights of pure zinc dust and kieselguhr are added, and the whole is well shaken and, after 5 minutes, filtered into a dry flask, refiltering until clear. The filtrate contains nitrite ions equivalent to 95 per cent. of the nitrate in the original solution. The nitrite, in strong solutions, is then determined by adding 10 c.c. of $N/10$ permanganate and 5 c.c. of sulphuric acid (sp. gr. about 1·124) to 50 c.c. of the filtrate, shaking vigorously, allowing to stand for 15 minutes, adding 5 c.c. of potassium iodide solution (10 per cent.), and titrating the separated iodine with thiosulphate; 1 c.c. of $N/10$ thiosulphate corresponds to 2·30 mgrms. of nitrite ion. The permanganate should be standardised by a blank experiment. Weak solutions are determined colourimetrically by α-naphthylamine and sulphanilic acid. Less than 0·1 mgrm. of nitrate ion per litre may be determined by the method. Iron salts must be absent.—F. Sodn.

Oxalic acid; The preparation of —— *by fusing sawdust with potassium hydroxide.* A. v. Hedenström. Chem.-Zeit., 1911, 35, 853—854. (See also this J., 1907, 716; 1908, 999; 1910, 564.)

Laboratory experiments undertaken with a view to ascertain the most favourable conditions for the production of oxalic acid from sawdust. 3·72 grms. of crystallised oxalic acid were obtained from the oxalate formed by heating 3 grms. of purified cotton-wool with 12 grms. of potassium hydroxide (dissolved in 20 c.c. of water) with constant stirring to 280° C., in a nickel crucible. Only about 1 grm. of acid was obtained when the temperature was not allowed to exceed 225° C. 3 grms. of air-dry oak sawdust (losing 5 per cent. at 100° C.) similarly treated yielded 3·66 grms. of acid when heated to 280° C., but only 2·3 grms. by heating only to 235°—240° C. Preliminary extraction of the sawdust with dilute potassium hydroxide solution was found to reduce the yield. No decomposition of oxalic acid was found to occur when 4 grms. of the acid were heated with 12 grms. of potassium hydroxide for ½ hour at 280° C.—A. Sbld.

Perboric acid and some similar compounds [*percarbonates, persulphates, perchlorates, and periodic acid*] ; *Detection of* ——. W. Lenz and E. Richter. Z. anal. Chem., 1911, **50**, 537—544.

A comparison of the behaviour of (*a*) sodium perborate, (*b*) potassium percarbonate, (*c*) ammonium persulphate, (*d*) potassium perchlorate, and (*e*) periodic acid towards certain reagents has given the following results : *a* and *b* are decomposed by water, with the formation of hydrogen peroxide and evolution of oxygen ; *c* gives oxygen only. Permanganate solution, in the presence of sulphuric acid, is decolourised by *a* and *b*, and by *c*, slightly on heating ; *d* and *e* have no effect ; alkaline permanganate is turned blue by *d*. With silver nitrate solution, a heavy black precipitate is produced by *a* (a mirror on warming in the presence of ammonia) ; a white precipitate turning grey on warming, is obtained with *b* ; a solution of *c* becomes turbid through the separation of blue molecular silver ; *d* has no action ; and *e* gives a pale yellow precipitate, readily soluble in ammonia. *a*, *b*, *c*, and *e* cause the darkening of freshly precipitated manganous hydroxide (in absence of air) ; *d* has no effect. The precipitate obtained by adding sodium hydroxide to cobalt nitrate solution, in absence of air (*e.g.*, under petroleum ether), is darkened at once by *a*, *b*, or *c* ; but not by *e* or *d*. When nickel sulphate is treated similarly, a black precipitate is obtained with *c*, the others having no effect. Alkaline lead acetate solution, heated with an excess of *c*, gives a yellow-red precipitate after a time ; with *e*, a heavy white crystalline precipitate is produced ; *a*, *b*, and *d* have no effect. Cerous chloride solution, in the presence of ammonia, is coloured yellow by *a* and *b* ; the others have no effect. Iodine is liberated from potassium iodide by *c*, and in the presence of sulphuric acid, by *a* and *b* ; *d* has no effect. Fuchsin solution, containing sodium acetate, is decolourised by *a*, *b*, and *c* on warming, but not by *d*. Aniline sulphate solution is coloured a pale yellow when heated with *a* or *b*, *c* gives a dark brown precipitate, and *d* has no action.—F. Sodn.

Carbonates ; Fractional precipitation of ——. R. C. Wells. J. Washington Acad. Sci., 1911, **1**, 21—24.

The author has made a series of experiments upon the fractional precipitation of carbonates from dilute solutions containing two metallic salts in equivalent quantities, enough sodium carbonate being added for one metal only. At first both metals are precipitated in nearly equivalent proportions, but one then proceeds slowly to dissolve and the other to precipitate, the change going on for several days at the ordinary temperature, and the precipitate becoming more crystalline in character. In general the separation is not complete, but the metals may be arranged in a series, such that the first one is precipitated to a greater extent than the next, and so on ; the order found is mercury, lead, copper, cadmium, zinc, iron, nickel, manganese, silver, calcium, and magnesium, the series representing the order of the precipitating power of carbonates upon metallic salts under similar conditions, although not the order of solubility of the carbonates.
—F. Sodn.

Bleaching liquors ; Electrolytic production of ——. F. Foerster. Chem. Ind., 1911, **34**, 373—378, 402—413.

Further experimental work has been done on the electrolysis of solutions of alkali chlorides, and former conclusions have been confirmed. The early limitation of the increase of hypochlorite-concentration at the anode, due to cathodic reduction, is prevented by the addition to the electrolyte of calcium chloride or alkali chromate, whereby there are formed around the cathode diaphragms of calcium hydroxide or chromium chromate, which prevent or lessen diffusion from anode to cathode. The conditions favourable to the formation of hypochlorite, and unfavourable to its destruction with formation of chlorate, are found to be : 1. High chloride-concentration. 2. High current density. 3. Low temperature. 4. Neutral electrolyte. 5. Platinised electrode. Conditions 2 and 3 are antagonistic, and it is therefore necessary with high current density to cool the electrolyte continuously. But cooling below 10° C. is not desirable, as at lower temperatures separation of a solid substance (probably chlorine hydrate) at the anode occurs and interferes with the reaction. Rise of temperature from 15° to 30° C., on the other hand, reduced the attainable concentration of hypochlorite, with current densities of 0·015 to 0·12 ampère per sq. cm., by 18 per cent. of its value at 15° C. In laboratory experiments, neutral bleaching liquors were obtained containing 80 grms. of available chlorine per litre ; these, however, involved a very high expenditure of electrical energy—about 14 times the theoretical amount. Weaker solutions, however, can be produced much more economically—solutions containing 37·5 grms. and 17·5 grms. respectively of available chlorine required 1·77 and 1·17 times the theoretical expenditure of energy. With very high current densities there is little or no advantage in a platinised electrode ; but with sheet electrodes and lower densities the advantage is considerable. The author confirms Geibel's observation (this J., 1906, 1224) that the grey platinised electrodes of Heræus answer admirably for this work. The increase of current density caused by substituting a grating or network electrode of wire for a sheet metal electrode does not result in a corresponding increase of yield : possibly because the higher current density is to some extent counterbalanced by the greater facility for diffusion of chlorine away from or of ClO' ions towards the anode.

The industrial electrolytic preparation of hypochlorites was formerly carried out in a cell devised by Kellner, consisting of a stoneware trough containing vertical glass partitions reaching nearly to the bottom, and against which the electrodes were supported. The liquid was made to circulate again and again through the cell by a pump, till the maximum concentration of hypochlorite was reached. Using a 10 per cent. sodium chloride solution, a liquor containing 10 grms. of available chlorine per litre was obtained, corresponding to about 66 per cent. of the current, and at an expenditure of 6·0 kilowatt-hours per kilo. of chlorine. The low yield was probably due to wastage by the passage of current from end to end of the cell below the glass partitions, and better results have been obtained by a cell, also devised by Kellner, in which the liquid flows from side to side, parallel with the glass partitions, and through narrow semicylindrical troughs which connect the divisions of the cell. Each division is at a slightly lower level than the preceding one, and bent double-polar electrodes are used (see this J., 1906, 482). Each time it passes out of the cell the liquid is cooled before re-entry ; and a little calcium chloride and Turkey red oil are added to the electrolyte to produce a cathodic diaphragm of lime. Using 15 per cent. salt solution, 30—35 grms. of available chlorine per litre can be obtained with this cell, at an expenditure of 6·4—7·1 kilowatt-hours per kilo of chlorine. The improvement is largely due to the lessened wastage of current by shunt circuits, partly also to the higher current density which is allowed by the rapid circulation and good cooling arrangements. The increased rate of diffusion from the anode, which might be expected to result from the rapid circulation of the electrolyte, is lessened by the arrangement of having the entrance and exit of the liquid above the electrodes, and also by the anode being below the cathode, and thus as far removed as possible from the place of greatest motion. As in all such cells, however, the circumstances are favourable to the absorption of atmospheric carbonic acid, and small additions of alkali must be made from time to time to counteract the effect of this on the hypochlorite. Moreover, platinum must be used for both electrodes, and the cathode platinum is subject to slow disintegration from the formation of sodium-platinum alloy and its subsequent decomposition. A cell devised by Schuckert contains alternate single-pole electrodes, the anodes of thin sheet platinum (0·02 mm. thick), the cathodes of carbon. From such an electrolytic cell the liquid flows beneath a glass partition into the adjoining slightly lower cooling cell, and from this over the upper edge of another glass partition into the next electrolytic cell, and so on. Calcium chloride and hydroxide and rosin soap are added to the liquid to form the cathode diaphragm ; and owing to the alkalinity of this addition, and the lessened exposure to air, no alkali need be added to counteract carbon dioxide. The cooling is not so efficient as in Kellner's cell, and the temperature in the electrolytic cells reaches 35°—40° C. but the results are comparable with those last quoted. For weak liquors, cells with carbon anodes can be used ; but high concentrations cannot be attained with them—partly because the reaction goes on within the porous anode as well as at its surface, and the liquid, which cannot freely diffuse, becomes impoverished in salt, and partly because of the slow, yet continuous, oxidation of the anode and production of carbon dioxide. Hans and Oettel have devised such a cell ; the electrodes are carbon plates, which with lateral continuations of glass form partitions in the trough. The liquid enters at the bottom, and leaves at the top to be cooled ; each electrode is anode on one side and cathode on the other. The results obtained are similar to those obtained with the old form of Kellner cell.

Instead of producing bleaching liquors directly, the electrolytic process may be used to produce chlorine, which is then caused to act upon milk of lime (or alkali-solution, also produced by the electrolysis). The chlorine is produced at a lower cost for power than the equivalent amount of hypochlorite, and any concentration of bleaching liquor can be produced with equal ease ; moreover, the large quantities of sodium chloride solution run to waste with the "direct" bleaching liquors are saved. On the other hand, the bleaching properties of the solution obtained are not so high, and the alkali hydroxide simultaneously produced has to be dealt with, which in a small works may be undesirable. In the Hargreaves-Bird cell, the iron gauze cathode rests against an asbestos plate forming the wall, through which the liquid slowly percolates into a neighbouring vessel where it is carbonated ; the carbonate is more easily crystallised, and more easily sold, than the hydroxide. In a similar cell with horizontal electrodes devised by Billiter the caustic liquor soaks through a false bottom of asbestos, and is then concentrated, yielding 50 per cent. caustic soda, and salt which is returned to the process. The indirect process cannot profitably be embarked upon unless an annual yield of at least 5000 tons of bleaching powder is needed, save where the cost of transport of bleaching powder enhances its price, and the cost of power is low. For smaller demands it would be better to buy bleach, or to make it from milk of lime and liquid chlorine, or to make hypochlorite directly, according to circumstances. It may even be advisable to electrolyse hydrochloric acid, or a mixture of salt solution and sulphuric acid, in which case hydrogen is evolved at the cathode, and there is no alkali to be dealt with. Parenthetically, the author points out that sodium perborate is now coming into commerce as a bleaching agent, and may under certain circumstances present advantages over hypochlorites. Alkali hypochlorites are in general preferable to bleaching powder, partly because slightly soluble organic salts of calcium, depositing in the fabrics, impede the action of bleaching powder, and require for their subsequent removal longer treatment and stronger acid than sodium compounds, partly because they are already neutral or faintly acid, whilst bleaching powder is alkaline, and must have acid carefully added to it before it will bleach equally rapidly.—J. T. D.

Nitrites ; Action of hydrazine sulphate on ——, and a new method for the determination of nitrogen in nitrites. B. B. Dey and H. K. Sen. Z. anorg. Chem., 1911, **71**, 236—242.

By the interaction of barium nitrite solution and hydrazine sulphate, barium sulphate is precipitated and hydrazine nitrite formed, but the latter slowly decomposes (more rapidly with rising temperature), a mixture of nitrogen and nitrous oxide being evolved. If an excess of hydrazine salt be employed, the decomposition of the nitrite appears to proceed according to the equations, $N_2H_4,2HNO_2 = N_2+N_2O+3H_2O$ and $N_2H_4,HNO_2 = NH_3+N_2O+H_2O$, and, the proportion of nitrogen evolved as such being the same for other nitrites as for barium nitrite, the method furnishes an accurate and convenient method for the determination of nitrite nitrogen in nitrites generally, including those of organic bases. The nitrite solution is treated with an excess of hydrazine sulphate in a nitrometer, and, after dissolving the nitrous oxide by introducing water and shaking until the volume of gas remains constant (three washings with 20 c.c. of water each generally suffices), the residual nitrogen is measured ; this volume represents two-thirds of the total nitrite nitrogen. A determination may be made in 15 minutes.—F. Sodn.

Aluminium nitride ; Properties of ——, and its practical utilisation. E. Kohn-Abrest. Bull. Assoc. Chim. Sucr. et Dist., 1911, **28**, 1010—1018.

After giving an account of his work on the preparation of aluminium nitride (this J., 1910, 570), the author discusses its possible production on the large scale in the electric furnace from alumina or from bauxite by admixture with carbon, and summarises the relative cost of different nitrogen compounds as follows, basing the figures on the price of 1 kilo. of nitrogen :—

	Nitrogen in the crude product.	Net cost at works.	Selling price in France.
	per cent.	in francs.	in francs.
Aluminium nitride, from bauxite	33·0	0·55	0·74
Alumium nitride, from aluminaa	34·0	1·04	1·34
Calcium cyanamide	20·0	—	1·15
Sodium nitrate	15·5	0·69	1·49
Ammonium sulphate	20·5	—	1·65

From this it appears that the price of the nitrogen of aluminium nitride prepared from bauxite is much less than that from other sources ; but it is pointed out that it remains to be seen what the cost of producing ammonia on the commercial scale from this source would be, and whether boiling water, alkalis, or aluminates would be the most suitable means for effecting the decomposition. It has also to be determined whether the new compound when used as a fertiliser will yield all its nitrogen in the form of ammonia to the soil.—J. P. O.

Mercurous nitrate ; Action of ammonia on ——. H. Saha and K. N. Choudhuri. Z. anorg. Chem., 1911, **71**, 309—312. (Compare this J., 1910, 975.)

The black substance obtained by the action of ammonia on mercurous nitrate is found, contrary to the assertion of Barfoed (J. prakt. Chem., **39**, 201), to be a mixture of metallic mercury and a white compound of the empirical formula, $N_2Hg_2H_4O_5$. The latter is readily soluble in strong ammonia.—F. Sodn.

Silicon sulphides. II. L. Cambi. Atti R. Accad. dei Lincei, Roma. 1911. [5], **20**, I., 433—440. Chem. Zentr., 1911, **2**, 263—264.

The black and the yellow variety of silicon monosulphide (see this J., 1911, 83) behave very differently on hydrolysis. The yellow sulphide reacts vigorously with water, sometimes even becoming ignited. If the hydrolysis be effected with ice-cold water in an atmosphere of hydrogen, a white product is obtained which oxidises in contact with water at the ordinary temperature with liberation of hydrogen. It is readily attacked by alkalis, including ammonia, silica being formed and hydrogen liberated. It is oxidised to silica by the air. It has strong reducing properties and when heated in vacuo at 400° C. decomposes into hydrogen and silica containing some free silicon. This white substance appears to be silicoformic anhydride, $(H.SiO)_2O$, and the hydrolysis may be represented by the equation :—$SiS+2H_2O = H.SiOOH+H_2S$, the silicoformic acid produced at first being subsequently converted into the anhydride.

When the yellow sulphide is treated with dry hydrogen chloride at 240°—260° C., hydrogen sulphide is evolved, and by condensing the reaction product a liquid is obtained consisting chiefly of silicochloroform (b.pt. 33° C.). It has not been possible to obtain definite products by the action of water or of hydrogen chloride on the black sulphide. The latter appears to contain two constituents, of which one yields silica and the other products from which silicon can be obtained. It is probably a product of the decomposition of the yellow sulphide according to the scheme: $2SiS \rightarrow Si + SiS_2$. The yellow sulphide is stable only at temperatures of 980°—1000° C., and higher, but can be isolated by rapid cooling of its vapour.—A. S.

Mesothorium; The properties of technically prepared ——. O. Hahn. Chem.-Zeit., 1911, 35, 845—846.

Mesothorium is the first disintegration product of thorium. It is composed of two constituents, mesothorium 1, and mesothorium 2, the latter giving β- and γ- rays. By its gradual disintegration, mesothorium forms in the first place, radiothorium, and afterwards, thorium X, emanations, and thorium A-B-C-D. With these latter, radiothorium exists in equilibrium, and emits α-, β- and γ- rays. The disintegration of mesothorium takes place at first with an increase of radioactivity. This increase, starting with pure mesothorium, would last, it is calculated, for 3·2 years, and would be followed by a slow decrease for 10 years, a value half that of the original mesothorium being reached in 5·5 years. Technically prepared mesothorium, however, contains about 25 per cent. of radium, which causes the period of decrease to be much extended. It takes 1800 years for the radioactivity of radium to be reduced to one-half, and assuming that radioactivity is inversely proportional to the rate of disintegration, the radioactivity of mesothorium must be 300 times that of an equal weight of radium. As technically prepared mesothorium has a radioactivity equal to that of pure radium bromide, and as it contains 25 per cent. of radium bromide, the remainder must consist of 0·25 per cent. of mesothorium, and 74·75 per cent. of inactive substance. The author has succeeded in separating the inactive substance, obtaining consequently a product whose radioactivity was nearly four times as great as that of an equal weight of pure radium bromide, but attempts at the further separation of the mesothorium and radium were unsuccessful owing to the similarity of the chemical properties of the two substances. Pure mesothorium sends out only β- and γ-rays, so that in technically prepared mesothorium α-rays are in the first place due only to the presence of radium. As radiothorium is formed, however, the α-activity attains a high value.—T. St.

Radium emanation; Action of —— on thorium salts. Herschfinkel. Comptes rend., 1911, **153**, 255—257.

The observation of Ramsay and Usher (Ber., 1909, 42, 2930), that a small proportion of carbon dioxide is evolved from thorium nitrate under the influence of the radium emanation, has been confirmed by the author, but the same gas has been obtained, and in larger proportion, by the action of potassium permanganate on the salt. There is no evidence, therefore, that thorium has been transformed into carbon by the emanation, as suggested by Ramsay and Usher, the appearance of the gas being sufficiently accounted for by the oxidation of slight organic impurity (probably oxalic acid).—F. Sodn.

Potassium cyanide in the presence of potassium ferrocyanide; Titration of ——. Treadwell. *See* XXIII.

Potash in Russia. Chem. Tr. J., Aug. 12, 1911. [T.R.]

Potash was produced at Novorossisk from the stalks of the sunflower in greater quantities than usual. The exports for 1910 exceeded those of 1909 by 1690 tons. The syndicate of eighteen firms which was recently formed is expected to increase these figures for 1911.

Patents.

Sulphurous acid; Apparatus for the manufacture of ——. H. H. T. Burbury. First Addition, dated Jan. 27, 1911, to Fr. Pat. 420,596, Sept. 20, 1910.

In apparatus for the absorption of sulphur dioxide, water is atomised and injected into the tube, through which the gas is passing on its way from the furnace to the absorbing vessel.—O. R.

Sulphuric acid by the lead-chamber process; Process of recovering lost and unused nitrous compounds in the manufacture of ——. A. Taraud and P. Truchot. Fr. Pat. 425,913, April 18, 1910.

The residual gases proceeding from the Gay-Lussac towers are brought into intimate contact with alkaline liquors, especially sodium carbonate solution, with the formation of nitrates and nitrites. The washing may take place in towers or scrubbers, by means of sprayers or atomisers, or by any means which provides a large surface of absorption to the residual gases. The injection of a current of air is recommended, especially when the presence of nitric oxide is suspected in the gases under treatment. —O. R.

Formic acid; Process of preparing concentrated ——. Soc. pour L'Industrie Chim. à Bâle. Fr. Pat. 425,321, April 1, 1910.

A formate is treated with concentrated sulphuric acid in the presence of pure, concentrated formic acid, it being found that when the latter is in excess, it is not affected by sulphuric acid. After the reaction, the formic acid is distilled off, preferably under diminished pressure.—O. R.

Ammonia; Process of producing ——. Badische Anilin und Soda Fabrik. Fr. Pat. 425,099, Nov. 24, 1910. Under Int. Conv., Jan. 8, and April 21, 1910.

The yield of ammonia, which is produced synthetically by heating nitrogen and hydrogen in the presence of iron as catalytic agent, is greatly increased by the inclusion of certain foreign substances in the catalytic mass. The claim specifies a large number of such foreign substances, more especially the elements of the iron group, and the oxides, hydroxides, or salts of the alkali and alkaline-earth metals; compounds, which can give rise to the formation of sulphur, selenium, tellurium, phosphorus, arsenic, boron, etc., under the conditions of synthesis, are to be avoided as catalysts.—O. R.

Ammonia and its derivatives; Process of preparing ——. A. Brochet and G. Boiteau. Fr. Pat. 425,952, April 19, 1910.

Nitrogen and hydrogen are passed over certain catalytic agents at temperatures ranging from 250° to 750° C. Suitable catalytic agents are any of the alkaline-earth metals, their carbides, nitrides, cyanamides, or mixtures of the same.—O. R.

Ammonia and its compounds; Process of manufacturing —— from oxides of nitrogen. Elektrochem. Werke, G. m. b. H. Fr. Pat. 426,307, Feb. 21, 1911. Under Int. Conv., March 3, 1910.

Oxides of nitrogen and reducing gases, such as hydrogen, water-gas, or a suitable hydrocarbon, are passed over a catalytic agent heated to a temperature of from 350°—700° C. Asbestos impregnated with 10 per cent. of metallic copper is specified as the most suitable catalytic mass.—O. R.

Ammonium sulphate; Manufacture of ——. M. G. Christie, Crigglestone, Yorks. Eng. Pat. 15,817, July 1, 1910.

Moist gases containing ammonia are passed into a saturator, which is maintained at a temperature high enough to prevent condensation of the moisture from the gases. Sulphur dioxide is passed into the liquor in the saturator, which is at the same time electrolysed, the sulphur dioxide being preferably passed into the liquid around the anode. It may be preferable to have the electrolytic bath apart from the saturator, and to circulate the liquor through both the saturator and the bath. The sulphurous gases are converted into sulphuric acid in the anode compartment of the electrolytic bath, and the sulphuric acid obtained forms ammonium sulphate in the saturator.—O. R.

Ammonium nitrate from ammonium sulphate and sodium nitrate; Manufacture of ——. F. A. Freeth, Great Crosby, Lancs., and H. E. Cocksedge, London. Eng. Pat. 16,454, July 9, 1910.

When equivalent quantities of ammonium sulphate and sodium nitrate are added to a certain "nucleus" solution, double decomposition takes place quantitatively with precipitation of sodium sulphate. After removal of the latter, dilution with water, and cooling to a certain temperature, practically pure ammonium nitrate separates out and a mother liquor is left, which requires only concentration to revert to the state of the "nucleus" solution. The "nucleus" solution consists of a solution which is saturated with respect to ammonium nitrate, sodium nitrate, and the double salt, $3NH_4NO_3.(NH_4)_2SO_4$, at the temperature to which the liquor is subsequently cooled for the separation of ammonium nitrate.—O. R.

Ammonium nitrate from ammonium bicarbonate, or the components thereof, and sodium nitrate; Manufacture of ——. F. A. Freeth, Great Crosby, Lancaster, and H. E. Cocksedge, Herne Hill, London. Eng. Pat. 16,455, July 9, 1910.

Sodium nitrate, ammonium bicarbonate (or its components), and water are made to react at any temperature at which the substances will form ammonium nitrate (preferably below 35° C.) and in such quantities as will yield, when the reaction is finished and the precipitated sodium bicarbonate has been removed at the temperature of the reaction, a solution saturated with respect to sodium bicarbonate and also saturated or nearly saturated with respect to ammonium bicarbonate and ammonium nitrate. The solution, after removal of the sodium bicarbonate, is then treated so as to get rid of all or most of the bicarbonate remaining in solution (for instance, by heating at or below atmospheric pressure) and is subsequently cooled to a temperature below that at which the reaction was performed (as low as —25° C., if desired), when pure or practically pure ammonium nitrate separates. Equivalent quantities of ammonium bicarbonate and sodium nitrate, the latter in such quantity that it is equivalent to the ammonium nitrate which has been removed by cooling, are then added to the mother liquor (small adjustments being made to compensate for losses during the process of removing the soluble bicarbonates, for addition of wash water, etc.), and the cycle of operations is repeated. As an example, 200 parts by weight of sodium nitrate, 210 parts of ammonium bicarbonate, and 100 parts of water are stirred together at any temperature between 33° C. and 22° C., and, when the reaction is finished, the precipitated sodium bicarbonate is separated from the solution at 22° C. The remaining solution is then heated to remove the soluble bicarbonate and is subsequently cooled. At —1° C., about 55 parts of ammonium nitrate are obtained, per 100 parts of water, or about 100 parts by cooling to —22° C.—F. Sodn.

Refining salt and recovering its impurities as by-products; Process of ——. C. Glaser and G. J. Muller, Baltimore, Md. Reissue No. 13,268, dated July 11, 1911, of U.S. Pat. 957,416, May 10, 1910 (this J., 1910, 756).

In addition to the precipitating agents mentioned in the original patent, claim is made for sodium hydroxide and sodium ferrocyanide. For example, to the crude salt solution, prepared as before described, sodium ferrocyanide is added to precipitate any iron as Prussian blue; this is followed by barium chloride, to precipitate sulphates; then just sufficient sodium carbonate is added to neutralise any free acid and precipitate a small proportion of the calcium chloride present, as well as any remaining heavier metals, after which more sodium carbonate is added to precipitate all the calcium present, and finally sodium carbonate or hydroxide, to precipitate magnesium as carbonate or hydroxide. The impurities are thus removed and, at the same time, sodium chloride is added to the solution.—F. Sodn.

Potassium salts and other products; Process of extracting —— *from silicious rocks.* E. Hart, Easton, Pa. U.S. Pat. 997,671, July 11, 1911.

An insoluble potassium-bearing rock is fused in the presence of barium sulphide so as to give a glass, and the potassium, thus rendered soluble, is extracted from the powdered product by a mineral acid. Potassium alum, for example, is obtained by fusing orthoclase (1 mol.) with barium sulphate (1 mol.) and powdered carbon (2 atoms) and treating the product with sulphuric acid.—F. Sodn.

Potassium compounds; Separation of —— *by insoluble fluorine salts.* L. Rivière. Second Addition, dated April 13, 1910, to Fr. Pat. 413,677, Dec. 8, 1909 (this J., 1910, 1123).

In the treatment of liquors containing potassium salts with silicofluorides, the action is allowed to proceed with continuous agitation up to the point when the reverse action is about to set in; the liquid is then filtered and the potassium silicofluoride is treated with a suitable carbonate for the formation of potassium carbonate and the regeneration of the silicofluoride. For the second reaction sodium carbonate solution, or calcium or barium carbonate suspended in water may be used, the last-named being the most suitable owing to the stability of barium silicofluoride.—O. R.

Bromides; Process of manufacturing ——. H. H. Dow, Assignor to The Dow Chemical Co., Midland, Mich. U.S. Pat. 997,972, July 18, 1911.

Lime and sulphur are boiled with water to form calcium sulphydrate, and the latter is treated with bromine, with the formation of calcium bromide and hydrobromic acid. The latter is neutralised with lime, and the resulting calcium bromide is converted into an alkali bromide by acting on it with the corresponding alkali sulphate. —O. R.

Gas and lime; Apparatus for manufacturing ——. G. G. Floyd, Kirkwood, Mo. U.S. Pat. 997,982, July 18, 1911.

An inclined retort of oval cross-section is divided into two chambers by means of a longitudinal, curved, and perforated partition. The one chamber contains a mineral carbonate and the other carbonaceous fuel, means being provided for the continuous supply of mineral and fuel at the upper ends of the retort chambers, and for the discharge of mineral by gravity at the bottom.—O. R.

Cyanogen compounds; Process and apparatus for the production of ——. The Nitrogen Co. Fr. Pat. 425,025, Oct. 6, 1910.

A metal such as barium, lithium, calcium, strontium, etc., in contact with a molten salt, is made to react with carbon or a reagent containing carbon, to form a carbide, and the latter, held in suspension in the fused salt, is treated with nitrogen or ammonia with the formation of a metallic cyanide, which is finally converted by means of an alkali metal into alkali cyanide and the metal first employed. The reactions may be advantageously carried out in a vessel, which is divided into two parts by means of a median wall, the compartments communicating at the bottom by means of a bath of molten lead. In one cell, a mixture of fused barium and sodium chlorides is electrolysed with the formation of barium and sodium, which alloy with the lead; in the other, the alloy of barium, sodium, and lead is subjected to the successive actions or carbon and nitrogen. The carbon may be supplied either in the form of wood charcoal or of a liquid hydrocarbon under pressure, in which case lampblack is formed with evolution of hydrogen. The specific gravity of fused sodium cyanide is much less than that of the carbides undergoing decomposition, but a small amount of agitation nevertheless suffices to keep the carbides in suspension whilst the reactions are in progress. When a suitable quantity of sodium cyanide has been prepared, agitation is discontinued and the temperature is reduced, the floating cyanide being then easily withdrawn.—O. R.

Arsenical liquid rich in dissolved arsenic; Manufacture of ——. Degeorge et Cie. Fr. Pat. 425,042, Jan. 17, 1911.

Arsenious oxide is dissolved in boiling caustic alkali solution in considerable excess over the amount necessary to form the corresponding arsenite; thus 4 parts of arsenious oxide may be dissolved in 2 parts of boiling water containing 1 part of caustic potash.—O. R.

Hydrated aluminate-silicates or artificial zeolites in the form of hard and translucent grains; Process for producing ——. J. D. Riedel Aktien-Ges. Fr. Pat. 425,342, Jan 28, 1911. Under Int. Conv., Jan. 4, 1911.

In the fusion of alumina, aluminium silicates, or aluminates with an alkali silicate or its component constituents for the production of artificial zeolites (see Fr. Pat. 374,525 of 1907, this J., 1907, 872), less alkali silicate is used than was specified in the previous patent. Whereas in the latter the molecular proportions of alumina, silica, and sodium oxide, were 1 : 10 : 10, respectively, the molecular proportions recommended in the present patent are 1 : 4 : 4—5, respectively. It is claimed that the grains thereby obtained after cooling are coarser, harder, and more readily hydrated, with less tendency to form crystalline silicates.—O. R.

Nitrites and nitrates; Process of treating mixtures of nitrites and nitrates for the preparation of pure ——. Norsk Hydro-elektrisk Kvaelstofaktieselskab, Norway. Fr. Pat. 425,997, Feb. 13, 1911. Under Int. Conv., Feb. 14, 1910.

A mixture of a nitrite and nitrate is treated with a quantity of nitric acid equivalent to the amount of nitrite present, and the nitrous gases, which are evolved, are absorbed with restricted access of air by an alkaline solution, with the formation of pure nitrite; the residue of the mixture treated consists of pure nitrate.—O. R.

Oxygen; Manufacture of —— *and apparatus and materials therefor.* J. Harger, Gateacre, Lancaster. Eng. Pat. 17,628, July 25, 1910.

The apparatus, which is intended specially for the continuous supply of oxygen to submarines, diving bells, etc., consists of a long horizontal tube or other chamber, into which the material yielding oxygen, preferably in the form of pencils as described in Eng. Pat. 16,693 of 1910 (this J., 1911, 895), drops automatically from a magazine above and is mechanically pushed forward past an igniting device, to drop, when exhausted, into a receiver, from which it is removed in any suitable manner. The hot oxygen passes back to heat the oncoming material and thence, through a purifier which is filled with stiff fibre or coiled wire, coated with crystals of potassium hydroxide or other purifying substance, out of the apparatus. Owing to the heat of the reaction, the process, by proper insulation, can be made to go on continuously when once started.

—F. Sodn.

Boron compounds [boron suboxide] and methods of producing the same. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y. Eng. Pat. 7103, March 21, 1911.

A mixture of boric anhydride and magnesium or other reducing agent (preferably 2 or more parts of boron to 1 of magnesium) is heated to a temperature above 1250° C., the heat of reaction being, if desired, made to co-operate in reaching the necessary temperature. The product (boron suboxide), which, after washing with water and dilute sulphuric acid, is substantially free from magnesium and contains about 85 per cent. of boron and 15 of oxygen, and is specially suitable for the treatment of copper preparatory to casting, in accordance with Eng. Pat. 25,031 of 1910 (see Fr. Pat. 422,441 of 1910; this J., 1911, 553).

—F. Sodn.

Ammonium sulphate; Manufacture of ——. E. Henss, Soden, Germany. Eng. Pat. 20,875, Sept. 7, 1910. Under Int. Conv., Sept. 8, 1909.

See Ger. Pat. 227,946 of 1909; this J., 1911, 85.—O. R.

VIII.—GLASS; CERAMICS.

Glass; The viscosity of ——. V. Vesely. Sprechsaal, 1911, **44**, 441—443, 456—459.

In order to measure the viscosity of a specimen of glass, a small bead of the glass is melted between two hooks of an alloy of 60 per cent. of platinum and 40 per cent. of iridium. The hooks and bead are suspended vertically inside a tube furnace, heated by gas and air under pressure, the temperature of which is measured by a thermo-couple. A wire attached to the upper hook passes through the top of the furnace, over a wheel and is counterpoised by a weight. As soon as the furnace has been raised to the desired temperature, another weight is attached to the lower hook by a wire, which together with the wire attached to the upper hook forms part of an electric circuit in which a Leclanché element and a galvanometer are included. The glass bead serves to insulate the two hooks, but when these, under the influence of the forces exerted by the weights in opposite directions, are forced through the softened glass and touch, the completion of the circuit is shown by the swing of the galvanometer needle. The time which elapses between hanging on the lower weight and the touching of the two hooks is taken to be proportional to the viscosity coefficient. Re-melting a specimen of glass and keeping it melted for two hours did not produce a change in the viscosity coefficient, exceeding the limit of error of the apparatus, which in no case amounted to more than 10 per cent. From curves in which temperatures are plotted as ordinates, and the time intervals as abscissae it is easy to determine the relative working powers of various kinds of glass and the limits of temperatures between which they can be most suitably worked. The working power of a glass is also affected by its conductivity for heat and by its specific heat, which can be calculated from its chemical composition. A number of experimental glasses were made in order to determine the influence of different metallic oxides on the viscosity, No. I being taken as a standard for comparison. Nos. II., III. and IV. were derived from No. I., and show the effect produced by varying the content of sodium oxide, whilst the other constituents remained the same. Increasing amounts of sodium oxide rendered the glass more easily fusible, decreased the viscosity, and increased the range of temperature within which the glass was workable. The decrease in viscosity is nearly proportional to the increase in sodium oxide. Nos. V., VI. and VII., also derived from No. I., showed the effect of potassium oxide. Increased amounts of this constituent decrease the viscosity in the same way, but only to about half the extent produced by sodium oxide. Nos. VIII. and IX. showed that an increase in the content of calcium oxide increased the viscosity, and decreased the limits within which the glass was workable, at least in the case of glasses rich in alkali. The rise in viscosity is not proportional to the increase in calcium oxide, and almost disappears in glass very rich in calcium, a result which is also influenced by the decrease in the content of silica. Nos. XI. and XII.—glasses poor in alkali—possessed a greater viscosity at lower temperatures than No. X., but at about 775° C. the viscosity was equal in all three, and at higher temperatures No. XII., the richest in calcium, possessed the smallest viscosity, and No. X. the highest viscosity. Nos. XIII. and XIV. showed that an increase in magnesium oxide considerably increased the viscosity and diminished the range of temperature within which the glass was workable, results which are in agreement with practical experience. The following table gives the composition, heat conductivity, and specific heat of the experimental samples :—

No.	SiO_2.	Na_2O.	K_2O.	Al_2O_3. Fe_2O_3.	CaO.	MgO.	Heat conductivity in cm.—1 g.sec.—1	Specific heat.
I.	73·29	16·09	0·90	1·38	8·04	0·22	0·002158	0·2036
II.	70·08	19·09	0·87	1·61	7·49	0·21	0·002115	0·2048
III.	67·68	21·69	0·82	1·92	7·19	0·25	0·002100	0·2074
IV.	65·36	24·53	0·95	1·52	7·06	0·23	0·002090	0·2122
V.	71·85	15·86	2·78	1·41	7·53	0·26	0·002102	0·2102
VI.	70·36	15·80	4·60	1·19	7·63	0·21	0·002069	0·2030
VII.	66·97	15·65	8·39	1·28	7·25	0·20	0·001991	0·1992
VIII.	68·77	15·70	0·75	1·31	13·22	0·32	0·002211	0·2036
IX.	65·73	15·32	0·69	1·51	16·49	0·37	0·002248	0·2038
X.	69·94	13·65	1·00	2·63	12·65	—	0·002243	0·2016
XI.	67·10	12·88	0·79	2·98	16·28	—	0·002261	0·2024
XII.	64·81	12·26	0·82	2·52	19·22	—	0·002283	0·2002
XIII.	68·00	13·23	0·91	2·54	11·16	4·01	0·002142	0·2031
XIV.	65·01	12·92	0·73	2·58	11·33	7·30	0·002107	0·2052

—W. C. H.

[*Pottery*] *Lead question ; Contribution to the solution of the* ——. W. Pukall. Sprechsaal, 1911, **44**, 391—393, 407—409, 425—427.

Since the author published some results of work on this question, several important contributions have been made (see this J., 1910, 353, 950) which he here reviews. He considers that the results given in the paper issued by the Kaiserl. Gesundheitsamt, are vitiated by the fact that pure chemicals were used, instead of commercial materials, for compounding the glazes ; that many of the glazes were unsuitable for the classes of work involved ; and that the number of glazes examined was not large enough to afford a basis for general conclusions. The solubility of certain constituents of the body in the glaze itself seems to have been overlooked. In determining the amount of lead dissolved from a glaze by boiling for half an hour with 4 per cent. acetic acid, more reliable results are obtained when the glaze is in the form of beads or threads than when it is in the form of powder. The author has found that the amounts of lead dissolved are the same whether the glaze is fritted or not, and that they are so small, that they would not be dangerous to health. Still it is desirable that a definite limit of the amount of lead which is dissolved should be fixed, and an easy quantitative process for its estimation adopted. Owing to the presence of sulphur compounds in the furnace gases, the clay, or the other raw materials, lead sulphate may be formed. The danger arising from lead in glazes is also reduced owing to the fact that the amount dissolved from the glaze diminishes, and eventually disappears, with repeated boiling. The process of estimating the lead by comparing the brownish black colour produced by the addition of hydrogen sulphide water to the acetic acid solution, with the colour similarly developed in a solution containing a known amount of lead is recommended as quicker and easier than the chromate method detailed in the official publication. It is questionable whether 50 c.c. of the 4 per cent. acetic acid are enough to use for every litre of capacity of the articles to be tested. The author has observed that if a new lead-glazed article is exposed to hydrogen sulphide a thin brownish-black film of lead sulphide is formed, which can be wiped off, and another film, less intense in colour, will then form. In the production of silver lustre ware, the silver oxide is completely dissolved by the glaze to a clear glass if subjected to a highly oxidising flame, but a reducing flame brings about the rainbow colour effects characteristic of lustre ware, and if its action be continued long enough, the article becomes covered with a grey dust of metallic silver, which can be wiped off. These and similar observations have led the author to form a theory to account for the solubility of lead contained in glazes. Reducing gases are produced in the kiln, by the feeding of fresh fuel to the fires, or by the production of sulphur dioxide from the clay or the raw materials, and these reduce the lead oxide to metallic lead. The metallic particles, especially if the glaze be thin, tend to draw together into small grains, which are reconverted into lead oxide as soon as strongly oxidising conditions are set up in the kiln, and the portions of the surface surrounding the grains are comparatively poor in lead. The accumulated lead oxide may therefore attack the body and form new and perhaps easily reducible lead aluminium silicates, or the object may be covered with a number of spots of lead oxide, or basic lead compounds, which would be easily attacked by a 4 per cent. solution of boiling acetic acid. In order to obtain plumbiferous glazes which will resist the acid treatment, the following points should be attended to in the manufacture ; the firing must be continued for a long time ; very thin fluid glazes and lack of uniformity in the depth of the glaze coating must be avoided ; excessive reducing periods must be avoided, and a strong draught maintained ; the articles must be protected from the direct impact of the in-rushing furnace gases, and cooled slowly in a strongly oxidising atmosphere, contact with reducing gases from the residual fuel being avoided.

—W. C. H.

Patent.

Earthenware plates ; Manufacture of ——. R. Rupp, Zürich, Switzerland, and E. Jacob, Saarbrücken, Germany (Administrator in R. Rupp's Bankruptcy). Eng. Pat. 25,740, Nov. 5, 1910.

Thin earthenware plates of large size (specially for covering walls and floors, etc.) are made by burning a large thick slab or block of tempered clay and then dividing it into thin plates by sawing or cutting. The plates may be glazed without warping, even if heated to a higher temperature than in the burning.—A. T. L.

IX.—BUILDING MATERIALS.

Cement ; Michaelis' boiling test for ——. H. Kühl. Chem.-Zeit., 1911, **34**, 815—816.

The author criticises Hentschel's modification of Michaelis' test for cement (this J., 1911, 749), and considers the original test to be more reliable as well as simpler. In the event of a cement binding so slowly that a pat of sufficient coherence is not obtained in 24 hours, he considers it preferable to wait another 24 hours, rather than hasten the binding by employing abnormal temperatures as proposed by Hentschel.—A. Sbld.

Cement ; [Influence of magnesia on] the setting of ——. W. A. B. Walling. Chem. News, 1911, **104**, 54.

The author discusses the properties of dolomitic cement, and claims that his experiments on lightly calcined magnesia show that the latter has no powers of setting with water ; any cementitious properties of the above cements he attributes to the calcium silicate present, the setting powers increasing with the amount of lime and decreasing with the amount of magnesia. He prepared a large number of magnesium silicates by clinkering pure magnesia and sand at 1100°—1500° C., and found that the various silicates had no setting properties on hydration; clinker prepared from Medway clay and lightly calcined magnesite also gave negative results.—O. R.

Applying cement mortar by compressed air. Times Eng. Suppl., Aug. 9, 1911, 23.

When concrete or cement mortar is applied as a protective covering to structural steel work, the ordinary method is to surround the steel members with wooden forms and pour the wet mixture into place, some form of wire mesh or metal lath being employed as an anchorage; but a radically different arrangement is adopted in covering the steel work which forms an important feature of the reconstruction of the Grand Central Terminal yards of the New York Central and Hudson River Railroad in New York City.

The essential parts of the "cement gun" there used consist of superimposed steel tanks forming two compartments, from the bottom of which a dry mixture of sand and cement, entirely under the control of the operator, is ejected by compressed air through a hose line carrying a nozzle at its discharge end. To this nozzle a second and smaller hose delivers a supply of water under pressure. The mixture of sand, cement, and water shoots out of the nozzle orifice with considerable force and impinges upon the surface of the steel work at which it is pointed. The mortar issuing in the form of a spray adheres to the surface of the steel and forms a coating which may be made as thick as desired.

The discharge of the cement and the sand is regulated by varying the speed of a large feed wheel at the bottom of the lower compartment, which has deep notches around its entire circumference. This wheel is revolved by a small compressed air motor, and the small charges of the sand and cement mixture collected in the notches or pockets around the periphery of the wheel are fed successively into the rapidly moving stream of air which issues from the inlet connection. The material is blown through a curved outlet and passes thence into the hose line supplying the discharge outlet of the gun. The water comes in contact with the mixture of cement and sand just it as passes through the nozzle, which is furnished with an annular chamber from which the water is sprayed under pressure from a series of carefully proportioned orifices, and the hydration is begun there and continues until the surface to be covered is reached. The mixture issues from the gun nozzle at a velocity of about 350 ft. per second, and when it strikes the steel surface the large and coarse grains of sand rebound until the thin film of fine cement mortar which immediately adheres to the steel offers a plastic base in which the coarse particles become embedded; the mixture then builds up to any desired thickness upon this film. It is apparent, therefore, that when the swift moving stream of material hits the steel surface, and between that time and the instant when the mortar cover begins to build up, there is a tendency for the sand grains to clean off any rust after the manner of an ordinary sand blast. The deposition of the thin film of cement against the steel is advantageous, as it secures an excellent bond and makes an efficient protective covering over the metal. As the cement is literally shot upon the steel a coating of great density is secured, while the force of the impact drives out all superfluous water and the concrete takes its initial set in a very short time, all possibility of voids or air pockets being said to be avoided.

Ferro-concrete; Disintegration of iron-rust in ——. E. Donath. Z. angew. Chem., 1911, 24, 1398—1402.

It is known that in ferro-concrete work not only does the iron remain free from rust, but any rust originally present is removed from the iron, chemically changed and to a certain extent absorbed by the cement. Three theories have been advanced to account for this action. The first, due to Rohland, attributes the effect to the solvent action of bicarbonates and bisulphates on the ferric or ferrous oxide, owing to the presence of carbon dioxide absorbed from the air. The author has repeated Rohland's experiments and confirms the fact that calcium bicarbonate solution does attack iron rust and that this action is intensified by the presence of alkali sulphates and calcium sulphate. It would appear that only the ferrous oxide constituent of the rust is dissolved, but the removal of this is sufficient to loosen the adherence of the rust to the iron. These results were obtained with an aqueous extract of Portland cement saturated with carbon dioxide. The author, however, rejects Rohland's theory on the ground that in concrete, the quantity of free calcium hydroxide present is nearly always so great that no general existence of bicarbonate is probable. The second theory, advanced by Dünkelberg, is to the effect that ammonia, which is normally absorbed by iron rust (see this J., 1911, 958), becomes oxidised in presence of lime and air to nitrous and nitric acids, which keep the iron clean. Whilst such an oxidation can indeed occur, the author rejects this hypothesis under practical conditions for the same reason, namely that any acid formed would be neutralised by the excess of lime before it could exert any solvent action on the rust. The third theory has been advanced by Michaëlis, and is founded on the acid function of ferric hydroxide in presence of strong bases, the latter author having prepared a tricalcium hydroferrite. The author has now shown that if a mixture of powdered iron rust and quicklime, or Portland cement be moistened with water and allowed to dry for some hours, the iron oxides are partially converted into a form in which they are more readily soluble in solvents such as dilute acetic acid or a solution of sugar in potassium hydroxide. Thus Michaëlis' hypothesis is by far the most acceptable of the three, being more in conformity with the practical facts than either of the others. It is possible, however, that with substances like cement and iron rust, both of which are of complex composition, other actions may simultaneously come into play.—J. F. B.

Utilisation of blast-furnace wastes or by-products. Hagar. *See* X.

Patents.

Artificial stone; Manufacture of ——. J. J. Fraser, Glasgow. Eng. Pat. 5079, March 1, 1911.

The claim is for the use of "coal sludge," the sedimentary deposit from coal washing, in conjunction with magnesium oxychloride cement and the filling materials commonly utilised, especially ground slag.—O. R.

Stone; Artificial ——. R. E. Brand, Casper, Wyoming, U.S.A. Eng. Pat. 11,509, May 12, 1911. Under Int. Conv., May 14, 1910.

The stone consists of hornblende, carbon and Portland cement. The carbon, preferably in the form of coal cinders, and the hornblende, are crushed to the size of sugar crystals, mixed with the cement and with water, and left for a day in a mould. The slab is left for one day in water, and for eighteen days in the air. Suitable proportions are 2 parts of cement, 2 parts of hornblende, and 1 part of carbon, and these are claimed together with method and materials.—A. T. L.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Blast-furnace wastes or by-products; Utilisation of ——. E. M. Hagar. Min. and Eng. World, July 15, 1911, 105—106.

An account of the present state of progress in utilising slag, furnace gases, and flue-dust in American practice. The production of Portland cement in the United States has increased from under 1 million barrels in 1895 to over

8 millions in 1900 and over 73 millions in 1910; and this includes "Universal Portland cement," *i.e.*, cement made from blast-furnace slag, in the years from 1900, when the production was 32,000 barrels, to 1910, when it was 7 millions, or nearly 10 per cent. of the total production. The new plants approaching completion will bring the production of slag cement up to above one-eighth of the whole Portland cement production, or over 2 million tons. The Lake Superior iron ores are very constant in their composition, and the resulting slag is therefore very uniform; hence it presents a great advantage, as a raw material for cement manufacture, over natural clays, the composition of which is very variable. The slag is granulated by water, dried, ground, mixed with the proper proportion of limestone, ground again and burnt in rotary kilns, which are now made 140—150 feet long and 8—10 feet in diameter.

The iron ore in the flue-dust of the American furnaces amounts to about 3 per cent. of the total ore charged, or about $1\frac{1}{4}$ million tons per annum. This is now passed through a rotary kiln, when the coke-dust is burnt off, and the ore agglomerated into nodules, containing about 60 per cent. of metallic iron, and forming a more valuable material for the blast furnace than any natural ore. In the treatment of the dust endless chains carrying scrapers pass forward through the kiln to prevent the sintered material from adhering to the lining, and are cooled in water on their return outside the kiln. A modern blast furnace will provide sufficient gas to drive its own blowing engines and furnish besides, through the medium of gas engines driving electric generators, 700 kilowatts. —J. T. D.

Iron and steel castings; Vanadium in ——. G. L. Morris. Amer. Foundrymen's Assoc., 1911, July, 479—488.

The addition of 0·1 per cent. of vanadium to cast-irons is claimed to increase their strength by from 10 to 25 per cent. depending on the initial strength of the iron. It is suggested that this is due to its intensifying effect on the silicon and manganese, and also to its combination with the carbon. It appears to produce a more even distribution of the graphite, and in the case of chilled castings a deeper, stronger, and tougher chill. Instances are quoted of its use in the production of locomotive cylinders, piston rings, and cylinder and valve bushings with satisfactory results. The effect of the vanadium on steel castings is stated to increase their elastic limit by about thirty per cent., and to give a fifty per cent. greater power of withstanding alternating stresses.—A. H. C.

Iron and vanadium; Simultaneous volumetric determination of ——. E. Müller and O. Diefenthäler. Z. anorg. Chem., 1911, **71**, 243—249.

The method depends on the reduction of vanadic acid to a vanadyl salt by means of alcohol and hydrochloric acid (which does not reduce ferric salts) and subsequent titration with permanganate, iron being determined iodometrically or by a second titration with permanganate after complete reduction with sulphur dioxide. The analysis of ferrovanadium, for example, is carried out as follows:—About 1 grm. of the powdered alloy is dissolved in concentrated nitric acid, the solution is evaporated with strong hydrochloric acid, a further 20 c.c. of hydrochloric acid and 50 c.c. of alcohol are added, and the mixture, after being gently boiled, is evaporated on the water-bath to about 5 c.c. It is then diluted to a measured volume, and a portion is titrated with $N/10$ permanganate (in the presence of manganous sulphate), the iron being finally determined by either of the methods given above. The analysis may be somewhat accelerated by using a solution of hydrogen chloride gas in alcohol for the reduction. —F. Sodn.

Nickel steels; Variations of —— caused by prolonged heating or by the action of time. C. E. Guillaume. Comptes rend., 1911, **153**, 156—160.

A continuation of the author's previous researches (see this J., 1897, 614; 1898, 355, 850; 1899, 768; 1903, 300, 422, 868, 911). Comparison of measurements made during a period of about 12 years, of nickel steel bars (containing 35—36 per cent. of nickel) which were simply allowed to cool in the air from forging at a red heat and then kept almost constantly at a temperature below 20° C., and of similar bars re-heated to 150° C., and then gradually cooled during 50 days to 40° C., shows markedly reduced variations in the latter. Similar results were obtained with tempered or drawn bars and with wires, kept at the laboratory temperature, after a stoving from 100° C. to 25° C.; also with alloys containing 44 and 56 per cent. of nickel. On the other hand prolonged keeping of the alloys at tropical temperatures appears to continue the effect of the former heatings and is found to increase the variations. The results of the author's experiments show: (1), the necessity of stoving (as above) most of the nickel steels used for the construction of instruments of precision, etc.; (2) the possibility of calculating (by extrapolation) during several years, the length of a standard kept within certain limits of temperature; (3) the necessity of determining anew the value of a standard subjected to the prolonged action of abnormal temperatures. An alloy containing about 42 per cent. of nickel is used for standards of length, on account of its stability and its slight oxidisability, together with a low coefficient of expansion (appreciably less than that of platinum).—A. Sbld.

Nickel steels; Cementation of ——. I. F. Giolitti and F. Carnevali. Atti della R. Accad. di Torino, 1911, **46**. Chem. Zentr., 1911, 2, 308—309.

The experiments on the cementation of ordinary steel (see this J., 1908, 1154; 1909, 205; 1910, 430) have been extended to a series of nickel steels containing from 2 to 30 per cent. of nickel and also silicon and manganese and traces of phosphorus and sulphur. Ethylene and carbon monoxide were used as carburising agents at 950° and 1050° C. With regard to the formation of eutectic, hypereutectic, and hypoeutectic layers in the carburised metal, nickel steels behave qualitatively in the same way as carbon steels, but not quantitatively. In the nickel steels the variation in the carbon content of the different layers is much more regular. With increasing nickel content, especially above 5 per cent., the maximum carbon content of the carburised zone diminishes. The eutectic zone of steels containing 2—5 per cent. of nickel contains 0·6—0·65 per cent. of carbon as compared with 0·9 per cent. in carbon steels. Two photographs are given in the original showing the influence of the carburising agent on the microstructure of the metal; it is stated that with carbon monoxide the steel consists essentially of pearlite, whilst with ethylene it consists of martensite.—A. S.

Nickel steels; Cementation of ——. II. F. Giolitti and G. Tavanti. Rass. Mineraria, Metall. e Chim., 1911, **34**. Chem. Zentr., 1911, 2, 309. (See preceding abstract.)

Further experiments were made with nickel steels containing from 20 to 50 per cent. of nickel at temperatures of 1000° C., 1050° and 1100° C. With respect to velocity of cementation the best results were obtained with carbon monoxide in presence of wood charcoal; the specific action of the carbon monoxide preponderated over that of the charcoal.—A. S.

Chromium steels; Cementation of ——. F. Giolitti and F. Carnevali. Atti della R. Accad. di Torino, 1911. **46**. Chem. Zentr., 1911, 2, 310.

Experiments were made with a 2·3 per cent. chromium steel in the same way as with nickel steels (see preceding abstracts). In microphotographs of the carburised steel the carbide structure was plainly visible. The results with the chromium steel using carbon monoxide, ethylene, and carbon monoxide, or dioxide, and charcoal, as carburising agents, were similar to those previously obtained with carbon steels, the only notable difference being that the hypereutectic zone appeared much more rapidly in the former than in the latter when carbon dioxide and charcoal was used as carburising agent at 1000° and 1100° C. The presence of chromium causes an increase in the maximum carbon concentration of the carburised zone. —A. S.

Copper ; Extraction of gases from —— by chemical reaction. and the determination of oxygen. M. Guichard. Comptes rend., 1911, **153**, 272—275.

The amount of gas contained in copper has been determined by measuring the volume of gas evolved when the metal is made to combine with other elements. Experiments with iodine and oxygen respectively show that commercial copper may contain sufficient dissolved gas to affect a determination of oxygen made with the metal, by several thousandths. The error may, however, be reduced to some ten-thousandths by employing wire (0·1 mm. at most) which has been heated for a long time in a vacuum at 600° C.—F. Sodn.

Vanadium in New Mexico. P. A. Larsh. Eng. and Min. J., 1911, **91**, 1248.

The presence of vanadium in the dumps and mines of the old Georgetown silver-mining district of Grant County, N.M., has recently attracted attention. From the fines contained in the dumps a concentrate is being obtained by jigging which contains 7·5 per cent. of vanadium, 40 per cent. of lead, and 317·6 oz. of silver per ton.—R. W. N.

Silico-metallic alloys ; Researches on some ——. R. Frilley. Rev. de Metallurgie. 1911, **8**, 457—554.

Owing to the difficulty attending the decomposition and chemical examination of these compounds, physico-chemical methods were employed. and the application of these. consisting chiefly in the examination of the density and the molecular volume, constitutes the most original portion of this work. Reference is made to a small amount of work previously done in this direction by Guillet and others. Many compounds were examined, and the results are given in the form of diagrams. accompanying the theoretical deductions. Inflections in the density curves denote definite compounds. The results of the examination of the silicon alloys were as follows : Manganese : the existence of $SiMn_2$, SiMn, Si_2Mn, and $SiMn_5$ was shown, and that of Si_2Mn_3 was disproved. Chromium : the compounds $SiCr_2$, Si_2Cr, Si_2Cr_3. $SiCr_3$, SiCr. and Si_3Cr_2 were detected. Nickel : of the usually admitted six compounds, only $SiNi_2$, SiNi, and Si_2Ni_3, were indicated on the curve representing the densities of the alloys. Iron : Fe_2Si, FeSi, $FeSi_2$. Fe_2Si_3, Fe_3Si_2, and Fe_3Si_4. were indicated. Tungsten : these alloys are difficult to prepare. Two definite compounds were found, Si_3W_2, and Si_3W, both of which had been found by other workers. Copper : although these are compounds in commercial use, the study of their composition is far from complete. The results obtained would tend to show the existence of a large number of definite compounds ; those previously detected were verified, and at the same time four new ones, Cu_5Si_3, Cu_3Si_2, CuSi, and $CuSi_4$, were found. Aluminium : there would appear to be only one definite compound : this requires for its formation a supplementary source of energy, and is therefore not found in fusion products, but only in electrolytic products containing less than 5 per cent. of silicon. With the metals of the alkaline earths, no very definite results could be obtained. owing to the great amount of impurities always present. The alloys studied in the above were prepared in the electric furnace. The author has applied the methods here used to the study of other series of compounds. such as copper-aluminium, copper-tin, and mercury-cadmium. in which latter group a series of compounds has been detected which has not been hitherto described. Amongst other accessory points, the author ascribes the decomposition of commercial ferro-silicon to the presence of small quantities of aluminium.
—R. W. N.

Arsenides of tin. N. Parravano and P. De Cesaris. Atti R. Accad. dei Lincei. Roma. 1911, [5], **20**. 1, 593—596. Chem. Zentr., 1911, 2, 350.

A thermal and micrographic study of tin-arsenic alloys showed that two compounds, SnAs and Sn_3As_2, are formed, the former being strongly dissociated in the melt. These two compounds form eutectic mixtures. No evidence could be obtained of the existence of the compounds, Sn_2As_3 (Descamps), Sn_3As_4 (Spring), and Sn_6As (Headden).
—A. S.

Silver-bearing ("Gouge") ores ; Assay of ——. C. R. Keyes and D. F. Riddell. Bulletin Amer. Inst. Mining Eng., 1911, July, [55], 559—568.

Experiments were carried out upon a rich silver ore in order to determine the effects of each of the fluxes ordinarily used in the crucible assay upon the silver yield, and to show what type of charge gives the best results on an ore which is high in copper and sulphur and at the same time a typical roasting ore. It is concluded : (1) That a dead roast is not so accurate as a run with a large excess of nitre. (2) An excess of borax causes low value determinations especially in the presence of sulphur, copper, and iron. (3) An excessively acid flux fuses with great difficulty and it is hard to handle the buttons, and when the ores contain matte-forming materials the value determinations are low. (4) A very basic flux is open to the same objections. In ores containing copper the loss is not so great but in zinc ores the results are too high. Neither method is practical. (5) Ores high in copper cannot be run by any crucible method without scorifying the lead buttons. (6) Direct scorification of copper-bearing ores does not give as high values as a combination of the crucible and scorification methods. (7) For ores containing much copper or zinc, a large excess of litharge in the charge greatly improves the buttons, decreasing the time and temperature of fusion with very close actual valuations for the silver content of the ore, and the method is quick, easy and accurate.—A. H. C.

Samples ; Preparation of assay ——. L. D. Huntoon. Eng. and Min. J., 1911, **91**, 1249.

With ores containing the values in brittle minerals. the rich ore is almost entirely separated from the poor portions if several passes are required in pulverising and the fine material is screened out after each pass. As it is extremely difficult to properly mix pulps varying largely in value, such a procedure often leads to discrepancies in the assay results. Screens should be avoided, the pulverising machinery being adjusted, wherever possible. to deliver a product of the desired degree of fineness, without oversize. The following weights are sufficient to ensure reliable samples : ½-in. ore, 50 lb. ; ¼-in., 25 lb. ; 10-mesh, 6 lb. ; 20-mesh, 3 lb. ; 40-mesh, 24 oz. ; and 60-mesh, 5 to 6 oz. Pulverising to 100-mesh assists the fusion, but is not necessary for accuracy of sampling. Experiments on Cripple Creek gold ores are quoted to bear out the statements.—R. W. N.

The gold industry and the cyanide process. Min. and Eng. World, Chicago. July 29, 1911. [T.R.]

In 1906 to 1910, for the first time. the world's gold output for a 5-year period exceeded 100.000.000 ozs. The following is the summary of gold production in modern times by 5-year periods :—

Period.	Fine ounces.
1906—1910	105,701,290
1901—1905	76,732,498
1896—1900	62,234,698
1891—1895	39,412,823
1886—1890	27,306,411
1881—1885	39,973,773
1876—1880	27,715,550
1871—1875	27,955,068
1866—1870	31,350,430
1861—1865	29,747,913
1856—1860	32,431,312

The total output from 1493 to 1890 amounted to 401,311,148 fine ounces.

For this expansion in the world's output of gold. the spread of the cyanide process is responsible. Nor is this largely due to the opening of new fields. It is the lower-grade properties, whose exploitation has been rendered possible by the cyanide process, which now furnish the bulk of the supply of gold, and upon which the world must depend for its future requirements.

The United States now yields about 26·5 per cent. of the world's gold output ; the Transvaal produces 35·3 per cent., and the rest of the British Dominions, 25 per cent. The remaining 15 per cent. comes chiefly from Russia, Mexico, India, South America, and China, in the order named.

Copper poisoning. C. A. Hansen. Metallurgical and Chemical Engineering, February, 1911. [T.R.]

The author states that 5000 lb. of electrolytic copper scrap —uncontaminated except for a small amount of admixed iron—were melted in a 3-phase arc furnace of the ordinary steel-furnace type, the experiment lasting some 5 hours. A few hours after pouring off all of the 10 men in the furnace building suffered inconvenience in breathing. For the 24 ensuing hours severe nausea was experienced in each case and a soreness throughout the entire system similar to that of acute *grippe*.

Since in all other respects the run resembled an ordinary steel run, the trouble is attributed to copper which was shown to be present in the furnace fumes. The temperature of the copper bath as a whole at no time exceeded 1300° C., so that probably the copper was volatilised only at points directly beneath the electrodes.

From the severity of the attack, coupled with the short time the men were exposed to the fumes, and that in a building which was well ventilated, the author is of opinion that very serious results might obtain under less favourable conditions.

In 5 years of continuous research work on a large scale with furnace processes which involved, among others, tellurium, tellurides, arsenic, arsenides, zinc and sulphite ores, the only physical inconvenience suffered has been an occasional carbon monoxide headache.

Tin mining in Bolivia. Bd. of Tr.J., Aug. 10, 1911. [T.R.]

The Bulletin Commercial (Brussels) of 5th August states that the tin mines of Bolivia have become important. Tin exists in great abundance in Bolivia, notwithstanding the fact that the mines have been worked during the last 300 years. The Pulacayo mines, for instance, which belong to the Huanchaca Company, have reached a depth of about 2250 feet, and the extent of their wealth cannot yet be estimated.

Cadmium in U.S.A. Min. and Eng. World, Chicago, July 22, 1911. [T.R.]

The Missouri Bureau of Labour states that until very recently nearly all cadmium used in America was imported from Germany. The discovery that the mineral exists in the Joplin blende, to the average extent of 0·358 per cent., caused the Cleveland Smelting Co. to draw some of its raw material from Missouri. The present demand for cadmium is, however, not great enough to consume all this state could furnish.

In 1908 the average worth per pound of cadmium was 84 cts., which then gave a short ton the value of $1680. A ton of Joplin zinc ore, worth $40, contains 7·16 lb. of cadmium, if all could be recovered without loss, and at the price per pound which prevailed in 1910 this quantity was worth $5·01. Its recovery does not impair the value of the zinc ore, probably, in fact, adding to it.

Patents.

Bessemer converters. G. J. Stock, Darlington. Eng. Pat. 11,869, May 13, 1910.

The converter is worked in conjunction with a furnace working continuously in which the materials to be refined are first melted. The waste heat from this furnace is recovered in an economiser built up of pipes, and is utilised to heat the air to be used in the furnace and converter. —A. H. C.

Steel castings; Process of hardening the face of ——. J. W. Gebhard, Joliet, Ill. U.S. Pat. 997,801, July 11, 1911.

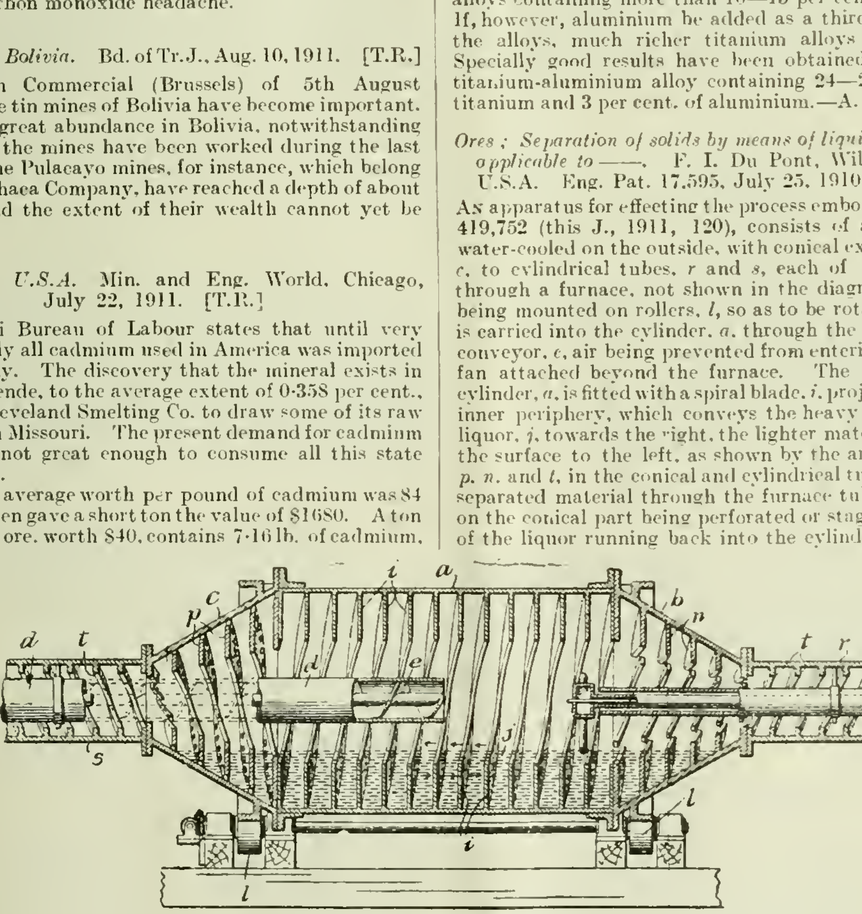
In the process of producing steel castings, what is claimed is that whilst the mould is made in any well known manner, a coating is applied to its face, consisting of some "finely ground high carbon mineral mixed with silica and oil" so as to form a paste, and then the mould is poured in the usual way. In another claim the treatment of portions of the face of the mould with a coating of the carbon product mixed with silica, oil, and aluminium, is specified, whilst a third alternative is, that the coating of the mould face "where desired is effected" with the carbon product, mixed with silica and a vegetable oil. The mould and coating are then dried, when the former may be filled with the molten steel.—B. M. V.

Titanium; Process for increasing the efficiency of —— in the form of ferro-titanium alloys for refining steel and cast iron. T. Goldschmidt. Ger. Pat. 235,461, Oct. 28, 1909.

In refining iron or steel by addition of ferro-titanium, it has not been found possible to obtain good results with alloys containing more than 10—15 per cent. of titanium. If, however, aluminium be added as a third component to the alloys, much richer titanium alloys can be used. Specially good results have been obtained with an iron-titanium-aluminium alloy containing 24—25 per cent. of titanium and 3 per cent. of aluminium.—A. S.

Ores; Separation of solids by means of liquids, particularly applicable to ——. F. I. Du Pont, Wilmington, Del., U.S.A. Eng. Pat. 17,595, July 25, 1910.

An apparatus for effecting the process embodied in Fr. Pat. 419,752 (this J., 1911, 120), consists of a cylinder, *a*, water-cooled on the outside, with conical extensions, *b* and *c*, to cylindrical tubes, *r* and *s*, each of which extends through a furnace, not shown in the diagram, the whole being mounted on rollers, *l*, so as to be rotated. The ore is carried into the cylinder, *a*, through the tube, *d*, by the conveyor, *e*, air being prevented from entering by a suction fan attached beyond the furnace. The interior of the cylinder, *a*, is fitted with a spiral blade, *i*, projecting from the inner periphery, which conveys the heavy material in the liquor, *j*, towards the right, the lighter material passing on the surface to the left, as shown by the arrows; spirals, *p*, *n*, and *t*, in the conical and cylindrical tubes convey the separated material through the furnace tubes, the spirals on the conical part being perforated or staggered to admit of the liquor running back into the cylinder. Means are provided for maintaining the liquid at constant level in the cylinder and for the removal of gases; any substances volatilised in the furnaces find their way back to the cylinder, where they are condensed.—B. G. McL.



Metals; Purification and alloying of —— and apparatus therefor. W. S. Simpson, London. Eng. Pat. 11,832, May 12, 1910.

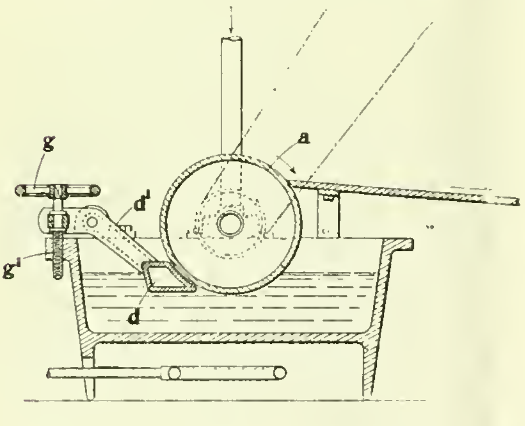
This apparatus consists of a metallic receptacle in which is a crucible, the intervening space being lined with magnesite. The top and bottom of the crucible are suitably connected with an electric circuit by means of which the crucible is heated and the contents melted. Fitting on the top of the metal receptacle is a lid capable of being hermetically sealed, and fitted with a rod for stirring the metal or for introducing another metal to form an alloy. The lid is also connected with a vacuum pump and has an air inlet. The fusion takes place *in vacuo* whereby oxidation of such metals as aluminium, magnesium, and calcium is obviated. The whole is mounted on trunnions to enable the contents of the crucible to be poured. —A. H. C.

Classifying or grading crushed ore; Methods of and apparatus for ——. G. H. Stanley, Johannesburg. Eng. Pat. 25,746, Nov. 5, 1910.

The "undersize" is forced through the screen only by the flow of liquid, while the "oversize" is removed directly from the face of the screen by gravity. To this end the screen is set vertically or inclined towards the stream of pulp. The screen may be shaken. Large pieces of wood, etc., may be allowed to flow over the top.—B. M. V.

Sheets or films of metals; Production of ——. W. G. Wagner, London. Eng. Pat. 17,115, July 19, 1910. Addition to Eng. Pat. 19,388, Aug. 23, 1909.

This patent has for its object the regulation of the thickness and condition of the surface of sheets produced by the process described in the chief patent. The sheet is formed by the roller, *a*, which can be water-cooled, rotating in the bath of molten metal. A former, *d*, carried by hollow arms, d^1, can be lowered or raised by the screwed spindle, g^1, and the hand wheel, *g*, thereby determining the thickness of the sheet of metal. The surface of the former can be shaped in any way so as to secure any particular appearance of the sheet, and the temperature of the former itself can be controlled by either internal gas jets, or water, according to the nature of the metal.—A. H. C.



Antimony: Extraction of —— from ores containing it. M. Ruthenburg, London. Eng. Pat. 28,030, Dec. 2, 1910.

This process consists of circulating the sodium sulphide solution or electrolyte through the leaching tank containing stibnite and through the electrolytic vessel by means of carbon dioxide under pressure. Hydrogen sulphide and sodium carbonate are produced. Caustic lime in regulated amount is added to the contents of the leaching tank, thus producing sodium hydroxide. The calcium carbonate is recovered and converted into lime. By regulating the amount of carbon dioxide, the anode can be kept clear from a film of sulphur.—A. H. C.

Concentrating-amalgamators. R. Luckenbach, Colwyn, Pa. U.S.A. Eng. Pat. 2963, Feb. 6, 1911.

The ore-pulp and a mixture of potassium cyanide and caustic soda is fed into one end of a covered oblong trough containing mercury. Within the trough rotates a spiral fitted with teeth, to stir and move forward the pulp. The end of the trough is partly closed by an inclined hump, over which the now barren pulp is lifted by a plain spiral. The amalgam may be discharged at intervals through a cock immediately in front of the hump.—B. M. V.

Steam generated by pouring molten slag into water; Purifying ——. Bell Bros., Ltd., and W. L. Johnson, Middlesbrough. Eng. Pat. 7518, March 25, 1911.

The molten slag is run into water containing milk of lime which absorbs the greater part of the sulphurous acid. The steam passes into a tower, where it meets a stream of hot caustic soda which is returned by means of a pump through a coil of pipes in a tank to the container at the top of the tower. The steam after leaving the top of the tower mixes with a small quantity of ammonia which neutralises the remainder of the sulphurous acid.—A. H. C.

Zinc; Electrolytic refining of ——. K. Namekawa, J. Miyazawa, K. Miyabara, and S. Emura, Tokyo, Japan. U.S. Pat. 998,379, July 18, 1911.

The zinc is deposited from a zinc sulphate solution on a suitable cathode and in order to increase the conductivity a current is passed from the solution to the lead anode at intervals, by which means the lead sulphate is converted into lead oxide which can easily be removed from the surface of the anode. The zinc is obtained as a coherent deposit by adding to the electrolyte a compound of vegetable origin which has been heated almost to the point of carbonisation, and thick deposits are obtained by using a number of cathodes and lead anodes in a similar manner. —A. H. C.

Ferroso-ferric oxide; Process of preparing and utilisation of pure ——. T. Goldschmidt. Fr. Pat. 425,482, Jan. 14, 1911. Under Int. Conv., Nov. 4, 1910.

Iron scale formed in the working of iron and steel, is calcined in an oxidising furnace, screened, and separated magnetically from admixed sand or other impurities. A yield of 60—80 per cent., and even more, of pure Fe_3O_4 may thus be obtained in the form of fine plates or scales, which can be advantageously used in alumino-thermic mixtures.—O. R.

XI.—ELECTRO-CHEMISTRY.

Lead accumulator plates; Rapid formation of —— in solutions of sulphuric acid and a chlorate or perchlorate. G. Schleicher. Z. Elektrochem., 1911, 17, 554—569.

The author has investigated the formation of smooth lead plates in solutions of varying concentration of sulphuric acid and sodium perchlorate or potassium chlorate, with varying current densities. The results of his analysis enable him to advance theoretical arguments to explain the texture and capacity of the plates, depending mainly on the circumstances under which the lead sulphate is deposited, after its formation from the $Pb^{\cdot\cdot}$ ions which are given off from the lead plate. Generally speaking, with a high concentration of sulphuric acid, in the absence of any salt whose anion gives a soluble lead salt, the precipitation is made quickly close to the plate, and therefore a dense and non-porous deposit results. On increasing the ratio of chlorate or perchlorate ion to sulphate ion, unless the latter is very large, the precipitation takes place further from the anode and produces a more porous deposit; with too great a concentration of chlorate or perchlorate, the deposit becomes quite non-adherent. The porosity of the deposit influences greatly the local current density and the conditions for the formation of lead peroxide. In general the authors' results confirm those of Just and others (this J., 1909, 1317) and of Le Blanc and Bindschedler (this J., 1902, 776). The former workers, using a suitable electrolyte of potassium nitrate and sulphuric acid, were able to obtain more rapid rise of capacity than with sulphuric acid alone. According to the present author chlorate and perchlorate may be substituted for nitrate with the same effect, the perchlorate being actually superior to the other two on account of the superior cathodic stability of the perchlorate ion.—W. H. P.

Electrical resistance materials with variable temperature-coefficients. H. Körber. Z. angew. Chem., 1911, **24**, 1402—1405.

The author refers to a certain type of electrical resistance material employed for various heating purposes. According to this process, nickel, quartz, china clay and certain fluxes are fused together and then compressed by hydraulic machinery into plates or rods. At the places where the brass terminals are clamped on, an extra proportion of powdered nickel is incorporated with the mass. These resistances when new give a strong steady heat, but owing to the oxidation of the nickel, after a relatively short time, they either fail in efficiency or fuse. The portions near the terminals are particularly liable to get too hot, become oxidised and finally to fuse. The author attributes the failure of these resistances entirely to the use of a base metal, and has successfully evolved a substitute by employing a non-oxidisable metal, namely silver. Any noble metal in the form of powder is mixed with a fluid silicate (water-glass) with the addition of a manganese compound and metallic aluminium; the mixture is fired in a crucible at a temperature of about 1000° C. The product is freed from any particles of unoxidised aluminium, mixed with a binding material to a plastic mass and pressed into moulds. For a resistance with a negative temperature-coefficient the mixture may consist of 7—8 parts of silver, 8—10 parts of water-glass, 4 parts of manganese peroxide and 0·5 part of aluminium. For a resistance with a positive temperature-coefficient there may be employed 10 parts of silver, 0·2—0·5 part of manganese peroxide, 10 parts of water-glass and 1—2 parts of aluminium. The proportion of manganese compound employed specifically determines the nature of the temperature-coefficient of the product. The aluminium, or alternatively magnesium, component of the mixture is necessary for the uniform distribution of the silver; it becomes oxidised during firing and the proportion of aluminium oxide determines the specific resistance of the product. In moulding the resistances, the parts intended to receive the terminals are composed of the resistance material mixed with free powdered silver, and silver wires are embedded in this layer. The chemical process which takes place in the firing is not accompanied by fusion; the product is a pale brown powder and is regarded as a kind of metal-glass. The resistances have a high current capacity: a rod of 100 mm. length and 3—4 mm. square section will carry 2 ampères.—J. F. B.

Electrolytic production of bleaching liquors. Foerster. *See* VII.

Patent.

Magnetite electrodes; Process for the production of ——. Chem. Fabr. Buckau. Ger. Pat. 235,307, July 23, 1910.

A hollow or trough-shaped piece of iron is subjected on its inner side to the action of steam at a high temperature. It is stated that by proceeding in this manner, the oxidation of the iron is propagated in an essentially radial direction, whereby the particles produce such a pressure one upon the other that a dense, non-porous coating of magnetic oxide is obtained specially suitable for electrodes.—A. S.

XII.—FATS; OILS; WAXES.

Fat; Formation of —— *in oleaginous fruits (olives).* F. Scurti and G. Tommasi. Ann. R. Staz. Chim.-Agrar. Sperim. di Roma, 1910, II., 4, 253—286.

Fruit, leaves, and wood were collected from olive trees at intervals of 15 days from Aug. 3 to Nov. 5, 1909, and analysed. The results of the investigation show that the formation of oil in the mesocarp of the olive differs substantially from the formation of fat in oleaginous seeds and in woody plants, in which latter cases it is generally accepted that fats are formed from carbohydrates, and act as reserve food substances. In the olive, on the contrary, no evidence could be obtained of the presence of notable quantities of carbohydrates, and the oil must be regarded as a waste product. From immature olives the authors isolated a waxy alcohol, identical with the oleanol, $C_{31}H_{50}O_3$, first discovered in olive leaves by Canzoneri (this J., 1906, 1159) and obtained in a pure state by Power and Tutin (this J., 1908, 640). This alcohol is elaborated in the leaves and thence passes into the fruit; in the first stage of development of the latter, it forms almost the whole of the fatty matter (ether extract) present therein. As the ripening of the fruit progresses, the proportion of oleanol diminishes, with corresponding increase in the content first of fatty acids and later of glycerides. It is concluded that after the development of the fruit, marked by a rapid increase of volume and weight, and active formation of cellulose, proteins, pentosans, etc., the period of oil production follows, characterised by three distinct phases, namely: (1) influx of waxy matter (oleanol), (2) formation of fatty acids, (3) formation of glycerides. —A. S.

Oil of Cornus sanguinea, L. [Cornel oil] and its detection in olive oil. S. Grimaldi. Staz. sperim. agrar. ital., 1911, **44**, 291—300. Chem. Zentr., 1911, **2**, 397.

Cornel oil is a yellowish brown oil of pleasant odour, soluble in hot but insoluble in cold alcohol: sp. gr. 0·921—0·9225 at 15° C.; Butyro-refractometer reading, 62°—63° at 25° C.; "thermal value" (Tortelli), 53°—54°; iodine value of oil, 100—101, of fatty acids, 102·5—103; saponification value of oil, 192—192·5, of fatty acids, 195—195·5; solidif. pt. of fatty acids, 29°—31° C.; m. pt. of fatty acids, 34°—37° C.; unsaponifiable matter, 0·2 per cent.; the oil begins to solidify at 0° C. and becomes completely solid at −12° to −15° C. For detecting the oil in olive oil, 5 c.c. of the sample are carefully warmed with 1 c.c. of a 1 per cent. solution of agar-agar in nitric acid of sp. gr. 1·4, and after a few minutes the mixture is cooled. If cornel oil be present, the oily layer is yellowish red and the acid layer straw yellow.—A. S.

Soya bean oil; Composition of ——. S. Keimatsu. Chem.-Zeit., 1911, **35**, 839—840.

The sample of oil examined contained about 12 per cent. of saturated fatty acids, mainly stearic and palmitic acids, and about 80 per cent. of unsaturated fatty acids, about half of which consisted of an acid isomeric with linolic acid yielding a hydroxy acid of m. pt. 158° to 159° C. Ordinary linolic acid (yielding a sativic acid of m. pt. 173°—175° C.) and oleic acid were also present, together constituting about 15 per cent. of the unsaturated acids. The oil contained 0·2 per cent. of phytosterol, in which no stigmasterol could be detected.—C. A. M.

Fatty oils from umbelliferous plants. C. Grimme. Pharm. Zentralh., 1911, **52**, 661—667. Chem. Zentr., 1911, **2**, 368—369.

The oils were obtained by extracting the seeds of the plants with ether, and after evaporating off the solvent were dried in a current of carbon dioxide. (1) Caraway seed (*Carum Carvi*, L.) oil: yield 14·8 per cent. The greenish brown oil had a strong aromatic odour and taste. (2) Parsley seed (*Petroselinum sativum*, Hoffm.) oil: yield 16·7 per cent. A reddish brown oil of characteristic odour and taste. (3) Celery seed (*Apium graveolens*, L.), oil: yield 16·7 per cent. A greenish brown oil of aromatic odour and taste. (4) Anise seed (*Pimpinella Anisum*, L.) oil: yield 10·4 per cent. A greenish brown oil with characteristic odour and a sweet aromatic taste. (5) Fennel seed (*Foeniculum officinale*, All.) oil: yield 9·9 per cent. A dark green oil of characteristic odour and taste. (6) Dill seed (*Anethum graveolens*, L.) oil: yield 17·2 per cent. A dark green oil of harsh taste, yielding a deposit at the ordinary temperature. (7) Carrot seed (*Daucus carota*, L.) oil: yield 13·1 per cent. The greenish brown oil had an unpleasant odour and taste. (8) Cumin seed (*Cuminum cyminum*, L.) oil: yield 9·9 per cent. A greenish brown oil of unpleasant odour and taste. (9) Chervil seed (*Anthriscus cerefolium*, Hoffm.) oil: yield 13·2 per cent. A greenish brown oil of unpleasant taste. (10) Coriander seed (*Coriandrum sativum*, L.) oil: yield 18·8 per cent. A greenish brown oil of pleasant aromatic odour and taste. (11) Ajowan seed (*Ptychotis ajowan* D.C.) oil: yield 22·8 per cent. A greenish brown oil having a thymol-like odour and taste. The characters of the oils and of the fatty acids therefrom are shown in the following tables:—

form of a spray, or in other state of fine division, into an atmosphere of hydrogen. Thus the mixture of fat and palladium may be heated to about 160° C. in a jacketed chamber provided with a stirring device, and then forced through nozzles into a second chamber in which the temperature is maintained at about 100° C., and into which a current of hydrogen is passed. If still harder products are desired the process may be repeated, before separating the treated fat from the catalytic agent.—C.A.M.

Fats and fatty acids; Process for the reduction of unsaturated ——. Verein. Chem. Werke Akt.-Ges. Fr. Pat. 425,729, Feb. 8, 1911. Under Int. Conv., Aug. 5, 1910, and Jan. 26, 1911.

The industrial application of the reduction method of Paal and Roth (this J., 1908, 864; 1909, 611) is difficult, owing to the colloidal palladium used being converted into the inactive gelatinous form during the process, and also to the large volumes of liquid required. These difficulties are stated to be overcome by using as catalysers, metals or hydroxides of the platinum group precipitated by a wet process on inert substances. Among the inert substances mentioned are oxide and carbonate of magnesium, calcium carbonate, kieselguhr, wood meal, barium sulphate, talc, and charcoal. Metals such as magnesium, nickel, or cobalt may also be used as vehicles for the catalytic agent, the finely divided metal suspended in water being mixed with a solution of a small quantity of a palladium or platinum salt, whereby palladium or platinum is deposited on the particles of metal.—A. S.

Oil from:	Sp. gr.	Solidif.pt.	Refractive index.	Acid value.	Saponif. value.	Iodine value (Wijs).	Fatty acids.	Glycerol.	Unsapon. matter.
							per cent.	per cent.	per cent.
1	0·9268 (15°)	— 7°	1·4710 (35°)	2·9	178·3	128·5	91·06	9·51	2·74
2	0·9243 (15°)	— 14°	1·4778 (35°)	3·4	176·5	109·5	91·67	9·46	2·18
3	0·9236 (15°)	— 12°	1·4783 (35°)	1·8	178·1	94·8	93·00	9·63	0·79
4	0·9232 (15°)	— 3°	1·4738 (16°)	1·9	178·4	108·6	92·62	9·64	0·96
5	0·9304 (15°)	— 2°	1·4795 (35°)	2·8	181·2	99·0	89·82	9·75	3·68
6	0·9282 (25°)	— 2°	1·4795 (35°)	3·1	176·0	119·6	92·56	9·45	1·14
7	0·9296 (15°)	— 6°	1·4723 (30°)	2·1	179·4	105·1	92·00	9·69	1·53
8	0·9256 (15°)	— 8°	1·4720 (30°)	3·3	179·3	91·8	91·53	9·62	2·06
9	0·9265 (15°)	— 9°	1·4672 (35°)	1·0	183·1	110·2	91·92	9·95	1·45
10	0·9284 (15°)	— 4°	1·4704 (30°)	1·3	182·0	99·8	91·14	9·87	2·26
11	0·9267 (15°)	—2°	1·4710 (35°)	3·9	176·8	108·8	92·56	9·45	1·13

Fatty acids from:	M. pt.	Solidif. pt.	Refractive index at 35°.	Neutralisation number.	Iodine value (Wijs).	Mean molecular weight.
1	— 7°	— 8° to — 10°	1·4679	182·8	124·6	307·2
2	— 7° to — 8°	— 10°	1.4679	180·1	108·2	311·8
3	— 2°	— 4° to — 5°	1.4778	177·2	93·4	316·9
4	2° — 3°	0°	1·4704	179·0	110·0	313·7
	1° — 2°	0°	1·4710	180·5	98·8	311·1
6	5°	1° — 2°	1·4760	181·0	114·2	310·3
7	— 1° to — 2°	— 5°	1·4625	179·0	102·7	313·7
8	— 1°	— 4°	1·4748	181·6	90·1	309·3
9	4° — 6°	2°	1·4580	183·2	115·7	307·3
10	3° — 4°	1°	1·4593	179·6	98·6	312·6
11	4° — 5°	3°	1·4650	178·0	109·2	315·5

—A. S.

Seal oil for medicinal use. A. Wingard. Svensk. Farmaceut. Tidsskr., 1911, 10 and 11; Pharm. J., 1911, 231.

An investigation of the properties of seal oil showed that it is very similar to cod-liver oil, while possessing less taste and smell: and practical trials indicated that it was equally valuable as a nutrient. The solidifying point, specific gravity, and viscosity, the acid, saponification, ester, Hehner, Reichert-Meissl, and acetyl values, and the content of glycerol, phosphorus, and iodine are practically identical for the two oils, as well as the ratio between solid and liquid fatty acids. Small differences exist in regard to the Valenta figure, barium figure, and cholesterol content. The chief difference was found to be in the percentage of unsaturated fatty acids, of which seal oil contains a proportion than cod-liver oil, as shown by the refractive index, the iodine and bromine absorption values, the Maumené figure, and the "auto-oxidation."

Patents.

Oils, fats and the like; Treatment of ——. N. Testrup, London. Eng. Pat. 7726, Mar. 30, 1910.

Unsaturated fatty bodies, previously melted if required, are mixed with a suitable catalytic agent, such as finely divided palladium, and the mixture introduced in the

Preparing moulded articles of rubber substitute [*"Faktis," vulcanised oil*]. Ger. Pat. 235,596. *See* XIV.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Patents.

Liquids, particularly paints; Straining apparatus for ——. J. R. and H. N. Torrance, Bitton. Eng. Pat. 15,609, June 29, 1910.

The paint or other mixture is introduced into a straining container, which is subjected to an endwise vibratory motion, and is also rotated about a longitudinal axis during the process of straining; the container may, in addition, receive continual shocks from a jigging motion during the rotation. The endwise motion may be effected by causing the container to rotate with its longitudinal axis obliquely to the longitudinal axis about which it rotates, whilst the jigging motion may be produced by *e.g.* a ratchet wheel. The paint may be introduced into the straining vessel through openings in the hollow or partially hollow spindle.—C. A. M.

Distemper. E. J. Buckley, Stoke-upon-Trent. Eng. Pat. 19,380, Aug. 18, 1910.

Pitcher or other waste material from potteries is mixed with suitable ingredients. Thus 40 lb. of pitchers to $1\frac{1}{2}$ gallons of water may be ground with $4\frac{3}{4}$ lb. of colouring material, 6 lb. of gum arabic to 1 gallon of water, and 182 grms. (0·396 lb.) of ammonium bichromate.—H. E. P.

Printing ink and the like: Manufacture of ——. R. C. Child, London. Eng. Pat. 7722, March 30, 1910.

Liquid tar from coal, mineral oil, wood, peat, etc., is incorporated with finely ground anthracite coal, or pulverised shale or both, or with other pigment, to form a printing ink. Suitable proportions claimed are equal weights of tar of 1·156 sp. gr., containing about 40 per cent. of hard pitch, and of powdered anthracite coal. —C. A. M.

Linoleum, lincrusta, muraline, and the like; Process for the manufacture of ——. K. J. Polony. Ger. Pat. 235,258, Feb. 2, 1910.

Decorticated maize cobs or maize stalks or roots, after drying and grinding, are used instead of cork in the manufacture of linoleum, etc.—A. S.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Soft rubber and rubbered materials; Removal of smell of ——. M. Schnurpfeil. Gummi-Zeit., 1911, 25, 1691.

A tin about 2 cm. (4/5 inch) high is filled with animal charcoal, in which the rubber articles are buried. It is then kept for 4 to 8 hours in a room at 60°—70° C. The charcoal after it has been used can be revivified by ignition. Materials proofed with rubber are best rendered odourless by air heated to 70°—75° C. The use of ammonia cannot be recommended. Unburnt magnesia is useful.—H. E. P.

Isoprene from terpene hydrocarbons; Preparation of ——. H. Staudinger and H. W. Klever. Ber., 1911, **44**, 2212—2215.

A good yield of almost pure isoprene is obtained by heating the diluted vapours of limonene or dipentene to a high temperature. The dilution can be brought about either by mixing the vapours with an indifferent gas, such as nitrogen or, better, by carrying out the operation under reduced pressure. In the laboratory this is best effected by means of an electrically heated platinum spiral. Under a pressure of 2—3 mm. a yield of about 60 per cent. of isoprene was obtained from dipentene. The product obtained was mixed with only small amounts of trimethylethylene, and other by-products were gaseous hydrocarbons and liquid hydrocarbons which boiled between 100° C. and 150° C. Very much poorer yields are obtained with the vapours of turpentine, and camphene and pinene give either no or very little isoprene. The process appears suitable for distinguishing between the terpinolenes and terpines on the one hand and dipentene and limonene on the other. By treating tetramethyldiketo*cyclo*butane in a similar manner pure dimethylketene is produced. —J. C. C.

Patents.

Rubber or gums; Extracting —— *from rubber vines, shrubs, bulbs or the like.* R. Bridge, Castleton. Eng. Pat. 16,407, July 9, 1910.

After crushing between rollers or flat plates the separated woody matter is removed by a current of air. The material is then passed in a wet state between rollers. The rollers may have plain, fluted or grooved peripheries, arranged to give a plurality of nips. One of the plates may be reciprocable. A perforated grid may be used, with or without an endless conveyor device to pass the material through the rollers again. During crushing and rolling a shower of hot or cold water or steam may be applied. —H. E. P.

Rubber substitute [*"Faktis," vulcanised oil*]; *Preparation of moulded articles of* ——. Alexander and Posnansky. Ger. Pat. 235,594, Nov. 24, 1908.

By carrying out the vulcanisation of oils in two distinct stages the product can be worked up in a similar manner to rubber. The oil is treated with sulphur or sulphur chloride in the usual way, but when the reaction has proceeded to the production of a more or less viscous mass, it is stopped by cooling the mixture. A similar result may be attained by using a quantity of sulphur or sulphur chloride insufficient for complete vulcanisation. The product thus obtained can be worked up in the same way as raw rubber by kneading, rolling, etc., and mixed with other substances (where necessary also with a further quantity of sulphur or sulphur chloride) and moulded into different forms. The vulcanisation of the oil is then completed in the usual way.—A. S.

XV.—LEATHER; BONE; HORN; GLUE.

Liming hides for sole leather. J. Terrell. Leather, 1911, 3, 570—571.

The three-pit system of liming, now so common for sole leather, is described. The hides are given nine days altogether, three days in a lime which has been used for two previous packs, three days in a lime which has been used for one pack, and three days in a freshly made lime. By this method regular results are obtained. The actions which take place in the process are divided into two classes: (1) bacteriological, and (2) chemical. In the first pit the bacterial action is to soften the epidermic structure and so render easy the removal of the hair. The chemical action is largely confined to the second and third pits, and consists in swelling the fibres, saponifying the fatty matters, and dissolving some of the interfibrillar substances.—J. R. B.

Tanning instruction in America. Oil, Paint and Drug Rep., July 31st, 1911. [T.R.]

A plan has been formulated by the National Association of Tanners to bring about instruction in the art of tanning and finishing leather. The association has decided to co-operate with the Pratt Institute, Brooklyn. Two courses are offered—a trade course in tanning intended for men already engaged in the industry, and a technical course in tanning and leather chemistry, designated for graduate chemists who desire to specialise in this line.

Patents.

Gelatin; Process for the preparation of —— *from the solution obtained by extraction of glue-stuff ("Leimgut") with sulphurous acid at a low temperature.* E. Hauck. Ger. Pat. 234,859, Dec. 31, 1909.

A suitable salt (*e.g.*, aluminium sulphate, alum, or calcium acid phosphate) is added to the acid solution in order to precipitate impurities and the precipitate is washed until the washings are neutral. It is stated that by this method, gelatin of the finest quality can be obtained from ordinary bones.—A. S.

Artificial horn; Manufacture of —— *from casein.* A. Bartels, Harburg. Eng. Pat. 8318, April 3, 1911. Addition to Eng. Pat. 21,750, Sept. 19, 1910 (see Fr. Pat. 420,543 of 1910; this J., 1911, 376.)

The hardening agent is added to the casein and the mixture kneaded and pressed as described in the chief patent. —H. E. P.

XVI.—SOILS; FERTILISERS.

Nitrogenous fertilisers; Experiments on different ——. G. Ampola. Ann. R. Staz. Chim.-Agrar. Sperim. di Roma, 1910, II., 4, 73—115.

The investigation comprised laboratory experiments on the effects of mixing together different kinds of fertilisers and of exposing such mixtures to the air; and field tests with wheat, rye, and maize as to the value of the different fertilisers. The detailed results of the field trials are given in tables. With regard to nitrate compounds, calcium nitrate proved more effective than sodium nitrate, acting more quickly and giving higher yields of both grain and straw. In the case of the ammoniacal fertilisers, the results obtained with calcium cyanamide were always satisfactory, although the yields were slightly inferior to those obtained with ammonium sulphate.—A. S.

Active principles of seeds [beans]; Influence of fertilisers on ——. F. Scurti and G. Tommasi. Ann. R. Staz. Chim.-Agrar. Sperim. di Roma, 1910, II., 4, 302—311.

Conflicting statements have been made with respect to the toxicity of different kinds of beans (compare Dunstan and Henry, this J., 1903, 1255; Guignard, this J., 1909, 38) and it has been suggested by Comes (Atti del R. R. Istit. d'Incorag. di Napoli, 1909, 73) that the probable explanation is that under the influence of cultivation the amount of toxic principles in a plant diminishes. He states that if a plant which, in its wild state, possesses therapeutic value, be cultivated on manured and irrigated soil, then after some generations, the content of active principles will be so reduced, that the plant will be valueless for the purpose mentioned. In order to test this hypothesis, the authors examined the effect of applying different fertilisers to two varieties of *Phaseolus vulgaris* and of *Phaseolus multiflorus* respectively, grown in pots and in the field. In the seeds collected from the plants the total nitrogen and protein-nitrogen were determined and the non-protein-nitrogen, obtained by difference, was taken as a measure of the active principles (hydrocyanic acid) present. The results are given in tables and show that the application of fertilisers produces a reduction in the content of non-protein nitrogen in the seeds. This effect is especially marked with sodium nitrate, the non-protein nitrogen of the seeds being reduced to about one-third of that present in seeds from plants grown in unmanured soil.—A. S.

Cuscuta arvensis Beyr. and C. Trifolii Bab. [dodder]; Action of chemicals on the germinating power of ——. G. D'Ippolito. Staz. sperim. agrar. ital., 1911, 44, 301—308. Chem. Zentr., 1911, 2, 370.

The growth of dodder seeds on soils, sterilised and unsterilised, which had been treated with different substances, was studied. Ammonium nitrate, sodium carbonate, calcium cyanamide, and formalin killed the seeds, whilst potassium nitrate and carbonate almost entirely destroyed the germinating power; sodium nitrate, calcium nitrate, and manganese hydroxide were less effective, whilst manganese sulphate had no effect at all. For the destruction of dodder, treatment of the soil with a 2 per cent. solution of ammonium nitrate or a 1 per cent. solution of formalin, is recommended.—A. S.

Properties of aluminium nitride, and its practical utilisation. Kohn-Abrest. *See* VII.

Influence of enzymes on the respiration of higher plants. Lwow. *See* XVIII.

XVII.—SUGARS; STARCHES; GUMS.

Sugar solutions; Saturation ratios of ——, and their determination. H. Claassen. Deutsche Zuckerind., 1911, 36, 554—555.

It has been shown that Koydl's method of determining the crystal content (this J., 1910, 167) gives results indicating that in many raw sugars the adhering syrups have a purity of only 60°, or even less, *i.e.*, for one part of water only 1·54, 1·55, 1·70, 1·74 or 1·82 parts of sugar are dissolved; whereas in a pure saturated sugar solution for one part of water, at 0° C. 1·79, at 10° C. 1·90, and at 20° C. 2·04 parts of sugar are dissolved. It is generally agreed that these low values are to be attributed to the inaccuracy of Koydl's process. This is caused by a variety of errors, though principally by the precipitation of sugar by the wash-liquors.—J. P. O.

Starch; Velocity of saccharification of —— by acids. H. Van Laer. Bull. Soc. Chim. Belg., 1911, 25, 249—264.

The author's experiments prove that the course of the hydrolysis of starch solutions by dilute acids follows the law of a unimolecular reaction, provided the concentration of the starch does not exceed about 5·5 per cent. Beyond this concentration deviations in the direction of retardation are encountered. The hydrolysis was carried out in most cases by heating at 120° C. in an autoclave, the extent of saccharification being measured by the increase in cupric-reducing power. The rate of hydrolysis was found to be the same whether starch paste or soluble starch was employed, but the starch of maize was somewhat less rapidly saccharified than potato starch. Solutions of hydrochloric, sulphuric, oxalic and tartaric acids and monosodium phosphate of equivalent strengths, exhibited saccharifying powers in proportion to the concentration of hydrogen ions; in the case of monosodium phosphate saccharification was very slow. In comparative experiments with concentrations of sulphuric acid ranging from $N/400$ to $N/66·6$, the rate of hydrolysis of starch in dilute solutions was found to increase with the concentration of acid, but somewhat less rapidly. When the concentration of starch was very great, however (25 grms. of starch to 20 c.c. of acid), the rate of hydrolysis increased more rapidly than the concentration of acid. The author concludes that the laws of saccharification of starch by dilute acids do not differ essentially from those of the hydrolysis of sucrose by the same agents, whatever be the physical state of the starch employed.—J. H. L.

Cellulose and starch; Xanthogenic esters of ——. H. Ost, F. Westhoff and L. Gessner. Annalen, 1911, 382, 340—360.

The authors have prepared the xanthogenic ester of starch according to the method described in this J., 1907, 628, and have studied its properties comparatively with those of the corresponding cellulose compound (viscose). Starch does not react with carbon bisulphide when only one molecular proportion of sodium hydroxide is present per $C_6H_{10}O_5$; with two or more molecules, reaction takes place with concentrations of sodium hydroxide down to 3—4 per cent.; no reaction occurs with alkali of 50 per cent. concentration. Analyses of the product, purified by alcohol, left no doubt that one molecule of starch combines with 2 atoms of sulphur and 2 atoms of sodium, so that the formula of the freshly formed xanthogenate may be written $C_6H_8O_3(ONa)(OCSSNa)$. The same holds good for the cellulose xanthogenate. The analysis of these compounds is complicated by the fact that hydrolysis of the original ester sets in almost as soon as it is formed, so that even with the most rapid purification, the values for combined sulphur and sodium do not exactly correspond with the theoretical values. It is best to purify the gelatinous reaction-product by kneading it with slightly diluted alcohol direct, without first dissolving it in water. Hydrolysis of the ester takes place in two directions simultaneously; the sodium combined directly with the carbohydrate is split off more rapidly than the sodium-xanthic residue. This process of spontaneous hydrolysis has been termed "ripening." In the case of starch viscose, ripening is accompanied by a progressive decrease in viscosity owing to the depolymerising action of the excess of alkali on the carbohydrate: in the case of cellulose viscose there is an initial decrease of viscosity due to the same cause, but later this is overcome and the viscosity increases, owing to the splitting off of xanthic residues. The spontaneous hydrolysis of the starch ester takes place more slowly than that of the cellulose ester. The authors show that the cellulose regenerated from viscose, when dried at 120°—125° C., has the same composition as ordinary cellulose. Although it has more pronounced hygroscopic properties, the authors do not consider that the regenerated cellulose should be termed a "cellulose hydrate." Prolonged contact with sodium hydroxide has a disintegrating action on cellulose, and the product may perhaps be correctly termed a non-reducing "hydrocellulose," or a depolymerised cellulose. —J. F. B.

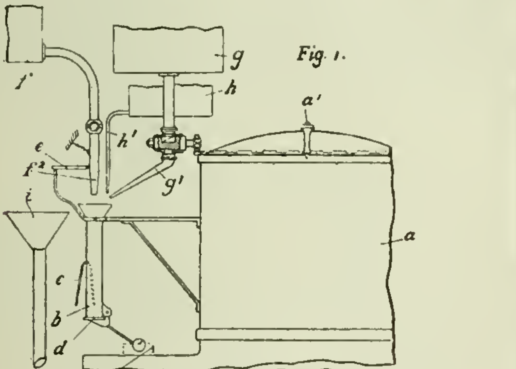
Patents.

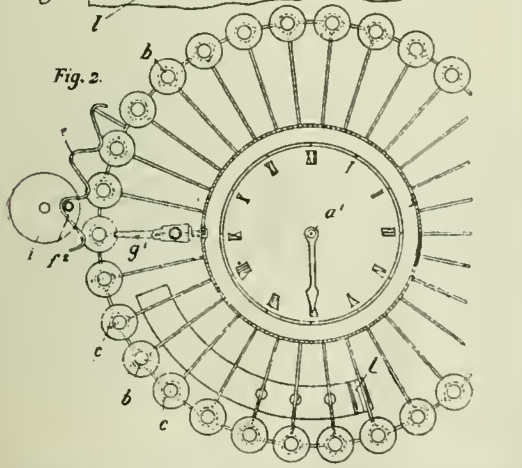
Sugar; Apparatus for dissolving —— and filtering the syrup [liquor] obtained. E. Bébien, Paris. Eng. Pat. 133, Jan. 3, 1911.

The apparatus comprises two cylindrical vessels, one fixed on top of the other with bolts. The upper cylinder, which serves for the reception of unrefined sugar and water, is provided with a removable, perforated bottom. A removable holder, having a perforated bottom, and containing the usual filtration material, is disposed in the upper part of the lower cylinder; this holder is fitted with a horizontal flange on which is placed a ring of rubber or other material, so that the joint between the two cylinders may be made air-tight. The lower cylinder, which receives the liquor, is provided with a cock near the bottom, whilst a perpendicular, exterior glass tube, communicating with the upper part of the lower cylinder, acts as an air-vent and shows when this cylinder is filled with liquor.—L. E.

Sugar in condensed water, etc.; Automatic device for the detection of ——. G. Dietz. Ger. Pat. 234,369, Feb. 16, 1910. Under Int. Conv., July 5, 1909.

The apparatus is shown in the accompanying figures and is intended for the detection of sugar by means of the colour reaction produced with sulphuric acid and a substance such as α-naphthol, thymol, etc. A frame carrying a number of test-glasses, *b*, rotates together with a clockwork system round the vertical axis, a'. As the whole rotates, each glass, *b*, passes in succession under the outlets, f^2, g', h', of the receptacles, *f*, *g*, *h*, containing respectively the water to be examined, sulphuric acid, and a reagent such as α-naphthol or thymol. The device, *e*, is for the purpose of holding the movable outlet, f^2, which normally discharges into the vessel, *i*, over the mouth of the glass, *b*, for a definite period. Each test-glass, *b*, has a siphon, *c*, for running off any excess of water. The test-glasses are emptied by the striking of the closing device, *d*, against a projection, *l*. The outlets of the receptacles, *g* and *h*, may be controlled by a single cock provided with two separate bores and operated by a system of toothed wheels worked by the shaft, a', or, as shown in the figure, only one of these outlets may be controlled in this way, the other, h', discharging continuously. —A. S.





Cane juice [sugar]; Method of treating ——. E. W. Deming, New York, Assignor to Deming Apparatus Co., New York. U.S. Pat. 997,605, July 11, 1911.

To separate suspended impurities from sugar juices in continuous flow, the juice is treated with lime, heated, and freed from the bulk of the resulting precipitate by gravity, the stream of partially clarified juice being treated with an acid precipitant for lime and finally freed from the residual suspended matters by gravity.—L. E.

XVIII.—FERMENTATION INDUSTRIES.

Malt; Influence of mechanical and thermal conditions on the moisture and extract determinations in ——. A. Wlokka. Z. angew. Chem., 1911. 24. 1405—1410.

The author has investigated the limits of variation in results due to small variations in the details of treatment in the determinations of moisture and extract in pale malts. In drying malt in the same oven for 3¾ hours at 104°—105° C., the average difference between duplicate determinations was 0·07 for grist and 0·05 per cent. for fine meal; the fine meal always gives off more moisture than grist, average 0·25 per cent. more, which exaggerates the differences in the extracts calculated on dry substance. Comparing the effect of drying for 2 hours as against 3¾ hours, the author found an average surplus for the longer time of 0·05 per cent. in grist and 0·08 per cent. in meal; meal requires rather longer to part with the whole of its moisture than grist, owing to its more compact consistence. Duplicate determinations carried out in two different ovens of the same size and pattern (Scholvien's) gave sufficiently concordant results, average difference 0·05 per cent., maximum 0·11 per cent.; Gartrell's gas-regulator is approved by the author. Drying at a temperature of 104°—105° C., as compared with 101°—102° C. for 3¾ hours, showed an average excess of 0·08 per cent., maximum 0·20 per cent. in favour of the higher temperature. The dimensions of the drying-glasses, influencing the thickness of the layer of malt during drying, have a very considerable influence on the result; in the same drying oven glasses 4·2 mm. wide gave higher results than glasses 3·5 mm. wide, the average difference being 0·18 per cent. with 2 hours' drying and 0·09 per cent. with 3¾ hours. The author makes the following recommendations: In trade analyses, in order to eliminate differences as far as possible, the same moisture determination should be employed in calculating the results of both grist and fine meal extract determinations. The time of drying should be 3 hours after insertion in an oven previously heated to 104°—105° C., and this temperature should be maintained for at least 2¾ hours during the determination. An agreement as to a uniform drying apparatus, as regards design, size, draught, etc., is urgently required. If the Scholvien apparatus is adopted a uniform size of drying glass should also be specified. If these conditions be adopted the limits of error should be reduced to 0·15—0·20 per cent. For the determination of extract, the author prefers a mashing apparatus in which each beaker is provided with a propeller stirring device; in such an apparatus the speed of the propeller may vary from 50 to 90 revs. per min. without affecting the results; but in the case of mashing beakers provided only with thermometer stirrers, clumps of starchy residues may remain if the speed is too slow, and the author recommends that 90 revs. per min. be fixed as the minimum speed for such stirrers in the analysis of fine meal.—J. F. B.

Plants; Influence of enzymes on the respiration of higher ——*[and on the fermenting power of zymase]*. S. Lwow. Bull. Acad. St. Petersbourg, 1911, 655—678. Chem. Zentr., 1911, 2, 370—371.

THE author examined the influence of diastase and emulsin on the fermenting power of commercial zymase preparations (Hefanol and Zymin) and on the respiration of higher plants (*Vicia Faba*). It was found that Taka-diastase at a certain concentration prevents the alcoholic fermentation of sucrose by Hefanol and Zymin. Merck's diastase, on the other hand, strengthens the action of the zymase. After being boiled, solutions of both kinds of diastase act in an opposite manner to the unboiled solutions. Similar results are obtained with dextrose, maltose, or starch instead of sucrose. Taka-diastase has a stimulating action on the respiration of *Vicia Faba*, especially on the living plants. Emulsin (boiled and unboiled) has a destructive action on zymase, but not on living higher plants.—A. S.

Phosphoric acid and its compounds; Importance of —— in brewing. A. Fernbach. Annales de la Brasserie et de la Distillerie, 1911, **14**, 217—221; Z. ges. Brauw., 1911, **34**, 359—362.

RECENT investigations have led to the conclusion that phosphorus is present in barley, not in inorganic combination, but as a constituent of a complex organic substance, phytin, which is probably an anhydro-hydroxymethylenediphosphoric acid. During germination this substance is decomposed by a specific enzyme, phytase, secreted by the embryo, and the phosphorus appears in the malt in the form of inorganic phosphates which pass into the wort. The respiration of the grain during malting is accompanied by oxidation of carbohydrates, in which process organic acids are formed as intermediate products, and these effect a partial transformation of neutral into acid phosphates. The influence of phosphates on the diastatic action during mashing is closely related to the acidity or alkalinity of the wort. The reaction most favourable to saccharification is that shown by primary phosphates (MH_2PO_4), *viz.*, neutrality to methyl orange, and it has been shown by Maquenne and Roux that under these conditions, at 50° C., a complete conversion of starch into maltose can be attained. Normal and secondary phosphates (M_3PO_4 and M_2HPO_4), which are alkaline to methyl orange, retard saccharification. The author has shown that malt-extract behaves towards indicators, as a mixture of primary and secondary phosphates; the greater the proportion of the former to the latter, during mashing, the greater will be the production of maltose. During fermentation the phosphates of the wort not only constitute a food essential for the multiplication of the yeast, but also play a leading part in zymase-action. The quantity of phosphates in brewery worts is much more than sufficient to allow of the maximum growth of yeast occurring in practice. It is probable that the form in which the surplus phosphates are present, is an important factor as regards the stability of the beer, acid phosphates acting more beneficially than the normal salts. The recent researches of Harden and Young have demonstrated the great importance of phosphoric acid for the fermentative action of zymase. The observation, made by Lange some years ago, that treatment of yeast with solutions of phosphates stimulates its activity, has led to the practice of washing yeast with phosphoric acid. The beneficial results obtained by this process are due partly to the bactericidal action which phosphoric acid, in common with other acids, exerts, and partly to a specific influence on the zymase.—J. H. L.

Wort and beer; Determination of acids in ——. E. Moufang. Woch. Brau., 1911, **28**, 329—331.

THE following conclusions are based on an experimental study of the determination of acidity in malt liquors:—The use of colourless phenolphthalein as indicator is preferable to the older Tüpfel method using red phenolphthalein; the acidity so measured is that due to free acids (including carbonic acid) and primary phosphates (MH_2PO_4). For the determination of free acids including also secondary phosphates (M_2HPO_4), the best indicator is a solution of dimethylaminoazobenzene. The alkali recommended for titration is $N/20$ barium hydroxide, delivered from a burette graduated in 1/100 c.c. To obtain liquids sufficiently light in colour for titrating, dark beers should be diluted to 1/10 and light beers to 1/5 of their original concentration, 25 c.c. of the diluted liquid being used for titration after a further dilution, if desirable, with 30—60 c.c. of water. The use of asbestos for clearing cloudy worts may lead to appreciable errors, owing either to alkali contained in the asbestos, or to removal of acid-albumins from the wort. Carbon dioxide may be completely removed from beers by boiling for three minutes. The loss of volatile acid during this operation is very slight if an air condenser is used, and no loss occurs with a water condenser. The limit of error, in titrating as described above, is about 5 parts in 200.—J. H. L.

Wines; Ferment causing bitterness ("amertume") of ——, *an agent of dehydration of glycerol.* E. Voisenet. Comptes rend., 1911, **153**, 363—365 (see also this J., 1910, 894, 1126).

THE organism responsible for the disease of bitterness in wine has been further studied by the author. It is very easy to cultivate in liquid media at 30° C. It forms small rods 4—5 µ long and 1 µ thick, generally isolated and mobile, but sometimes joined end to end in continuous or broken lines forming, in old cultures, filaments either isolated or in ramified bundles. On gelatin cultures it forms small colonies not producing liquefaction. It may be grown in mineral nutrient media containing fermentable matter. It ferments various sugars and polyhydric alcohols, especially glycerol, coagulates milk, and resists desiccation when heated to 100° C. in the dry state. In peptonised Laurent medium, containing 1 per cent. of glycerol, the growth of the bacillus is arrested by the following substances present in the quantities stated, per litre: alcohol 100 grms., cream of tartar 3·5 grms., tartaric acid 1·1 grm., formic acid 0·4 grm., acetic acid 1·2 grm., butyric acid 1 grm., lactic acid 1·6 grm., acrylic acid 1·4 grm., and sodium carbonate 1·5 grm. Acrolein, produced by the organism from glycerol, arrests growth when present to the extent of 0·15—0·20 grm. per litre, but even 1 grm. per litre is not sufficient to kill the bacillus. When the organism is grown in peptonised medium containing glycerol at 20° C., the presence of acrolein may be detected after 24 hours; the quantity then rises to a maximum of about 0·1 grm. per litre, and afterwards diminishes as the activity of the organism becomes paralysed by the products formed. In presence of 0·1—0·3 per cent. of glycerol, fermentation is arrested after 3—7 days, owing to lack of fermentable matter, for addition of more glycerol produces further activity. In presence of 1—2 per cent., on the other hand, fermentation is arrested owing to the acids produced, and can be made to proceed again by neutralising with chalk. The acrolein appears to be formed by the organism, by a direct process of dehydration of glycerol. There is no evidence for the formation of intermediate compounds, and the ordinary products of fermentation of glycerol (viz., butyric, lactic, and succinic acids, glycerose and dihydroxyacetone) are not converted into acrolein by the organism.—J. H. L.

Aliphatic terpene from oil of hops and its identity with myrcene. Semmler and Mayer. *See* XX.

Patents.

Carbon dioxide from fermentation backs, etc.; Apparatus for collecting —— and compressing the same. T. C. Palmer and W. J. Fraser and Co., London. Eng. Pat. 16,194, July 6, 1910.

The apparatus consists of a vessel, *e.g.*, a truncated cone having an inlet for the gas at the bottom narrow end which is in communication with the fermentation back. An outlet pipe connected with a pump enters the vessel at the side and extends inside towards the middle of the vessel. Between the lid at the top of the conical vessel and the body is clamped a flexible diaphragm, conveniently constructed of copper, the centre of which automatically rises and falls according to the pressure of the gas inside the vessel. The centre of this diaphragm is flexibly connected by a rod and ball-and-socket joint with a valve situated in the outlet pipe, so that when the diaphragm rises under the pressure of the gas, the valve is lifted and gas is withdrawn by the pump. The diaphragm is returned to its original position and the valve is closed by means of springs.—J. F. B.

Beer or ale; Method of treating ——. L. Wallerstein, New York. U.S. Pat. 997,873, July 11, 1911.

A proteolytic enzyme, in a state of activity, is extracted from yeast and added to beer or ale, the latter being subsequently bottled and pasteurised.—L. E.

XIXa.—FOODS.

Milk products; Some Asiatic ——. D. Hooper. J. Asiatic Soc. of Bengal, 1911, 7, 63—67.

Analyses are given of four substances; the first two are a kind of dried skim cheese prepared in North-Western India and Afghanistan, etc., and known as karut or kurut, the third product is obtained by acidifying hot milk and is known as chhana, whilst the fourth, dahi, is prepared by allowing buttermilk to ferment. Their composition was found to be as follows:—

	Karut. 1.	Karut. 2.	Chhana.	Dahi.
	per cent.	per cent.	per cent.	per cent.
Water	9·0	8·8	62·45	89·58
Fat	3·0	7·1	19·80	2·40
Casein..........	74·4	58·0	15·63	3·15
Sugar, etc.	7·0	8·7	0·37	3·70
Lactic acid	trace	1·4	0·50	0·57
Ash	6·6	16·0	1·25	0·60
	100·0	100·0	100·00	100·00

—W. P. S.

Yams; Composition of Indian ——. D. Hooper. J. Asiatic Soc. of Bengal, 1911, 7, 57—62.

Results are recorded of the analysis of 40 specimens of different species of yams (*Dioscorea*); the tubers contained from 70 to 85 per cent. of water and the figures given below are calculated on the dry substance. The samples contained from 70 to 82 per cent. of carbohydrates consisting mainly of starch, 7·20 to 15·93 per cent. of proteins, 0·56 to 1·52 per cent. of fat, 1·52 to 10·77 per cent. of crude fibre, and 3·31 to 9·65 per cent. of ash. The amounts of crude fibre and ash were much higher in the wild than in the cultivated varieties of the tubers. The average composition of the Indian yams was: Fat, 1·02, proteins, 10·87, carbohydrates, 77·01, crude fibre, 5·16, ash, 5·94 per cent. The samples were also examined for the purpose of detecting the presence of an alkaloid (dioscorine) known to be contained in certain of the species. It was generally found to be present in the wild tubers (*D. daemona, D. bulbifera, D. pentophylla,* and *D. alata*) but not in the cultivated tubers to any great extent. The alkaloid is removed by soaking the tubers in water. —W. P. S.

Teas; Valuation of ——. A. A. Besson. Chem.-Zeit., 1911, 34, 813—815, 830—832. (See also this J., 1897, 694; 1909, 285; 1910, 446.)

An examination of a large number of samples of tea showed the presence of stalks in widely varying proportions, China teas containing decidedly less, on an average, than those of India and Ceylon. The following percentages of stalk were found: Green China teas 0·4—5·3, Foochow teas 4·1—17·5, Hankow 8·6—17·1, Ceylon 5·8—43·4, Indian 11·5—37·4, Java 4·4—29·9. The stalks contain less caffeine, extractive and mineral matters than the leaves. It is, however, clearly shown that the proportion of stalks bears no relation to the value of the tea, many fine teas containing decidedly more than a number of inferior samples. Tables are given showing the percentage of stalk, moisture, mineral matter, and caffeine (in many cases), in 86 samples together with the wholesale prices. In the China teas, the percentages of caffeine vary from 2·13 to 3·64; in Ceylon teas from 2·80 to 4·10; in Indian teas from 3·31 to 4·15, and in Java teas from 2·22 to 4·54.—A. Sbld.

Influence of fertilisers on active principles of seeds [beans]. Scurti and Tommasi. *See* XVI.

Patents.

Grain of all kinds and wheat in particular; Process for improving and preserving ——. W. E. Lake, London. From Schneider, Jaquet und Co., Ges. m. b. H., Strassburg-Konigshofen, Germany. Eng. Pat. 7178, Mar. 22, 1911.

The grain is moistened and dried by aeration; immediately after the termination of this operation, the process of moistening and drying is repeated. Fermentation in the grain is thus prevented and the grain, and the flour milled from it, do not deteriorate when stored.—W. P. S.

Liquids, particularly milk; Process for sterilising —— [by ultra-violet rays]. A. G. Bloxam, London. From C. Ahrndsen, Frankfurt a/Main, Germany. Eng. Pat. 12,333, May 22, 1911.

The liquid, such as milk, is frozen into blocks or plates which are then exposed to the action of ultra-violet rays. As the blocks thaw, a thin film of liquid is formed which is sufficiently transparent to enable it to be sterilised thoroughly by the rays.—W. P. S.

Milk-powder; Manufacture of dry ——. H. V. and A. A. Dunham, Bainbridge, N.Y., Assignors to Casein Co. of America, New York. U.S. Pat. 997,976, July 18, 1911.

Milk is concentrated under reduced pressure at a temperature below 212° F., and is then completely dried by exposing it in the form of a thin film on the surface of a rotating drum which is heated considerably above 212° F., the period of contact being about six seconds.—W. P. S.

XIXb.—WATER PURIFICATION; SANITATION.

Sterilisation of drinking water by ultra-violet light. J. Courmont. Chem. Zeit., 1911, 35, 806.

The author discusses the remarkable sterilising power of the ultra-violet light from a quartz mercury vapour lamp. For sterilising water, which is comparatively transparent to the radiation, it is sufficient to place the lamp in the axis of a cylindrical vessel 60 cm. in diameter. Liquids containing colloids (wine, beer, peptone solution, etc.) absorb the ultra-violet rays rapidly, and therefore sterilisation is limited to the surface layer. It is therefore necessary that for greatest efficiency the water to be sterilised must be as clear as possible. The action of sterilisation is in no way connected with ozone or hydrogen peroxide formation.—W. H. P.

Aerated waters (eau de seltz); Action of —— on lead, tin, and antimony. A. Barillé. Comptes rend., 1911, **153**, 351—353.

The author found that seltzer water, after contact for six months with alloys of tin and lead used for making the tops of "siphons," contained the two metals in quantities corresponding to 0·09—0·11 grm. of lead sulphate and 0·031—0·038 grm. of stannic acid per litre. According to Moissan 0·002 grm. of lead per litre should be regarded as dangerous, and according to Meillère tin salts in aerated waters may have a toxic action. The rates at which the metals dissolve, doubtless depend on the composition of the alloy, but within six months, equilibrium is attained and the water then contains the quantities stated above, whether the lead-content of the alloy is 0·5 or 40 per cent. Less lead and tin are dissolved from plates of the pure metals than from alloys, solution in the latter case being probably assisted by electrolytic action. These results indicate that commercial tin, containing 0·5 per cent. of lead, is as dangerous as alloys containing much more. In Germany siphon-heads must not contain more than 1 per cent. of lead, but alloys of tin with 10 per cent. of antimony may be used. Antimony dissolves from such alloys however: in two months a seltzer water had dissolved 0·157 grm. of antimony oxide per litre. The author recommends that the interior surface of the metallic parts of siphons should be completely covered with a protective coating of glass or fine porcelain, or with a silicious glaze, which will not crack on long use. The central tube should always be of glass.—J. H. L.

Copper poisoning. C. A. Hansen. *See* X.

Patents.

Screening apparatus for the removal of solids from sewage and other liquids. S. H. Adams, Fulford, York. Eng. Pat. 18,985, Aug. 12, 1910.

The screen consists of continuous parallel bars inclined downwardly in the direction of flow of the liquid. The screen may be arranged in a chamber through which the liquid flows, the lower end of the screen terminating in a sump or pocket from which the screenings can be drawn off through a valve or similar outlet. Various methods of arranging the screen and sump are described; the sump may communicate with the discharge pipe for the screened liquid, baffle plates may be fitted in the channel or conduit through which this communication is effected, and a storm water overflow may be provided. The screen itself is either fixed or so arranged that its angle of inclination may be altered.—W. P. S.

Sewage sedimentation tanks. S. H. Adams, Fulford, York. Eng. Pat. 28,006, Dec. 2, 1910.

The sedimentation tank described has an inclined floor, at the lowermost part of which a valved outlet is provided. The floor is covered with perforated tiles through which the sludge or sediment can pass, the perforations being inclined towards the outlet. Plates or ridge-like tiles spaced apart may be used instead of the perforated tiles. The areas of the perforations are so proportioned to the bore of the outlet that the amount of liquid passing through the perforations is less than the amount which the outlet is capable of discharging, a scouring of the floor of the tank being thus ensured. An automatic flushing tank may be connected with the outlet or sludge pipe of the tank. —W. P. S.

Filter-stones; Methods of cleaning and sterilising ——. H. Jarvis, Buffalo, U.S.A. Eng. Pat. 29,814, Dec. 22, 1910. Under Int. Conv., Dec. 22, 1909.

The porous cylinder or filter-candle is immersed in boiling water and air is forced outwards through the walls of the cylinder, the interior hollow space of the cylinder being connected with a force-pump for this purpose. The action of the pump is then reversed and the hot water is drawn through the walls of the cylinder into the central space, and is then forced out again. Water is thus forced backwards and forwards through the walls of the cylinder a number of times, and, finally, the latter is removed from the tank of hot water and air is forced through the walls.—W. P. S.

Purifying air; Process of ——. A. K. Cross, Winthrop, Mass. U.S. Pat. 996,705, July 4, 1911.

Air is forced through water or other suitable liquid capable of giving off oxygen on electrolysis. The water or other liquid is electrolysed and the oxygen given off is mixed with the air. The hydrogen or other gas given off is prevented from mixing with the air and oxygen, and is collected separately.—W. H. C.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Cinchona-testing stations. Chem. and Drug., Aug. 12, 1911, **79**, 78.

A cinchona-testing station is to be opened shortly in connection with the Java Government cinchona-plantations, and the following rules governing its working are published in a recent number of the "Javasche Courant." The station will supply information regarding the cultivation of cinchona, the botany and chemistry of the crop, and entomology in its relation to cinchona. It will make analyses of bark at charges ranging from 5 to 7·5 florins (8s. 3d. to 12s. 5d.), depending on the amount of information asked for. The work of the station will be carried out by the staff of the cinchona-plantations, and correspondence should be addressed to the Government Testing Station, Tjinjiroewan. When an investigation requires that a Government officer shall travel, the extra cost involved will be charged to the inquirer. In managing the stations the Director of Agriculture will be advised by a small committee of three to five members, and one of these members will be nominated each year by the Director to look after the routine business of the station. The committee will meet at least twice a year, and issue a report in March of each year.

Cinchona disease. A. Rant. Chem. and Drugg., 1911, **79**, 182.

Corticium javanicum attacks the stems and branches of various dicotyledons, in particular cinchona, but also tea, coffee, cocoa, cinnamon, indigo, etc. It exists in four different forms, namely, as a light rose-coloured or white incrustation on the lower parts of branches, as small whitish lumps, as a web-like mycelium of mould threads and occasionally in small cracks in barks as the fruiting form of a mould, *Necator decretus*. This is reddish in the interior and becomes wax-like towards the exterior. *Necator* forms on the upper surfaces of the branches; it is comparatively seldom seen on cinchona. When cinchona is attacked the leaves gradually acquire autumn tints and finally die, often without falling off. Brownish spots appear on the branches suggesting that the fungus eats its way into the plant. Humidity and shade are two of the chief factors in promoting the growth of the disease: the former because the stomata open wider and the latter because shade increases the quantity of plant acids. It is important to avoid wet, cloudy and confined districts for cultivating plants liable to attack. *Cinchona succirubra*, which is more open growing, is less affected than *C. Ledgeriana* with its close habit of growth.—E. F. A.

Quinine alkaloids; Fluorescence phenomena in the group of ——. P. Rabe and O. Marschall. Annalen, 1911, **382**, 360—364.

The authors have studied the fluorescence of the alkaloids of the quinine group and their derivatives, using sunlight, the light of a mercury-vapour "Uviol" lamp and the filtered ultraviolet rays of an arc lamp. An examination of the alkaloids in the solid state by means of the ultraviolet rays showed that the connection between fluorescence and chemical constitution is a very close one, since the shade of the fluorescence varies even between pairs of stereoisomerides. The fluorescence was always found to be stronger with "Uviol" light than with sunlight. The quality and intensity of the fluorescence of solutions varies with the solvent, but the variations follow no regular lines. When alcoholic solutions are gradually diluted with water, in many cases an increased fluorescence is observed at first, subsequently it becomes weaker. Examined in sunlight in sulphuric acid solution, the four alkaloids show various shades and intensities of blue fluorescence, their hydrochlorides, however, show none at all; substituting groups have various effects, in many cases changing the colour of the fluorescence and sometimes suppressing it altogether. The salts of the alkaloids in aqueous solutions have different intensities of fluorescence according to the acids with which they are combined. For instance, 0·1 grm. of quinine in 20 c.c. of $N/10$ acid shows strong fluorescence with sulphuric, nitric, phosphoric, hydrofluoric and trichloracetic acids; moderate fluorescence with tartaric and acetic acids; weak fluorescence with hydriodic, hydrobromic and hydrochloric acids.—J. F. B.

Morphine in the preparation of tincture of opium; Supposed loss of ——. E. H. Farr and R. Wright. Brit. Pharm. Conf. Report, 1911, 1—2. Pharm. J., 1911, **87**, 158—160.

Using the official assay processes there is always a loss of opium in preparing the tinctures. This was proved by assaying the opium and then determining the morphine in the tincture and the marc. The average loss was 4·78 per cent. of the total. Changes were made by altering the volumes of the filtrates measured in the assay process, and in the extent of dilution of the mixture of the tincture liquors after admixture with lime. The loss was then reduced, on the whole, to 2·4 per cent. of the total. The loss is probably due to the occlusion of the alkaloid, making it practically impossible to completely extract it by water or alcohol.—F. Shdn.

Morphine in opium and opium preparations; Determination of ——. G. Frerichs and E. Mannheim. Apoth.-Zeit., 1911, **26**, 613—615.

In determining morphine by the process described in the German Pharmacopœia, 5th Ed., care should be taken to test the ethyl acetate with wet litmus. If the litmus is reddened after wetting, it can be purified by means of potassium carbonate and water, and dried with sodium sulphate. The shaking after the addition of the ammonia must last for 10 minutes and be vigorous. A specially constructed conical flask fitted with a stopper held in place by a clamp is very useful for this purpose. When the precipitated morphine has been collected on the filter, it is washed with water saturated with ethyl acetate. The filter is returned to the flask and the whole dried at 120° C. and weighed. In place of a funnel fitted with a filter paper, a porcelain Hirsch funnel can be used, the sieve being covered with two layers of strong filter paper.—F. Shdn.

Morphine in opium and its preparations; Determination of ——. M. Debourdeaux. J. Pharm. Chim., 1911, **4**, 13—18, 65—69, 105—112.

The author has shown previously (this J., 1910, 1225) that a variable portion of the morphine in opium cannot be extracted by water alone. In the present paper a comparison of the methods of determination of morphine prescribed in the German, Belgian, Swiss, United States, English and French pharmacopœias is made, and different sources of error are pointed out. From the results of the investigation, it is concluded that the following methods are the best:—

Total morphine in opium. 15 grms. of opium passed through a No. 100 sieve, are triturated with 6 grms. of slaked lime which has also been passed through a No. 100 sieve. The mixture is diluted with water to 171 grms., and after two hours, with frequent agitation, is filtered. 104 c.c. or 105·5 grms. of the filtrate are shaken first with 10 c.c. of 95 per cent. alcohol, and then with 50 c.c. of ether (66°), 2 grms. of ammonium chloride are added, and after further agitation in order to dissolve the salt, the whole is left for 24 hours for the morphine to crystallise. The ether is decanted off through a tared Gooch crucible, and the residue is treated with a further 10 c.c. of ether, which is then also passed through the Gooch crucible. The remaining solution, with the morphine, is now poured into the crucible, which is washed with six portions of 5 c.c. of water saturated with morphine and ether. The washing is continued, if necessary, till the ammonium chloride is completely removed. The crucible, with the morphine, is dried at 100° C., washed with five portions of 100 c.c. of crystallisable benzene, again dried at 100° C. and weighed.

Soluble morphine in opium. 18 grms. of morphine, passed through a No. 100 sieve, are treated with 144 grms. of water, and after 2 hours, with agitation, the mixture is filtered. 127 grms. of the filtrate are triturated with 5·3 grms. of slaked lime, and water added to make the total weight 162 grms. After 1 hour, with agitation, the mixture is filtered and 104 c.c. or 105·5 grms. of the filtrate are treated as described above.

Morphine in laudanum, tincture, etc. 150 grms. of the laudanum or tincture are evaporated to about 45 grms., or 7·5 grms. of extract are dissolved in 40 grms. of water. The solution is triturated with 6 grms. of slaked lime, and made up to 156 grms. with water. 100 grms. of the filtered solution are treated as described above.—A. S.

Brucine nitric acid reaction, and the preparation of a new alkaloid, bis-apomethylbrucine. H. Leuchs and R. Anderson. Ber., 1911, **44**, 2136—2145.

Brucine was treated at 0° C. with $5N$ nitric acid. When all had gone into solution, a saturated solution of sulphur dioxide was added. The precipitated salts were decomposed with potassium bicarbonate, and the crude base was dissolved in concentrated hydrochloric acid and the solution diluted. The pure base, bis-apomethylbrucine, $C_{21}H_{22}O_4N_2$, turns brown at 260° C., but does not melt below 305° C. It is only soluble with difficulty in absolute alcohol and hot water, a red colour rapidly developing in the latter solvent. The aqueous solution is alkaline to litmus, and gives a permanent deep indigo-blue colour with ferric chloride. The alkaline solution is yellow, but turns brown on oxidation. Brucine was dissolved in $5N$ nitric acid at 0° C. and the solution allowed to stand. A reddish-brown powder separated, having the composition, $C_{21}H_{20}O_4N_2,HNO_2$. The corresponding base was isolated by adding excess of a solution of potassium bicarbonate to the nitric acid solution of brucine and shaking out with chloroform. Addition of hot light petroleum precipitated the base in the form of dark-coloured needles, containing one molecule of water of crystallisation. It behaves as a quinone hydrate. It is converted into cacotheline nitrate, $C_{21}H_{21}O_7N_3,HNO_3$, by gently warming with nitric acid. Bis-apomethylbrucine was oxidised to a quinone by means of sulphuric acid and chromic acid. The product was dissolved in hydrochloric acid when a red crystalline powder soon separated, having the composition, $C_{21}H_{20}O_4N_2,H_2CrO_4,HCl$. The free quinone was obtained by treating this salt with sodium bicarbonate, water and chloroform.—F. Shdn.

Alkaloids; Formation of —— *in plants.* G. Ciamician and C. Ravenna. Atti R. Accad. dei Lincei, Roma, 1911, [5], **20**, 1., 614—624. Chem. Zentr., 1911, 2, 293.

The authors examined the effect of supplying pyridine, piperidine, and carbopyrrolic acid to *Datura* and the same substances and also asparagin, ammonia, dextrose, and phthalic acid to tobacco plants. The results of the experiments indicate that vegetable alkaloids are formed from amino-acids. In the tobacco plants the largest quantity of alkaloids was produced by application of asparagin; pyridine and ammonia gave similar results. Dextrose also caused an increase in the quantity of nicotine, but phthalic acid caused a decrease. Small quantities of isoamylamine were always present together with the alkaloids in the tobacco plants. In all cases, both with *Datura* and tobacco plants, the substances supplied to the plants were completely assimilated. In the case of *Datura*, the largest quantity of alkaloids was produced by application of pyridine.—A. S.

Almonds; Hydrocyanic acid in the ripening of bitter and sweet ——. G. De Plato. Ann. R. Staz. Chim.-Agrar. Sperim. di Roma, 1910, II., 4, 117—127.

During the ripening of bitter almonds, the content of free and loosely bound (liberated by steam) hydrocyanic acid diminishes gradually, until finally none is present when ripening is complete. The combined (glucosidic) hydrocyanic acid increases during ripening until the cotyledons form, and then diminishes progressively with the hardening of the latter, but does not completely disappear. In sweet almonds the content of loosely bound and glucosidic hydrocyanic acid diminishes as the cotyledons are forming, and has completely disappeared by the time the latter have become hardened. The proportion of protein-nitrogen increases during ripening, amounting to 97 per cent. of the total nitrogen when ripening is complete. This is the reverse of what happens during germination, when the protein is converted into amygdalin. Amygdalin appears to be an intermediate product in the formation of proteins during the ripening of almonds. In sweet almonds owing to the more active metabolism, the amygdalin is rapidly utilised and hence does not persist in the ripe seeds as in the bitter almonds.—A. S.

Aliphatic terpene from oil of hops; Identity of —— *with myrcene. Constituents of essential oils.* F. W. Semmler and E. W. Mayer. Ber., 1911, **44**, 2009—2012.

A specimen of the oil of hops was obtained with the sp. gr. 0·8781 at 23°/20° C., and $\alpha_D = -0{\cdot}1°$. This was fractionated, and the lower fraction distilled twice over sodium. It then boiled at 62°—63° C. at 17 mm., had the sp. gr. 0·7937 at 20° C., and $n_D = 1{\cdot}4716$; it was optically inactive. When reduced with sodium and alcohol, dihydromyrcene was obtained, boiling at 62°—63° C. at 17 mm., with the sp. gr. 0·7767 at 20° C., and $n_D = 1{\cdot}4507$. Treating the latter substance with bromine, the tetrabromide, $C_{10}H_{18}Br_4$, was formed, and after crystallising from methyl alcohol, melted at 87° C. The hydrocarbon from the oil of hops when heated with acetic acid and sulphuric acid under pressure, passes into myrcenol, boiling at 104°—108° C. at 17 mm., having the sp. gr. 0·9027 at 20° C., and $n_D = 1{\cdot}4790$.—F. Shdn.

Lecithin of eggs; characteristic colour reaction. C. Casanova. Boll. Chim. Farm., 1911, **50**, 309—313. Chem. Zentr., 1911, **2**, 231.

For the detection of lecithin the following test is proposed: The solution is heated for a long time at 50°—60° C. to expel any alcohol present, then extracted with ether, and the ethereal solution concentrated, treated with 2 c.c. of a 10 per cent. solution of ammonium molybdate and then covered with a layer of concentrated sulphuric acid. In presence of lecithin a cherry-red colour is produced, changing gradually to greenish yellow and deep blue. Cholesterol and phytosterol do not interfere with the reaction.—A. S.

Benzaldehydes; Separation and transformations of ——. E. Erlenmeyer, G. Hilgendorff, and T. Marx. Biochem. Zeits., 1911, **34**, 386—404.

Synthetic benzaldehyde cannot be resolved into its two constituents, storax-benzaldehyde, and hetero-benzaldehyde, by fractional distillation. The only practicable way is to make use of the varying velocities of reaction possessed by these bodies, *e.g.*, the rate of condensation in the Perkin reaction. These aldehydes can be converted the one into the other. Alkalis convert storax-benzaldehyde into hetero-benzaldehyde and synthetic benzaldehyde. Storax-benzaldehyde when heated with platinised asbestos passes into the synthetic form. The cinnamic acids corresponding to these three forms of benzaldehyde can be readily distinguished on crystallising them from ether. Hetero-benzaldehyde possesses a more penetrating odour than the milder storax-benzaldehyde. The differences in these three aldehydes must be attributed to differences in the benzene nucleus. Results of a similar nature have been found with benzene and stilbene. (See this J., 1910, 296.)—F. Shdn.

Benzoic acid; Detection of ——. G. Denigès. Bull. Soc. Pharm. de Bord., June, 1911, **249**. Pharm. J., 1911, **87**, 201.

The following is a modification of Jonescu's method:—To 4 c.c. of an aqueous solution supposed to contain benzoic acid, placed in a test-tube, add 0·2 c.c. of 20 per cent. (by volume) acetic acid, 0·2 c.c. of solution of ferric chloride diluted with an equal volume of water, and 0·2 c.c. of one-volume hydrogen peroxide; boil for ten to fifteen seconds. There is obtained a violet colouration even when the sample contains not more than 0·5 mgrm. of benzoic acid per c.c. In cases where smaller quantities are concerned a blank experiment should be made at the same time, heating both tubes in a boiling water-bath for the same length of time. To detect a benzoate by this method the solution should be acidified with sulphuric or hydrochloric acid, shaken out with ether, decanted, filtered, the ether evaporated in a test-tube in presence of 4 c.c. of distilled water previously boiled, and then treated as above. When the acid is present in alimentary products, the suspected matter, liquid or solid, is treated with water, and distilled in a current of steam after acidulation with dilute sulphuric acid; the distillate is extracted with ether, and the process carried out as above.

Paraldehyde; Characters and tests of ——. R. Richter. Pharm. Zeit., July 5, 1911, 536; Pharm. J., 1911, **87**, 201.

The requirements of the new German Pharmacopœia in regard to paraldehyde, include specific gravity, 0·998 to 1·000; boiling point, 123° to 125° C.; and solidifying point, 6° to 7°; it is also described as containing about 4 per cent. of acetaldehyde, and the absence of excess of this is required to be shown by the non-production of a yellow or brown colour within an hour when paraldehyde, 6 c.c., is shaken with 2 c.c. of caustic potash solution and 4 c.c. of water. Careful examination of pure materials, however, shows that these requirements are not quite consistent. A mixture of pure paraldehyde and acetaldehyde—the latter constituting 4 per cent. of the total—had specific gravity 0·993 and solidifying point 6·5°; but 54 per cent. of it distilled below 122·7° (corr.), and the remainder from 122·7° to 124·2°. Such a mixture, however, is not commercially obtainable, owing to the spontaneous formation of a little metaldehyde on keeping, which raises the solidifying point. Samples of paraldehyde obtained from four of the best German makers had solidifying points from 9·5° to 10·5°, and specific gravities 0·998 to 1·001. The result of the test for aldehyde with caustic potash was found to be greatly affected by temperature. Since no temperature is specified for this test it must be assumed that it is to be carried out at ordinary room temperature, which is defined as from 15° to 20° C.; but when a specimen of paraldehyde containing 4 per cent. of acetaldehyde was submitted to this test at 15° C., the first faint tint was shown in forty minutes, whereas when the same sample was tested at 20° C., the first tint appeared in twenty minutes, and a yellow colour after forty minutes. When the test was carried out at 12° to 13°, the sample just fulfilled the requirements of giving no yellow colour within an hour.

Aromatic inner anhydrides; Reaction of —— *depending on influencing the crystalline shape of iodoform.* B. Bardach. Z. anal. Chem., 1911, **50**, 545—548.

In continuation of previous investigations (Z. anal. Chem., 1909, **48**, 438; this J., 1911, 108), it is found that when a solution of iodoform is added to that of an aromatic inner anhydride, or a compound capable of yielding the same, the iodoform is precipitated in needle-shaped crystals, instead of in the usual form, and that the reaction may be applied as a test for such substances. Compounds which influence the crystalline shape of iodoform in this way are divided into two classes, the first acting directly or in the presence of traces of certain salts (*e.g.*, after the addition of spring water), the second requiring a preliminary treatment with iodine. The test is carried out as follows:—(*a*) A 2 per cent. solution of iodoform in alcohol is added, drop by drop, to a not too concentrated and nearly neutral solution of the substance, containing spring water; the separation of needle-shaped crystals of iodoform indicates an aromatic inner anhydride, especially of the type of euxanthone and its derivatives. Albumin, which has a similar effect, must be removed before testing. (*b*) If a negative result (hexagonal crystals) be obtained in *a*, a few drops of Lugol's solution (4 grms. of iodine, 6 grms. of potassium iodide, and 100 c.c. of water) and excess of ammonia are added to about 3 c.c. of the solution to be tested, more iodine being added, if necessary, until there is a slight darkening. After an hour, the solution is filtered, if necessary, and iodoform solution added as above, the precipitate being examined microscopically. Needle-shaped crystals indicate aromatic inner anhydrides (such as coumarin), aromatic hydroxy-acids with long side-chains, or polyhydroxyketones. The reaction can be used in conjunction with Millon's reaction for distinguishing phenols from aromatic hydroxyacids with long side-chains.—F. Sodn.

Bismuth subchloride; Note on the constitution of commercial ——. J. B. P. Harrison. Brit. Pharm. Conf. Report, 1911, 4. Pharm. J., 1911, **87**, 179.

If the composition of a sample of commercial bismuth subchloride is represented by BiOCl, then it has in all probability been prepared by one of the modifications given in the British Pharmaceutical Codex in which the parent compound is first brought into solution. If on the other hand the subchloride has been produced by boiling bismuth subnitrate with sodium chloride solution, the composition will generally be $Bi_{12}O_{13}Cl_{10}$, but it will always correspond with that of the subnitrate used.—F. Shdn.

Influence of fertilisers on active principles of seeds [beans]. Scurti and Tommasi. *See* XVI.

XXII.—EXPLOSIVES; MATCHES.

Patents.

Explosive. R. Imperiali, Naples. U.S. Pat. 998,007, July 18, 1911.

A mixture of alkali nitrate (85 parts) and aluminium powder (15 parts) to which is added 10 parts of an agglutinant consisting of mononitronaphthalene (75 parts), glycerin (5), collodion (15) and potassium permanganate (3 parts).—G. W. McD.

Match striking surface. E. J. Buckley, Stoke-on-Trent. Eng. Pat. 18,411, Aug. 4, 1910.

Pitcher or broken pot (china, earthenware, or porcelain) is ground to the required degree of fineness, mixed with an adhesive substance, and applied to any suitable base. —G. W. McD.

XXIII.—ANALYTICAL PROCESSES.

Potassium cyanide in the presence of potassium ferrocyanide; Titration of ——. W. D. Treadwell. Z. anorg. Chem., 1911, 71, 219—225.

The disturbing influence of potassium ferrocyanide on the titration of potassium cyanide with silver nitrate has been examined experimentally, and is found to be due to a reduction in the silver ion concentration, presumably accompanying the formation of complex salts. The titration may, however, be readily effected by adding a little potassium iodide (about 0·1 grm. per 50—100 c.c. of solution), which acts as a sufficiently delicate indicator of the silver ions. The solution should be faintly alkaline and approximately decinormal.—F. Sodn.

Rapid determination of sulphuric acid with porous clay crucible. Klein. *See* VII.

Nitric acid; Method for determining ——. Romijn. *See* VII.

Perboric acid and some similar compounds [percarbonates, persulphates, perchlorates, and periodic acid]; Detection of ——. Lenz and Richter. *See* VII.

Nitrites; Action of hydrazine sulphate on —— *and a new method for determining nitrogen in* ——. Dey and Sen. *See* VII.

Iron and vanadium; Simultaneous volumetric determination of ——. Müller and Diefenthäler. *See* X.

Oil of Cornus sanguinea, L. [cornel oil] and its detection in olive oil. Grimaldi. *See* XII.

Influence of mechanical and thermal conditions on the moisture and extract determinations in malt. Wlokka. *See* XVIII.

Determination of acids in wort and beer. Moufang. *See* XVIII.

Determination of morphine in opium and its preparations. Frerichs and Mannheim. *See* XX.

Determination of morphine in opium and its preparations. Debourdeaux. *See* XX.

Lecithin of eggs; characteristic colour reaction. Casanova. *See* XX.

Detection of benzoic acid. Denigès. *See* XX.

Aromatic inner anhydrides; Reaction of —— *depending on influencing the crystalline shape of iodoform.* Bardach. *See* XX.

Patents.

Dangerous gases; Apparatus for the detection of ——. F. J. Turquand and W. E. Gray, London. Eng. Pats. 8582, April 9, 1910, and 17,146, July 19, 1910.

In apparatus in which the detection of dangerous gases is effected by measurement of the relative diffusivity through porous septa of the gas sample and a gas of known composition, discrepancies are liable to be caused by pressure variations in the apparatus owing to changes of temperature and atmospheric pressure. The present device consists of two insulated cylindrical chambers connected together by a transparent capillary tube in which there is a column of liquid to act as a pressure indicator; each of the two chambers is closed by a porous septum—carbon, unglazed porcelain, paper dipped in collodion, rubber, etc.—over which an impermeable cap may be placed. The chambers are also placed in contact by subsidiary septa with a reservoir of fresh gas—usually air—which is maintained at the existing atmospheric pressure by means of a tube attached to it in which a column of liquid adjusts the gas volume to the pressure, or this may be effected by means of a pocket constructed of material of sufficient resiliency to maintain a constant pressure in the reservoir. A slow-acting porous septum may also be directly interposed between the diffusion chambers, in order to equalise conditions in the two chambers, after a reading has been taken, sufficient rest being given to the device to allow it to recover its normal position. To carry out a test the impervious cap is removed from the porous septum of one of the chambers, and this is exposed at the place where it is desired to make the test; the maximum reading of the indicator is then noted, after which the exposed chamber is closed until the indicator assumes its original position, when a second reading may be obtained by uncovering the other chamber.

To facilitate the return of the indicator column to the zero point in the capillary tube, the latter is slightly widened at the centre when mercury is used and slightly contracted for alcohol and other liquids. To maintain the two chambers at equal temperatures they may be connected by a rod of good heat-conducting material. The apparatus may assume several forms, one form being suitable for attachment to a miner's lamp: in another form the indicator is a U-tube containing a column of mercury the position of which is recorded by its power to complete an electrical circuit.—B. G. McL.

Fire-damp or other combustible gases; Apparatus for indicating the presence of ——. F. H. Schroeder, Recklinghausen, Germany. Eng. Pat. 27,990, Dec. 1, 1910.

The heat developed when inflammable gases come in contact with spongy platinum is used as a measure of the combustible content of mine gases. Spongy platinum is intimately mixed with substances which are bad conductors of heat, such as kieselguhr and asbestos, in such proportions that the mass so produced cannot heat up to the ignition temperature of the gases. This mixture is surrounded by a further quantity of the non-conducting materials, which ensures that no particle of spongy platinum can come into direct contact with the gas. The whole is retained in a vessel with porous or perforated side walls. The temperature changes in the mass are recorded by means of an electrical resistance pyrometer of special form.—B. G. McL.

XXIV.—MISCELLANEOUS ABSTRACTS.

Insecticide. W. C. Carnell, Philadelphia, Pa. U.S. Pat. 997,601, July 11, 1911.

Dry, finely powdered sulphur is mixed with an excess of dry, air-slaked finely divided lime, the mixture being heated in a tightly closed vessel to reacting temperature. The insecticide thus obtained is a dry powder which contains polysulphides and thiosulphate and an excess of lime, and which, on treatment with water, contains, as main product, calcium polysulphides and thiosulphate.—L. E.

Books Received.

Mines and Quarries: General Report, with Statistics for 1910. Part I. District Statistics. [Cd. 5794.] Price 6½d.

This return, which forms the first part of the General Report on Mines and Quarries for 1910, contains statistics of the number of persons employed, the output of minerals, and accidents at mines and quarries in the United Kingdom, arranged according to the inspection districts. The total output of the undermentioned minerals in the United Kingdom in 1910, as compared with 1909, was as follows:—

—	1909.	1910.
	Tons.	Tons.
Coal	263,774,312	264,433,028
Iron ore	14,804,382	15,226,015
Clays and shale	14,067,810	14,090,320
Limestone (other than chalk)	11,811,122	12,512,736
Igneous rock	6,283,297	6,608,705
Sandstone	4,600,084	4,386,281
Chalk	4,436,923	4,631,432

The total number of persons employed in and about the mines of the United Kingdom was 1,078,083, of whom 1,049,407 worked at the 3253 mines under the Coal Mines Act and 28,676 at the 663 mines under the Metalliferous Mines Act. In coal mines there was an increase of 35,409 persons over 1909. Of the total, 848,381 were employed underground. Of 1,201,026 surface workers, 6221 were females. The total number of workers under sixteen, surface and underground, was 72,094. At the quarries, 85,837 persons were employed. With regard to accidents, there were at the mines under the Coal Mines Act, 1242 separate fatal accidents, causing 1775 deaths. The total number of deaths (1775) from accidents in coal mines is the highest yet recorded in any one year; those from explosions have only been exceeded twice—in 1866 (651 deaths) and 1878 (586 deaths). The number of deaths from falls of ground is also the highest recorded, namely, 636. The report states that one must go back to 1890 to find a higher death-rate from all causes underground, namely, 2·09 per 1000. That year, like the one under review, was marked by serious colliery explosions.

Applied Electrochemistry. M. de Kay Thompson, Ph.D., Assist. Prof. of Electrochemistry in Massachusetts Institute of Technology. The Macmillan Company, New York, U.S.A. 1911. Price 9s. net.

Large 8vo volume, containing 314 pages of subject matter, with appendix containing tables, etc., filling seven pages more, and alphabetical indexes of names and subjects. There are 137 illustrations. The subject matter is classified as follows:—I. Coulometers or voltameters. II. Electrochemical analysis. III. Electroplating, electrotyping, and production of metallic objects. IV. Electrolytic winning and refining of metals in aqueous solutions. V. Electrolytic reductions and oxidation. VI. Electrolysis of alkali chlorides. VII. Electrolysis of water. VIII. Primary cells. IX. The lead storage battery. X. Edison storage battery. XI. Electric furnace. XII. Products of the resistance and arc furnace. XIII. Electrometallurgy of iron and steel. XIV. Fixation of atmospheric nitrogen. XV. Production of ozone.

Chemistry of the Coal-Tar Dyes. By Irving W. Fay, Ph.D. Professor of Chemistry, Polytechnic Institute, Brooklyn, N.Y. Constable and Company, Ltd., London. 1911. Price 16s. net.

Large 8vo volume, containing 458 pages of subject matter, with alphabetical index. The contents are classified thus:—I. Coal tar and its products. II. The hydrocarbons and their derivatives. III. Nitro- and nitroso-dyestuffs. IV. Triphenylmethane dyestuffs. V. Classification. VI. Azo-dyestuffs. VII. The seven food colours (*i.e.* permitted by U.S. Government for use in foodstuffs, beverages, etc.). VIII. The pyronines. IX. Indamines, indophenols, thiazines, and oxazines. X. Eurhodines and safranines. XI. Quinoxalines, quinoline and acridine dyestuffs. XII. Aniline black. XIII. Alizarin dyestuffs. XIV. Indigo. XV. Sulphur dyestuffs. XVI. Mordants. XVII. Experimental work.

Carl Graebe's Untersuchungen über Chinone. Herausgegeben von Herman Decker. Verlag von Johann Ambrosius-Barth. Leipzig. 1911. Price M.10.

Large 8vo volume, containing frontispiece portrait of Graebe, 654 pages of subject matter, eight pages of a glossary arranged according to date of the issue of Graebe's publications (1865—1910), and alphabetical indexes of authors' names, and of subjects. The subject matter is classified under the following chapter headings: I. Benzene derivatives. II. Naphthalene derivatives. III. Anthracene derivatives. IV. Phenanthrene derivatives. V. Pyrene, picene and chrysene. VI. Acenaphthene derivatives. VII. On colour in its relation to constitution.

The Manufacture of Sulphate of Ammonia. By Gascoigne T. Calvert. John Allan & Co., The "Gas World" Offices, 8, Bouverie Street, London, E.C. 1911. Price 7s. 6d. net.

8vo volume, containing frontispiece, 140 pages of subject matter, with 97 illustrations, an appendix of 10 pages further, with two illustrations, and an alphabetical index.

The subject matter is classified as follows :—I. Composition and analysis of ammonium sulphate. II. Raw materials. III. Plant required for the manufacture. IV. Starting, working, and stopping the plant. Difficulties and remedies. V. Alkali, etc., Works regulation Act. Factory Acts. Respirators, etc.

THE SOIL SOLUTION. THE NUTRIENT MEDIUM FOR PLANT GROWTH. By FRANK K. CAMERON. U.S. Department of Agriculture. The Chemical Publishing Co., Easton, Pa., U.S.A. 1911. Price $1.25. Williams and Norgate, 14, Henrietta Street, Covent Garden, London, W.C.

8vo volume, containing 125 pages of subject matter and an alphabetical index of subjects. The leading themes of this work are as follows :—I. The soil. II. Soil management. III. Soil analysis and historical methods of soil investigation. IV. The plant food theory of fertilizers. V. Dynamic nature of soil phenomena. VI. Film water VII. Mineral constituents of the soil solution. VIII. Absorption by soils. IX. Relation of plant growth to concentration. X. Balance between supply and removal of mineral plant nutrients. XI. Organic constituents of the soil solution. XII. Fertilizers. XIII. Alkali.

THE AGRICULTURAL LEDGER. 1911. No. 3. (Vegetable Product Series, No. 114.) Glycine Hispida (Soy Bean). The Soy Bean in India. David Hooper. Superintendent Government Printing, India. 1911. Price 2 annas. or 2d.

PAMPHLET, 8vo. size, 33 pages of subject matter. The subject is treated under the following heads :—I. Experimental cultivation in India. II. Races in India. (*a*) The yellow races of soy bean. (*b*) The green races. (*c*) The black races. (*d*) The brown races. (*e*) The mottled races. II. Composition of the bean and analyses of Indian-grown soy beans. III. The oil. IV. Oil-cake. V. Soy-bean hay (forage), and straw. VI. Use as food. VII. Trade.

KOLLOIDCHEMISCHE BEIHEFTE. (Ergänzungshefte zur Kolloid-Zeitschrift.) Monographien zur reinen und angewandten Kolloidchemie. Herausgegeben von Dr. Wo. Ostwald. Bd. II. Heft 10—11. Theodor Steinkopff's Verlag. Dresden. 1911. Price : Single numbers, M. 1.20 each. M. 1 each for those taking the whole volume of 12 numbers.

THIS 8vo number (page 343—408) contains two articles :—I. J. Leimdörfer. Die technischen Seife als kolloide Lösungen (5 illustrations and 2 tables). II. P. P. von Weimarn. Der kolloide Zustand und seine Bedeutung für die verschiedenen Zweige der Naturwissenschaft. (1 illustration).

HANDBOOK FOR IRONFOUNDERS. Issued by the Frodair Iron and Steel Company, Ltd., Fenchurch House, London, E.C. 1911.

POCKET-BOOK size, containing 155 pages, the last eight of which are ruled and blank for memoranda. The contents are as follows :—I. The different elements in pig iron. II. Interaction of different chemical elements. III. Selection of irons for special castings. IV. Hints on cupola practice. V. Blowing machines. VI. Chilled castings. VII. Cylinder castings. VIII. Adding steel to cast iron in the cupola. IX. Areas of round, square, and rectangular pouring gates. X. Arrangement and regulation of cupola blast. XI. Relation between transverse test records on Admiralty and Standard Engineer's Bar. XII. Approximate (working) capacities of foundry ladles. XIII. Thermometer scales. XIV. Judging temperature of molten iron by colour. XV. Approximate melting capacities of different cupolas. XVI. Bibliography. XVII. British and metric equivalents, etc., etc. There are also twenty ruled analytical tables left blank for filling in results obtained, and an alphabetical index of subjects.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

Patent Specifications may be purchased at the Sale Branch of the Patent Office, Quality Court, Chancery Lane, London, W.C., fifteen days after the date on which acceptance of the complete specification is advertised. The price is 8d. each.

I.—GENERAL PLANT ; MACHINERY.

APPLICATIONS.

17,472. Wheatly, Sheldon, and Tomlinson. Packing for Gay Lussac, Glover, and like towers.* Aug. 1.

17,695. Bahler. Revolving tubular kilns.* Aug. 3.

17,775. Reeves. Dilution and distribution of liquids and solutions. [Australian Appl., Aug. 4, 1910.] Aug. 4.

17,853. Kipper and Dax. Supplying air to roasting furnaces, drawing off the gases, and rendering them harmless.* Aug. 4.

18,017. Epstein. Condensation and absorption, and arrangements therefor for different purposes. Aug. 8.

18,057. Seltner. Jigging process, and apparatus for separating materials of different specific gravities.* Aug. 9.

18,216. Sanborn. Evaporating apparatus.* Aug. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

18,513 (1910). Morton. Apparatus for mixing or heating liquids or semi-liquids. Aug. 10.

18,768 (1910). Helbronner and von Recklinghausen. Apparatus for treating liquids with ultra-violet rays. Aug. 16.

21,068 (1910). Dinckels. Evaporators. Aug. 16.

27,500 (1910). Fruit Juice Co. (Fernbach and Cholet). Apparatus for concentrating liquids. Aug. 16.

29,061 (1910). Kestner. Apparatus for concentrating liquids to high densities. [Dec. 14, 1909.] Aug. 16.

29,097 (1910). Foster. Radiation pyrometers. Aug. 16.

30,004 (1910). Krause. Methods of filtration and filter material. [Jan. 3, 1910.] Aug. 16.

30,098 (1910). Gasnier. Apparatus for the periodical interruption of the flow of gases. [April 28, 1910.] Aug. 10.

616 (1911). Schmidt. Thermostats. Aug. 16.

2245 (1911). Dieker (Maschinenbau-Anstalt, Eisengiesserei und Kesselschmiede). Centrifugal machines. Aug. 10.

4635 (1911). Nice. Furnaces. Aug. 16.

4991 (1911). Watson. Evaporators. Aug. 10.

7050 (1911). Uhl. Centrifugal machines. Aug. 10.

11,111 (1911). Kummerer, and Ges. f. Elektrotechnische Industrie. Photometers. Aug. 10.

II.—FUEL : GAS ; MINERAL OILS AND WAXES ; DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

APPLICATIONS.

17,436. Societa per l'utilizzazione dei combustibili Italiani, and Civita. Utilisation of peat in gas producers. July 31.

17,451. Linney. Gas mantles. Aug. 1.

17,469. Climie. Gas producers.* Aug. 1.

17,480. Houskeeper. Filaments for incandescent lamps [U.S. Appl., Aug. 5, 1910.]* Aug. 1.

17,492. Mathys (Herren Front G. m. b. H.). Incandescent mantles.* Aug. 1.

17,509. Alston and Houston. Gas producers. Aug. 1.

17,588. Freylicht Ges. m. b.H. Mantles for incandescent gas-lighting. [Ger. Appl. May 6, 1911.]* Aug. 2.

17,610. Testrup, Rigby, and Söderlund. Commercial utilisation of peat. Aug. 2.

17,770. Främbs, and Bender und Främbs G. m. b. H. Production of steam for gas generators.* Aug. 4.

17,888. Williamsons, Ltd., and Curtis. Composition for combustible purposes. Aug. 5.

17,947. Sutcliffe. Carburetting air for lighting, heating, etc. Aug. 8.

18,019. Cooper and Woodrow. Purification of gas. Aug. 9.

18,063. Weiser. Method and means for operating coking stills. [Austrian Appl., Jan. 17, 1911.]* Aug. 9.

18,089. Zepler and Sutton. Incandescent gas mantles. Aug. 10.

18,112. King. Treating kerosene and paraffin to increase their efficiency in internal combustion engines. Aug. 10.

18,134. Deutsch Luxembergische Bergwerks und Hütten A.-G. and Keibel. Burning top furnace gases for drying and heating.* Aug. 10.

18,176. Kesson. Process and apparatus for charring peat. Aug. 11.

18,193. Woltereck. Process for the desulphuration of coke. Aug. 11.

18,210. Wetter (Balfour). Reducing or limiting the effect of explosions in coal and other mines. Aug. 11.

18,277. Reis. Apparatus for producing gas from petroleum and the materials employed in such production. Aug. 12.

18,300. Armstrong and Mordan. Solidification of hydrocarbon oils.* Aug. 12.

Complete Specifications Accepted.

18,016 (1910). Berlin-Anhaltische Maschinenbau A.-G. Abteilung Koln Bayenthal. Gas purifiers. [Apr. 20, 1910.] Aug. 10.

18,143 (1910). Whitfield. Gas producers. Aug. 10.

21,375 (1910). Rosenhain. Apparatus for the detection and localisation of the presence of inflammable or explosive gases or dust. Aug. 16.

22,794 (1910). Cohn. Incandescent mantles for inverted burners. Aug. 10.

22,803. (1910). Lewis. Electrodes for arc lamps. Aug. 16.

23,080 (1910). Verity and Lewis (Higgins). Increasing the calorific value of fuel and apparatus therefor. [April 20, 1911.] Aug. 10.

23,639 (1910). Schilling. Metallic filaments for electric lamps. [Dec. 29, 1909.] Aug. 16.

24,924 (1910). Schwarz. Gas fired continuous kilns. Aug. 16.

27,645 (1910). Muller and Veltener Schwemmstein-Industrie Ges. f. Schlackenverwertung. Utilising the residues of combustion of furnaces. Aug. 10.

6644 (1911). Noël. Apparatus for using naphthalene in explosion motors. [Mar. 17, 1910.] Aug. 10.

8004 (1911). Schwab. Incandescing bodies for electric lamps. [April 9, 1910.] Aug. 16.

8701 (1911). Robinson and Robinson. Composition for increasing the efficiency of fuel. Aug. 16.

III.—TAR AND TAR PRODUCTS.

Complete Specifications Accepted.

1687 (1911). Tanne and Oberländer. Separating solid hydrocarbons from naphtha residues and tars. [Addition to 27,116, 1909, and Divided Appl. on 23,125, 1910, Oct. 6.] Aug. 16.

8279 (1911). Pyzel. Truck for sweating out, from crude paraffin and the like, substances melting at different temperatures. [Divided Appl. on 22,313, 1910.] Aug. 16.

IV.—COLOURING MATTERS AND DYES.

Applications.

17,437. Meister, Lucius, und Brüning. Manufacture of preparations suitable for the indigo vat. [Ger. Appl., Aug. 1, 1910.]* July 31.

17,465. Read Holliday and Sons, Turner, and Morgan. Manufacture of a series of new aromatic mono- and diaminosulphonamides derived from β-naphthylamine suitable for the production of organic colouring matters. Aug. 1.

18,158. Johnson (Badische Anilin und Soda Fabrik). New condensation products of the anthraquinone series. Aug. 10.

18,205. Newton (F. Bayer und Co.). Manufacture of new dyes suitable for development. [Addition to 1441 of 1911.] Aug. 11.

18,239. Johnson (Badische Anilin und Soda Fabrik). Manufacture of sulphur colouring matters. Aug. 11.

18,240. Johnson (Badische Anilin und Soda Fabrik). Manufacture of new compounds of the anthraquinone series. Aug. 11.

Complete Specifications Accepted.

18,761 (1910). Imray (Meister, Lucius, und Brüning). Manufacture of a new form of indigo. Aug. 10.

20,025 (1910). Newton (F. Bayer und Co.). Manufacture of new azo dyestuffs. Aug. 16.

21,021 (1910). Newton (F. Bayer und Co.). Manufacture of new azo dyestuffs. [Addition to 19,545 of 1910.] Aug. 10.

21,473 (1910). Newton (F. Bayer und Co.). Manufacture of new azo dyestuffs. Aug. 16.

24,486 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds and colouring matters of the anthracene series. Aug. 10.

25,184 (1910). Meister, Lucius, und Brüning. Manufacture of vat dyestuffs of the anthraquinone series. [Nov. 1st, 1909.] Aug. 16.

27,047 (1910). Newton (F. Bayer und Co.). Manufacture of new mordant dyestuffs of the triphenylmethane series. Aug. 16.

27,627 (1910). Newton (F. Bayer und Co.). Manufacture of a new disazo dyestuff. Aug. 10.

974 (1911). F. Bayer und Co. Manufacture of new trisazo dyestuffs. [April 20, 1910.] Aug. 16.

9257 (1911). Meister, Lucius, und Brüning. Manufacturing vat dyestuffs. [June 16, 1910. Addition to 9116 of 1911.] Aug. 10.

9529 (1911). F. Bayer und Co. Production of azo dyestuffs on the fibre. [Aug. 2, 1910.] Aug. 16.

14,904 (1911). Meister, Lucius, und Brüning. Manufacture of new vat dyestuffs. [Sept. 12, 1910.] Aug. 10.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

17,676. Hirsch. Producing a glazed coating on those spots of unglazed paper which are to receive a picture. [Ger. Appl., Aug. 3, 1910.]* Aug. 3.

17,714. Lietzenmayer. Treatment of material for making paper, cardboard, etc. [Ger. Appl., Aug. 3, 1910.]* Aug. 3.

17,803. Oldrich Duda. Utilisation of the bark of willow-switches and osiers.* Aug. 4.

17,851. Ludwig. Applying layer of gelatin to paper and cardboard.* Aug. 5.

17,864. John Bright and Bros., and Oldroyd. Treatment of cotton goods to reduce their inflammability. Aug. 5.

17,873. Marcus. Manufacturing absorbent media, bandaging material, dress shields, etc. Aug. 5.

17,962. Clausen and Claus. Waterproof paper cups.* Aug. 8.

18,191. Aktschomin. Manufacture of brown wood pulp and half cellulose from resinous kinds of wood. Aug. 11.

Complete Specifications Accepted.

22,027 (1910). Lovell. Making fibrous absorbent resilient material. Aug. 10.

29,046 (1910). Vereinigte Glanzstoff-Fabriken A.-G. Manufacture of cellulose products. [Oct. 20, 1910.] Aug. 10.

7099 (1911). Boult (Dobler). Manufacture of blotting paper, cardboard, etc. Aug. 10.

8313 (1911). Vereinigte Glanzstoff-Fabriken A.-G. Conversion of formyl esters of cellulose or solutions thereof in formic acid into solid plastic solutions. [May 18, 1910.] Aug. 10.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

17,626. Petzold. *See under* VII.

17,902. Winternitz and Zaesde. Printing on textiles. [Ger. Appl., July 17, 1911.]* Aug. 5.

17,938. Knecht. Textile printing. Aug. 8.

17,999. Johnson (F. A. Bernhardt). Production of dyeings on vegetable and animal fibrous matter.* Aug. 8.

18,018. Breh. Washing and drying linen, textiles, etc. [Ger. Appl., Aug. 6, 1910.]* Aug. 8.

Complete Specifications Accepted.

19,117 (1910). Knecht and Peter Spence and Sons. Discharging and dyeing of fibres. [*See* 26,132 of 1910.] Aug. 16.

9529 (1911). F. Bayer und Co. *See under* IV.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

17,411. Matignon. Synthetic preparation of ammonia. [Fr. Appl., Aug. 13, 1910.]* July 31.

17,424. Johnson (Chem. Fabr. Griesheim-Elektron). Manufacture of acetic acid. July 31.

17,472. Wheatly, Sheldon, and Tomlinson. *See under* I.

17,589. Jaubert. Manufacture of hydrogen. [Fr. Appl., Aug. 6, 1910.]* Aug. 2.

17,604. Ashcroft. Manufacture of ammonia and ammonia compounds. Aug. 2.

17,626. Petzold. Process for purifying the soda-lye from the mercerisation process. [Addition to 99,308 of 1908. Ger. Appl., Dec. 2, 1910.]* Aug. 2.

17,666. Heys (Nitrogen Co.). Separation of gases.* Aug. 3.

17,923. Battersby. Dissolving silicates of soda and potash. Aug. 8.

18,038. Albert. Manufacturing sulphuric acid by contact or catalysis.* Aug. 9.

18,073. Smith and Lane. Apparatus for treating air for diffusion. Aug. 9.

18,206. Block. Condensing and cooling ammonia. Aug. 11.

18,207. Lidholm. Producing ammonia from nitrolime. [Swedish Appl., Sept. 12, 1910.]* Aug. 11.

Complete Specifications Accepted.

18,300 (1910). Ges. f. Chemische Industrie in Basel. Apparatus for the electrolysis of fused alkali chlorides. [Dec. 22, 1909.] Aug. 10.

18,764 (1910). Wagner. Manufacture of borax and the like. Aug. 16.

19,141 (1910). Henry. Manufacture of ammonium nitrate. Aug. 16.

19,249, 19,250, and 19,251 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia. Aug. 16.

20,777 (1910). Häusser. Manufacture of nitrogen oxides. Aug. 16.

27,477 (1910). Bollo and Cadenaccio. Reducing sulphates of the alkalis and alkaline earths into sulphides by certain catalysts. [Nov. 29, 1909.] Aug. 10.

28,892 (1910). Moore and Hall. Condenser for acid vapours. Aug. 16.

561 (1911). McCowan. Manufacture of zinc sulphate. Aug. 16.

4177 (1911). Harger. Apparatus for supplying oxygen for respiration in mines, etc. Aug. 16.

11,245 (1911). Hale. Apparatus for recovering corrosive acids from their absorbents. Aug. 10.

13,187 (1911). Pietzsch and Adolph. Vessels for manufacture and storage of hydrogen peroxide. [June 3, 1910.] Aug. 10.

17,047 (1911). Ges. f. Chemische Industrie in Basel. Apparatus for the electrolysis of fused alkali chlorides. [Dec. 22, 1909. Divided Appl. on 18,300 of 1910.] Aug. 10.

VIII.—GLASS; CERAMICS.

Applications.

18,053. Wolf-Burckhardt and Borchers. Glass and method of manufacturing same. [Ger. Appl., Feb. 20, 1911.]* Aug. 9.

18,289. Pilkington. Furnaces for use in drawing glass.* Aug. 12.

Complete Specifications Accepted.

19,428 (1910). Woodall. Externally heated kilns for burning pottery, etc. Aug. 16.

1637 (1911). Lucietto. Ceramic tiles for decorations imitating mosaic. Aug. 10.

6227 (1911). Hatfield. Glass tubing to facilitate the flow of liquids therein. Aug. 16.

10,293 and 10,324 (1911). Benedictus. Strengthened glass. [Dec. 7, 1910.] Aug. 10.

IX.—BUILDING MATERIALS.

Applications.

17,544. Pettigrew and Gerbel-Strover. Treatment of heated refractory materials. Aug. 1.

18,041. Powell. Treatment of timber. Aug. 9.

Complete Specifications Accepted.

18,715 and 18,716 (1910). McLellan. Simultaneously heating and coating the surfaces of stone, brick, etc., with metals and vitreous materials. Aug. 16.

19,172 (1910). Marks (Middleton). Process for impregnating wood. Aug. 16.

28,694 (1910). Johnson (Chem. Fabrik und Asphaltwerke A.-G.). Manufacture of asphalt slabs and blocks. Aug. 10.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

17,434. Stobrawa. Manufacturing homogeneous iron and steel from pig iron in the fixed basic Martin furnace. [Ger. Appl., Aug. 1, 1910.]* July 31.

17,563. Richards. Treatment of iron or steel to prevent rusting. Aug. 2.

17,605. Ashcroft. Electrolytic manufacture of sodium and potassium and electrolyte for use therein. Aug. 2.

17,648. Beauchamp. Manufacturing zinc white from zinc ores and tailings. Aug. 3.

17,719. Sulman and Metals Extraction Corporation. Recovery of zinc from sulphide ores. Aug. 3.

17,722. Dempster. Method of working refractory metals. [U.S. Appl., Jan. 12, 1911.]* Aug. 3.

17,847. Harriss. Mechanical ore roasting furnaces. Aug. 5.

17,879. Wieküler-Küpper-Brauerot A.-G. Tinning the interior of metal vessels, vessels for beer, etc. [Ger. Appl., Sept. 12, 1910.)* Aug. 5.

18,008. Schneemilch. Furnace for extracting zinc.* Aug. 8.

18,016. Levoz. Manufacture of iron and steel.* Aug. 8.

18,081. Allan. Disintegration of ores. Aug. 9.

18,086. Martin. Process for separating complex zinc ores. Aug. 10.

18,189. Murex Magnetic Co., and Lockwood. Separation of ores. Aug. 11.

18,194. Woltereck. Treatment of ores. Aug. 11.

18,202. Sanborn, McMahon, Overbury, and Young. Fume destroying process.* Aug. 11.

18,219. Harris and Anderson. Apparatus for preventing corrosion of metals. Aug. 11.

18,226. Turbo Amalgamation and Extraction Co., and Lockwood. Amalgamation of the precious metals and apparatus therefor.* Aug. 11.

18,227. Turbo Amalgamation and Extraction Co., and Lockwood. Precipitation of precious metals.* Aug. 11.

18,253. Leslie. Treatment of ores by the cyanide process.* Aug. 12.

Complete Specifications Accepted.

18,780 (1910). Marks (Siemens und Halske A.-G.). Hardening and roughening the surface of tantalum. Aug. 10.

19,518 (1910). Gabriel. Alloy, mixture or combination of metals. Aug. 10.

19,620 (1910). Dunham-Massey. Blast furnaces. Aug. 10.

23.359 (1910). Rumpler. Treating aluminium articles for the formation thereon of galvanic metallic coatings. [Oct. 9, 1909.] Aug. 10.

23,669 (1910). Hill. Crucible furnaces. Aug. 16.

27,668 (1910). Thiel. Converter processes. [Addition not granted.] Aug. 16.

28,589 (1910). Lake (Universal Ore Reduction Co.). Extracting metals from their ores. Aug. 16.

10,368 (1911). Boult. (A.S. Norske Titanfarveverker). Manufacture of yellow pigments from titaniferous iron ores. Aug. 16.

13,806 (1911). Rodeck. Electro-deposition of metals. [June 10, 1910.] Aug. 16.

XI.—ELECTRO-CHEMISTRY.

Applications.

17,435. Steinert. Insulating substance for damping the sound of exposed electric conductors.* July 31.

17,597. Felten und Guilleaume Carlswerk A.-G. Treating substances by electro-osmosis. [Ger. Appl., Aug. 2, 1910.]* Aug. 2.

17,605. Ashcroft. *See under* X.

17,690. Schiff. Carbon electrodes.* Aug. 3.

17.723. British Thomson-Houston Co. (General Electric Co.). Arc lamp electrodes. Aug. 3.

17.810. Welch and Harvey Frost and Co. Electrical heating apparatus, particularly vulcanisers. Aug. 4.

18,078. Meirowsky und Co. A.-G. Electric insulation material. [Ger. Appl., April 18, 1911.]* Aug. 9.

Complete Specifications Accepted.

18,680 (1910). Rideal. Utilisation of the silent electric discharge. Aug. 10.

28,536 (1910). Ruthenburg. Electrodes for electric furnaces. Aug. 16.

30,390 (1910). Popp. Electric furnaces. [May 6, 1910]. Aug. 10.

5167 (1911). British Thomson-Houston Co. (General Electric Co.). Insulating material. Aug. 10.

XII.—FATS; OILS; WAXES.

Applications.

17,822. Aktschourin. Manufacture of resin soap. Aug. 4.

Complete Specifications Accepted.

4262 (1911). Oga. Extracting oil and manufacturing oil cakes. Aug. 16.

7617 (1911). Oelwerke Stern-Sonneborn A.-G. Testing oils. [June 30, 1910.] Aug. 10.

11,903 (1911). Yu Ling Li. Mill for the wet grinding of soja grains (soya beans). [Divided Appl. on 20.275 of 1910.] Aug. 10.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

17,461. O'Keefe. Composition for treating leather, fabrics, etc.* Aug. 1.

17,648. Beauchamp. *See under* X.

17,704. Börnen. Production of fresco paintings and coloured weather-proof architectural ornaments.* Aug. 3.

18,308. Schror. Anti-corrosive or protective paint for metallic surfaces. Aug. 12.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

17,726. Kochnitzky and Friedl. De-resination of raw rubber.* Aug. 3.

17,810. Welch and Harvey Frost and Co. *See under* XI.

Complete Specification Accepted.

3049 (1911). Bridge. Extracting rubber or gums from rubber vines, shrubs, etc. Aug. 16.

XV.—LEATHER; BONE; HORN; GLUE.

Application.

18,286. Johnston. Treatment of leather. Aug. 12.

Complete Specification Accepted.

24,982 (1910). Becker. Puering and bating hides and skins. Aug. 10.

XVIII.—FERMENTATION INDUSTRIES.

Application.

17,703. Stevenson. Manufacture of baker's yeast from brewers' and similar yeasts. Aug. 3.

Complete Specifications Accepted.

15,504 (1910). Von Stuckrad. Manufacture of fruit wine. Aug. 10.

18,696 (1910). Kuhn. Brewing of beer. Aug. 16.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

17,395. Dreyer. Manufacture of fruit-juice. July 31.

17,423. Willcox and Hall. Production of ozone and its utilisation for the preservation of chilled meat, etc. July 31.

17,554. Shelmerdine. Sterilisation of milk. Aug. 2.

17,759. Von Vangel. Manufacture of foodstuffs. Aug. 4.

18,004. Landin. Manufacture of dietetical products. [Swedish Appl., Aug. 8, 1910.]* Aug. 8.

18,050. Poulsen. Pasteurising apparatus. [Danish Appl., Aug. 9, 1910.]* Aug. 9.

18,219. Anderson. Apparatus for softening and purifying water. Aug. 11.

18,287. Cramer. Making infants' food from cows' milk.* Aug. 12.

18,305. Künker. Apparatus for boiling down fruit and extracting its juice. Aug. 12.

Complete Specifications Accepted.

28,168 (1910). Kingzett and Sanitas Co. Apparatus for disinfecting by means of fumigation. Aug. 10.

29,080 (1910). Haddan (U.S. Incinerator Co.). Incinerators for garbage, excrement, etc. Aug. 16.

29,891 (1910). Wilbuschewitsch. Manufacture of tea. Aug. 10.

887 (1911). Swiss Dry Milk Co. Manufacture of dry milk. [Dec. 26, 1910.] Aug. 16.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

17,413. Newton (F. Bayer und Co.). Production of aliphatic hydrocarbons with more than one double bond. July 31.

17,414. Newton (F. Bayer und Co.). Manufacture of diamines of the adipic or beta-alkyl-adipic acids. July 31.

17,616. Sefton-Jones (J. A. von Wülfing). Preparations containing formic aldehyde. [Addition to 15,671 of 1911.]* Aug. 2.

17,985. Soc. Chim. des Usines du Rhone (G. P. Monnet et Cartier.). Manufacture of nitrophenylnitromethanes, their homologues, and derivatives. [Addition to 6076 of 1911. Ger. Appl., April 27, 1911.]* Aug. 8.

XXII.—EXPLOSIVES; MATCHES.

Application.

17,611. Cocking and Kynoch, Ltd. Explosives. Aug. 2.

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Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Suspended particles; Electrical precipitation of ——. F. G. Cottrell. J. Ind. Eng. Chem., 1911, 3, 542—550.

After a brief review of early experimental work on the use of electrical discharges for effecting the deposition of suspended particles (see Lodge, this J., 1886, 572), the author gives a description, with photographs, of some applications of the method (see Fr. Pat. 388,238 of 1908 and U.S. Pat. 945,917 of 1910; this J., 1908, 946; 1910, 222) on the large scale. Alternating current may be used for the treatment of tolerably quiescent masses of gas or liquid in order to induce agglomeration of particles suspended therein into aggregates sufficiently large to settle under the influence of gravity. This method has been applied in California to the separation of emulsified water from crude petroleum (see Beazley, Oil Age, April 21, 1911, 2—4). For the treatment of large volumes of rapidly moving gases, however, the use of high-tension direct current is the only practicable method. Discharges are produced from pointed electrodes, and the suspended particles move with a velocity proportional to their charge towards the electrode of opposite sign, which is usually a smooth surface, on which the particles are deposited. For the pointed electrodes, asbestos or mica twisted up with metal wires, or otherwise fastened to metal supports, is used; in use a deposit of moisture or acid mist renders the asbestos or mica conducting, but if necessary they may be rendered conducting by a special treatment before use. The current is produced by transforming alternating current up to 20,000—30,000 volts, and then commutating this high-potential current into intermittent direct current by means of a special rotary contact maker driven by a synchronous motor. This process was first applied satisfactorily to the deposition of sulphuric acid mist in a works where sulphuric acid was produced by the Mannheim contact process. The electrodes consisted of three concentric cylindrical screens of iron wire, the inner and outer ones being wrapped with asbestos twine and acting as discharge electrodes, whilst the intermediate screen and the outer leaded glass containing vessel acted as collecting electrodes, from which the deposited acid drained into a leaden pan below. The acid mist was delivered in the centre at the bottom and passed alternately upwards and downwards through the annular spaces between the screens and between the outer screen and the containing vessel. In a large experimental apparatus of this form, with a capacity of 100—200 cb. ft. of gases carrying mist per minute, the power consumption was about 0·2 kilowatt, and a larger apparatus for the treatment of the whole of the mist from a Mannheim contact unit has since been installed. The same process, but with apparatus modified and constructed to suit the particular conditions, has been applied successfully on the large scale for the removal of suspended matter from the gases evolved in lead and copper smelting works and the gases from Portland cement kilns and it is suggested that it may also be found useful for the cleaning of blast-furnace gases, and, in certain circumstances, for attacking the smoke problem in large cities.—A. S.

Patents.

Separating-liquid carried off by separated solids in the separation of solids by means of liquids; Process and apparatus for the recovery of ——. E. I. du Pont, Wilmington, Del., U.S.A. Eng. Pat. 17,602, July 25, 1910.

The material is passed through a washing liquid (such as alcohol) which is more volatile than the separating liquid and in which the latter (*e.g.*, bromide of antimony or tin) is soluble, and the washing liquid is subsequently separated by volatilisation. The recovery is effected in an apparatus consisting of an air-tight tank, divided into sections by transverse partitions. The washing liquid is made to circulate in this tank in one direction, while the material under treatment is caused to travel in the opposite direction, by means of a conveyor extending through the partitions. Each section is surrounded by a heater, which causes the washing liquid only to volatilise, and the vapour passing out of each section of the tank is separately condensed and returned into the preceding section. The separating liquid, free from washing liquid, is finally pumped back to the separating vessel, and the washed solids pass out of the tank, through an inclined wing, into a second similar tank, containing water or other relatively inexpensive liquid, which is maintained at a temperature above the boiling point of the washing liquid, so that any accompanying washing liquid is recovered by rectification and returned to the first tank.—F. Sodn.

Delivering at equal pressures two different gases or fluids received under unequal pressures. A. C. Ionides, jun., and J. B. Swan, London. Eng. Pat. 18,267, Aug. 2, 1910.

The gases to be mixed are discharged through two valves controlled by a float contained within a chamber. After passing the inlet valves the gases pass by separate pipes to two discharge chambers into which they are admitted through non-return valves and from which they pass to a mixing chamber. From the latter the mixture of gases issues.—W. H. C.

Fumes and gases; Apparatus for purifying ——. S. Elliot, Caversham. Eng. Pat. 19,992, Aug. 27, 1910.

Improvements in the beater apparatus described in Eng. Pat. 16,889 of 1902 (this J., 1903, 989). Any water which escapes through the strainer above the beater tank is returned down a front passage to an auxiliary tank fitted with an adjustable overflow which serves to separate soot and other floating matter. From the auxiliary tank the water is returned to the beater tank through side passages provided with ports. The bottom and sides of the beater tank may be fitted with deflecting plates which compel the water to move up and down.—B. M. V.

Gases and vapours; Removing nebular particles from ——. O. Imray, London. From A. Spiegel, Darmstadt, Germany. Eng. Pat. 4489, Feb. 22, 1911.

The periphery of a drum mounted so as to rotate horizontally within a casing is formed of bundles of sieves of very fine wires stretched between plates and lying parallel to

the axis of the drum. The inner surface of the casing is provided with channels which terminate in liquid-sealed tubes. The gas enters the drum which has a partition in the centre, at one end, and passes outward through the wires to the casing wall and then returns through the wires again on the other side of the partition to the outlet at the other end of the drum. As the drum is rotated at a high speed, the fine wires cut every part of the stream of gas and striking the liquid particles cause them to coalesce into drops which flow along the channels in the casing to the liquid-sealed outlets.
—W. H. C.

Heating large quantities of air so as to obtain a high degree of pressure. J. Hagemeister, Vordingborg, Denmark. Eng. Pat. 27,075, Nov. 21, 1910.

A gas burner is arranged within concentric nozzles the distance between which can be adjusted so as to regulate the supply of air. The gas for the burner is preheated by being caused to pass through a coil of piping, which is wound round the pipe, above the burner, through which the products of combustion pass.—W. H. C.

Compressing precipitates in settling vessels; Process and apparatus for ——. F. Tiemann, Berlin. Eng. Pat. 29,581, Dec. 20, 1910. Under Int. Conv., Oct. 15, 1910.

The apparatus which is especially suitable for separating vegetable juices from the enclosing fibrous matter, consists of a vertical cylinder into the upper part of which the mixed juice and fibrous matters are fed. A number of conical bells are arranged, one above the other, within the vessel and each bell has a juice-discharge pipe at the apex provided with a valve to regulate the flow. As the fibrous matter sinks down it becomes compressed by the weight of liquid above and the expressed juice flows out through the bells, at a reduced speed, allowing time for clarification. The liquid pressure in the upper part of the vessel is obtained by the use of standpipes of much smaller cross-section than the cylinder; this is done to avoid the necessity of keeping a large quantity of liquid in the cylinder for a long time.—W. H. C.

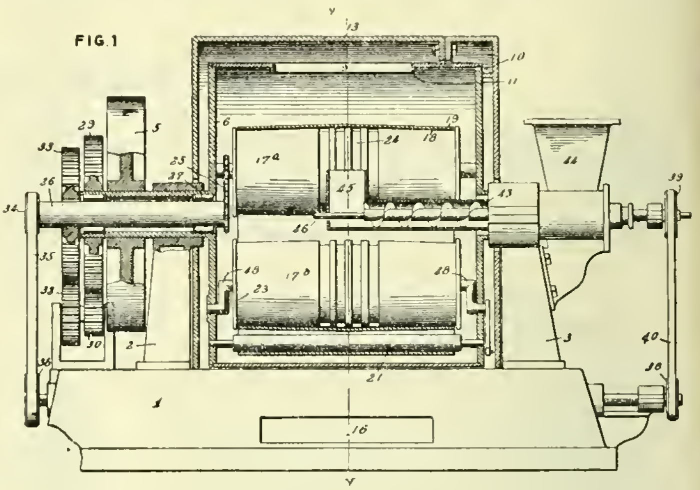
Cooling towers. O. H. Mueller, London. Eng. Pat. 8694 of 1911; date of appl., Dec. 5, 1910. Under Int. Conv., April 9, 1910.

The air inlet chamber of the tower, situated beneath that portion occupied by the filling material, is divided into a number of separate ducts of different lengths, so that air may be admitted directly and independently to each portion of the bottom of the tower. The draught or chimney portion of the apparatus at the top is also divided by vertical partitions into a number of separate draught conduits.—W. H. C.

Extracting process and apparatus therefor. J. J. Berrigan, Orange, N.J. U.S. Pat. 994,631, June 6, 1911.

The apparatus which is intended to perform continuously the same functions as are usually performed intermittently by a filter-press, is shown in one form in the diagrams. The standards, 2, and 3, fixed on the base, 1, act as supports for the stationary casing, 13, within which, mounted on bearings, 27, supported on the roller bearings, 29 and 30, and capable of being rotated by the driving wheel, 5, is a horizontal cylinder, 6, which has freely journalled in the end plates a number of rollers, 17*a*, 17*b*, 17*c*, 20, 21, and 22. These rollers have wound round them, in the manner shown in Fig. 2, an endless band of strong filtering or pressing material which may or may not be perforated or may consist of two layers of different material, 18 and 19, one placed over the other, the belt being kept tight by placing one of the rollers on a movable bearing, 48. The whole system of rollers and belting rotates with the cylinder, 6, and the rollers also rotate about their own axes by motion conveyed from the pulleys, 36 and 34, by the belt, 35, along the inner shaft, 26, mounted on roller bearings, 32 and 33, and the chain-drive, 25. The material is conveyed from the hopper, 44, by the worm, 43, driven from the pulleys, 38 and 39, and belt, 40, and discharges through the feeding shoot, 45. The rollers, 17*a* and 17*b*, which perform the pressing or filtering operation may be fluted as at 24; the material as it leaves the shoot is thrown, by the centrifugal force of the rotating drum, between the belt and the roller, 17*a*, where it is pressed, the liquid passing through to the periphery of the drum whence it is removed through the outlet, 10; the belt on leaving this roller carries the solid material with it—any material which may adhere to the roller being removed by the scraper, 47, and again thrown centrifugally on to the belt—and is caused to take a reverse bend round the guide roller, 20, where the material is opened out and may be washed by a jet of liquid supplied from the nozzle, 46, after which a second pressing takes place on the roller, 17*b*. The belt then takes another reverse bend round the roller, 17*c*, where, the belt now moving towards the periphery, the pressed material is thrown off along the scraper plate, 105, through the opening, 9, which is provided with a flange, 11, to prevent egress of liquid, whence it is conveyed to

FIG. 1



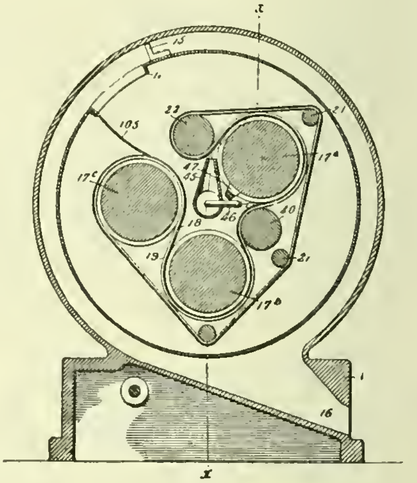


Fig. 2.

the outlet, 16, by the projecting plate, 15, which removes the adhering material from the walls of the stationary casing. Without departing from the principle the apparatus is capable of several modifications, for example—the belt when free from solid material and returning to be recharged may be caused to pass over a series of guide rollers behind a guarding cylinder where it is centrifugally dried: the dry material may be removed laterally from the belt by a second worm conveyor; the inner filtering cloth may be covered with a thick perforated belt which has the effect that when passing over the press rolls the material bulges the filter cloth into these perforations whence it is again thrown out when passing over the reverse rolls; the belt may be dispensed with and the treatment take place in a rotary perforated basket with a filtering liner, the conveying and pressing of the material being effected by rollers and scrapers independently driven from the axis of the basket. In any of the forms the rolls may be suitably heated. It will be seen that as several of the rollers are freely journalled in the cylinder, the pressure between the rollers and the belt is dependent on the speed of rotation of the cylinder and on the weight of the rollers. (See also this J., 1911, 10.)—B. G. McL.

Combining comminuted solids and liquid; Apparatus for ——. E. A. Faller, Assignor to Cement Appliances Co., New York. U.S. Pat. 998,762, July 25, 1911.

The finely divided solid particles are introduced from a bin into a current of air passing through a conduit so as to obtain a current of air mixed with the solid particles. A rotary motion is imparted to this current, and as it passes forward through the main, a current of the liquid, either by itself, or previously mixed with air and having a rotary motion in an opposite direction, is introduced into the main. The desired mixture finally issues from the end of the main.—W. H. C.

Furnace; F. J. Zippler, Avalon, Pa. U.S. Pat. 998,940, July 25, 1911.

The lower part of the furnace lining is provided with main tuyères, above which the lining is protected by a water jacket. Immediately above the water jacket the lining projects forward and downward towards the centre of the furnace, so as to form an overhanging portion, immediately below which auxiliary tuyères are placed.—W. H. C.

Separator; Centrifugal ——. J. J. Berrigan, Orange, N.J. U.S. Pat. 998,949, July 25, 1911.

The separator consists of a horizontal drum having a conical prolongation and mounted so as to be rotated on its axis. The material to be separated is fed into the end of the cylindrical portion and the separated solid matter is carried forward into the conical part by suitable conveyor blades mounted on the axis and finally discharged from the smaller end. The liquid flows back from the conical to the cylindrical portion of the apparatus, from which it is discharged.—W. H. C.

Liquid impelling or circulating device. W. W. Castle, East Weymouth, Mass., Assignor to W. J. Carlin and D. J. Kiley, Boston, Mass. U.S. Pat. 999,092, July 25, 1911.

A short by-pass pipe is attached to the main through which the liquid usually flows and the by-pass is provided with a propeller. A valve is arranged in the main which opens the passage through the latter and closes that to the by-pass when the propeller is not working. When, however the propeller is at work, the valve automatically closes the main passage and opens that to the by-pass, and the liquid is prevented from passing along the main except through the by-pass.—W. H. C.

Superheating-generator; E. Wiart, La Ferté-Bernard, France. U.S. Pat. 999,284, Aug. 1, 1911.

The liquid to be vapourised and superheated is conveyed from a storage tank to the vapourisers by a feed-pump; these vapourisers consist of one or more vertical cylindrical vessels suitably heated. The liquid is first caused to pass round these in coils where it is preheated, after which it is sprayed into the vapourisers. The vapour passes to a number of superheaters in series, consisting of vertical cylindrical vessels connected together by valved pipes and suitably heated. The superheated vapour passes away from the last superheater, the exit pipe being connected by a by-pass with the suction side of the feed-pump. —B. G. McL.

Constant-temperature bath. T. B. Freas, Assignor to V. Weber and Co., Chicago, Ill. U.S. Pat. 999,710, Aug. 1, 1911.

The temperature of the bath is maintained by two or more electric heaters, the controlling switches of which are operated by electro-magnetic mechanism; the main and auxiliary heaters being regulated from thermo-responsive devices which are subject to the temperature of the bath and to the temperature of the surrounding air respectively. —B. G. McL.

Wood charcoal for filters; Method of revivifying ——. A Bertels. Ger. Pat. 236,340, Oct. 8, 1909.

Gases containing little or no free oxygen and free from combustible substances, *e.g.*, combustion or generator gases, are passed through the charcoal at a temperature high enough to volatilise volatile impurities. The vessel containing the charcoal is provided with inlets at different heights for the hot gases. The filter-chamber itself may be used as receptacle for the charcoal during the revivifying operation, the combustion gases being obtained from a portable furnace or generator which is moved from one filter-chamber to another as required; or each charcoal receptacle may be provided with a lower portion serving as gas generator or furnace chamber.—A. S.

Plaster of Paris mass for the drying of air, especially for metallurgical purposes, or for drying other gases. F. Lossen. Ger. Pat. 236,549, Feb. 26, 1910.

A mixture of plaster with an inert salt such as sodium chloride is mixed to a paste with a cold saturated solution of the salt, and after setting, the solid plaster is freed from the salt by washing with water saturated with calcium sulphate, and is then dehydrated by means of hot air at a temperature of about 120° C. The resulting plaster is very porous and absorbs moisture from air or other gases much more rapidly than ordinary plaster.—A. S.

Filling material for reaction towers. E. T. Steinbrecht. Ger. Pat. 236,880, July 6, 1907.

The filling material consists of blocks of impermeable material, which on more than two sides are provided with round, oval, or angular hollows for the collection of floating particles or dust.—A. S.

Clinkering, roasting, calcining, or otherwise treating materials; Processes of ——; F. W. Yost, Chicago, U.S.A. Eng. Pat. 14,276, June 13, 1910. Under Int. Conv., June 11, 1909.

See Fr. Pat. 417,037 of 1910; this J., 1910, 1393.—T. F. B.

Filtering machines. J. Drage, Boulder, West Australia. Eng. Pat. 608, Jan. 9, 1911. Under Int. Conv., Feb. 21, 1910.

See Fr. Pat. 424,857 of 1911; this J., 1911, 879.—T. F. B.

Filter; High-pressure ——. A. Dondey and J. C. Testro, South Melbourne, Victoria. U.S. Pat. 999,759, Aug. 8, 1911.

See Eng. Pat. 4329 of 1910; this J., 1910, 1145.—T. F. B.

Centrifugal machines. S. G. S. Dicker, London. From Jahn-Kommandit Ges., Arnswalde, Germany. Eng. Pat. 2245, Jan. 28, 1911.

See Fr. Pat. 425,382 of 1911; this J., 1911, 880.—T. F. B.

Sawdust; Process of rendering —— absorbent. V. Raisin, Assignor to Comp. Indus. des Alcools de l'Ardèche, Paris. U.S. Pat. 998,858, July 25, 1911.

See Fr. Pat. 400,737 of 1908; this J., 1909, 1024.—T. F. B.

Gas; Apparatus for bringing a —— into contact with a liquid. H. T. Durant, Assignor to The Metals Extraction Corporation, Ltd., London. U.S. Pat. 999,213, Aug. 1, 1911.

See Eng. Pat. 25,679 of 1909; this J., 1910, 1446.—T. F. B.

Heating and evaporating liquids by means of steam; Apparatus for ——. D. B. Morison, Hartlepool. U.S. Pat. 1,000,285, Aug. 8, 1911.

See Eng. Pat. 24,074 of 1909; this J., 1910, 1362.—T. F. B.

Distilling apparatus for use with a high vacuum. P. Porges, L. Singer, and L. Steinschneider. Fr. Pat. 427,607, March 21, 1911. Under Int. Conv., July 26, 1910.

See Eng. Pat. 29,145 of 1910; this J., 1911, 941.—T. F. B.

Explosive gases; Process for filling with porous materials receptacles for containing ——. Acétylène Dissous et Applications de l'Acétylène. Fr. Pat. 427,816, June 6, 1910.

See Eng. Pat. 23,856 of 1910; this J., 1911, 349.—T. F. B.

Apparatus for the purification of liquids, especially of oils of all kinds, hydrocarbons, and the like, by alkaline or acid liquids. Ger. Pat. 236,718. *See* IIa.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Peat fuel deposits in Sweden. C. H. Graves. Min. and Eng. World, Chicago, Aug. 5, 1911. [T.R.]

There are immense deposits of peat in central and northern Sweden and an entire absence of coal deposits. A new invention proposes to prepare peat powder which may be blown by an electric fan into the combustion chamber of a furnace or steam boiler. Heated air is used to carry the powder, and the combustion is said to be complete. The experimental plant for the manufacture of peat powder was installed at Back, in the interior of Sweden, at a peat bog about 8 ft. deep. The capacity of the digging machine was about 40 cu. yds. per hour. Alongside were laid movable tracks and upon them small dump cars conveyed the peat to a field, where it was spread out to dry. Swedish peat, when dug out of the bog, contains 90 per cent. water and 10 per cent. vegetable matter. The air removes about 30 per cent. of the moisture. The peat is then carried by trolleys to the crushers. From these the fine peat drops into a sieve, or bolting machine, and is bolted. From this the resulting powder is carried by a scraper chain to the top of the oven, the coarser products of the bolting being re-ground and re-bolted. The first bolting is said to yield about 50 per cent. of powder. After drying in the oven the powder is again bolted and packed in sacks. It still contains about 15 per cent. water, but that is not enough to interfere with its combustion. The peat powder when finished must be all fine, of uniform pulverisation, and free from vegetable fibres. The waste fibres can be sold for domestic use.

The Northern Steam Boiler Association has tried peat powder as fuel under steam boilers. The air was heated in the smoke flues of the furnace to about 200° F. previous to blowing the powder into the furnace. It was found that one ton of coal was equivalent to 1·4 tons of peat powder, the latter being of poor quality, and to 1·2 tons if better quality had been used. The "heat effect" of the boiler is stated to have amounted to an average of 75 per cent. when heated by peat powder and 64 per cent. when heated by coal. This is said to be partly because of the more intimate mixture of the heated air and fuel possible when peat powder is employed and the more complete control of the proportions. The saving effected in using the powder was 17 per cent.

Transvaal coals; Testing ——. M. T. Murray. J. Chem., Met. and Min. Soc., South Africa, 1911. **11**, 600—609.

The author's experiments are not completed but have been published, as the Engineering Standards Chemical Sub-Committee is at present discussing the question. *Sampling.*—Great care is necessary on account of the high proportion of ash, 10 to 20 per cent. being usual. The author uses an 80-mesh final sample for most determinations. *Ash.*—Two grms. are burnt in a muffle or over a Méker burner, allowance being made for the calcination of calcium carbonate and the oxidation of pyrites. *Fixed carbon.*—More concordant results can be obtained and the nature of the coke better determined by heating 50 grms. of a 10-mesh sample in a luted crucible (with a small vent) in in a wind furnace than by treating only 2 grms. of a finer sample. *Sulphur.*—This element is generally high (up to 3 per cent.) and is usually present as pyrites and organic matter, but may sometimes occur wholly or partially as calcium sulphate. *Ultimate analysis.*—The following is an analysis (by A. Whitby) of a fairly representative Transvaal coal, though the ash and sulphur are lower than the average:—Total carbon, 73·97; hydrogen, 4·81; nitrogen (by Kjeldahl's method), 1·62; sulphur, 0·46; oxygen (by difference), 5·99; moisture, 2·40; ash, 10·75 per cent. This sample contained 59·05 per cent. of fixed carbon and 27·8 of volatile matter. The values for the heat of combustion, calculated by the Dulong, Mahler, and Goutat formulæ, respectively, were higher by 6·9, 0·73 and 8·3 per cent. than the value measured by the calorimeter. *Calorific power.*—The author uses a Mahler-Cook bomb, as he considers its insulation from air-currents more nearly perfect than in other forms. He also finds it advantageous occasionally to stir the water in the jacket, while, for the water in the calorimeter he recommends a mechanical stirrer: cessation of stirring causes a large variation in the radiation loss. The author's motor and crank arrangement gives 36 double stirs per minute. The thermometers should be checked against a standard and should be graduated to 0·01° C. By means of a telescope, readings to 0·001 or 0·002° C. are obtainable. For the electrical ignition fine iron wire is used, of which 4 in. weighing 0·0264 grm. is burnt, generating 34 calories. *Calibration.*—The water equivalent of the author's calorimeter determined by the combustion of naphthalene and sucrose respectively was found to be 780 and 778 when the heats of combustion were taken as 9692 and 3954. The use of these materials or of benzoic or salicylic acid is open to some objection, so the author tentatively suggests the use of pure sugar carbon, the purity of the carbon being checked by absorption of carbon dioxide and the heat of combustion taken as 8100, which is a generally agreed upon figure. *Nitric acid and sulphuric acid corrections.*—The author considers that formation of nitric acid introduces a considerable error, and suggests washing out the bomb with water, titrating the total acid with dilute alkali and then estimating the sulphuric acid as barium sulphate. In practical work sulphur burns only to sulphur dioxide (2250 cals. per grm.) while in the bomb it is generally allowed for as sulphuric acid (4388 cals. per grm.). *Oxygen pressure used.*—The work of E. A. Allcut (Engineering, Dec. 2, 1910, 755) is referred to as showing the necessity for a standard pressure. Twenty-five atmospheres is usually specified, but in South Africa less oxygen is often used on account of its high cost. The Transvaal coals behave somewhat differently to English coals, and with a pressure of 25 atm., the ashes of most of the former fuse to a solid mass and when a slag solidifies to a glass the latent heat of fusion has to be considered. This latent heat is about 85—130 cals. per grm. for substances likely to form the ash. *Correction for radiation.*—Carelessness in making this correction seems to be one of the chief sources of error. For accurate work, the author uses the Regnault-Pfaundler formula which necessitates the taking of equal numbers of readings during each of the three periods, *viz.*, "initial," when the calorimeter is adjusting itself to the temperature of the atmosphere; "main," or combustion, when the temperature is rising; and "final," when the calorimeter is losing heat by radiation. Readings are taken at intervals of one minute, fifteen seconds and one minute respectively for the three periods. It is admitted that the Regnault-Pfaundler method is too long for use in practical work, but it is suggested that any approximate method before adoption as standard must give results agreeing closely with those obtained by some such accurate formula, and the author is continuing his work in this direction.—B. M. V.

Coal; A new constituent of ——. A. Pictet and L. Ramseyer. Chem.-Zeit., 1911, **35**, 865, 907.

By extracting coal with boiling benzene or by its distillation under reduced pressure (10 mm.), a colourless liquid hydrocarbon having a violet fluorescence was isolated, which was found to be hexahydrofluorene, $C_{13}H_{16}$. It boils under ordinary pressure at 250° C. and has a specific gravity of 0·920 at 20° C. Its vapours when passed through a red-hot tube are resolved into fluorene and hydrogen; on brominating, the hydrocarbon yields the mono- and di-bromo derivatives of fluorene; on oxidation with potassium permanganate it yields acetic, oxalic and adipic acids, but no phthalic acid. Four of the hydrogen atoms are therefore linked to one benzene nucleus and two to the other. The constitution of other hydroaromatic hydrocarbons also isolated from coal could not be established. The hydroaromatic bodies present in coal are resolved into aromatic hydrocarbons and hydrogen during the usual dry distillation.—A. Sbld.

Methane from carbon monoxide or non-poisonous illuminating gas from water-gas; Technical solution of the problem of preparing ——. E. Erdmann. J. Gasbeleucht. 1911, **54**, 737—743.

It is stated that the problem of converting the carbon monoxide in water-gas into methane by Sabatier and Senderens' catalytic method on a technical scale has been solved in an experimental plant installed in England by the Cedford Gas Process Co. The failure of Elworthy's earlier attempt in this direction (Eng. Pats. 12,461 of 1902 and 14,333 of 1904; this J., 1903, 900; 1905, 1066) was due chiefly to two causes:—(1) the deficiency of hydrogen in ordinary water-gas, and (2) the loss of activity of the nickel used as catalyst. These difficulties have been overcome in the process described in the paper (see Eng. Pats. 17,017 and 22,219 of 1909; this J., 1910, 1242), the principal new feature of which is that the water-gas, after being washed and freed from tar and carbon dioxide, is partially liquefied in a Linde apparatus in order to separate it into a portion rich in hydrogen and a portion consisting mainly of carbon monoxide. It is found best to adjust the valves of the apparatus so that the gas evolved contains 13—14 per cent. of carbon monoxide and then to add sufficient of the portion rich in carbon monoxide (93—94 per cent.) to bring the content of carbon monoxide up to 17 per cent. When once the valves have been regulated, it is possible to obtain continuously a gas containing 17 per cent. of carbon monoxide, 79 of hydrogen, and 4 of nitrogen; the content of carbon monoxide at different times does not vary by more than a fraction of 1 per cent. The portion of the gas rich in carbon monoxide from the Linde apparatus is utilised for working the compressors. During its passage through the Linde apparatus the gas is freed completely from the sulphur compounds which were the chief cause of the loss of activity of the nickel catalytic mass in the subsequent reduction process. The reduction apparatus consists of three vertical quartz tubes, 1½m. long and 12 cm. diameter, each containing pumice impregnated with 200 grms. of finely divided nickel. The tubes are contained in an iron casing which is heated electrically to 280°—300° C. at the beginning of the process. The gas also is preheated before passing into the reduction chamber. After the reduction has once commenced more than sufficient heat is evolved not only to maintain the temperature of reaction but to heat the entering gas to 300° C. From the reduction chamber the gas passes through a condenser, to separate water, to the holder. Details of an experimental run of 60 hours are given. 392 cb. m. of gas rich in methane were obtained from 1080 cb. m. of crude water-gas, and 268 cb. m. of carbon monoxide were obtained as a secondary product from the Linde apparatus. The water-gas used, contained 51·7 per cent. of hydrogen, 39·5 of carbon monoxide, 4 of carbon dioxide and 4·8 of nitrogen, and had a calorific value of 2542 cals. The mixed gas entering the reduction chamber contained 80·9 of hydrogen, 16·3 of carbon monoxide, and 2·8 of nitrogen, (calorific value, 2592 cals.), and after reduction it consisted of about 31 per cent. of methane, 62 of hydrogen, and 6 of nitrogen, with traces of carbon monoxide and dioxide, and having a calorific value of 4220 cals. The cost of the process depends primarily on the cost of the water-gas. For English conditions the following figures are given:—

	s.	d.
12,360 cb. ft. of water-gas at 2·45d. per 1000 cb. ft.	2	6·3
Cost of conversion into 4485 cb. ft. of gas containing about 32 per cent. of methane at 1·76d. per 1000 cb. ft. of latter	0	7·9
4485 cb. ft. of "synthetic gas" cost .... or 8½d. per 1000 cb. ft.	3	2·2

The working of the process in connection with by-products coke-ovens is contemplated, and it is estimated that it will be possible to produce a "mixed gas" at a cost of 4·3d. per 1000 cb. ft. (excluding freight of coal) by adding to the coke-oven gas an equal quantity of the "synthetic gas" and carburetting the mixture so that it has an illuminating power of 14 candles. The water-gas can be replaced by Mond gas, and where this is available it is undoubtedly the cheapest raw material for the production of the "synthetic gas," 1000 cb. ft. of the valuable constituents (carbon monoxide, hydrogen, and methane) of Mond gas costing only 0·8d.—A. S.

Hydrocarbon gases; Absorption of —— *by non-aqueous liquids.* A. S. McDaniel. J. of Phys. Chem., 1911, **15**, 587—610.

The absorption of methane, ethane, and ethylene by several organic liquids (chiefly hydrocarbons and alcohols) has been determined at a series of temperatures between 20° and 60° C. A method of temperature control for keeping the burette and absorption pipette at the same temperature was devised, enabling direct observations of the absorption to be made at the various temperatures and thus eliminating many errors arising from the effect of vapour pressure. Comparison with the relative absorptive powers of the same liquids for other gases such as nitrogen, carbon monoxide and dioxide, and hydrogen shows that the relations are quite different for the two groups of gases: the absorptive power of the alcohols as compared with the hydrocarbon liquids is exactly reversed. The specific nature of the gas may exercise quite as much influence as the nature of the liquid.
—A. Sbld.

Gasoline: Production of —— *from natural gas.* F. P. Peterson. Petroleum, 1911, **6**, 2179—2182.

Comparisons of the condensation method with the freezing method of obtaining gasoline from natural gas are rendered difficult on account of the extremely variable nature of the gas. There are no less than five groups of compounds present. This also makes it difficult to estimate the probable yield. 1000 cb. ft. of butane gas would yield 34 galls. of butane. The author knows cases in which 13 galls. per 1000 cub. ft. of gas have been obtained. In the system described, a gas pump is used giving a vacuum of 27½ ins. The machine driving the gas pump also drives a small stationary compressor working to 75 lb. per sq. ft. The gas is condensed by water-cooled condensers yielding gasoline of about 90° Bé. The yield is about 50 galls per day.—H. E. P.

Petroleum refineries; Use for waste of ——. Oil, Paint, and Drug Rep., Aug. 7, 1911. [T.R.]

Salts of naphtha acid, once thrown away from the kerosene and lubricating oil factories, recently have been used in various ways in industry. Naphtha acids have for some time been used in the manufacture of cheap soaps, but the disagreeable smell attached to this waste required the application of perfumes to neutralise it. Very recently chemists have succeeded in almost eliminating this disagreeable odour, and the consequence has been a considerable increase in the use of the acids. The appreciation in the value of tallow has brought about a rise in the value of oleic acid, which is used in the textile industries. At the present time a large Baku firm is introducing naphtha acid in place of oleic acid. It is stated that several wagonloads of naphtha acid have been sold, and it is hoped that in the near future this acid will be used extensively.

Mineral oil refineries; Waste sulphuric acid from ——. St. von Pilat and W. Starkel. Petroleum, 1911, **6**, 2177—2179.

THE authors have examined the waste sulphuric acid from refineries on the large scale, in connection with the problem of regeneration. The sulphuric acid was estimated by precipitation with barium chloride. The total acid was estimated by titration with $N/10$ alkali. The difference between the two results gave the acid compounds other than sulphuric acid present. It was concluded that the chemical action of the sulphuric acid is mainly one of polymerisation. This is shown by the gradual solidification of the tar in presence of sulphuric acid, and by its liquefaction after the acid has been removed. The products of polymerisation are removed on account of their greater solubility in sulphuric acid than in the petroleum distillate. The formation of sulphonic and sulphinic acids, and sulphides, is to be regarded as a subsidiary reaction. It was not found possible to obtain the acid products in a crystalline condition, from the barium or sodium salts or even from the acid chlorides after treatment with phosphorus pentachloride. The formation of benzene-, toluene- or xylene-sulphonic acids would, however, hardly be expected under the conditions prevailing (low temperature, short time, and small amount of sulphuric acid).
—H. E. P.

Extinguishing oil fires by means of frothy liquids. Chem. Trade Review, June 10, 1911. Eng. and Min. J., 1911, **92**, 201.

IN a recent test, a mixture of one quart each of caustic soda and alum solutions yielded 15 quarts of a yellowish-white foam (density 0·14) which could be sucked up and distributed like water with a hose. When added to water or petroleum spirit the foam spread itself over the surface of the liquid and remained almost unchanged for 20 minutes. Petroleum spirit to a depth of 20 in. was placed in a basement, 30 sq. ft. in area, and fired; the fire was extinguished in 78 seconds with 18 galls. of the frothy mixture. A burning petroleum spirit tank, 6 ft. in diameter and 9 ft. high, was similarly extinguished in 13 seconds. The petroleum spirit was practically unaffected, burning as usual after removal of the froth.—W. E. F. P.

[Oil-fired] Open-hearth furnaces for small castings. MacGregor. *See* X.

Gas analysis by fractional combustion. Ubbelohde and de Castro. *See* XXIII.

PATENTS.

Peat briquettes; Plant for the manufacture of ——. T. Franke, Wiesbaden, Germany. Eng. Pat. 14,640, June 17, 1910.

THE wet peat is forced along a conical perforated double-walled casing by means of a conical worm having projecting ribs in the blades and mounted on a perforated hollow shaft. By producing a vacuum in the double-walled casing and hollow shaft, the removal of water is facilitated. The peat is then fed through a flattened nozzle to a set of three hollow perforated rollers, where a further amount of water is removed and the fibre is partially disintegrated. After leaving the rollers, it passes into a hopper, where it meets, and is mixed with, finely divided coke. By means of another worm and cone the mixture is forced through a tube, past a cutting device, and into a press having a hollow perforated piston for the further removal of water. The briquettes then pass to the glazing and drying tanks.
—G. W. McD.

Fuel; Process of increasing the calorific value of ——, and apparatus therefor. J. W. Verity and F. C. Lewis, Liverpool. Partly from E. B. Higgins, Philadelphia, U.S.A. Eng. Pat. 23,080, of 1910, dated April 20, 1911.

FUELS such as coal, slack, coke, peat, etc., are treated at the ordinary temperature and in the presence of moisture with chlorine, bromine or iodine, either separately or together; or with their reciprocal compounds, such as iodine chloride; or with their compounds containing oxygen and hydrogen, such as hypochlorous acid; or, finally, with the compounds of chlorine with oxygen, such as chlorine peroxide.—A. T. L.

Coke; Method of quenching and removing ——. A. Bleichert und Co., Leipzig-Gohlis, Germany. Eng. Pat. 3518, Feb. 11, 1911. Under Int. Conv., Feb. 11, 1910.

A TROLLEY quenching-tank with a coke holder in it is run in front of the oven and the coke is shot in and quenched. By a cable attached to the coke holder the trolley and its contents are moved from the coke oven to a point where the cable is deflected upwards, carrying with it the holder and its contents, which are conveyed to, and emptied out at, a bunker. By reversing the cable the empty holder is returned to the trolley tank which passes back to the front of the oven for a fresh supply of coke.
—G. W. McD.

Coke ovens, retort furnaces, and the like. Stettiner Chamotte-Fabrik Akt.-Ges., vormals Didier, Stettin, Germany. Eng. Pat. 6924, March 20, 1911. Under Int. Conv., Sept. 12, 1910.

IN a furnace having horizontal heating flues and gas conduits in the walls between the retorts, each heating flue has several gas-supply conduits opening into it at different distances from the air inlet end, in order to render the heating more uniform. Each dividing wall between adjacent retorts or ovens is formed with two sets of heating flues, and two sets of horizontal gas supply conduits, one set for each flue, are provided between each pair of heating flues. The gas conduits of a set open to the heating flue by orifices which are of increased height as they are nearer the discharge end of the flue. The whole of the gas-conduits formed in one dividing wall of the battery of ovens, are fed from a vertical gas-distributing box in the front wall of the oven, and each separate conduit can be regulated by a valve which is mounted removably in the distributing box so as to facilitate access to the conduits. Each set of heating flues is in communication with a vertical air-supply flue at one end of the oven and a downtake for the combustion products at the centre of the oven, these flues being connected with regenerators beneath the ovens.—A. T. L.

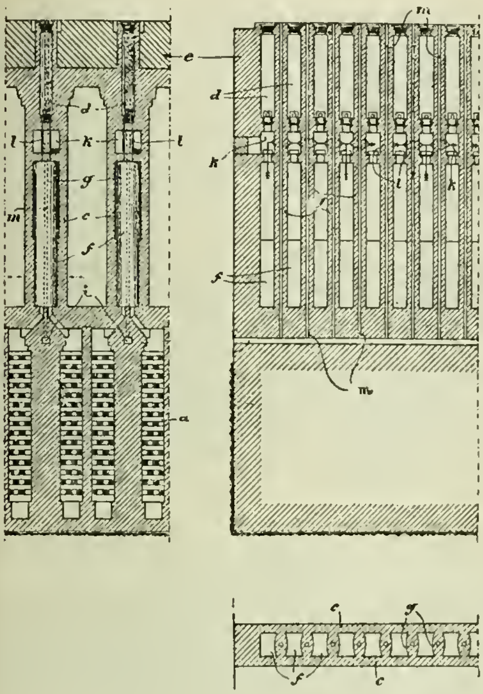
Coke-oven. C. Schroeter, Chicago, Assignor to The Schroeter By-Product Coke-oven Construction Co., Phoenix, Ariz. U.S. Pat. 998,805, July 25, 1911.

AN addition to the claims already made by the patentee (this J., 1909, 646) of a recuperator space with an insulated metal bed-plate placed below the air chamber and of chequer-brickwork regenerators placed in the foundation walls of the oven.—B. G. McL.

Chamber oven; Large —— for the production of gas and coke. H. Koppers. Ger. Pat. 234,410, Dec. 25, 1909.

THE patent relates to ovens having heating walls, *c*, provided with vertical flues, *f*, communicating above with a horizontal conduit, *k*, the heating walls being connected

by brickwork, *g*. According to the present invention, the brickwork, *g*, is connected with the roof, *e*, of the oven by columns or pillars, *l*, disposed in the conduit, *k*. These pillars, whilst not interfering with the discharge of the products of combustion through the conduit, *k*, allow of the cooling channels, *m*, being continued through the roof of the oven to the outer air, and at the same time serve to carry over the weight of the roof to the brickwork, *g*.
—A. S.



Gas in retorts; Manufacture of ——. G. P. Lewis and C. L. True, London. Eng. Pats. 17,043, July 18, 1910, and 4047, Feb. 17, 1911.

The yield of gas obtained from coal, wood, etc., is increased and the quality improved by spraying oil on to the red-hot mass in the retort. In order to prevent deposition of soot in the retort, the oil is emulsified by agitation with alkaline soapy water; chlorine gas or chloride of lime may also be used to hasten emulsification.
—B. M. V.

Gas producers. C. Whitfield, Rocklands, Ireland. Eng. Pat. 18,143, July 30, 1910.

The producer is specially intended for bituminous fuel, and is of the type having upper and lower grates, with the gas-outlet at a point midway between them. The lower part of the producer has a fixed grate and enclosed ash-pit. The upper part of the producer chamber is of considerably larger diameter and has an inclined annular, or basket-shaped, grate surrounding the upper end of the lower part of the producer chamber. Beneath this annular grate is an annular ash-pit provided with a door and with air inlets. Steam may be admitted above the fuel in the upper part of the producer as well as to the ash-pits.
—A. T. L.

Air gas; Production of ——. Boulton and Paul, Ltd., Norwich, and H. W. Egerton, Castessey. Eng. Pat. 24,991, Oct. 27, 1910.

In order to obtain air gas of constant composition, rather more air than is necessary is pumped into an inverted water-sealed bell or aerometer, the rise and fall of which controls a by-pass which returns excess air to the atmosphere. The aerometer may also be adapted to control the speed of the blower. The air from the aerometer passes through a distributor over the surface of the hydrocarbon contained in a vapourising chamber, and thence to the service pipe. The surface of the hydrocarbon exposed to the current of air is varied by a fan-like baffle, adjustable from outside the apparatus.—B. M. V.

Gas generating plant. M. and J. H. White, Luton. Eng. Pat. 28,711, Dec. 9, 1910. Addition to Eng. Pat. 10,357, April 27, 1910 (this J., 1911, 481).

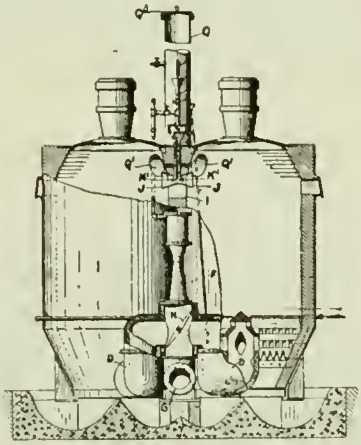
The furnace is provided with a tapered tubular sliding shaft, adapted to regulate the quantity of material in the combustion chamber, and adjust the suction draught. A portion of the exterior of the shaft is made cylindrical and by means of set screws passing through an annular flange fixed to the top of the furnace, the shaft may be secured in the desired position.—B. N.

Gas producing plant; Suction ——. H. V. Senior and F. H. Livens, Lincoln. Eng. Pat. 28,922, Dec. 13, 1910.

The apparatus is designed for the use of wood refuse, peat, lignite, bituminous coal, etc., as fuel, the gases passing from the generator into an annular chamber, which heats both the incoming air, or the air and water vapour, and the fresh fuel. The gases pass through several vertical pipes into main pipes which slant downwards towards a dust collector and scrubber, the pipes being provided with cleaning rods and discs, which may be operated at any time during the working of the apparatus, but normally are drawn back and secured out of the way. In the dust collector and scrubber, the gases after descending on each side to a water seal, which receives and collects the dust, ascend through a central chamber and meet broken currents of water falling over baffle-plates. The water seal permits the removal of the deposit whilst the plant is at work.
—B. N.

Gas producer. J. A. Herrick, New York. U.S. Pat. 998,614, July 25, 1911.

A reversible double producer; one part operating with an up-draught while the other is on the down-draught system. The producers, as shown in the diagram, are connected at the top by a passage, I, through the brickwork; centrally placed in this passage is a box, J, having open ends and provided with steam jets, K^1, which point in opposite directions and which are used alternately to draw the gas from the top of one producer into the other. The air blast supplied by a steam-jet blower, F, enters by way of the reversing valve, H, and the pipe, D, under the grate of one producer, the crude gas generated in this producer passing over and downwards through the fuel



bed in the other producer and finally leaving by the pipe, G. The reversing mechanism simultaneously reverses the blast and gas exit valve and the steam jets between the producers. A burning-off pipe, Q, with cover, Q^3, connected to both producers by the openings, Q^1, is also provided.—B. G. Mc.L.

Gas producer. G. Steinl, Assignor to T. J. Shaw, Ginger, Texas. U.S. Pat. 998,809, July 25, 1911.

Supported on two longitudinal beams above the grate of an ordinary vertical gas producer is placed a rectangular exhaust chamber, having an inclined top and inclined apertures in its side walls; between the two beams is a horizontal, cylindrical fire-proof retort which is connected with the suction pipe leading from the top of the exhaust chamber. The upper portion of the producer operates on the down-draught principle.—B. G. Mc.L.

Gas producer. W. B. Chapman, Assignor to W. B. Hopping, New York. U.S. Pat. 999,698, Aug. 1, 1911.

A down-draught gas producer has a vertical gas outlet pipe passing downwards throught the ash-pan surrounding the open bottom of the producer. The ash-pan may be dry or contain water which is then used to cool the outlet pipe. The upper end of the pipe is screened by a hood which may be fixed or have an irregular upper surface and be rotated to agitate the fuel bed. Stirring of the fuel and ash beds may also be effected by two independently driven agitators revolving round the outlet pipe, or by an agitator and ash plough rotating together. The latter expels the ashes towards the edge of the pan.—B. M. V.

Gas-producer. J. A. Herrick, New York. U.S. Pat. 999,784, Aug. 8, 1911.

A blast-box in the lower part of the producer has top and bottom ridges formed by the meeting of inclined walls, the walls adjacent to the bottom ridge having blast apertures. The walls between the top and bottom inclined parts consist of alternate vertical and inclined parts, the vertical parts having blast apertures.—A. T. L.

Gas-producer. H. J. Lea, Assignor to The Colonial Trust Co., Pittsburg, Pa. U.S. Pat. 999,807, Aug. 8, 1911.

A vapouriser heated by the gases in the upper part of the producer is formed of a body-portion and a flat cover-plate, the body-portion having the shape of a spiral groove of two turns increasing in cross-section from the air and water inlet to the vapour outlet, which is at the greatest radius of the spiral. This vapouriser covers in the top of the producer leaving a central orifice for the charging hopper.—A. T. L.

Gas-producer for the manufacture of gas from lignite. C. Koller. Fr. Pat. 427,662, March 23, 1911. Under Int. Conv., March 25 and July 30, 1910.

The fuel-column rests upon a rotating base plate which forms a water-trough and is provided with a central tuyère suitably elevated. Curved radial blades are fixed to the rotating base-plate so as to force the clinkers and ashes out to the circumference and deliver them up an inclined guide which may be fixed at any desired point on the periphery of the lower part of the producer casing. The body of the producer is of metal, not lined with fire-brick, and forms an annular steam-boiler, being provided with the usual fittings. The hot gases before leaving the producer circulate around the column of fresh lignite in the upper part of the producer. The fuel feed valve in the charging hopper comprises a perforated disc working over a similar fixed disc.—A. T. L.

Gas-scrubber. G. M. S. Tait, Montclair, N.J., Assignor to Tait Producer Co., New York. U.S. Pat. 998,930, July 25, 1911.

A vertical gas-scrubber in which the gas passes upwards through the packing material, is surmounted by a chamber containing a water injector. By means of this injector a portion of the gas which has passed through the scrubber is drawn into the chamber from which there is a gas-outlet pipe; the water from the injector collects in the bottom of the chamber and passes by way of a siphon tube to the water distributor in the scrubber.—B. G. McL.

Explosive wave [e.g., in blowpipe burners]; Porous material to interrupt the propagation of an ——. Soc. Acétylène Dissous et Applications de l'Acétylène. Fr. Pat. 427,817, June 6, 1910.

The porous material is made by placing metallic wires, balls, or shavings of determined diameter or thickness, under compression in a mould. By varying the size of the wires, etc., and the degree of compression, a material of any desired degree of porosity can be obtained.
—G. W. McD.

Inflammable liquids; Storage of ——. C. Ruppel, Charlottenburg, Germany. Eng. Pat. 14,633, June 20, 1911 Under Int. Conv., June 20, 1910.

An arrangement for preventing the entrance of quenching-water into the piping of protected receptacles for inflammable liquid. The layer of refractory material protecting the receptacle is carried up and round the piping above this layer, to such a height that even after the uncovered part of the piping has been fused, the quenching-water cannot enter the piping and force out any inflammable liquid.—G. W. McD.

Hydrocarbon oils; Process of treating ——. W. P. Bending, Los Angeles, Cal. U.S. Pat. 998,670, July 25, 1911.

The oil is allowed to fall in a finely divided condition, in contact with an ascending current of hot air, its descent being suitably interrupted to ensure more intimate contact; it is then collected and delivered into the bottom portion of the body of oil under treatment. Further quantities of oil are continuously pumped up from the upper portion of the body of oil, and exposed to hot air as before, until the whole mass is purified.—T. F. B.

Liquid bituminous compound and process for making the same. H. R. Kasson, and S. S. Saxton, Chicago. U.S. Pat. 998,691, July 25, 1911.

The compound is prepared by heating a mixture of residuum oil of petroleum and commercial oleic acid (red oil) to 212° F. and then adding it to the melted bitumen or asphaltum: the mixture at 212° F. is then mixed with an equal weight of water at 212° F. to which ammonia has been added. The composition maintains its liquid form at ordinary temperatures.—B. G. McL.

Oil [petroleum]; Process of refining ——. H. G. Burrows, Orcutt, Cal. U.S. Pat. 998,837, July 25, 1911.

Crude oil which contains mineral matter in suspension, and which is of too great viscosity to permit of the settling out of the same, is refined by distilling at a velocity sufficient to carry over mechanically the mineral matter with the distillates, which being of lower viscosity permit of the settling out of the mineral matter. The process is carried out by passing the oil continuously through an elongated conduit which is progressively heated, the vapours being drawn off at intervals along the conduit.—B. G. McL.

Combustion; Process for utilising the residues of —— *of furnaces.* A. Muller, Berlin, and Veltener Schwemmstein-Industrie Ges.f. Schlackenverwertung, Velten, Germany. Eng. Pat. 27,645, Nov. 28, 1910.

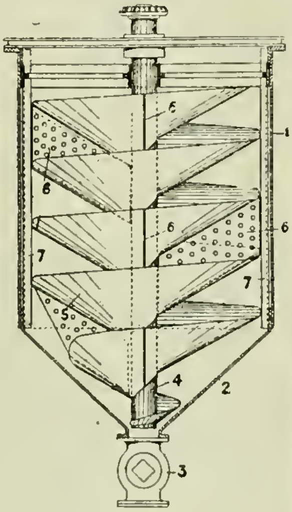
See Fr. Pat. 423,467 of 1910; this J., 1911, 608.—T. F. B.

Hydrogen and finely-divided carbon (soot) from acetylene or a mixture of acetylene with other hydrocarbons; Process and apparatus for the continuous manufacture of ——. R. P. Pictet, Wilmersdorf, Germany. Eng. Pat. 24,256, Oct. 19, 1910. Under Int. Conv., Oct. 21, 1909.

See Fr. Pat. 421,838 of 1910; this J., 1911, 542.—T. F. B.

Oils of all kinds, hydrocarbons, and the like ; Apparatus for the purification of liquids, especially of —— by alkaline or acid liquids. Dessauer Dachpappen- und Teerprodukten-Fabr. Röpert und Mathis Ges. m. b. H. Ger. Pat. 236,718, Sept. 15, 1910.

The apparatus consists of a vertical mixing vessel, 1, with a conical lower portion, 2, provided with an outlet-cock, 3. Inside the vessel is an agitating screw, 5. Radial partitions, 6, alternate ones of which are perforated, are mounted in the spaces between the blades of the screw, and projections, 7, of triangular cross-section are fixed to the wall of the vessel to act as baffles, from which the particles of liquid thrown outward by the centrifugal force, are caused to rebound on to the agitator. —A. S.



Gas-producer. A. S. Cambridge, Keighly. U.S. Pat. 997,962, July 18, 1911.

See Eng. Pat. 19,639 of 1909 ; this J., 1910, 1148.—T. F. B.

[Illuminating] gas ; Process for making liquefied ——. Schweizer. Flüssiggasfabr. L. Wolf A.-G. Fr. Pat. 426,954, Jan. 5, 1911. Under Int. Conv., Jan. 13, 1910.

See Eng. Pat. 595 of 1911 ; this J., 1911, 882.—T. F. B.

Gas purifiers. Berlin-Anhaltische Maschinenbau A.-G. Abteilung Köln-Bayenthal, Germany. Eng. Pat. 18,016, July 28, 1910. Under Int. Conv., April 20, 1910.

See Fr. Pat. 418,272 of 1910 ; this J., 1911, 76.—T. F. B.

Gases ; Apparatus for purifying, cooling, and mixing ——. H. E. Theisen, Munich, Germany. Eng. Pat. 22,433, Sept. 27, 1910.

See Fr. Pat. 404,336 of 1909 and Addition thereto ; this J., 1910, 201 ; 1911, 346.—T. F. B.

Naphtha residues and tars ; Process for separating solid hydrocarbons from ——. J. Tanne, Rosniatow, Galicia, and G. Oberländer, Berlin. Eng. Pat. 1688 of 1911, date of Appl., Oct. 6, 1910. Under Int. Conv., Oct. 27, 1909. Addition to Eng. Pat. 23,125 of 1910, dated Oct. 7, 1909.

See Addition of Oct. 6, 1910, to Fr. Pat. 409,516 of 1909 ; this J., 1911, 409.—T. F. B.

Paraffin-wax ; Apparatus for treating ——. A. Campbell, Crocrannoch, Rangoon, Assignor to The Burmah Oil Co., Ltd., Glasgow. U.S. Pat. 999,628, Aug. 1, 1911.

See Fr. Pat. 405,974 of 1909 ; this J., 1910, 408.—T. F. B.

Apparatus for testing the illuminating power of gas. Eng. Pat. 18,199. *See* XXIII.

Coal and ore washer or separator. U.S. Pat. 998,606. *See* X.

Calorimeter. U.S. Pat. 1,000,082. *See* XXIII.

Absorption apparatus for gas analysis. Fr. Pat. 427,492. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Ultraviolet radiation of quartz mercury vapour lamps ; Influence of various physical conditions on the ——. V. Henri. Comptes rend., 1911, **153**, 426—429.

Experiments on the ultraviolet radiation from a mercury vapour lamp have shown that this becomes more intense as the temperature of the luminous tube is allowed to rise, and by cooling the tube with water, the radiation was found to be 14 times less powerful than in air, the same number of watts being consumed. The yield seems to depend on the fall of potential in the luminous tube. Quartz mercury vapour lamps have proved to be a very constant source of ultraviolet rays and one of which the radiation is definite when the voltage, ampèrage and length of the tube are known.—F. Sodn.

Monazite sand from Travancore, India. See VII.

Analysis of monazite sand. Chesneau. *See* VII.

Patents.

Filaments for incandescing electric lamps ; Manufacture of ——. F. Eisner, London. Eng. Pat. 17,469, July 22, 1910.

Hydrazine or its compounds is used as the binding material in making the paste of a refractory metal or its compounds in the preparation of the filament. The resulting filament (of tungsten for example) is thus obtained entirely free from carbon, and from any constituents of the binding medium. It is claimed that the filament so formed does not undergo any appreciable shrinkage after its manufacture, and that its shrinkage during manufacture renders it thinner than a metal filament produced by the ordinary method.—T. St.

Carbon filament lamps ; Process for renewing ——. Allgem. Chem. Lab. O. H. Arendt. First Addition, dated Feb. 20, 1911, to Fr. Pat. 421,724, Oct. 22, 1910 (this J., 1911, 411). Under Int. Conv., Oct. 31, 1910.

In apparatus of the kind described in the principal patent, the tube through which the lamps are exhausted has a branch leading to a barometer tube provided with electric contacts, and the column of mercury controls electric circuits at the proper times for opening and closing the hydrocarbon supply cock and for switching on and off the current for the lamp filaments automatically. The arrangement also acts as an indicating device.—A. T. L.

Metal-filament lamps ; Process for renewing ——. Allgem. Chem. Lab. O. H. Arendt. Fr. Pat. 426,991, Feb. 11, 1911.

The lamps are opened and connected with a vacuum pump, and the black deposit on the walls of the bulbs is removed in known manner. After replacing any filaments which have been destroyed, the lamps are renewed by admitting metallic vapours of the metal of which the filament consists, through a fine jet into the heated bulb. The bulb is surrounded by a Dewar vacuum vessel so that its walls become heated by the passage of a current through the filament. The vapours are obtained by means of an electric arc, and the cock through which they are admitted to the lamp bulb may be connected with the switch controlling the lamp circuit. The renewal of the filaments may also be effected by evaporating suitable solutions in the bulbs, or by introducing substances from which the metal may be deposited by the passage of a current through the filament.—A. T. L.

Electric incandescence lamps ; Process for obtaining good electrical connection between the metal filaments and the leads in ——. C. H. Weber. Fr. Pat. 427,736, March 25, 1911. Under Int. Conv., March 26, 1910.

A solder is used which melts at a temperature much lower than the filaments themselves, and which can be decomposed by the passage of the current, leaving the metal of which the filament is composed. Suitable compounds for this purpose are the bisulphides of tungsten and of molybdenum.—A. T. L.

Electric incandescence lamps with filaments of brittle refractory metals; Manufacture of ——. H. G. Möller. Ger. Pat. 236,553, June 18, 1910.

In the production of lamp filaments from a brittle, refractory metal, the latter is usually made into a ductile alloy with another metal, which can be subsequently removed by fusion or volatilisation from the filament, after the latter has been placed in position in the lamp. According to the present patent the greater portion of the alloying metal is removed from the filament before the latter is placed upon its support in the lamp. Only sufficient of the alloying metal is left in the filament to render it just pliable enough to be placed in position on its support, and it is stated that this small proportion has no injurious effect on the quality of the lamp, and hence the lamp has not to be submitted to any special operation for the removal of the alloying metal. The process is stated to be specially applicable to lamps with very fine filaments.
—A. S.

Tungsten filaments; Process for the production of ——. A. Lederer, Atgersdorf, Austria-Hungary, Assignor to Westinghouse Lamp Co., Bloomfield, N.J. U.S. Pat. 999,235, Aug. 1, 1911.

See Eng. Pat. 14,942 of 1908; this J., 1909, 647.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Trinitrotoluene and tetranitromethylaniline. F. M. Vasquez. Mem. de Artilleria, Sept., 1910. Z. ges. Schiess- und Sprengstoffw., 1911, 6, 301—303.

In the manufacture of trinitrotoluene, mononitrotoluene is first prepared by using the waste acid resulting from the manufacturing process. The nitration is carried out in a jacketed apparatus provided with rotating arms. The toluene is run into the apparatus and whilst it is kept agitated, the waste acid and fresh nitric acid are added. The temperature is kept below 30° C. After settling for six hours the mononitrotoluene is separated from the waste acid. To the latter, fuming sulphuric acid and nitric acid are added. This fresh mixture is added to the mononitrotoluene in the agitating vessel and kept in continuous motion for six hours, at a temperature of 90° C. The steam is then shut off in the jacket, agitation is discontinued, and cold water and finally a refrigerated liquid at 2° C. are passed round the jacket. The dinitrotoluene is thus crystallized out in the mixing vessel and the waste acid can be run off. The latter is revivified by the addition of fuming sulphuric acid, and this fresh mixture is added to the dinitrotoluene. After warming and agitating, nitric acid is added and the temperature raised very gradually to 92° C. After heating for twenty hours the whole of the contents of the vessel is run into cooling tanks where the trinitrotoluene is allowed to crystallize out slowly, during some four to five days. The waste acid is then separated and used for the preparation of mononitrotoluene. The trinitrotoluene is washed with water, ground under edge runners, and finally washed in an alkali solution. It is then dissolved in acetone and sodium carbonate is added. The solution is heated in a steam-jacketed vessel for 4 hours, after which the acetone is distilled off and condensed, and the molten trinitrotoluene is run into cooling vessels to crystallize out. The crystals are thoroughly washed with water, dissolved in hot 96 per cent. alcohol and this solution is filtered and allowed to crystallize very slowly. Tetranitromethylaniline is prepared by dissolving 1 part of methylaniline in 10 parts of sulphuric acid, adding 5 parts of nitric acid, and keeping the mixture in agitation at 30° to 40° C. The product is purified in a similar manner to trinitrotoluene; after purification, it should have a melting point of 125° to 128° C.—G. W. McD.

Patents.

Anthraquinone dicarboxylic acid and its anhydride; Manufacture of an ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 26,432, Nov. 14, 1910.

See Fr. Pat. 423,986 of 1910; this J., 1911, 737. By heating alone, or in presence of acetic anhydride or other dehydrating agent, the anthraquinone-1·2-dicarboxylic acid is converted into its anhydride.—T. F. B.

Thiazolesulphonic acids; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 27,046, Nov 21, 1910.

Thiazolesulphonic acids may be prepared by treating with alkali thiosulphates the condensation products from aromatic aldehydes or benzyl halides and sulphonic acids of suitable amines of the naphthalene series; they are also produced by treating with thiosulphates mixtures of the above compounds capable of forming benzylidine or benzyl compounds, with naphthylaminesulphonic acid derivatives. *Example.*—The benzylidine compound obtained from 23·9 parts of 2-amino-8-naphthol-6-sulphonic acid and 15·1 parts of *m*-nitrobenzaldehyde, is boiled with 100 parts of sodium thiosulphate dissolved in water. On acidification and addition of common salt the thiazole compound is precipitated; by reduction it may be converted into the corresponding aminothiazolesulphonic acid (compare Fr. Pat. 353,928 of 1905; this J., 1905, 1061).
—T. F. B.

Diphenylmethane derivatives; Process for preparing unsymmetrically substituted ——. Anilinfarben- u. Extrakt-Fabr. vorm. J. R. Geigy. Ger. Pat. 236,046, July 15, 1910.

p-Chloromethyl-*o*-cresotinic acid or *p*-hydroxymethyl-*o*-cresotinic acid, or their anhydro-compounds, are caused to react with mono- or di-alkylated aromatic amines or with their derivatives substituted in the nucleus, but with a free *p*-position, preferably in presence of hydrochloric acid. The new diphenylmethane derivatives serve as primary products for the manufacture of chrome triphenylmethane dyestuffs.—T. F. B.

Benzoic acid from chlorinated toluene; Process for obtaining ——. A. Jessnitzer. Ger. Pat. 236,489, May 13. 1910.

Toluene which has been chlorinated in the side chain until it is entirely converted at least as far as benzyl chloride, is converted into benzoic acid by heating with a hypochlorite (*e.g.*, chloride of lime) in presence of water; the reaction is accelerated by air in presence of catalytic agents, such as metallic compounds, whereby a saving in hypochlorite may be effected. By this process a considerable saving in chlorine and in the time necessary for chlorination is effected.—T. F. B.

p-Dialkylaminobenzyl-1-aminoanthraquinones; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 236,769, July 3, 1910.

When a mixture f *a*-aminoanthraquinone, formaldehyde, and an aromatic dialkylamine is heated to a high temperature, a *p*-dialkylaminobenzyl-1-aminoanthraquinone is obtained, which may be employed in the production of vat anthraquinone dyestuffs.—T. F. B.

2·4-Diamino-i-phthalic acid or its acidyl derivatives; Process for preparing ——. M. T. Bogert. Ger. Pat. 236,848, May 9, 1909.

m-Xylylene-diamine is acidylated, and the product is oxidised and finally saponified, whereby the diaminophthalic acid ($NH_2 : NH_2 : COOH : COOH = 1 : 3 : 4 : 6$) is produced. It may be used in the preparation of dyestuffs and pharmaceutical compounds.—T. F. B.

Anthranol; Process for producing ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 426,994, Feb. 17, 1911.

SEE Eng. Pat. 1728 of 1911; this J., 1911, 350.—T. F. B.

Apparatus for the purification of liquids, especially of oils, hydrocarbons and the like. Ger. Pat. 236,718. *See* IIA.

IV.—COLOURING MATTERS AND DYES.

PATENTS.

Vat dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 9359, April 18, 1910.

VAT dyestuffs, containing not more than three atoms of halogen, are obtained by condensing α-keto derivatives of isatin or its homologues, or of its halogen substitution products (in which the oxygen of the α-keto group is replaced by easily movable or replaceable substituents, such as halogen, sulphur, amino, or alkyloxy) with α-naphthol or with its *p*-monohalogen derivatives, and treating the solution of the resulting products, in concentrated sulphuric acid, with bromine, slightly in excess of the amount theoretically required for the compound which is to be produced. For example, 273 parts of the condensation product from α-isatin-anilide and α-naphthol, are dissolved in 5500 parts of concentrated sulphuric acid cooled to —10° C.; 350 parts of bromine are slowly added, with continued stirring, and the temperature is allowed to rise within 8 hours to 30° C., stirring being continued the whole time. The product is poured on ice, filtered off, and dried. It dyes cotton fast pure violet shades from a hydrosulphite vat. The dye obtained by treating the condensation product of dibromo-isatin chloride and α-naphthol with one mol. of bromine, dyes cotton blue. —T. F. B.

Vat dyestuffs; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 236,407, April 28, 1910.

A SERIES of fast vat dyestuffs is produced by condensing halogenated anthraquinones or their derivatives with isatins or their homologues or analogues. The dyestuffs from α-chloro-anthraquinone and isatin, methylisatin, and chloro-isatin are bluish-red, that from 1·5-dichloro-anthraquinone and isatin is violet, whilst that from 1-methylamino-4-bromo-anthraquinone and isatin is blue.—T. F. B.

Intermediate products for use in the manufacture of azo dyes; Manufacture of ——. H. Levinstein, J. Baddiley, and Levinstein, Ltd., Blackley. Eng. Pat. 15,070, Dec. 21, 1910.

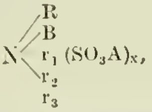
INTERMEDIATE products for use in making azo dyestuffs are obtained by condensing a naphthylaminesulphonic acid, or an aminonaphtholsulphonic acid containing the amino and hydroxyl groups in different nuclei, with glycerol monochlor- or monobrom- or dichlor- or dibrom-hydrin. *Example*: 100 parts of epichlorhydrin and 200 parts of crystallised sodium acetate are added to a neutral solution of 239 parts of 2·5-aminonaphthol-7-sulphonic acid in 2000 parts of water. The mixture is boiled under a reflux condenser for several hours, until the reaction is completed. The product may be isolated by acidifying the solution with hydrochloric acid, and is a grey powder, easily soluble in water, which is converted by nitrous acid into a soluble nitroso compound giving no coloration with sodium carbonate.—T. F. B.

Azo dyestuffs; Manufacture of ——. H. Levinstein, J. Baddiley, and Levinstein, Ltd., Blackley. Eng. Pat. 15,068, Dec. 21, 1910.

MONO-, dis-, and poly-azo dyestuffs are obtained by combining aromatic diazo or tetrazo compounds with the condensation products from aminonaphtholsulphonic acids or naphthylaminesulphonic acids and glycerol chlor- or bromhydrins described in Eng. Pat. 15,070 of 1910 (see preceding abstract). The dye from diazotised *p*-aminoacetanilide and the condensation product from 2·5-aminonaphthol-7-sulphonic acid and epichlorhydrin dyes cotton fast bright red shades. The product from picramic acid, epichlorhydrin, and 2-naphthylamine-6-sulphonic acid dyes wool orange-brown shades, which become rich brown on chroming. When tetrazotised benzidine is combined with two mols. of the condensation product from 2-amino-5-naphthol-7-sulphonic acid and α-dichlorhydrin, a substance is obtained which dyes cotton direct in violet shades.—T. F. B.

Indigo; Manufacture of a new form of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 18,761, Aug. 9, 1910.

WHEN indigo is allowed to form from its salts or leuco-compounds in presence of aminosulphonic acids containing residues derived from the benzyl group, a new variety of indigo is produced, which is easily reduced by very mild reducing agents, such as the cold glucose vat or fermentation vat. When made into a paste and diluted with water, a deep blue liquid is obtained, which settles with difficulty and which gives a blue filtrate when filtered; the paste when acidified with dilute acetic acid, only settles after a very long time. The benzylated acids in question correspond to the type,



$$N\begin{cases}R\\B\\r_1\,(SO_3A)_x,\\r_2\\r_3\end{cases}$$

where A means hydrogen or metal; R an aryl, alkyl, or a residue derived therefrom; B a residue containing benzyl, or substituted benzyl; r_1 is hydrogen, alkyl, aryl, benzyl, or substituted benzyl; r_2 is alkyl, and r_3 is halogen, sulphuric acid residue, alkylsulphuric acid residue, or an arylsulphuric acid residue, and wherein r_2 and r_3 may be absent. Examples of such compounds are, benzylaniline sulphonic acids, benzylsulphanilic acids or their sulphonic acids, benzylnaphthylamine sulphonic acids, benzylaminonaphtholsulphonic acids, chlorobenzylsulphanilic acids, benzyldimethylphenylammonium chloride mono- or disulphonic acids, *e.g.*, $HSO_3.C_6H_4.CH_2N(C_6H_5)(CH_3)_2Cl$, etc. The following is an example of the process:—One kilo. of an indigo melt of 20 per cent. strength, or the corresponding quantity of an alkali salt of indoxyl, is diluted with 1 to 5 kilos. of water and 50 grms. of a salt of benzylsulphanilic acid are added; the solution is precipitated, while stirring, by air or other oxidising agent, and the indigo obtained as a pigment-like product, which can still be filtered, though with difficulty.—T. F. B.

Compounds and colouring matters of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 24,486, Oct. 21, 1910.

BY treating 1-halogen-anthraquinone-2-aldehyde or a halogen derivative thereof, with copper or other substance which is capable of eliminating halogen, and preferably in presence of a diluent (naphthalene or nitrobenzene) and an alkaline substance (sodium carbonate, etc.) new condensation products are obtained, which appear to be 1.1′-dianthraquinonyl-2.2′-di-aldehyde; this compound and its halogen derivatives can be further condensed by means of reducing agents, such as sodium hydrosulphite, when a series of colouring matters is produced which appear to be identical with those obtained from 2.2′-dimethyl-1.1′-dianthraquinonyl according to Fr. Pat. 357,239 of 1905 (see this J., 1906, 66). The conversion of the intermediate products into the colouring matters takes place very readily, so that it may be effected either in bulk, or in the dye-bath, or on the fibre itself. Six examples of the process are given.—T. F. B.

Vat dyestuffs of the anthracene series; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 236,442, April 23, 1910. Addition to Ger. Pat. 215,182, Dec. 10, 1908 (see this J., 1909, 1310).

The nitro-derivatives of anthraquinone-carboxylic acid halogenides are condensed with diamines of the benzene or naphthalene series, and the products are reduced to the amino-compounds. The dyestuffs are brownish-orange to scarlet and may be diazotised on the fibre and developed; the shades then become deeper and more bluish, and are faster to washing.—T. F. B.

Phenanthridone derivatives; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 236,857, June 21, 1910.

Derivatives of phenanthridone, some of which may be used as vat dyestuffs and some for the preparation of dyestuffs, are obtained by the action of condensing agents on benzoylamino-o-halogenanthraquinones or their derivatives.—T. F. B.

Gallocyanines; Manufacture of condensation products of —— and derivatives thereof. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 24,682, Oct. 24, 1910.

See Fr. Pat. 422,720 of 1910; this J., 1911, 612.—T. F. B.

Indigo colouring-matters; Reducing ——. P. E. Oberreit, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 999,055, July 25, 1911.

See Addition of Oct. 21, 1909, to Fr. Pat. 348,360 of 1904; this J., 1910, 623.—T. F. B.

Triphenylmethane dye; Greenish-blue ——. M. Weiler, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 998,139, July 18, 1911.

See Ger. Pat. 234,519 of 1910; this J., 1911, 796.—T. F. B.

Triphenylmethane dye. A. Hausdörfer, Elberfeld, and C. Heidenreich, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 999,028, July 25, 1911.

See Fr. Pat. 425,676 of 1911; this J., 1911, 885.—T. F. B.

Vat dye. W. Bauer, Vohwinkel, and A. Herre and R. Mayer, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 998,596, July 25, 1911.

See Eng. Pat. 27,029 of 1909; this J., 1910, 1098.—T. F. B.

Vat dyestuffs of the anthracene series; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 426,891, March 6, 1911. Under Int. Conv., March 17, 1910.

See Ger. Pat. 235,094 of 1910; this J., 1911, 885.—T. F. B

Vat dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 427,326, Feb. 27, 1911. Under Int. Conv., March 14, 1910.

See Eng. Pat. 9359 of 1910: preceding.—T. F. B.

Disazo dye; Yellow ——. A. Zart, Vohwinkel, and H. Schweitzer, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 999,944, Aug. 8, 1911.

See Eng. Pat. 12,433 of 1910; this J., 1911, 612.—T. F. B.

[Anthracene] dyestuff and process of making same; Blue ——. M. Hessenland, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 998,772, July 25, 1911.

See Fr. Pat. 422,956 of 1910; this J., 1911, 613.—T. F. B.

Vat [anthracene] dyestuff. M. Hessenland, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 999,785, Aug. 8, 1911.

See Fr. Pat. 418,843 of 1910; this J., 1911, 78.—T. F. B.

Indigo; Process for making —— in various forms by means of isolated alkali compounds of indoxyl. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 426,880, Oct. 24, 1910. Under Int. Conv., Oct. 25, 1909.

See Eng. Pat. 24,820 of 1910; this J., 1911, 886.—T. F. B.

Sulphurised vat dyestuffs; Manufacture of brown ——. A. L. Laska, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 999,045, July 25, 1911.

See Eng. Pat. 1729 of 1911; this J., 1911, 612.—T. F. B.

Vat dyestuff of the anthracene series. F. Singer, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 999,680, Aug. 1, 1911.

See Eng. Pat. 28,679 of 1910; this J., 1911, 483.—T. F. B.

Azo dye. G. Kalischer, Frankfort on Maine, Germany, Assignor to Cassella Color Co., New York. U.S. Pat. 999,230, Aug. 1, 1911.

See Eng. Pat. 15,646 of 1910; this J., 1911, 948.—T. F. B.

Vat [anthracene] dye and process of making same. G. Kalischer, Frankfort, Germany, Assignor to Cassella Color Co., New York. U.S. Pat. 999,798, Aug. 8, 1911.

See Eng. Pats. 12,921 and 22,306 of 1910; this J., 1911, 531.—T. F. B.

Vat [anthracene] dyestuffs; Process for preparing ——. L. Cassella und Co. Fr. Pat. 427,268, May 23, 1910.

See Eng. Pats. 12,921 and 22,306 of 1910; this J., 1911, 531.—T. F. B.

Vat-dyeing colouring matter. K. Elbel and E. Wray, Assignors to Kalle und Co., A.-G., Biebrich, Germany. U.S. Pat. 999,439, Aug. 1, 1911.

See Fr. Pat. 413,799 of 1910; this J., 1910, 1099.—T. F. B.

Polyazo dye and process of making same. R. Haugwitz, Friedrichshagen, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 999,558, Aug. 1, 1911.

See Eng. Pat. 2232 of 1911; this J., 1911, 680.—T. F. B.

Monoazo dyestuff and lakes prepared therefrom. Act.-Ges. f. Anilinfabr. Fr. Pat. 427,760, March 25, 1911. Under Int. Conv., July 4, 1910.

See Eng. Pat. 9003 of 1911; this J., 1911, 796.—T. F. B.

Yellow dyestuff for wool and process of making it. Act.-Ges. f. Anilinfabr. Fr. Pat. 427,230, May 21, 1910.

See U.S. Pat. 982,050 of 1911; this J., 1911, 412.—T. F. B.

Anthraquinone dyestuffs containing sulphur; Manufacture of —— and products therefor. Act.-Ges. f. Anilinfabr. Fr. Pat. 427,596, May 31, 1910.

See Eng. Pat. 12,828 of 1910; this J., 1911, 677.—T. F. B.

Colouring substances; Process of manufacturing ——. X. Debedat, Bordeaux, France. U.S. Pat. 999,755, Aug. 8, 1911.

See Addition of Dec. 24, 1909, to Fr. Pat. 401,559 of 1909; this J., 1910, 939.—T. F. B.

Gallocyanine series; Production of leuco dyestuffs of the ——. Manuf. de Mat. Col. ancien. L. Durand, Huguenin, et Cie. Fr. Pat. 427,628, March 22, 1911. Under Int. Conv., April 11, 1910.

See Ger. Pat. 228 369 of 1910; this J., 1911, 18.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

German Imperial Textile Bureau; Proposed——. Bd. of Tr. J., Aug. 17, 1911. [T.R.]

A resolution was brought forward in the Reichstag last March on the subject of the establishment of an Imperial Textile Bureau. It was proposed that the Bureau should be used not only as a conditioning house but also as a central office for the encouragement of the German textile industry generally. It was intended, *inter alia*, to encourage the use of genuine instead of imitation material (*e.g.*, as regards dyes), to aim at the universal adoption of the metric system in the counting of yarns, to combat the weighting of silk, and to carry out investigations as to technical improvements. The "Aeltesten der Kaufmannschaft" of Berlin have now forwarded a note to the Ministry of the Interior deprecating the establishment of the Bureau in question owing to the impracticability of making one central office responsible for so many and such widely varying objects.

Pulp woods from the Cameroons. Herzberg. Papierfabrikant, 1911, **9**, 914—917, 948—950.

Samples of wood have been received at the Royal Prussian Testing Institute from the Cameroon Government, and have been tested for their suitability as raw materials for paper pulp.

Cotton-wood (*Bombax Malabaricum*). The samples of the stem had a diameter of 0·6 metre; the wood is traversed by very large vessels (up to 0·5 mm. diameter). The medullary rays are numerous and the cells contain brown matter which is not readily soluble; numerous parenchyma cells are present both in and outside the rays. The wood was treated by the soda process, using 100 parts of a 4 per cent. solution of sodium hydroxide to 16 parts of wood and digesting for 3½ hours under a pressure of 8 atmospheres. The pulp was sufficiently digested, showing a yield of 42·7 per cent., calculated on dry substance; it required 24 per cent. of bleaching powder for bleaching, this high consumption being partly due to the discolouration of the raw wood by mildew; the loss in bleaching was 6·5 per cent. When treated by the sulphate process with a lye containing 1 per cent. of sodium sulphide and 3 per cent. of hydroxide under similar conditions, the yield of cellulose was 43·8 per cent. By the sulphite process it was not possible satisfactorily to resolve the hard dark-coloured bundles of the medullary rays, which moreover were resistant to bleaching. The wood yielded 0·33 per cent. of ethereal extract. The fibres of cotton-wood pulp have an average length of 1·9 mm. (extremes, 2·6—1·1 mm.); average width 0·044 mm. (extremes, 0·067—0·029 mm.); short, broad parenchyma cells are very numerous; large porous vessels are characteristic. Cotton-wood appears to be well adapted for the commercial manufacture of pulp, and the fibres are such as to afford strong, well felted papers; these fibres rank in paper-making value very close to the fibres of the coniferous woods.

Elkwood (*Musanga Smithii*). The diameter of the stems was 0·6 metre; this wood shows no annual rings, and the large vessels and thin-walled fibres are the cause of its low specific gravity; the cells of the medullary rays contain a brown substance not readily eliminated. The wood was readily reduced to pulp by the soda process under the conditions adopted for cotton-wood, the yield being 47·7 per cent., calculated on dry substance; the consumption of bleaching powder was 26 per cent. and the loss in bleaching 6 per cent. Digested by the sulphate process the yield of cellulose was 47·1 per cent., whilst the sulphite process, as in the case of cotton-wood, was not adapted to resolve the hard brown medullary rays. This wood on extraction with ether gave 3—3·5 per cent. of extract consisting mainly of a saponifiable resin of pale colour and high melting point (240° C.). The fibres have the characteristic form of the fibres of leaf-wood trees, the vessels also are large and porous. The average length of fibre is 1·4 mm. and average thickness 0·056 mm. The pulp yields strong and well felted papers, but the resistance to folding is very much decreased by bleaching. The paper-making value of the fibres is about midway between that of the European leaf-wood and coniferous pulps.
—J. F. B.

Papers; Influence of substance on strength of——. A. Rehn. Papierfabrikant, 1911, **9**, 973—976.

The Prussian "normal" specifications for the composition and mechanical resistance of different classes of paper were originally formulated in connection with "normal" specifications of the "substance" or weight per sq. metre for each type. The convenience of the normal strength specifications, however, has proved so great, that orders are frequently given for papers conforming with these specifications but differing very widely from the normal weights. In the case of extreme differences in substance, it is very difficult for the paper-maker to produce, even from the same quality of stuff, papers which conform with the normal standards as regards strength. For instance, a paper was ordered according to specification 5a, but of substance of 280 grms. per sq. m. With the usual stock it was impossible to obtain such a paper with breaking length above 3000 m., whereas when this stock was run in a substance of 140 grms. per sq. m., the "normal" breaking length of 4000 m. and over, was readily obtained. With the same stock the breaking length of the paper falls as the substance is increased, it also falls as the substance is decreased, being at a maximum at some intermediate point. It by no means follows that the maximum breaking length corresponds with the "normal" substance of the paper, since the latter "normals" have been framed without regard to this factor. With very heavy papers the breaking stretch is also lower than with papers of moderate substance. On the other hand, the resistance to folding increases with the substance of the paper, since, unlike breaking length and stretch, the weight of the strip does not occur as a denominator in calculating the resistance to folding. The cause of the decrease in relative strength (breaking length and stretch) is undoubtedly the inferior felting of the fibres when heavy papers are being run. With heavy substances it is impossible to run as much water on the wire with the stuff as with papers of moderate substance. In the case of very thin papers, the cause of the fall in relative strength is less obvious; possibly it is due to unavoidable inequalities in the thickness of the strips such as are liable to occur with thin papers. The author thinks that the normal strength specifications should be revised on a sliding scale in conformity with the substance of the paper.—J. F. B.

Goldbeaters' skin; Paper as a substitute for——. W. Theobald. Papierfabrikant, 1911, **9**, 983.

Many attempts have been made to introduce paper as a substitute for the very costly prepared skins used by goldbeaters, but only with partial success. Paper in fact was employed before goldbeaters' skin for making leaf-metals, and the Japanese and Chinese still use paper, made from the fibres of the mulberry tree, for goldbeating. For the first stages of goldbeating, animal parchment has been used since the 17th century, also vegetable parchment in the later stages. Comparative experiments have shown that animal parchment permits only a relatively very slight reduction of the thickness of the metal sheet; parchment paper allows the metal to be beaten somewhat thinner, but when the limit is passed, the metal adheres so firmly to the paper that it cannot be separated without damage. According to a process devised by J. Heinrich (Ger. Pat. 123,197) thin, tough paper of substance of 25—30 grms. per sq. m., is steeped in a hot solution of borax or alum. After stretching the paper over frames, a coating first of albumin and then of isinglass solution is applied first to one side and, after it has dried, to the other. Papers of various kinds are now used in many goldbeaters' shops, but only for the first stages: the leaf metal is always finished between the ordinary goldbeaters' skin. Leaf made from baser metals, however, is beaten throughout between paper. A paper which will serve all the purposes of skin for the manufacture of gold-leaf has still to be discovered.—J. F. B.

Linoleum industry of Scotland. Oil, Paint, and Drug Rep., Aug. 7, 1911. [T.R.].

Floorcloth exports from the United Kingdom last year totalled 36,123,800 square yards, valued at £1,882,000. This was 4,325,400 yards and £248,900 value greater than the exports in 1909. Notwithstanding a larger volume of trade in 1910, the linoleum industry of Scotland has been experiencing trying times, owing mainly to the great increase in the cost of the raw materials. Linseed oil is nearly 100 per cent. higher than a year ago, while jute has advanced during the same period by about 20 per cent.

Patents.

Balloon envelopes; Means for preventing diffusion of gases through ——. J. Harger, Gateacre, Lancashire. Eng. Pat. 17,460, July 22, 1910.

The envelope is formed of two or more layers, at least one (the fabric) having the necessary tensile strength whilst the other consists of a suitable liquid or semi-liquid in which the gases to be confined, as well as the surrounding air are insoluble or nearly so. For example, the outer layer may be of prepared (oiled or varnished) cotton or silk and the inner of an extremely viscid fluid. Or, preferably, the envelope is formed of two layers of prepared fabric with a saturated solution of calcium chloride between them. In this case the two layers of fabric are preferably united at intervals in zonal lines in order to prevent the liquid layer from draining to the lowest points of the envelope. In making the envelope, the two (or three) materials are stuck or sewn together, and the liquid or liquids is or are pumped in between them, through small inlet pipes, air-bubbles being extracted by vacuum or otherwise. The balloon is then inflated to its fullest size and the excess of liquid forced out again, leaving a thin film over the inner surface.—E. W. L.

Vegetable fibres; Process for converting —— into silky yarns or "simili-silk." J. M. J. Debourg. Fr. Pat. 427,113, May 19, 1910.

Fibres, such as flax, hemp, ramie, nettle, are packed in shallow circular trays which are stacked one above the other in a cage. This cage is lowered into an autoclave which is heated by a perforated steam-coil passing around the outside of the cage and terminating in a vertical portion passing through holes in the centre of the trays, up the axis of the autoclave. The fibres are first digested in a solution of sodium carbonate of about 0·5 per cent. concentration for two hours under a pressure of 2—3 atmospheres. The liquor is drained off and replaced by one containing, per 1000 litres of water: 108 kilos. of slaked lime, 5·25 of sodium bisulphite, 5·5 of sal ammoniac, 0·56 of sodium peroxide and 5·75 of magnesium salt. The fibres are again heated for two hours, washed, acidified and washed. The treated fibres are carded, combed and spun according to their nature.—J. F. B.

Artificial silk; Production of ——. G. Guadagni, Pavia, Italy. Eng. Pat. 25,986, Nov. 8, 1910. Under Int. Conv., Nov. 9, 1909. Addition to Eng. Pat. 1265 of 1908, dated Sept. 28, 1907.

Referring to the process of dissolving cellulose in cuprammonium solution described in the chief patent (this J., 1908, 682), it is found that a more concentrated solution of cellulose, having a greater degree of fluidity, is obtained by adding to the ammonia contained in the agitator, after the insufflation of air has taken place, a quantity, about equal in weight to that of the cellulose to be treated, of a concentrated solution of sodium hydroxide of density ranging from 10° to 25° B. in proportion to the temperature at which the operation takes place, adding subsequently in the order named hydrated copper oxide and cellulose as described in the previous specification.—J. F. B.

Artificial silk; Manufacture of collodion ——. F. Wislicki. Fr. Pat. 427,694, March 23, 1911. Under Int. Conv., March 23, 1910.

The collodion-cotton or the drawn "silk" previous to denitration is subjected to the prolonged action of hot water or a hot dilute solution of a mineral or organic acid or an acid solution containing a small quantity of an oxidising substance. For instance, the non-denitrated silk is steeped in a bath containing 100 grms. of sulphuric acid per litre, maintained at a temperature of 70° C. This bath may also contain potassium chlorate or other oxidising agent in the proportion of about one-tenth of the quantity of sulphuric acid. The temperature and time of treatment may be varied within wide limits. Such treatment is claimed to make the silk, after denitration, more stable, brighter and softer than ordinary collodion silk; its attraction for dyestuffs is also reduced, and the dyeing is more level.—J. F. B.

Artificial threads, etc., from cuprammonium-cellulose solutions; Preparation of —— by precipitation with caustic alkali solution. R. Hömberg. Ger. Pat. 235,366, July 23, 1910.

Colloids such as albumin, glue, or the like, or their products of hydrolysis by enzymes, *e.g.*, pancreatin, are added to the precipitating liquid. Threads prepared in this way are stated to have a softer "handle."—A. S.

Artificial silk, etc.; Preparation of a plastic mass for —— from milk. Naamlooze Vennootschap Hollandsche Zyde Maatschappy in Amsterdam. Ger. Pat. 236,908 June 24, 1910.

The protein constituents of milk are decomposed by the action of a pyrophosphate, and the soluble decomposition products are precipitated in known manner. The precipitate either directly, or after again dissolving and reprecipitating with ammonia or alkali, is then converted into a plastic form.—A. S.

Formyl esters of cellulose or solutions thereof in formic acid; Process for the conversion of —— into solid plastic solutions. Verein. Glanzstoff-Fabrik. A.-G., Elberfeld, Germany. Eng. Pat. 8313. April 3, 1911. Under Int. Conv., May 18, 1910.

About 10 parts of artificial silk waste are caused to swell and dissolve in about 100 parts of formic acid, and about 50 parts of 80 per cent. lactic acid are then added to the solution. The excess of formic acid is distilled off in a vacuum at 40°C. and the remaining viscous syrup, which can be drawn into threads, hardens on cooling and standing into a solid plastic and transparent mass.—P. F. C.

Cellulose formates; Manufacture of ——. Vereinigte Glanzstoff Fabriken, A.-G. First Addition, dated March 13, 1911 (Under Int. Conv., Nov. 23, 1910) to Fr. Pat. 420,856, Sept. 28, 1910. (See Eng. Pat. 15,700 of 1910; this J. 1910, 1199.)

In the original specification, the treatment of artificial silk wastes for the production of solutions of formic esters of cellulose was described. In the present addition it is mentioned that it is not necessary to treat the cellulose actually in the form of waste silk. Solutions of cellulose which for any reason are defective for spinning purposes may be precipitated in bulk and the cellulose recovered, purified and converted into formate. Further, solutions of cellulose in cuprammonium may be made expressly for the purpose of subsequently converting the hydrated cellulose into formates.—J. F. B.

Cellulose esters in definite forms; Process for preparing ——. L. Lederer, Sulzbach, Germany. U.S. Pat. 999,236, Aug. 1, 1911.

Cellulose esters are prepared in the same physical form as the raw material employed by first treating the cellulose with a hydrolysing agent and esterifying the hydrocellulose so produced by treatment with an acid anhydride in combination with carbon tetrachloride, separating and washing the product.—J. F. B.

Cellulose-ester composition. C. Ellis, Larchmont, N.Y., Assignor to Ellis-Foster Co. U.S. Pat. 999,490, Aug. 1, 1911.

A PLASTIC substance like celluloid is made from a cellulose ester (nitrocellulose) and a chloral derivative of an oil, *e.g.*, 70 per cent. of nitrocellulose and 30 per cent. of a combination of castor oil with chloral.—H. H. S.

Cellulose acetate; Manufacture of ——. Soc. L'Oyonnithe. Fr. Pat. 427,265, March 1, 1911.

CELLULOSE is treated with a mixture of glacial acetic acid, acetic anhydride and ammonium bisulphate at a temperature above 50° C. 400 parts of glacial acetic acid are mixed with 300 of acetic anhydride; 20 parts of dry powdered ammonium bisulphate are introduced and the mixture is heated at 35°—40° C. until the salt is dissolved. 100 parts of cellulose are steeped in this liquid and the mixture is heated above 50° C. with occasional stirring, until a sample of the syrupy solution gives a product which, when purified and dried, is soluble in acetone, methyl or ethyl acetate, etc.—J. F. B.

Plastic material [*cellulose acetate*]; *Non-inflammable* ——. Comp. Franç. du Celluloïd. Fr. Pat. 427,804, June 3, 1910.

A NON-INFLAMMABLE plastic material is claimed consisting essentially of a mixture of cellulose acetate and the mono-acetyl derivative of ethylaniline in variable proportions, according to the hardness of the product desired. For instance, cellulose acetate, 50 parts, mono-acetylethylaniline, 30 parts, and a solvent such as acetone, 20 parts, are incorporated together and treated in various ways common to the celluloid industry. Homologues of acetylethylaniline may be employed if desired and solvents other than acetone; mineral or other filling substances may be incorporated with the mass.—J. F. B.

Paper and pulp machines; Multiple-colour ——. H. Parker, Nashua, N.H., U.S.A. Eng. Pat. 22,449, Sept. 28, 1910.

THE machine is designed to work pulp or paper stock of different colours, keeping each colour separate from the other. It is described in connection with a "save-all" dealing with the back-waters from different paper machines. It consists essentially of a cylinder-mould revolving in a vat which is divided transversely by partitions, these partitions in the tank outside the cylinder engaging by means of packing-rings with corresponding partitions inside the cylinder. Preferably the compartments inside the mould are divided into longitudinal chambers by longitudinal radial partitions inside the cylinder, also bottom plates are secured to the chambers inclined towards the ends of the cylinder, so that suction may be applied at the ends, operating on the surface of the mould in the chambers. The removal of the layers of different coloured pulps by means of a "doctor" may be assisted by means of compressed air.—J. F. B.

Sizing paper; Preparation of emulsions suitable for ——. A. Mitscherlich. Ger. Pat. 235,965, Aug. 25, 1910. Addition to Ger. Pat. 220,066, Dec. 16, 1908.

THE emulsions prepared according to the chief patent (this J., 1910, 483) contain iron and always stain the paper. In order to obtain emulsions free from iron, the crude sulphite-cellulose waste lye, after mixing with animal size, is precipitated with hydrochloric acid, the precipitate is separated from the solution, re-dissolved with the aid of borates, and the solution mixed with an alkaline solution of rosin. A solid product may be obtained from the emulsions thus prepared by addition of a solid salt having a strong attraction for water.—A. S.

Animal substances such as wool, silk, or hair; Treatment of ——. L. Meunier, Lyons, France. U.S. Pat. 998,370, July 18, 1911.

SEE Eng. Pat. 4557 of 1910; this J., 1910, 1199.—T. F. B.

Fabrics from artificial silk; Process for making ——. J. Wilkinson, and Bradford Dyers' Assoc., Ltd. Fr. Pat. 427,381, March 15, 1911.

SEE Eng. Pat. 10,186 of 1910; this J., 1911, 679.—T.F.B.

Cellulose products; Process for the manufacture of ——. Vereinigte Glanzstoff-Fabr., A.-G., Elberfeld, Germany. Eng. Pat. 29,046, Dec. 14, 1910. Under Int. Conv., Oct. 20, 1910.

SEE Fr. Pat. 424,419 of 1910; this J., 1911, 740.—T.F.B.

Cellulose derivatives; Process for producing dyed acidylised ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 427,445, March 16, 1911. Under Int. Conv., March 24, 1910.

SEE U.S. Pat. 994,738 of 1911; this J., 1911, 888.—T.F.B.

Horsehair; Manufacture of artificial ——. Lyxhayr Ltd. and W. A. Dickinson. Fr. Pat. 426,967, Jan. 18, 1911.

SEE U.S. Pat. 998,237 of 1911; this J., 1911, 1009.—J.F.B.

Triturating machine for treating old paper and similar waste. A. van Hemelryk. Fr. Pat. 426,955, Jan. 6, 1911.

SEE Eng. Pat. 433 of 1911; this J., 1911, 951.—T.F.B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Weighted silk; Treatment of —— *to make it fast to light without tendering the material.* O. Meister. Sealed note 1734 deposited April 22, 1907. Bull Soc. Ind. Mulhouse, 1911, **81**, 151—152.

SILK, heavily weighted with tin salts, is treated with acetic acid containing 1—5 per cent. of formaldehyde or its sodium bisulphite compound. This process can be used with advantage to replace the thiocyanate treatment.—P. F. C.

Printing colours; The use of formic acid to improve the stability of ——. A. Scheurer. Sealed note 1163 deposited Jan. 3, 1900. Bull. Soc. Ind. Mulhouse, 1911, **81**, 153—155.

IN preparing printing colours with nitro-alizarins it is not practicable to use aluminium acetate as the mordant, on account of the rapidity with which the aluminium lake is thrown down. This precipitation is avoided if the aluminium acetate is replaced by aluminium and calcium formates together with formic acid. Example: The following printing colour gives good results:— 250 parts of nitro-alizarin (α or β), 65 parts of aluminium formate (18·25° B.), 65 parts of calcium formate (14·5° B.), 100 parts of formic acid (16° B.) and 520 parts of gum thickening. An addition of 50 parts of a strained paste of tin sulphoricinate is advantageous with colours thickened with starch and gum. The process is applicable to other alizarin dyestuffs.—P. F. C.

Indigo; Steam discharging of —— *by means of chlorates, nitrates, and bromates.* G. Tagliani. Sealed note 1731 deposited April 8, 1907. Bull. Soc. Ind. Mulhouse, 1911, **81**, 156—159.

IN order to protect the indigo ground and the fibre itself from being affected by the oxides of chlorine liberated during the steaming of chlorate discharge prints on deep indigo bottoms, the author proposes to pad the fabric before printing in a solution of size to which glycerin has been added. He suggests that these substances, being hygroscopic, cover the fibre with a thin layer of moisture which acts as a protective against the corrosive vapours contained in the steamer. F. Noelting in a report on this note states that although the process is novel, it does not give very satisfactory results when tried on a small scale; possibly on a larger scale it would work better.—P. F. C.

Patents.

Bleaching of textile substances by means of emulsified stearine. E. Lasbordes. Second Addition, dated Feb. 22, 1911, to Fr. Pat. 399,514, Feb. 8, 1909 (this J., 1909, 979 and 1122).

The scouring and bleaching processes are now carried out in one operation for it has been found that stearine prepared as previously described is effective for bleaching purposes in a neutral or very slightly alkaline bath. —P. F. C.

Textile and other materials; Machines for drying and otherwise treating —— with fluids. R. Pawlikowski, Görlitz, Germany. Eng. Pat. 17,089, July 18, 1910. Under Int. Conv., Oct. 18, 1909.

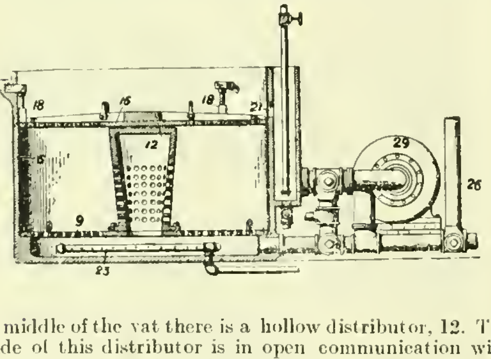
A machine is described for the continuous treatment of materials such as threads, yarns, ribbons, etc., with fluids, liquids or gases, by passing them through baths in a zig-zag course in an opposite direction to the flow of the fluid. The materials are contained in bobbin-shaped carriers capable of rolling on their axes, which are attached by means of swinging levers to the links of a chain which moves them forward over the bottoms of a series of troughs, arranged one above the other in a zig-zag course, in which the materials may be consecutively washed, bleached, dyed and treated with soap solution, etc. After the liquid treatments the chain conducts the carriers into a second portion of the apparatus in which there is an ascending current of warm air, or other gaseous reagent, and in which the carriers are conducted gradually downwards also in a zig-zag path on guides or channels. Alternatively the liquid treatments may be effected by means of sprays or drip-pipes.—J. F. B.

Dyeing-machine. C. Frohlich, Assignor to Klauder-Weldon Dyeing Machine Co., Amsterdam, N.Y. U.S. Pat. 999,304, Aug. 1, 1911.

The dyeing-machine described consists of a casing adapted to contain a dye-liquor, a rotary reel or skein-carrying device mounted in the casing, and means for changing the speed of rotation and its direction, operated by hand from the outside of the casing.—J. F. B.

Dyeing and bleaching machine. T. Frusher and T. Frusher, jun., Brooklyn, N.Y. U.S. Pat. 1,000,251, Aug. 8, 1911.

The material to be dyed is packed into a vat, 6, provided with a perforated false bottom, 9, beneath which is a perforated steam pipe, 23, for heating the dye-liquor. In the middle of the vat there is a hollow distributor, 12. The inside of this distributor is in open communication with the space below the false bottom, 9. When enough material has been put into the vat, a perforated cover, 16, is put into position and fastened by means of screws, 18. Dye-liquor is then run down from a reservoir through a pipe, 26, and is circulated by means of a pump, 29, which forces the liquor through the perforations in the false bottom and distributor, through the material and then through the perforations in the cover. The liquor then runs through an opening, 21, in the side of the vat and returns to the pump.—P. F. C.

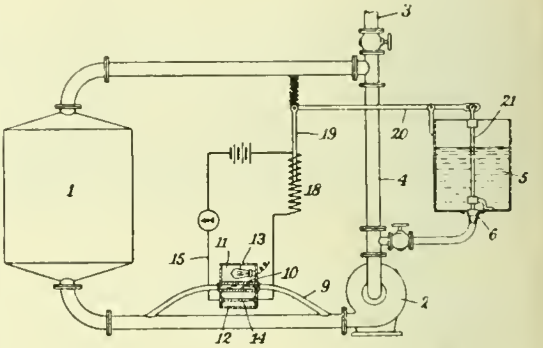


Dyeings on fabrics; Production of fast ——. Badische Anilin und Soda Fabrik. First Addition, dated March 7, 1911, to Fr. Pat. 359,466, Nov. 15, 1905. Under Int. Conv., Jan. 12, 1911.

The process described in the principal patent (this J., 1906, 373) is specially applicable to the dyeing of yarns, even and thoroughly penetrated dyeings being obtainable on very tightly twisted yarns. It is particularly advantageous with those dyestuffs which have a tendency to produce superficial dyeings.—P. F. C.

Measuring and regulating the concentration of dyestuff solutions; Process for ——. W. Bratkowski, P. de Lange Az and R. Pusch. Fr. Pat. 427,128, March 10, 1911. Under Int. Conv., March 12, 1910.

This process depends on the use of an element of selenium or some other electrical conductor characterised by the property of varying its electrical resistance according to the amount of light to which it is exposed. In the figure, 1 is a dye-vessel containing the material to be dyed and 2 is a circulating pump connected by pipes, 4 and 6, with a reservoir, 5, containing a strong solution of dyestuff, and by pipes, 4 and 3, with a water supply. To determine its concentration, dye-liquor is made to flow along a branch pipe, 9, and through a suitable glass vessel, 10, enclosed in two casings, 11 and 12, which entirely exclude light. In the casing, 11, is placed a constant source of light, 13, and in the casing, 12, a selenium element, 14, which is intercalated in an electrical circuit, 15. As the concentration of the dye-liquor flowing through the vessel, 10, changes, the amount of light from the source, 13, which passes through it and falls on the element, 14, also varies, thus producing a change in the electrical resistance of the selenium, which in turn alters the strength of the current through the circuit, 15. This circuit contains a solenoid, 18, and inside it is suspended a movable soft iron core, 19, which rises or falls as the current through the solenoid varies. These movements are transmitted by a lever, 20, and a rod, 21, to the plug, 6, which regulates the flow of the concentrated dyestuff solution from the reservoir, 5. By this means the concentration of the circulating dye-liquor can be automatically kept constant.—P. F. C.



Dyeing vegetable fibres with direct or substantive dyestuffs in one bath; Process for wetting out and ——. G. C. Dörr. Fr. Pat. 427,756, March 25, 1911. Under Int. Conv., April 1, 1910.

A dye-bath is prepared containing the required amount of dyestuff and about 20 grms. of an alkali silicate per litre. The material to be dyed is then entered at a temperature at which the liquor is bearable to the hand and the bath is gradually heated to the boil whilst stirring. After 30—60 minutes boiling the material is allowed to cool in the bath. The silicate has the property of simultaneously scouring the material (thus rendering previous preparation unnecessary) and of precipitating the dyestuff on to and into the fibre.—P. F. C.

Discharge effects on fibre ; Production of —— and pastes to be used therein. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 27,038, Nov. 21, 1910. Addition to Eng. Pat. 30,505, Dec. 30, 1909.

In addition to the compounds mentioned in Eng. Pats. 30,505 of 1909 and 25,957 of 1910 (see Fr. Pat. 414,937 and Addition thereto ; this J., 1910, 1247 ; 1911, 21) and 21,052 of 1910 (this J., 1911, 355), it is found that sulphinium compounds which contain at least one aralkyl residue can be employed in the production of discharge effects on material which has been dyed with vat or sulphide dyestuffs. The aralkyl sulphinium compound may contain one or more salt-forming groups which may be situated in either the aralkyl or one of the other residues. Examples of such sulphinium compounds are dimethylbenzylsulphiniummethyl sulphate (from methylbenzylsulphide and dimethyl sulphate) and dimethylbenzyl sulphiniummethyl sulphate-para-sulphonic acid or an inner salt (obtainable from benzylchloride-para-sulphonic acid and sodium-methyl-mercaptan and subsequent treatment with dimethyl sulphate). Details are given of the method of applying compounds of this class for the production of white and coloured discharge effects on indigo grounds.—P. F. C.

Colour effects ; Manufacture of fabrics showing ——. Teinturerie C. Marot. First Addition, dated Mar. 17, 1911, to Fr. Pat. 423,535, Dec. 10, 1910 (this J., 1911, 617).

In order to make the effect threads more supple and thus facilitate the weaving process, the lead salt employed (preferably the sesquicarbonate) is mixed with mineral oil and with petroleum spirit containing a small quantity of paraffin in solution. The lead salt can be finally removed from the effect threads by treating the fabric after dyeing with a boiling dilute solution of alkali for a few minutes.—P. F. C.

Printing on fabrics, papers, etc. ; Process of ——. M. Fortuny. Fr. Pat. 427,307, May 24, 1910.

A printing surface is prepared by one of the two following methods. (*a*) A suitable fabric (such as a fine silk) is coated with a layer of gelatin and the required design is printed on to it (either by hand or by photographic means) and treated with an alkali bichromate solution. The surface is next exposed to light for a period sufficient to render the printed parts insoluble and is finally washed to remove the unaffected gelatin. (*b*) The design is printed on to a fine material with a soluble substance and the whole fabric is next coated with an insoluble preparation such as a If drying oil. the fabric is then immersed in a suitable solvent, the latter traverses the insoluble surface by endosmosis and dissolves the soluble substance underneath it with which the design was executed. This causes the corresponding parts of the insoluble coating to fall away, leaving the rest fixed to the fabric to form the reserve of the design. A printing surface prepared by either of these processes may be used for continuous printing by arranging it in the form of an endless band around two rotating rollers, the lower one being so fixed that it presses the endless printing surface against the moving fabric to which the design has to be transferred. This lower roller may also be used for carrying the printing colour to the back of the printing surface and pressing it through the unreserved parts on to the moving fabric. Or, if desired, the fabric which is used as the basis of the printing surface may be of a spongy nature so that it can act as a colour pad.—P. F. C.

Finishing and rendering impermeable and non-inflammable natural or artificial fabrics and fibres ; Composition for ——. J. Achard and C. Gonon. Fr. Pat. 427,562, May 30, 1910.

Commercial cellulose acetate is mixed with its own volume of tetrachloro-ethane or tetrachloro-acetylene and the product is further diluted to the required consistence.—P. F. C.

Finish for fabrics ; A water-resistant ——. E. T. J. Watremez. Fr. Pats. 427,573 and 427,574, March 20, 1911.

By adding ammonium acetate to an alum solution, the excess of mineral acid which the latter contains is replaced by a weaker acid without causing precipitation. On warming such a mixture, however, alumina is thrown down, the amount of precipitate depending on the quantity of ammonium acetate added. If, in the preparation of a filling material from alum, gelatin and tannic acid (see following abstract) the excess of mineral acid in the alum is neutralised with ammonium acetate, a clear liquid is obtained which does not precipitate until it is heated. Therefore, by impregnating a fabric with such a cold filling and then drying it by heat, the coagulation takes place in the interior of the fibre and a much more satisfactory finish is obtained. In preparing a filling for delicate shades, the sumac extract may be omitted. A mixture of alum solution with ammonium acetate in suitable quantity may be used for waterproofing fabrics.
—P. F. C.

Gelatin finish for fabrics ; A water-resistant ——. E. T. J. Watremez. Fr. Pat. 427,574, March 20, 1911. Under Int. Conv., Jan. 11, 1911.

A filling material is prepared by heating a gelatin solution with an aluminium tannate obtained by the action of an aluminium salt (such as aluminium acetate or alum) on syrupy sumac extract. Enough ammonia is added to neutralise the excess of free acid.—P. F. C.

Mercerising cotton in the form of skeins ; Method of ——. P. Hahn, Niederlahnstein, Germany. Eng. Pat. 28,329, Dec. 6, 1910.

See U.S. Pat. 994,076 of 1911 ; this J., 1911, 799.—T. F. B.

Dyeing, bleaching, mordanting, and otherwise treating wool, cotton, and other fibrous substances ; Apparatus for ——. F. Goetz, Strasbourg, Germany. Eng. Pat. 16,206, July 7, 1910.

See Fr. Pat. 421,566 of 1910 ; this J., 1911, 486.—T. F. B.

Washing or dyeing cops or similar articles ; Apparatus for ——. E. Herzog, Erlach, Austria-Hungary. U.S. Pat. 999,499, Aug. 1, 1911.

See Eng. Pat. 8086 of 1910 ; this J., 1910, 1153.—T. F. B.

Discharge effects on coloured grounds ; Process of producing ——. B. Wuth, Assignor to Soc. of Chem. Industry in Basle, Basle. U.S. Pat. 1,000,313, Aug. 8, 1911.

See Eng. Pat. 7094 of 1910 ; this J., 1910, 1006.—T. F. B.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Sulphuric acid manufacture ; Intensive processes of ——. T. Meyer. Z. angew. Chem., 1911, **24**, 1520.

The author points out that Petersen (this J., 1911, 743) in comparing tangential chambers with Falding's, places a Falding chamber of 4750 cub. m. content side by side with a tangential set of one-third of that capacity. To compare these, in regard to the consumption of lead, is obviously unfair. From results already yielded by tangential chambers it is quite reasonable to expect that a set of the size of Falding's chamber would yield results in every respect as good as those published by Falding. There is yet but little recorded experience of the working of Falding's chambers—after some years it will be possible to compare his system with others. So far, it is doubtful whether it represents an advance in any respect save size.
—J. T. D.

Nitrosylsulphuric acid ; Reduction of ——, by mercury. O. Wentzki. Z. angew. Chem., 1911, **24**, 1468.

The ascription by Divers (this J., 1911, 598) to the author of the error of representing the system $2Hg+H_2SO_4$ as equivalent to 2H, is not justified. The author's explanation of the formation of the blue compound, summarised in the equation—

$$Hg_2+2HSNO_5+H_2SO_4=Hg_2SO_4+H_2N_2S_2O_9+H_2O,$$

is really, as indicated by the following equations,

$$Hg+2HSNO_5=H_2S_2N_2O_9+HgO$$
$$HgO+Hg+H_2SO_4=Hg_2SO_4.$$

The explanation given by Divers (*loc. cit.*) is rejected by the author, as being directly opposed to the behaviour of nitrosylsulphuric acid towards reducing agents.—J. T. D.

Calcium nitrate and nitrite; Valuation of ——. Stutzer and Goy. Chem.-Zeit., 1911, **35**, 891.

Commercial "calcium nitrate" and "calcium nitrite" prepared from atmospheric nitrogen contain small amounts of nitrite in presence of large amounts of nitrate, and the reverse. The nitron method of Busch (this J., 1905, 289, 291 and 458) has been applied to the analysis of these products. (1) The nitrite is oxidised to nitrate by hydrogen peroxide and the total nitrogen determined by the nitron method; then the nitrite in another portion is destroyed by hydrazine sulphate, after which nitron is again used. (2) The nitrite is estimated by titration with permanganate, and nitron is then added. Method (1) gave bad results, but method (2) was satisfactory. When nitron is to be added, not more than 1 c.c. of sulphuric acid (100 grms. per litre) should be used in the oxidation with permanganate. Since nitron is a dear reagent, the total nitrogen is estimated usually (in 50 c.c. of a solution of 10 grms. of the substance in 1 litre of water) by the method of Devarda (this J., 1893, 550).—H. E. P.

Calcium carbide. "Times," Aug. 19, 1911. [T.R.]

An Order in Council is published respecting calcium carbide, whereby this substance is practically brought under the Petroleum Acts. Five pounds of carbide may be kept without a licence provided it is kept in hermetically closed vessels each containing not more than 1 lb.

Syrian self-burning limestone. Oil, Paint, and Drug. Rep., Aug. 7, 1911. [T.R.]

The U.S. Consul at Jerusalem states that while making a trip through the Hauran his attention was directed to a curious stone which might be described as a self-burning limestone. The rock lay in a stratum between ordinary limestone; it was of a grayish black colour, and when freshly broken had an odour of petroleum. The quarrying is easy, as the rock is quite soft and full of seams. The stone is now broken into small pieces and burnt in a clamp. After about twelve hours the stone inside has become converted into lime. Any pieces not thoroughly burned are burned over again. The lime is white and said to make a very strong plaster, but sells at a low figure because of the low cost of production. Great quantities of lime are made in this way.

Bismuth carbonate. L. Vanino. Pharm. Zentralh., July 20, 1911, 761. Pharm. J., 1911, **87**, 301.

It has been shown that the ordinary carbonate, or oxycarbonate, of bismuth is somewhat variable in composition; the formula usually assigned to it is $Bi_2O_2(CO_3)_2$, or the same with half or one molecule of water. It was found that on pouring the strongest obtainable solution of bismuth nitrate into sodium carbonate solution, washing the precipitate until all nitrate was removed, and drying *in vacuo*, a compound was obtained represented by the formula $5Bi_2O_3,Bi_2(CO_3)_3$. Attempts were then made to reduce the quantity of water by employing the compound which bismuth nitrate forms with mannitol; if these two substances are mixed in molecular proportions a compound is obtained which forms a clear solution in a small quantity of water. On adding to such a solution at 0° C. a saturated solution of the calculated amount of potassium carbonate to form normal carbonate a brisk evolution of carbon dioxide occurred, but no permanent precipitate was formed; when, however, the potassium carbonate was added in the form of fine powder, a precipitate was formed, and this was washed three times with a little water, then with alcohol and ether, and dried in the air; analysis showed it to have the composition $Bi_2O_2CO_3$. A similar result was obtained when a strong solution of ammonium carbonate was used instead of potassium carbonate.

Monazite sand from Travancore, India. Bull. Imp. Inst., 1911, **9**, 103—105.

A deposit of naturally concentrated monazite sand, of considerable extent, has been discovered near Quilon, Travancore, India. The sand contains 4 per cent. of thoria and consists principally (46—50 per cent.) of monazite; ilmenite and zircon are the other chief constituents, with some rutile and traces of spinel, garnet, quartz, and hornblende. A specimen of pure monazite separated from the sand contained 8·5 per cent. of thoria. The monazite can be readily concentrated by means of an electro-magnet. A specially prepared concentrate contained 8·87 per cent. of thoria, and pure monazite separated from this contained 10·08 per cent. of thoria. The concentrate prepared on the commercial scale from this deposit contains 5—6 per cent. of thoria, as compared with less than 4 per cent. in that from Brazilian sand; and the pure monazite separated from the Travancore deposit is richer than that obtained from Brazilian and Carolina deposits, resembling more the monazite found in Ceylon (compare this J., 1906, 933).—A. S.

Monazite sand; Analysis of ——. G. Chesneau. Comptes rend., 1911, **153**, 429—431.

The following method of analysis, based on the initial separation of the contained phosphoric acid, has been adopted by the author:—About 2·5 grms. of the finely pulverised mineral are fused at a full red heat for an hour, or until quite homogeneous, with 15 grms. of potassium sodium carbonate, the fused mass is taken up with a boiling 1 per cent. solution of sodium hydroxide, and, after filtering, the residue is washed with cold water and treated with a hot 5 per cent. solution of hydrochloric acid; the insoluble matter is then submitted to the same treatment as before, so as to complete the decomposition. This gives an insoluble residue containing oxides of titanium and zirconium, etc., an alkaline solution containing alumina, silica, and all the phosphoric acid, and an acid solution containing the rare earths, etc.; the first two are analysed by the usual methods, but the acid solution is treated as follows: After removal of lead, copper, etc. (if present), it is diluted so as to contain exactly 4 per cent. of hydrogen chloride, and is then treated (hot) with crystals of oxalic acid (4 grms. per 100 c.c.) and allowed to stand for two days. A solution is thus obtained containing titanium, zirconium, iron, etc., which is analysed by known methods, and a precipitate of rare earth oxalates which, after washing with water containing oxalic acid, is dried and ignited at a temperature below 500° C. The oxides produced are dissolved in concentrated nitric acid, a little hydrogen peroxide (Merck's perhydrol, diluted to "10 volumes") being added if cloudy, and the clear solution is evaporated to dryness at 130° C.; when acid fumes have ceased to be evolved, the residue is redissolved in 150 c.c. of water, and the thorium separated by the method of Wyrouboff and Verneuil (this J., 1898, 265), by double precipitation with pure hydrogen peroxide, a little ammonium nitrate being added to prevent the thorium peroxide from entering into colloidal solution. The filtrate from the thorium is then diluted to 500 c.c., and, in one portion (100 c.c.), the total rare earths are precipitated by ammonia and weighed. In a further 100 c.c., cerium is determined by Job's method, which is applied in the following way. The solution is evaporated nearly to dryness, 10 c.c. of nitric acid and 2 grms. of lead peroxide are added, and the mixture is digested in the cold for an hour, after which it is filtered through asbestos (preferably using a Blair's tube with 3 cm. of asbestos, in fine pulp), pure nitric acid serving as the washing liquid, and very dilute hydrogen peroxide (about 0·5 volume strength) is added to the filtrate until exactly decolourised; the volume required is then compared with that of the same hydrogen peroxide solution used in decolourising a solution of ammonium ceric nitrate containing a known and as nearly as possible an equal weight of cerium, which has been treated in a similar manner. Finally, the yttrium earths are determined in the remainder of the solution by the double potassium sulphate method, and the oxides of lanthanum and the didymiums are obtained by difference. The author finds that the decomposition of monazite sand by hydrochloric acid is incomplete, and that when the mineral is attacked by sulphuric acid, some thorium remains in the insoluble residue.—F. Sodn.

Cerium; Separation [*and determination*] *of* ——. C. James and L. A. Pratt. Chem. News, 1911, **104**, 61—62.

The method depends on the fact, ascertained by the authors, that when a faintly acid or neutral solution of rare earth nitrates is boiled with potassium bromate, cerium is precipitated, free from other rare earths, as basic nitrate, containing varying amounts of basic bromate. The concentrated solution of oxides in nitric acid is made nearly neutral, heated to boiling, and potassium bromate is added in slight excess. As soon as fumes of bromine are observed, lumps of marble are added, and boiling is continued for a few hours, until nearly all the cerium (about 99 per cent.) is precipitated (hydrogen peroxide test); the precipitate is then washed with a 5 per cent. solution of ammonium nitrate, and, after dissolving in hydrochloric acid, the cerium is precipitated as oxalate or sulphate. Under these conditions, a cerium product may be obtained, on the large scale, of such purity that a saturated solution of the nitrate gives no absorption bands when observed through a layer 20 cm. thick. By double precipitation, the method may be applied quantitatively, boiling being continued, in the presence of a smooth lump of marble (containing no crevices), until the cerium is entirely precipitated; the precipitate is washed with ammonium nitrate solution, and filter paper and precipitate are treated with nitric acid and a little potassium bromate (to oxidise the paper); the solution is then boiled to remove excess of acid, and the residue is dissolved in water and treated, as before, with potassium bromate and marble, the precipitate, washed with ammonium nitrate, being dissolved in hydrochloric acid, the solution filtered and evaporated to remove excess of acid, the residue taken up with acid, and the cerium finally precipitated as oxalate and weighed as oxide. Powdered marble is not applicable as the neutralising agent. —F. Sodn.

Thulium. C. James. J. Amer. Chem. Soc., 1911, **33**, 1332—1344.

The author has succeeded in separating thulium from accompanying rare earth elements by converting a large quantity of yttrium earth oxides, from several minerals, into bromates and submitting these to fractional crystallisation. The best sources of thulium were found to be ytterspar, euxenite, and a columbate from Northern Norway. Euxenite was decomposed by heating the very finely ground mineral with strong sulphuric acid, powdering the product, agitating with water, and precipitating the rare earth metals as oxalates by adding oxalic acid to the aqueous extract. The columbate, after ignition, was powdered, and fused with twice its weight of sodium hydroxide, the cold melt allowed to stand with water, then heated with hydrochloric acid, and oxalic acid added to the filtered solution. The powdered ytterspar was added to a boiling mixture of sodium hydroxide (an equal weight) and rather less than half its weight of water; the mixture was then heated to dull redness, and, after boiling with water and filtering, the residue was treated with a slight excess of hydrochloric acid, and oxalic acid was added to the acid extract. The ytterspar earth oxalates were ignited to oxides, and these then dissolved in hydrochloric acid and reprecipitated as oxalates, which were converted into sulphates with strong sulphuric acid; the anhydrous sulphates were dissolved in cold water and the solution poured upon barium bromate, covered with a layer of water, and heated upon the water-bath, so as to obtain the corresponding bromates. The earths from euxenite, gadolinite, etc., which contained members of the cerium group, were subjected to the sodium sulphate treatment, and, after separating the insoluble double sulphates, the solution was precipitated by means of oxalic acid, and the yttrium earth oxides, obtained by igniting the oxalates, were converted into bromates as above. The bromates were then fractionated, when nearly all the erbium accumulated in the more soluble fractions (along with thulium, ytterbium, and lutecium), thulium collecting in the fractions between erbium and ytterbium as the crystallisation was continued. When free from erbium, the thulium solutions possessed a bluish green colour. The purest thulium thus obtained was found to contain only a trace of ytterbium. When the fractions became too small to crystallise from water, a mixture of alcohol and water was used with good results. The following compounds were prepared: *Thulium oxide*, Tm_2O_3, a dense white powder with faint green tint; *bromate*, $Tm_2(BrO_3)_6,18H_2O$, as pale, bluish green hexagonal prisms; *chloride*, $Tm_2Cl_6,14H_2O$; *sulphate*, $Tm_2(SO_4)_3,8H_2O$; *nitrate*, $Tm_2(NO_3)_6,8H_2O$; *oxalate*, $Tm_2(C_2O_4)_3,6H_2O$, obtained as a white precipitate with greenish tint by treating a slightly acid thulium solution with oxalic acid; *acetylacetonate*, $(CH_3COCHCOCH_3)_6Tm_2,2H_2O$, prepared by precipitating a solution of thulium chloride by an excess of ammonia, washing the precipitate, dissolving in a warm mixture of absolute alcohol and acetylacetone, and evaporating the solution; and *phenoxyacetate*, $(CH_2(C_6H_5O)COO)_6Tm_2,6H_2O$, prepared by dissolving thulium hydroxide in a solution of phenoxyacetic acid in dilute alcohol and evaporating the clear liquid. The author claims to have established the elementary nature of thulium, since, after about 15,000 operations, the absorption spectrum underwent no change.—F. Sodn.

Europium. C. James and J. E. Robinson. J. Amer. Chem. Soc., 1911, **33**, 1363—1365.

The authors have prepared about 100 grms. of europium oxalate from crude oxides containing neodymium, samarium, gadolinium, and yttrium earths, and small quantities of lanthanum, cerium, and praseodymium, by converting these into double magnesium nitrates, fractionally crystallising with 30 and later with 50 per cent. nitric acid, and eliminating europium from the most soluble portion by addition of the isomorphous bismuth magnesium nitrate, finally diluting the solutions containing the europium, precipitating with hydrogen sulphide, and precipitating the europium as oxalate in the filtrate by means of oxalic acid. In order to get rid of small quantities of samarium, the oxalate was ignited to oxide, and this was again subjected to a series of crystallisations by converting into the double magnesium nitrate and mixing with bismuth magnesium nitrate, subsequently precipitating the aqueous solution with hydrogen sulphide and oxalic acid as before. —F. Sodn.

Thorium salts; Action of niton (*radium emanation*) *on* ——. W. Ramsay. Comptes rend., 1911, **153**, 373—374.

Referring to the results and criticism of Herschfinkel (see this J., 1911, 1012), it is pointed out that the sample of thorium nitrate, used by the author, and from which carbon dioxide was obtained under the influence of the radium emanation, and also the emanation itself were specially purified before use, so as to remove all possible organic matter or carbon dioxide. Moreover, similar experiments in which nitrates of bismuth, mercury, and silver were employed gave no trace of carbon dioxide. Referring to the use of permanganate, attention is called to the fact that carbon dioxide is usually obtained from this substance on heating.—F. Sodn.

Potassium ammonoplumbite. E. C. Franklin. J. of Phys. Chem., 1911, **15**, 509—520. (See also this J., 1905, 844.)

Potassium ammonoplumbite has been obtained by the action of potassium amide dissolved in liquefied ammonia on lead imide, in accordance with the equation:— $PbNH+KNH_2=PbNK+NH_3$. The salt separates from its solution in liquefied ammonia in the form of beautiful colourless crystals, having the composition, $PbNK,2{\cdot}5NH_3$, which readily lose successively one-half molecule and one molecule of ammonia, giving products represented by the formulæ, $PbNK,2NH_3$, and $PbNK,NH_3$. —A. Sbld.

Silicic acid gels; Structure of ——. Theory of dehydration. R. Zsigmondy. Z. anorg. Chem., 1911, **71**, 356—377.

The author discusses the question of the structure of silicic acid gels and gives the results of an ultramicroscopic study of such gels. These results show that the structure of the gels is essentially amicroscopic, and that Bütschli's network structure can in no way be regarded as the true finest structure of the gels, but represents rather a coarser heterogeneity due to the accumulation of liquid in a conglomerate of silicic acid amicrons permeated throughout by amicroscopic hollow spaces. These hollow spaces must be in communication with one another, for a complete impregnation of the gels with liquids of the most varied character is possible. The peculiar behaviour of the gels on dehydration and rehydration observed by van Bemmelen admits of a simple explanation if the diminution of the vapour pressure be regarded as due to the diminution of the tension of the water in the very small capillaries of which the gel may be assumed to consist. If the capillarity law be assumed to hold for very small capillaries, the diameter of the hollow spaces in the silicic acid gel is found by calculation to be about $5\mu\mu$ for a vapour pressure depression of 6 mm. In accord with such a fine structure is the optical behaviour of the gel and also the fact that whilst it will allow the passage of crystalloids, it retains colloidal particles on its surface, and can hence be used as an ultra-filter for the separation of the disperse phase of colloidal solutions from the dispersion medium.—A. S.

Aluminium bromide as a solvent. B. A. Isbekow and W. A. Plotnikow. Z. anorg. Chem., 1911, **71**, 328—346.

Fused aluminium bromide is a good solvent for many inorganic compounds (especially chlorides and bromides) and for many organic compounds (carbon tetrabromide, hexabromobenzene, *m*-dibromobenzene, dimethylpyrone). The solutions of inorganic salts in the fused bromide, with few exceptions (stannic bromide, arsenic tribromide) are good electrical conductors. The conductivity is due to the formation of complex compounds and complex ions. Neither aluminium bromide, on the one hand, nor antimony tribromide or mercuric bromide, on the other, exhibit any notable power of conducting the current, but mixtures of the former with either of the two last-mentioned salts are good conductors. A few experiments were made on the electrolysis of salts dissolved in fused aluminium bromide. With platinum electrodes bromine separated at the anode in all cases, and at the cathode, antimony from antimony tribromide, mercury from mercury bromide, and aluminium from potassium bromide dissolved in aluminium bromide. Bromine was not separated when an aluminium anode was used in a mixture of potassium bromide and aluminium bromide, nor with an antimony anode in a mixture of antimony tribromide and aluminium bromide. In the electrolysis of mercuric bromide dissolved in aluminium bromide, insoluble mercurous bromide separated. In a quantitative test with antimony tribromide, a current yield of 74·5 per cent. of antimony was obtained.—A. S.

"*Hyperol*" [*compound of hydrogen peroxide and urea*]; *Use of —— in the laboratory.* J. Milbauer. Chem.-Zeit., 1911, **35**, 871.

The compound of hydrogen peroxide and urea, described by Tanatar (J. Russ. Phys.-Chem. Ges., **40**, 376), mixed with a small quantity of citric acid to render it more stable, has been put on the market under the name of "hyperol," in the form of a fine crystalline powder or as tablets of 1 grm. each. It yields 34 per cent. of hydrogen peroxide as compared with the theoretical 35·9 per cent. for a compound of the formula, $CO(NH_2)_2H_2O_2$. It dissolves in water (up to 60 per cent.) and in alcohol, whilst ether extracts hydrogen peroxide from it. It contains no sulphuric acid and leaves no ash on combustion. On heating, evolution of oxygen begins at 60° C. For most analytical and preparative processes "hyperol" is an efficient substitute for hydrogen peroxide solution. It is especially suitable for use in the determination of volatile sulphur in fuels, by the methods of Hempel, Graefe, etc., any oxides of nitrogen formed being decomposed by the urea, and the freedom of the "hyperol" from sulphuric acid allowing of a volumetric and a gravimetric determination being made on the same sample.—A. S.

Hydrogen peroxide; New reaction for the detection of ——. O. von Sobbe. Chem.-Zeit., 1911, **35**, 898.

Hydrogen peroxide is found to give a characteristic grey precipitate with ammoniacal silver nitrate solution and the reaction is stated to be more delicate than that with potassium iodide and starch paste.—A. Sbld.

Nitrous oxide. Chemistry of anaesthetics. III. C. Baskerville and R. Stevenson. J. Ind. Eng. Chem., 1911, **3**, 579—582. (See also this J., 1911, 830, 980.)

The paper comprises a bibliography relating to the preparation, analysis and purification of nitrous oxide and a description of some experiments on methods of analysis. It is recommended that nitrous oxide to be used for anæsthetic purposes should contain at least 95 per cent. of nitrous oxide and no solids, liquids, combustible organic matter, chlorine, or other oxides of nitrogen. The two last-mentioned impurities may be detected by passing 10 litres of the gas slowly (in 3 hours) through silver nitrate and ferrous sulphate solutions. The best method for the determination of the nitrous oxide is to pass the gas (dried and freed from carbon dioxide) over reduced copper in an atmosphere of hydrogen, then reduce the cupric oxide formed by means of hydrogen, and absorb the water in a weighed calcium chloride tube. The result must of course be corrected if other oxygen compounds than nitrous oxide be present in the gas.—A. S.

Ozone; Formation of ——. C. Harries. Z. Elektrochem., 1911, **17**, 629—633.

The production of ozone by the silent discharge is not an electrolytic phenomenon, but probably due to radiation of very short wave length. The ordinary ultra-violet rays act destructively on ozone. Low temperature and sufficiently high frequency—at least 100 alternations per second—of current are the favourable factors in producing ozone. At 20° C. and 7400 volts, 18 to 19 per cent. of ozone can be produced from pure oxygen; the maximum possible yield is perhaps 25 per cent. By electrolysis of dilute sulphuric acid with specially cooled electrodes 28 per cent. has been obtained. The blue colour of ozone is certainly not due to the presence of nitrogen oxides. Ozone of high concentration is very explosive in the gaseous form, though not when liquid. It forms unstable compounds with alkali hydroxides, of formulæ RO_4H, and also yields addition-compounds—"ozonides"—with many organic substances. Ethylene ozonide, $C_2H_4O_3$, and propylene oxozonide, $C_3H_6O_4$, for example, are fairly stable, yet very explosive oils, which can be distilled in a vacuum, and yield with water formaldehyde and formic acid (or the corresponding acetic compounds) and hydrogen peroxide. The "oxozonides" are usually formed if ozone of high percentage be used. Many substances decompose ozone, which usually seems to break up according to the equation: $O_3=O_2+O$ or $2O_3=3O_2$; with aldehydes of the acetic series, substances of "peroxide" nature are formed—$C_2H_5CHO+O_3=C_2H_5\cdot CHO_2+O_2$, and the well-known reaction with iodide, studied by Ladenburg, $O_3+2KI+H_2O=O_2+I_2+2KOH$, is of similar character. The existence of more than one form of condensed oxygen has often been suggested, and the formation of "oxozonides" indicates the possibility of the presence in high percentage ozone of O_4 as well as O_3. The author has examined this question by fractionally distilling highly concentrated liquid ozone, collecting the more volatile and the less volatile portions in two different bulbs, and analysing the contents gravimetrically and also by reaction on iodine. The two methods agreed in the case of the more volatile distillate, but the less volatile portions always showed a larger amount of iodine set free than corresponded with the weight of ozone present; again an indication that along with O_3, O_4 was probably present, which would set free, weight for weight, 1½ times as much iodine as O_3:—$O_4+4KI+2H_2O=O_2+2I_2+4KOH$. In the discussion E. H. Riesenfeld stated that he had found ozone to react with many inorganic substances as a whole: *e.g.*, that one molecule of ozone converts three molecules, not one, of sulphur dioxide into trioxide. R. Luther pointed out that the reaction of ozone with iodides was investigated very completely, long before Ladenburg, by Brodie (Phil. Trans. Roy. Soc., 1872, **162**, A, 435), who had also instanced cases of triatomic oxidation by ozone, amongst others that quoted by Riesenfeld.—J. T. D.

Electrical precipitation of suspended particles. Cottrell. *See* I.

Fusion and volatilisation of highly refractory materials [*metals and oxides*]. Ruff and Goecke. *See* X.

Some sources of error in the gasometric determination of nitrate and nitrite by the methods of Schlösing and Piccini. Ruff and Gersten. *See* XXIII.

PATENTS.

Acids from their absorbents; Apparatus for recovering corrosive ——. F. M. Hale, Catford, Kent. Eng. Pat. 11,245, May 9, 1911.

THE apparatus is applicable to the recovery of any corrosive liquid, capable of vaporisation by heat, from kieselguhr, randanite, or other inert absorbent. It consists of a tower, with a grid at the bottom, and an opening which can be closed, at the top, and provided with a means of supplying hot air at the top or bottom. The mass of absorbent impregnated with the liquid is fed on to a layer of glass wool at the bottom of the tower, and is also covered with a layer of glass wool. The tower is provided with an outlet for the acid vapours leading to a condensing plant, and with an outlet at or near the bottom for the removal of the absorbent. The apparatus may be surrounded by a flue connected with a furnace to supply heat to the outside of the tower.—W. C. H.

Bicarbonate of soda; Method of obtaining ——. N. Wrinkle and R. G. Paddock, Assignors to Natural Soda Products Co., San Francisco, Cal. U.S. Pat. 1,000,138, Aug. 8, 1911.

NATURAL water containing acid and normal carbonates of sodium, the latter in excess, together with organic matter in suspension, and sodium chloride and sulphate in solution, is filtered to remove the suspended matter, and evaporated by solar heat in order to extract urao (trona) from the solution in sufficient quantity to exhaust the bicarbonate component, and leave the excess of the normal carbonate in the solution. The urao is separated from the mother liquor, dissolved in fresh water, and this solution is carbonated to form sodium bicarbonate from the normal carbonate constituent. The bicarbonate is allowed to deposit from the solution and all but about 10 per cent. is recovered; the solution containing the remainder is added to a further quantity of the water that is being evaporated to yield a greater quantity of urao than would be obtained by evaporation of water not so treated.—W. C. H.

Ammonia; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 61, Jan. 2, 1911.

A MIXTURE of, or containing, nitrogen and hydrogen is brought into contact with metallic molybdenum, or a suitable molybdenum compound, which may have received preliminary treatment before introduction into the contact tube and may be employed in conjunction with other catalytic agent, such as nickel, or an indifferent substance, such as carbon, or be precipitated on a suitable carrier, such as quartz. For example, ammonium molybdate, phosphomolybdate, or molybdic acid is heated in a current of pure ammonia, to dull redness, and the compound of molybdenum and nitrogen thus produced is introduced into a contact tube, and a current of nitrogen and hydrogen, in combining proportions, passed through the tube, at 550° C. and 100 atmos. pressure, the ammonia in the exit gases being separated in any suitable manner. The initial materials may also be introduced directly into the contact tube, and any alteration be allowed to take place *in situ*.—F. SODN.

Ammonia; Process for the manufacture of —— *from crude calcium cyanamide by means of water and steam.* Bayrische Stickstoffwerke A.-G. Ger. Pat. 236,705, March 27, 1910.

A MIXTURE of crude calcium cyanamide and water is subjected to the action of steam in a counter-current apparatus similar to an ammonia distilling column. It is stated that the complete conversion of the cyanamide-nitrogen into ammonia is attained with a steam pressure of 2—3 atmospheres, without any formation of dicyandiamide.—A. S.

Ammonium sulphate; Process of manufacture of ——. Soc. Industr. de Prod. Chimiques. Fr. Pat. 427,065, May 18, 1910.

CALCIUM sulphate is made to react with ammonium carbonate, by agitating, for example, a solution of the latter with a suspension of the former, or by passing ammoniacal gases and carbon dioxide into a similar suspension, preferably heating during or after the reaction.
—F. SODN.

Sodium [*barium, strontium, calcium, magnesium, or zinc*] *sulphite and ammonium chloride; Process of manufacture of* ——. Friedrich und Co. and F. Hirch. First Addition, dated March 17, 1911, to Fr. Pat. 402,872, May 10, 1909 (see Eng. Pat. 11,123 of 1909; this J., 1909, 1034).

THE process described in the principal patent is extended to include the manufacture of the sulphites of barium, strontium, calcium, magnesium, and zinc. The chloride of the metal is either dissolved or suspended in water, and sulphur dioxide and ammonia gases introduced into the liquid in molecular proportions, sufficient heat being generated by the reaction to dissolve the ammonium chloride formed and cause the sulphite to separate in a nearly pure state. The liquid is kept feebly acid almost to the end of the operation, and ultimately, the gas supply is regulated so that the liquid becomes neutral and a sample of the filtered liquid gives no precipitate with the solution of chloride used; the hot liquid is then separated from the sulphite and allowed to crystallise. About two-thirds of the calculated quantity of zinc sulphite is precipitated, and the other sulphites are precipitated almost completely.—F. SODN.

Calcium perborate; Process of making stable ——. R. Grüter, Assignor to Chem. Werke vorm. Dr. H. Byk, Charlottenburg, Germany. U.S. Pat. 999,497, Aug. 1, 1911.

STABLE calcium perborate is prepared by treating sodium perborate with calcium chloride in presence of a quantity of water insufficient to cause any material amount of hydrolytic action, reducing the clots or lumps of calcium perborate formed by grinding, separating the product from the mother-liquor and washing it with water.—J. F. B.

Perborates of calcium, magnesium, and zinc; Preparation of ——. Chem. Fabr. Grünau Landshoff und Meyer A.-G. and A. Bräuer. Ger. Pat. 237,096, June 21, 1910.

AQUEOUS solutions of salts of calcium, magnesium, or zinc are treated with sodium metaborate in presence of hydrogen peroxide.—A. S.

Calcium aluminate and other products; Process of making ——. S. Peacock, Chicago, Ill., Assignor to American Cyanamide Co., New York. U.S. Pat. 1,000,290, Aug. 8, 1911.

PHOSPHORUS pentoxide and calcium aluminate are produced in a single operation by heating a mixture of about 1053 lb. of aluminiferous material, such as bauxite, and about 2000 lb. of phosphate rock, to a temperature of about 1500° C. The components of the mixture are so proportioned that there will be sufficient calcium oxide present to combine chemically with all the alumina, ferric oxide and silica that are also present. The heated mixture is formed into thin layers, to facilitate the evolution of the phosphorus pentoxide.—W. C. H.

Phosphorus pentoxide and cementitious products; Process of producing ——. F. S. Washburn, Assignor to American Cyanamide Co., Baltimore, Md. U.S. Pat. 1,000,311, Aug, 8, 1911.

FINELY divided, crude phosphates of aluminium and calcium are mixed together in the ratio of about 1000 lb. of the former to 4680 lb. of the latter, so that at least one chemical equivalent of alumina is associated with at least one chemical equivalent of lime. This mixture is subjected to a temperature, not greatly exceeding 1700° C., sufficient to separate the oxides of phosphorus from the alumina and lime, and the oxides of phosphorus thus sublimed are suitably recovered, whilst the cementitious product remains behind.—W. C. H.

Nitrides; Manufacture of ——. O. Serpek. Fr. Pat. 426,868, May 13, 1910.

A CURRENT of nitrogen is passed over a mixture of alumina and carbon at a high temperature, in the presence of free or combined sulphur. In presence of sulphur the reaction is accelerated and the quantity of nitride produced is increased.—F. SODN.

Cyanides and cyanamides; Process of preparing alkali or alkaline-earth ——. Badische Anilin und Soda Fabrik. Ger. Pat. 235,662, April 18, 1909. Addition to Ger. Pat. 200,986, March 31, 1907 (see Fr. Pat. 387,001 of 1908; this J., 1908, 809).

ALKALI or alkaline-earth cyanides or cyanamides are obtained by heating compounds of nitrogen and silicon or aluminium (*e.g.*, the nitrides) with alkali or alkaline-earth oxides or salts, with or without a flux. It is advisable, to avoid loss of nitrogen, not to raise the temperature higher than is necessary to produce a homogeneous melt. Instead of using the pure nitrogen compounds of silicon or aluminium, mixtures of these may be used, either with other nitrides, or with the oxides.—T. F. B.

Antimony oxide; Process of treatment of —— *with a view to the elimination and recovery of contained arsenious products.* M. Rosazza. Fr. Pat. 427,310, May 25, 1910.

ANTIMONY oxide is submitted to the action of heat, so that contained arsenic is eliminated in the form of fumes of arsenious oxide (which are aspirated to a suitable condenser), the temperature and admission of air being so regulated that no antimony is carried over. Any arsenic remaining in the antimony oxide is finally eliminated by boiling with water, the dissolved arsenic being recovered by precipitation with zinc or iron.—F. SODN.

Hydrogen; Process for generating ——. S. Saubermann, Berlin. Eng. Pat. 401, Jan. 6, 1911.

STEAM and hydrocarbons (such as those derived from iron carbides) are passed over red-hot iron which has been mixed with (preferably 5—10 per cent. of) copper, lead, vanadium, or aluminium, either together or separately. These metals catalytically accelerate the reaction between steam and iron, and also decompose the hydrocarbons.
—F. SODN.

Hydrogen; Generation of —— *from silicon and alkali solutions without external heat.* Consortium für Elektrochem. Ind. G. m. b. H., Nuremberg, Germany. Eng. Pat. 11,640, May 13, 1911. Under Int. Conv., May 14, 1910.

THE temperature necessary for the generation of hydrogen from silicon and caustic alkali solutions, is obtained by the solution of the powdered alkali or alkali oxides in water, or by the heat produced in the chemical reaction between aluminium or aluminium alloys and the alkali.—B. N.

Hydrogen; Process and apparatus for the preparation of —— *by autocombustion.* G. F. Jaubert. Fr. Pat. 427,191, May 21, 1910.

HYDROGEN is produced by the ignition and autocombustion in a closed generator, of a mixture consisting of an excess of a combustible substance (metal, metalloid, or alloy), capable of decomposing steam at a high temperature, an oxidiser or other substance to maintain the combustion, and a substance evolving steam on heating (which is omitted, partially or wholly, if steam be introduced from an external source). Suitable mixtures, which may be packed in metal cartridges, to be opened and placed directly in the generator, are the following:—(*a*) Powdered iron (20 kilos.), slaked lime (10), potassium perchlorate (6); (*b*) ferrosilicon, with 75 per cent. of silicon, (20), litharge (10), soda-lime, containing two-thirds of sodium hydroxide, (60); (*c*) ferrosilicon (20), powdered iron (5), wheaten-flour (3), lime (5), and potassium chlorate (3). If the ingredient evolving steam be omitted, the generator may be surrounded by a water-jacket, the two vessels being connected so that the necessary steam is supplied from the latter by the heat of the reaction; a pipe from the generator conveys the gas either to the exterior, or, through a purifying and drying apparatus, to be utilised. The generator described is closed by a heavy lid which, for safety, is held in position merely by its own weight. A modified apparatus, intended specially for use in filling balloons, consists of several generators, connected with a purifier and mounted on a carriage.—F. SODN.

Graphite and other by-products in the manufacture of ammonia; Production of ——. E. Collett and M. Eckardt, Christiania, Norway. Eng. Pat. 5713, March 7, 1911. Under Int. Conv., March 10, 1910.

THE residue obtained in the reaction between calcium cyanamide and water is treated with an acid, and the undissolved crude graphite is filtered off and washed; pure graphite is prepared by further treatment with suitable reagents. Claim is also made for the mixture of nitrates of calcium and nitrogen bases obtained as by-product when nitric acid is employed in the process.—F. SODN.

Oxalic acid and other oxygenated carbon products; Process for the manufacture of ——. A. Deiss, Marseilles, France. U.S. Pat. 999,551, Aug. 1, 1911.

SEE Fr. Pat. 406,722 of 1909; this J., 1910, 564.—T. F. B.

Sulphates of the alkalis and of the alkaline earths; Process for reducing —— *into their corresponding sulphides by means of the action of certain catalysing agents.* V. Bollo and E. Cadenaccio, Genoa, Italy. Eng. Pat. 27,477, Nov. 25, 1910. Under Int. Conv., Nov. 29, 1909.

SEE Fr. Pat. 423,228 of 1910; this J., 1911, 620.—T. F. B.

Phosphates of potash and ammonia; Process for the manufacture of ——. C. Kliugbiel, Duisburg, Prussia. Eng. Pat. 2304, Jan. 30, 1911. Under Int. Conv., Jan. 29, 1910.

SEE Ger. Pat. 229,913 of 1910; this J., 1911, 438.—T. F. B.

Electrolytic cells for the electrolysis of alkaline salts. M. Wildermann, Ealing. U.S. Pat. 998,063, July 18, 1911.

SEE Eng. Pat. 26,568 of 1910; this J., 1911, 620.—T. F. B.

Ammonia; Process of making ——. F. Haber, Karlsruhe, and R. le Rossignol, Berlin, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 999,025, July 25, 1911.

SEE Eng. Pat. 14,023 of 1910; this J., 1910, 1453.—T. F. B.

Ammonium nitrate; Process for producing ——. Gewerkschaft des Steinkohlenbergwerks Lothringen. and F. Uhde, Gerthe, Germany. Eng. Pat. 10,759, May 3, 1911.

SEE Fr. Pat. 417,505 of 1910; this J., 1911, 85.—T. F. B.

Ammonium carbonate; Process for obtaining solid ——. J. Bueb. Fr. Pat. 427,045, March 8, 1911.

SEE Eng. Pat. 22,586 of 1910; this J., 1911, 421.—T. F. B

Alumina; Manufacture of pure —— from aluminium nitride. O. Serpek. Fr. Pat. 427,110, May 19, 1910.

See Eng. Pat. 13,088 of 1910; this J., 1911, 361.—T. F. B.

Hydrogen peroxide; Method of preventing the decomposition of aqueous solutions of ——. M. Schlaugk, Hanover, Germany. Eng. Pat. 29,282, Dec. 16, 1910.

See U.S. Pat. 992,265 of 1911; this J., 1911, 747.—T. F. B.

Hydrogen peroxide; Product yielding ——. A. Klages, Salbke-Westerhüsen, F. Sommer, Berlin, and Saccharin-Fabr. A.-G. vorm. Fahlberg, List, und Co., Salbke-Westerhüsen, Saxony. Eng. Pat. 12,008, May 18, 1911.

See Fr. Pat. 425,958 of 1911; this J., 1911, 956.—T. F. B.

Hydrogen peroxide; Vessels for the manufacture and storage of ——. A. Pietzsch and G. Adolph. Munich, Germany. Eng. Pat. 13,187, June 1, 1911. Under Int. Conv., June 3, 1910.

See Ger. Pat. 233,856 of 1910; this J., 1911, 747.—T. F. B.

Alkali superoxides; Process of rendering —— harmless for the purpose of using same in the laundry, bleaching, and other industries. E. Scheitlin, Basle, Switzerland. Eng. Pat. 29,997, Dec. 24, 1910. Under Int. Conv., Dec. 24, 1909.

See Fr. Pat. 423,949 of 1910; this J., 1911, 616.—T. F. B.

Hydrogen; Method of liquefying ——. Heylandt-Ges., Hamburg, Germany. Eng. Pat. 16,615, July 12, 1910. Under Int. Conv., July 12, 1909.

See Fr. Pat. 418,138 of 1910; this J., 1911, 86.—T. F. B.

Hydrogen; Method of and apparatus for preparing ——. G. F. Jaubert, Paris. Eng. Pat. 153, Jan. 3, 1911. Under Int. Conv., Jan. 14, 1910.

See Fr. Pat. 422,296 of 1910; this J., 1911, 685.—T. F. B.

Nitrogen [from air]; Process of obtaining ——. C. E. Acker, Ossining, N.Y., Assignor to The Nitrogen Co., New York. U.S. Pat. 999,003, July 25, 1911.

See Eng. Pat. 24,413 of 1910; this J., 1911, 621.—T. F. B.

Process of treating earthy materials. U.S. Pat. 999,494. *See* IX.

VIII.—GLASS; CERAMICS.

Patents.

Glass; Strengthened ——. E. Benedictus, Paris. Eng. Pats. 10,293, April 28, 1911 (under Int. Conv., Dec. 7, 1910) and 10,324, April 28, 1911.

The strengthened glass consists of two sheets of glass which are made to adhere by the interposition of (*a*) a sheet of bleached gelatin, rendered tenacious and supple by the addition of albumin, fibrin, protein and glycerin, or (*b*) a sheet composed of a mixture of celluloid or nitrocellulose and gelatin, obtained by the solution of the two materials preferably in glacial acetic acid, or (*c*) a sheet of celluloid, gelatinised by immersion in a bath of gelatin, or (*d*) a sheet of gelatin, nitrated by immersion in a solution of celluloid or collodion. In the process of manufacture the sheets may be inserted between the two glass plates, directly they leave the preparing bath, or the faces of the strengthening sheets may be softened by acetic acid or other solvent, or a solution of the strengthening material may be poured direct upon one of the glass plates, and the second plate of glass applied after the free face of the material has been softened by means of a solvent. In any case the three sheets are compacted together by pressure, and the removal of the solvent may be accelerated by warming. The entrance of air between the glass plates may be prevented by using acetic acid in the form of vapour for softening the faces of the sheets of strengthening material before the application of pressure, or the edges of the sheet of strengthened glass may be luted with paraffin, or the sheet of strengthening material may be slightly smaller than the glass sheets, and so leave an unfilled margin all round the periphery, which can be luted if desired. (See also Eng. Pat. 1790 of 1910; this J., 1910, 818.) When the strengthening layer consists wholly or in part of gelatin, the second patent covers the treatment of the gelatin, at the moment of adhesion, with a liquid inert to gelatin, volatile and desiccative, such as ethyl alcohol, anhydrous or containing little water, in order to remove from the gelatin any moisture which would prejudicially affect the solidity and transparency of the strengthened glass. To ensure the safety of the gelatin sheet its edges may be treated in some way to render them insoluble (*e.g.*, by a solution of potassium bichromate, etc.) or a marginal space between the glass sheets may be luted with paraffin, pitch or the like.
—W. C. H.

Bricks, tiles, cements and other ceramic products; Continuous kiln for burning ——. M. Coulaud. Fr. Pat. 427,513, March 18, 1911.

The partition walls which divide the kiln into compartments are built of refractory bricks, and provided with a number of transverse perforations, whereby the supply of combustible gases is divided and distributed uniformly through the whole of each compartment. In the base of each compartment, just in front of the perforated partition, following the direction of flow of the gases, is arranged a suitable number of holes, each of which opens into a longitudinal flue in the base of the kiln. By this means, as soon as the gases exert no more useful effect in the kiln, they are drawn down and serve to heat the bases of the succeeding compartments before being discharged to the chimney. Suitable valves are provided to regulate the flow of the gases through the desired compartments of the kiln in turn.—W. C. H.

Glass; Method for preparing constituent mixtures for the manufacture of ——. J. Kersten, Bonn, Germany. Eng. Pat. 1859, Jan. 25, 1911.

See Fr. Pat. 424,902 of 1911; this J., 1911, 896.—T. F. B.

IX.—BUILDING MATERIALS.

Wood preservation. Oil, Paint and Drug Rep., Aug. 7, 1911. [T.R.]

The Forest Service of the Department of Agriculture has just published a bulletin on the consumption of wood preservatives in the United States during the past year. The quantity of creosote used during 1910 increased by 7,000,000 gallons to 63,000,000 galls. over the amount of the previous year, and of zinc chloride there was a reduction of about 2,000,000 to 17,000,000 lbs., as compared with 1908 figures. There were also used small quantities of corrosive sublimate, water-gas tar, crude oil, and refined coal tar. These figures are based upon reports of 49 firms working 71 treating plants, which represent 96 per cent. of the plants in operation during that year, and show a greater consumption of creosote than has ever been reported in any previous year. About 71 per cent. of the creosote used was imported mainly from England and Germany. During 1910 as a result of the use of these preservatives more than 100,000,000 cubic feet of woods were treated.

Cement; A scheme for the rapid analysis of ——. C. N. Wiley and W. A. Ernst. J. Ind. Eng. Chem., 1911, **3**, 551—553.

It is stated that by the following method a complete analysis of cement can be made in 2—2½ hours, and that the results agree closely with those obtained by the usual methods. The method of determining silica is a modification of that proposed by Hentschel (Tonind. Zeit., **35**

265). 0·5 grm. of cement is treated with water and 10 c.c. of glacial acetic acid in a porcelain dish, and after breaking up any lumps, the mixture is heated and stirred until no particles of cement remain. The mass is treated with dilute hydrochloric acid until the reddish colour is destroyed, filtered, and the silica washed with hot water, ignited, and weighed. The filtrate from the silica is made up to 200 c.c., and two aliquot portions are taken. In one the iron and aluminium are precipitated by adding a few drops of nitric acid and then ammonia. The precipitate is filtered off, washed, ignited, and the oxides weighed. The filtrate is made up to 400 c.c., and the calcium is precipitated as oxalate, which is filtered off, washed, and titrated with permanganate in the usual way. The filtrate from the calcium oxalate is concentrated to 200 c.c., acidified with hydrochloric acid, and sodium ammonium phosphate solution and about 5 c.c. of ammonia solution are added. After cooling, the mixture is shaken vigorously until the precipitate begins to form, after which about 15 c.c. of ammonia solution are added and the shaking continued for 10 minutes. The precipitate is allowed to settle, filtered off, washed, ignited, and the magnesium pyrophosphate weighed. In the second aliquot portion, the aluminium and iron are separated by the Zimmermann-Reinhardt method. The iron is reduced by adding, to the boiling solution, drop by drop, a solution of stannous chloride (25 grms. of stannous chloride dissolved in 100 c.c. of concentrated hydrochloric acid and the solution diluted with water to 1 litre) until the liquid is colourless. After cooling and making up to 300 c.c., 25 c.c. of manganese sulphate solution (67 grms. of the crystallised salt dissolved in 500—600 c.c. of water and the solution made up to 1 litre after addition of 138 c.c. of phosphoric acid of sp. gr. 1·7 and 130 c.c. of sulphuric acid of sp. gr. 1·82) are added, the whole is stirred vigorously, treated with 10 c.c. of a saturated solution of mercuric chloride and titrated with permanganate. In a separate 1 grm. portion of the cement, after digestion with acetic acid and addition of dilute hydrochloric acid, the sulphuric anhydride is determined as barium sulphate.
—A. S.

Concrete; Electrolytic destruction of reinforced ——. C. E. Magnusson and G. H. Smith. Engineering, 1911, **92**, 174. Also O. J. Olgiati and H. Roberts, *ibid*, 232—233.

Steel bars, ¾ in. in diameter, to one end of which copper wires were soldered, were embedded to a depth of 6½ inches in cylindrical blocks of concrete, 9 in. long and 6 in. in diameter. The bottoms of the blocks were kept moist for 30 days before a current of about 100 volts was applied. All the blocks cracked sooner or later, evidently owing to the increase in volume of the iron, due either to oxidation or conversion into a salt. Dry concrete is an insulator, but when the pores are filled with water or a saline solution, electrolytic conduction takes place. The mechanical properties of blocks of concrete, placed between electrodes in water or saline solutions, and subjected to the action of currents of 0·07 ampère or less, were not injured. Attempts to fill the pores with some non-conducting material, *e.g.*, soap and alum, were not very successful. A coat of zinc, applied to the iron before embedding it in the concrete, was useless, and a coat of paint, such as aluminium paint, only prevented electrolytic action for a time, depending on the durability of the vehicle or varnish, and also greatly reduced the maximum shearing strength of the concrete. Concrete containing an aluminium wire, instead of an iron bar, was not corroded when immersed in water or a saline solution; a current flowed when the circuit was closed but dropped to 0·001 ampère in about 10 minutes. It is suggested that iron bars coated electrolytically with aluminium might be tried. The experiments confirm the observation that alternating currents do not attack ferro-concrete, provided the positive and negative waves are equal, and the heating not excessive.

Olgiati and Roberts embedded iron and carbon electrodes, firmly and loosely, in concrete cylinders, and tested these and blocks without electrodes with direct and alternating currents. Collapsible iron electrodes, composed of sheet iron rolled with filter paper between the layers, and iron tubes filled with oil, were used in order to determine the rise of temperature; these electrodes passed right through the block and were connected with the current leads outside. In the electrolytic tests the current was passed from copper rings pushed over the concrete cylinders, through the concrete to the electrode. The blocks were placed in water and currents of 0·1 ampère or greater intensity were used. Weak direct currents apparently cause material to be washed out from ferro-concrete, gas to be liberated, and a rusty deposit to be formed on the surface of the block. The apparent resistance of the concrete rises until a crack is developed, after perhaps 14 days, and then decreases. Weak alternating currents produced neither "gassing" nor corrosion, but when raised to 3 ampères (which caused a temperature rise to 45° C.) the blocks split in 10 hours. With direct currents the carbon electrodes burst the blocks in much the same way as the iron electrodes, and some compounds were apparently formed between the carbon and the concrete. No splitting took place with the loose carbon electrodes, and alternating currents did no harm to the blocks. The main conclusions are that mere thermal expansion will destroy ferro-concrete, when produced by currents of high density, either alternating or direct. Weak currents, insufficient to act thermally, cause corrosion, owing to the formation of iron oxide at the anode which penetrates into the concrete at a rate depending upon the porosity, current intensity, gas pressure, etc. The oxygen seems to be due to electrolysis of water and not to be taken up from the concrete. The progressive corrosion of the iron is not accompanied by any gradual reduction in the strength of the concrete, but the gas pressure may hasten disruption. Large leakages of direct or alternating currents may cause structural failure in a few hours, and though small leakages of the latter may sometimes be disregarded, much depends upon the shape of the current waves. Small leakages of direct currents may cause an insidious undermining of the mechanical strength. There would be little danger if the concrete could be kept dry, but as moisture always finds its way in, stray electric currents must be guarded against.—W. C. H.

Magnesia floors. Oil, Paint and Drug. Rep., Aug. 7, 1911. [T.R.]

The use of magnesia in the production of flooring is becoming extensive in Germany, and is known in the United States. Considerable exports of magnesium chloride have been made to various American purchasers, particularly in Los Angeles, Cal., to be taken up for mixture with sawdust for the production of flooring. The flooring composition consists of a solution of magnesium chloride to which pulverised magnesia is added. If to this cement sawdust be added in considerable proportions, the combination, when it becomes hard, possesses many of the qualities of both wood and stone. One Hamburg firm impregnates the wood meal with oil before mixing it with the magnesia paste, and thereby renders it non-absorbent. In Germany, flooring of this kind from 23 to 25 millimeters (0·905 to 0·984 inch) thick costs 7·5 marks per square meter laid. Manufacturers of the artificial wood plates use cork waste as well as sawdust, and produce a variety of building materials, including floorings, wainscotting, and roofing plates.

British road dust problem statistics. Oil, Paint, and Drug Rep., Aug. 7, 1911. [T.R.]

The U.S. Roads Improvement Association has made an investigation of the dust problem in the United Kingdom. The information was obtained by circularising the road authorities in different parts of the country. 134 authorities used crude or ordinary gas tar; twenty-five used distilled or refined tar, and six used oil-gas tar. The prices varied from 1d. to 4d. per gallon, the usual price being between 2d. and 2½d. Twenty-nine authorities used proprietary materials. In 33 cases the area treated per gallon of tar was between three and five square yards; in 99 cases it was between five and seven yards; in 19 cases, between seven and nine yards, and in 5 cases more than nine yards. When specially prepared tarry materials, oil-gas tar, or ordinary tar mixed with oil was used, the average spread to the gallon was greater than when crude or distilled tar was employed.

After the tar treatment, 77 authorities used sand to cover the surface; 37 small (one-fourth inch) granite chippings and granite dust; 10 used large (over one-fourth inch) granite chippings; 14 used limestone chippings or dust; 8 used slag chips or slag dust; 19 used road grit removed from the road before treatment, and 15 used local materials, such as shingle, pea gravel, cinder dust, etc. In five cases no material was placed on the road after treatment. In 84 cases hand spreading was used, while machine spreading was practised in 49 cases. The average cost of treating the road surface, including all expenses of preliminary sweeping, tar, sand, or other material spread after treatment, and labour, varied between 0·7d. and 3d. The usual cost was 1d. to 1¼d. when machine spread and 1¼d. to 1⅜d. when hand spread. Where two coats had been given the cost of the second coat was much lower than the first.

In 61 cases the treatment lasted a season, six to nine months; in 54 cases, twelve months; in five cases, over twelve months, and in five cases less than a season. In several cases when giving the road a second treatment it was necessary to treat only the centre of the highway, the sides remaining in fairly good condition. In some districts the treatments lasted two years.

Electrical precipitation of suspended particles. Cottrell. *See* I.

Patents.

Marble; Manufacture of artificial —— from leather, in which tannic acid is obtained as a by-product. O. E. Henschkel, London. Eng. Pat. 12,845, May 26, 1910.

Leather cuttings or waste are treated as described in Eng. Pat. 12,844 (see p. 1079). The dried powder obtained is added to a solution of magnesium carbonate in hydrochloric acid to which magnesia has been added, until a semi-liquid or plastic mass is obtained. This is poured into moulds or spread out on smooth surfaces. The colour and veining of the product are black and white, but any suitable colouring matter can be added in the process.—A. Sbld.

Plaster-board; Method of making ——. J. W. Voglesong, Elyria, Ohio, Assignor to Pittsburgh Plate Glass Co., Pittsburg, Pa. U.S. Pat. 999,474, Aug. 1, 1911.

A mixture of plaster of Paris and water, with or without fibrous matter, is placed upon a "former" in a pressure chamber, additional water is added, and then the air pressure in the chamber is increased, slowly at first and afterwards more rapidly, so that any excess of water is pressed out through the "former" whilst the plaster is setting.—A. S.

Wood; Processes for the preservation of ——. H. Devaux and H. Bouygues. Fr. Pat. 426,782, March 3, 1911.

In order to retain the antiseptic substances (*e.g.* creosote, etc.) injected into wood to preserve it, other bodies are associated with these substances, which are soluble in them when heated (*e.g.* paraffin, stearic acid, etc.), and on cooling in the impregnated wood acquire there the solid form and thus retain the antiseptic liquids in those parts to which they have been forced by injection or impregnation.—W. C. H.

Concrete and like articles; Utilising waste material for the manufacture of ——. D. Howells, Dowlais. Eng. Pat. 27,494, Nov. 25, 1910.

One part by measurement each of "rubbish" from coal mines, coke breeze, refuse from "coal washeries," "cinder refuse from steel separator," and ground unslaked lime is mixed with water. In the manufacture of props, etc., for use in mines, a quantity of Portland cement equal to one-eighth the quantity of the mixture is added, and for the making of "baulks," etc., one-eighth part of sawdust may be added.—B. N.

Cement; Apparatus for producing ——. C. Ellis, Larchmont, N.Y., Assignor to Ellis-Foster Co. U.S. Pat. 999,492, Aug. 1, 1911.

Rotary inclined kiln sections, each of progressively decreasing cross-section from above downward, are provided with means for differential heating of, and feeding argillaceous or calcareous material into, any section, and also with means for removing and regrinding the materials from any section. The heating is adapted to produce a continuous flow of heating gases through the clinkering, calcareous, and argillaceous sections successively.—H. H. S.

Concrete; Process of coating ——. C. Ellis, Larchmont, N.Y., Assignor to Ellis-Foster Co. U.S. Pat. 999,493, Aug. 1, 1911.

Concrete is rendered waterproof by a coating of an unsaponifiable resin, such as Pontianac rubber resin, which may be mixed with a pigment.—H. H. S.

Concrete, etc.; Waterproofing-coating composition for ——. C. Ellis, Montclair, N.J., Assignor to Ellis-Foster Co. U.S. Pat. 999,708, Aug. 1, 1911.

The composition consists of Pontianak rubber resin which has been heated to a temperature of from 500° to 650° F., with a loss of about 20 per cent. in weight. —W. P. S.

Hydraulic cement, mortar and concrete; Process of rendering —— impervious to water, and the product formed thereby. The Impervious Products Co. Fr. Pat. 426,889, March 6, 1911. Under Int. Conv., March 9, 1910.

A paste is made of some more or less insoluble, inorganic substance capable of giving a thick plastic mass with water, water and a thick, unsaponifiable, bituminous liquid, and to this paste an additional amount of water is added which is required for mixing the cement, mortar or concrete. The bituminous liquid is added successively in small quantities and triturated with the hydrated inorganic substance until the whole mass acquires a uniform colour and a clean appearance. To the paste of inorganic material, water and bituminous liquid, water is added so long as the paste will mix with it, without separation of the bituminous liquid, in small quantities at the time, and the whole mass triturated continuously. The materials employed are slaked lime, and liquid asphaltum, the quantities being one part, by weight, of quicklime, 1½ parts of water, and two parts of liquid asphaltum. A colouring matter may be added to the hydrated lime, either before or after the addition of the bituminous liquid.—W. C. H.

Earthy [cement-forming] materials; Process of treating ——. [Producing oxides of nitrogen from air.] C. Ellis, Larchmont, N.Y., Assignor to Ellis-Foster Co. U.S. Pat. 999,494, Aug. 1, 1911.

Combination of the oxygen and nitrogen in the air is effected by heating earthy materials or cement-forming materials or calcined cement, which may act as catalytic agents, in an electric arc in presence of air. The oxides of nitrogen are then removed.—H. H. S.

Portland cement; Process for the neutralisation and utilisation of the excess lime in ——. A. A. V. Poulsen. Fr. Pat. 427,776, March 27, 1911.

Portland cement, in the form of bricks, is mixed with crude but dry diatomaceous earth, such as Tripoli earth, mountain-meal, infusorial and similar earths, and moulded with it in order that the chemically active silicic acid of these earths may be brought into uniform and intimate contact and may combine with the lime of the cement bricks when finely ground.—W. C. H.

Mortar; Process for the preparation of ——. J. Wassen. Ger. Pat. 237,089, May 29, 1910.

Claim is made for the addition of picric acid, as a disinfectant, to mortar or to substances used in the preparation of mortar.—A. S.

Cement from furnace-slag; Manufacture of ——. W. Lessing, Troisdorf, Germany. U.S. Pat. 998,358, July 18, 1911.

See Eng. Pat. 19,070 of 1908; this J., 1908, 1153.—T.F.B.

Wood-impregnating liquids: Process of preparing ——. J. Dehnst, Halensee, Germany. U.S. Pat. 999,013, July 25, 1911.

See Fr. Pat. 418,520 of 1910; this J., 1911, 88.—T. F. B.

Plaster; Continuous furnace for burning ——. W. A. Bishop and C. Tomkins. Fr. Pat. 426,917, March 7, 1911.

See Fr. Pat. 986,350 of 1911; this J., 1911, 426.—T. F. B.

Producing phosphorus pentoxide and cementitious products. U.S. Pat. 1,000,311. *See* VII.

Continuous kiln for burning bricks, tiles, cements, and other ceramic products. Fr. Pat. 427,513. *See* VIII.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Steel; Power required to cut ——. P. V. Vernon. Engineer, 1911, **112**, 182—183.

The experiments summarised in the following table were undertaken in order to determine the relationship between the quality, other than that shown by analysis and physical tests, of the steel cut and the power required to cut it. The tests were made on a hexagon turret lathe having a single pulley head and with ball-bearings throughout, driven by a variable speed motor which was calibrated so that the actual horse-power at the pulley could be read on a chart from the speed and the ammeter readings, allowance being made for the ampères required to run the lathe light. The same high-speed cutting tool was used throughout the tests, it being sharpened after each test. No law governing the above relationship could be deduced. It is shown that in all cases annealed steel requires more power to cut it than unannealed steel, and that as a general rule the power required increases with the carbon content although there are exceptions such as tests 8 and 15 and tests 2 and 9 (see table). The author considers that the experiments show clearly that figures relating to the cutting powers of machine tools are valueless unless accompanied by much fuller particulars than the composition and physical properties of the materials being cut.

Power Required to Cut Steel.

Kind of steel.	Test No.	Condition.	Analysis.					Physical tests.					Net H.P.	Mean pressure on tool. Tons per sq. in.
			Carbon. Per cent.	Silicon. Per cent.	Manganese. Per cent.	Sulphur. Per cent.	Phosphorus. Per cent.	Max. stress. Tons per sq. in.	Elastic stress. Tons per sq. in.	Elongation on 4·5 in. Per cent.	Reduction of area. Per cent.	Hardness. Brinell number.		
English bright drawn	1	As received	0·21	0·075	0·670	0·038	0·033	31·32	31·00	20·90	61·52	158	2·375	48·98
	2	Annealed	0·20	0·075	0·670	0·038	0·033	26·80	16·40	32·44	68·04	125	3·000	61·87
American bright drawn	3	As received	0·14	0·038	0·580	0·096	0·092	33·52	29·20	17·33	55·84	166	2·375	48·98
	4	Annealed	0·14	0·038	0·590	0·096	0·092	30·24	22·00	23·33	62·17	148	3·000	61·87
Siemens basic...	5	As received	0·08	0·005	0·250	0·030	0·030	24·20	15·40	27·55	56·32	120	4·000	82·50
	6	Annealed	0·08	0·005	0·240	0·032	0·030	23·68	16·00	33·34	69·04	118	5·000	103·12
Siemens open hearth basic	7	As received	0·22	0·017	0·530	0·041	0·053	28·00	15·60	30·44	60·40	136	4·000	82·50
	8	Annealed	0·22	0·017	0·540	0·044	0·053	32·00	18·00	27·77	51·73	149	6·000	123·75
	9	Heat treated	0·20	0·017	0·532	0·041	0·054	32·00	21·00	26·44	64·76	163	0·500	134·06
Siemens-Martin acid	10	As received	0·36	0·113	0·640	0·022	0·040	36·28	22·00	24·44	60·64	174	7·000	144·37
	11	Annealed	0·48	0·056	0·542	0·019	0·022	38·00	25·20	24·00	60·40	182	7·500	154·68
	12	Heat treated	0·48	0·060	0·552	0·019	0·021	41·24	29·00	18·88	62·84	194	6·750	139·22
Siemens-Martin acid	13	As received	0·72	0·150	0·840	0·025	0·039	52·88	33·00	14·44	21·48	240	6·000	123·75
	14	Annealed	0·72	0·140	0·839	0·025	0·039	41·72	23·60	22·90	53·92	193	6·700	138·18
	15	Heat treated	0·72	0·140	0·830	0·028	0·039	46·20	26·80	19·55	37·80	205	5·500	113·43

All fractures were silky fibrous, except Nos. 13 and 14, which were fibrous in centre and crystalline outside.

Cutting test consisted of reducing the bar from 2 in. to 1 in. at 204 turns per minute. 106·8 ft. per minute maximum, or 80 ft. per minute on mean diameter of cut. Feed 56 cuts per inch. Metal removed 8·58 cubic inches per minute. Same tool used throughout and sharpened for each cut.

—A. H. C.

Small castings; [Oil-fired] Open hearth furnaces for ——. W. MacGregor. Trans. Amer. Foundrymen's Assoc., 1911, 373—379.

The paper refers entirely to oil-fired furnaces, and mainly to the practical design of a five ton furnace, with regenerators and stack. Such small furnaces must be designed to burn the necessary amount of fuel in the smallest amount of space, which in turn demands a short flame. According to the experts of the U.S. Navy, the factors favourable to a short flame are:—I. A pure carbon fuel. II. Initial heating of air. III. Intimate diffusion of air and fuel. IV. Large surface of fuel exposed for impact of this air. In connection with IV., the author thinks compressed air preferable to superheated steam for atomisation as it certainly produces a shorter and hotter flame. Some analyses given of the flue gases show the necessity for long and narrow regenerators for oil-burning furnaces to afford time for complete combustion of the volatile hydrocarbons.—B. M. V.

Steel; Loss of carbon during solution of —— *in potassium cupric chloride.* H. Isham. J. Ind. Eng. Chem., 1911, **3**, 577—579.

The author describes experiments the results of which show that the apparent loss of carbon observed by Moore and Bain (this J., 1908, 845) on dissolving steel in potassium cupric chloride solution is due to gaseous carbon compounds in the latter which are evolved at a faster rate when the steel is dissolving than when air is being blown through the solution alone. If the potassium cupric chloride solution be purified by blowing air through it for 3—4 days before use, the results then show that there is no appreciable loss of carbon during solution of the steel. (See also Isham and Aumer, J. Amer. Chem. Soc., 1908, **30**, 1236.)—A. S.

Rust; A new method for the determination of ——. H. Jacob and R. Kaesbohrer. Chem.-Zeit., 1911, **35**, 877—878.

The pieces of iron or steel under test are made to form the cathodes in a bath of dilute sodium sulphate solution (½ to 5 per cent.), platinum or carbon plates being used as the anodes. The hydrogen evolved at the cathodes either removes the rust or renders it capable of easy removal. The authors use a current of about 1 ampère and allow the action to proceed overnight. Good electrical connections are essential, and owing to the heating of the solution and consequent evaporation, suitable means of keeping the volume constant must be adopted. The plates under test are weighed before and after. Blank tests made with cleaned cast- and wrought-iron plates are stated to have shown no action.—T. St.

Galvanised iron; The structure of ——. W. Guertler. Int. Z. Metallog., 1911, **1**, 353—376.

Iron is coated with zinc (1) by dipping in molten zinc, (2) by immersing in zinc dust and heating (Sherardising), and (3) electrolytically. In the first two processes the zinc immediately in contact with the iron combines to form a layer of crystals having the composition, $FeZn_3$. The electrolytic process also gives rise to an intermediate layer, but small in amount and of a nature not definitely settled. The material, $FeZn_3$, is electronegative to both zinc and iron, and consequently, when, by the removal of the outer coating of zinc, it becomes exposed, it accelerates corrosion at the expense of both metals. The zinc coating obtained by dipping always shows some included crystals of the approximate composition, $FeZn_7$, which are also electronegative to zinc and accelerate the corrosion of the zinc coating. The zinc coatings obtained by Sherardising and electrolytically are porous. No marked superiority can be ascribed to any one of the three processes.—T. St.

Briquetting metal borings. R. Moldenke. Trans. Amer. Foundrymen's Assoc., 1911, 489—517.

In the utilisation of metallic waste by briquetting under high pressures without the use of a binding material. it has been found that the entangled air, by expanding when the briquettes were placed in the furnace caused them to disintegrate, thus leading to all the troubles attending the use of loose material. In the process described, the borings, after passing an exhaust fan to remove dust, and an electro-magnet separator to remove brass, are fed into the hopper of the press and thence into a die, carried by a revolving table, where they receive their first compression, the air escaping as the borings curl into each other. The die is then carried by the table to the next position, where a pressure of up to 35,000 lb. per sq. in. is applied by plungers above and below, where another plunger forces out the finished briquette on to a band conveyor. Whilst a melt with borings alone gives a loss up to 50 per cent., with pig iron only a loss of about 3 per cent., the loss with briquettes is from 8 to 10 per cent. and with briquettes made from a mixture of 80 per cent. of borings and 20 per cent. of pig iron there is only a loss of 3·5 per cent. The paper is illustrated by a number of photographs of the machines used.—A. H. C.

[*Cyanide process*] *Sand charges; Aeration of* ——. A. J. Deane. Eng. and Min. J., 1911, **92**, 198.

The author points out that although the aeration of the cyanide solution is of greater benefit and importance than that of the ore charge in many instances, in others the aeration of the ore charge is decidedly the more important factor. When the ore contains easily oxidisable minerals, or when oxidisable compounds are formed in it during the course of the treatment, the frequent aeration of the charge is necessary in order that the oxygen contained in the cyanide solution may remain available for the reaction by which the gold is brought into solution. On the other hand, when soluble salts capable of rapid oxidation are dissolved by the cyanide solution, frequent aeration of the latter becomes necessary for the same reason.—W. E. F. P.

Platinum-gold-silver bullion; Parting ——. Eng. and Min. J., 1911, **92**, 259.

The bullion should contain more than 75 per cent. of silver, and nitric acid must not be used for parting as in the presence of silver, platinum would be partly dissolved. Sulphuric acid free from chlorine should be used in the proportion of 2 or 3 oz. of strong acid per oz. of alloy. —B. M. V.

Anode sludge; Treatment of the ——, *in electrolytic refineries.* E. F. Kern. Met. and Chem. Eng., 1911, **9**, 417—420.

Anode sludge, formed during the electrolytic refining of copper and lead, contains considerable quantities of gold and silver. After screening to remove nodules of metal, and filtering through muslin to remove excess of electrolyte, the sludge is washed dried and treated by one of the following processes:—(*a*) *Direct cupellation:* Used for treatment of copper anode sludge. The latter is charged on to molten lead in a cupelling furnace, the copper, lead, and bismuth are oxidised and with the litharge returned to the smelting furnace for further treatment. The arsenic, antimony, sulphur, selenium, and tellurium are oxidised and volatilised and partly enter the scoria. The resulting Doré bullion is upwards of 900 fine (gold and silver). (*b*) *Fusion:* The copper or lead sludge is mixed with soda ash and a small quantity of nitre and smelted in a basic-lined reverberatory furnace, producing a slag which contains the arsenic, antimony, tellurium, selenium, and sulphur and most of the bismuth and copper. The residue on the hearth is then cupelled to Doré bullion as before. The Doré bullion produced varies from 900 to 975 fine. (c) *Fractional scorification:* Lead anode sludge, containing only a small amount of copper, is first scorified in the "antimony-slagging" furnace for the removal of the bulk of the antimony and arsenic, the scoria being skimmed off and treated in another furnace for the production of hard lead. The metal is then withdrawn to a second basic-lined furnace and re-scorified to remove bismuth, the scoria being skimmed off and treated for bismuth by chemical leaching methods. Finally the metal is withdrawn to a third basic-lined furnace and re-scorified to remove the remaining lead and most of the copper, leaving Doré bullion. The lead-copper oxide scoria is smelted with the regular charges in a lead blast furnace for the recovery of the copper as matte and the lead as base bullion. The Doré bullion obtained in the above processes is cast into plates of suitable dimensions and parted either electrolytically or by boiling with concentrated sulphuric acid in cast iron or cast steel kettles. (*d*) *Parting with concentrated sulphuric acid:* (1). The sludge is boiled with excess of the acid. the treatment being similar to the parting of Doré bullion. The process is not suitable for sludge containing much arsenic or antimony. (2). The sludge is mixed with a calculated quantity of the acid (sufficient to dissolve the copper, antimony, etc., but not enough to dissolve the silver) and the pasty mixture is heated until the sulphur dioxide is expelled. A small amount of fresh sludge is added to precipitate any dissolved silver, the residue is leached with water to remove the soluble sulphates and is then scorified to Doré bullion. The sulphate solution is treated by the usual method of crystallisation, or by passing over iron, for the recovery of the metals. (*e*) *Parting with dilute sulphuric acid:* The sludge is boiled with dilute sulphuric acid (1 of acid to 2 or more of water), the solution of the metals being facilitated by the addition of small quantities of nitre and the injection of air, and, in from 20 to 30 hours, practically all the copper—together with a portion of the silver—is dissolved, bismuth and antimony being converted to basic sulphates and lead to lead sulphate. The dissolved silver is precipitated by the addition of a small quantity of fresh sludge or by suspending strips of metallic copper in the solution, the precipitated metal being collected with the insoluble residue which is then scorified to Doré bullion. The *Cabell-Whitehead* process is a modification of the dilute acid treatment in which the silver sulphate residue from the parting kettles (a mixture of the anhydrous sulphates of silver and copper) is used, instead of nitre, to facilitate the solution of the copper, bismuth, etc.; the time of treatment is thus reduced by 6 or 8 hours.—W. E. F. P.

Copper; Electrolytic determination of ——. F. W. Traphagen. Chem. News, 1911, **104**, 69—70.

When an electrolytic deposit of copper is dark owing to the presence of arsenic, it should be redissolved in nitric acid and the solution, diluted with water, again electrolysed, the process being stopped as soon as the copper has been deposited. Copper is separated from bismuth, antimony, and arsenic by precipitating as thiocyanate, gently igniting the precipitate, dissolving in nitric acid, and electrolysing. In the presence of arsenic, antimony, tellurium, and selenium, as, for example, with electrolytic slimes, 100 mgrms. of iron are added to the nitric acid solution of the sample (from which silver has been removed as chloride), and ammonia is added to precipitate the iron, still having the solution acid; the mixture is brought to the boil, allowed to settle, and the iron precipitate filtered off, this precipitate being redissolved and the iron precipitated as before (if necessary, twice) in order to ensure all the copper being in solution; the combined filtrates are then electrolysed. For special materials the following details are given:—*Converter copper.* 0·5 grm. is dissolved in 8 c.c. of nitric acid, 8 c.c. of water, and 1 c.c. of sulphuric acid, and, after expelling fumes, the solution is diluted and electrolysed; a deduction is made for the silver present, unless this has been precipitated, before electrolysis, by adding just sufficient dilute sodium chloride solution. *Mattes.* 1 grm. is moistened with water, 8 c.c. of nitric acid and 1 c.c. of sulphuric acid are added, the solution is evaporated to dryness, the residue taken up with water and 8 c.c. of nitric acid, and the solution electrolysed after filtering. *Slags.* 2 grms. are decomposed in a platinum dish with 8 c.c. of nitric acid, 8 c.c. of hydrofluoric acid, and 1—2 c.c. of sulphuric acid, the mixture is evaporated until sulphuric fumes appear, and is then taken up with water and 10 c.c. of nitric acid and electrolysed. *Sulphide ores.* 1 grm. is evaporated to dryness with 8 c.c. of nitric acid and a little potassium chlorate, and the residue is taken up with water and from 6 to 10 c.c. of nitric acid, diluted, allowed to settle, and electrolysed. *Oxidised ores.* 1 grm. is evaporated to dryness with 8 c.c. of nitric acid, 10 c.c. of hydrochloric and 2 c.c. of sulphuric acid are added, and the mixture evaporated until sulphuric acid fumes appear; it is then taken up with 8 c.c. of nitric acid and water, allowed to settle, and electrolysed.
—F. Sodn.

Copper; Notes on the metallurgy of wrought ——. F. Johnson. Met. and Chem. Eng., 1911, **9**, 396—401.

The peculiarities of "under-poled," "tough-pitch" and "over-poled" copper are indicated and it is pointed out that although with comparatively pure metal the trial ingot has a level surface when poured at the proper "pitch," the poling of impure copper has frequently to be stopped at a stage where the trial ingot shows a depression ("under-pitch") in order that the metal may be fit for subsequent rolling or forging hot (see also Hofman and others, this J., 1907, 471). In considering the effect of mechanical work upon copper, the author states that although by hot-rolling the metal may acquire a tenacity equal to that conferred upon it by severe cold-working and annealing, hot-working should be stopped at such a temperature as will allow a certain amount of molecular rearrangement or recrystallisation to take place after distortion; subsequent cold-working may then be possible to a greater extent before annealing will be necessary. The tensile strength and limit of elasticity of the metal are continuously increased by cold-working, stage by stage, but the extensibility is diminished; annealing has the effect of lowering the tensile strength and raising the elongation. By cold-working of sufficient severity to stress the metal beyond its elastic limit, a state of instability is induced which may render the metal susceptible to "age-cracking" or secular brittleness; a hard and non-crystalline variety of the metal is then produced which is restored to the soft state by annealing. Twinning is characteristic of the structure of wrought copper, this phenomenon being exhibited even in hot-wrought specimens. The author refers to the work of Le Chatelier who found that the tensile strength of pure copper decreased from 14·7 tons per sq. in. at 15° C. to 12·9 tons at 200° C. and 4·6 tons at 530° C. Roberts-Austen has shown (this J., 1894, 155) that copper containing 0·1 per cent. of bismuth is not only considerably weaker than either pure or arsenical copper at normal temperature, but possesses, at 160° C., only one-third of its tensile strength at 15° C.; the author considers that these results tend to give an exaggerated idea of the malignant influence of bismuth, for the following reasons:—(1) Copper containing as much as 0·1 per cent. of bismuth is seldom, if ever, met with in actual practice, since practically the whole of this impurity is removed by bessemerisation; (2) commercial copper invariably contains an equilibrium-proportion of oxygen which greatly modifies the harmful effect of bismuth; (3) the injurious effect of bismuth, at both high and low temperatures, is considerably reduced by arsenic, which, to the extent of even 0·5 per cent., is a desirable constituent of copper for purposes other than those requiring high electrical conductivity of the metal. In an investigation to determine the suitability of various kinds of copper and copper alloys for staying locomotive fireboxes, F. W. Webb (Inst. Civil Eng. 1902) concluded that tensile tests, whether made at high or low temperatures, afforded no reliable indications of the behaviour of the metal in actual practice. The author is of opinion that, where the metal is sufficiently soft, uniformity of tensile tests over a wide range of temperature is probably the best guide in the selection of material for this and similar purposes, but points out that mechanical tests at the temperature of an air- or oil-bath are not comparable with the conditions prevailing in actual practice, *e.g.*, where a stay is strongly heated at one end and kept cool at the other. In conclusion, the author refers to the work of the Royal Technical Research Commission of Berlin (1898) concerning the influence of heat, chemical composition and mechanical work upon the strength and ductility of copper (this J., 1899, 47) and briefly summarises the results of that investigation.—W. E. F. P.

Nickel copper matte; Roasting of ——. E. F. Kern and H. W. Walter. Sch. of Mines Quart., 1911, **32**, 364—388.

The records obtained when anhydrous ferrous, nickel, and copper sulphates were heated, are tabulated and show that the decomposition temperature of ferrous sulphate was 580° C., of copper sulphate 647° C., and nickel sulphate 727° C. A basic sulphate having the composition $Fe_2(SO_4)_3FeO$ was formed above 280° C. while a basic sulphate of nickel only formed above 727° C.; copper sulphate gave no basic sulphate. The methods of analysis most applicable to copper-nickel mattes are given and the results of the analyses of a matte after roasting at varying temperatures and for different lengths of time are tabulated. It is concluded:—1. That the mattes contain the nickel as the subsulphide, Ni_2S, and when these are "blown" to almost complete elimination of the iron sulphide, they contain an alloy of nickel and copper in the proportion in which these metals existed in the matte. 2. That the best method to employ for the rapid roasting of the matte is to start roasting at about 450° C., to keep below 500° C. until the particles are coated with a film of oxide, and then to desulphurise at about 700° C., continuous rabbling being necessary to prevent sintering.—A. H. C.

Metallic [copper-nickel] solid solutions; Formation of —— *by diffusion in the solid condition.* G. Bruni and D. Meneghini. Atti R. Accad. dei Lincei, Roma, 1911, [5], **20**, 1., 671—674. Chem. Zentr., 1911, **2**, 435—436.

A nickel wire was coated electrolytically with copper until the whole had the same composition as "constantan" (60 of copper to 40 of nickel). The wire was then heated to 1000° C. in a resistance furnace and at intervals its electrical resistance at 15° C. was determined. After a slight diminution at first, probably due to the copper deposit becoming more compact, the resistance increased to ten times its original value and finally attained the same value as that of a "constantan" wire of the same size. In appearance also the wire after heating was similar to "constantan." The experiment thus affords an illustration of the formation of a copper-nickel solid solution by inter-diffusion of the two metals at a temperature 180° C. below the melting point of copper.—A. S.

Manganese bronze; Analysis of ——. J. R. Huber. Met. and Chem. Eng., 1911, **9**, 403—404.

The analysis is conducted in practically the same manner as described in the original process (this J., 1910, 1062), the chief difference being in the determination of the zinc, for which the following procedure has been found more satisfactory. The filtrate from the lead sulphate being diluted to a known volume, the copper is removed from an aliquot portion by electrolysis without the addition of nitric acid; 10 c.c. of sulphurous acid (or sufficient to reduce the iron present) are added to the liquid which is then stirred, neutralised with sodium hydroxide and bicarbonate (using methyl orange as indicator), and diluted to 400 c.c. 4 or 5 drops of hydrochloric acid and about 2 grms. of ammonium thiocyanate are then added and the liquid is heated to boiling and kept hot while a rapid stream of hydrogen sulphide is passed through it for about 30 minutes. To ensure complete precipitation of the zinc, a dilute solution of sodium bicarbonate is added, drop by drop, (after the passage of the hydrogen sulphide for 15 minutes) until the black precipitate produced is not redissolved with undue rapidity. The zinc sulphide is thus precipitated in a granular form and, when settled, is filtered off, washed with hot water, redissolved in dilute hydrochloric acid and finally precipitated with sodium ammonium hydrogen phosphate. After boiling off the hydrogen sulphide and decomposing the thiocyanate with nitric acid, the aluminium is determined (by the phosphate method) in the filtrate from the zinc sulphide.—W. E. F. P.

Zinz smelting furnace; Rotating ——. P. Speier. Oesteir. Zeits. Berg- und Hüttenw., 1911, **59**, 443—445.

A furnace for smelting zinc ores is described consisting of an iron casing lined with fireclay and capable of being rotated on its longitudinal axis. The retort is filled from a hopper situated above it, and then after partly rotating, the condensers are fixed in position; subsequently by further rotating the retort the residues may be emptied into a container beneath the furnace. (See also this J., 1911, 549). Six photographs illustrate the construction of the furnace and condensers.—A. H. C.

Lead-tin alloys; The nature of the transformation in solid ——. D. Mazzotto. Int. Zeits. Metallog., 1911, **1**, 290—352.

The author has studied the effect of annealing on the temperature and intensity of the recalescence phenomenon exhibited by lead-tin alloys, in order to test his view that the heat evolved is the heat of solution liberated due to the separation of tin from the solid solution of tin in lead. An alloy containing 33·3 per cent. of tin and 66·7 per cent. of lead was chiefly used. The annealing temperature was attained both by heating from the ordinary temperature and by cooling from fusion. The results obtained are all explainable on the basis of an equilibrium diagram, on the lead side, of type V. of Roozeboom, in which, at the temperature of the eutectic, a solid solution with a maximum amount of tin, viz., 18 per cent., is formed. Both above and below that temperature solid solutions are formed containing smaller proportions of tin. Thus maximum values of both temperature and intensity, were obtained by annealing at the eutectic temperature, since this favours the formation of the solid solution containing the greatest amount of dissolved tin, and the heat of transformation was found to be a maximum for an alloy whose concentration was a little greater than that of the solid solution saturated at the eutectic temperature. Again, the temperature of the maximum intensity of the transformation was found to rise as the concentration of tin in the alloy rose, and to reach a maximum when the concentration was about 18 per cent., and for all alloys with higher concentrations of tin, the temperature of maximum intensity of the transformation remained constant at the maximum temperature previously reached, although the intensity of the transformation diminished. Always, the effects of annealing at the various temperatures were to produce results directly referable to the tendency to form solid solutions of the saturation compositions corresponding to those temperatures in the equilibrium diagram.—T. St.

Cinnabar ores; Treatment of low-grade ——. C. A. Mulholland. Min. and Eng. World, Aug. 5, 1911, 241—242.

The following process is suggested for further investigation in connection with the treatment of cinnabar ores from which the mercury cannot be profitably extracted by the ordinary methods of distillation; it has not yet been tried on a commercial scale. The ore is concentrated into a slime, this being effected by suitable crushing and screening, followed by the treatment of the finer material in spitzkasten, cone separators, etc. The slime is heated, during agitation, with a solution of an alkali hydrosulphide containing at least 1 mol. of alkali sulphide and 1 of alkali hydroxide to each mol. of mercuric sulphide present. When the latter has dissolved, the solution is separated by decantation and treated with an excess of zinc hydroxide, by which a precipitate of zinc and mercuric sulphides is produced together with a solution of alkali hydroxide; the solvent is regenerated from the latter by the action of the hydrogen sulphide from the next operation. The precipitate is separated by decantation or filter-press and treated with dilute sulphuric acid and steam, resulting in the production of hydrogen sulphide, zinc sulphate and a precipitate consisting of metallic mercury and mercuric sulphide. After separation from the zinc sulphate solution the precipitate is distilled as usual for recovery of the metal. The zinc solution is employed for the preparation of a further quantity of zinc hydroxide. Assuming the efficiency of the process to be 80 per cent., the author estimates that, with low mining and crushing costs, ore containing 0·3 per cent. of mercury could be profitably treated on the lines indicated.
—W. E. F. P.

Wolfram concentrate; Assay of ——. H. W. Hutchin. Analyst, 1911, **36**, 398—403.

The paper deals with and compares the various methods in use for determining tungstic acid in wolfram concentrates as prepared for the market.

1. "*Aqua regia ammonium tungstate*" *method*:—Grind the ore very finely. To 1 grm. in a 200 c.c. beaker add 10 c.c. of strong hydrochloric acid (do not allow to cake), then 110 c.c. more acid, cover, and boil down to 5 c.c. Cool, add 5 c.c. of strong nitric acid, and keep just boiling for 5—10 minutes. Dilute to 100 c.c., allow to settle, decant through a 9 cm. filter, and wash by decantation. Add 10 c.c. of water, and, gradually, 10 c.c. of ammonia (1 : 1). Remove any deposit from the sides of the beaker into the liquid, boil, stir well, and boil till the undissolved residue settles readily. Allow to settle, and decant through the original paper into a 200 c.c. flask. Wash by decantation, then thoroughly wash the filter, and keep beaker, cover, and filter. Evaporate the ammonium tungstate solution to small bulk, transfer to a weighed platinum dish, evaporate to dryness on a water-bath, ignite, first gently and then strongly, and weigh. Treat the residue in the beaker with 5 c.c. of hydrochloric acid, boil nearly to dryness, add a few c.c. of nitric acid, boil for a few minutes, and wash by decantation as before. Wash the filter-paper, and also the original filter-paper with hot dilute caustic soda solution and then with water. Heat the alkaline solution to boiling, add about 2 grms. of ammonium nitrate, stir well whilst boiling, filter through the original paper, and wash. Nearly neutralise with nitric acid, add a few c.c. of mercurous nitrate solution (see this J., 1909, 609), stir, filter through a small ashless paper, wash, ignite, and add the weight to that of the main quantity. It is doubtful whether the nitric acid is required in this process, but further experience is needed

to decide definitely. If the ammoniacal filtrate is turbid the ignited tungstic acid should be digested on the water bath with 1 grm. of caustic soda and enough water to cover it, till no more dissolves, washed into a beaker, 3 grms. of ammonium nitrate added, the liquid boiled, and any insoluble matter collected and weighed, deducting the weight from the original total. Soluble silicates and arsenates rarely occur in concentrates; they would cause low results, through solution of tungsten in the acid. Arsenic as mispickel, tantalite and columbite do not affect the determination. Titanium as ilmenite renders the tungstic acid insoluble in ammonia.

2. *Aqua regia mercurous nitrate method*:—After treatment with acids and washing as in (1), add 15 c.c. of water and 5 c.c. of 10 per cent. solution of caustic soda, wash cover and filter with dilute caustic soda, and add these washings to the contents of the beaker. Rub down any deposit from the beaker sides into the liquid, boil, add 3 grms. of ammonium nitrate, boil for a minute more, allow to settle, filter, and wash with dilute solution of ammonium nitrate. Dilute to about 200 c.c., acidify with nitric acid, make faintly alkaline with ammonia, add sufficient mercurous nitrate solution, and precipitated mercuric oxide to neutralise the free acid added with it. Stir, filter, wash first by decantation and finally on the filter, dry, ignite, and weigh. Treat the residue a second time as before.

3. *Soda digestion mercurous nitrate method*:—See this J., 1909, 609, but neutralise, after addition of mercurous nitrate, with mercuric oxide instead of ammonia.

4. *Soda fusion mercurous nitrate method*:—Fuse 0·625 grm. in a nickel dish with about 1 inch of stick caustic soda and 3 grms. of sodium peroxide. Pour the melt on a clean sheet of nickel, transfer dish and melt to a beaker and dissolve in water. Destroy any manganate by a little sodium peroxide, transfer to a 250 c.c. measuring flask, make up to volume, allow to settle, and determine tungsten in 200 c.c. as in (3). Titanium, tantalum, and niobium do not interfere. Arsenic is for the most part removed by the accompanying tin. A number of results are given showing the concordance of the methods.
—J. T. D.

Highly refractory materials [*metals and oxides*]; *Fusion and volatilisation of* ——. O. Ruff and O. Goecke. Z. angew. Chem., 1911, **24**, 1459—1465.

An account of results obtained with the electric furnace described last year (this J., 1910, 886), modified by introducing a second carbon tube surrounding the resistance-tube at a distance of a few millimetres, which acts as a radiation screen and greatly increases the efficiency of the furnace. The following table of melting-points is given, all at pressures of 2—5 mm. except the last five, which were determined in nitrogen at atmospheric pressure. Gold, 1071° C.; manganese, 1247°; chromium, 1514°; platinum, 1750°; molybdenum, 2110°; iridium, 2225°; tungsten, 2575°; uranium carbide, 2425°; vanadium carbide, 2750°; ferrous oxide, 1419° (about); ferrosoferric oxide, 1538°; ferric oxide (with decomposition), 1548°; lime, 1995°; alumina, 2020°; chromium oxide, 2059°; uranium oxide, 2176°; zirconia, 2500°. Determinations of the melting-points of Seger cones 28 to 42 under atmospheric pressure agreed almost exactly with the results of Simonis (Sprechsaalkalender, 1911, 106); at low pressures those melting above 1800° C. lost alumina so rapidly by volatilisation before melting that no trustworthy results could be obtained. Discussion of the accuracy of the results shows a probable error of observation of ± 5° up to 1750°, ± 10° to 2200°, and ± 20° to 2750°, apart from the uncertainty of the comparison of the optical pyrometer with the air-thermometer, which is probably about 10° at 1750° and 50° at 2750° C.

Under atmospheric pressure, alumina melts at 2020° C. without any sensible indication of volatilisation; but at 3—8 mm. the volatilisation is so rapid at 1700° C. that that temperature is probably very near the boiling-point at 6 mm. Lime, under atmospheric pressure, melts at 1990°—1995° C., and boils at a temperature about 20° higher. Under reduced pressure it could not be melted, possibly because the rapid volatilisation prevented its temperature from rising high enough. Magnesia could not be melted either at reduced or atmospheric pressure; from the appearances in the furnace the conclusion is drawn that its boiling-point under atmospheric pressure is little above 2000° C.—J. T. D.

Tantalum for standard weights. Comité Internat. des Poids et Mesures. Procès Verbaux des Séances. II., 6. Session de 1911. Nature, Aug. 24, 1911, 251.

Owing to the high price of platinum, a suitable substitute for this metal in the construction of standard weights has been sought. Tantalum, which resists all mineral acids except hydrofluoric acid, has been found to satisfy the necessary requirements of permanence and hardness, and it is suggested that a series of standard weights of 100 grms., made of tantalum, should be established for use in chemical research. The cost would probably not be more than one-third of that of iridio-platinum weights.—A. S.

Mineral production of Queensland. Board of Trade J., Aug. 17, 1911. [T.R.]

The following particulars of the mineral production of Queensland in 1910, as compared with the previous year, are taken from the Annual Report for 1910 of the Under-Secretary for Mines of that State:—

	1909.		1910.	
	Oz. troy.	£	Oz. troy.	£
Gold	455,577	1,935,178	441,400	1,874,955
Silver	1,001,383	99,093	861,202	92,685
	Tons.		Tons.	
Copper ore	14,494	853,196	16,387	932,489
Coal	756,577	270,726	871,166	322,822
Tin ore	3,326	244,927	2,953	243,271
Wolfram ore	606	56,348	856	88,116
Lead ore	5,240	68,543	2,391	30,401
Molybdenite ore	93	9,272	106	12,050
Other minerals	—	119,281	—	113,433
Total value	—	3,656,564	—	3,710,222

Aluminium; World's production of ——. Board of Trade J., Aug. 17, 1911. [T.R.]

The world's production of aluminium has risen from 11,500 metric tons in 1905 to 24,200 metric tons in 1909, and 34,000 metric tons in 1910. The aluminium trade is in the hands of only twelve companies, of which five, viz., the Aluminium Industrie Akt.-Ges., of Neuhausen, the Soc. Electro-Métallurgique Française, of Froges, the Comp. des Produits Chimiques d'Alais et de la Camargue, of Salindres, the British Aluminium Company, Ltd., and the Aluminium Company of America, account for nine-tenths of the total output. The price of aluminium per kilogramme was 27s. in 1890, 2s. in 1900, 3s. 3d. to 3s. 9d. in 1905, 1s. 3d. to 1s. 6d. in 1909, and 1s. 3d. to 1s. 7d. in 1910.

Electrical precipitation of suspended particles. Cottrell. *See* I.

Ether separation of iron and vanadium. Deiss and Leysaht. *See* XXIII.

Patents.

Steel; Manufacture of ——. T. J. Heskett, London. Eng. Pat. 17,647, July 25, 1910.

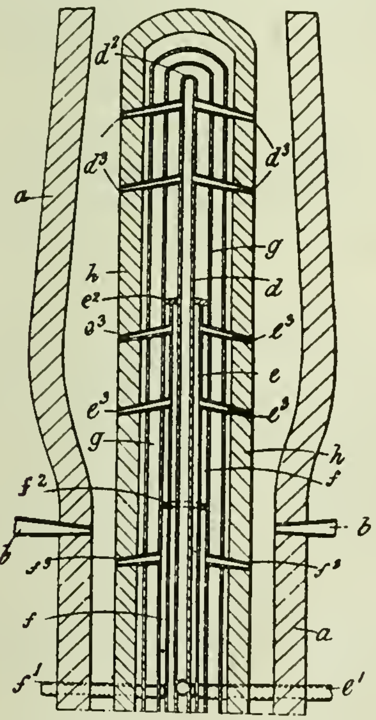
The process is a modification of that described in Eng. Pat. 16,940 of 1909 (this J., 1910, 1164). Instead of passing direct to the converter, the molten iron overflowing from the well of the cupola passes into an intermediate chamber from which—after removal of the slag—it overflows into the converter. In addition to the usual tuyères at the base, both the cupola and the converter are provided with low-pressure tuyères disposed above the surface of the molten metal. The gaseous products from the converter pass into the intermediate chamber and thence to the cupola by means of the two wide conduits through which the molten metal continuously flows to and from the intermediate chamber.—W. E. F. P.

Steel; Manufacture of ——. W. R. Walker and J. H. Gray, New York. U.S. Pat. 1,000,217, Aug. 8, 1911.

The method consists in subjecting the charge of an open-hearth furnace to the oxidising action of the flame and gases to remove the carbon, silicon and phosphorus, removing the slag near the end of the heat, supplying a fresh basic slag in the same furnace, excluding the flame and gases, and applying heat electrically in a non-oxidising atmosphere to deoxidise and desulphurise the metal in the bath.—W. H. P.

Blast furnaces. J. Dunham-Massey, London. Eng. Pat. 19,620, Aug. 22, 1910.

The claim is for an improved arrangement by which the blast may be supplied at any zone in the furnace, thus preventing "cobbing," *i.e.*, the cooling and sticking of the ore in the furnace. In the figure, a, is the furnace wall with tuyères, b, in the usual position; d is a central pipe supplied at the bottom through d^1, which delivers the blast through d^3 at the highest zone of the furnace. Surrounding this is another pipe, e, supplied by e^1 and delivering gas by e^3 at the intermediate zone. In the same way f, f^1, and f^3 supply the melting zone or hearth. The tubes are closed at the upper ends by the brick domes or arches, d^2, e^2, f^2. g is a water jacket through which all the radial tubes pass before supplying the blast to the furnace. h is an enclosing fire-brick structure. By this arrangement the supply and intensity of the blast at each part of the furnace can be separately controlled.—W. H. P.



Calcining or agglomerating furnaces; Hearth floor for ——. B. J. Wildbore, London. From A. Haggenmiller, Tarica, Peru. Eng. Pat. 17,420, July 22, 1910.

The hearth floor is composed of a number of hollow, metal air-boxes having perforated tops, each box being provided with a separate air-supply pipe and means for regulating the amount of air admitted.—W. E. F. P.

Furnaces; Gas-heated smelting or heating ——. Dellwik-Fleischer Wassergas Ges. m. b. H., Frankfort-on-the-Maine, Germany. Eng. Pat. 30,295, Dec. 30, 1910. Under Int. Conv., Dec. 31, 1909.

The furnace consists of two smelting chambers in axial alignment. Ports for the admission of air and gas are situated at the outer ends of the two chambers, and also intermediate between them. Thus by means of suitable valves both or either of the furnaces singly may be used at a given time. When both are working together, the air and gas are admitted directly to the furnace at the outer end of the first combustion chamber and pass out at the outer end of the second chamber. The "air" ports and flues are used alternately for the admission of air and for the passage of the products of combustion to the chimney. These flues are interdigitated in order to utilise to the greatest extent the heat contained in the exhaust gases.—T. St.

Furnace. W. Scheffler, Gulfport, Miss. U.S. Pat. 999,597, Aug. 1, 1911.

The crucible rests upon a hollow support capable of telescoping within a guide, and of being raised or lowered by a flexible device. This device may be arranged within the tubular support and guide in order to be protected from the furnace.—A. H. C.

Furnace for roasting blende, pyrites, etc. E. C. Bracq. Fr. Pat. 426,789, May 11, 1910, and First Addition thereto, dated Feb. 4, 1911.

(1). The hearth of the furnace is disposed around a vertical cylinder or pipe in the form of a helix, from the top of which the ore is gradually and continuously propelled to the exit at the base by means of rabble arms operated by an endless chain. On reaching the bottom the rabble arms pass through a vessel containing water and thence around the outside of the furnace to the top of the hearth. It is claimed that the continuous hearth prevents loss of ore by dusting; while the system of rabbling is less destructive to the rabble arms than other methods. (2). The rabble-arm is water-cooled and does not pass outside the furnace as in the original apparatus. It is operated by external mechanism from a vertical shaft within the central pipe of the furnace, and, on reaching the lowest part of the hearth, returns by the same path to the top. During its passage up and down the helical hearth, the rabble-arm also rotates about its own axis, resulting in a more regular action of the furnace.
—W. E. F. P.

Furnace; [Metallurgical] Electric ——. E. Stassano, Turin, Italy. Eng. Pat. 8901, April 10, 1911.

The melting chamber of the furnace has the form of a sphere or ellipsoid, with the lower portion cut away by a plane constituting the bottom of the chamber. The chamber is arranged within a casing, which is mounted on pivots so as to oscillate within a ring, and the latter is again supported on a second pair of pivots, fixed at an angle of 90° with respect to the former pivots. The vertical axis of the chamber is thus caused to travel around a conical path, by the rotation of a member which engages an axially-projecting part on the bottom of the casing. The electrodes are mounted within chambers provided with annular spaces constituting water jackets, and water is supplied by means of flexible cables or pipes. Pistons slide in the annular spaces, and are connected with the electrodes by means of rods. By regulating, through cocks or the like, the flow of water, which is independently admitted on either side of each piston, the circulation of the cooling water may be utilised for the control of the electrodes.—B. N.

Oxide of zinc; Method of extracting —— from ores and tailings. F. C. Beauchamp, London. Eng. Pat. 17,587, July 25, 1910.

The tailings, etc., are first treated with sulphuric acid to dissolve out metals, which are then precipitated as hydroxides by means of lime. By treating the mixed hydroxides with sodium hydroxide or ammonia the zinc is separated in solution and afterwards re-precipitated by the addition of sulphuric acid or a solution of zinc sulphate. The hydroxide thus obtained is washed and finally heated to yield the oxide.—T. St.

Zinc ores; Treatment of silicious ——. F. B. Dick, Hampton, Middlesex. Eng. Pat. 17,785, July 26, 1910.

The finely divided ore is mixed with water, and sulphuric acid (strong or diluted) is gradually added to the mixture during agitation. The quantity of acid employed is not substantially in excess of that required for converting the zinc and other elements (if present) into sulphates, while the amount of water used is only slightly in excess of that necessary for dissolving the zinc sulphate produced. After evaporation to dryness, the mass is heated to a temperature sufficient to render the hydrated silica insoluble without decomposing the zinc sulphate; and the residue is then leached with water. The zinc is recovered from the solution as metal by electro-deposition, or as oxide by evaporation and ignition. the resulting sulphuric acid in the former, or oxides of sulphur in the latter, case being returned to the process.—W. E. F. P.

Zinc; Electrolyte for, and method of depositing ——. E. F. Kern, Assignor to P. S. Brown, New York. U.S. Pats. 999,568 and 999,655, Aug. 1, 1911.

(1). The electrolyte is a solution of zinc chloride containing chloride of aluminium or another metal, with or without an alkali chloride. It may also contain grape sugar or some other organic addition agent. (2). The electrolyte is a solution containing zinc chloride and a double chloride of aluminium and another metal which may be one of the alkalis. The alkali chloride may also be in excess. —A. H. C.

[Aluminium] Alloy. C. E. P. Gabriel, Birmingham. Eng. Pat. 19,518, Aug. 20, 1910.

An alloy composed of about 98·38 per cent. of pure (*i.e.*, 98 to 99 per cent.) aluminium and 1·62 per cent. of electrolytic copper, is not readily subject to oxidation, and has a high tensile strength. At the same time it is easily worked into tubes, plates, wires, and the like.—W. H. P.

Alloy. J. Jones, Wilmerding, Pa., Assignor to Westinghouse Electric and Manufacturing Co. U.S. Pat. 998,777, July 25, 1911.

An alloy containing copper, zinc, manganese, and tungsten steel, with or without tin, or tin and aluminium. —A. H. C.

Metals; Production of —— from their ores by reduction. J. Härdén, St. Ives, Cornwall, and Electric Furnaces and Smelters, Ltd., London. Eng. Pat. 21,206, Sept. 12, 1910.

Relates mainly to the production of tin. The ores are reduced in an electric arc furnace by means of anthracite, the temperature attained being 1500° to 2000° C. The tin so formed contains impurities, sulphur, arsenic and iron. To effect their removal, so soon as the metal has separated out, an amount of a strong and rapid oxidising agent such as saltpetre or a perchloride just sufficient for their oxidation is added, together with an additional quantity of slagging material. Very pure tin is thus obtained by a single process. At the high temperature reached, some of the tin percolates through the lining of the furnace. The lining is accordingly supported on a wrought-iron backing of V-section, the ridge being perforated to allow the percolated metal to escape into a wrought-iron channel situated beneath. which is kept heated by a fire. This channel and the furnace lining are inclined to allow of the tin being drawn off.—T. St.

Gold, aluminium, silver and similar bronze leaf; Manufacture of ——. H. E. W. Johnson, Ealing, Middlesex. Eng. Pat., 27,020. Nov. 21, 1910.

Bronze powder is mixed with a suitable glutinous material, *e.g.*, collodion solution, and sprayed evenly over a large surface (of glass, metal, paper, etc.) on which it is allowed to dry, and from which it is readily removed in the form of foil after loosening by immersion in water.—E. W. L.

Coal and ore washer or separator. J. M. Draper and C. Hamilton, Manchester. U.S. Pat. 998,606, July 25. 1911.

The claim is for an ore jigger receiving vertical reciprocating motion in a water tank and having a sieve-like bottom formed of two sheets of perforated metal, one of which is capable of being moved horizontally over the other so that the perforations are open at the end of each upward stroke and closed at the end of each downward stroke.—W. H. C.

Metals; Refining ——. W. C. Arsem, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 998,665, July 25, 1911.

Gold and silver, or gold, silver and platinum are separated by heating an alloy of these metals in a vacuum to a temperature of 1300° C. in order to distil off the silver, and in the latter case further heating to about 1500° C. to distil off the gold.—A. H. C.

Ores; Treatment of precious metalliferous ——. J. C. Clancy, Assignor to Clancy Metals Process Co., New York. U.S. Pat. 998,749, July 25, 1911.

The ore is treated with a thiocyanate solution containing a haloid salt, *e.g.*, an iodide, or a solution containing in addition a soluble cyanide. The liquor is then electrolysed.—A. H. C.

Extracting precious metals from their ores; Composition of matter to be used in ——. H. Foersterling, Perth Amboy, N.J., Assignor to Roessler and Hasslacher Chem. Co., New York. U.S. Pat. 999,215, Aug. 1, 1911.

A homogeneous mixture of an alkali cyanide and halide (the halogen having a higher atomic weight than chlorine), made, for instance, by melting and solidifying a mixture of sodium cyanide and sodium bromide.—F. Sodn.

Roasting sulphurous and other minerals; Process and apparatus for ——. A. Nemes. Fr. Pat. 426,851, March 4, 1911. Under Int. Conv., Aug. 26, 1910.

The finely powdered ore is conveyed by an air-blast to horizontal burners from which it is injected into a furnace chamber provided with appropriate exits for the resulting sulphurous gases and roasted product. In addition to the blast conveying the ore, air is supplied to the burners in regulated quantity, all the air employed being previously heated by passing through channels in the body of the furnace. With ores containing sufficient sulphur, no fuel is employed for heating the furnace; but in other cases the furnace is heated by any appropriate means. —W. E. F. P.

Metallic deposits; Process for obtaining ——, or deposits of metallic compounds. M. U. Schoop. Fr. Pat. 426,882, Oct. 7, 1910.

By means of heated compressed air, or other suitable gas or vapour, the powdered metal or metallic oxide is projected on to the object upon which the deposit is required, the conditions being such as to cause the fusion and coalescence of the metallic particles and the formation of a continuous coating upon the object in question. —W. E. F. P.

[*Gold*] *Alluvials; Process and apparatus for treatment of auriferous or other* ——. H. Brings. Fr. Pat. 426,950, Nov. 25, 1910.

After the removal of the larger stones, etc., the auriferous alluvial is separated into coarse and fine products by means of a shaking washer-classifier consisting of oscillating, perforated, metal plates suitably mounted upon an iron frame. The coarse product is conveyed to amalgamating tables and the fine material passes through the perforated plates into an amalgamating trough in which, by mechanical agitation and other means, contact between the mercury and the particles of alluvial is effected. The product issuing from the trough passes over inclined tables of special construction for the final recovery of the mercury and amalgam.—W. E. F. P.

Metals; Cleaning of —— destined to receive a galvanic deposit. Les Établissements S. Grauer et Cie. and W. Dürr. Fr. Pat. 427,378, March 15, 1911.

The objects traverse a cleaning solution in suspended pans of sheet metal, which are given an appropriate rotary movement.—B. N.

Tungsten alloys, particularly ferro-tungsten; Process for manufacture of ——, and their introduction into molten metals. T. Goldschmidt. Fr. Pat. 427,774, March 27, 1911. Under Int. Conv., Feb. 17, 1911.

Alloys of tungsten with iron or other metals are produced by means of the alumino-thermic reaction for which a mixture of the oxide of iron or other metal with tungsten trioxide, metallic aluminium, and lime or fluorspar is employed; a mixture of the oxide of the metal with calcium tungstate (natural or artificial) and metallic aluminium may also be used. For the purpose of introducing the tungsten alloy into a fused metallic bath, the alumino-thermic reaction is effected upon the surface of the molten metal.—W. E. F. P.

Copper; Process of depositing —— from its solutions by means of scrap-iron. W. Günther. Ger. Pat. 236,091, April 22, 1910.

When copper is precipitated from its solutions by means of scrap iron in the usual way, the deposit consists of a mass of fine particles of copper contaminated by iron compounds and other impurities. According to the present patent, the particles of copper are caused to unite to a coherent mass by passing an electric current at intervals during the process. When the current is first passed, the loose particles of copper on the iron cathode unite to form a porous coating, and when this has acquired a certain thickness, the current is stopped, but it must be again passed from time to time, as the adherence of the copper deposit diminishes as solution of the iron proceeds. —A. S.

Steels direct from cast iron; Process and apparatus for the manufacture of hard ——. H. A. G. Cinille, Epierre, Savoy. Eng. Pat. 18,010, July 28, 1910.

See Fr. Pat. 416,771 of 1909; this J., 1910, 1458.—T. F. B.

Ores; Treatment of ——. C. E. Baker, Chicago. Eng. Pat. 18,452, Aug. 4, 1910.

See U.S. Pat. 972,149 of 1910; this J., 1910, 1256.—T. F. B.

Tantalum; Process for hardening and roughening or otherwise treating the surface of ——. E. C. R. Marks, London. From Siemens und Halske A.-G. Berlin. Eng. Pat. 18,780, Aug. 9, 1910.

See U.S. Pat. 974,835 of 1910; this J., 1910, 1393.—T. F. B.

Alloys; Process of producing —— and the separation of metals. P. F. Cowing, New York. Eng. Pat. 20,337, Aug. 31, 1910.

See U.S. Pat. 969,773 of 1910; this J., 1910, 1210.—T. F. B.

Aluminium articles; Process of treating —— for the formation thereupon of galvanic metallic coatings. C. Rümpler, Schöneberg, Germany. Eng. Pat. 23,359, Oct. 8, 1910. Under Int. Conv., Oct. 9, 1909.

See U.S. Pat. 992,600 of 1911; this J., 1911. 753.—T. F. B.

Metal; Treatment of —— for the production of sound castings. L. Weiss, Barmen-Rittershausen, Germany. Eng. Pat. 29,376, Dec. 17, 1910.

See U.S. Pat. 982,326 of 1911; this J., 1911, 554.—T. F. B.

Copper alloys and process of making same. J. Naulty and J. Scanlin, Philadelphia. Eng. Pat. 41, Jan. 2, 1911. Under Int. Conv., July 23, 1910.

See U.S. Pat. 974,419 of 1910; this J., 1910, 1392.—T. F. B.

Ferroso-ferric oxide; Manufacture and use of ——. H. and K. Goldschmidt, Essen on Ruhr, Germany. Eng. Pat. 534, Jan. 9, 1911.

See Fr. Pat. 425,482 of 1911; this J., 1911, 1020.—T. F. B.

Zinc or zinc oxide; Process of separating ——. G. Wannschaff and J. Savelsberg, Papenburg, Germany. U.S. Pat. 999,420, Aug. 1, 1911.

See Eng. Pat. 5577 of 1911; this J., 1911, 902.—T. F. B.

Zinc; Process for extracting —— from substances containing zinc or zinc oxide. G. Wannschaff and J. Savelsberg. Fr. Pat. 426,897, March 6, 1911. Under Int. Conv., March 7, 1910.

See Eng. Pat. 5577 of 1911; this J., 1911, 902.—T. F. B.

Concentrating-amalgamator. R. Luckenbach, Colwyn, Pa. U.S. Pat. 999,814, Aug. 1, 1911.

See Eng. Pat. 2963 of 1911; this J., 1911, 1020.—T. F. B.

Light metals; Electrolytic production of ——. Virginia Laboratory Co. Fr. Pat. 426,749, May 10, 1910.

See Eng. Pat. 11,175 of 1910; this J., 1911, 695.—T. F. B.

Sodium and potassium; Manufacture of metallic ——. E. A. Ashcroft. Fr. Pat. 426,990, Feb. 10, 1911. Under Int. Conv., Feb. 28, 1910.

See Eng. Pat. 5013 of 1910; this J., 1911, 493.—T. F. B.

Ores; Process for desulphurising ——. U. Wedge. Fr. Pat. 427,234, Jan. 19, 1911. Under Int. Conv., Jan. 20, 1910.

See U.S. Pat. 976,525 of 1910; this J., 1910, 1459.—T. F. B.

Rare metals; Process for producing refractory —— from their oxides or other compounds. Electric Furnaces and Smelters, Ltd. Fr. Pat. 427,537, March 20, 1911. Under Int. Conv., March 23, 1910.

See Eng. Pat. 7303 of 1910; this J., 1911, 695.—T. F. B.

Plaster of Paris mass for the drying of air, especially for metallurgical purposes, or for drying other gases. Ger. Pat. 236,549. *See* I.

XI.—ELECTRO-CHEMISTRY.

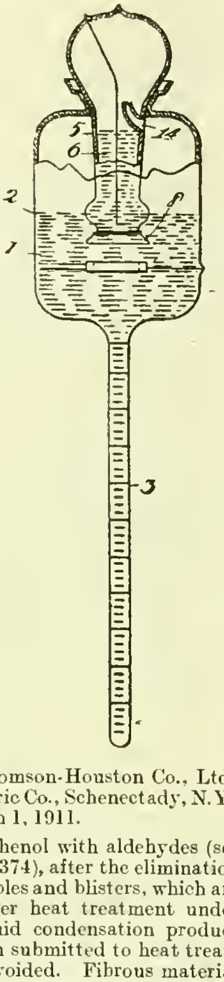
Aluminium bromide as a solvent. Isbekow and Plotnikow. *See* VII.

Electrolytic destruction of reinforced concrete. Magnusson and Smith. *See* IX.

PATENTS.

Electrolytic meters. E. Weintraub, Lynn, Mass. U.S.A. Eng. Pat. 3648, Feb. 13, 1911. Under Int. Conv., Feb. 14, 1910.

The electrolyte, 1, enclosed in the vessel, 2, contains potassium thiocyanate, thus providing a solution in which hydrolysis is practically absent. The container, 5, fitting in an air-tight manner into the vessel, 2, holds the mercury anode, 6, the latter being separated from the electrolyte by an osmotic membrane, 8, of goldbeater's skin, which closes the lower end of the container. A passage, 14, is provided through the wall of the container, whereby by inverting the instrument the mercury can be returned from the fall tube, 3, to the container, 5, this passage being in such a position that the volume of the container above it is greater than the volume below it.—B. N.



Insulating material. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 5167, March 1, 1911.

The condensation products of phenol with aldehydes (see this J., 1908, 686 and 690; 1909, 374), after the elimination of water, are apt to contain bubbles and blisters, which are not entirely avoidable even after heat treatment under pressure. If, however, the liquid condensation product be dried in the open air and then submitted to heat treatment, the blisters are entirely avoided. Fibrous material or mineral matter may be added to the liquid condensation product before it is dried. The mineral substance is preferably one which will absorb water (*e.g.*, plaster of Paris), and in this case the mass can be moulded in a steel mould before the air drying, and again heated under pressure in the mould till the final hard condition is reached. The products so obtained are strong and tough, free from pores and cavities and impervious to moisture.—W. H. P.

Electrodes for electric furnaces. O. Imray, London. From The Shawinigan Carbide Co., Ltd., Montreal, Canada. Eng. Pat. 9633, April 20, 1911.

The electrode comprises a metal conducting head, provided with a number of screw-threaded sockets, into which short graphite rods are fixed. The lower ends of these are recessed and screw-threaded, and rods of amorphous carbon are fixed into the recessed ends, thus forming a series of pencils. A packing of electrically conductive substance, the conductivity of which is lower than that of the pencils, encases the latter, and a sheet iron shell encloses the substance and rods.—B. N.

Storage battery and process of treating the same. T. A. Edison, Orange, N.J., Assignor to Edison Storage Battery Co., West Orange, N.J., U.S. Pat. 999,762, Aug. 8. 1911.

The claims comprise (1) an active material for the negative electrode of a storage battery, comprising electrolytically active finely divided iron (or other metallic material), and bismuth (or bismuth amalgam) intimately associated with the active particles, and (2) the process of treating the active material of storage batteries, by soaking the pockets containing it, in a solution of bismuth trichloride in acetone.—W. H. P.

Furnace; Electric rotating resistance ——. Imbert Process Co. Fr. Pat. 427,063, May 18, 1910.

The envelope of the furnace consists of a refractory cylinder with a horizontal axis, at the extremities of which are the terminals of the current, these being maintained constantly in electrical contact with the resistance material. The electrodes, placed at the ends of the cylinder, are in the form of annular discs, the centres of which form orifices for charging and discharging. The discs are arranged so as to be easily dismounted when necessary.—B. N.

Anode for electrolytic apparatus. A. T. K. Estelle. Fr. Pat. 427,127, March 10, 1911.

The anode, for the electrolysis of alkali salts, consists of a heavy metal which combines with the anions of the electrolyte forming a solution of a salt of specific gravity considerably greater than that of the electrolyte. The anode, which is in two parts, is disposed below the cathode, one part being fixed and connected with the source of current, and the other part formed of layers of detached pieces. The latter are disposed on the fixed portion, and the pieces are of dimensions such that the solution of the metallic salt may be able to flow easily through the channels or free spaces between the pieces. These may be formed of spongy iron, or other porous product with pure iron as the base. The spongy iron may be produced from magnetic iron ore, preferably Swedish, by treatment with gaseous reducers without fusion of the charge.—B. N.

Electrodes for electric accumulators. H. P. R. L. Pörscke and J. A. E. Achenbach. Fr. Pat. 427,415, March 16, 1911. Under Int. Conv., April 27, 1910.

The electrodes, for use with alkaline electrolyte, are constructed of nickel or cobalt oxide, as active mass, or other metallic oxides or salts which are bad conductors, without the addition of inactive conducting material. The active mass is spread by friction on metallic netting of fine mesh, which forms a suitable conducting support. The netting may be furnished with a wire, plate or tube on one of its sides, and rolled around this conducting support as tightly as possible, the cylinder being then wrapped with an iron or nickel wire fastened at the ends to the central conducting piece. Several cylinders, formed in this way, are bound to a common metallic frame.—B. N.

Electric discharges; Process for producing non-interrupted —— in gases. C. F. R. von Koch. Fr. Pat. 427,745, March 25, 1911. Under Int. Conv., March 26, 1910.

Permanent electric discharges of great stability are produced by bringing the gases to be treated to a temperature sufficiently elevated to make them conductors of electricity. The discharges may be produced between electrodes in the form of a ring or short tube, through which the whole or part of the gas may be passed.—B. N.

Furnace; Electric —— with a receptacle for the charge arranged on the furnace chamber. A. Helfenstein, Vienna. Eng. Pat. 17,650, July 25, 1910. Under Int. Conv., July 27, 1909.

See Fr. Pat. 418,567 of 1910; this J., 1911, 94.—T. F. B.

Furnaces; Electric ——. V. Popp, Paris. Eng. Pat. 30,390, Dec. 31, 1910. Under Int. Conv., May 6, 1910.

See Addition of May 6, 1910, to Fr. Pat. 409,244 of 1909; this J., 1911, 36.—T. F. B.

Furnaces, electric; Method of supplying —— with triphase currents. Soc. Anon. Electrométallurgique (Proc. P. Girod), Ugine. France. Eng. Pat. 13,731, June 8, 1911. Under Int. Conv., June 9, 1910.

See Fr. Pat. 416,927 of 1910; this J., 1910, 1394.—T. F. B.

Furnace; Electric ——. H. Pauling, Assignor to Salpetersäure-Ind.-Ges., Gelsenkirchen, Germany. U.S. Pat. 999,586, Aug. 1, 1911.

See Eng. Pat. 8443 of 1909; this J., 1909, 715.—T. F. B.

Furnace; Electric —— *for treating gases.* H. Pauling, Gelsenkirchen, Germany. U.S. Pat. 999,587, Aug. 1, 1911.

See Eng. Pat. 3251 of 1911; this J., 1911, 905.—T. F. B.

Electric-furnace electrode. Electric furnace. C. Hering, Philadelphia. U.S. Pats. 999,719 and 999,720, Aug. 1, 1911.

See Fr. Pat. 419,715 of 1910; this J., 1911, 221.—T. F. B.

Furnace; Electric resistance —— *for making aluminium nitride.* O. Serpek. Fr. Pat. 427,066, May 18, 1910.

See Eng. Pat. 12,601 of 1910; this J., 1911, 361.—T. F. B.

Furnaces; Electric ——. Electric Furnaces and Smelters, Ltd. Fr. Pat. 427,075, March 9, 1911. Under Int. Conv., April 23, 1910.

See Eng. Pat. 9897 of 1910; this J., 1911, 632.—T. F. B.

Electrolysis of fused alkali chlorides; Apparatus for the ——. Ges. f. Chem. Industrie in Basel, Basle, Switzerland. Eng. Pats. 18,300, Aug. 2, 1910, and 17,047 of 1911, date of appl., Aug. 2, 1910. Under Int. Conv., Dec. 22, 1909.

See Fr. Pat. 417,246 of 1910; this J., 1911, 27.—T. F. B.

Lead electrodes of secondary batteries or accumulators; Process for renovating and improving the structure of ——. E. H. Naylor. Fr. Pat. 427,316, Jan. 3, 1911. Under Int. Conv., Jan. 21. 1910.

See Eng. Pat. 1558 of 1910; this J., 1911, 292.—T. F. B.

Utilisation of the silent electric discharge [for the sterlisation of water]. Eng. Pat. 18,680. *See* XIXb.

XII.—FATS; OILS; WAXES.

Olive oil; Bleaching and decolourisation of ——. Communication from the French Consul at Florence to the Minister of Foreign Affairs. Ann. Falsif., 1911, 4, 355.

To meet the popular demand for a pale oil the Italian olive oil producers use a process of decolourising with citric acid or with tannin, preference being given to the latter since it may be used either during or after filtration, or merely added to the washing water. The amount of tannin used varies from 1 to 5 per cent. according to the colour of the oil. A satisfactory method of bleaching is to cause the oil to fall in a fine spray from a height of 6 metres into a large vessel filled to about two-thirds of its capacity with water, and so arranged that the oil is exposed to the action of air and sunlight.
—C. A. M.

Fatty oils from coniferous trees. C. Grimme. Chem.-Zeit., 1911, **35**, 925-926.

Although oils obtained from the seeds of coniferous trees, in consequence of their marked drying properties, have long been used in the manufacture of varnishes, the literature relating to them is very scanty. The author has examined the oils from nine of the more easily accessible species, all of which grow in Europe with the exception of *Pinus gerardiana*, which is a native of the East Indies, and the seeds of which are a commercial article. (1). *Pinus sylvestris*, L. (Scotch pine): the seeds contain 32·1 per cent. of a very viscous, brownish-yellow oil, which is known in commerce as pine tree oil or pine oil. (2). *Pinus montana*, Mill. (mountain pine, knee pine): the seeds contain 29·6 per cent. of a thick oil, of a yellow colour with green opalescence by reflected light. (3). *Pinus cembra*, L. (Swiss pine): the seeds contain 35·7 per cent. of a very viscous, yellow oil, in which palmitic, oleic, and linolic acids, together with hydroxy-acids and small quantities of myristic acid were detected. (4). *Pinus picea*, L. (Silver fir): the seeds contain 32·8 per cent. of a clear, brownish yellow oil, which is known in commerce as pitch tree oil or pitch oil. (5). *Pinus abies*, L. (Norway spruce): the seeds contain 31·6 per cent. of a golden yellow oil, which is known in commerce as red pine seed oil or pinaster seed oil. (6). *Pinus pinea*, L. (stone pine): the seeds contain 21·8 per cent of a thick brown oil. (7). *Pinus gerardiana*, Wall. (Gerard's pine): the seeds (neja or neoza nuts), contain 30·7 per cent. of a very viscous, greenish yellow oil. (8). *Cupressus sempervirens*, L. var. *horizontalis*, Mill. (cypress): the seeds contain 10·8 per cent. of a green oil which becomes turbid at the ordinary temperature. (9). *Thuja occidentalis*, L. (American arbor vitæ): the seeds contain 15·0 per cent. of a green oil, which becomes turbid at the ordinary temperature. The characters of the oils and of the fatty acids separated therefrom are shown in the following tables:—

Oil.	Sp. gr. at 15° C.	Solidif. pt.	Refract. index.	Acid value.	Saponif. value.	Iodine value (Wijs).	Fatty acids.	Unsaponif. matter.
		° C.					per cent.	per cent.
1	0·9326	—28 to —29	1·4704 (35°)	0·8	189·8	147·1	91·48	2·06
2	0·9318	—25 to —26	1·4698 (35°)	0·8	189·6	145·7	91·34	2·18
3	0·9316	—20 to —21	1·4710 (40°)	0·3	188·0	156·3	92·26	0·92
4	0·9268	—25 to —26	1·4879 (35°)	5·2	190·5	120·9	89·75	3·43
5	0·9312	—26	1·4742 (35°)	0·9	192·0	120·5	91·51	1·53
6	0·9326	—22	1·4685 (40°)	4·2	192·6	120·9	91·52	1·62
7	0·9307	—17	1·4679 (35°)	1·6	191·3	118·3	91·46	1·64
8	0·9320	—4	1·4857 (35°)	2·3	188·6	135·1	91·58	2·06
9	0·9298	—8	1·4795 (35°)	2·1	186·7	154·8	89·90	3·22

Fatty acids from.	M. pt.	Solidif. pt.	Refract. index.	Iodine value (Wijs).	Neutralisation value.	Mean mol. wt.
	° C.	° C.				
1	—10	—7 to —8	1·4626 (40°)	153·6	191·3	293·3
2	0	—4	1·4634 (40°)	150·5	191·2	293·4
3	—9	—11	1·4607 (40°)	158·0	189·0	296·8
4	—11 to —13	—15 to —16	1·4895 (35°)	121·6	192·1	298·8
5	—12 to —16	—17 to —19	1·4672 (40°)	121·8	190·4	301·5
6	—15 to —16	—19	1·4636 (40°)	120·8	194·3	288·7
7	0	—3	1·4613 (40°)	125·0	196·7	285·2
8	4—5	1	1·4795 (40°)	142·1	193·0	290·7
9	—3	—7 to —8	1·4736 (40°)	155·7	185·7	302·1

—A. S.

Cocoanut oil of high iodine value. W. D. Richardson. J. Ind. Eng. Chem., 1911, 3, 574.

Several shipments of cocoanut oil were recently found to give iodine values ranging from 18 to 24, and on inquiry the oil was found to have been prepared from copra admixed with large proportions of the waste material (parings of the rind) from desiccated-cocoanut factories. Experiments showed that there was a considerable difference between the oils extracted by means of ether from the "meat" of cocoanuts and from the rind. The former had an iodine value of 8·9 and titer test, 23·3° C., whilst the latter had an iodine value 40·25 and titer test, 25·5° C. The other constants of the oils, such as the saponification value, were identical with those of ordinary cocoanut oil.—A. S.

Glycerin production and exports of Spain. Board of Trade J., Aug. 17, 1911. [T.R.]

The July Report of the British Chamber of Commerce for Spain states that the production of glycerin in that country in 1910 amounted to about 2,500,000 kilos., of which 1,500,000 kilos. were obtained from candle lye and 1,000,000 kilos. from soap lye. The number of distilleries is about 15. The most important centres of production are Madrid and Barcelona, followed by Bilbao, San Sebastian, and Seville. A large part of the production is consumed in Spain and the rest exported, mostly in a crude state, chiefly to the Netherlands, the United Kingdom, Germany, and the United States. In 1910 the total exports amounted to 893,760 kilos., as against 1,043,467 kilos. in the previous year. Of the exports in 1909, 521,374 kilos. went to the Netherlands, and 150,707 kilos. to the United Kingdom.

Examination of linseed cake. Vuaflart. *See* XIXa.

Patents.

Soja grains [soya beans]; Mill for the wet-grinding of ——. Y. Y. Li, Valées, France. Eng. Pat. 11,903 of 1911, date of Appl., Dec. 30, 1910.

The mill consists of a lower fixed grinding stone and an upper rotary stone; the grinding surfaces of the stones have curved grooves, the depth and width of which are large towards the centre of the stones, and diminish gradually in the direction of the circumference. Between the curved grooves are small straight channels which are also reduced in depth and width from the centre to the circumference of the stones. Means are provided for rotating the upper stone, for delivering the moistened soja grains to the centre of this stone, and for supplying water to the mill during the grinding process.—W. P. S.

[Detergent] Composition comprising an alkaline peroxide in unalterable form; Process for the manufacture of a hard and dense ——. E. Thomann, Zürich. Eng. Pat. 30,185, Dec. 29, 1910.

Potassium nitrate (12 parts) is fused and incorporated with an alkali peroxide (10 parts) with continual stirring, and the mixture cooled and broken into pieces, which if desired may be coated with a solution of an acid substance such as potassium bisulphate, aluminium sulphate, boric acid, etc., so that when the composition is dissolved it yields a neutral solution. The dry substance is stated to be not affected by atmospheric moisture or by contact with organic substances, *e.g.*, soap powder.—C. A. M.

Emulsions from aqueous soap solutions; Process for the preparation of ——. F. Kripke, Ges. m. b. H. Ger. Pat. 236,254, 1909.

Aqueous soap solutions are mixed with such quantities of acids or acid salts that the emulsions first formed are not broken again. The quantity required differs according to the acid used. With hydrochloric acid, the emulsion produced in a 1 per cent. soap solution is permanent so long as less than 11/12 mol. of acid is present.—A. S.

Fats and unsaturated acids; Process for the reduction of ——. C. Paal, Erlangen, Germany. Eng. Pat. 5188, March 1, 1911. Under Int. Conv., Aug. 5, 1910.

See Fr. Pat. 425,729 of 1911; this J., 1911, 1022.—C. A. M.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Patents.

White-lead manufacture; Buckle for ——. H. P. Cavarly, Richmond Hill, N.Y. U.S. Pat. 999,205, Aug. 1, 1911.

A lead buckle is cast in the form of a hollow cylinder having a central hollow core. The annular space between the casing and the core is provided with a number of longitudinal partitions.—W. P. S.

[Zirconium] Pigments and lakes; Preparation of white ——. L. Weiss. Ger. Pat. 235,495, June 5, 1910.

Claim is made for the use of the oxide or salts of zirconium as pigments. The oxide, silicate, basic carbonate, phosphate, and basic sulphite are mentioned, as possessing a sufficiently pure white colour, unaffected by heating. With the exception of the carbonate, they are not attacked by acids or alkalis. They are non-poisonous, not affected by hydrogen sulphide, mix satisfactorily with the usual vehicles, and possess good covering power.—A. S.

Metal-polish. C. Ellis, Larchmont, N.Y., Assignor to Ellis-Foster Co. U.S. Pat. 999,491, Aug. 1, 1911.

A non-inflammable metal polish, practically free from solvent action on surfaces coated with paint and varnish, can be made by mixing heavy petroleum naphtha, of flash point 95°—110° F., with 10 per cent. of carbon tetrachloride and a polishing abrasive.—H. H. S.

Lead pigments and method of making same. A. S. Ramage, Buffalo, U.S.A. Eng. Pat. 17,770, July 26, 1910. Under Int. Conv., Jan. 3, 1910.

See Fr. Pat. 419,470 of 1910; this J., 1911, 224.—T. F. B.

White lead; Process for the manufacture of ——. L. Falk, Reval, Russia. U.S. Pat. 999,637, Aug. 1, 1911.

See Eng. Pat. 29,962 of 1909; this J., 1910, 890.—T. F. B.

Zinc white oxide; Process for the manufacture of ——. J. S. Withers, London. From A. Blum, Monterrey, Mexico. Eng. Pat. 29,485, Dec. 19, 1910.

See Fr. Pat. 424,380 of 1910; this J., 1911, 747.—T. F. B.

Vehicles for paints and the like; Manufacture of ——. F. H. Walker, Bromley, and C. E. Sohn, Harringay. U.S. Pat. 999,611, Aug. 1, 1911.

See Eng. Pat. 2114 of 1909; this J., 1909, 1260.—T. F. B.

Condensation products from phenols and formaldehyde; Process for the manufacture of insoluble ——. F. Pollak, Berlin. Eng. Pat. 21,401, Sept. 14, 1910.

See Fr Pat. 420,404 of 1910; this J., 1911, 373.—T. F. B.

Ink; Quickly drying —— *and process for manufacturing the same.* A. Rüter, Pyrmont, Germany. Eng. Pat. 29,389, Dec. 17, 1910. Under Int. Conv., Dec. 18, 1909.

See Fr. Pat. 410,635 of 1909; this J., 1910, 831.—T. F. B.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Artificial rubbers ; Hydrocarbons of the butadiene series and some —— preparable from them. C. Harries. Annalen, 1911, **383**, 157—227.

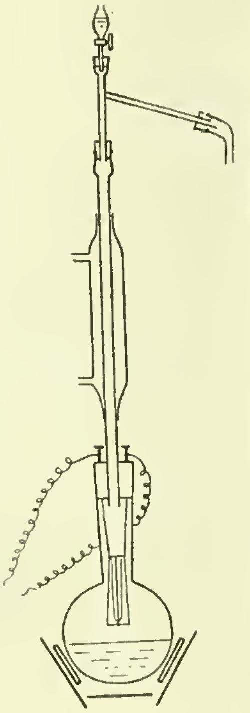
I. *Synthesis of hydrocarbons of the butadiene series.* The methods of preparation of isoprene are discussed, and a table of the density and optical constants of isoprene prepared by different methods is given. In conjunction with K. Neresheimer the author gives two new methods. Methyltetramethyleneglycol was prepared from ethyl pyruvate in absolute alcohol, and sodium. The diacetate, oxide, sym. diphenyldiurethane, tetraphenyldiurethane and dibromide of this body were prepared. (1). 40 grms. of the bromide were then heated with 150 grms. of quinoline, when about 2 c.c. of a mobile liquid distilled over, smelling strongly of decomposition-products of quinoline. It was redistilled over a little quinoline, shaken with dilute sulphuric acid, and fractionated over calcium chloride. The isoprene boiled at 30°—37° C. (2). 15 grms. of the bromide were heated with 25 grms. of a 33 per cent. absolute alcoholic solution of triethylamine for 3 hrs. in a sealed tube at 100° C. After careful evaporation *in vacuo* the bis-quarternary bromide remained as a viscous mass, which was dissolved in water and decomposed with double the calculated amount of moist silver oxide. After filtration and evaporation *in vacuo*, the bis-quarternary base remained as a thick syrup. As soon as decomposition began *in vacuo*, the liquid was distilled at atmospheric pressure. Isoprene distilled over, with water and triethylamine, most of which condensed in an intermediate receiver, while the isoprene accumulated in an ice-cooled flask. Any isoprene in the intermediate flask was subsequently driven over by gentle warming. The isoprene was shaken with cooled dilute sulphuric acid, and rectified over sodium on the water bath. The principal quantity came over at 36°—37° C. Density=0·6804. Molecular refraction, MR_d (21°)=25·45. Molecular dispersion, $MD_{\gamma-\alpha}$ (21°)=1·25. The residue boiled at 40° C. The yield was over 50 per cent. In a further method, more applicable technically trimethylethylene was prepared by Grignard's method from acetone and ethyl bromide. This amylene was brominated in cold glacial acetic acid. Isoprene was prepared by allowing the bromide to drop upon soda-lime saturated with carbon dioxide, heated to 600° C. The action depends on the porous nature of the soda-lime ; this is contained in an iron vessel provided with wire nets inside. A yield of about 60—75 per cent. was obtained in the distillate. (2). *Erythrene* (butadiene) was obtained by reduction of methylethyl ketone with sodium, yielding secondary butyl alcohol. This was dehydrated by phosphorus pentoxide, and the butylene was brominated in chloroform. The butylene dibromide was transformed into erythrene by the soda-lime method described above. The erythrene obtained was crude, and was purified by transformation into the tetrabromide, with subsequent reduction by Thiele's method. This process is scarcely promising from a technical point of view, but is better for laboratory work than that of F. Bayer und Co. (3). *βγ-dimethylbutadiene* was obtained from pinacone. This was prepared by the Holleman method from acetone and magnesium amalgam. The anhydrous pinacone was dissolved in chloroform, and well-dried hydrochloric acid gas was passed into the cooled solution. White crystals separated, which appeared to consist of the monohydrochloride of pinacone. On distillation with soda-lime as above, dimethylbutadiene (b.p. 71° C.) was obtained. Further experiments on this hydrocarbon were made with material prepared by the process described in Eng. Pat. 13,677 of 1910 ; this J., 1911, 307 (pinacone is transformed into dimethylbutadiene by treatment with heated potassium bisulphate).

II. Some artificial rubbers. The comparison of natural and artificial rubbers is very difficult. Since the nitrosite and bromide do not give sharp melting points, the ozonide method appears the most certain. In some cases vulcanisation tests were performed, using the cold cure method (2½ per cent. of sulphur chloride in carbon bisulphide. Two series of rubbers were obtained, the "normal" by heating the hydrocarbons alone or with acetic acid, and the "sodium," by the catalytic action of alkali metals, especially sodium. The two series are not identical. Even in the autopolymerisation method a small quantity of an apparent isomeride results, in which the double bonds appear to lie in another position. This may be concluded since methylglyoxal seems to result from the decomposition of the ozonide.—Normal series. (1). *Isoprene rubber* can be obtained by the autopolymerisation process or by the method of the author (see this J., 1910, 502), in which isoprene is heated with glacial acetic acid for about 8 days in a sealed tube at 100° C. The amount of acetic acid is immaterial, as is variation in temperature from 95°—120° C., though the yield varies from causes at present unknown. Pure isoprene gives the best yield. The dried product must be kept in carbon dioxide in the dark, since it readily oxidises. The rubber prepared at lower temperatures is the more stable. Elementary analysis showed that the product was almost chemically pure. Vulcanisation tests showed that perhaps the best result is obtained by the autopolymerisation process (see Fr. Pat. 419,316 of 1910 ; this J., 1911, 226), when the isoprene is polymerised at the lowest possible temperature without any added substances. Natural rubber which had been reprecipitated several times gave a bad result by the vulcanisation test. The isoprene rubber yielded a bromide, nitrosite, and iozonide, behaving in the same way as natural rubber. This also held for distillation of the rubber *in vacuo*. A terpene fraction is also produced in the polymerisation of isoprene. (2). *Butadiene rubber* $(C_8H_{12})x$ was prepared in the same way, but at a rather higher temperature. A terpenic by-product results here also. (3). *Dimethylbutadiene rubber* $(C_{12}H_{20})x$ was obtained similarly, though more slowly ; better by the autopolymerisation method. 50 grms. of dimethylbutadiene heated for 23 days and nights in a sealed tube at 100° C. gave 16 grms. of rubber after distillation *in vacuo* at 110° C. The terpene fraction was small. The rubber was once precipitated from ether by alcohol. It resembles its lower homologue, but in general is more easily soluble. It is a good rubber which can easily be cold-cured. Its derivatives, the bromide, nitrosite and diozonide, are very similar to those of isoprene rubber. Decomposition of the ozonide yields acetonylacetone, with a small quantity of another product. —Abnormal series. (1). "*Sodium*" *butadiene rubber* was first discovered. The hydrocarbon is converted in contact with metallic sodium almost quantitatively to rubber, in 3 hrs. at 35°—40° C., more slowly at ordinary temperatures. The rubber is steel-gray in presence of sodium, but bright yellow after washing with alcohol. When freshly prepared, it is soluble in ether, chloroform, and benzene, but later loses this property more and more. The solutions are very viscous. When not further purified it is electrified by rubbing, which suggests its suitability for insulation. It can easily be vulcanised. The product exceeds in strength all other such products from artificial rubbers. Ozonization gave an unexpected result ; apparently only one O_3-molecule became added to the C_8H_{12} molecule. This suggests that the rubber contains a conjugated double bond. The ozonide is being further investigated. The rubber yields a nitrosite and bromide. (2). "*Sodium*" *isoprene rubber* is obtained by heating isoprene, (as pure as possible), with sodium wire to 60° C. in a sealed tube for 50 hrs. The purity of the isoprene is very important in this method. The yield is almost quantitative. The product, once precipitated from ether by alcohol, is of high purity, from the results of elementary analysis. Ozonization yields a mixture of mono- and di-ozonide. Unlike the ozonide from ordinary rubber, these do not yield a decomposition product giving more than a slight pyrrol reaction. The behaviour is thus quite different from "normal" isoprene rubber. (3). "*Sodium*" *dimethylbutadiene rubber* was obtained in a similar manner.—Regarding the constitution of rubber, the author does not consider that Pickles (this J., 1910, 707) has adduced sufficient evidence to disprove the 8-ring formula. It will be of great interest to determine whether butadiene rubber actually yields a cyclooctadiene derivative by ozonization. Although this has not been proved, it appears likely. The diozonide of cyclooctadiene is already known, and a proof of such identity would be of importance in deciding the constitution of rubber.—H. E. P.

Terpene bodies; Decomposition of some —— by glowing metallic wires. C. Harries and K. Gottlob. Annalen, 1911, **383**, 228—229.

The "isoprene lamp" is described, by which oil of turpentine can be continuously transformed into isoprene. A platinum wire (120 cm. or 48 in. long, resistance at medium red heat 9 ohms, taking 5 amp. at 220 volts) is heated to redness above the surface of the boiling liquid. A reflux condenser, through which circulates water at 50° C., is attached to the flask. The isoprene is collected by a side-tube leading to a vessel cooled in a freezing-mixture. The product is rectified through a column and the fraction 35°—37° C. is separated. Commercial pinene in this way gives a very small yield of isoprene (about 1 per cent.), while commercial carvene gives 30—50 per cent. (according to the amount of limonene present) of isoprene of high purity. Gaseous products also result, while the residue is a high-boiling oil.

—H. E. P.



Indiarubber and rubber substitutes. A. Klages. Z. angew. Chem., 1911, 24, 1505—1508.

The German import of rubber in 1910 was valued at M.184,000,000 (£9,200,000); the world's annual production has increased from 62,000 tons in 1905 to 76,000 tons in 1910, valued at about £40,000,000. The world's demand must be much greater than this, for the high price of rubber in recent times has limited its applications. The technical treatment of rubber in Germany occupied in 1908 over 100 works with 35,000 workmen, and an invested capital of £5,500,000. An elastic substance produced by the polymerisation of isoprene, was discovered by Tilden in 1882, again obtained by Hofmann in 1908, and proved to be rubber by Harries in 1909. Since then research on the industrial production of synthetic rubber has been widely instituted in many large works, and many patents for the formation of isoprene have been taken out. The Elberfeld Farbenfabrik, for instance, condenses formaldehyde with acetone in alkaline solution to 2-ketobutanol, from which by removal of a molecule of water, methylene-acetone, and eventually isoprene, is obtained. Heinemann obtains it by the reaction of ethylene, acetylene, and methyl chloride :—

$$CH \vdots CH + CH_2 : CH_2 = CH_2 : CH \cdot CH : CH_2.$$
$$CH_2 : CH \cdot CH : CH_2 + CH_3Cl = HCl + CH_2 \cdot C(CH_3) \cdot CH : CH_2.$$

Small amounts of pure isoprene thus obtained were offered by the Caoutchouc Syndicate in London at £10 per kilo., and crude isoprene (about 50 per cent.) at £2. Substances resembling rubber have been produced from other hydrocarbons, among them the phenylisoprene obtained by the author and Lauk, the product from which has a fair elasticity both in compression and tension, but cannot be vulcanised. In the author's opinion, no substance should be considered as resembling rubber unless on vulcanising it yields substances similar to vulcanised rubber or to ebonite. At present the rubber on the market is almost exclusively "wild" rubber, but the yield from plantations is beginning, and it is calculated that by 1916—1917 this will amount annually to about 98,000 tons, in addition to the 76,000 tons of "wild" rubber, the yield of which will probably not diminish. The following tables show the price per lb. of various kinds of rubber for four years, and the acreage of plantations in cultivation in 1911 :—

	1908.		1909.		1910.		1911.	
	s.	d.	s.	d.	s.	d.	s.	d.
Kassai I. red	2	7	4	5½	8	0	4	8
Mozambique	3	1½	4	3½	8	11	4	8
Fine Para hard ...	3	4	5	4	12	0	5	7
Manaos negroheads	2	4	3	11	8	0	4	0½
Mexican	2	4	3	6½	7	4	3	9

	Acres.
Malay Peninsula	400,000
Ceylon and Southern India	235,000
Borneo	200,000
German Colonies	45,100
Mexico, Brazil, Africa	100,000

The yield varies: in Ceylon 100 kilos., in Samoa 90, in the Malay Peninsula 200 kilos. per acre. The American species of *Hevea* seem particularly well adapted for artificial planting, and the plantation rubber is in no respect inferior to wild rubber. Whether artificial rubber will be equally good is not yet proved. It is now very costly, but the history of other synthetic products shows that a very sudden alteration might take place in that respect. The chief rubber-producing countries are :—South and Central America (Amazon), Africa (Congo), India, and the Malay Archipelago. In America the trees are chiefly *Euphorbiaceæ—Hevea, Castilloa*, and *Manihot Glaziovii*; in Africa, they are chiefly Lianas of the genus *Landolphia*. India produces rubber from species of *Ficus*, and in the plantations are cultivated chiefly species of *Hevea*. The latex from these plants contains some 40 per cent. of rubber-substance, together with water, rubber resins, inositol, proteins, peptones, sugars, ethereal oils, and other complex substances, which have an influence on the colour and other properties of the rubber. The coagulation of the rubber is effected by very diverse means :—dilute acetic, sulphuric, or hydrofluoric acid, mercuric chloride, formalin, salt, fruit juices, or by smoking. It is hindered or prevented by ammonia. The rubber appears to exist in minute spherules in the latex. The resins are extracted by appropriate solvents—acetone or ethyl acetate. This is usually done in separate works. The resins are now an article of commerce. They have been but little investigated, but they are certainly not genetically connected with rubber. They are brittle substances of low melting-point, partly lævo-rotatory, partly inactive; have a high iodine-value, and form additive compounds with sulphur and with nitric acid. They do not interfere with vulcanisation of the rubber, but a better product is yielded by rubber from which they have been removed. Rubber is valued chiefly by its external appearance and strength. It is to be wished that recent analytical methods—the nitrosite and tetrabromide methods—were more in use among technologists as valuation methods. The rubber from *Hevea brasiliensis* is regarded by all as a standard quality: it contains 95 per cent. of pure rubber substance. The crude rubber is thoroughly washed with water between rollers, to remove mechanical impurities, dried at a low temperature, and vulcanised, either in the cold by treatment with sulphur chloride, or by heating with sulphur. If 7—14 per cent. of sulphur be used, the result is soft rubber: if 15—40 per cent., hard rubber or ebonite. The mechanism of vulcanising is not well understood. Rubber vulcanised with sulphur chloride possibly contains solid solutions of addition-products in excess rubber: that vulcanised with sulphur perhaps adsorption-compounds of colloidal sulphur and rubber. Ebonite contains a definite disulphide, of composition corresponding to the formula $C_{10}H_{16}S_2$. It can be obtained in solution, and then shows a tendency, like soft rubber, to gelatinise with certain solvents. When heated it gives off hydrogen sulphide, and leaves a monosulphide which will again take up sulphur. The original rubber cannot be regenerated from vulcanised products—the molecule is destroyed when the sulphur is removed. "Regenerated" rubber has simply had mechanically mixed sulphur and filling materials removed, but a certain heightening of the plasticity of the rubber is effected by the process. As substitutes for rubber are found, besides regenerated rubber, only "oil-rubbers." These products are made by vulcanising fatty oils, either with sulphur chloride or with sulphur. They have not the characteristic resistance to tension of rubber, though they possess a certain elasticity of compression. They are also valued as filling materials.—J. T. D.

Caoutchouc; Determination of —— [as tetrabromide] by Budde's method. Influence of protein. D. Spence and J. C. Galletly. Gummi Markt, 1911, 5, 109—113.

The experience of the authors is that, in its present form, Budde's method does not give concordant results, and that in cases of duplicate determinations yielding the same figures these figures are frequently far from the true value. The influence of protein on the determination has previously been referred to (this J., 1909, 1320), but Budde's own observations (this J., 1909, 1465) cannot be accepted as conclusive because they were made on proteins other than that accompanying caoutchouc. Experiments were made in order to ascertain what relationship, if any, subsists between the percentage of nitrogen in a given rubber, and the percentage of bromine in its tetrabromide but the results obtained were inconclusive when different rubbers were compared with one another. By comparing the percentage of nitrogen in a given rubber, *e.g.*, Maniçoba, with that present in the tetrabromide derived from it, it was, however, shown that practically the whole of the nitrogenous impurities present were precipitated with the tetrabromide and therefore have an influence upon the bromine content of the precipitate. By centrifugalising solutions of Maniçoba and of Entrefine Islands Para rubbers for six successive periods of half an hour at a speed of 2000 revolutions per minute, and preparing and analysing bromides from them, it was found that the bromine content was increased to 70·34 and 69·13 per cent. respectively (theoretical value = 70·17 per cent.), but it was also found that the bromide still contained nitrogen. The authors conclude that other impurities than protein are removed from the rubber by centrifugalising, and that these also are precipitated with the tetrabromide if not previously removed. Further, the fact that a value (70·34), actually higher than the theoretical (70·17), was obtained in the case of Maniçoba, whilst the tetrabromide still contained nitrogen, indicates that the rubber is over-, rather than under-brominated under the conditions of the experiment. It is only when the impurities precipitated with the rubber bromide themselves contain bromine, that they have any influence upon the accuracy of the volumetric determination of rubber. The authors have therefore with much labour, separated such impurities from a solution of Maniçoba rubber by a process of fractional centrifugalisation. The product contained between 5·17 and 6·31 per cent. of nitrogen, and 28·1 and 17·43 per cent. (in two samples) of "ash." When treated with bromine by the Budde process the product was found to contain from 15·57 to 16·08 per cent. of bromine. This amount is insufficient to influence the result of a volumetric determination to any considerable extent. The authors' results are therefore so far in favour of a volumetric bromide method, as against a gravimetric method.—E. W. L.

Caoutchouc; Determination of —— as tetrabromide. D. Spence and J. C. Galletly. Caoutchouc et Guttapercha, 1911, 8, 5313—5316.

The authors find satisfactory results are obtained when the decomposition of the tetrabromide is effected by heating with a mixture of sodium carbonate and potassium nitrate, instead of by means of nitric acid (see this J., 1911, 436, 499). 0·01 to 0·5 grm. of the tetrabromide was intimately mixed in a platinum crucible with about 1 grm. of the alkaline mixture and a layer of the latter was placed on top, and the whole then heated to redness for half-an-hour, care being taken not to bring the contents of the crucible into a state of fusion. After cooling, the mass was dissolved in water, the solution filtered, and the bromine determined gravimetrically. The results obtained, when compared with those obtained by a Carius determination on an identical sample were found to agree well, the tendency being for the former to be a little high. This was found to be due to the presence of a small quantity of some silver salt which was not decomposed by the dilute nitric acid added to the solution before precipitation. The use of sodium carbonate alone, instead of in admixture with potassium nitrate, also leads to good results, the tendency to to high values being rather more marked. By the use of stronger nitric acid this tendency is overcome owing to the destruction of the insoluble silver salt formed. The authors suggest that 0·3 to 0·4 grm. of the bromide be used, and that the solution be made thoroughly acid with nitric acid before precipitation with silver nitrate. The heating should be carried just up to the point of fusion.—E. W. L.

Rubber exports from the Amazon Basin, 1910—11. Board of Trade J., Aug. 26, 1911. [T.R.]

The following are statistics of the exports of rubber from Pará, Manaos, Iquitos, and Itacoatiara during the crop year (year ended 30th June) 1910—11 :—

	Fine.	Medium.	Coarse.	Caucho.	Total.
	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.
To the United States from					
Pará	2,971,162	354,405	3,046,840	539,406	6,911,813
Manaos	3,116,920	870,814	1,332,803	1,041,035	6,361,572
Iquitos	111,922	22,341	39,627	50,718	224,608
Itacoatiara	10,984	2,876	6,432	247	20,539
Total	6,210,988	1,250,436	4,425,702	1,631,406	13,518,532
To Europe from					
Pará	4,600,059	536,677	1,154,691	1,773,051	8,064,478
Manaos	5,691,315	891,691	982,347	2,161,352	9,726,705
Iquitos	634,462	180,297	258,829	1,073,376	2,146,964
Itacoatiara	41,886	7,489	24,899	1,753	76,027
Total	10,967,722	1,616,154	2,420,766	5,009,532	20,014,174
Grand Total	17,178,710	2,866,590	6,846,468	6,640,938	33,532,706

Kilo. = 2·2046 lb.

The total exports of rubber from the Amazon Basin in 1909—10 amounted to 38,953,475 kilos., and in 1908—9 to 38,234,871 kilos.

Patents.

Rubber; Manufacture of —— from isoprene. W. R. Hodgkinson, London. Eng. Pat. 9219, April 16, 1910.

Isoprene or mixtures containing isoprene are condensed to form rubber or a similar substance by heating with an

amide of an alkali metal, or a nitride of the type of magnesium nitride, in the absence of an oxidising agent.
—H. E. P.

Caoutchouc; Process for producing artificial ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 6540, March 15, 1911. Under Int. Conv., March 31, 1910.

MIXTURES of isoprene, erythrene, or similarly constituted hydrocarbons with double bonds, are employed in the production of caoutchouc or caoutchouc-like substances, instead of the simple hydrocarbons themselves, as described in Eng. Pats. 17,734 (see Fr. Pat. 419,316 of 1910; this J., 1911, 226), 15,254 (this J., 1910, 1215); and 25,850 (see Fr. Pat. 422,955 of 1910; this J., 1911, 637) of 1910, and with or without the addition of substances which promote polymerisation (*e.g.*, acids or acid salts, etc.). For example, 100 parts of isoprene and 100 parts of cooled erythrene are heated for 48 hours in an autoclave to 120° C. A tough, elastic substance is obtained which on treatment with steam is converted into a substance similar to natural caoutchouc.—E. W. L.

Rubber latex; Machine or apparatus for coagulating —— by smoke. Bertrams, Limited, R. F. Gillespie and P. M. Matthew, Edinburgh. Eng. Pat. 24,325, Oct. 20, 1910.

SMOKE from a furnace fed with leaves, boughs, nuts, etc., is passed through a soot trap into a smoke-chamber in which travels an endless band. Latex is fed on to the latter in one of a number of ways, for example, by the belt itself dipping into or "licking" the latex, which is contained in a vessel at the bottom of the smoke chamber, or by allowing the latex to run down a shoot on to the band. When the coagulated rubber forms a layer on the band, of sufficient thickness, say ⅜ in. or ½ in., the sheet is removed, washed and dried.—E. W. L.

Rubber latex; Smoking and coagulating ——. O. Shaw and R. T. Cooke, Manchester. Eng. Pat. 26,870, Nov. 18, 1910.

THE latex is coagulated by smoke, forced in by compressed air or gas, through injectors. The apparatus for this purpose includes means for regulating the smoke supply and for heating the latex.—H. E. P.

Indiarubber or other substances; Grinding mill for ——. A. Wood, Uxbridge. Eng. Pat. 2812, Feb. 3, 1911.

THE grinding and mixing mill includes a box or hopper for materials, with inclined movable tray or shoot, provided with a sifting appliance, which conveys the coarser materials into a well or chamber. An apparatus is provided which raises these and returns them to the hopper for regrinding.—H. E. P.

Rubber; Production of soft resilient ——. F. W. Howard, New York. Eng. Pat. 8987, April 11, 1911.

VULCANISED rubber is re-softened by treatment with heated oil, below the temperature of vulcanisation. Vegetable oils, especially linseed, are preferable.—H. E. P.

Fibroïn, albumin, and similar substances; Process for increasing the elasticity of the products [rubber substitutes] obtained from solutions of —— in formic acid. S. Diesser, Chem. Laboratorium und Versuchs-station für Handel und Industrie. Ger. Pats. 236,302 and 236,303, Oct. 19, 1909 and Feb. 2, 1910.

(1.) IF a solution of pentamethylenediaminedisulphine or the substance of formula, $(CH_2)_9N_2S_6$, in formic acid or other suitable solvent be added to the solution of fibroïn, albumin, etc., in formic acid, or if the polymethylene derivative be dissolved along with the protein compound in formic acid, the product obtained by evaporating the mixed solution has a greater elasticity, the larger the proportion of the polymethylene-derivative used. (2.) Instead of adding pentamethylenediaminedisulphine itself, its components are used, so that the compound is produced in the mass of plastic substance.—A. S.

Indiarubber; Industrial manufacture of ——. G. Reynaud, Paris. Eng. Pat. 25,201, Oct. 29, 1910. Under Int. Conv., April 23, 1910. Addition to Eng. Pat. 25,087 of 1910, dated Nov. 6, 1909.

SEE Addition of April 23, 1910, to Fr. Pat. 419,860 of 1909; this J., 1911, 968.—T. F. B.

Rubber; Process for producing a substance similar to ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated March 10, 1911, to Fr. Pat. 419,316, Aug. 12, 1910. Under Int. Conv., March 31, 1910.

SEE Eng. Pat. 6540 of 1911; preceding.—T. F. B.

Rubber; Process for making products resembling vulcanised ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 427,299, March 14, 1911. Under Int. Conv., April 6, 1910.

SEE Eng. Pat. 6642 of 1911; this J., 1911, 969.—T. F. B.

Rubber or substances resembling rubber; Process for producing —— and ferments for carrying out the process. W. M. Callender. Fr. Pat. 427,012, March 8, 1911. Under Int. Conv., March 15, 1910.

SEE Eng. Pat. 6486 of 1910; this J., 1911, 909.—T. F. B.

Caoutchouc and an intermediate product; Synthetic production of ——. W. H. Perkin, C. Weizmann, F. E. Matthews, and E. H. Strange. Fr. Pat. 427,286, March 7, 1911. Under Int. Conv., March 9, 1910.

SEE U.S. Pat. 991,453 and Eng. Pat. 5932 of 1910; this J., 1911, 833 and 909.—T. F. B.

Waterproofing-coating composition for concrete, etc. U.S. Pat. 999,708. *See* IX.

Compound [from rubber] for treating hides, skins, or leather. Eng. Pat. 17,596. *See* XV.

XV.—LEATHER; BONE; HORN; GLUE.

Wattle bark; Utilisation of ——. Bull. Imp. Inst., 1911 9, 116—121.

THE cultivation of wattle-trees is being extended in Natal, Transvaal, and in British and German East Africa. In British East Africa the plantations have reached the stage at which bark production can be commenced, and a small consignment has been recently placed on the London market. The exports of wattle bark, chiefly to Germany, for the four years, 1906—1909, from Natal, Cape Province, and Australia, were:—

	Natal.		Cape Province.		Australian Commonwealth.*	
	Weight.	Value.	Wt.	Value.	Weight.	Value.
	Cwt.	£	Cwt.	£	Cwt.	£
1906 ..	295,130	89,056	1437	318	431,896	162,453
1907 ..	476,786	136,873	9616	2514	358,167	132,342
1908 ..	491,748	133,510	5233	1053	260,364	102,410
1909 ..	705,848	192,950	9572	1746	—	—

* These figures are for "tanning materials" and may include some mallet bark.

Among the advantages of wattle bark as a tanning materia are that it varies very little in quality as marketed: it is rich in tannin, which can be easily extracted: and it is cheaper than other materials of similar quality and properties (compare Paessler, this J., 1911, 499). In the following table are given analyses of barks from British Territory which are now on the market or may be so in the near future :—

Name.	Source.	Tanain.	Non-tannins.	Ash.	Moisture.
		per cent.	per cent.	per cent.	per cent.
Black wattle bark	Natal	35·2—39·8	7·3—10·3	1·5—2·8	9·5—11·7
,, ,, ,, ...	Cape Province	40·1—44·1	7·1—13·0	1·5—1·8	10·1—10·9
,, ,, ,, ...	British E. Africa	36·7—42·1	9·4—12·7	1·5—2·4	10·2—13 0
,, ,, ,, ...	Australia	38·3	4·4	—	11·1
Golden ,, ,, ...	S. Australia	40·2—49·5	9·0—9·4	—	11·2

Samples of wattle-bark, with specimens of leather tanned with them, can be seen at the Imperial Institute.—A. S.

Pickling process [*Leather*] *especially as applied to light skins and to foreign sheep skins.* M. Armand. Leather, 1911, **3**, 621—622.

The pickling process may be used as a method for preservation of skins before tanning and also as an actual process in the tanning. One advantage of pickling unwoolled skins is that they are subjected to fewer drying operations, the latter acting injuriously on the tenacity of the leather fibres. A further advantage is that a pickled skin tans more rapidly and regularly and produces a leather which dyes much better than a non-pickled skin. The pickling process consists of subjecting the skins to the combined action of acid and common salt; in the one-bath method the acid and salt are applied together, and in the two-bath method, the skins are first submitted to the action of an acid liquor to which some salt has been added, and finally to a strong salt solution. The acid and salt act as antiseptics and prevent the putrefaction of the skin substance. Acid alone would produce too much swelling and the action of the salt is to prevent and reduce this swelling. Sulphuric acid is the most common acid used but there are dangers attending its use. Formic and butyric acids are recommended for pickling because the skins can be de-pickled merely by rinsing in water.—J. R. B.

Light in the tannery, especially in chrome tanning; The effect of ——. B. Kohnstein. Collegium, 1911, 291—296.

The effects produced by sunlight in the tannery are of two kinds, those due to the light rays and those due to accompanying heat rays. An example of the former effect is that of the bleaching of chamois leather by the sun, in which action the heat rays play no part, while the ozonising action of sunlight on enamelled leather is more effective than that produced by heating in a stove. Leuchs in a book on tanning (Nuremberg, 1828) notes the ease of an American tanner who effected a saving of 17½ per cent. of bark by keeping his liquors protected from light and air; a gain in weight of 4 per cent. was obtained in the leather which was of an exceptionally good colour. Leuchs also points out the fact that the natural tanning materials (bark, roots, fruit, etc.), are darkened by the action of light in the same way as is the leather made from them. Leather tanned with quebracho extract is particularly sensitive to light, becoming a flesh-red colour. It is therefore advisable for the tanner to have the tan-pits deep, not only to obtain an equable temperature throughout the year, but also to guard against light. Air and light should be excluded as much as possible also in the operation of leaching; this is done very effectively in the manufacture of extract in autoclaves. The change of the light-coloured tannins into compounds of a darker colour under the influence of light is, in most cases, an oxidation effect similar to the oxidation of hæmatoxylin ($C_{16}H_{14}O_6$) to hæmatin ($C_{16}H_{12}O_6$) in logwood. Chamois leather, which, in the process of manufacture is coated with oxidised fatty acids of a yellow colour, is bleached by exposing to the rays of the sun. The bleaching is only on the side on which the sun's rays fall. Enamelled leather, prepared with linseed oil varnish, after drying in the stove is exposed in a field in order that the ozonising action of the sun's rays may give it the required glaze, flexibility and non-sticking properties. If chrome leather when removed from the first bath is exposed to the light, it becomes a dark brown or grey green colour; it is therefore carefully protected by covering if it must remain any length of time before entering the second bath. Parts of the skin which have been exposed to the light become, after the tanning, flat or horny according to the degree of dampness and the duration of the action of the light. After the reduction with sodium thiosulphate the grain becomes of a plush-like texture and the leather cannot be glazed well. This defect is not so apparent if the goods are to be dyed black such as for box-calf or *glacé* kid but is very noticeable when the colour is any other than black. The action of light upon a skin impregnated with potassium bichromate is very similar to the bichromate-gelatin process of photographic printing. Under the action of light the reduction of the chromic acid is brought about. The more chromic acid which is formed from the bichromate and the more intense and prolonged the action of the light, the greater is the tendency of the gelatin to become liquid and reduce the chrome compounds. The chromed gelatin shows a honeycomb structure. Mayer has shown that the potassium bichromate is not chemically combined with the gelatin but embedded in the honeycomb structure of the colloid and that the gelatin becomes insoluble as the result of the transformation of bichromate into chromium sesquioxide.

$$K_2Cr_2O_7 = Cr_2O_3 + K_2O + 3O.$$
$$K_2O + K_2Cr_2O_7 = 2K_2CrO_4$$

The chromate is very little sensitive to light in the presence of gelatin. Eder has shown that the free oxygen takes no part in the tanning process but is liberated and not absorbed by the gelatin; and also that the chromium sesquioxide acts on the excess of bichromate forming Cr_2O_3,CrO_3.

$$K_2Cr_2O_7 + Cr_2O_3 = CrO_3,Cr_2O_3 + K_2CrO_4$$

In stronger light and by subsequent absorption of water the insoluble hydroxide is formed

$$Cr_2O_3 + 3H_2O = Cr_2(OH)_6.$$

—D. J. L.

Tanning by means of bromine and hypobromites. Meunier and Seyewetz. Collegium, 1911, 289—291.

In a former work (Monit. Scientif., 1909. 91) the authors have noticed that bromine-water has the property of rendering insoluble in boiling water sheets of gelatin which have been previously swollen in water. This constitutes a new example of tanning by means of a substance of an oxidising character to which class of reactions belongs the quinone tanning process discovered by the authors. The process also shows that, as with quinone, it is possible to tan gelatin or skin by means of a purely chemical reaction without the intervention of any colloidal precipitating action. As an example of the process, if thin sheets of gelatin are swollen in water, then introduced into a bromine solution (15 grms. per litre) for 2—3 hours and finally the excess of bromine removed by washing in running water for 48 hours, the gelatin, which previously melted in water at 60° C. will have become completely insoluble in boiling water. A number of determinations of the amount of bromine fixed by the gelatin gave percentages of bromine on the dry material varying from 0·46 to 2·40, according to the proportion of bromine water to gelatin. The brominated gelatin had in these cases been washed for 48 hours in a flask but the washing was found to be incomplete; a sample which contained 1·96 per cent. of bromine by the above method had the bromine reduced to 0·89 per cent. by washing in running water for 24 hours. Washing for 3 hours with a solution of sodium bisulphite left 0·90 per cent. of bromine in a sample and this seems to be the lower limit of bromine in the product required to render the gelatin insoluble. Solutions of bromine rapidly become rich in hydrobromic acid especially under the influence of light and this action is accelerated when bromine acts as an oxidising agent in the presence of water and a reducing substance such as skin. The study of the action of the bromine on skin is thus complicated by the presence of this acid which has a strong swelling and hydrolysing action on the skin. These effects have been avoided by adding salt or alkali which results in the formation of an alkali hypobromite; on a practical scale it is better to use salt and so produce a kind of pickling while the tanning is in progress. For example, 1 kilo. of raw skin is introduced into a tumbler with 2 litres of water and 100 grms. of salt, 2—3 litres of bromine-water of 20 grms. per litre strength are added gradually and in several hours the tannage will be completed. The excess of bromine is removed by washing for 2 hours with water or more quickly with sodium bisulphite solution and the skin is left light yellow in colour. The skin may be afterwards tanned by any other method utilising the advantage that very little material is fixed by the bromine tannage.—D. J. L.

Dum palm nuts as vegetable ivory; Use of ——. Bull. Imp. Inst., 1911, **9**, 105—109.

In a report made by the Imperial Institute to the Government of the Anglo-Egyptian Sudan in 1905, the possibility of the use of the nuts of *Hyphœne thebaica* (the Dum or Doum palm of the Sudan) as a substitute for "ivory nuts" or "corosos nuts" (*Phytelephas macrocarpa*) for use in the manufacture of buttons, etc., was discussed. The nuts however are inferior to corosos nuts on account of the large central cavity, which involves considerable waste in cutting, and the impossibility of polishing the material to a sufficiently high finish; and their selling value at that time would not have paid for the cost of collection and transport. Since then, however, the price of corosos nuts has risen from £9—£12 to £20—£35 in London, and at the present time, nuts from *Hyphœne* species are being imported into Italy and Germany. Nuts suitable for the purpose mentioned above have been received at the Imperial Institute from the Sudan, Natal and Rhodesia, and they can probably also be obtained from other parts of British Africa.—A. S.

Patents.

Hides and skins; Puering or bating ——. H. Becker, Frankfort-on-Maine, Germany. Eng. Pat. 24,982, Oct. 27, 1910.

Bacterial cultures (derived from dog-dung), their metabolic products and enzymes, are employed in the process in conjunction with digestive juices, mixtures of digestive enzymes, and of fat-decomposing substances. If necessary, substances capable of dissolving lime, such as sugar, ammonium salts, organic acids, or the like, may also be added. The treatment with the digestive juices, etc., may be made simultaneously with the bacterial treatment, or subsequently thereto.—W. P. S.

Hides, skins or leather; Compound [from rubber] for treating ——. F. G. Browne, Murrumbeena, Australia. Eng. Pat. 17,596, July 25, 1910.

Finely divided old vulcanised rubber is treated with sodium sulphite solution to remove free sulphur. It is washed, dried and mixed with molten paraffin wax. After thorough incorporation by stirring and boiling, the mixture is cooled. Benzine or naphtha are then added. —H. E. P.

Glue manufacture; Preliminary preparation of chrome-tanned leather for ——. C. Stiepel. Ger. Pat. 235,592, March 12, 1909.

The leather is treated first with an alkali carbonate solution, then washed, and afterwards treated with acid. —A. S.

Plastic composition [from glue] and moulded articles therefrom; Process for making a ——. Kämmer und Reinhardt. Fr. Pat. 427,553, March 20, 1911. Under Int. Conv., May 30, 1910, and March 13, 1911.

See Eng. Pat. 7325 of 1911; this J., 1911, 970.—T. F. B.

Water-resistant gelatin finish for fabrics. Fr. Pats. 427,573 and 427,574. *See* VI.

Manufacture of artificial marble from leather. Eng. Pat. 12,845. *See* IX.

Manufacture of manure [from leather waste]. Eng. Pat. 12,844. *See* XVI.

XVI.—SOILS; FERTILISERS.

Dihydroxystearic acid in good and poor soils. O. Schreiner and E. C. Lathrop. J. Amer. Chem. Soc., 1911, **33**, 1412—1417. (See this J., 1911, 40.)

An examination of 84 soils, of widely varying productivity and origin, for dihydroxystearic acid, with a view to ascertaining the distribution of this compound in the soils of the United States, shows the acid to be a common constituent, being present in 33 per cent. of the soils examined, both in those under long cultivation and in virgin lands. The acid was detected by extracting 5—10 lb. of soil, for 24 hours with 5—10 litres of 2 per cent. sodium hydroxide solution, acidifying the supernatant liquid with sulphuric acid, filtering, extracting the filtrate with ether, evaporating the ethereal extract over a small volume of water, boiling the aqueous solution vigorously, and filtering, while hot, through a filter paper wet with hot water, extracting the cool filtrate again with ether, evaporating over water, boiling, and filtering as before, and finally evaporating the aqueous solution to small bulk and allowing it to stand, when the acid separates in star-like clusters of white plates or needles which melt, when pure, at 99° C. Of 25 good soils of high or average productivity, only two contained the acid, whereas it was present in all of 10 soils which were known to be very infertile, and, out of a total of 35 poor soils examined, 51 per cent. contained the acid. The soil conditions under which it is found are generally poor drainage, poor aeration, too great compactness, deficiency in lime, lack of good oxidation, lack of good nitrification, and tendency for fungus development and exceptional poorness of crops. No single factor can, at present, be said wholly to explain its origin, but it would seem that the acid is either a direct or indirect factor in the low productivity of soils, and it is considered to be a readily recognised symptomatic factor of poor soil conditions.—F. Sodn.

Explosives; New uses of —— *in agriculture.* F. H. Gunsolus. J. Franklin Inst., 1911, **172**, 153—161.

In addition to the known use of blasting explosives for clearing new land of stumps of trees and boulders, they have been used more recently in many other ways in agriculture. The most important new application is the use of dynamite for the production of a deep layer of moisture-retaining surface-soil. Holes, 2·5—5 ft. deep, are made at a distance apart of 15—20 ft., and in each hole 0·25—0·5 lb. of slow-acting dynamite of 15—25 per cent. strength is exploded, after filling the holes with a compact tamping of wet clay. The cost, including explosives, blasting supplies, and labour, is 12—20 dollars (£2 10s. to £4 3s. 4d.) an acre. A similar method is used for blasting between trees in orchards, in order to overcome root cramping, wet rot, etc., when the trees begin to fail. Explosives are now largely used also for making ditches, the method being specially advantageous in swampy clay ground. The cost is usually 8—10 cents (4d.—5d.) per cubic yard of excavation, and it is possible for 3 men to excavate, by blasting, 1000 ft. or more per day. Ponds or swamps may frequently be drained by blasting openings through the underlying impervious subsoil.—A. S.

Calcium cyanamide; Preparation of —— and its uses as a manurial agent. Bull. Imp. Inst., 1911, **9,** 44—51, 123—134.

The article gives an account of the manufacture of calcium cyanamide, and its use as a manure, and a summary of the available information regarding the results of field trials with various crops. From consideration of the results obtained by various workers, it appears that calcium cyanamide may either be harrowed in or applied as a top dressing, the former method being usually preferable, and the manure being applied, to the extent of 25—45 lb. of nitrogen per acre, when the soil is wet or when there is a prospect of rain. On fairly good soils, calcium cyanamide is about equal to ammonium sulphate in manurial value, but it is inferior on poor moorland or sandy soil.—A. S.

Ammonium citrate solutions [for analysis of fertilisers]; Preparation of neutral —— by the conductivity method. R. A. Hall. J. Ind. Eng. Chem., 1911, **3,** 559—563.

370 grms. of citric acid are dissolved in water and sufficient ammonia to leave a slightly acid solution, and small measured portions of the solution are mixed with different measured volumes of dilute ammonia solution (100 c.c. of ammonia solution of sp. gr. 0·9 per litre) and after making up to 200 c.c. in each case and determining the electrical conductivity at 25° C., the amount of the dilute ammonia solution required to obtain an exactly neutral solution can be easily ascertained by plotting the conductivities (or more simply the direct Wheatstone bridge readings) against the volumes of dilute ammonia solution added (see this J., 1911, 700).—A. S.

Potassium [in fertilisers]; Practical method for the reduction of potassium platini-chloride in the determination of ——. A. Fiechter. Z. anal. Chem., 1911, **50,** 629—632.

The author simplifies Neubauer's method for determining potassium in fertilisers (this J., 1900, 1040), by reducing the potassium platini-chloride with magnesium. The double chloride, after being washed with alcohol, is dissolved on the filter in hot water (40—50 c.c. usually suffice). Dilute hydrochloric acid and magnesium clippings or ribbon are added to the resulting solution and the mixture heated; complete reduction is effected in a few minutes. The spongy platinum thus obtained is filtered off through a platinum Gooch crucible containing asbestos, washed several times with hot water, ignited and weighed. 0·2 grm. of magnesium suffices for the reduction of the double chloride from quantities of potassium oxide up to 0·05 grm., 0·5 grm. for that from 0·2 grm., and 0·8—1·0 grm. in the case of 0·5 grm. of the alkali.—A. Sbld.

Patents.

Manure; Manufacture of —— [from leather waste.] O. E. Heuschkel, London. Eng Pat. 12,844, May 26, 1910.

Leather cuttings or waste are steeped in an alkaline solution to extract the soluble tannin, which is recovered by neutralising the drawn off and filtered liquid with acid, and concentrating *in vacuo*. The leather pulp is subjected to the action of a hot hydrochloric or sulphuric acid solution, and the resulting tough mass, after treatment with potassium permanganate solution, is drained, dried and ground. It is used dry or dissolved in water. (Compare U.S. Pat. 841,501 of 1907; this J., 1907, 332).—A. Sbld.

Fertiliser mixer and distributor. J. V. Carter, Elliott, S.C. U.S. Pat. 999,297, Aug. 1, 1911.

The apparatus comprises a number of hoppers for receiving the materials, each connected with a chamber having a semi-cylindrical lower portion. A horizontal, rotating worm conveyor is mounted in each chamber for moving the materials through the chambers and delivering them into a common funnel-shaped hopper in which they are mixed and thence delivered on to the ground. Cleaning blades are fitted over each worm to aid in mixing the materials and to prevent them from clogging the worms. The whole apparatus is mounted on a wheeled carriage, the necessary gearings, etc., for operating the different parts of the apparatus being provided.—W. P. S.

Superphosphates; Process of making ——. G. Cusatelli, Taranto, Italy. U.S. Pat. 997,968, July 18, 1911.

See Fr. Pat. 419,716 of 1910; this J., 1911, 228.—T. F. B.

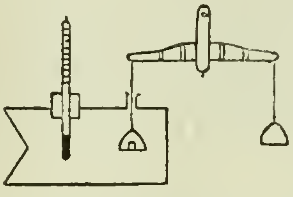
Fertiliser, insecticide, and fungicide; Product for use as a ——. W. F. K. Stock. Fr. Pat. 427,727, March 24, 1911. Under Int. Conv., April 28, 1910.

See Eng. Pat. 10,511 of 1910; this J., 1911, 228.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Beet seed; Determination of moisture in ——. H. Plahn-Appiani. Centr. Zuckerind., 1911, **19,** 1549—1550.

In the ordinary commercial examination of beet seed it is only necessary to ascertain the moisture that is expelled by direct desiccation in a relatively short time, and not the so-called "colloid water." The German standard method for doing this has been modified from time to time; but now the prescribed details are to dry approximately 5 grms. of the seed balls to constant weight, in a water-bath at 100° C., for at least 14 hours. When a number of samples have to be examined, this method is very tedious. With the object of obviating the loss of time, the author proposes to weigh the samples directly in the oven, with the balance arranged in the manner shown in the illustration, and to add 0·025 grm. to each weighing. Although in this way it was found possible to decrease the ordinary duration of drying by 5—6 hours, further endeavours were made to shorten the process. Raising the temperature, and subdividing the sample, are both precluded, the first because decomposition occurs above 100° C., and the second on account of the fact that the colloid water, or a portion of it, according to the number of the cells ruptured, is then included in the result. It was, however, noticed that the decrease in the weight of 5 grms. after 60 minutes is in proportion to the amount of water present in the sample; and acting upon this a table was drawn up, as the average of a large number of determinations, showing the decrease of weight after 30 and 60 minutes, and the respective percentages of water. Attention is called to the fact that in drying beet seed constant weighings first occur after 110—125 minutes, according to the moisture content; but that after further desiccation a gradual decrease takes place to be again followed by constant weighings. According to the author, the moisture content should be taken at the time when the constant weighings are first observed. —J. P. O.



Dry substance; Uniform determination of the —— in all kinds of sugar factory products. T. Koydl. Z. Zuckerind. Böhm., 1911, **35,** 491—497.

In the course of his experiments on the crystal content of raw sugar and the nature of the syrup adhering to the crystals (this J., 1910, 167), the author has obtained results indicating that the customary methods used for determining the content of dry substance do not give correct relative values between raw sugar on the one hand and juices and syrups on the other, the water being expelled in the former case in half an hour, *in vacuo*, at 105—110° C., whereas in the latter, heating must be prolonged for 8—24 hours under the same conditions. It is pointed out that in order to obtain comparable results with all kinds of sugar factory products, the determination must always be carried out under similar conditions. Either (1), the raw sugar may be converted into a syrup, and treated as such, or (2), the juice or syrup may be mixed with sugar crystals, and dried according to the procedure adopted for raw sugars. As the first method would be very tedious, it is advocated that raw and carbonated juices, syrups, and

massecuites should be mixed in suitable proportions with sugar crystals, and desiccated according to the method prescribed for raw sugars. It is considered by the author that the fineness of the grain of the raw sugar has an influence upon the result, and he therefore mixes crystals of different size in the average proportions in which they occur in raw beet sugar, *viz.*, 1 part of 2·0 to 1·3 mm. diam. of axis, 1 part of 1·3 to 0·65, and 1 part of 0·65 to the finest crystal meal. Sand as the distributing agent should not be used, since according to the author's experiments the results are not the same as when sugar is employed.
—J. P. O.

Manganese in honey. A. Gottfried. Pharm. Zentralh., July 27, 1911, 788. Pharm. J., 1911, **87**, 276.

It having been observed that the ash of honey was frequently of a strong green colour, the amount of manganese in a number of samples was determined colorimetrically by Marshall's method. 25 grms. of honey were incinerated, the ash taken up with hot dilute nitric acid, silver nitrate and ammonium persulphate added, and the red colour produced was then compared with known quantities of permanganate solution. Twenty-five samples of honey were examined, and the manganese was found to be from 0·5 mgrm. to 4·4 mgrms. per cent. The quantity of manganese was not proportional to the ash, but showed some parallelism to the amount of nitrogenous matter, which suggests that, like the latter, it may have been derived from the bees and not from the plants yielding the nectar.

Starch and glucose industries in the United States. Oil, Paint, and Drug Rep., Aug. 7, 1911. [T.R.]

In a preliminary report just issued by the Census Bureau, covering the investigation of 1909 into the glucose and starch industries of the United States, it is shown that there was produced in connection with the glucose industry, including all syrups, 769,660,000 lb. of glucose, valued at $17,923,000; 8,154,000 gallons of corn (maize) oil, valued at $2,803,000; of stockfeed at a total valuation of $6,014,000. The production of corn-starch is given as 637,227,000 lb., valued at $15,808,000. The increase in the quantity of corn-starch between 1904 and 1909, amounting to 324,777,000 lb., contrasted with the decrease in the output of wheat and potato starch, is a striking feature of the statistics. This increase is not a result of increased exportation of the commodity, but results from the increase in the domestic consumption. The exports of starch from the United States during the year ending June 30, 1910, amounted to 51,535,570 lb.; the imports during the same period were 10,625,862 lb. Glucose is consumed chiefly in the confectionery trade and in the manufacture of malt liquors. 112,730,639 lb. was exported during the year ending June 30, 1910; the imports during the same time were 146,729 lb. Grape sugar, the solid variety of glucose, amounting to 159,060,000 lb. valued at $3,621,000, was produced during 1909; 37,089,449 lb., were sold to foreign countries. A summary of the glucose and starch industries shows that in 1909 there were 116 establishments in the United States, with capital to the amount of $37,861,000. The cost of the materials used in these industries was $36,234,000; salaries and wages paid, $4,016,000; miscellaneous expenses, $2,969,000. The value of the products is given at $48,631,000. The value added by manufacture, or the value of the products less cost of materials, is quoted at $12,397,000.

Patent.

Sugar; Process for the clarification of ——. F. Wellensiek. Ger. Pat. 236,535, Nov. 10, 1908. Addition to Ger. Pat. 226,430, June 28, 1908.

The claim is for the application of the process described in the chief patent (see Fr. Pat. 404,556 of 1909; this J., 1910, 231) to sugar juices. The sugar solution is treated with a sufficient quantity of the humus compound to impart to it a distinct colour and then well mixed with the quantity of quicklime necessary to give an alkaline reaction to the mixture. Clarification takes place with precipitation of albuminous impurities; the precipitate settles rapidly and can be easily separated by filtration.—A. S.

XVIII.—FERMENTATION INDUSTRIES.

Barley; Valuation of —— in view of the probable yield of extract from the malt. C. J. Lintner. Z. angew. Chem., 1911, **33**, 1561—1564.

The external characters of the grain, together with the bushel-weight (hectolitre-weight) have long served as means for judging the suitability of a barley for brewing. Later, the importance of the protein-content came to be recognised, a low content being associated with a high malt extract. The following rule has recently been formulated by E. Haase:—A barley containing 85—90 per cent. of "good grains," with a thousand-grain weight of 38—40 grms., and having a protein-content of 7 per cent. of the dry substance, will give a low-cured malt yielding 82 per cent. of extract, reckoned on the dry substance, or a highly cured malt of 81 per cent. of extract; every increase of 1 per cent. in the protein-content corresponds to a decrease of 1 per cent. in the extract. A new criterion has recently been introduced by Jalowetz, in the protein-content of the grains, or the "protein-quotient," obtained by dividing the percentage of protein in the barley by the number of grains per 100 grms. Two barleys having the same content of protein may, if the size of the grains differs, show a different nitrogen-content per grain, and it is this latter, which, according to Jalowetz, should be regarded as indicating the behaviour of the barley during malting. The determination of the protein-quotient involves that of the thousand-grain weight, and a screening test, the assumption being made that grains of nearly equal size contain the same amount of protein. This assumption is not always justified, as Jalowetz has pointed out, especially when the barley is not all of one origin. The determination of the extract of barley is not different in principle from that in the case of malt, and the results obtained in the two cases do not differ much. The estimation of the extract of barley is, however, more troublesome and liable to greater errors than that of malt, owing to the unmodified state of the endosperm and the lack of diastatic enzyme, necessitating very fine grinding and the use of malt extract. No less than nine methods of carrying out the determination are at present in use, and the results may vary by 3 per cent. according as one or another method is employed. The author considers that the determination of the starch serves equally well for judging a brewing barley, and it is much simpler. Good results are obtained by the polarimetric starch determination, as devised by Belschner and Lintner, and modified by Wenglein and Schubert. This method depends on the solution of the starch by hydrochloric or sulphuric acid of a given concentration, precipitation of undesirable matters by phosphotungstic acid, and examination of the clear filtrate in a polarimeter. The yield of extract may be calculated from the percentage of starch by adding, according to Wenglein, 14·7, and according to Reichard, 13·5. It is not necessary, however, to transform the starch value into extract; it may be taken directly as indicating the value of a barley. Good results in brewing can only be expected from well nourished and ripened grain, and the starch value will usually indicate whether or not a barley is satisfactory in this respect. A good barley should contain 60—64 per cent. of starch. The valuation of barley by analysis is not a substitute for examination of the external characters of the grain, but should be supplementary. The analysis should include, besides a determination of protein, and extract or starch, that of water, germinative power and thousand-grain weight, and also a screening test.—J. H. L.

Yeast cells; Alteration in the fermentative characteristics of ——, on killing by means of acetone. R. O. Herzog and O. Saladin. Z. physiol. Chem., 1911, **73**, 263—283.

The authors have carried out a large number of experiments to determine the relative velocities with which solutions of dextrose, lævulose, mannose and galactose are fermented by living yeast and by the same yeast after killing with acetone. The course of fermentation was followed polarimetrically, and velocity constants, k and v, calculated by means of the two formulæ:—

$$k = \frac{1}{t} \log \frac{C_0}{C_t} \quad \text{and} \quad v = \frac{1}{t} \log \frac{C_0 + (C_0 - C_t)}{C_t}$$

in which C_0 and C_t are the optical rotations of the solutions before fermentation and after a time-interval, t. The values of k were found to be less constant than those of v. For the preparation of the "acetone-yeast" or "Dauerhefe," 200 grms. of pressed yeast (a bottom-fermentation beer yeast) were stirred with ¾ litre of acetone for 1 minute and then quickly filtered with the aid of a pump. After similar treatment with ether, and then again with acetone, the dead yeast was washed three times with ether and dried in the air. The quantities of yeast employed for 25 c.c. of sugar solution were, in parallel experiments, 0·5 and 1·0 grm. of living yeast and 5 and 10 grms. of dead yeast. This doubling of the yeast quantity gave rise to an almost exact doubling of the velocity-constant (v), except in the fermentation of mannose by living yeast, where the proportionality was not exact. Galactose did not undergo fermentation. The relative velocities of fermentation of dextrose, lævulose and mannose by living yeast were found to be as 1 : 0·63 : 0·52, whilst in the case of acetone-yeast the corresponding values were 1 : 1·06 : 0·81. The quantities of living yeast which would be required to ferment solutions of mannose, lævulose and dextrose at the same rate are in the proportion 1 : 0·82 : 0·52 ; to produce equally rapid fermentation by means of acetone-yeast the quantities of the latter required would be 6 : 4·6 : 4·8 in the respective cases. The killing of yeast by acetone, therefore, not only diminishes its absolute fermentative power, but alters its relative activity towards the three sugars studied. This change might be attributed to an alteration in the permeability of the cell membrane, or to the existence of different zymases within the cell. The simplest explanation, however, is based on the composite nature of the yeast-ferment, demonstrated by Harden and Young (see this J., 1906, 490, 1111 ; 1907, 62 ; 1908, 824 ; 1909, 1157 ; 1910, 711). The treatment of yeast with acetone and ether affects injuriously a substance which is important for the rapid fermentation of dextrose but relatively less important for that of lævulose.—J. H. L.

Yeast-juice ; Preparation of active —— by maceration. A. v. Lebedeff. Z. physiol. Chem., 1911, 73, 447—452.

Details are now given of the method of preparing maceration-juice already outlined (see this J., 1911, 147). A bucketful of fresh brewery yeast is poured into a vessel holding at least 50 litres, and is washed by slowly running on cold tap water and stirring from time to time, until the water remains clear and almost uncoloured. The yeast is then allowed to subside, if necessary over night, in which case a large piece of ice should be added if the weather is warm. The yeast deposit is collected on a cloth filter and afterwards pressed until it can be easily sifted through a 5 mm. sieve. The sifted yeast is spread out on filter-paper to a depth of 1—1·5 cm. and allowed to dry in an oven at 25°—30° C., two days being usually required for this. For the production of the juice 50 grms. of dried yeast (larger amounts in several lots of 50 grms.) are stirred to a homogeneous paste with 150 c.c. of water in a porcelain dish, and then kept in an oven for 2 hours at 35° C. or for 6 hours at 25° C. On filtering through an ordinary folded filter paper, a clear filtrate is obtained, 25—30 c.c. passing through in the first 15—20 minutes, and 70—80 c.c. in 12 hours. In summer it is advisable to cool the filtrate with ice. The juice so obtained has several advantages over pressed yeast-juice prepared by Buchner's method. It is usually much more active ; on addition of sugar, fermentation occurs at once or after a short time. It is free from glycogen and shows no auto-fermentation. When prepared from the same dried yeast it always has the same activity, and as the activity of the dried yeast remains unaltered for several months it permits, for the first time, of strictly comparable experiments with different yeasts carried out at different times.
—J. H. L.

Yeast-gum ; Remarks on the work of Euler and Fodor on ——. E. Salkowski. Z. physiol. Chem., 1911, 73, 314—316.

The view expressed by Euler and Fodor (this J., 1911, 915) that invertase may be a complex carbohydrate related to yeast-gum is contested by the author, who has repeatedly obtained very active invertase preparations containing no trace of yeast-gum. He ventures the opinion that invertase may be the magnesium salt of an acid containing both nitrogen and phosphorus. Several statements of minor importance in the paper of Euler and Fodor are criticised as being misleading.—J. H. L.

Wine ; Determination of volatile acids in ——. K. Windisch and T. Roettgen. Z. Unters. Nahr. Genussm., 1911, 22, 155—170.

On the basis of a large number of experiments the authors draw the following conclusions :—In determining the volatile acidity of wine by the official (German) method the whole of the volatile acids can only be obtained in 200 c.c. of distillate, if the wine does not contain more than 0·2 per cent. If it contains much more than this, it should be diluted, 50 c.c. of the diluted sample being used ; it is not permissible to take 50 c.c. of the original wine and continue the distillation until 250 or 300 c.c. of distillate have been obtained, for appreciable amounts of lactic acid will pass over in the extra 50 or 100 c.c. The 50 c.c. of wine taken for distillation must be reduced to 25 c.c. by adjusting the flame, and maintained at this volume till the end. Considerable errors may arise if the volume is kept much above or below 25 c.c. The pressure of the steam used should not greatly exceed one atmosphere, or high results are obtained owing to distillation of lactic acid. A small tin can with a safety tube serves very well as a steam generator. The bore of the tube by which the steam enters the distilling flask should be about 4 mm., reduced to 1 mm. at the end, which may be bent at right angles. Variation in the time occupied by the distillation does not influence the results ; half an hour is, however, usually sufficient. Lactic acid, and to a greater extent its anhydride, lactide, are volatile in steam. By repeated steam distillation a wine may be completely freed from lactic acid. The quantity passing over may be reduced by using a dephlegmator such as that of Kunz (Z. Unters. Nahr. Genussm., 1901, 4, 673), which is certainly to be recommended when the volatile acids are distilled off preparatory to the determination of lactic acid in the residue. The Kunz apparatus may possibly be used with advantage also in the determination of volatile acids. On steam-distillation only traces of lactic acid are decomposed into formic acid and aldehyde.—J. H. L.

Alcoholic beverages ; Comparative toxicity of various ——. J. Friendenwald. Boston Med. and Surg. Journ., July 13, 1911. Pharm. J., 1911, 87, 300.

Experiments have been made with a view to determining the comparative toxicity of various alcoholic beverages. The results obtained, show that wine is more toxic than alcohol or whisky, and that red wines are more toxic than white wines. White wines are manufactured from the juice of the grape alone, while red wines are produced by the fermentation of the entire grape, including the skin and the seed, which contain the essential oils together with other toxic substances. Thus it seems clear that the toxicity of alcoholic beverages is not proportionate to the alcohol content, but rather to other substances which they contain. The liqueurs and rum are the most toxic of all drinks ; beer and ale are about as toxic as whisky.

Brewing ; Use of radio-activity in ——. W. Caspary. Allg. Brauer- u. Hopfen-Ztg., 1911, 1647 ; Z. ges. Brauw., 1911, 34, 418.

Recent investigations have shown that radio-active emanation has an important influence on the growth and function of yeast. The application of this to the production of uniform, strongly aromatic and palatable beers is proposed. One or more cylinders containing emanation are lowered into the wort during fermentation. Storage casks are similarly provided, the development of aroma during after-fermentation being thereby improved. (See also Ger. Pat. 235,173 ; following.)—J. H. L.

Patents.

Brewing process with application of radioactivity. W. Caspari. Ger. Pat. 235,173, Dec. 2, 1909.

The claim is for making use of radioactivity in the brewing process, especially during the fermentation. (See also preceding abstract.)—A. S.

Fruit wine; Manufacture of ——. H. von Stuckrad, Berlin. Eng. Pat. 15,504, June 28, 1910.

A quantity of "pure or concentrated fruit acid or acids" is added before or after fermentation to the fruit juice which has been diluted with water and mixed with sugar previous to the fermentation, in order that the finished wine will contain approximately the same amount of acidity as that contained in sparkling grape wine. For instance, orange juice is diluted with water until the acidity is reduced to about 7 per cent., sufficient invert sugar is added to make the solution contain about 20 per cent. of sugars, and fermentation is allowed to take place. After clarification, water and alcohol are added if required, and "fruit acid" is introduced. The quantity of "fruit acid" added is determined solely by taste.—W. P. S.

Bacteria and yeasts; Apparatus for the production [culture] of ——. M. Cohendy, Paris. Eng. Pat. 26,773, Nov. 17, 1910. Under Int. Conv., Nov. 22, 1909.

A cylindrical vessel, the lower end of which is conical, is mounted in an outer casing. The vessel and casing are hermetically closed by a cover, common to both, which is provided with a thermometer tube and a tapped tube through which filtered air may be admitted to the inner vessel; this tube may also serve for exhausting the air from the vessel. The casing is partially filled with water and is mounted over a gas furnace provided with an automatic regulator. An exhaust steam pipe, pressure gauge, and safety valve, are fitted at the upper part of the casing, and tubes may be provided for circulating cold water through the casing after the sterilising process has been completed. A tube extends down to the lower part of the inner vessel for taking up substances deposited in the conical part, whilst decantation is effected by means of a second tube which is bent horizontally at a short distance from the bottom of the vessel. These two tubes are connected at the top of the vessel with two lateral filtered-air inlets which are fitted with filtering plugs.—W. P. S.

Maize or other cereals; Process of cooking ——. F. Pampe, Halle on Saale, Germany. U.S. Pat. 999,852, Aug. 8, 1911.

See Fr. Pat. 385,266 of 1907; this J., 1908, 586.—T. F. B.

XIXa.—FOODS.

Bread made from different varieties of wheat flour; The nutritive value of ——. J. M. Hamill. Report to the Local Government Board. Food Reports, No. 14, 1911, 1—53. [Cd. 5831.]

The Report gives an account of the different varieties of wheat flour produced at the present day, deals with the nature of the chief chemical and physiological evidence which is at present available as to the dietetic values of flours and bread made therefrom, and makes reference to the position in these respects of so-called "standard" bread and flour. Whilst the evidence obtained does not permit any conclusive statements to be made, the difference in nature and in nutritive value between breads made from different classes of flour, such as wholemeal flour, "entire" wheat flour, households, patent grade flour, straight-run or straight-grade, special flours, etc., do not appear to be of much importance. A naturally white "patent" flour obtained from one variety of wheat may contain considerably more total protein, and furnish more available energy than an "entire" wheat or wholemeal flour from another kind of wheat. One kind of bread may suit an individual better than another kind, suitability in this case being the result of flavour, the nature of the other ordinary constituents of the dietary, etc., and the commercial supply of breads of all classes serves a useful purpose in allowing a choice to be made. There is no reason to consider that the varieties of bread regarded as of lower quality, "households," for instance, are in any physiological sense inferior to that of the higher priced breads made from high grade and specially white flour. "Entire" wheat flours (including stone-ground flours and "standard" flour) are in nearly the same position as "households," although when made from weak wheats they will usually contain less available protein than "households" made from strong wheats. They may, however, contain additional constituents, such as organic phosphorus compounds, etc., the presence of which is important in maintaining good health, and this consideration also applies to wholemeal flour and to "germ" flours.—W. P. S.

Milk; Composition of ——. H. D. Richmond. Analyst, 1911, **36**, 390—392.

The average results from over 19,000 samples of milk examined by the Aylesbury Dairy Company during 1910 show:—

	Morning's milk.	Evening's milk.	Average.
Specific gravity	1·0322	1·0319	1·0320
Milk-fat	3·53	3·92	3·73
Solids not fat	8·90	8·89	8·89

As usual, the lowest fat content occurred in May and June, and the highest in October and November. The percentages falling below the mimimal limit of fat fixed by the Sale of Milk Regulations were:—

	2·9 to 3·0 per cent.	2·8 to 2·9 per cent.	2·7 to 2·8 per cent.	Below 2·7 per cent.
April	1·6	0·3	0·5	0·9
May	3·0	2·1	0·8	0·5
June	3·0	1·2	1·0	0·1
July	0·7	0·7	0·1	—

The rule that samples of milk which, though containing less than 8·5 per cent. of non-fatty solids, are yet genuine, if they contain 0·5 per cent. of nitrogen and 0·7 per cent. of ash, is not an absolute one, but has very few exceptions. —J. T. D.

Milk; Determination of the specific gravity of very small quantities of ——. A. Kreidl and E. Lenk. Biochem. Zeits., 1911, **35**, 166—168.

The method depends on the fact that butter fat is not extracted or dissolved from milk by the ordinary solvents for fats, the casein appearing to form a colloidal coating around the globules and preventing the solution of the fat. A mixture of benzene and chloroform, or of benzene and carbon tetrachloride, etc., is prepared, having a specific gravity equal to the average specific gravity of normal milk of the kind under examination. One drop of the milk is then added to the mixture when it will float near the surface of the mixture, or sink to the bottom according to whether its specific gravity is below or above the normal value. The drop of milk may remain in the mixture for some hours without any of the fat going into solution. The results obtained are trustworthy and the specific gravity of sour milk may be determined by means of the method.—W. P. S.

Milk and dairy produce; Action of ozone on ——. W. Freund. Chem.-Zeit., 1911, **35**, 905—906.

Experiments made to sterilise milk with ozonised air showed that a partial sterilisation is effected and that the acidity increases decidedly more slowly in the treated milk. The process is however regarded as quite impracticable as the milk acquired an unpleasant flavour and the ozone was found to have a chemical action on the constituents of the milk (see this J., 1905, 341). Ozonised air (containing 0·0027 grm. of ozone per litre) passed through the milk was found to cause a brownish colouration in 135 seconds and after passing for 55 min., flocculent matter separated on the surface of the milk. The process of churning was found to be accelerated by previous treatment of the acid cream with ozone, but the butter acquired a tallowy flavour. Fresh butter and cheese exposed to strongly ozonised air were found to have an unpleasant acrid taste, and the butter on keeping developed a tallow-like flavour.—A. Sbld.

Foodstuffs ; Handling, transportation, and storage of perishable ——. *Part II.* J. S. Hepburn. J. Franklin Inst., 1911, **172**, 173—193. (See also this J., 1911, 826.)

After a description of the methods of dressing, transporting, storing, and marketing, poultry, a short section is devoted to the chemical changes and bacterial growth in milk at low temperaures. On storing milk at about 0° C., the casein is rapidly digested, with formation of soluble compounds ; the proportions of caseoses, amino-acids, and probably peptones increase. For example whereas in fresh milk the casein-nitrogen amounted to 78 per cent. of the total nitrogen, after 5 weeks at 0° C., it amounted to only 50 per cent. The acidity of the milk increases and the proportion of lactose decreases on storing at low temperatures. Even with an acidity corresponding to 101 c.c. of $N/10$ sodium hydroxide per 100 c.c., the milk did not curdle. The bacterial growth increased enormously in the stored milk, but caused no change in the odour or taste and the milk did not curdle, even on heating. Liquefying organisms were more numerous and acid-forming bacteria less numerous than in milk stored at higher temperatures. Certain species of bacteria, such as *B. formosus*, *B. solitarius*, and *B. Ravenel*, proved especially resistant to cold, and frequently were the predominating species after storage. A bibliography of contributions from the Food Research Laboratory of the Bureau of Chemistry, U.S. Dept. of Agriculture, is appended to the paper.—A. S.

Apples ; Constituents of ——. C. Thomae. J. prakt. Chem., 1911, **84**, 247—248.

The fresh peelings of apples were distilled with steam. The distillate showed a small amount of flocculent matter, with a slight pellicle on the surface, and drops of oil. The aqueous portion smelled pleasantly of apples. The ethereal extract of the distillate gave a soft mass, which crystallised when moistened with alcohol. The filtrate from the crystals, when evaporated, left an oil smelling of apples. After treating the peelings with sodium carbonate solution, extracting with ether and evaporating, a considerable amount of a colourless powder was obtained. This substance is odourless and cannot be readily wetted. It can be combined with plant fat or resin, to form a substance of the same composition as that produced as a protective coating when the fruit is dried.—F. Shdn.

Linseed cake ; Examination of ——. L. Vuaflart. Ann. Falsificat., 1911, **4**, 381—388.

The allowance of 4 per cent. of impurities in linseed approved by the Incorporated Oil Seed Association is shown to require some modification. In one case, for instance, it led to a sample of linseed containing 8 per cent. of colza seed being passed as containing the required 96 per cent. of pure seed. In the author's opinion, if the amount of impurities as determined by the method of the I.O.S.A. in a homogeneous sample exceeds 4 per cent. the fatty and non-fatty constituents should be separately determined, and a correction made, and if the limit of 4 per cent. is still exceeded the sample should be condemned. In determining the cellulose, the filtration is rendered easier and the results more accurate by extracting the fat prior to the treatment of the fibre with acid and alkali. Samples of very pure linseed cake gave 8·4 and 9·1 per cent. of cellulose. Determination of the mucilage does not afford evidence of the purity of linseed cake, and the test cannot be made in the presence of starch. It has been stated that in linseed cakes of non-French origin the mucilage has been rendered insoluble by the action of steam, but the author's experiments show that these cakes contain as much mucilage as French linseed cakes do. Thus the following results were obtained :—French cakes, 19·2 to 28 ; Calcutta linseed cakes, 21·8 to 23·3 ; Azof cakes, 24·3 to 28·7 ; and La Plata cakes 33·4 (?) to 34·1 (?) per cent.—C. A. M.

Patents.

Milk ; Preservative treatment of ——. T. G. Molliuger, Kalamazoo, Mich., U.S.A. Eng. Pat. 24,162, Oct. 18, 1910.

The milk is pumped at a pressure of about 100 lb. per sq. inch through narrow copper tubes fitted in a steam-jacket, the tubes being so arranged that they form a single, continuous channel. In this part of the apparatus the milk is heated to a temperature of from 130° to 155° C., the rate of flow being such that the milk passes through the apparatus in about 2 seconds. It then passes through a number of tubes arranged in a jacket where its temperature is reduced to 98° C., at which temperature it is transferred to bottles or other receptacles, sealed up, and allowed to cool slowly (in about 15 minutes) to 70° C. The milk is finally allowed to cool to the ordinary temperature.—W. P. S.

Tea [tablets] ; Manufacture of ——. M. Wilbuschewitsch, Nischninovgorod, Russia. Eng. Pat. 29,891, Dec. 23, 1910.

Tea siftings or tea leaves are extracted with water and the extract is evaporated under reduced pressure to a syrupy consistence ; this syrup is then mixed with tea leaves or tea siftings at a temperature of from 40° to 60° C., and the mass is allowed to ferment for a period of 45 minutes. The temperature is then raised to above 70° C., the mass is stirred until its water-content has been reduced to about 10 per cent., and is then pressed into bricks or tablets. For the preparation of black tea, the drying process is continued until the mass contains only about 6 per cent. of water.—W. P. S.

Sterilising apparatus [for foods]. G. Bengs, Fort Wayne, Ind. U.S. Pat. 999,294, Aug. 1, 1911.

The apparatus comprises an outer shell provided with connections for the supply of a heating or cooling medium, and a revolving frame mounted inside the shell and provided with a number of crates acting as supports for food receptacles, these crates being disposed longitudinally of the frame and diagonally relative to its path of motion.
—A. S.

Milk ; Desiccating ——. M. Ekenberg, Assignor to Techno-Chemical Laboratories, Ltd., London. U.S. Pat. 999,972, Aug. 8, 1911.

See Eng. Pat. 16,375 of 1909 ; this J., 1910, 1175.—T.F.B.

Plastic mass for artificial silk, etc., from milk. Ger. Pat. 236,908. *See* V.

XIXb.—WATER PURIFICATION ; SANITATION.

Waters ; Determination of organic matters in —— *by permanganate.* H. Noll. Z. angew. Chem., 1911, **24**, 1509—1518.

In determining organic matters in water by means of Kubel's permanganate process in presence of sulphuric acid, the loss of oxygen by direct action of sulphuric acid on the permanganate and on any manganese dioxide formed is negligible ; indeed, the sulphuric acid acts favourably, by retarding the reaction of permanganate with manganous sulphate to produce dioxide. This reaction occurs in accordance with Guyard's well-known equation ; and though manganese dioxide does exert a catalytic influence in reducing permanganate to the state of dioxide, yet this influence is, under the prescribed conditions, entirely negligible. The reduction of permanganate by organic substances proceeds in acid solution to manganous sulphate, though occasionally some manganese dioxide may also be precipitated ; in neutral solution manganese dioxide is formed, though a large excess of powerfully reducing substances may carry the action further. In determinations, a large excess of permanganate should always be present, otherwise the dioxide separated may take part in the oxidation, thus both delaying the process, and tending to low results. For the same reason the addition of manganous sulphate to waters containing chlorides, sometimes recommended, is not advisable, because of the manganese dioxide formed ; in such cases, Schulze's method (alkaline solution) is preferable. According to the author, Kubel's method, in spite of its admitted defects, is a useful and trustworthy comparative method.—J. T. D.

Chlorine in potable waters ; Volhard's method for the determination of ——. A. T. Stuart. J. Amer. Chem. Soc., 1911, **33**, 1344—1349.

Experiments on the use of varying quantities of indicator in Volhard's method lead to the conclusion that the method is only applicable to the determination of chlorine in water when the amount of silver nitrate added in excess of that required is very small (equivalent to not more than 0·0002 grm. of chlorine).—F. Sodn.

Sewage effluents ; Determination of dissolved oxygen absorbed by —— containing nitrites, and of the amount of nitrite in sewage effluents and in water. R. W. Clarke. Analyst, 1911, **36**, 393—395.

Winkler's iodometric method is interfered with by nitrites, because the cycle of equations :

$$2HNO_2+2HI=N_2O_2+2H_2O+I_2\ ;$$
$$2N_2O_2+2H_2O+O_2=4HNO_2,$$

goes on and prevents a definite end-point being reached in the thiosulphate titration. This trouble is avoided if the liquid be rendered neutral by addition of magnesium carbonate. The author proceeds as follows :—The effluent is diluted appropriately with tap-water, thoroughly shaken, and five bottles of about 300 c.c. capacity are filled with the liquid. The amount of oxygen is determined each day by adding 1 c.c. of a 33 per cent. solution of manganous chloride at the bottom of the bottle, followed by 3 c.c. of a solution containing 33 per cent. of sodium hydroxide and 10 per cent. of potassium iodide. After shaking, standing, and allowing to settle, 3 c.c. of hydrochloric acid are added, the bottle is well shaken again, enough magnesium carbonate to neutralise the free acid is added, and the contents are then poured into a flask and titrated with $N/50$ thiosulphate. It is assumed that the amount of nitrite does not change from day to day, an assumption which experience seems to justify.

To determine nitrites, a bottle holding at least 500 c.c., and provided with a tight stopper (a quart milk-bottle with spring-fastened stopper, is convenient), is filled within 20 c.c. with a measured quantity of the water or effluent ; 4 c.c. of manganous chloride solution and 12 c.c. of the caustic soda and potassium iodide solution are added, then 1 grm. of potassium iodide, and the bottle is closed, thoroughly shaken, and allowed to stand overnight. The clear solution is manganese [sodium] nitrite free from dissolved oxygen. A stoppered bottle of about 300 c.c. (known) capacity is carefully filled by siphoning, 3 c.c. of hydrochloric acid are added and the contents thoroughly mixed, then magnesium carbonate is added to neutralisation, and the liberated iodine is titrated with thiosulphate.—J. T. D.

Nicotine in tobacco extracts ("Thanaton") ; Comparative studies on methods for the determination of ——. J. Tóth. Chem.-Zeit., 1911, **35**, 926—927.

The author gives the results of a comparison made by Krampera of the methods of Kissling, Ulex, Degrazia, Koenig, and Tóth for the determination of nicotine in tobacco extracts. In order to render Tóth's method simpler and less expensive, the mixture of ether and petroleum spirit (this J., 1901, 942) has been replaced by xylene, which gives solutions quite suitable for titration or polarisation. The method thus modified is recommended as an international standard process for commercial purposes. Kissling's method was found to be accurate but too tedious for technical use. The method of Ulex gave too high results (compare Kissling, this J., 1911, 305). Degrazia's method (this J., 1911, 506) is simple and rapid, but as the prescribed quantity (180 grms.) of distillate may not always contain the whole of the nicotine, a further quantity of 50 c.c. should be collected and polarised. It was not found possible to use Degrazia's method for the analysis of tobacco, the solutions obtained not being sufficiently pure for polarimetric examination. Koenig's titration method gave accurate results, but the solutions were too dark-coloured for polarimetric examination, even when xylene was used instead of toluene.—A. S.

Electrical precipitation of suspended particles. Cottrell. *See* I.

Patents.

Liquids [water] ; Treatment of ——. C. Neff and A. Brandes, Hanover, Germany. Eng. Pat. 11,938, May 13, 1910.

In order to increase the effect of the process described in Eng. Pat. 12,258 of 1907 (this J., 1907, 1129), the water is caused to travel in frictional contact over an extensive surface of prepared aluminium. The preparation consists in removing the surface skin from ordinary corrugated sheet aluminium by scouring with sand.—W. H. C.

Silent electric discharge ; Utilisation of the —— [for the sterilisation of water]. E. K. Rideal, Elstead, Surrey. Eng. Pat. 18,680, Aug. 8, 1910.

The water is sterilised by the combined effects of the ultra-violet rays and of the ozone which are produced by the same silent discharge, contact between the water and the ozonised air being avoided in the apparatus itself. This consists of three concentric tubes, the outermost and innermost of which are made of aluminium or some suitable metal, the intermediate tube being of quartz or other material pervious to ultra-violet rays. Between the outer tube and the intermediate one water flows, while between the outermost and the innermost tubes the silent discharge takes place. Air passes through the space between the innermost and the intermediate tube and is there ozonised. It may be collected on leaving the apparatus and used to sterilise the water further or for other purposes. The same object may be effected in an apparatus in which the water and air spaces are separated by parallel plates instead of tubes.—W. H. P.

Water ; Process for the clarification and purification of ——. Chem. Fabr. Flörsheim, Dr. H. Noerdlinger. Ger. Pat. 236,754, June 10, 1910.

Products obtained by the action of air and heat on wood tar and wood tar oils, after being rendered soluble in water by means of alkali, are added to the water, and the latter is then treated with sufficient of a soluble silicofluoride or hydrofluosilicic acid to give a neutral or faintly acid reaction. The order in which the reagents are added may be reversed. The silicofluoride and the organic substance interact to form a coarse flocculent precipitate, which includes any iron present in the water, and carries down with it suspended impurities.—A. S.

Draining and utilising slime of any kind, particularly that obtained from sewage ; Process for ——. Richter und Richter, and F. Richter, Frankfort, Germany. Eng. Pat. 17,871, July 27, 1910.

See Fr. Pat. 421,276 of 1910 ; this J., 1911, 479.—T. F. B.

Oxygen baths ; Catalytic process for preparing ——. L. Elkan-Erben G. m. b. H. Ger. Pat. 235,619, Jan. 9, 1910.

To obtain oxygen baths containing a large percentage of dissolved oxygen, it is proposed to add tannin or a substance containing tannin to the water (see also Ger. Pat. 230,175 of 1909; this J., 1911, 284).—T. F. B.

Sterilisation of liquids. V. Henri, A. Helbronner, and M. von Recklinghausen. First Addition, dated May 27, 1910, to Fr. Pat. 403,945, June 11, 1909.

See Eng. Pat. 12,947 of 1910; this J., 1911, 708.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Solanaceous drugs from India. Bull. Imp. Inst., 1911, **9**, 110—116. (See also this J., 1898, 1177; 1901, 66; 1903, 1013; 1905, 149.)

Datura Stramonium. Specimens of the leaves, seeds, roots, fruit, and stems and one very small complete plant were examined. With the exception of the last-named, in which only scopolamine, could be detected, hyoscyamine was the predominant alkaloid in all cases, being in most cases accompanied by scopolamine. No atropine could be detected in any of the samples, but there was evidence of the presence of a third alkaloid in the roots. Indian *Datura Stromonium* appears to be quite equal to the European plant with regard to total content of alkaloids, the figures obtained (referred to dry material) being:—seeds, 0·186; fruits, 0·46; leaves, 0·41—0·45; stems, 0·25—0·26; and roots, 0·214 per cent.

Datura fastuosa. Scopolamine was the predominant alkaloid in the twigs and leaves, and the sole alkaloid in the fruits and roots of this plant grown in Assam. The results with the Indian plants resembled those obtained with European plants.

Datura Metel. The Indian plant (seeds and leaves) contains considerably less alkaloid than the European plant (0·23—0·25 as compared with 0·50—0·55); in one sample scopolamine was the predominant alkaloid as in the European plant, but another sample contained more hyoscyamine than scopolamine.

Hyoscyamus reticulatus. Seeds, 0·082; whole plant (1), 0·240, (2) 0·116 per cent. of total alkaloid. Hyoscyamine was the only alkaloid that was identified. It is stated that camels, sheep, and goats eat this species of *Hyoscyamus.*

Hyoscyamus niger. The results agreed with those obtained with the European plant. Leaves, 0·062; seeds, 0·081 per cent. of total alkaloid.—A. S.

Quinine; Determination of —— in certain organic liquids. T. Cockburn and J. W. Black. Analyst, 1911, **36**, 396—398.

The authors have found Nishi's method of precipitating the quinine from an ethereal solution by means of an ethereal solution of citric acid (Analyst, 1909, **34**, 443) to be accurate. The quinine citrate formed is almost completely insoluble in ether, slightly soluble in cold water and in alcohol, readily soluble in hot water. The authors have slightly modified the manipulative details, and carry out the method (with urine, for example) as follows:—250 c.c. of the urine are made strongly alkaline with sodium hydroxide, warmed, and three times extracted with ether (at as high a temperature as practicable). The combined ether extracts are washed with water, placed in a flask, the ether evaporated, and the residue dried in the steam-bath. It is dissolved in 20 c.c. of anhydrous ether and filtered into a weighed 4-oz. conical flask, with the ethereal washings of flask and filter. With the flask is weighed a filtering-tube, consisting of a small thistle-funnel with 10 mm. bulb packed with asbestos. To the ethereal solution is added 10 c.c. of saturated ethereal solution of citric acid, and after 24 hours the liquid is filtered through the tube by suction, and the precipitate washed three times with 10 c.c. of ether which is similarly drawn off through the filter-tube. Filter-tube and flask are now dried, at first at a low temperature, finally at 100° C., and weighed. The process may be used for the determination of quinine in presence of caffeine, but not for the separation of quinine from other cinchona alkaloids.—J. T. D.

Berberine; Synthesis of ——. A. Pictet and A. Gams. Comptes rend., 1911, **153**, 386—388.

By condensing homopiperonylamine with homoveratryl chloride, homoveratrylhomopiperonylamine was formed; it melted at 136° C. This was dehydrated and reduced with tin and hydrochloric acid with the production of veratrylnorhydrohydrastinine a secondary base, m. pt. 208°—210° C. Hydroberberine was obtained from this compound by dissolving it in hydrochloric acid and heating with methylal, thus completing the synthesis of berberine. (See this J., 1911, 646.)—F. Shdn.

Morphine methyl bromide—"Morphosan." K. Schuster. Zeits. d. allgem. oesterr. Apoth. Verein., July 22, 1911, 303. Pharm. J., 1911, **33**, 275.

Several methods may be employed for the preparation of morphine methyl bromide, $C_{17}H_{19}NO_3(CH_3)Br,H_2O$, which is chemically identical with morphosan. It is obtained by the direct action of methyl bromide upon morphine, or by treating methyl-morphine with hydrobromic acid; also by acting on morphine with dimethyl sulphate, then adding a metallic bromide, evaporating to dryness, and extracting with alcohol, acetone, or methyl alcohol; or the morphine methyl-sulphate first formed may be decomposed by the bromide of a metal forming an insoluble sulphate. Morphine methyl bromide forms white needle-shaped crystals, odourless, having a bitter taste, soluble in water (1 in 20 at 15°), less so in alcohol, almost insoluble in ether, chloroform, and acetone. It becomes anhydrous at 100° to 110°, and melts with decomposition at 264° to 265° C. Like morphine, it gives a blue colour with ferric chloride, and produces a blue precipitate in a dilute solution of ferric chloride and a ferricyanide; if 0·05 grm. is dissolved in 5 or 6 drops of strong sulphuric acid by stirring with a glass rod, it dissolves with a yellow colour, due to the bromine, whereas morphine forms a colourless solution. Other reactions of morphine methyl bromide are as follows:—If the solution in strong sulphuric acid is warmed for fifteen minutes on the water-bath it becomes olive green in colour, and on cooling and adding a drop of nitric acid, a blood-red colour is produced; silver nitrate gives with morphine methyl bromide a yellowish-white precipitate, which becomes brownish on standing from reduction; if 0·01 grm. is stirred with a mixture of 3 or 4 drops of 40 per cent. formaldehyde solution and 3 c.c. of strong sulphuric acid, a red-violet colour is produced, gradually changing to blackish-green; Fröhde's reagent, with a trace of morphine methyl bromide, gives a violet colour, quickly passing into dark green; Erdmann's reagent give a slight yellow colouration, changing to dirty green on warming, finally becoming brown. An aqueous solution of morphine methyl bromide should be neutral and free from sulphate; the absence of morphine may be shown by adding a very little ammonia to the solution and rubbing the sides of the vessel with a glass rod, when not more than an opalescence should result. The compound should leave no ash on ignition, and determination of the bromine by means of silver nitrate should show 21 per cent. in the anhydrous substance.

Œnanthe crocata; Chemical examination of ——. Frank Tutin. Pharm. J., 1911, **87**, 296—298.

The material employed in this investigation consisted of the entire dried plants of *Œnanthe crocata*, Linné, which had been specially collected for the purpose in early spring, and therefore represented chiefly the tuberous roots.

The roots were found to be devoid of enzyme, and no part of the plant, at any stage of growth, contained an alkaloid.

An alcoholic extract of the plant, when kept for some time deposited an amount of crystalline sucrose equivalent to 3·8 per cent. of the weight of dried material employed.

The above-mentioned alcoholic extract, when distilled in a current of steam, yielded a yellow essential oil possessing a somewhat unpleasant odour. This oil had the following constants:—Sp. gr. at 15°/15°=0·9381; a_D = +1° 16′ in a 25 mm. tube. From the portion of the alcoholic extract which was soluble in water there were isolated a small amount of a colourless crystalline substance (m. pt. 83°), which, on keeping, assumed a purple colour, and some salicylic acid. It also contained some amorphous products and a very large amount of dextrose and lævulose. The portion of the extract which was insoluble in water consisted of a dark-coloured, viscid resin amounting to nearly 3 per cent. of the weight of the plant employed. From this material the following compounds were isolated: Triacontane, $C_{30}H_{62}$; hentriacontane. $C_{31}H_{64}$: a phytosterol (m. pt. 135°); ipuranol, $C_{23}H_{38}O_2(OH)_2$; palmitic acid; and a mixture of unsaturated acids consisting chiefly of linolic acid. The greater amount of the material insoluble in water was, however, of a resinous nature. The neutral portions of the petroleum and ether extracts of this resin represent the toxic principle of the *Œnanthe crocata*.

Nitroglycerin [in pharmaceutical preparations]; Determination of minute quantities of ——. W. L. Scoville. Amer. J. Pharm., 1911, **83**, 359—364.

MINUTE quantities of nitroglycerin, such as are contained in tablets and other pharmaceutical preparations, may be conveniently determined by the use of phenoldisulphonic acid, the method of applying the test being essentially the same as in water analysis. In the case of an alcoholic solution, a volume containing 0·00065 grm. (=1/100 grain) of nitroglycerin is allowed to evaporate spontaneously, and, at the same time, an equivalent quantity of a standard solution of potassium nitrate (containing 0·722 grm. of the pure fused salt per litre) is evaporated at a low temperature; 2 c.c. of the phenoldisulphonic acid reagent are added to each dry residue, and the mixture is well stirred and allowed to stand for about ten minutes; then each is diluted with water, rendered slightly alkaline with potassium hydroxide, cooled, diluted to 100 c.c., and the colours are compared in a colourimeter. For tablets, five are powdered, 10 c.c. of alcohol are added, and the mixture is shaken frequently during 1—2 hours; it is then filtered and 2 c.c., or other volume containing 1/100 grain, are evaporated and treated as above.—F. SODN.

Menthol production in Germany and German colonies. H. Thoms. Apoth.-Zeit., 1911, **26**, 686—687.

A NUMBER of peppermint plants were obtained from Japan, the species being *Mentha canadensis var piperascens* Briq. Some of these were cultivated at Dahlem near Berlin, and others in German South West Africa. The Dahlem plants yielded 0·893 per cent. of oil reckoned on the dry weight of the plant. This oil had the sp. gr. 0·8954 at 22° C., and became solid at +14·5° C. The total menthol content was 78·817 per cent. The dried plants from Africa yielded 0·976 per cent. of oil reckoned on the dry material. The sp. gr. was 0·9032 at 22° C. and the oil solidified at 20°—20·5° C. The percentage of total menthol was 84·83. (See this J., 1910, 1472).—F. SHDN.

Ketones in essential oils; Determination of ——. E. K. Nelson. J. Ind. Eng. Chem., 1911, **3**, 588—589.

FROM the results of an examination of Walther's method for the determination of ketones by boiling with excess of an alcoholic solution of hydroxylamine hydrochloride in presence of sodium bicarbonate, and then titrating the excess of hydroxylamine (this J., 1899, 1161; 1900, 78, 1901, 289), the author concludes that the method cannot be recommended for any particular oil until the influence on the reagent of other substances than ketones in the oil has been determined by working with known mixtures. The method however gives fairly accurate results, sufficient to afford a criterion of purity, in the case of oils in which carvone, camphor, pulegone, or thujone is the main constituent.—A. S.

a-Naphthalenic ketones free from the β-isomerides; Method of preparing ——. E. Caille. Comptes rend., 1911, **153**, 393—394.

A SOLUTION of naphthalene sulphocarboxylate and an acid chloride is cooled to 0° C., and freshly sublimed aluminium chloride gradually added. The addition product is filtered off after 24 hours and decomposed by means of water acidulated with hydrochloric acid and cooled with ice. Yields of 60—80 per cent. are obtained, and a single crystallisation or distillation of the product is sufficient for purification.—F. SHDN.

Alcohols, acid anhydrides, ethers, and esters; Photochemical decomposition of ——. D. Berthelot and H. Gaudechon. Comptes rend., 1911, **153**. 383—386.

A QUARTZ vessel of 40 c.c. capacity was filled with ethyl alcohol and placed for four hours at a distance of 6 cm. from a mercury vapour lamp constructed to work at 110 volts, but actually using 3·6 ampères at 45—50 volts. Of the gas produced, 70 per cent. was hydrogen. Some aldehyde was produced. Ethers under these circumstances gave less hydrogen and more hydrocarbons, but no carbon dioxide. Methyl ether gave a mixture of carbon monoxide, hydrogen and methane. Anhydrides of acids gave no hydrogen. Acetic anhydride yielded carbon dioxide, carbon monoxide, methane, and ethane. Esters gave both carbon monoxide and carbon dioxide in varying proportions, besides combustible gases. A similar result was obtained with ethyl acetoacetate. The esters of aromatic acids were less readily decomposed. (See this J., 1910, 1081).—F. SHDN.

Musk trade of Tibet. Perfumery and Ess. Oil Record, 1911, **2**, 188. [T.R.]

IT is stated that musk is the most important article of export from Tibet, being sent in large quantities to Europe. The principal market is at Tatsienlon, the capital of the Principality of Kiala. At this town from 25,000 to 30,000 pockets, weighing from 1000 to 1200 kilos., are sold annually between September and April. Fifty years ago musk was sold at twice its weight in silver: its value is now 12 to 13 times its weight in silver. Three qualities are recognised by the Tibetans—first, golden yellow; second, clear red brown; and third, deep red brown. Occasionally a variety of a very clear yellow colour is met with, and is valued highly. The musk is almost always sold in "pockets." The "pockets" are frequently adulterated by the Tibetans, who add foreign matter to increase their bulk, and as the Tibetans will not allow previous examination of the contents of the pockets, great experience is necessary in buying. The Chinese merchants at Tatsienlon are also said to adulterate to the extent of 75 per cent., by the addition of a mixture of blood, yolk of egg, and meal, which is pounded and heated until its colour is that of musk, and this fraud is still more difficult to detect. The musk is sent to Tonking, from whence it is exported direct to Europe. According to Chinese Customs statistics the following quantities of musk passed through that port during the five years named:—

	Kilos.	Value.
1905 ..	1411 ..	£94,400
1906 ..	1424 ..	90,880
1907 ..	1709 ..	148,400
1908 ..	1358 ..	97,120
1909 ..	1240 ..	82,400

Citronella oil. Proposed standards, and determination of geraniol. J. C. Umney. Perfumery and Ess. Oil Record, 1911, **2**, 172.

As the result of experiments by the author in conjunction with E. J. Parry and the chemists of several large soap manufacturers the following characters and tests for Ceylon citronella oil for judgment of its purity and odour value are given:—Sp. gr. at $\frac{15·5° C.}{15·5° C.}$, 0·898 to 0·910; optical rotation, −7° to −13°; acidity expressed as acetic acid, not above 0·25 per cent.; soluble in 2—3 vols. of 80 per cent. by vol. alcohol and clear on further addition of the alcohol up to 10 vols.; acetylisable constituents stated as geraniol, at least 58 per cent.

For the determination of the geraniol, 10 c.c. of the oil with 15 c.c. of acetic anhydride (Note 1) and 1 grm. of anhydrous sodium acetate are boiled for two hours under a reflux condenser. The mixture is cooled without removing the flask from the condenser, and about 50 c.c. of water are slowly added through the condenser tube. The contents of the flask are heated to not more than 70° C. for about 10 minutes, poured into a separating funnel and washed with cold neutral brine (Note 2) until all soluble acid is removed. The washed acetylated product is dried with anhydrous normal sodium sulphate, and from 2·5 to 5 grms. saponified with alcoholic potash in the usual way. Any free acidity is neutralised before measuring the volume of $N/2$ potassium hydroxide, and saponification is completed by heating on a boiling water bath for 45 minutes. The excess of alkali is titrated with $N/2$ acid.

Note 1.—The acetic anhydride should contain at least 95 per cent. of actual anhydride, and be free from higher homologues.

Note 2.—Water may be used instead of brine, but the latter is to be preferred, as it separates more rapidly from the oil.

Nitrous oxide. Chemistry of anaesthetics. III. Baskerville and Stevenson. *See* VII.

Patents.

Therapeutic [bacterial] preparations; Manufacture of ——. Kalle und Co., Akt.-Ges., Biebrich on Rhine, Germany. Eng. Pat. 29,559, Dec. 20, 1910. Under Int. Conv., Jan. 3, 1910. Addition to Eng. Pat. 21,414 of 1910, dated Sept. 14, 1909 (see this J., 1911, 307).

The power possessed by choline and neurine of dissolving the bodies of acid-resisting bacteria (*e.g.*, tubercle bacilli), is found to be common to bases of the ammonium group and to their acidyl derivatives; this invention consists in the use of such compounds, other than choline and neurine, for the above purpose. *Example.*—Ten grms. of moist tubercle bacilli are finely triturated with from 10 to 20 grms. of a 50 per cent. solution of tetramethylammonium hydroxide: liquefaction is completed by allowing the mass to stand at about 35° C. The solution takes place more rapidly at 50°—52° C. Other examples are given in which dimethyldiethylammonium hydroxide, trimethylbenzylammonium hydroxide, and benzoylmethoxytrimethylammonium hydroxide are used. The solutions produced may be concentrated by addition of lecithin, cerebrin, etc., until the finished preparations contain about 10 per cent. of bacilli and 2 per cent. of lecithin.—T. F. B.

Organic derivatives of arsenic acid; Manufacture of ——. H. Bart, Bad Dürkheim, Germany. Eng. Pat. 568, Jan. 9, 1911. Under Int. Conv., Jan. 7, 1910.

Aryl substitution products of arsenic acid, having the general formula, $RAsO(OK)_2$ (where K denotes a cation), are manufactured by causing compounds containing the group, $—As(OK)_2$ or $—As=O$, to react in neutral, acid, or alkaline solution, or suspension, preferably with the application of heat, on aromatic diazo compounds which, besides the diazo group, may contain carboxyl or other substituent, but excepting normal diazobenzene. For example, *p*-bromophenylarsonic acid is prepared by dissolving one part of *p*-bromoaniline in 2 parts of concentrated hydrochloric acid (sp. gr. 1·16) and 10 parts of water, diazotising in the usual way, and introducing 3 parts of sodium arsenite into the diazo solution, the sodium arsenite being dissolved in 5 parts of water and 1 part of 96 per cent. alcohol; then slowly heating the solution to 70° C., and, when the evolution of nitrogen ceases, filtering from the separated oil, and adding hydrochloric acid to precipitate the compound, which crystallises in white needles, sparingly soluble in water; it may be recrystallised from alcohol.
—F. Sodn.

Arsenophenols; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 235,430, July 28, 1910. Addition to Ger. Pat. 206,456, Dec. 6, 1907 (this J., 1909, 328).

The halogen derivatives of hydroxyarylarsinic acids are converted by reduction into halogenated hydroxyarylarsenoxide and finally into halogenated arsenophenols, which differ from the non-halogenated compounds in that they form alkali salts which are soluble in neutral solutions (see also Eng. Pat. 4246 of 1909; this J., 1909, 1167).—T. F. B.

Phenylalkylacetic acid; Derivative of ——. W. Kropp and L. Taub, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 996,096, June 27, 1911.

Claim is made, in general, for amide compounds of the phenylalkylacetic acids of the formula,

$$C_2H_5.CY(C_6H_5).CO.NH.X,$$

(where X indicates hydrogen replaceable by $—CO.NH_2$ and Y hydrogen replaceable by alkyl); and, in particular, for the amide of phenylethylacetic acid,

$$C_2H_5.CH(C_6H_5).CO.NH_2.$$

The latter melts at 86° C. and the urea compound at 147° C. The amide of phenyldiethylacetic acid melts at 54° C., and its ureide at 132°—133° C. The amide compounds claimed are crystalline bodies, soluble in hot alcohol and hot benzene, and possessing sedative, hypnotic and antipyretic properties.—W. E. F. P.

Suprarenal gland; Process of preparing extractive compounds of the ——. C. E. Vanderkleed, Collingswood, N.J., Assignor to H. K. Mulford Co., Philadelphia, Pa. U.S. Pat. 1,000,214, Aug. 8, 1911.

The precipitate obtained by treating a zinc sulphate extract of the suprarenal gland with ammonia is mixed with an aqueous solution of boric acid; the insoluble zinc borate is then removed by filtration. The filtrate thus obtained contains the physiologically-active substances of the gland.—W. P. S.

Nicotine; Industrial synthesis of ——. J. A. A. Anzies. First Addition, dated Feb. 22, 1911, to Fr. Pat. 425,370, Jan. 3, 1911 (see this J., 1911, 923).

Nicotine may be prepared by the condensation of halogen or hydroxyl derivatives of methylpyrrol or of methylpyrrolidine with pyridine. For example, an equimolecular mixture of methylpyrrol and pyridine is passed, together with thionyl chloride, over a mass of a metallic chloride, such as aluminium chloride; the methylpyrrol derivative condenses at once with the pyridine, forming nicotyrine, which is readily hydrogenated to nicotine by treatment with zinc and hydrochloric acid, iron and acetic acid, hydrogen in presence of iron or cobalt at 250° C., etc. When methylpyrrolidine is employed in place of methylpyrrol, nicotine is formed directly. The halogen or hydroxyl derivatives of methylpyrrol or methylpyrrolidine must be used in the nascent state or as soon as prepared, as they are very unstable.—T. F. B.

Formaldehyde; Manufacture of ——. Soc. l'Air Liquide. Fr. Pat. 426,873, May 14, 1910.

A mixture of oxygen with a large excess of methyl alcohol vapour is passed over a suitable catalytic agent, such as copper, pumice, etc., which may be heated in order to start the reaction; the process is regulated according to need, by varying the proportions of alcohol and oxygen, and by altering the velocity of the mixture, in such a manner that no considerable amount of carbon dioxide is formed. The gases passing from the apparatus are condensed as usual. The condensed liquid consists of formaldehyde diluted with unoxidised methyl alcohol; it may be conveniently separated by adding sufficient water to reduce the aldehyde to 40 per cent. strength, and then distilling the mixture in a rectifying column. The process is said to be much more rapid and to give higher yields than when air is used as the oxidising agent.—T. F. B.

Medicinal plants or vegetable products; Process for preparing —— *to facilitate the extraction by infusion of their active principles.* H. Allendorff. Fr. Pat. 427,839, March 28, 1911.

To obtain infusions of certain plants, such as haricot husks, stigmata of maize, etc., which possess diuretic properties, it is necessary to continue the extraction for long periods, during which some of the active principles may be destroyed. It is found that a preliminary treatment of the material, reduced to powder or small fragments, with water saturated with carbon dioxide, and the evaporation of the whole to dryness, furnishes a product from which 30 per cent. more extract can be obtained, on subsequent infusion with boiling water, than when the carbon dioxide treatment is omitted.—T. F. B.

Cinnamic acid esters ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 235,357, May 19, 1910.

Esters of cinnamic acid with polyhydric alcohols are obtained by esterifying cinnamic acid or its salts or derivatives with the alcohol or its derivatives, or by heating a salt of cinnamic acid with water and the dihalogenide corresponding to the alcohol. The products form efficient substitutes for Peru balsam for use in skin treatment ; they are more easily soluble, and therefore more easily absorbed, than the benzyl cinnamate contained in Peru balsam.—T. F. B.

Hydrastinine derivatives ; Process for preparing 1-alkyl-, 1-aralkyl-, or 1-aryl- ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 235,358, June 3, 1910.

The acidyl derivatives of homopiperonylamine (with the exception of the formyl derivative) are converted by treatment with condensing agents into dihydro-isoquinoline bases, which are then transformed into the halogen-alkylates or halogen-aralkylates. The products possess therapeutic properties similar to those of hydrastinine itself (compare Ger. Pat. 234,850 of 1910 ; this J., 1911, 923).—T. F. B.

Diglycollic acid esters with phenols and their derivatives ; Process for preparing ——. C. F. Boehringer und Söhne. Ger. Pat. 236,045, Dec. 4, 1909. Addition to Ger. Pat. 223,305, May 22, 1908 (see this J., 1910, 1227).

The esters of diglycollic acid with phenols, described in the chief patent, may also be prepared by treating mixtures of phenols or substituted phenols and diglycollic acid or its salts, with an acid condensing agent, such as phosgene, phosphorus oxychloride, phosphorus halides, etc., with or without addition of a tertiary organic base and an indifferent solvent ; these additions are desirable when the reaction is carried out without applying heat. —T. F. B.

Unsaturated hydrocarbons ; Process for preparing sulphurous acid compounds of ——. Badische Anilin und Soda Fabrik. Ger. Pat. 236,386, Aug. 19, 1910.

Unsaturated hydrocarbons with two double linkages, of the general formula, R.R.C : CR.CR : C.R.R, where R is hydrogen, alkyl, or aryl, are converted into sulphurous acid derivatives by the action of sulphur dioxide, either alone or in presence of a suitable diluent. The compounds are colourless ; if only small quantities of sulphur dioxide are used the products are partially soluble in water ; by using larger amounts and increasing the time of the reaction, insoluble products are formed. All the products are decomposed by heat into sulphur dioxide and the original hydrocarbon ; this property may be employed for isolating such hydrocarbons from mixtures. The examples given in the specification show the application of the process to 2.3-dimethyl-1.3-butadiene and to crude isoprene obtained from oil of turpentine.—T. F. B.

Oleum cadinum ; Process for preparing a nearly odourless and non-irritant, therapeutically active preparation from ——. E. Ganz. Ger. Pat. 236,446, July 27, 1910.

The oil is subjected to a long process of heating and stirring, the temperature being gradually increased, until a viscous fluid is obtained on cooling. The product is brown in colour, and possesses all the therapeutic activity of the original oil, but has only a faint, not unpleasant odour, and does not irritate the skin.—T. F. B.

Compounds rich in sulphur (thiozonides) ; Process for preparing ——. P. Koch. Ger. Pat. 236,490, Aug. 27, 1909. Addition to Ger. Pat. 214,950, March 19, 1908 (see this J., 1909, 1326).

In place of using terpene alcohols and esters, as in the principal patent, it is proposed to employ such pure terpenes, free from oxygen, or natural or artificial mixtures containing the terpenes, as will take up more than half their weight of sulphur when heated, before evolution of hydrogen sulphide commences. Whereas turpentine oil can take up no more than 30 per cent. of its weight of sulphur, many pure terpenes, obtained by eliminating water from the corresponding alcohols, can add on much greater amounts of sulphur when heated to 140°—160° C. ; for example, myrcene takes up more than 70 per cent. of its weight, and limonene as much as 100 per cent.—T. F. B.

Ethyl alcohol ; Process for preparing absolute ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 236,591, Dec. 22, 1909.

Ninety per cent. or stronger alcohol can be completely dehydrated in a short time by means of anhydrous sodium sulphide. The sulphide is indifferent towards ethyl alcohol, and can be entirely recovered by heating after use.—T. F. B.

Lecithin ; Process for producing —— from the seeds of leguminous plants and other vegetable products. H. Buer. Ger. Pat. 236,605, Sept. 17, 1910.

The materials containing lecithin are extracted with about 50 times the quantity of 96 per cent. alcohol (calculated on the extractive matter present) at a pressure of one-half to one atm., or by means of a reflux condenser, at 80°—90° C. After standing for a long time to allow the fat, cholesterol, and colouring matters to separate, the alcoholic extract, containing the lecithin and the bitter principles, is evaporated to about 60 or 80 per cent. of its volume and again allowed to stand for a long time until the lecithin has separated. It is stated that by this process the lecithin is obtained entirely free from fat and bitter principles.—T. F. B.

Mercury compounds of the indole series ; Process for preparing ——. C. F. Boehringer und Söhne. Ger. Pat. 236,893, May 18, 1910.

A new series of therapeutic compounds, insoluble in alkali, is obtained by the action of mercuric acetate on indole derivatives.—T. F. B.

Acetaldehyde and condensation and polymerisation products thereof ; Manufacture, from acetylene, of ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 29,073, Dec. 14, 1910.

See Fr. Pat. 425,057 of 1911 ; this J., 1911, 923.—T. F. B.

Nitrophenylnitromethanes, their homologues and derivatives ; Manufacture of ——. Soc. Chim. des Usines du Rhône, ancien. Gilliard, P. Monnet, et Cartier, Paris. Eng. Pat. 6076, March 10, 1911. Under Int. Conv., March 12, 1910.

See Fr. Pat. 426,635 of 1911 ; this J., 1911, 981.—T. F. B.

Dimethylphenylbenzylammonium sulphonic acid ; Manufacture of a ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 9359, April 15, 1911. Under Int. Conv., Aug. 30, 1910. Addition to Eng. Pat. 7204 of 1911, dated March 22, 1910.

See Ger. Pat. 234,916 of 1910 ; this J., 1911, 982.—T. F. B.

Phenolphthalein di-isovalerate. H. Vieth, Assignor to Knoll und Co., Ludwigshafen on Rhine, Germany. U.S. Pat. 998,726, July 25, 1911.

See Eng. Pat. 27,095 of 1908; this J., 1909, 674.—T. F. B.

Casein; Soluble ——. C. A. Baechler, Zürich, Switzerland. U.S. Pats. 999,083 and 999,084, July 25, 1911.

See Eng. Pat. 6247 of 1908; this J., 1908, 1036.—T. F. B.

Tobacco; Method of removing nicotine from ——. J. Sartig, Nikolassee, Germany. U.S. Pat. 999,674, Aug. 1, 1911.

See Eng. Pat. 11,460 of 1910; this J., 1911, 109.—T. F. B.

Salts of halogenised fatty acids of high molecular weight; Process for producing ——. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 426,793, Nov. 29, 1910. Under Int. Conv., Dec. 24, 1909.

See Eng. Pat. 28,871 of 1910; this J., 1911, 648.—T. F. B.

Hydro-cinchona alkaloids; Process for making ——. Verein. Chininfabr. Zimmer und Co. Fr. Pat. 426,953, Jan. 3, 1911. Under Int. Conv., March 26, 1910.

See U.S. Pat. 989,664 of 1911; this J., 1911, 649.—T. F. B.

Yohimbine derivatives soluble in water; Process for manufacturing ——. F. Landé and E. Simon. Fr. Pat. 427,095, March 9, 1911.

See Eng. Pats. 14,576 of 1910 and 877 of 1911; this J., 1911, 307 and 711.—T. F. B.

Mineral waters and similar preparations; Process for rendering radio-active artificial ——. H. H. Hewitt. Fr. Pat. 427,741, March 25, 1911. Under Int. Conv., April 2, 1910.

See Eng. Pat. 7954 of 1910; this J., 1911, 572.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Photographic prints; Method of toning ——. W. Triepel, Berlin. Eng. Pat. 24,378, Oct. 20, 1910.

The toning solution consists of potassium ferricyanide (15 grms.), potassium bromide (10), sodium sulphite (4), thiourea (2), and sodium hydroxide (2 grms.) dissolved in a litre of water. If the mixed solids are to be stored in tablet form, lithium oxide is used instead of sodium hydroxide.—G. W. McD.

Photographic screens; Method of manufacturing polychrome ——. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils, Lyon-Monplaisir, France. Eng. Pat. 8153, March 31, 1911. Under Int. Conv., April 7, 1910.

See Fr. Pat. 425,586 of 1910; this J., 1911, 925.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Trinitrotoluene and tetranitromethylaniline. Vasquez. *See* III.

New uses of explosives in agriculture. Gunsolus. *See* XVI.

Patents.

Detonating compositions for use in rim-fire cartridges, percussion caps, and the like. Eley Bros., Ltd., Edmonton, and E. Goodwin, London. Eng. Pat. 2682, Feb. 2, 1911.

Mercury fulminate containing 22 per cent. of water (3 parts) is incorporated with a powdered mixture of barium peroxide (16), stibnite (7), and trinitrotoluene (4½ parts). The mercury fulminate is used in the form of a "mud," obtained by precipitation from its solution in potassium cyanide or pyridine. Powdered glass, sulphur and other ingredients may also be added if required.—G. W. McD.

Blasting-cartridges; Device for introducing energising material into the charge of ——. G. M. Peters, Cincinnati, and M. F. Lindsley, Kings Mills, Ohio, Assignors to The King Powder Co., Cincinnati, Ohio. U.S. Pat. 999,396, Aug. 1, 1911.

A receptacle for containing an explosive is connected at its base with a controlled horizontal outlet-pipe to which a vertical tube, pointed at its lower end and provided with a piercing arrangement and a pointed valve, is attached. A predetermined quantity of explosive is admitted to the tube which is adapted for insertion into the charge of a blasting-cartridge.—W. E. F. P.

Explosives; H. Chamant. Fr. Pat. 427,188, May 20, 1910.

Chlorates or perchlorates of the alkali metals are incorporated with a jelly, made by gelatinising collodion cotton with liquid organic nitro or azo compounds, at about 40°—50° C. The following are given as examples: Potassium chlorate (80 parts) and jelly (20 parts). Sodium chlorate (70 parts) and jelly (30 parts). Ammonium perchlorate (80 parts) and jelly (20 parts).—G. W. McD.

Bursting charges and explosives for shells, mines and torpedoes; Method of manufacture of ——. C. E. Bichel. Fr. Pat. 427,566, March 20, 1911. Under Int. Conv., March 21, 1910.

Bursting charges (trinitrotoluene, etc.), which are kept separate from the shells until they are required for use, are usually contained in cardboard or metallic cases. It is proposed, after melting and casting the explosive in the required shape, to cover the charge with a thin conducting envelope. On placing the charge, so prepared, in a galvanising bath and passing a current, a very thin metallic sheath encloses the whole charge, rendering it moisture-proof, and allows almost maximum charging density.
—G. W. McD.

Explosive charges; Method of increasing the efficiency of ——. M. Mallett, Saint Etienne, France. Eng. Pat. 3879, Feb. 15, 1911. Under Int. Conv., Feb. 17, 1910.

See Fr. Pat. 412,751 of 1910; this J., 1910, 1038.—T. F. B.

Explosives; Process for making material for ——. Satanite Powder Co. of California. Fr. Pat. 427,838, March 28, 1911.

See U.S. Pat. 989,519 of 1911; this J., 1911, 650.—T. F. B.

Phosphorus with sulphur (sulphur phosphides); Process for producing compounds of —— *rich in sulphur and which are suitable for the production of non-poisonous priming materials.* V. Paul, Kassel, Germany. Eng. Pat. 29,989, Dec. 24, 1910.

See Fr. Pat. 424,522 of 1910; this J., 1911, 769.
—G. W. McD.

XXIII.—ANALYTICAL PROCESSES.

Iron; Precipitation of —— *by hydrazine hydrate.* E. Schirm. Chem.-Zeit., 1911, 35, 897.

Iron is found to be completely precipitated by hydrazine from ferric solutions containing sulphuric acid without a trace of this acid being carried down. 10 per cent. ammonia is first added to the boiling ferric solution until a slight turbidity persists, and hydrazine is then added drop by drop until the precipitation is complete. The reddish-brown precipitate rapidly changes to a black granular powder which is easily washed. It is dried, burnt with the filter, strongly ignited and weighed as ferric oxide. Alternatively the iron is precipitated from the hot solution by an excess of ammonia as directed by Pattinson (this J., 1905, 7), and then a few drops of hydrazine are added to convert the precipitate into the black powder. Attempts to effect a simple and rapid separation of iron and zinc by precipitating the iron with hydrazine were unsuccessful, the zinc being partly carried down.—A. Sbld.

Separations; Scheme of analytical —— without the use of hydrogen sulphide. E. Ebler. Z. anal. Chem., 1911, **50**, 603—609. (See also this J., 1898, 1187; 1905, 859.)

The author has previously formulated a scheme of qualitative analysis without the use of hydrogen sulphide by employing hydroxylamine and hydrazine salts and hydrogen peroxide (Z. anal. Chem., 1905, **48**, 61). Instead of distilling off the arsenic after separation of the silver and phosphoric acid, it is now found preferable to distil off this element at the outset, by heating the substance with hydrazine bromide and concentrated hydrochloric acid, according to Jannasch and Seidel's method (this J., 1910, 722). In the separation of barium from strontium by concentrated hydrochloric acid (Z. anal. Chem., 1909, **48**, 175) it is recommended to filter through asbestos (in a Gooch crucible) instead of using a hardened filter, as the success of the separation depends on the rapid filtration of the barium chloride. The alkali metals are best separated in a fresh portion of the original substance, after treatment with baryta or after fusion with ammonium chloride and calcium carbonate.—A. Sbld.

"Cupferron"; Quantitative separations by means of ——. O. Baudisch. Chem.-Zeit., 1911, **35**, 913.

In view of the fact that "cupferron" (the ammonium compound of nitrosophenylhydroxylamine—see this J., 1910, 115) is not now obtainable commercially, the author gives the following detailed directions for preparing it:—60 grms. of nitrobenzene, 30 grms. of ammonium chloride, and 1 litre of distilled water are thoroughly stirred or shaken in a capacious flask till completely and uniformly emulsified. The flask is kept cool (not above 16°—18° C.) whilst zinc-dust is gradually added with continuous shaking, till the odour of nitrobenzene ceases (80 grms., more or less, will be needed, and the operation will require about half-an-hour). The liquid is filtered with suction, the zinc hydroxide washed once or twice, the filtrate cooled to 0° C. and saturated with sodium chloride. The precipitated phenylhydroxylamine, 70—85 per cent. of the theoretical yield, is filtered off, and dried between filter-paper. (Being a poisonous substance, and readily absorbed by the skin, any upon the person must be washed off with water and alcohol.) It is now dissolved in 300—500 c.c. of ordinary commercial ether, filtered, and cooled to 0° C. Dry ammonia gas is now passed through for 10 minutes, and then somewhat more than the calculated quantity of amyl nitrite is added suddenly (excess is not disadvantageous). At once the whole mass becomes solid and rises in temperature, through the sudden precipitation of the ammonium nitrosophenylhydroxylamine. The crystals are filtered, washed with ether, dried on filter-paper, and kept in a well stoppered bottle containing a lump of solid ammonium carbonate. In this condition the substance will keep indefinitely.—J. T. D.

Iron and vanadium; The ether separation of ——. E. Deiss and H. Leysaht. Chem.-Zeit., 1911, **35**, 869—871, 878—879.

A source of error in the separation of vanadium from iron by means of ether is the slight solubility of quinquevalent vanadium in ether. The first separation yields only about 90 per cent. of the total vanadium. To obtain all the vanadium, about 10 washings of the separated ether with hydrochloric acid (sp. gr. 1·10) saturated with ether are necessary, but if with the hydrochloric acid a few drops of hydrogen peroxide are added, the vanadium dissolved in the ether can be completely removed by 3 or 4 washings. An indication of the final removal is given by the colour of the separated acid. Under 0·01 per cent. of vanadium in steel can be accurately determined by means of this modification. The authors recommend the use of the separating funnel devised by Rothe.—T. St.

Nitrate and nitrite; Some sources of error in the gasometric determination of —— by the methods of Schlösing and Piccini. O. Ruff and E. Gersten. Z. anorg. Chem., 1911, **71**, 419—426.

The authors have examined the effect of arsenites and sulphides on the gasometric analysis of nitrates and nitrites. The results obtained show that in the determination of nitrates by Schlösing's method (see De Koninck, this J., 1894, 763), low results are obtained in presence of arsenious acid or of hydrogen sulphide. In presence of arsenious acid a portion of the nitric acid is reduced to nitrous acid which is absorbed by the liquid in the nitrometer, whilst in presence of hydrogen sulphide, ammonia is formed in addition to nitric oxide and is absorbed by the acid reaction mixture. In Piccini's method (see Pellet and De Koninck, this J., 1901, 156), for the determination of nitrites, arsenious acid is without influence if neutral solutions be used, but hydrogen sulphide renders the method useless owing to the partial reduction of the nitrous acid to ammonia.—A. S.

Residues; Analysis of insoluble ——. E. Ebler. Z. anal. Chem., 1911, **50**, 610—614.

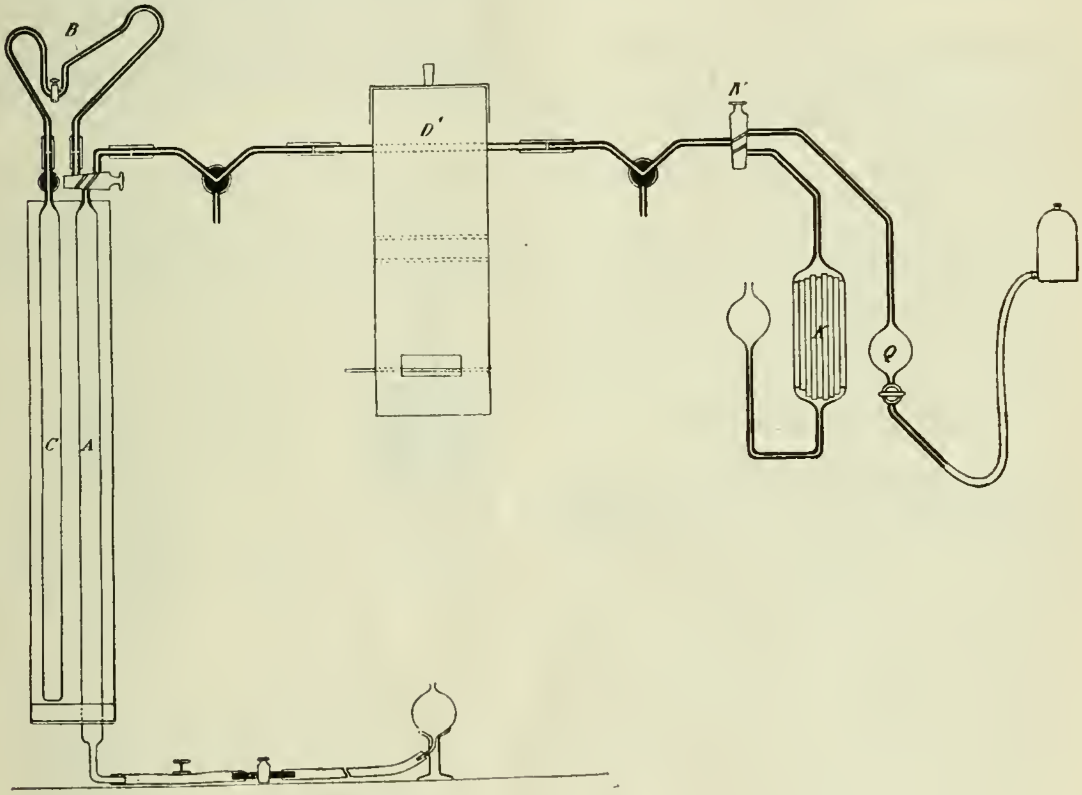
The substance is first extracted with a hot nitric acid solution of ammonium nitrate to dissolve any lead chloride or sulphate. The residue is fused with alkali bisulphite (avoiding too high a temperature). The melt, after addition of a few drops of dilute hydrochloric acid, is extracted with water and the mixture filtered. The filtrate contains the metals orginally present as insoluble (ignited) oxides and as complex cyanogen compounds. The insoluble portion of the melt is triturated with water to a thin paste which is shaken, at the ordinary temperature, with an equal quantity of zinc dust and some dilute sulphuric acid; the mixture is filtered and the residue washed. The filtrate contains the halogens originally combined with silver; the residue is treated, on the filter, with warm dilute nitric acid till all the silver and zinc are dissolved, and the silver is precipitated in the solution by hydrochloric acid. The residue is ignited (with the filter), weighed and fused in a covered porcelain crucible with 2—3 times the quantity of such a mixture of sodium and potassium carbonates and sulphur as should just suffice to convert the residue (taken as tin oxide) into sodium sulphostannate. The mixture is covered with a layer of sodium and potassium carbonates to prevent the sulphur being burned off, and the fusion is continued at a moderate temperature, until brownish-yellow spots appear. The fusion is thoroughly extracted with hot water; tin and antimony sulphides are precipitated from the aqueous extract by dilute acids, then filtered off, washed and separated by one of the ordinary methods. The filtrate from the sulphides is freed from hydrogen sulphide and sulphur, and treated as stated below. The insoluble portion of the alkali-sulphur melt is fused with calcined sodium carbonate over the blowpipe and the fusion well extracted with hot water. The insoluble portion contains the alkaline earths which are separated by one of the usual methods. The aqueous extract of the fusion is acidified with hydrochloric acid, united with the filtrate from the tin and antimony sulphides and evaporated to dryness. The residue is heated to 150°—200° C. to render the silica insoluble and then extracted with hot dilute nitric acid. Phosphoric acid is precipitated by addition of ammonium molybdate to the acid filtrate. The residue of silicic acid on the filter is ignited, weighed, and identified by heating with magnesium powder or with hydrofluoric acid.—A. Sbld.

Halogens in organic compounds; New method for determining ——. T. St. Warunis. Chem.-Zeit., 1911, **35**, 906—907.

To determine halogens in organic compounds the author fuses the substance with sodium peroxide and potassium hydroxide as directed in his method for determining sulphur (this J., 1910, 1476). The melt, after cooling, is dissolved in water, and dilute nitric acid (free from chlorine) is added drop by drop to the cold solution, care being taken to avoid any heating. The acid liquid is then filtered, if necessary, and the halogen determined either gravimetrically by precipitation with silver nitrate, or volumetrically after neutralising the solution with alkali hydroxide. With compounds containing iodine, small quantities of alkali iodate are formed; a few drops of sulphurous acid are therefore added, with stirring, to the solution of the melt to reduce the iodate and to fix any iodine liberated by the nitric acid. It was found that no alkali cyanide was formed in the analysis of substances also containing nitrogen.—A. Sbld.

Gas analysis by fractional combustion. L. Ubbelohde und de Castro. J. Gasbeleucht., 1911, **54**, 810—814.

When a mixture of hydrogen, carbon monoxide, methane and ethane is passed over copper oxide heated to 270° C., only the hydrogen and carbon monoxide are burnt. The contraction is equal to the volume of hydrogen in the sample, and the volume of carbon dioxide formed to that of the carbon monoxide. If the remaining gas be passed over copper oxide heated to bright redness, the methane and ethane are burnt. The increase in volume is equal to the volume of ethane burnt, and the volume of carbon dioxide formed is equal to the volume of methane and twice that of the ethane. In this way, the volumes of the four constituents can be determined. The analysis is carried out by means of the apparatus shown. The gas, which may be coal-gas from which carbon dioxide, oxygen and unsaturated hydrocarbons have been removed by absorption in the usual way, is measured over mercury in a Drehschmidt burette, A, which may be connected with a manometer, B, and compensating tube, C. The burette is connected with a quartz combustion tube, 20 cm. long and 7 mm. internal diameter with walls about 1 mm. thick, and this is connected with a cock, IV, leading to a potash pipette, K, or to a pipette, Q, filled with mercury. The quartz tube is packed with copper oxide and is surrounded by a vertical sheet-iron casing, D^1, so that it can be kept at a steady temperature of 270° C. by a burner in the lower part of the casing. The tube can also be heated to redness by a burner placed beneath it. Before commencing the combustion the quartz tube is filled with nitrogen. The gas is passed to and fro over the copper oxide, heated to 270° C., six times from the burette, A, to the pipette, Q, and is then allowed to cool and the contraction and the volume of carbon dioxide are determined. The combustion tube is then heated to redness and the process is repeated.—A. T. L.



Testing Transvaal coals. Murray. *See* IIa.

Use of "hyperol" [compound of hydrogen peroxide and urea] in the laboratory. J. Milbauer. *See* VII.

Valuation of calcium nitrate and nitrite. Stutzer and Goy. *See* VII.

Analysis of monazite sand. Chesneau. *See* VII.

Separation [and determination] of cerium. James and Pratt. *See* VII.

New reaction for hydrogen peroxide. Von Sobbe. *See* VII.

Nitrous oxide. Chemistry of anaesthetics. III. Baskerville and Stevenson. *See* VII.

Rapid analysis of cement. Wiley and Ernst. *See* IX.

Loss of carbon during solution of steel in potassium cupric chloride. Isham. *See* X.

Determination of rust. Jacob and Kaesbohrer. *See* X.

Electrolytic determination of copper. Traphagen. *See* X.

Analysis of manganese bronze. Huber. *See* X.

Assay of wolfram concentrate. Hutchin. *See* X.

Tantalum for standard weights. *See* X.

Determination of caoutchouc as tetrabromide. Spence and Galletly. *See* XIV.

Determination of caoutchouc by Budde's method. Influence of protein. Spence and Galletly. *See* XIV.

Preparation of neutral ammonium citrate solutions by the conductivity method. Hall. *See* XVI.

Reduction of potassium platinichloride in the determination of potassium [*in fertilisers*]. Fiechter. *See* XVI.

Determining moistures in beet seed. Plahn-Appiani. *See* XVII.

Uniform determination of dry substance in all kinds of sugar products. Koydl. *See* XVII.

Valuation of barley in view of the probable yield of extract from the malt. Lintner. *See* XVIII.

Determination of volatile acids in wine. Windisch and Roettgen. *See* XVIII.

Determination of the specific gravity of very small quantities of milk. Kreidl and Lenk. *See* XIXA.

Examination of linseed cake. Vuaflart. *See* XIXA.

Determination of organic matter in waters by permanganate. Noll. *See* XIXB.

Volhard's method for the determination of chlorine in potable waters. Stuart. *See* XIXB.

Determination of dissolved oxygen absorbed by sewage effluents containing nitrites, and of the amount of nitrite in sewage effluents and in water. Clarke. *See* XIXB.

Determination of nicotine in tobacco extracts. Tóth. *See* XIXB.

Determination of quinine in certain organic liquids. Cockburn and Black. *See* XX.

Determination of ketones in essential oils. Nelson. *See* XX.

Determination of minute quantities of nitroglycerin. Scoville. *See* XX.

PATENTS.

Illuminating power of gas; Apparatus for testing the ——. H. O. Carr and U. O. S. Nairne, London. Eng. Pat. 18,199, July 30, 1910.

An apparatus for testing the illuminating power of gas as it comes directly from the exhausters, comprising a condenser, purifier and photometer. The photometer, which may also be used alone with clean gas, is of the jet type, the burning gas issuing from a standard nozzle being regulated to a constant height by a micrometer tap, and the pressure measured in order to determine the illuminating power. To allow for differences in the specific gravity of the gases tested, a tap with a quadrant graduated empirically in specific gravities is provided between the pressure gauge and jet. The pressure gauge described is of the float, chain and pointer type.—B. M. V.

Indicating the presence or escape of gases; Means for ——. A. di Legge, Ancona, Italy. Eng. Pat. 22,303, Sept. 26, 1910.

Two compound metallic strips formed preferably of zinc and iron are arranged parallel to each other at a short distance apart. To the surface of one of the plates a small quantity of platinum sponge is fixed and the plates are connected with a battery and electric bell so that should the plates come into contact a current flows and the bell is rung. When the temperature of the air surrounding the plates rises, the device becomes heated as a whole, and, owing to the construction, no deformation of the plates occurs. But when the atmosphere contains even a small quantity of an inflammable gas, the catalytic action of the platinum sponge causes local rise of temperature and consequent deflection of one of the plates so that contact is made and the alarm is rung.—W. H. C.

Calorimeter. G. M. Evans, New York, and J. S. Beckett, Fanwood, N.J., Assignors to Fuel Engineering Co., New York. U.S. Pat. 1,000,082, Aug. 8, 1911.

In a bomb calorimeter, the fuel is ignited by a high-tension spark. The fuel is contained within a metal receptacle within the bomb and in electrical connection with it. This receptacle is provided with a sparking plug having an insulated terminal, and suitable leads or terminals are provided for connection with the source of current.
—A. T. L.

Gas analysis; Absorption apparatus for ——. A. Lomschakow. Fr. Pat. 427,492, March 17, 1911.

The apparatus is designed to bring the reagent into intimate contact with the gas. The absorption chamber, 1, Fig. 1, is connected by means of a central perforated tube, 5, with a receiving chamber, 2, which is in turn connected with a chamber, 3. The chambers, 1 and 2, being filled with the reagent, the gas from the measuring

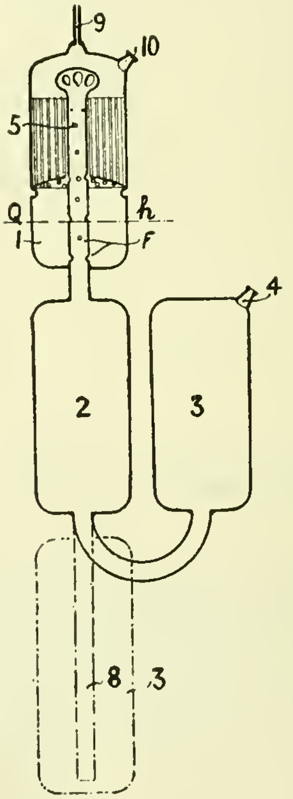


FIG. 1.

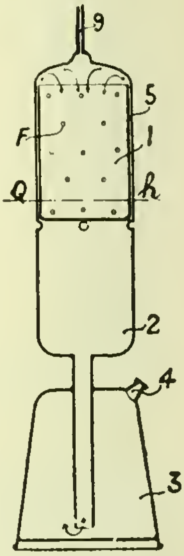


FIG. 2.

burette is admitted by the capillary 9, and passes chiefly down the tube, 5, into the chamber, 2. The reagent, flowing in small jets through the perforations, F, of the tube, 5, displaces the gas from the chamber, 2, into the chamber, 1, until a common level, Q—*h*, is reached within and around the tube, 5. Further washing of the gas with the liquid can be effected by applying pressure in the chamber, 3, for example by a rubber bulb connected with the neck, 4. Several modifications of the apparatus are described. In the form shown in Fig. 2, the chamber, 1, is formed by an open-topped vessel with perforated walls, the annular space, 5, around the walls serving the purpose of the central tube, 5, in Fig. 1.—A. T. L.

Albumin in liquids ; Apparatus for determining the amount of ——. A. Kwilecki, Breslau, Germany. Eng. Pat. 14,720, June 21, 1911. Under Int. Conv., Feb. 24, 1911.

The albumin is precipitated and measured in a test-tube having a conical and graduated bottom. The test-tube is immersed in water at the desired temperature. The water is contained in an ampulla-shaped flask with two marks on the neck. The flask is filled to the lower mark with water, at the room temperature, and it is then heated until the water expands and reaches the upper mark when it will be at the required temperature for precipitating the albumin.—G. W. McD.

Liquids ; Apparatus for ascertaining the composition of any boiling mixture of ——. C. v. Linde, Munich, Assignor to Linde Air Products Co., Cleveland, Ohio. U.S. Pat. 999,574, Aug. 1, 1911.

The liquid to be examined is contained in a vertical cylindrical boiler which is contracted conically at the top, the boiling being brought about by an internal heating coil; placed centrally and immersed in the liquid is a small cylindrical vessel which contains a fluid mixture of known composition. Exterior to the boiler is a U-tube pressure gauge, one limb of which is connected with the inner cylinder and the other with the space above the liquid in the boiler; the difference in pressure is thus obtained. When the apparatus is used for a mixture of liquids which can exist only in the gaseous state at ordinary temperature, a valve is placed on the pipe connecting the U-tube with the inner vessel, and on the vessel side of this valve, connections are made with an auxiliary vessel and pressure gauge.—B. G. McL.

Oils ; Process and apparatus for testing ——. Oelwerke Stern-Sonneborn A.-G., Hamburg, Germany. Eng. Pat. 7617, March 27, 1911. Under Int. Conv., June 30, 1910.

See Ger. Pat. 232,233 of 1910 ; this J., 1911, 652.—T. F. B.

Colour-measuring device. F. Hellige, Freiburg, Germany. U.S. Pat. 998,091, July 18, 1911.

See Eng. Pat. 20,692 of 1910 ; this J., 1911, 575.—T. F. B.

Measuring and regulating the concentration of dyestuff solutions. Fr. Pat. 427,128. *See* VI.

XXIV.—MISCELLANEOUS ABSTRACTS.

Silica standard of length. G. W. C. Kaye. Roy. Soc. Proc., 1911, A 85, 430—447.

After a description and discussion of the materials which have hitherto been used for the construction of standards of length, an account is given of the design and construction of the silica standard of length at the National Physical Laboratory (this J., 1910, 1201). It consists of a silica tube into which are fused at its ends optically-worked plane parallel slabs of silica, which carry the graduations. The undersides of the slabs are platinised, the graduations having been made by cutting through the platinum film ; the lines are viewed from above. The platinum films are protected by silica cover-slips. The platinising was effected with the so-called "liquid platinum"—a slightly gummy solution of a platinum salt which on ignition yields a bright deposit of platinum ; on heating for 2 or 3 minutes at about 900° C. (bright cherry redness) the film becomes hard and strongly adhering.—A. S.

Nickel ; A new catalytic reaction with finely divided ——. [*Formation of hexene from heptylic alcohol*]. H. van Beresteyn. Bull. Soc. Chim. Belg., 1911, **35**, 293—300.

It is found that vapours of heptylic alcohol are decomposed, in an atmosphere of hydrogen, by finely divided nickel heated to 220° C. (the most favourable temperature), with formation of normal hexene, carbon monoxide and hydrogen. The following reactions are assumed to take place : $CH_3(CH_2)_5CH_2OH = CH_3(CH_2)_3CH : CH_2 + CH_3OH$; $CH_3OH = CO + 2H_2$.—A. Sbld.

Colloidal systems ; Properties of —— *II. Adsorption as a preliminary to chemical reaction.* W. M. Bayliss. Proc. Roy. Soc., 1911, B, **84**, 81—98.

When a chemical reaction takes place in a heterogeneous system, there are two stages preliminary to the chemical reaction itself. The first is diffusion or the motion of one of the reacting bodies in order that contact with the other may take place. Secondly, at the surface of separation of the two phases there is a concentration of the substance in solution, whenever such concentration is capable of reducing the potential of the surface energy (Willard Gibbs). This form of condensation at surfaces of contact in heterogeneous systems is called "adsorption," and it is desirable that the name should be confined to this phenomenon. The mathematical expression connecting the amount of a substance adsorbed with its concentration in solution is of an exponential form. The process of adsorption may or may not be followed by chemical action properly so-called, but even if this is not the case a kind of complex is formed which may admit of separation from the rest of the system. Such bodies may be called "adsorption compounds" or when both components are colloids, "colloidal complexes." The author gives actual proof of the existence and isolation of such complexes in the case of the colloidal acid of Congo red and colloidal bases. If excess of hydrochloric acid be added to Congo red, the blue acid is precipitated ; this may be converted into a deep blue colloidal solution by suspending in water and dialysing. On adding to this colloidal solution freshly-precipitated and well washed aluminium hydroxide suspended in water, a dark blue precipitate falls which can be washed by decantation and again suspended in water. This is a "colloidal compound" of the aluminium hydroxide and the acid of Congo red, as may be shown by warming, when the solution rapidly becomes red, and deposits red flakes of the aluminium salt formed by chemical action between the colloidal acid and base. This process may be repeated with various other hydroxides. The author also gives a number of references to the work of other observers who have had reason to suspect the formation of similar "adsorption compounds." There is considerable reason to believe that some such complex is usually formed between an enzyme and its substrate as a preliminary to the main action which is chemical. In the case of the removal of trypsin from solution by caseinogen one has to decide whether the separation is as a chemical or as an adsorption compound. In the process (known to be adsorptive) of the removal of Congo red and other negative colloids from their solutions by means of filter paper, it is found that the adsorption is increased in the presence of neutral salts. In the same way the author shows that the removal of trypsin from solution by caseinogen, as well as by soluble starch and by filter paper, is facilitated by the use of 0·018 molar calcium sulphate instead of water. Thus it is likely that all the primary products are adsorption compounds. Some experiments on the removal of trypsin by charcoal appear to show irregularities in this connection, but they are probably due to the action of calcium sulphate in increasing the size of the charcoal particles, and thus tending to reduce rather than increase the adsorption of trypsin. The author has carried out further experiments with trpysin and invertase in which he measures activity of the enzyme in solutions of varying concentration. the concentration of the substrate being kept constant. The reciprocal of the time taken to effect a change of a given magnitude is taken as a measure of the activity. If this activity is proportional to the amount of "adsorption compound" present, it should be connected with the concentration of the enzyme in solution by an expression of exponential form. The simplest such expression would be [$x = y^{\frac{1}{n}}$] where x is the reciprocal of the time taken for a given change and y is the concentration of the enzyme. It is actually found in the author's experiments that this expression is closely followed. n being constant in a single experiment over a fairly large range of concentration, and varying from 1 to about 2 in different experiments. It appears therefore that the action of an enzyme is probably preceded by the formation of an "adsorption compound" of enzyme and substrate, and that the rate of enzyme action at any given moment is a function of the amount of the adsorption compound in existence at that moment.—W. H. P.

Books Received.

Bulletin of the Imperial Institute. Vol. IX. No. 2 Price 1s.

This issue of the Bulletin contains the results of investigations in connection with "Amang" (heavy sands obtained in the Chinese process of tin-mining in Malaya) from the Federated Malay States. monazite sand from Travancore (India). the use of dum palm nuts as vegetable ivory, solanaceous drugs from India; also notices respecting the utilisation of wattle bark, kapok and its cultivation. the preparation of calcium cyanamide, and its uses as a manurial agent. the distribution and uses of titanium ores, etc. (See under VII., XV., XVI., XX.)

Collection des Manuels Pratiques d'Analyses Chimiques à l'Usage des Laboratoires Officiels et des Experts. Publiés sous la Direction de M. F. Bordas. Directeur des Laboratoires du Ministère des Finances, et M. Eugene Roux, Directeur du Service de la Répression des Fraudes au Ministère de l'Agriculture.

(1.) Huiles Minérales. Petroles, Benzols, Brais, Paraffines, Vaselines, Ozokérite. Par Henri Delehaye. Librairie polytechnique Ch. Béranger, successeur de Baudry et Cie., 15, rue des Saints Péres. Paris. 21, rue de la Régence. Liège. 1911. Price 4 fr.

Small 8vo volume, containing 210 pages of subject-matter, and table of contents. There are four illustrations and numerous tables. The treatment of the entire subject is as follows:—I. Definition and description. II. Analytical processes for the examination of petroleum products, etc. III. Interpretation of results as regards, *a*. American petroleums; *b*, Russian: *c*, Roumanian. IV. Shale oils. V. Benzines from rich gas. VI. Pitch. VII. Paraffins. VIII. Ozokerite. IX. Lignite wax. X. Vaseline. XI. Bitumens and asphaltums. XII. Benzols. XIII. Appendix with Riche and Halphen's method of distinguishing American from Russian petroleums, etc., and tabulated matter. XIV. Laws and regulations.

(2.) Soude. Potasse. Sels. Dénaturation des Sels. Par P. Méker. Price 5 fr.

The volume contains 237 pages of subject-matter. and table of contents. The volume is divided into four sections. Part I. treats of analytical processes relating to soda and the salts of sodium. having industrial value, such as sodium carbonate, sulphate. nitrate. etc. Part II. comprises potash. and the more important potassium salts. Part III. Common salt. and the denaturing processes it must undergo for industrial or agricultural uses.

(3.) Matières Tannantes. Cuirs. Gelatines. Colles. Noirs. Cirages. Par L. Jacomet. Price 5 fr.

The volume contains 241 pages of subject-matter. a bibliographic index. and a classified table of contents. There are twenty illustrations. The text is arranged as follows:—I. Analytical study of tanning agents. II. Hides. Leathers. III. Glues. sizes and gelatins, etc. Animal glues. Fish glues. Casein sizes. Vegetable sizes. Conversion of starch into sugar. Dextrin. Gum arabic. etc. IV. Animal charcoal. Lampblack. Noir d'Allemagne, etc. V. Blackings, Polishes. Lacquers. Varnishes. etc. Emulsions. Mucilages, etc. VI. Tables and official circulars. Conditions of the French and Belgian armies for the acceptance of leathers are specified.

(4.) Alcools. Alcool. Alcool Dénaturé. Denaturants. Par Louis Calvet. Price 6 fr.

Contains 360 pages of subject-matter, with 31 illustrations. and an alphabetical index of subjects. The subject-matter is classified under the following heads:—I. Definitions. changes. frauds and adulterations. II. Resumé of the French and foreign legislation on alcohol. III. Alcohols. Denaturants. Denatured alcohols. IV. Determination of alcohol in certain products. V. Other methods than those officially employed, to distinguish methylic in presence of ethylic alcohol. VI. Official methods in foreign analyses. VII. Alcoholometry. VIII. Tables and numerical data. formulæ. etc. Appendix. Chronological list of laws, ordinances, and circulars relating to alcohols.

Organische Farbstoffe. Von Dr. E. Ristenpart. Einzelschriften zur Chemischen Technologie. Herausgegeben von Prof. Dr. Th. Weyl. Vierte Lieferung. Verlag von Johann Ambrosius Barth. Dörrienstrasse 16. Leipzig. 1911. Price M. 9.

Large 8vo volume. containing 108 pages of subject-matter. with an alphabetical index of subjects. This section is followed by 55 sheets of dyed specimens. with names. and specific conditions under which the shades of colour were obtained. etc. The text is illustrated with 20 engravings and numerous tables. and is classified as follows:—I. Tar. and the production of raw products. II. Intermediate products. III. Dyestuffs. *a*. Basic; *b*, acid; and *c*, Substantive dyestuffs. *d*. Sulphur dyestuffs; *e*. Mordant dyestuffs; *f*. Vat-dyestuffs; *g*. Pigment colours. IV. Detection of colours on the fibre.

*New Books.

Birkinbine, J. L. W.: Exploration of certain iron-ore and coal-deposits in the State of Oaxaca, Mexico. N.Y., J. L. W. Birkinbine, 29 W. 39th Street. 1910 [1911]. c. 23 p. il. maps. 8°. 25 c.

Castell-Evans, J.: Physico-chemical tables for the use of analysts. physicists. chemical manufacturers. and scientific chemists. In 2 v. v. 1. Chemical engineering and physical chemistry; v. 2, Physical and analytical chemistry. Phil., Lippincott. 1911. 508; 700 p. 8°. v. 1, $8; v. 2, $12.

Dieterich, F. G.: The inventor's universal educator; an educational cyclopædia and guide for inventors, patentees, manufacturers. mechanics. and all others connected directly or indirectly with patents. Washington, D. C., F. G. Dieterich. 1911. c. 143 p. il. 12°. $1.

Elbs. Prof. K.: Übungsbeispiele f. die elektrolytische Darstellung chemischer Präparate. Zum Gebrauch im Laboratorium f. Chemiker u. Elektrochemiker. 2., ergänzte Aufl. (VIII. 139 S. m. 9 Abbildgn.) 8°. Halle, W. Knapp. 1911. Cloth M. 5.40.

Erlenmeyer, Dr. E.: Blei- u. Eisenbilanz bei experimenteller chronischer Bleivergiftung. (74 S.) gr. 8°. Bonn, C. Georgi. 1911. M. 1.50.

Emich, Prof. F.: Lehrbuch der Mikrochemie. (XIII, 212 S. m. 30 Abbildgn.) gr. 8°. Wiesbaden, J. F. Bergmann. 1911. M. 6.65.

Gooch, F. A., and Ph. E. *Browning*: Outlines of qualitative chemical analysis. 3rd ed., rev. N.Y., Wiley. 1911. c. 6+145 p. 8°. $1.25.

Iddings, J. P.: Rock minerals; their chemical and physical characters and their determination in thin sections. 2nd ed. N.Y., Wiley. 1911. c. 13+617 p. figs. pls. 8°. $5.

Jellinek, Dr. K.: Der Hydrosulfit. 1. Tl. Grundzüge der physikal. Chemie des Hydrosulfits im Vergleich zu analogen Schwefelsauerstoffderivaten. (VI, 188 S. m. 15 eingedr. Kurven.) Lex. 8°. Stuttgart, F. Enke. 1911. M. 6.

Johnson, J. P.: The mineral industry of Rhodesia; interleaved with blank paper for notes. N.Y., Longmans. 1911. 90 p. il. pls. O. $3.

Jumelle, M.-H., et H. *Perrier de La Bathie*: Les plantes à caoutchouc de l'ouest et du sud-ouest de Madagascar. in-8°. Paris, A. Challamel. 1911. 1 fr.

Krantz, Fr.: Die Entwickelung der oberschlesischen Zinkindustrie in technischer, wirtschaftlicher u. gesundheitlicher Hinsicht. (IV, 92 S. m. Abbildgn. im Text u. auf 7 Taf.) gr. 8°. Kattowitz, Gebr. Böhm. 1911. M. 6.; Cloth M. 6.75.

Kremann, Prof. R.: Anwendung physikalisch-chemischer Theorien auf technische Prozesse u. Fabrikationsmethoden. (XI, 208 S. m. 35 Abbildgn.) Hrsg. v. L. M. Wohlgemuth. gr. 8°. Halle, W. Knapp. 1911. M. 9.60.

Louis, H.: Metallurgy of tin. N.Y., McGraw-Hill. 1911. 138 p. il. 12°. $2.

Mourlon, C.: La nouvelle industrie des lampes électriques à filaments métalliques. Lampe Z., pl. in-4°. Paris, Libr. gén. des sciences, arts et lettres. 1911. 2 fr. 50.

Nicou, M.-P.: Étude sur les minerais de fer scandinaves. Laponie suédoise. Grængesberg. Gisements de minerais pauvres, 6 pl., 37 fig. in-8°. Paris, H. Dunod et E. Pinat. 1911. 7 fr. 50.

Norton, C.: Modern yeasting and distillation; a work on the manufacture of whiskey and alcohol. Chic., Mitchell, Larimer and Titus. 1911. 68 p. il. 8°. $12.

Schwers, Dr. H.: Le fer et le manganèse dans les eaux souterraines. La déferrisation et la démanganisation. in-8°. Paris, H. Dunod et E. Pinat. 1911. 1 fr.

Wild, L.: Der Strassenstaub u. dessen Bekämpfung. Ein Beitrag zur Förderg. der Strassenhygiene m. spezieller Berücksicht. der Oberflächenteerung (System Basel) u. verschiedener Systeme zur Herstellg. v. Teermakadam-Strassen. (98 S. m. 38 Fig.) gr 8°. Basel, Helbing and Lichtenhahn. 1911. M. 2.

*Dissertations.

Billig, G.: Untersuchungen in der Anthrachinon-Reihe. Berlin-Charlottenburg. 1911. 56 S. 8°.

Eifler, K.: Ueber die Eisenarmierung kreisrunder Betonplatten. Dresden. 1911. 67 S. m. 9 Taf. 8°.

Emmert, B.: Ueber die Elektrolyse quartärner Stickstoffverbindungen. Würzburg. 1909. 48 S. 8°.

Jacob, A.: Das Verhalten der salpetrigen Säure in Wasser. Dresden. 1911. 71 S. 8°.

Jahns, E.: Ueber einige Bromderivate des o- und p-Acettoluids, des o-Anisidins und des Phenacetins. Rostock. 1909. 41 S. 8°.

Käding, Ch.: Ueber das Anhydrid des 1-o-Carboxylphenyl-5-methyl-3-pyrazolons. Rostock. 1909. 72 S. 8°.

Kellerhoff, E.: Die Kupfersalze der Ferro- und Ferricyanwasserstoffsäure. Erlangen. 1911. 63 S. 8°.

Kliegl, A.: Zur Kenntnis aromatischer Nitroverbindungen. Tübingen. 1909. 71 S. 8°.

Knorr, A.: Chinoide und teilchinoide Verbindungen. München. 1909. 76 S. 8°.

Langbein, P.: Ueber Derivate des Triazols. Würzburg. 1910. 54 S. 8°.

Nest, J. S. van: Beiträge zur Kenntnis der Quecksilberhalogenide. München. 1909. 50 S. 8°.

Redlich, B.: Beiträge zur Kenntnis von para-Aethyltoluol. München. (Techn. Hochsch.) 1911. 36 S. 8°.

Runne, H.: Beiträge zur Erforschung der Angosturaalkaloide. Braunschweig. 1911. 37 S. 8°.

Sgalitzer, F.: Ueber Hydrazinverbindungen des Isatins und deren Reduktion. München. (Techn. Hochsch.) 1911. 55 S. 8°.

Sichling, K.: Ueber die Natur der Photochloride des Silbers und deren Lichtpotentiale. Braunschweig. 1911. 59 S. m. 30 Fig. 8°.

Speithel, R.: Ueber die Vorgänge der Autoxydation bei Aldehyden. Karlsruhe. 1911. 107 S. 8°.

Ullmann, E.: Ueber die licht-elektrische Ermüdung des Zinks. Rostock. 1910. 48 S. m. 11 Fig. im Text. 8°.

Viertel, A.: Beitrag zur Kenntnis des 1-Aminoanthrachinons. Dresden. 1911. 67 S. 8°.

Walter, Fr.: Ueber einige Pyrine des 1-Phenyl-5-Pyrazolons. Rostock. 1910. 73 S. 8°.

Winter, H.: Ueber Vorkommen und Reindarstellung des Scandiums. Berlin. 1911. 83 S. 8°.

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*Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding lists can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

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Patent Specifications may be purchased at the Sale Branch of the Patent Office, Quality Court, Chancery Lane, London, W.C., fifteen days after the date on which acceptance of the complete specification is advertised. The price is 8d. each.

I.—GENERAL PLANT: MACHINERY.

APPLICATIONS.

18,330. Loring. Apparatus for treating granular or pulverulent material with liquids. Aug. 14.

18,359. Menard. Obtaining a quantity of fluid at a predetermined temperature and pressure. [Fr. Appl., Sept. 3, 1910.]* Aug. 14.

18,386. Cases. Liquefaction of gases.* Aug. 14.

18,465. Humphrey and Rusdell. Raising or forcing liquids. Aug. 14.

19,171. Knight. Filters. Aug. 26.

19,172. Knight. Filtering diaphragm or film. Aug. 26.

COMPLETE SPECIFICATIONS ACCEPTED.

19,190, 24,941, and 28,899 (1910). Phillips and Phillips. Simultaneous desiccation and consolidation of pulps. Aug. 23.

19,617 (1910). Humphrey. Raising or forcing liquids. Aug. 23.

20,041 and 20,240 (1910). Ramén. Tunnel kilns or furnaces. Aug. 30.

20,247 (1910). Ramén. *See under* X.

23,045 (1910). Phillips and Bulteel. Effecting catalytic reactions between gases and vapours. Aug. 30.

23,855 (1910). Acétylène Dissous. *See under* XXII.

7630 (1911). Siemens Bros. (Siemens Schuckert-Werke). Apportioning and mixing device. Aug. 23.

II.—FUEL: GAS; MINERAL OILS AND WAXES; DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

APPLICATIONS.

18,351. Grote. Manufacture of metal filaments for electric lamps. Aug. 14.

18,392. Hoge, and "Z." Electric Lamp Manuf. Co. Manufacture of filaments for incandescent electric lamps. Aug. 14.

18,393, 18,394, and 18,395. Edgeworth. Apparatus for carbonising peat. Aug. 15.

18,424. Stammer. Rapid production of dry or semi-dry peat. Aug. 15.

18,426. McEwen and Gibbons. Cooling and utilising the heat of coke or other material discharged from retorts, etc. Aug. 15.

18,659. Aldama. Obtaining products from solid carbonaceous materials. Aug. 18.

18,744. Rollason. Manufacture of gas from coal.* Aug. 21.

18,936. Blaugas Patent G. m. b. H. Manufacture of liquid illuminating gas. [Ger. Appl., Aug. 30, 1910.]* Aug. 23.

19,051. Macklow-Smith and Pullen. Gas calorimeters. Aug. 25.

COMPLETE SPECIFICATIONS ACCEPTED.

12,013 (1910). Crossley and Rigby. Production of briquette fuel. Aug. 23.

19,022 (1910). Mathot. Gas producers. Aug. 23.

19,074 (1910). Lowe and Ely. Treatment of ammoniacal liquors. Aug. 23.

22,225 (1910). Wagener. Regenerative coke ovens. Aug. 23.

24,018 (1910). Westphal. Retort furnaces. Aug. 23.

24,637 (1910). Westinghouse Metallfaden Glühlampenfabrik. Decarbonising metal filaments for electric lamps. Aug. 30.

27,334 (1910). Hodgkinson. Artificial fuel. Aug. 30.

29,673 (1910). Evans. Purification of coal-gas and like gases. Aug. 30.

2392 (1911). Gill and Middleton. Charging of gas retorts. Aug. 30.

12,024 (1911). Blondel. Manufacture of electrodes for arc lamps. Aug. 23.

IV.—COLOURING MATTERS AND DYES.

APPLICATIONS.

18,349. Newton (Bayer und Co.). Manufacture of developing dyestuffs. Aug. 14.

18,357. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters. Aug. 14.

18,589. Imray (Meister, Lucius, und Brüning). Manufacture of indigo and indigoid dyestuffs in a finely-divided form. [Addition to No. 18,761 of 1910.] Aug. 17.

COMPLETE SPECIFICATIONS ACCEPTED.

20,096 (1910). Newton (Bayer und Co.). Manufacture of dyestuffs of the oxazine series and of leuco compounds. Aug. 30.

20,217 (1910). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of *o*-aminoazo dyestuffs. Aug. 30.

20,324 (1910). Imray (Meister, Lucius, und Brüning). Manufacture of a new form of indigo. Aug. 23.

1235 (1911). Kalle und Co. Manufacture of azo colouring matters. Aug. 23.

9841 (1911). Meister, Lucius, und Brüning. Manufacture of dyestuffs of the anthraquinone series. Aug. 23.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

APPLICATION.

18,590. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of products from cellulose or materials containing cellulose. Aug. 17.

COMPLETE SPECIFICATIONS ACCEPTED.

19,166 (1910). Hübner. Method of finishing artificial silk. Aug. 24.

22,101 (1910). Crowther. Destroying cotton or other vegetable fibres and silk fibres in wool and woollen material. Aug. 30.

24,980 (1910). Newton (Bayer und Co.). Manufacture of cellulose formates. Aug. 23.

27,258 (1910). Eichengrün. Production of celluloid-like masses from acetylcellulose. Aug. 23.

11,969 (1911). Hazlewood and Sons, and Hazlewood. Manufacture of filling or loading material for fabrics, paper, etc. Aug. 23.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

APPLICATIONS.

18,877. Ransford (Cassella und Co.). Dyeing cotton or linen cloth with vat colours. Aug. 22.

19,190. Silverwood. Mercerising. Aug. 26.

COMPLETE SPECIFICATIONS ACCEPTED.

25,117 (1909). Meister, Lucius, und Brüning. Process for fixing anthraquinone dyestuffs. Aug. 30.

19,494 (1910). Wolffenstein. *See under* XII.

669 (1911). Meister, Lucius, und Brüning. Production on cotton of dyeings capable of being discharged. Aug. 30.

9842 (1911). Meister, Lucius, und Bruning. Fixing anthraquinone dyestuffs. Aug. 23.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

APPLICATIONS.

18,463. Sulphates, Ltd., Thwaites, and Ralph. Obtaining iron, zinc, and cobalt compounds from liquors. Aug. 15.

18,497. Lewis, Spickett, and Tritschler. Manufacture of oxygen. Aug. 16.

19,032. Meister, Lucius, und Brüning. Manufacture of nitric acid. [Ger. Appl., April 6, 1911.]* Aug. 24.

19,043, 19,044, and 19,045. Dunham. Art of converting phosphorites.* Aug. 24.

COMPLETE SPECIFICATIONS ACCEPTED.

19,074 (1910). Lowe and Ely. *See under* II.

21,128 (1910). Westhausser. Manufacture of hydrochloric acid or hydrobromic acid from chlorine and bromine. Aug. 30.

25,504 (1910). Soddy. *See under* XX.

5833, 5834, 5835, and 5836 (1911). Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia and catalytic agents therefor. Aug. 23.

6684 (1911). Friedrich. Preparation of ammonium chloride and sulphites of calcium, strontium, barium, magnesium, zinc, or iron. Aug. 23.

12,227 (1911). Burkheiser. Conversion of ammonium sulphite into ammonium sulphate. Aug. 30.

VIII.—GLASS; CERAMICS.

Application.

18,856. Benedictus. Strengthened glass. [Addition to No. 10,324 of 1911.]* Aug. 22.

IX.—BUILDING MATERIALS.

Application.

18,820. Gutensohn. Fireproof compound. Aug. 21.

Complete Specifications Accepted.

19,346 (1910). Accettola. Manufacture of artificial marble. Aug. 23.

20,247 (1910). Ramén. *See under* X.

2865 (1911). Lancel. Kilns for bricks, etc. Aug. 23.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

18,406. Twynam. Refining molten pig-iron for steel-making and other purposes. Aug. 15.

18,467. Coolidge. Refractory metallic bodies and their manufacture. [U.S. Appl., Aug. 15, 1910.]* Aug. 15.

18,488. Dekker. Treatment of ores.* Aug. 16.

18,804. Scheitlin. Furnaces for producing sodium by electrolysis. [Ger. Appl., Aug. 20, 1910.]* Aug. 21.

19,053. Harris. Mechanical ore-roasting and like furnaces. Aug. 25.

19,092. Cowper-Coles. Electrolytic refining of copper. Aug. 25.

19,093. Cowper-Coles. Electrodeposition of copper. Aug. 25.

19,095. Cowper-Coles. Protection of iron and steel surfaces. Aug. 25.

Complete Specifications Accepted.

18,943 (1910). Minerals Separation Ltd. (Greenway). Concentration of copper ores. Aug. 23.

19,449 (1910). Martin. Separation of zinc, copper, and other sulphide ores. Aug. 23.

20,247 (1910). Ramén. Method of working tunnel kilns for burning bricks of ore, clay, etc. Aug. 30.

29,710 (1910). Davidsen. Manufacture of iron and steel. Aug. 30.

3361 (1911). Mellen and Mellen. Manufacture of aluminium alloys. Aug. 23.

6296 (1911). Sauer. Utilising waste heat from blast furnaces, smelting furnaces, etc. Aug. 30.

12,012 (1911). Allgem. Deutsches Metallwerk. Copper-zinc alloys having a high percentage of zinc. Aug. 30.

XI.—ELECTRO-CHEMISTRY.

Applications.

18,733. Planiawerke A.-G. f. Kohlenfabr. Carbon electrode for electrical purposes. [Ger. Appl., Oct. 6, 1910.]* Aug. 19.

18,793. Marino. Lead oxide agglutinant for increasing the strength and porosity of the active material of the plates of secondary batteries. Aug. 21.

18,804. Scheitlin. *See under* X.

Complete Specifications Accepted.

176 (1911). British Thomson-Houston Co. (General Electric Co.). Insulating compounds. Aug. 30.

11,626 (1911). Schwerin. Process for treating finely subdivided substances by electric osmose. Aug. 30.

11,906 (1911). Chem. Fabr. Griesheim-Elektron. Depolarisers for galvanic cells or batteries. Aug. 23.

15,128 (1911). Siemens und Halske A.-G. Manufacture of manganese peroxide anodes. Aug. 30.

XII.—FATS; OILS; WAXES.

Application.

18,642. Verein. Chem. Werke. Reduction of fats and unsaturated fatty acids. [Ger. Appl., Jan. 26, 1911.]* Aug. 18.

Complete Specifications Accepted.

19,494 (1910). Wolffenstein. Soaps suitable for washing and bleaching. Aug. 30.

25,669 (1910). Wijnberg. Apparatus for obtaining waxes, fats, and oily substances. Aug. 23.

7616 (1911). Oelwerke Stern-Sonneborn. Oil-testing machine. Aug. 30.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

18,379. Wülfing, Dahl, und Co. Manufacture of lakes. [Ger. Appl., Aug. 16, 1910.]* Aug. 14.

18,732. Boehm, Ltd., and Reihl. Drying oils for paints, etc. Aug. 19.

18,818. Boehringer und Sohne. Materials for coating and impregnating purposes. [Ger. Appl., Aug. 22, 1910.]* Aug. 21.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

18,431. Gottlob. Production of artificial caoutchouc or substances similar to caoutchouc. [Austrian Appl., Aug. 30, 1910.]* Aug. 15.

18,507. Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of rubber-like compounds by polymerising unsaturated hydrocarbons.* Aug. 16.

18,969. Bush. Process for treating waste indiarubber. Aug. 24.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

18,573. Jirovsky. Manufacture of mocha leather. Aug. 17.

18,770. Röhm. Treatment of hides and skins for the manufacture of leather. [Ger. Appl., Dec. 22, 1910.]* Aug. 21.

XVI.—SOILS; FERTILISERS.

Application.

19,043 to 19,045. Dunham. *See under* VII.

COMPLETE SPECIFICATION ACCEPTED.

24,500 (1910). Freudenthal. Arrangement and working of superphosphate chambers. Aug. 30.

XVIII.—FERMENTATION INDUSTRIES.

APPLICATION.

18,853. Brüne. Drying process for producing malt of desired character. [Ger. Appl., Dec. 27, 1910.]* Aug. 22.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

APPLICATIONS.

18,365. Danilevsky. Extracting and utilising the nutritive substances in fish.* Aug. 14.

18,455. Remington. Treatment of flour. Aug. 15.

18,716. Remington. Baking powder, self-raising flour, etc.* Aug. 19.

18,984. Pearson and Pearson. Water softening and filtering apparatus under pressure.* Aug. 24.

COMPLETE SPECIFICATIONS ACCEPTED.

19,637 (1910). Hildesheim. Manufacture of chocolate, cocoa, and products having a cocoa base. Aug. 23.

10,121 (1911). Steinmetz Patent Müllerei Ges. Manufacture of flour from grain. Aug. 23.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

APPLICATIONS.

18,356. Johnson (Badische Anilin und Soda Fabrik). Manufacture of isoprene. Aug. 14.

18,588. Callender. Manufacture of isoprene. Aug. 17.

18,642. Verein. Chem. Werke. *See under* XII.

18,812. Bayer und Co. Manufacture of bromodiethylacetylurea. [Ger. Appl., Aug. 31, 1910.]* Aug. 21.

18,813. Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. Aug. 21.

18,935. Newton (Bayer und Co.). Manufacture of erythrene and isoprene. Aug. 23.

COMPLETE SPECIFICATIONS ACCEPTED.

25,504 (1910). Soddy. Separation of mesothorium from monazite sand and its concentration in crude products. Aug. 23.

27,555 (1910). Newton (Bayer und Co.). Manufacture of erythrene and its homologues. Aug. 23.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATION.

18,783. Shaw. Three-colour photographic processes. Aug. 21.

COMPLETE SPECIFICATIONS ACCEPTED.

19,601 (1910). Caille. Photographic reproduction of colours. Aug. 30.

7201 (1911). Enjolras. Collodion silver bromide instantaneous photographic plate. Aug. 23.

XXII.—EXPLOSIVES; MATCHES.

COMPLETE SPECIFICATION ACCEPTED.

23,855 (1910). Acetylene Illuminating Co. (Acétylène Dissous). Manufacture of porous material for preventing propagation of explosive waves, for dissolved acetylene and like containers. Aug. 23.

XXIII.—ANALYTICAL PROCESSES.

APPLICATIONS.

18,385. Fitchett. Automatic apparatus for the detection of explosive, noxious, and other gases. Aug. 14.

18,502. Arndt. Apparatus for testing air or other gases and liquids. [Divided Appl. on No. 27,253 of 1910.]* Aug. 16.

19,051. Macklow-Smith and Pullen. Gas calorimeters. Aug. 25.

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Journal and Patent Literature.

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT ; MACHINERY.

Patents.

Mixing or beating liquids or semi-liquid substances ; Apparatus for ——. J. W. Morton, Glasgow. Eng. Pats. 18,511, Aug. 5, 1910, and 1655, Jan. 23, 1911.

The blades or beaters are attached to a shaft and frame which is suspended within the vessel, the contents of which are to be agitated. The end of the horizontal spindle or shaft opposite to the driving gear is supported by a screw which passes through the side of the vessel. The ends of the beaters are provided with bosses, having slots by which they are attached to the spindle or shaft.
—W. H. C.

Distributor and mixer for solids or liquids. Siemens-Schuckert Werke Ges. m. b. H. Fr. Pat. 427,072, March 9, 1911. Under Int. Conv., March 10, 1910.

Two horizontal discs are arranged on a common axis, in contact ; the upper one is rotated and has a number of perforations arranged in rings at successive distances from the centre, so that as the disc rotates, the holes come successively under the outlets of the hoppers which contain the materials to be mixed. The lower disc has a series of openings corresponding in position with the openings in the upper disc, and communicating with annular channels formed in the lower disc and a second set of openings on the lower side, serving to allow the materials which are pushed along the channels by scrapers attached to the under surface of the upper disc, to fall through into a receiving chamber below.—W. H. C.

Small coal ; Consolidation of —— *into large coal ; and physical process for the simultaneous desiccation and consolidation of pulps.* H. J. Phillips, London, and A. Phillips, Tredegar, Monmouth. Eng. Pats. 19,190, Aug. 16, 1910 ; 24,941, Oct. 27, 1910 ; and 28,899, Dec. 13, 1910.

In a press comprising a cylinder and plunger, in order to provide for the escape of liquid, either the cylinder or plunger is made up of a series of separate rings in contact with one another. The cylinder may consist of a series of flat rings secured together by long bolts, or it may take the form of a close-coiled helical spring of rectangular cross-section. The plunger may consist of concentric rings, or of a close-coiled spiral spring. The rings may be grooved. The process is applicable to briquetting powdered coal, using only water as binding agent ; for compressing wet peat ; for compressing fibrous pulps such as those of wood, cotton and flax, into lump paper and "papier maché" ; for compressing bone, pulped with hot water ; for briquetting small iron ore into lumps which can be smelted ; and for consolidating disintegrated rubber with water, naphtha or benzol.—A. T. L.

Raising or forcing liquids ; Methods of —— *and apparatus therefor.* H. A. Humphrey, London. Eng. Pat. 19,617, Aug. 22, 1910.

An addition to the methods of operating internal combustion pumps, as described in Eng. Pats. 20,736 of 1906, 18,594, 18,595, 19,341 and 25,638 of 1907, and 7824 and 15,820 of 1910 (this J., 1911, 524 and 940 ; see also this J., 1910, 75), by which the admission of fresh liquid, instead of taking place by the momentum of the column of liquid on the explosion stroke, is effected on the second or return stroke. The far end of the delivery pipe is closed and forms an air cushion in which the enclosed air is compressed until a pressure is attained exceeding that in an air cushion above the liquid in the high-level discharge chamber ; the non-return valves then open and allow of the discharge of liquid into this chamber ; when the kinetic energy of the column of liquid has been expended and the liquid comes to rest, the valves close. The pressure of the air in the cushion now imparts kinetic energy to the column of liquid in the delivery pipe, causing it to pass backwards towards the pump, the momentum continuing until the pressure in the air cushion has fallen below that at which the valves from the low-level tank open and a fresh charge of liquid has been drawn in, and also until—if the pump is of the two-cycle type—the moving column is brought to rest by compressing a fresh combustible charge in the explosion chamber of the pump. If the pump is of the four-cycle type, the moving column is brought to rest by compressing air in a second cushion chamber which causes a second forward movement of the liquid with compression of air in the first cushion chamber, the momentum imparted to the column of liquid on the second return stroke causing compression of a fresh combustible charge in the explosion chamber of the pump. Means are provided for maintaining or altering the volume of air compressed in the cushion chambers.—B. G. McL.

Raising or forcing water ; Explosion apparatus for ——. G. Poore and H. A. Harvey, London. Eng. Pat. 24,188, Oct. 19, 1910.

The apparatus and mode of action are substantially the same as in Eng. Pat. 20,934 of 1910 (this J., 1911, 791). In the present patent the impelling force is derived from the explosion of a mixture of hydrogen and oxygen produced electrolytically in a small vessel in the explosion chamber ; a certain quantity of air is mixed with the gases to reduce the violence of the explosion. The switches for controlling the sparking and electrolysing currents are controlled by a float.—B. G. McL.

Pyrometers ; Radiation ——. C. E. Foster, Letchworth, Herts. Eng. Pat. 29,097, Dec. 15, 1910.

A self-contained radiation pyrometer comprises a heat-transmitting part, *e.g.*, a tube with closed end, which is introduced into the furnace, molten metal, etc., of which the temperature is to be measured, and a heat-sensitive part which may be of any known kind, *e.g.*, that described in Eng. Pat. 30,478 of 1909 (this J., 1910, 596). These two parts are secured to one another in fixed relative positions, and in such a way that the heat-transmitting member may be renewed without affecting the calibration of the instrument. Means are provided for preventing gases or convection currents passing from the hot end to the heat-sensitive member. This may be done by providing open vertical branch tubes between the two parts of the instrument, the gases or hot air being carried away by a natural or forced draught. In another form, a transparent screen, which may be of mica, is used to protect the heat-sensitive part.—A. T. L.

Cooling melted substances; Apparatus for ——. Korsör Margarinefabrik Aktieselskab, Korsör, Denmark. Eng. Pat. 29,564, Dec. 20, 1910. Under Int. Conv., Dec. 20, 1909.

The melted substance is spread over the cooled inner or outer surface of a vertical drum, from which it is afterwards removed by a scraper. Fig. 1 is a plan of one form of the apparatus. The melted substance is introduced through the pipe, *c*, which enters the drum, *a*, vertically in the centre at the top, as shown in plan at *d*, and is then bent twice at right angles and extends downwards parallel to the wall of the drum, as shown in plan at *f*; the vertical portion of the pipe within the drum is perforated with holes through which the melted substance passes into a distributor, *e*, of the same vertical height as the cooling surface of the drum. The supply pipe, *c*, is rotated about the central shaft, and a uniform layer of the material is deposited through *e* on the inner wall of the drum, whence it is removed by the adjustable scraper, *h*. The annular space between the inner and outer walls of the drum is filled with water and contains a cooling coil, *b*. In another form of the apparatus, shown in plan in Fig. 2, the supply pipe for the melted material, the distributor, *e*, and the scraper, *h*, are fixed, whilst the cooling drum, *a*, provided with a cooling coil, *b*, is rotated: in this case the melted material is deposited on the outer surface of the drum.—A. S.

Fig. 1

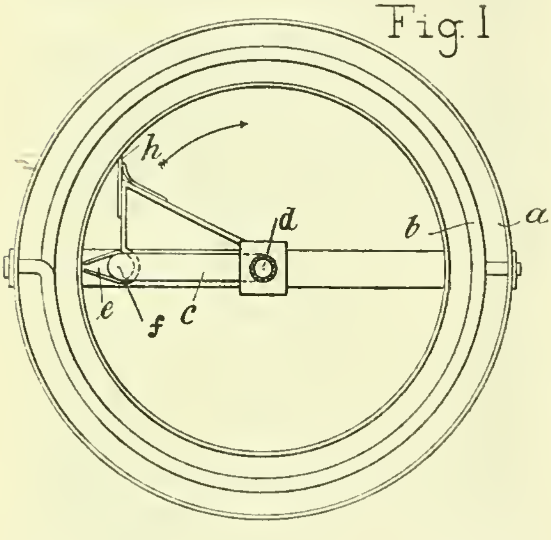
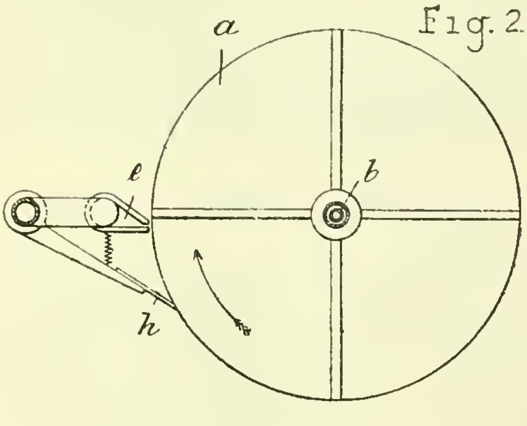


Fig. 2



Filtration and filter material. A. E. Krause, Jersey City, N.J., U.S.A. Eng. Pat. 30,004, Dec. 24, 1910. Under Int. Conv., Jan. 3, 1910.

The liquid to be filtered (particularly liquids carrying oil and grease) is passed through a filter-bed prepared by intimately mixing a compressible, fibrous, mineral, filtering material with a granular material such as sand, for the purpose of rendering the whole mass non-compressible. —W. H. C.

Filter. G. Alexander, New York. Eng. Pat. 12,355, May 22, 1911.

A sheet of filtering material is clamped between two separable shells or casings made from spun sheet metal; the lower casing is made in two sections one of which is dished upwardly and perforated at the top whilst the other is flat and fits tightly into the lower portion of the dished section. The clamping is effected by a nut swivelled on to one of the casings and screwing upon the delivery tube fixed to the other casing. The delivery tube extends beyond the screw-thread of the nut so as to avoid impinging of the filtered liquid against the latter. A special method of effecting the swivel connection and of constructing a hollow handle for the nut are described.—A. S.

Impact-filter. T. H. Neikirk, Midas, Nev. U.S. Pat. 1,000,540, Aug. 15, 1911.

A horizontal drum having the form of a truncated cone with open ends is mounted so as to be rotated on a hollow shaft. The drum is lined with suitable filtering material, a space being left between the lining and the drum for the escape of the filtrate. The material to be filtered is delivered under pressure into the hollow shaft and passes into disc-shaped distributors mounted on the shaft and from which it is forced against the filtering material. —W. H. C.

Furnaces. F. J. Nice, Pontiac, Mich., U.S.A. Eng. Pat. 4635, Feb. 23, 1911.

The combustion chamber of the furnace is divided by pillars of brickwork into a central passage and lateral longitudinal passages, communication being arranged between the passages through the spaces between the posts. The latter are arranged in such a way as to obstruct the direct passage of the flame to the extreme lateral passages.—W. H. C.

Rotary furnace. J. L. Briggs, Clarksburg, W. Va., Assignor to L. Pearlman, Philadelphia, Pa. U.S. Pat. 1,000,321, Aug. 8, 1911.

A horizontal rotary furnace has a cylindrical central part with enlargements at each end. The enlargement at one end is larger than that at the other, and both have openings, that in the larger end being larger than that at the other end. The smaller end is connected with a stack to take away the waste gases.—W. H. C.

Kiln; Multifloor ——. C. Brüne, Radeberg, Germany. U.S. Pat. 1,001,347, Aug. 22, 1911.

The kiln consists of a vertical cylindrical structure enclosing several superimposed drying chambers, in each of which is placed a mixing chamber provided with apertures at the top and at the bottom. Conduits are provided for conveying the heated air from the heating chamber placed in the lower part of the kiln through each of the mixing chambers and also for the admission of cold air. —B. G. McL.

Evaporators. J. B. Watson, Burton-upon-Trent. Eng. Pat. 4991, Feb. 28, 1911.

THE evaporator consists of a horizontal cylinder in which a drum, formed of horizontal tubes, is rotated. The heating agent is passed through the tubes which are divided into sections. Each section is separated from the next by an expansion chamber. In this way the heating medium is allowed to expand as it passes from section to section, with the result that the temperature of each successive section is lower than that of the one before. —W. H. C.

Evaporation ; Process of ——. D. M. Neuberger. Fr. Pat. 427,077, March 9, 1911.

THE process is applicable to the evaporation of liquids containing solid, viscous, or oily matter in suspension. The liquid is injected in an atomised state into the intermediate part of a chamber and a current of warm air or gas, having a lower density than the atomised liquid is delivered into the chamber at the same level but at a different angle. The concentrated liquid is removed from the bottom of the vessel also at a different angle. The angles of entry and discharge and the volumes and pressures of the fluids are so arranged that three stratified layers persist within the vessel—a still layer of gas below, through which the concentrated liquid falls to the discharge ; a layer of light air or gas above, saturated with vapour and which is continually being discharged into the air and replenished from the middle layer, which consists of a mixture of atomised liquid, vapourised liquid and air or gas.—W. H. C.

Centrifugal machines for separating solid substances from liquids and assorting the substances according to different degrees of fineness. A. Uhl, Hohburg b/Warzen, Germany. Eng. Pat. 7050, March 21, 1911.

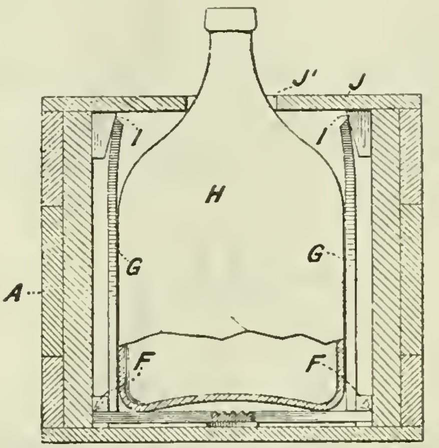
THE materials to be separated are introduced into the drum of the machine in a direction parallel to the periphery of the drum, through a central, vertical pipe forming the axis of the drum, which is connected to two horizontal branches, each of which terminates in a vertical distributor on opposite sides of the drum. The drum is lined with segment-shaped trays and is provided with liquid-discharge chambers placed opposite each other behind the distributors. Owing to the method of introducing the material, the solid particles are sorted into sizes, those which collect in the tray nearest to the distributors being the largest and successive trays collecting finer and finer material up to the last before the opposite distributor, in which only the finest material collects, the clear liquid passing away through the adjacent liquid-discharge chamber. When the drum is full it is only necessary to lift out the trays to obtain the dry material sorted out in sizes.—W. H. C.

Separating insoluble, solid bodies contained in liquids ; Process and apparatus for ——. J. E. Hatton and J. P. Sala. Fr. Pat. 427,090, March 9, 1911. Under Int. Conv., March 11, 1910.

THE liquid to be treated is forced under pressure into a stationary vessel already full of the liquid. The liquid in the vessel is in a state of rapid rotation produced by a vertical or horizontal agitator which is rapidly rotated in the centre of the vessel. The discharge for the clear liquid is near the axis of the agitator. The centrifugal force developed causes the solid particles to migrate towards the walls of the vessel, the centre of which contains only clear liquid. The liquid as it is forced into the vessel near the walls displaces clear liquid from the centre and for this reason must enter at a higher pressure than that at which the clear liquid leaves. The solid particles either sink down to a tranquil zone at the bottom of the vessel and are withdrawn, or pass along with some of the liquid to an adjacent but separate settling vessel. The outlet for the clear liquid is sometimes protected by a filter, but as this is in the centre of the space subject to the centrifugal force, no solid particles can reach the filtering medium to clog it.—W. H. C.

Carboys ; Receptacle for ——. K. F. Stahl, Pittsburg, Pa., Assignor to General Chemical Co., New York. U.S. Pat. 1,000,449, Aug. 15, 1911.

THE carboy, H, is placed within the receptacle, A, and kept in position by a number of strips, G, held against the lower part of the carboy by the blocks, F, and bent against the upper part of the carboy by separate wedges, I, for each strip. A cover, J, having an opening, J′, for the neck of the carboy is placed over the receptacle and serves to retain the wedges, I, in position.—W. H. C.



Pulp-agitating apparatus. W. C. Paterson, Denver, Colo. U.S. Pat. 1,000,689, Aug. 15, 1911.

A STAND-PIPE open at both ends is disposed centrally within a tank having a conical bottom, the lower end of the pipe being located in the lower part of the tank and having free communication with the contents. A cylindrical partition, located in the upper part of the tank, surrounds the stand-pipe. The annular chamber between the partition and the wall of the tank contains a flexible conduit member and float for drawing off the solution from the upper portion of the chamber, and by means of a rotary pump the liquid is discharged into the lower extremity of the stand-pipe. The upper portion of the cylindrical partition is "upwardly flared," and a baffle-plate is mounted directly above the upper extremity of the stand-pipe, so as to divert downwards the liquid that emerges from the pipe.—B. N.

Recovering the constituent solids of liquids and semi-liquids. L. C. and I. S. Merrell and W. B. Gere, Assignors to Merrell-Soule Co., Syracuse, N.Y. U.S. Pat. 1,000,931, Aug. 15, 1911.

THE liquid is first partially concentrated to thicken it and is then sprayed into a desiccating chamber. A current of air or other gaseous desiccating agent is first partly deprived of its moisture and then heated and forced into the desiccating chamber under pressure, so that it mingles intimately with the atomised liquid. The air absorbs moisture from the atomised liquid and the moisture-laden air and the desiccated solid particles pass over a partition or baffle into a depositing chamber, where the solid particles settle down and are removed, and the vapour-laden air passes on to a moisture-removing chamber, prior to entering the heating chamber, to be used over again.—W. H. C.

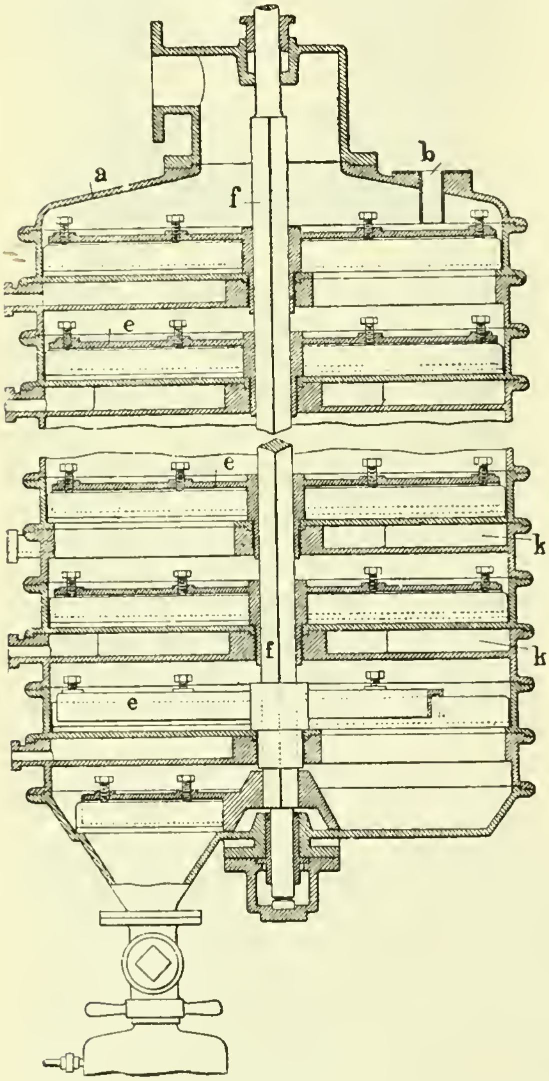
Crystallisable mixtures ; Apparatus for solidifying —— *without substantial crystallisation and forming strips thereof.* F. I. du Pont, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del., U.S.A. U.S. Pat. 1,001,072, Aug. 22, 1911.

THE material to be treated is fed on to a horizontal roller from a vertical receptacle placed above it in such a manner

that as the roller rotates, the material is distributed on its outer surface in a layer, the thickness of which is determined by means of a distributing roller and spreader. The treated material is removed from the roller, after the latter has made rather more than one-half revolution, by a scraper which operates in conjunction with a second roller device for breaking up the material.
—B. G. McL.

Desiccating column for various materials. G. P. Guignard and H. L. A. U. Watrigant. Fr. Pat. 427,458, May 28, 1910.

The material to be treated is fed through the tube, *b*, on to the top tray of the apparatus. The latter consists of a cylindrical casing, *a*, divided into compartments by heating chambers, *k*. A shaft, *f*, passes vertically through the centre and is provided in each compartment with several radial arms carrying knives or scrapers, *e*, which serve the double purpose of moving the material round and keeping the bottom plate of each shelf free from deposit. The material falls from shelf to shelf through sector-shaped openings which correspond with passages in the interposed heating shelves and are spaced spirally round the apparatus. The heating compartments are provided with baffles and the whole apparatus is connected with a vacuum pump. The dried material is discharged through an air-lock so that the vacuum may not be broken.
—W. H. C.



Cooling and liquefaction of gases, cool vapours, gaseous mixtures, mixtures of cool vapours and mixtures of gas and vapours; Process for the ——. R. Mewes. Fr. Pat. 426,908, March 6, 1911.

The introduction of the working fluid into the motor is usually accompanied by shocks which cause a rise in temperature and consequent loss of efficiency. The object of the invention is to overcome this difficulty by using rotary pumps such as the "Greindl," or by using "Roots" blowers in which the working fluid is introduced without giving rise to any shock.—W. H. C.

Separating by condensation vapours contained in gaseous mixtures; Refrigerating apparatus for ——. Soc. de Moteurs à Gaz et d'Industrie Automobile "Marques Otto." Fr. Pat. 427,042, March 8, 1911.

Several series of oblong coils of pipe are arranged with their axes in the same vertical plane in a narrow rectangular chamber the walls of which are protected by non-conducting covering. Baffles are arranged at suitable intervals to cause the vapour-laden air to take a circuitous path over the coils; the vapours are condensed by circulating a cold fluid through the coils, which are mounted on a carriage running on rails, so that they can be easily withdrawn when desired. The condensed liquid flows into collecting channels by which it is conducted to the discharge.—W. H. C.

Gases in liquids; Apparatus for the dissemination of ——. E. Weber-Stierlin. Ger. Pat. 235,732, Nov. 20, 1909.

The apparatus consists of two concentric tubes, provided with slits; in the annular space between the tubes, a number of ring-shaped layers of loose animal hair are disposed, each of which when introduced is subjected to the same degree of compression. It is stated that by the use of a layer of fibres (hairs), bubbles of gas of uniform size are obtained, which size can be varied by altering the degree of compression of the fibrous mass.—A. S.

Tunnel kilns or furnaces. A. Ramén, Helsingborg, Sweden. Eng. Pat. 20,041, Aug. 27, 1910.

See Fr. Pat. 420,234 of 1910; this J., 1911, 346.—T. F. B.

Retort furnaces. C. Westphal, Berlin. Eng. Pat. 24,018, Oct. 17, 1910.

See U.S. Pat. 988,842 of 1911; this J., 1911, 529.—T. F. B.

Evaporators. J. Dinckels, Mainz, Germany. Eng. Pat. 21,068, Sept. 9, 1910.

See Fr. Pat. 419,373 of 1910; this J., 1911, 119.—T. F. B.

Concentrating liquids; Apparatus for ——. The Fruit Juice Co., Ltd., London. From A. Fernbach and L. Cholet, Paris. Eng. Pat. 27,500, Nov. 25, 1910.

See Fr. Pat. 422,163 of 1910; this J., 1911, 525.—T. F. B.

Concentrating liquids to high densities; Apparatus for ——. P. Kestner, Lille, France. Eng. Pat. 29,061, Dec. 14, 1910. Under Int. Conv., Dec. 14, 1909.

See Fr. Pat. 422,811 of 1910; this J., 1911, 526.—T. F. B.

Apportioning and mixing device. Siemens Bros. Dynamo Works, Ltd., London. From Siemens-Schuckertwerke G. m. b. H., Berlin. Eng. Pat. 7630, March 27, 1911.

SEE Fr. Pat. 427,072 of 1911; preceding.—T. F. B.

Absorbing gases or vapours; Apparatus for ——. P. Schou, Copenhagen. U.S. Pat. 1,001,460, Aug. 22, 1911.

SEE Fr. Pat. 412,883 of 1910; this J., 1910, 1093.—T. F. B.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Fuel oil; Specifications for the purchase of —— with directions for sampling oil and natural gas. I. C. Allen. U.S. Bureau of Mines, Technical Paper 3, pp. 1—13, 1911.

THE following specifications are recommended to the U.S. Government for the purchase of fuel oil:—

General specifications.—(1). In determining the award of a contract, consideration will be given to the quality of the fuel offered by the bidders, as well as the price, and should it appear to be to the best interest of the Government to award a contract at a higher price than that named in the lowest bid or bids received, the contract will be so awarded. (2). Fuel oil should be either a natural homogeneous oil, or a homogeneous residue from a natural oil; if the latter, all constituents having a low flash point should have been removed by distillation; it should not be composed of a light oil and a heavy residue mixed in such proportions as to give the density required. (3). It should not have been distilled at a temperature high enough to burn it, nor at a temperature so high that flocks of carbonaceous matter began to separate. (4). It should not flash below 60° C. (140° F.) in a closed Abel-Pensky or Pensky-Martens apparatus. (5). Its specific gravity should range from 0·85 to 0·96 at 15° C. (59° F.); the oil should be rejected if its specific gravity is above 0·97 at that temperature. (6). It should be mobile, free from solid or semi-solid bodies, and should flow readily, at ordinary atmospheric temperatures and under a head of 1 ft. of oil, through a 4 in. pipe 10 ft. in length. (7). It should not congeal nor become too sluggish to flow at 0° C. (32° F.). (8). It should have a calorific value of not less than 10,000 calories per grm. (18,000 B.T.U. per lb.); 10,250 calories to be the standard. A bonus is to be paid or a penalty deducted according to the method stated under section (21), as the fuel oil delivered is above or below this standard. (9). It should be rejected if it contains more than 2 per cent. of water. (10). It should be rejected if it contains more than 1 per cent. of sulphur. (11). It should not contain more than a trace of sand, clay or dirt. (12). Each bidder must submit an accurate statement regarding the fuel oil he proposes to furnish. This statement should show: (*a*), the commercial name of the oil; (*b*), the name or designation of the field from which the oil is obtained; (*c*), whether the oil is a crude oil, a refinery residue, or a distillate; (*d*), the name and location of the refinery, if the oil has been refined at all. (13). The fuel oil is to be delivered f.o.b. cars or vessel, according to the manner of shipment, at such places, at such times, and in such quantities as may be required during the fiscal year. (14). Should the contractor, for any reason, fail to comply with a written order to make delivery, the Government is to be at liberty to buy oil in the open market and charge against the contractor any excess of price, above the contract price, of the fuel oil so purchased.

Sampling.—(15). Deliveries of fuel oil will be sampled by a representative of the Government. Whenever such action is practicable, the oil will be sampled as it is being delivered. The final sample will be made from samples taken from as large a proportion of the delivery as practicable, in order that the final sample may truly represent the delivery. (16). The final sample will be sealed and forwarded to the Federal Bureau of Mines, Pittsburg, Pa., for analysis. (17). If the contractor so desire, permission will be given him, or his representative, to witness the sampling of the delivery and the preparation of the final sample. (18). The final sample will be analysed and tested immediately after its receipt in Pittsburg.

Causes for rejection.—(19). A contract entered into under the terms of these specifications shall not be binding if, as the result of a practical service test of reasonable duration, the fuel oil fails to give satisfactory results. (20). It is understood that the fuel oil delivered during the term of the contract shall be of the quality specified. The frequent or continued failure of the contractor to deliver oil of the specified quality will be considered sufficient cause for cancelling the contract.

Price and payment.—(21). Payment for deliveries will be made on the basis of the price named in the proposal for the fuel oil, corrected for variations in heating value, as shown by analysis, above or below the standard fixed by the contractor. This correction is a *pro rata* one, and the price is to be determined by the following formula:—

$$\frac{\text{Delivered calories per gram (or B.T.U. per lb.)} \times \text{contract price}}{\text{Standard calories per gram (or B.T.U. per lb.)}} = \text{price to be paid.}$$

Water that accumulates in the receiving tank will be drawn off and measured periodically. Proper deduction will be made by subtracting the weight of the water from the weight of the oil deliveries. The report also deals with the following points:—

Determination of weight from volume.—The observed specific gravity should be corrected by adding or subtracting 0·0006 for each 1° C. above or below 15° C. The weight of 1 gallon in pounds is 8·3316 times the corrected specific gravity, or the weight of 1 cub. foot in pounds is 62·3425 times the corrected specific gravity.

Reporting analyses of fuel oil.—The determinations to be made are the specific gravity at 15° C., the calorific value, the proportions of water, sulphur and of earthy matter, etc., the flash-point, and the burning point.

Sampling wagon deliveries.—A pint dipper is filled with oil from the stream flowing from the wagon at regular intervals, 12 or more lots being taken. The sample should be labelled so as to show the total bulk represented. A continuous sample may be run off from a cock on the underside of the delivery pipe. If a sample is required of oil delivered in separate lots over a period of time, proportional quantities of samples taken from the various deliveries may be mixed and stored in a tightly stoppered tinned drum, provided deliveries are of uniform quality. An iron drum should not be used, as it will absorb sulphur.

Sampling a large tank or reservoir.—A dipperful should be taken from the bottom of the tank, and examined for sediment. If a considerable quantity of sediment is brought up, the oil should be rejected. If the oil has stood long enough to form strata of different densities, a sample should be taken by lowering an open iron pipe, 1 in. in diameter, vertically to the bottom of the tank, and then closing the bottom end by means of a conical wooden plug attached to a wire passing up through the tube. Similar samples should be taken from different parts of the tank and mixed together. Alternatively, bottle-fulls of oil may be taken from a number of different points in the tank.

Sampling a single drum.—This may be done by dipping to the bottom with a glass tube which is withdrawn while closed by the finger at the top end.

Forwarding samples.—Samples are best forwarded in a tin can with soldered stopper, space being left for expansion of the oil.

Sampling gas from a well.—The gas should be allowed to blow through a rubber tube which is inserted into a clean dry glass stoppered bottle for at least 15 minutes, the bottle being arranged bottom up. The bottle is then closed with a greased stopper, and sealed with paraffin wax.—A. T. L.

Naphthalene washers. Zwarg. J. Gasbeleucht., 1911, 54, 837—838.

Experiments were made to determine whether naphthalene could be removed from gas by means of the oil-gas tar formed in the manufacture of carburetted water-gas. The oil used was of Galician origin, and the tar gave the following results on fractionation: Water, 1 per cent.; light oil, below 170° C., 6·5; middle oil, 170°—230° C., 9; heavy oil, 230°—270° C., 18·5; anthracene oil, over 270° C., 42 per cent. The oil-gas tar dissolved 28—30 per cent. of naphthalene at 25—30° C., but could not be used alone in a naphthalene washer since tar containing 6 per cent. of naphthalene gives up 5·2 grms. of naphthalene per cub. metre of naphthalene-free gas passed through it. The tar was, however, used in the inlet chamber of a two-chamber washer, anthracene oil from coal-tar being used in the outlet chamber. The tar was changed when a fraction distilling between 200° and 270° C. deposited 21 per cent. of naphthalene on cooling for one hour to the temperature of the room. The anthracene oil was transferred to the inlet chamber when a similar fraction gave 1 per cent. of naphthalene, and was used in the inlet chamber until a similar test showed about 24 or 25 per cent. of naphthalene.—A. T. L.

Petroleums; Presence of cholesterol in Java ——. A. K. Koss. J. Russ. Phys.-Chem. Soc., 1911, 43, 697—707.

The author has made a number of experiments with Ledok and Gogor petroleums (from Java), the results being in disagreement with Engler's view (this J., 1908, 932) that the optical activity of petroleum is due to a product of the destructive distillation of cholesterol. For instance, when cholesterol was dissolved in a lævo-rotatory fraction of either of these petroleums and the solution completely distilled, the lævo-rotation of the distillate was found to be identical with that of the original fraction. Also the magnitudes of the lævo-rotations are not altered by treatment of these fractions with ozone.—T. H. P.

Census of production. Output by gas undertakings. [Cd. 5813.] [T.R.]

A blue-book has been issued by the Board of Trade summarising the preliminary results of the returns received under the Census Act, together with a short report by the Director of the Census. The chief figures arrived at are as follows:—

	Gross Output. Per million £	Material Used. Million £	Persons Employed. Thousands.
England and Wales	1,483	860	5,764
Scotland	208	116	885
Ireland	66	43	287
United Kingdom	1,757	1,019	6,936

In addition there were employed about 100,000 out-workers, and the figures show that with some seven million persons employed, there was added by labour a value of, roughly, 712 millions sterling to the value of the raw materials purchased. Included in the Preliminary Tables is a return of output from gas undertakings by companies and public authorities. These figures, so far as they relate to items connected with the chemical trade, together with the output of private firms and companies connected with the tar-distillation industries, are as follows:—

	From gas undertakings only.	Total output for U.K.
Crude tar	653,000 tons	846,000 tons
Ammoniacal liquor	£322,000	£361,000
Ammoniacal liquor and crude tar, not separately distinguished	£179,000	£179,000
Ammonium sulphate	105,000 tons	260,000 tons
Anthracene	296,000 lb.	3,126,000 lb.
Benzol and toluol	46,000 gals.	6,212,000 gals.
Carbolic acid	18,000 gals. 18,000 cwt.	688,000 gals. 160,000 cwt.
Naphtha	281,000 gals.	4,188,000 cwt.
Naphthalene	44,000 cwt.	283,000 cwt.
Pitch	85,000 tons	647,000 tons
Tar (ref.) and tar-varnishes	642,000 gals.	6,215,000 gals.
Tar oil, creosote, etc.	7,877,000 gals.	65,613,000 gals.
Other products	£199,000	£565,000

The total value of the above-mentioned products, produced by gas undertakings only, amounted in 1907 to £30,285,000, and is exclusive of the value of any gas and coke used in the gasworks where they were made. The exports of sulphate of ammonia amounted to 231,000 tons, or 89 per cent. of the total output; the imports are not separately specified, but they are negligible. The exports of carbolic acid amounted to 126,000 cwt., valued at £154,000, free on board; those of anthracene and naphthalene to 1,000 cwt., valued at £28,000, free on board; and the exports of all other coal-tar products (not dyes) were valued at £1,604,000, free on board. The net imports of coal-tar products (not dyes) were valued at £87,000 at port of landing.

Coke production in the United States. E. W. Parker. Mineral Resources, 1910. [T.R.]

The amount of coke produced in the United States in 1910 was 41,708,810 short tons, valued at $99,742,701, compared with 39,315,065 tons and $89,965,483 in 1909. The quantity of coal used for coking in 1910 was 63,088,327 short tons. There were 578 coking establishments in existence at the end of 1910, representing 104,440 ovens. Nine establishments, representing 894 ovens, were abandoned or dismantled, and 100 establishments were idle during 1910.

As regards by-product ovens, in 1910 there were 4078 completed and 1200 building. Their production amounted to 7,138,734 short tons of coke, an increase of 884,090 short tons over 1909. Of the completed ovens, 1387 were of the Semet-Solvay type, 2104 United Otto, 307 Rothberg, and 280 Koppers ovens; of those building, 900 were Koppers and 300 Didier ovens. The total value of the coke, gas, tar, ammonia, etc., produced at by-product recovery ovens during the last three years was as follows:—

	1908.		1909.		1910.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gas ... thousand cubic feet	16,205,925	$2,557,483	15,791,220	$2,609,211	27,692,858	$3,017,908
Tar ... gallons	42,720,609	1,007,613	60,126,006	1,408,611	66,303,214	1,599,453
Ammonia, sulphate or reduced to equivalent in sulphate ... pounds	43,329,426	1,286,224	123,111,197	3,227,316	70,247,543	1,841,062
Ammonia liquor ... gallons	—	—	—	—	4,654,282	295,868
Anhydrous ammonia ... pounds	15,445,030	2,530,979	4,871,014	448,455	20,229,421	1,725,266
All other products	—	—	—	380,355	—	—
Total value of by-products	—	7,382,299	—	8,073,948	—	8,479,557
Coke ... short tons	4,201,226	14,465,429	6,254,644	20,434,689	7,138,734	24,793,016
Grand total	—	21,847,728	—	28,508,637	—	33,272,573

The subjoined table shows the value of the coal-tar products imported into the United States during the last four years :—

Year.	Salicylic acid.	Alizarin and colours or dyes, natural aad artificial.*	Aniline salts.*	Coal-tar colours or dyes, not specially provided for.†	Coal tar, all preparations, not colours or dyes. ‡	Coal tar products not medicinal, not dyes, known as benzol, toluol, etc.*	Total.	
	Value.	Value.	Value.	Value.	Value.	Value.	Value.	Duty.
1907...	$1,240	$782,368	$667,758	$5,830,651	$911,096	$653,288	$8,846,401	$1,931,904
1908...	1,183	752,386	450,891	4,573,217	717,556	549,352	7,044,585	1,515,821
1909...	—	1,191,874	553.503	6,431,767	693,608	960,724	9,831.476	2,068,298
1910...	—	430,393	501,369	5,867,331	594,252	962,232	8,355,577	1,878,947

* Free of duty. † Duty 30 per cent. *ad val.* ‡ Duty 20 per cent. *ad val.*

Patents.

Briquette fuel ; Production of ——. K. I. Crossley and T. Rigby, Manchester. Eng. Pat. 12,013, May 14, 1910.

The vapours from the dryer of a briquetting plant for brown coal, peat, or similar fuel, are mixed with the air supply of a gas-producer of the recovery type, so as to save the cost of raising steam for the producer. The air and vapours may be drawn through the producer by suction, or a blower may be arranged between the dryer and the producer, or air may be forced through the dryer to the producer. A dust-collecting device may be interposed between the dryer and the producer. When the briquetting plant is used for wet-carbonised peat, and the peat is superheated before briquetting, as described in Eng. Pat. 12.010 of 1909 (this J., 1909, 1026), the vapours together with air are passed through a dust-separator and are then forced by a compressor through a steam superheater and then through the peat superheater of the briquetting plant, and finally to the gas-producer. The quantity of air mixed with the vapours is adjusted so that the mixture leaves the dryers at 85° C.—A. T. L.

Fuel ; Composition of matter for increasing the efficiency of ——. A. C. and W. J. Robinson, Montreal, Canada. Eng. Pat. 8701, Apr. 7, 1911.

A composition is prepared by sprinkling finely ground charcoal with a solution of potassium permanganate, and mixing the product with "black antimony," zinc dust and common salt. The composition is used in the proportion of 8 lb. to 1 ton of coal, and is applied by mixing with water and sprinkling over the coal. The proportions claimed are as follows, the preferred proportion being indicated in parenthesis :—Charcoal, over 1 (1¼) per cent. ; potassium permanganate, under ½ (⅛) per cent. ; "black antimony," 1 to 3 (1⅔) per cent. ; zinc dust, 1 to 5 (3⅓) per cent. ; salt, about 95 (93⅝) per cent.—A. T. L.

Gas-producer. J. A. Herrick, New York. U.S. Pat. 1,001,398, Aug. 22, 1911.

The producer is of the type having a rotating body-portion surmounted by a fixed upper portion into which the fuel is delivered from a rotating hopper. The upper portion of the producer is provided with a depending wall, forming an annular space through which the gases pass to the outlet. The blast is delivered partly into the upper and partly into the lower part of the producer. A fixed central tuyère-box at the bottom of the producer is provided with projections which crush the clinker as the body portion revolves, and the support for the tuyère has a spiral flange which forces the ashes downwards. —A. T. L.

Gas producers ; Process for the utilisation of small or dusty fuel in ——. A. von Kerpely. Ger. Pat. 235,488, June 5, 1910.

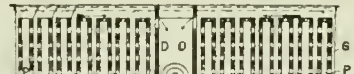
The producer is provided in its lower portion with a central rotary grate and above this with a step-grate, on to which the fuel fed in at the top of the producer falls and is distributed towards the centre of the producer. The step-grate may be water-cooled. Air (and if required also steam) is forced through the rotary grate, into the space between this and the step-grate, in which space combustion of the lowest layer of fuel is effected. The air and combustion gases then pass through openings at different heights in the step-grate and cause a partial carbonisation of the upper layers of fuel.—A. S.

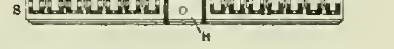
Paraffin and like mixtures ; Sweating truck for sweating out substances melting at different temperatures from crude ——. E. D. Pyzel, Amsterdam. Eng. Pat. 8279 of 1911, date of Appl., Sept. 26, 1910.

The truck is provided with a number of inclined sweating pans in tiers, one above the other, and a vertical collecting pipe is arranged in one corner of the truck with catch cups for receiving the molten products from each tier of pans. The collecting pipe has a swivel discharge orifice at the bottom by which products of different melting points may be run off into different gutters.—A. T. L.

Paraffin ; Apparatus for separating oil from —— and for the fractional melting of paraffin in perforated receptacles by means of circulating warm water. M. and L. Singer. P. Porges, and R. Neumann. Ger. Pat. 235,777, Oct. 8, 1910.

The vessel, G, filled with the warm water to be used for the "sweating" process, is divided into three or two compartments, B, B, H, or B, H respectively, by the partitions, D, D, or D, W. In the compartments, B, which have perforated walls and covers. the receptacles, P, containing the paraffin are placed, whilst the device, S, for circulating the water is disposed in the compartment, H. The openings in the partitions through which the water flows are provided with adjustable flaps or covers, to allow of regulating the circulation of the water.—A. S.





Briquet [of fuel or ore] and method of making the same. A. Zindler, Berlin. U.S. Pat. 1,000,479, Aug. 15, 1911.

See Fr. Pat. 395,385 of 1908 ; this J., 1909, 512.—T. F. B.

Coke ovens ; Regenerative ——. E. Wagener, Dahlhausen on Ruhr, Germany. Eng. Pat. 22,225, Sept. 24, 1910.

See U.S. Pat. 977,348 of 1910 ; this J., 1911, 12.—T. F. B.

Gas producers. R. E. Mathot, Brussels. Eng. Pat. 19,022, Aug. 12, 1910. Under Int. Conv., Aug. 31, 1909.

SEE Fr. Pat. 419,177 of 1910; this J., 1911, 75.—T. F. B.

Porous material intended to prevent the propagation of explosive waves; Manufacture of —— particularly applicable where the porous material is used in oxy-acetylene or other blowpipes and in dissolved acetylene and like containers. Acetylene Illuminating Co., Ltd., London. From Acétylène Dissous et Applications de l'Acétylène, Paris. Eng. Pat. 23,855, Oct. 14, 1910.

SEE Fr. Pat. 427,817 of 1910; this J., 1911, 1044.—T.F.B.

Naphtha residues and tars; Process for separating solid hydrocarbons from ——. J. Tanne, Rozniatow, Galicia, and G. Oberländer, Berlin. Eng. Pat. 1687 of 1911, date of Appl., Oct. 6, 1910. Addition to Eng. Pat. 27,116, Nov. 22, 1909.

SEE Ger. Pat. 227,334 of 1909; this J., 1910, 1367.—T.F.B.

Consolidation of small coal into large coal and simultaneous desiccation and consolidation of pulps. Eng. Pats. 19,190, 24,941, and 28,899. *See* I.

Apparatus for the detection and localisation of inflammable or explosive gases or dust. Eng. Pats. 21,375 and 7492. *See* XXIII.

IIB.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Methyl alcohol in the United States. Chem. and Drug., Aug. 26, 1911. [T.R.]

CRUDE methyl alcohol is usually termed "wood alcohol" in commerce in the United States, and because of the name "alcohol" in the title, many ignorant people have thought it was a cheap form of ordinary alcohol, and in prohibition sections have purchased it for drinking purposes. The results have frequently been fatal, and in other instances have caused a temporary or a permanent blindness due to paralysis of the optic nerve. Hence the enactment of a law in Minnesota last year providing that methyl alcohol must be called "wood naphtha" in trade, and must have this name given to it in catalogues and on labels. It is hoped in this way that the laity will become unfamiliar with the term "wood alcohol," and in calling for "wood naphtha" will not fall into the error of assuming that the substance may be used as a beverage. The New York State Pharmaceutical Association, at its recent annual meeting, agreed to endeavour to promote legislation like that in Minnesota, and the National Association of Retail Druggists believe that a national law along this line ought to be enacted.

PATENTS.

Ammoniacal liquors or waste liquors resulting therefrom; Treatment and purification of ——. F. R. Lowe and B. Ely, Alfreton, Derby. Eng. Pat. 19,074, Aug. 13, 1910.

AMMONIACAL waste liquors are allowed to flow through tanks containing various grades of coke, coke-breeze, or the like, so as to remove all suspended matter, and the filtered liquor is then passed into a tank, where it is intimately mixed with a quantity of animal charcoal. The mixture of liquor and animal charcoal passes from the mixing chamber into a settling tank, where bacterial action takes place, with the result that the animal charcoal absorbs any free ammonia present and the whole of the tar oils and phenoloid bodies. At the outlet of the settling tank the effluent is then pure enough to allow of its being discharged into rivers or streams.—O. R.

Ammonium sulphate from distillation gases; Process for the production of ——. R. Barth. Ger. Pat. 235,157, Jan. 14, 1910.

THE hydrogen sulphide expelled from the gas liquor is converted into sulphur dioxide and the latter added to the distillation gases in order to reduce the amount of sulphuric acid needed for the subsequent recovery of the ammonia. The hydrogen sulphide left in the gas after it has passed the condensers is removed by washing with the liquor coming from the hydrogen sulphide separator, which is rich in ammonia but contains little hydrogen sulphide.—A. S.

Incandescence mantles from artificial silk; Process for the preparation of ——. R. Pawlikowski. Ger. Pat. 236,159, Nov. 15, 1910.

THE filaments from the artificial silk solution, before the usual twisting operation, are wound on a roller to form the mantle, which is then subjected, whilst on the roller, to the operations of washing, impregnating, and drying. —A. S.

Electric lamps; Incandescing bodies for ——, and methods of manufacturing same. K. Schwab, Charlottenburg, Germany. Eng. Pat. 8004, March 30, 1911. Under Int. Conv., April 9, 1910.

WHEN lamp filaments consisting of drawn tungsten wires, free from any trace of non-metallic constituents, are used with alternating currents, the metal becomes crystalline and the filament deteriorates. According to the invention this may be prevented by the presence of a small quantity of non-metallic substance, preferably phosphorus, in the filament. The amount does not exceed 0·02 per cent. and its presence does not appreciably affect the conductivity. The filaments may be drawn from tungsten containing the non-metallic substance, or a tungsten-nickel alloy may be used. The alloy is made from phosphoric tungsten or phosphoric nickel, and the nickel is driven off from the filament by heating in a vacuum or in an inert atmosphere.—A. T. L.

[Lamp] Filaments; Electric ——. C. A. von Welsbach, Vienna. U.S. Pat. 1,001,105, Aug. 22, 1911.

AN osmium-alloy filament free from occluded gases is made from an osmium filament coated with a metallic oxide which can be reduced by the occluded gases. The lamp-bulb is dried and rinsed by alternately admitting dry reducing gases, and exhausting, and during the final exhaustion the filament is heated by the passage of a current so as to expel the occluded gases. The filament is finally brought to a white heat so as to reduce the oxide, and the bulb is sealed.—A. T. L.

Photometers. W. Kummerer, and Ges. für Electrotechn. Ind. m. b. H., Berlin. Eng. Pat. 11,111, May 8, 1911.

THE photometer is of the type in which a selenium cell is illuminated alternately by light from the two sources to be compared, by means of a rotating mirror mounted obliquely to the axis of rotation. A direct current is passed through the selenium, and unequal illumination from the two sources changes this to a pulsating direct current, which is commutated by a switch rotating with the mirror, and then passed through a direct current galvanometer, equal illumination being indicated by a zero reading. According to the invention, the pulsating direct current is passed through the primary of a transformer, and the secondary is connected in series with the commutator and galvanometer. In this way errors in commutation are reduced. The apparatus is also claimed for measuring the transparency of photographic plates by interposing them between a source of light and the photometer. —A. T. L.

Metallic filaments for electric lamps; Manufacture of ——. J. Schilling, Grunewald, Germany. Eng. Pat. 23,639, Oct. 12, 1910. Under Int. Conv., Dec. 29, 1909.

SEE Fr. Pat. 420,982 of 1910; this J., 1911, 410.—T. F. B.

Metallic filaments for incandescent electric lamps; Process for decarbonising ——. Westinghouse Metallfaden Glühlampenfabrik, Vienna. Eng. Pat. 24,637, Oct. 24, 1910. Under Int. Conv., Nov. 12, 1909. Addition to Eng. Pat. 2983 of 1910, dated Feb. 19, 1909.

See Addition of Oct. 26, 1910, to Fr. Pat. 412,443 of 1910; this J., 1911, 530.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Patents.

Acid tar; Treatment of ——. W. O. T. van Tienen, Rotterdam, Assignor to De Bataafsche Petroleum Maatschappij, The Hague. U.S. Pat. 1,000,646, Aug. 15, 1911.

See Eng. Pat. 23,368 of 1910; this J., 1911, 409.—T. F. B.

Anthraquinone series; Product of the —— *and process of making same.* F. Ullmann, Charlottenburg, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,001,325, Aug. 22, 1911.

See Fr. Pat. 423,720 of 1910; this J., 1911, 613.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Indigo yellow. Wuth. Färber-Zeit., 1911, **22**, 343—345.

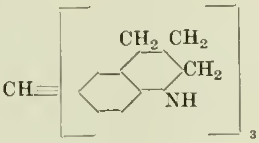
Indigo, when treated with excess of benzoyl chloride is transformed into dibenzoylindigo (m. pt. 108° C.). Engi and Fröhlich, however, have found that if the reaction be allowed to take place in the presence of a condensing agent such as a suitable metal or metallic salt, a new greenish yellow dyestuff is obtained which melts at 275°—277° C. and, unlike dibenzoylindigo, is not saponified by a solution of sodium hydroxide. This product is sold as Indigo Yellow 3 G Ciba (S.C.I.). Analysis shows that it is formed by the combination of one mol. of indigo with one mol. of benzoyl chloride. The acid chloride would most probably attack the imino groups first, but the stability of the new product to alkalis suggests that a subsequent condensation occurs resulting in the formation of a new ring. Substitution products of indigo such as dibromoindigo react with benzoyl chloride in the same way as indigo itself and the benzoyl chloride may also be replaced by its ring-substituted derivatives, by benzotrichloride or by benzal chloride. The new dyestuffs may also be chlorinated or brominated and give products which have greater affinities for cotton and dye faster shades than the dyestuffs from which they were prepared.—P. F. C.

Magentas and similar dyestuffs; Preparation of ——. Sealed Note No. 1136, deposited Oct. 16, 1899, by E. Suais. Bull. Soc. Ind. Mulhouse, 1911, **81**, 180—183.

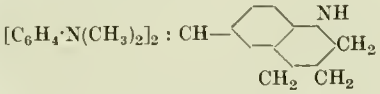
The process consists in condensing 1 mol. of a primary amine, 1 mol. of formaldehyde and 2 mols. of an aromatic hydrazine by means of sulphuric acid. The condensation product of the amine and formaldehyde may be prepared separately. Paramagenta is obtained as follows:—2·5 grms. of aniline are dissolved in 80 grms. of sulphuric acid and to the cooled solution are added 1·8 c.c. of 40 per cent. formaldehyde solution. On the next day 7 grms. of phenylhydrazine hydrochloride are added and the mixture is heated on the water-bath for 12—15 hours. It is then poured into water, precipitated by sodium carbonate and filtered. The residue is redissolved in water and excess of hydrochloric acid, the solution saturated with salt and the dyestuff filtered off. E. Noelting reports that the process is new but is of the opinion that it cannot compete with those already in vogue.—J. C. C.

Hydrotriquinolylmethane and the influence of quinoleic and tetrahydroquinoleic groups on the character of dyestuffs of the Malachite Green series in the light of Bamberger's theory. E. Schell. Rev. Gen. Mat. Col., 1911, **15**, 259—265.

The author adduces the following facts in support of Bamberger's views on the constitution of quinoline. (1) Triquinolylmethane, prepared by Skraup's reaction from pararosaniline as described by Schwartz (Ber., 1891, **24**, 3139—3143; this J., 1892, 25) gives on reduction with tin and hydrochloric acid a dodecahydrotriquinolylmethane having the constitution:



This compound on oxidation with lead peroxide yields a bluish-violet dyestuff whilst triquinolylmethane remains colourless. (2) Tetramethylparatriaminotriphenylmethane was prepared by condensing *p*-nitrobenzaldehyde with dimethylaniline and then reducing the nitro group of the product with zinc dust and hydrochloric acid. By subjecting this substance to Skraup's reaction with glycerin, picric acid and concentrated sulphuric acid, tetramethyldiaminodiphenylparaquinolylmethane was obtained. It melted at 164° C. and gave a green dyestuff on oxidation. On reduction it was transformed to the corresponding tetrahydro-compound, a substance melting at 159°—160° C. and having the formula:



This product on oxidation gave a blue dyestuff analogous to a pentalkyl violet. (3) The corresponding tetramethyldiaminodiphenylmetaquinolylmethane, obtained by condensing *m*-nitrobenzaldehyde with dimethylaniline and then reducing the product and converting it into the quinolyl compound, melted at 185°—186° C. and yielded on oxidation a green dyestuff analogous to Malachite Green, whilst its tetrahydro derivative melted at 179°—180° C. and yielded on oxidation a green dyestuff analogous to a meta-substituted Malachite Green. At the beginning of the paper the author reviews Bamberger's work on the constitution of naphthalene and quinoline.—P. F. C.

Hydroxyazo dyes; Bisulphite compounds of ——. N. N. Voroztsov. J. Russ. Phys.-Chem. Soc., 1911, **43**, 771—786.

The author has investigated the structure of the compounds formed by sodium bisulphite with the following hydroxyazo-dyestuffs: benzeneazo-*p*- and *o*-cresol and benzeneazo-α- and β-naphthol. It is found that all hydroxyazo-compounds do not react in the ordinary manner with bisulphite. Thus *p*- and *o*-hydroxyazobenzene and benzeneazo-*o*- and *p*-cresol undergo no change on prolonged boiling with aqueous alcoholic sodium bisulphite solution, whereas the azo-derivatives of α- and β-naphthol readily react under these conditions, giving crystalline compounds soluble in water. The acetyl-derivatives of the two azonaphthols also react with bisulphite, the compounds obtained yielding, on decomposition with cold dilute ammonia or caustic soda solution, the same hydroxyazo-compounds as are given, under similar conditions, by the bisulphite compounds of the non-acetylated azonaphthols; the acetyl groups evidently undergo hydrolysis during the reaction with bisulphite. The readiness with which these bisulphite compounds are decomposed, even by dilute alkalis, taken in conjunction with the fact that the analogously constituted hydrazobenzene-N-sulphonic acid (see Bucherer and Sonnenburg, J. prakt. Chem., 1910, [ii], **81**, 1) gives azobenzene only when heated with sodium hydroxide, is not in agreement with Spiegel's view (Ber., 1885, **18**, 1479) that these compounds are hydrazo-N-sulphonic derivatives. Then, too, aminoazo-compounds react with bisulphite giving products identical with those formed by the corresponding hydroxyazo-compounds. Thus successive treatment with bisulphite and ammonia affords a simple means for the quantitative conversion of the amino-azo- to the hydroxyazo-compounds of the naphthalene series. The author regards the compounds formed by bisulphite with the hydroxyazo-phenols of the naphthalene series as salts of sulphurous esters, those formed by the benzeneazo-naphthols for example, having the structure: $C_6H_5{\cdot}N:N{\cdot}C_{10}H_6{\cdot}OSO_2Na$. Although the phenols of the naphthalene series can be readily converted into the corresponding amino-compounds by being heated under pressure with ammonia and ammonium sulphite, thus: $R{\cdot}OH \rightarrow R{\cdot}O{\cdot}SO_2{\cdot}NH_4 \rightarrow R{\cdot}NH_2$, benzene-azo-α-naphthol does not undergo a similar change, the chief product formed under the conditions named being αα-dinaphthylamine-bis-azobenzene, $C_6H_5{\cdot}N:N{\cdot}C_{10}H_6{\cdot}NH{\cdot}C_{10}H_6{\cdot}N:N{\cdot}C_6H_5$.—T. H. P.

Azo colours; Action of sodium sulphite and bisulphite on some ——. R. Lepetit and E. Levi. Gaz. chim. ital., 1911, **41**, I., 675—688.

It has been shown previously (see this J., 1910, 411) that azo colours of the general formula, $NO_2{\cdot}C_6H_4{\cdot}N:N{\cdot}R$, are readily reduced by sodium sulphide to the corresponding amino-compounds, which may be diazotised and combined with suitable components to form tetrazo colours. Experiments have now been made to ascertain whether a similar reduction can be effected by means of sulphites. When benzeneazosalicylic acid or its *p*-nitro-derivative is boiled for a long time with sodium sulphite or bisulphite, the azo compound is decomposed and one or more sulphonic groups are introduced; reduction also takes place, and formation of ammonia. *p*-Nitrobenzeneazosalicyclic acid (Alizarin Yellow R) yields aminobenzeneazosalicylic acid, *p*-nitraniline, and the sulphonic acid of aminosalicylic acid. The last-named acid, and a hydrazo-compound, probably $C_6H_5NH{\cdot}N(SO_3H){\cdot}C_6H_3(OH)COOH$, are obtained from benzeneazosalicylic acid. By working at a relatively low temperature (below 60° C.), the action of sodium sulphite on *p*-nitrobenzeneazosalicylic acid can be confined mainly to one of reduction, the corresponding amino-compound being produced, without any notable decomposition of the azo-group.—A. S.

Indigo trade of India. Review of the Trade of India, 1910—1911. [T.R.]

The crop of 1910 showed a continuation of the contraction in area, but a fairly satisfactory yield was on the whole obtained. There was a good deal of disappointment with the outturn of the Java-Natal seed, but it is believed that this may have been due to neglect of the principle that fresh seed should be imported frequently. The outturn was estimated at some 3 per cent. less than in 1909. The low yield is reflected in the reduced exportation, but prospects are overshadowed by the prognostication of a rate war between competitors in the German synthetic indigo trade and by the menace of lower prices to be met. The accounts of the next crop are for the most part good both as regards quantity and quality.

The following statement shows the exports of indigo in 1910–11 and the five previous years, together with approximate quotations of average price in London:—

	From Calcutta.	From Madras ports.	From other ports.	Total.	Value.		Aver. price per cwt.
	cwts.	cwts.	cwts.	cwts.	Rs.	£	£ s. d.
1905–6	19,062	7,756	4,368	31,186	58,64,000 =	391,000	19 7 4
1906–7	19,309	11,159	4,634	35,102	70,05,000 =	467,000	20 6 0
1907–8	16,627	10,619	5,244	32,490	63,73,000 =	425,000	20 1 4
1908–9	17,698	4,636	2,612	24,946	49,05,000 =	327,000	20 10 8
1909–10	11,221	3,655	3,185	18,061	35,18,000 =	234,500	20 1 4
1910–11	10,985	2,364	3,590	16,590	33,53,000 =	223,500	20 15 4

Exports to the United Kingdom improved by 4·1 per cent. to 2982 cwt., and the Continent of Europe increased its demand from 3243 to 4902 cwt. This represents a net expansion of 1659 cwt. for Europe. Shipments to Egypt at 3232 cwt. as against 2586 cwt. in 1909–10, were 25 per cent. more; and those to the United States advanced from 1027 cwt. to 1315 cwt. But Asiatic Turkey took only 2671 cwt. in place of 4387 cwt. in the previous year. The demand in Persia has also contracted from 2730 cwt. to 1504 cwt. The demand from Japan has dropped suddenly from 1012 cwt. to 68 cwt.

PATENTS.

Azo dyestuffs; Production of new ——. P. A. Newton. London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 19,545, Aug. 20, 1910.

Mono- or dis-azo dyestuffs are obtained by combining diazotised aminobenzoyl- or sulphaminobenzoyl-2 : 5-aminonaphthol-7-sulphonic acids or their substitution products with the symmetrical urea of 2 : 5 : 7-aminonaphthol-sulphonic acid or with 5 : 5′-dihydroxy-2 : 2′-dinaphthylamine-7 : 7′-disulphonic acid. The dyes can be combined on the fibre with diazotised *p*-nitroaniline. The disazo dyestuff from 2 mols. of diazotised 2-*m*-sulphaminobenzoylamino-5-naphthol-7-sulphonic acid and the urea of 2-amino-5-naphthol-7-sulphonic acid

$$SO_3H{\cdot}C_{10}H_6(OH){\cdot}NH{\cdot}CO{\cdot}NH{\cdot}C_{10}H_5(OH){\cdot}SO_3H$$

dyes cotton in orange-red shades changing to yellowish scarlet by development with diazotised *p*-nitroaniline; and the monoazo-dyestuff obtained from 2-*p*-aminobenzoylamino-5-naphthol-7-sulphonic acid dyes cotton orange-red yielding a scarlet by developing with diazotised *p*-nitroaniline on the fibre. The monoazo-dyestuff obtained from diazotised 2-*p*-sulphaminobenzoylamino-5-naphthol-7-sulphonic acid and 5 : 5′-dihydroxy-2 : 2′-dinaphthylamine-7 : 7′-disulphonic acid dyes cotton in bluish red shades changing to fast Bordeaux when developed as above and the monoazo-dyestuff prepared from 2-*m*-aminobenzoylamino-5-naphthol-7-sulphonic acid dyes cotton red, changing, with diazotised *p*-nitroaniline on the fibre, to Bordeaux.—J. C. C.

Azo dyestuffs; Production of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 21,201, Sept. 12, 1910. Addition to Eng. Pat. 19,545, Aug. 20, 1910.

Dyestuffs similar to those described in the chief patent (see preceding abstract) are obtained by using diazo compounds prepared from aminophenyl-5-oxy-1 : 2-naphthimidazole-7-sulphonic acids, aminophenyl-5-oxy-1 : 2-naphthoxazole-7-sulphonic acids or aminophenyl-5-oxy-1 : 2-naphthathiazole-7-sulphonic acids.—J. C. C.

Azo dyestuff; Production of a new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 21,200, Sept. 12, 1910.

The tetrazo compound obtained from *pp′*-diaminodiphenylurea-*mm′*-disulphonic acid is combined in alkaline solution with *m*-phenylenediamine. It dyes cotton in yellow brown shades which when developed with diazotised *p*-nitroaniline become reddish brown. —J. C. C.

Azo dyestuffs; Production of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 21,202, Sept. 12, 1910.

p-Aminoazo compounds, obtained from diazotised aminonaphtholsulphonic acids or from diazo compounds of their derivatives substituted in the amino-group by substituents containing a heteronuclear amino-group which can be diazotised, are combined with aromatic benzenoid amines and the products are then converted into ureas by treatment with phosgene or thiophosgene or their equivalents. Example 1: 1-amino-6-naphthol-3-sulphonic acid is diazotised and combined with cresidine ($CH_3 : NH_2 : OC_2H_5 = 1 : 3 : 4$) and phosgene is passed into the alkaline solution of the resulting substance. The dyestuff gives orange shades on cotton which when developed with diazotised *p*-nitroaniline yield a red brown tint fast to light and washing. Example 2: *m*-aminophenyl-5-oxy-1:2-naphthimidazole-7-sulphonic acid is diazotised and combined with *p*-xylidine and the product treated as above with phosgene. The resulting dyestuff dyes cotton in yellow shades which after treatment with diazotised *p*-nitroaniline change to orange. Example 3: *m*-aminobenzoyl-2-amino-5-naphthol-7-sulphonic acid is diazotised and combined with *m*-toluidine and then treated as above. The dyestuff gives yellow shades on cotton which turn to orange with diazotised *p*-nitroaniline.—J. C. C.

Azo dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 21,473, Sept. 15, 1910.

New dyestuffs, possessing properties similar to those described in Eng. Pat. 21,201 of 1910 (preceding), are obtained by combining diazo derivatives of 2.5.7-, 1.5.7-, or 1.6.3-aminonaphtholsulphonic acids with 5.5′-dihydroxy-2.2′-dinaphthylamine-7.7′-disulphonic acid, to mono- or disazo dyes. When the dyed shades are treated with diazotised *p*-nitraniline, violet shades fast to washing are produced. (Reference is directed, under Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 24,296 of 1899.)—T. F. B.

Azo dye; Brown basic ——. H. Gorke, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 999,713, Aug. 1, 1911.

Claim is made for new basic azo dyes obtained from triaminodiphenyl. They dye artificial silk in brown shades. —J. C. C.

Azo dyestuffs dyeing cotton direct and their intermediate products; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 427,572, March 20, 1911. Under Int. Conv., March 29, 1910.

Claim is made for trisazo dyestuffs produced according to the following examples: 2-oxalylamino-4-chloro-5-amino-1-anisole is diazotised and combined with 1-naphthylamine-6-sulphonic acid, the resulting monoazo dyestuff is diazotised and combined with a second mol. of 1-naphthylamine-6-sulphonic acid and the disazo dyestuff thus obtained is diazotised and combined with 1-naphthol-3-sulphonic acid. Finally the oxalyl group is eliminated by heating with sodium hydroxide and the dyestuff is isolated by acidification. It dyes cotton in blue shades which when diazotised and developed on the fibre with *β*-naphthol become greener and fast to washing and light. —J. C. C.

Disazo dyestuff; Production of a new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 27,627, Nov. 28, 1910.

The dyestuff is produced by combining tetrazotised benzidine-*oo′*-disulphonic acid ($NH_2 : SO_3H = 1 : 2$) with 2 mols. of 5:5′-dihydroxy-2:2′-dinaphthylamine-7:7′-disulphonic acid. It dyes cotton in bluish violet shades. —J. C. C.

Disazo dyestuffs; Production of new ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 7422, March 24, 1911. Under Int. Conv., June 15, 1910.

The diazo compounds prepared from 5-amino-4-chloro-2-acidylamino-1-phenol ethers are combined with 1-naphthylamine-6- or 7-sulphonic acid, or with a mixture of both acids, the aminoazo-compounds thus produced are diazotised and combined with 1:3-naphtholsulphonic acid and the acidyl radicle is finally split off. The dyestuff obtained by using 5-amino-4-chloro-2-acetylamino-1-anisole in the first instance dyes cotton in blue shades which when diazotised and developed with *β*-naphthol on the fibre turn greenish blue.—J. C. C.

Trisazo dyestuffs; Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 974, Jan. 13, 1911. Under Int. Conv., April 20, 1910.

The diazo compounds of acidyl-*p*-phenylenediamines or their substitution products (such as *α*-oxalylamino-4-chloro-5-amino-anisol or 5-acetamino-2-amino-toluene) are combined with a suitable middle component capable of being further diazotised after combination; the amino-azo compounds are diazotised and combined with a second molecule of such a middle component; the amino-disazo compounds are then diazotised and combined with a pyrazolone or substitution product thereof, and finally the acidyl group is eliminated. The products dye cotton violet to blue shades, which can be developed on the fibre with *β*-naphthol, the shades produced being pure violet to blue, and fast to light and washing; they can be readily discharged by hydrosulphites to pure white. The following are mentioned as suitable "middle components":—*α*-Naphthylamine, 1-naphthylamine-6- or 7-sulphonic acid, aminonaphtholsulphonic acids, *m*-toluidine, cresidine.—T. F. B.

Trisazo dye; Reddish blue ——. H. Jordan, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 999,797, Aug. 8, 1911.

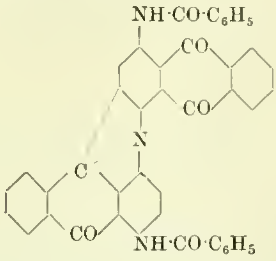
The dyestuff is obtained from *p*-phenylenediamine, 2 mols. of 1-naphthylamine-6-sulphonic acid and 1-phenyl-3-methyl-5-pyrazolone. It dyes cotton in reddish blue shades which when diazotised and developed with *β*-naphthol on the fibre change into slightly bluer shades. —J. C. C.

Dyestuffs of the oxazine series; Manufacture of —— *and of leuco compounds.* P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 20,096, Aug. 29, 1910.

A new series of oxazine dyes is obtained by condensing, in absence of free alkali, *p*-nitrosophenol or its homologues, quinone chlorimide, or *p*-hydroxyazo compounds obtained from phenol or its homologues (*e.g.*, benzene-azo-phenol), with pyrogallol derivatives such as gallic acid or its esters, gallaminic acid, gallanilide, pyrogallol-4- or 5-sulphonic acid, or by treating with oxidising agents a molecular mixture of the pyrogallol derivatives and *p*-aminophenol or its homologues (all products having a free *o*-position to the nitroso, chlorimide, azo, or amino group). The leuco compounds are obtained by reduction of the dyes with hydrosulphites, zinc dust, etc. On dyeing or printing with chrome mordants, the dyes yield reddish-violet shades fast to washing and to chlorine. When the dyes are treated with sulphites or bisulphites, compounds are obtained which can be readily fixed on the fibre, and are therefore of value for use in printing; they produce browner shades than the original dyes (see U.S. Pat. 985,424 of 1911; this J., 1911, 412).—T. F. B.

Vat dye; Olive gray ——. W. Mieg, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 996,109, June 27, 1911.

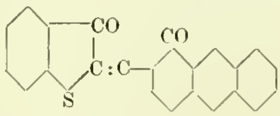
One part of dibenzoyl-*pp′*-diamino-*αα′*-dianthrimide (produced by condensing 1-benzoylamino-4-chloroanthraquinone with monobenzoyl-1:4-diaminoanthraquinone) is heated with 10 parts of concentrated sulphuric acid to 30°—35° C., until the mass has assumed a brown coloration. 10 parts of 40 per cent. fuming sulphuric acid are then added and the mixture is poured on ice. The dye is filtered off and washed with water. It dyes cotton from an alkaline hydrosulphite vat in fast olive gray shades. It has probably the constitution



—J. C. C.

Vat dye. W. Bauer and A. Herre, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 997,260, July 11, 1911.

New vat dyestuffs are obtained by condensing 1 mol. of a 2-arylido-3-ketodihydro-1-thionaphthene with 1 mol. of 1-anthrol. Example: A hot solution in glacial acetic acid of 282 parts of 2-*p*-aminodimethylanilido-3-ketodihydro-1-thionaphthene (obtained from nitrosodimethylaniline and 3-oxy-1-thionaphthene) and of 194 parts of 1-anthrol is heated on the water-bath for about half an hour. The dye which separates on cooling is filtered off and washed. With alkaline hydrosulphite it gives a brownish yellow vat from which cotton is dyed in pure fast violet shades. The constitution of the dye is probably



—J. C. C.

Indigo; Manufacture of a form of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 20,324, Aug. 31, 1910. Addition to Eng. Pat. 18,761, Aug. 9, 1910 (see this J., 1911, 1047).

The property of producing indigo in the form described in the principal patent, is also possessed by all aromatic acids and their salts and by aromatic bases and their salts, particularly bases of the type of phenyldimethylbenzylammonium chloride. The following substances are also especially energetic in this respect:—The naphtholsulphonic acids (1·2, 1·7, 2·6, 2·7, and 2·8); dimethylaniline-*p*-sulphonic acid; 1·5-naphthalenedisulphonic acid; 2-chloro-1-toluene-4-sulphonic acid; phenol-*p*-sulphonic acid; benzylsulphonic acid; the sulphonic acids of phenanthrene, anthracene, hydroxyanthraquinones, phthalic acid, benzaldehyde, phenylhydrazine, and benzoic acid; aryloxyacetic acids; phthalic acid; arylglycines and diglycines; salicylic acid; *β*-aminoanthraquinone; quinoline and quinolinium salts; aniline; dimethylaniline. The process is carried out as described in the original patent.—T. F. B.

Vat dyestuffs; Manufacturing ——. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 9257, April 13, 1911. Under Int. Conv., June 16, 1910. Addition to Eng. Pat. 9116 of 1911, dated April 25, 1910.

Vat dyestuffs are obtained by condensing aniline or a *p*-halogenated homologue with benzoquinone or its derivatives. Example: 12·7 parts of *p*-chloroaniline are dissolved with 10·8 parts of benzoquinone in 50 parts of alcohol and the mass is boiled for about an hour. The separated product is filtered off and washed with boiling alcohol. It gives a pale yellow vat with alkaline hydrosulphite from which wool is dyed in fast yellow shades.

—J. C. C.

Vat dyestuffs; Manufacture of new ——. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 14,904, June 26, 1911. Under Int. Conv., Sept., 12, 1910.

Brown vat dyestuffs are obtained by the action of naphthylamines on the di-, tri- and tetra-halogenated derivatives of benzoquinone. Example: 14·5 parts of *α*-naphthylamine and 12·3 parts of chloranil are boiled for 4 hours with 8 parts of sodium acetate and 150 parts of alcohol. The dyestuff is filtered off and boiled with water. It may also be prepared by using trichloroquinone or 2:5-dichloroquinone instead of chloranil.—J. C. C.

Dyestuffs of the anthraquinone series; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, A. Schmidt, and G. Kranzlein, Höchst on Maine, Germany. Eng. Pat. 9841 of 1911, date of Appl., Oct. 29, 1909. Addition to Eng. Pat. 24,920, Feb. 1, 1909.

Vat dyestuffs, similar to those described in the principal patent (see U.S. Pat. 958,325 of 1910; this J., 1910, 749), are obtained by causing two molecular proportions of *β*-anthraquinonylurea chloride or of *β*-anthraquinonylurethane to act on 1 mol. of a diamino-anthraquinone. If *α*-*α*-diaminoanthraquinones are used (*e.g.*, 1·4, 1·5, or 1·8) the dyes produced give reddish-brown shades on wool and cotton, whereas yellow shades are produced by the dyes obtained from the *β*-*β*-diamino-anthraquinones (*e.g.*, the 2·6 or 2·7).—T. F. B.

Trisulphonic acids of the safranine series; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 426,790, Nov. 28, 1910. Under Int. Conv., Feb. 8, 1910.

Trisulphonic acids of the safranine series are obtained by oxidising *p*-aminodiphenylaminemonosulphonic acids in the presence of monosulphonic acids of tertiary amines and transforming the indamines so produced into trisulphonic acids by oxidising them in the presence of sulphonic acids of primary amines. Example 1 describes the oxidation of *p*-tolyl-*p*-phenylenediaminesulphonic acid with ethylbenzylmetanilic acid and the oxidation of the product together with sulphanilic acid. The resulting dyestuff dyes wool from an acid bath in blue shades. The second example deals with a similar dyestuff produced by using *p*-ethoxyphenyl-*p*-phenylenediaminesulphonic acid instead of the *p*-tolyl derivative.—J. C. C.

Azo colouring matters; Manufacture of ——. Kalle und Co., A.-G., Biebrich on Rhine, Germany. Eng. Pat. 1235, Jan. 17, 1911. Under Int. Conv., Feb. 14, 1910. Addition to Eng. Pat. 8127 of 1910, dated April 13, 1909 (see this J., 1910, 1051).

This specification covers the dyestuffs produced by combining diazo compounds with the carbazole derivatives of 2·6·8-aminonaphtholsulphonic acid (obtained by condensing it with a hydrazine). The secondary disazo dyes (*e.g.*, the dye from amino-azobenzenesulphonic acid and the carbazole compound), have a very marked affinity for cotton, in some cases nearly as great as for wool. The dyes are said to be distinguished by their fastness and clearness of shade. The dyes from benzidine, the carbazole compound, and salicylic acid, resorcinol, *m*-diamines, etc., give fast brown shades when developed with diazotised *p*-nitraniline.—T. F. B.

Vat [anthracene] dyes. A. Lüttringhaus, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,002,066, Aug. 29, 1911.

A monochloro-anthraquinone-acridone is obtained by condensing *p*-chloro-aniline with a 1-halogen-anthraquinone-2-carboxylic acid. The product is a carmine-red powder, insoluble in 65 per cent. sulphuric acid, but soluble to a reddish-yellow solution in 70 per cent. sulphuric acid; it dyes cotton bluish-red shades from the vat.

—T. F. B.

Orthohydroxyazo dyestuffs capable of being chromed and new intermediate products; Production of ——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 427,023, May 17, 1910.

By the simultaneous action of formaldehyde and sulphites, 1-amino-2-naphthol and 2-amino-1-naphthol are transformed into the corresponding aminonaphtholmethylenesulphonic acids. These can be diazotised and the diazo compounds, on nitration, furnish nitrodiazo-acids. Orthohydroxyazo dyestuffs are produced by combining either the simple or nitrated diazo compounds with the usual components.—J. C. C.

Anthraquinone derivatives and their transformation into vat dyestuffs; Production of new ——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 427,189, May 21, 1910.

2-Halogenanthraquinone-3-carboxylic acids are prepared by halogenating the 2-halogen-2-methylanthraquinones in the side chain and treating the product with sulphuric acid or by oxidising the orthohalogenotoluylbenzoic acids in order to transform them into the corresponding halogenphthaloylbenzoic acids and treating the latter with condensing agents. The halogenated acids produced in this way are converted into the corresponding amino-, alkylamino-, arylamino-, or hydroxy-acids by heating with ammonia, primary or secondary amines of the aliphatic or aromatic series or with caustic alkali. If the above halogenated acids are condensed with mercaptans or phenols, arylthioanthraquinone-3-carboxylic acids or aryloxyanthraquinone-3-carboxylic acids are obtained. All the acids prepared as above from the halogenated acids are converted into vat dyestuffs when treated with condensing agents and the dyestuffs thus obtained furnish new dyestuffs when treated with halogens or halogenating agents.—J. C. C.

Vat dyestuffs of the anthraquinone series; New ——. Act.-Ges. für Anilinfabr. Fr. Pat. 427,479, March 17, 1911. Under Int. Conv., Aug. 15 and 16, 1910.

Claim is made for acylaminoanthraquinoneacridones which are vat dyestuffs producing blue shades. A typical one is prepared from anthraquinone-1 : 2-acridone by nitration, reduction, and treatment with benzoyl chloride, or from *p*-bromoanthraquinone-1 : 2-acridone by condensation with benzamide.—J. C. C.

Trisazo dyestuffs dyeing cotton direct; New black ——. Act.-Ges. für Anilinfabr. Fr. Pat. 427,787, March 27, 1911. Under Int. Conv., Oct. 26, 1910.

Trisazo dyestuffs are produced according to the following example: 4 : 4′-diaminodiphenylamine-2-sulphonic acid is tetrazotised and combined with 1 mol. of 2-amino-5-naphthol-7-sulphonic acid in alkaline solution. The intermediate product is acidified and diazotised and the resulting tetrazo compound is combined in alkaline solution with 2 mols. of *m*-phenylenediamine. The dyestuff produces violet black shades on cotton, which are fast to light. The same product is obtained by starting with 4-nitro-4′-aminodiphenylamine-2-sulphonic acid, and reducing the nitro-group after the combination of the diazo compound with 2-amino-5-naphthol-7-sulphonic acid.—J. C. C.

Vat dyestuffs of the anthraquinone series; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 25,184, Oct. 29, 1910. Under Int. Conv., Nov. 1, 1909.

See Fr. Pat. 422,956 of 1910; this J., 1911, 613.—T. F. B.

Vat [thioindigo] dyestuff; Green to black ——. K. Schirmacher, Höchst, and R. Leopold, Hochheim, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning. Höchst on Maine, Germany. U.S. Pat. 1,001,457, Aug. 22, 1911.

See Eng. Pat. 22,014 of 1910; this J., 1911, 176.—T. F. B.

Azo dyestuff; Bluish-red ——. K. Schirmacher, Höchst, and R. Leopold, Hochheim, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,001,458, Aug. 22, 1911.

See Eng. Pat. 22,289 of 1910; this J., 1910, 1297.—T. F. B.

Azo dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 20,025, Aug. 27, 1910.

See Fr. Pat. 427,572 of 1911; preceding.—T. F. B.

Disazo dye; Blue ——. H. Jordan and W. Neelmeier, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,000,269, Aug. 8, 1911.

See Eng. Pat. 7422 of 1911; preceding.—T. F. B.

Disazo dye; Yellow ——. A. Zart, Vohwinkel, and H. Schweitzer, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,001,183, Aug. 22, 1911.

See Eng. Pat. 12,433 of 1910; this J., 1911, 612.—T. F. B.

Trisazo dye; Black ——. M. Kahn and A. Ossenbeck, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,000,606, Aug. 15, 1911.

See Eng. Pat. 19,487 of 1910; this J., 1911, 885.—T. F. B.

Dyestuffs of the triphenylmethane series; Manufacture of mordant ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 27,047, Nov. 21, 1910.

See Fr. Pat. 425,676 of 1911; this J., 1911, 885.—T. F. B.

Vat dye. W. Bauer, Vohwinkel, and A. Herre and R. Mayer, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,001,919, Aug. 29, 1911.

See Eng. Pat. 27,773 of 1909; this J., 1910, 1296.—T. F. B.

Ortho-aminoazo dyestuffs; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 20,217, Aug. 30, 1910.

See Fr. Pat. 420,364 of 1910; this J., 1911, 351.—T. F. B.

Leuco dyestuffs of the gallocyanine series and process of making same. C. de la Harpe and R. Burckhardt. Assignors to Dye-Works formerly L. Durand, Huguenin, und Co., Basle, Switzerland. U.S. Pat. 1,000,899, Aug. 15, 1911.

See Ger. Pat. 228,369 of 1910; this J., 1911, 18.—T. F. B.

Disazo dyes and process of making same. A. L. Laska, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 1,001,286, Aug. 22, 1911.

See Eng. Pat. 1730 of 1911; this J., 1911, 677.—T. F. B.

Anthracene compounds and making same. M. H. Isler, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,001,408, Aug. 22, 1911.

See Ger. Pat. 236,857 of 1910; this J., 1911, 1048.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cellulose; Some new solvents for ——, *and their action on this substance.* H. G. Deming. J. Amer. Chem. Soc., 1911, 33, 1515—1525.

Cellulose in the form of filter paper is soluble in concentrated aqueous solutions of certain salts such as antimony trichloride, stannous chloride, and zinc bromide. In solution in aqueous hydrogen chloride or hydrogen bromide, these salts and many others dissolve cellulose with great ease, as do a few salts in formic acid and trichloracetic acid. It is probable that the process of solution is due to an attraction of cellulose for the metallic salt, which varies in magnitude with the degree of hydration and mechanical structure of the cellulose. This attraction results in a division of the salt between the fibre and the solution. The adsorption complex may now either become hydrated or pass into solution. The latter effect is only likely where a high temperature is employed, or where some agent (*e.g.*, an acid) is present which can bring about union with water. In support of this view it is found that cellulose modified by treatment with acids becomes soluble in certain reagents (*e.g.*, a solution of calcium chloride) in which it was previously insoluble. Chlorosulphonic, arsenic, and selenic acids have also the power of dissolving cellulose. From the acid solutions of salts in which cellulose has been dissolved, there are obtained by reprecipitation amorphous products which have marked reducing properties and are readily hydrolysed. These products are "modified celluloses." One of the formates of cellulose has been hydrolysed by concentrated hydrogen chloride giving a similar "modified cellulose." Further action of the hydrogen chloride converts the cellulose into products soluble in water and finally into dextrose.—W. H. P.

Cork; Origin of ——. S. Zeisel. J. prakt. Chem., 1911, **84**, 317—323.

The investigations of von Schmidt (this J., 1910, 845) are considered very incomplete and his conclusions unsupported by facts.—F. Sodn.

Patents.

Artificial silk; Method of finishing ——. J. Hübner, Cheadle Hulme. Eng. Pat. 19,166, Aug. 15, 1910.

In finishing artificial silk, the threads are treated with a solution of a hygroscopic substance such as glycerin or glucose, which may be acidulated with acetic, tartaric or other similar acid. In some cases the reagents may be applied in separate treatments, the treatment with the hygroscopic agent being followed by a weak acid bath. After treatment the threads are dried at a low temperature. This method of finishing is claimed to impart a soft silk-like "scroop" and appearance.—J. F. B.

Textile fibres; Process for obtaining ——. F. Kreissl and C. Seibert, Vienna. U.S. Pat. 1,001,284, Aug. 22, 1911.

See Fr. Pat. 425,955 of 1911; this J., 1911, 950.—T. F. B.

Cellulose formates; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 24,980, Oct. 27, 1910.

See Fr. Pat. 422,542 of 1910; this J., 1911, 532.—T. F. B.

Celluloid-like masses from acetyl cellulose; Process for the production of ——. A. Eichengrün, Berlin. Eng. Pat. 27,258, Nov. 23, 1910. Under Int. Conv., Nov. 29, 1909.

See Fr. Pat. 419,530 of 1910; this J., 1911, 205.—T.F.B.

Paper mass for industrial purposes; Process for the manufacture of a resistive ——. S. Radványi-Riegler, Budapest. U.S. Pat. 1,001,446, Aug. 22, 1911.

See Fr. Pat. 423,373 of 1910; this J., 1911, 615.—T. F. B.

Preparation of incandescence mantles from artificial silk. Ger. Pat. 236,159. *See* IIb.

Filling or loading material for finishing textiles, paper, etc. Eng. Pat. 11,969. *See* VI.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Shades obtained with metallic salts. P. Montavon. Rev. Gen. Mat. Col., 1911, **15**, 253—255.

Ferric oxide is usually fixed on the fibre by first padding the material in a solution of a ferric salt and then in a dilute solution of sodium carbonate. A less reddish shade can be dyed as follows:—A solution of a ferrous salt is obtained by dissolving 145 kilos. of ferrous sulphate, 50 kilos. of crude lead acetate (prepared from pyroligneous acid) and 5 kilos. of alum in 500 litres of boiling water and then gradually adding a solution of 5 kilos. of sodium carbonate. After standing, the supernatant liquor is decanted off and the residual precipitate is washed with 100 litres of boiling water which is afterwards added to the main solution together with enough water to produce the required degree of dilution. The material to be dyed is first padded "two ends" in clear lime water and then "two ends" in the ferrous solution. Before the final washing off, the batch of cloth is allowed to stand for about an hour so that the greenish ferrous hydroxide can be oxidised by air to the ferric compound which is of a buff shade. To obtain the khaki shade demanded by the French War Office, the material is padded in a mixture of solutions of iron acetate and chromium formate, then dried in a hot flue and steamed. In order to improve the handle of the fabric it is next treated with a boiling solution of sodium silicate containing chalk in suspension and is then washed. If the shade is too bright it can be "saddened" with Cachou de Laval. A pure straw shade may be obtained by padding the fabric (previously impregnated with a solution of lead acetate) in a neutral solution of sodium or potassium chromate whilst if a solution of basic lead acetate (prepared by boiling a solution of lead acetate with litharge) is substituted for the normal acetate, shades ranging from canary to orange can be obtained by varying the proportion of chromate.—P. F. C.

Patents.

Azo dyestuffs on the fibre; Process for the production of ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 9529, April 19, 1911. Under Int. Conv., Aug. 2, 1910.

Cotton fibre is dyed with a dyestuff obtained by combining 1 mol. of a tetrazotised *p*-diamine of the benzidine series with 1 mol. of a *m*-diamine or its sulphonic or carboxylic acids, and with 1 mol. of a phenol; when these dyed fibres are treated with diazotised nitranilines, yellowish-brown shades, fast to washing, are obtained, which can readily be discharged to pure white.—T. F. B.

Anthraquinone dyestuffs; Process of fixing ——. Farbwerke vorm. Meister, Lucius, und Brüning, A. Schmidt, and G. Kranzlein, Höchst on Maine, Germany. Eng. Pat. 9842 of 1911, date of appl., Nov. 1, 1909. Addition to Eng. Pat. 24,920, Feb. 1, 1909.

The dyestuffs obtained by condensing together two mols. of β-anthraquinonylurea chloride or of β-anthraquinonylurethane with one mol. of a diamino-anthraquinone (see Eng. Pat. 9841 of 1911; under Class IV.), may be dyed or printed on the fibre in the manner described in Eng. Pat. 25,117 of 1909 (see Addition of Oct. 30, 1909, to Fr. Pat. 410,842 of 1909; this J., 1910, 939).—T. F. B.

Anthraquinone dyestuffs; Process for fixing ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 25,117, Nov. 1, 1909. Under Int. Conv., Feb. 1, 1909. Addition to Eng. Pat. 24,920, Feb. 1, 1909.

See Addition of Oct. 30, 1909, to Fr. Pat. 410,842 of 1909; this J., 1910, 939.—T. F. B.

Discharging and dyeing of fibres. E. Knecht, Marple, and P. Spence and Sons, Ltd., Manchester. Eng. Pats. 19,117, Aug. 15, and 26,132, Nov. 10, 1910.

Discharges can be produced on dyed fabrics by means of titanous thiocyanate obtained by the double decomposition of titanous sulphate and barium thiocyanate. Titanous thiocyanate is a more efficient discharging agent than the sulphate and moreover it has no tendering action on cotton. The titanic hydroxide which is fixed on the fibre during the discharging process acts as a mordant, so that coloured discharge effects can be obtained by dyeing a discharged fabric with a suitable mordant dyestuff. Example: Calico dyed a light shade of indigo is printed in different patterns with the following discharge pastes. *Mordant*:—1 gall. of titanous sulphate (13 per cent. solution), 5 lb. of barium thiocyanate and 5 lb. of British gum. *Non-mordant*:—1 lb. of Hydrosulphite N.F., 5 lb. of British gum and 1 gall. of water. The printed fabric is dried, steamed for 5 minutes, then run through a boiling caustic soda solution at 4° Tw, washed and subsequently dyed with Alizarin Orange. The dyestuff is only fixed on those parts which were printed with the mordant discharge paste and in this way white and orange effects are obtained on a blue ground.—P. F. C.

Vat dyestuffs; Process for reserving ——. Badische Anilin und Soda Fabrik. Ger. Pat. 237,018, April 17, 1910.

White or coloured reserves may be obtained on textiles by printing them with a mixture containing a zinc salt and a thickening agent, and dyeing with a vat colour in a dyebath to which sodium sulphide or a similar sulphur compound (*e.g.*, an alkali polysulphide) has been added. —T. F. B.

Filling or loading material for finishing textile fabrics, paper, paint and other goods; Manufacture of ——. Hazlewood and Sons, Ltd. and E. Hazlewood, Eccles. Eng. Pat. 11,969, May 18, 1911.

For certain purposes a mixture of barium and calcium sulphates gives better results in the finishing and loading of textiles, paper, etc., than either of the two separately. Such a mixture is obtained according to this specification by precipitating a solution of the two chlorides, mixed in any desired proportions, by means of the necessary quantity of a soluble sulphate or sulphuric acid.—J. F. B.

Mercerised cotton goods; Treatment of ——. F. E. Böttiger, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 1,002,026, Aug. 29, 1911.

See Eng. Pat. 11,729 of 1909; this J., 1910, 209.—T. F. B.

Dyeings capable of being discharged; Process of producing on cotton ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 669, Jan. 10, 1911. Under Int. Conv., Feb. 4, 1910.

See Fr. Pat. 419,559 of 1910; this J., 1911, 206.—T. F. B.

Dyeing apparatus. E. de Journo, Allentown, Pa. U.S. Pat. 1,000,589, Aug. 15, 1911.

See Fr. Pat. 403,014 of 1909; this J., 1909, 1311.—T.F.B.

Multicoloured effects in spun and woven goods; Process of producing ——. M. Becke, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,002,118, Aug. 29, 1911.

See Ger. Pat. 228,693 of 1909; this J., 1911, 206.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Acids; Consumption of the commoner —— *in the United States.* C. E. Munroe. J. Washington Acad. Sci., 1911, 1, 70—73.

The author has utilised the data collected by the U.S. Bureau of the Census in order to ascertain the extent to which hydrochloric, nitric, and acetic acids are used in different industries. He has previously dealt in a similar manner with sulphuric acid (U.S. Census of Manufactures, Bull. No. 92, p. 23, "Chemicals and allied products," for 1905), salt (Bull. No. 83, p. 82, "Salt," for 1905) and sodium nitrate (this J., 1909, 598).

	Hydrochloric acid.		Nitric acid.		Acetic acid.	
	1900.	1905.	1900.	1905.	1900.	1905.
	lb.	lb.	lb.	lb.	lb.	lb.
Production	134,229,012	188,538,396	63,084,722	108,380,387	29,506,021	27,875,222
Consumption:—						
Bleaching materials	908,000	1,004,000	—	—	—	—
Chrome tannage	5,000,000	6,000,000	—	—	—	—
Cleaning façades	3,000,000	4,000,000	—	—	—	—
Disinfectants	2,500,000	3,200,000	—	—	—	—
Dyestuffs	6,559,464	7,632,027	1,703,160	663,585	7,000,000	4,000,000
Explosives	—	—	35,353,600	82,676,800	—	—
Fine chemicals	1,146,697	1,181,078	182,667	1,505,870	—	—
General chemicals	3,488,000	13,096,827	353,014	4,256,111	—	—
Glucose making	10,846,828	12,283,466	—	— —	—	—
Glue making	38,186,338	61,705,150	—	—	—	—
Lead acetate	—	—	—	—	1,056,584	979,513
Olive curing	2,500,000	3,500,000	—	—	—	—
Paper making	3,000,000	4,000,000	—	—	8,000,000	7,000,000
Parting metals	—	—	10,221,786	6,810,273	—	—
Pickling metals	27,000,000	30,000,000	—	—	—	—
Plastics	—	—	2,971,469	4,710,451	—	—
Reducing and refining metals	15,357,680	24,729,290	—	—	—	—
Refining metals	—	—	8,000,000	3,000,000	—	—
Soap making	400,000	393,246	—	—	—	—
Soldering	4,000,000	3,000,000	—	—	—	—
Textiles	6,000,000	7,000,000	—	—	8,000,000	10,000,000
Washing bone black	1,500,000	1,750,000	—	—	—	—
Washing sand and clay	1,500,000	2,000,000	—	—	—	—
White lead	—	—	—	—	3,349,809	3,980,150
All other uses	1,336,005	1,973,312	4,297,826	4,757,297	2,099,628	1,915,559

—A. S.

Ammonia from compounds containing nitrogen and carbon or nitrogen, carbon, and hydrogen; Catalytic preparation of ——. F. Schreiber. Chem.-Zeit., 1911, 35, 943.

When compounds containing nitrogen and carbon or nitrogen, carbon, and hydrogen, are heated in contact with a mass of hydrated ferric oxide at a temperature above 150° C., the nitrogenous compound is split up into ammonia and carbon dioxide. The author has employed as the contact material a bog iron ore containing hydrated ferric and ferrous oxides. Various organic nitrogenous substances, albumin, pyridine and cyanogen compounds, were mixed with the ore and placed in an inclined iron tube, having a thermometer inserted at the middle. The lower end of the tube was connected with a flask containing sulphuric acid for the absorption of the ammonia, whilst the raised end was connected with a washing bottle and aspirator for the passage of air at the end of the operation. When heated at a temperature of 350° C., pyridinesulphonic acid yielded 54 per cent. of its nitrogen in the form of ammonia, albumin yielded 47 per cent., potassium ferrocyanide, 73·7 per cent., Prussian blue, 62·3 per cent. The contact material yields the best results when heated at temperatures not exceeding 400° C. A similar production of ammonia is observed when gaseous nitrogenous compounds, *e.g.*, the cyanogen compounds present in producer-gas, are passed over the heated contact material in a continuous current.—J. F. B.

Borax; Preparation of ——. *II.* M. G. Levi and O. Garavini. Gaz. chim. ital., 1911, 41, I., 756—781.

The present paper contains further work on the preparation of borax from boric acid and sodium chloride (see this J., 1910, 485), together with some results of experiments on the interaction of boric anhydride and sodium chloride and of boric acid and sodium sulphate. In all the experiments platinum apparatus was used. With a mixture of boric acid and sodium chloride heated in a current of air, the percentages of sodium chloride decomposed in 8 hours at different temperatures were:—100° C., 0·25; 120° C., 0·97; 130° C., 3·70; 140° C., 10·5; 150° C., 16·7; 160° C., 15·4 (?); 170° C., 17·1; 180° C., 17·9; 230° C., 17·6. The reaction proceeds to a condition of equilibrium, which is soon attained, for at 170° C., 14·9 per cent. of the chloride was decomposed in ½ hour and only 16·4 in 2 hours; moreover when borax was added to the reaction-mixture the amount of sodium chloride decomposed was reduced. Up to 500° C. practically no more sodium chloride was decomposed than at 150° C., but from this temperature upwards the proportion decomposed increased regularly, until in 4 hours at 1200° C., 75 per cent. was decomposed; the loss of boric acid by volatilisation also increased with rise of temperature up to 10 per cent. in 4 hours at 1200° C. At the higher temperatures considerable amounts of chlorine were evolved, and this occurred also, although to a less extent, in an atmosphere of nitrogen. The liberation of chlorine appears to be due to three causes: (1) oxidation of hydrochloric acid by atmospheric oxygen; (2) dissociation of hydrochloric acid, accelerated by the catalytic action of the platinum apparatus: and (3) interaction of boric anhydride and sodium chloride. The reaction between boric acid and sodium chloride was considerably accelerated by passage of a current of superheated steam at temperatures of 500° C. and upwards, and liberation of chlorine was suppressed. In presence of steam the reaction was almost completed in 4 hours at 1000° C., and over 80 per cent. of the sodium chloride was decomposed in 35 mins. Even in presence of steam the reaction was retarded to a sensible though not great extent by addition of a large quantity of borax. If the reaction were applied technically, it would probably be preferable to stop after a certain proportion of the sodium chloride had been converted into borax, and extract the latter; to complete the reaction would necessitate a disproportionate consumption of heat, and result also in a greater loss by volatilisation.

According to Gmelin-Kraut's Handbuch (VII Edit., Vol. II., part 1, p. 417) borax and sulphuric anhydride are produced in France by heating a mixture of sodium sulphate and boric acid. The authors' experiments show that the velocity of the reaction is smaller with sodium sulphate than with sodium chloride, and that under the conditions requisite to obtain a good yield of borax, practically the whole of the sulphuric anhydride is dissociated, with formation of sulphur dioxide.—A. S.

Potassium ferrocyanide; Preparation and analysis of pure ——. K. Schröder. Z. anorg. Chem., 1911, 72, 89—99.

Potassium ferrocyanide, containing the normal quantity of water of crystallisation (3 mols.) may be obtained by crystallising the salt from a boiling saturated aqueous solution and drying the crystals between filter-paper at the ordinary temperature. The composition of the salt may be conveniently controlled by determining the iron-content by means of "cupferron" (this J., 1910, 115) after the salt has been decomposed with concentrated sulphuric acid. An aqueous solution of the ferrocyanide may also be decomposed by means of mercuric chloride, and the ferrous iron then titrated with permanganate.
—W. P. S.

Bologna luminous stones. L. Vanino and E. Zumbusch. J. prakt. Chem., 1911, 84, 305—317.

Experiments made with a view to ascertaining the factors which determine the phosphorescent quality of Bologna stones have shown that the sulphur content of good samples may vary between 12 and 33 per cent. The presence of polysulphides is usually accompanied by marked phosphorescing power, and stones containing monosulphide only are very deficient in this respect, but the proportion of polysulphide sulphur is, at the most, about 2·5 per cent., and material containing only the monosulphide is considerably improved by the addition of calcium oxide. Starch, up to 4 per cent., increases the phosphorescence, but a larger proportion has the reverse effect. The period of photo-chemical induction necessary for exciting maximum phosphorescence is found to be shorter in the case of stones of comparatively simple composition and high metal content than with those of more complex composition and low metal content, and the rate of decay is correspondingly less in the latter. Confinement in atmospheres of various gases (chlorine, ammonia, and hydrogen sulphide), and mixing with organic dyestuffs or other so-called optical sensitisers lead to no increase of phosphorescence. The effect of pressure is distinctly unfavourable; grinding in a mortar, for instance, causes a change of colour and reduces phosphorescence. Exposure to light also brings about a change of colour, the extent of which depends on the composition of the stone, but no connection has been traced between phosphorescing power and the readiness with which the colour changes.—F. Soddy.

Metallic acids; Action of salicylic acid upon the ——. [*Detection of titanium and its separation from other metals*]. J. H. Müller. J. Amer. Chem. Soc., 1911, 33, 1506—1511.

Sodium columbate (niobate) and tantalate give with salicylic acid precipitates which are yellow and colourless respectively. After digesting at boiling temperature for some hours, all the columbium or tantalum is removed from the solution. The precipitation is prevented by hydrofluoric acid. Orthotitanic acid is soluble in salicylic acid, giving an intense yellow solution, from which the titanium may be re-precipitated with ammonia. Zirconium and thorium hydroxides are practically insoluble in aqueous salicylic acid. It is therefore possible to separate titanium from any of the other four metals by making use of the solubility of its salicylate. The oxides are fused with potassium carbonate, taken up with water, digested at boiling temperature with salicylic acid and filtered. The precipitate on ignition leaves the oxide of columbium, etc., while the filtrate on treatment with ammonia gives a precipitate of titanic acid. It is not possible to make use of the intense yellow solution for colourimetric determination of the titanium, on account of interference by the common impurities of titanic oxide. It is however an excellent test for small quantities of titanium in the absence of iron and molybdenum, since 0·00005 grm. of titanic oxide in 100 c.c. gives a pale yellow colour.—W. H. P.

Colloidal sulphur. M. Raffo and J. Mancini. Z. Chem. Ind. Kolloide, 1911, 9, 58—61.

It has been pointed out previously that the stability of the colloidal sulphur solution prepared by one of the authors (this J., 1908, 747) was due to the presence of sulphuric acid and sodium sulphate. Experiments have now shown that the greatest stability is obtained when the solution contains definite proportions of these two substances, *viz.*, 6·4—7 per cent. of sulphuric acid and 3·76—3·93 per cent. of sodium sulphate; the sulphur content of the solutions was 2·6—2·8 per cent. Coagulation experiments with salts of potassium, sodium, magnesium, zinc, aluminium, and chromium, showed that potassium salts coagulate the colloidal sulphur much more readily than salts of other metals; of alkali salts the iodides proved most effective. $4N$ solutions of sodium salts precipitated approximately twice as much sulphur as $2N$ solutions did. With salts of magnesium, zinc, aluminium, and chromium, also, $4N$ solutions precipitated more sulphur than $2N$ solutions did, but not in the same proportion as in the case of sodium salts.—A. S.

Cerium salts from monozite residues as tanning materials. Eitner. *See* XV.

Patents.

Borax and the like; Manufacture of ——. W. G. Wagner, London. Eng. Pat. 18,764, Aug. 9, 1910.

A mixture of a mineral borate and sodium sulphate (the total sodium being equivalent to the boric acid present), with small coal or other carbonaceous matter, is heated, preferably to a temperature at which the mass sinters without fusing, and the product is mixed with water or mother liquor from a previous operation, and a current of carbon dioxide (or gases containing such) is passed through the mixture. A solution of borax is thus formed, hydrogen sulphide being evolved, and is separated from the calcium or magnesium carbonate, also produced, and crystallised.—F. Sodn.

Ammonium nitrate; Manufacture of ——. E. J. Henry, Manor Park. Eng. Pat. 19,141, Aug. 15, 1910.

Calcium (barium or strontium) nitrate and ammonium sulphite solutions (preferably concentrated) are mixed in about equivalent quantities, and, after separating from the precipitated calcium sulphite and removing any remaining calcium, if desired, by adding the calculated quantity of ammonium oxalate, the solution is evaporated until it has a boiling point of 125° C. and is then cooled to about 30°—40° C., when a large proportion of the ammonium nitrate crystallises in a very pure state. —F. Sodn.

Mesothorium from monazite sand; Process for the separation of —— *and for the concentration of mesothorium in crude products obtained from minerals containing thorium.* F. Soddy, Glasgow. Eng. Pat. 25,504, Nov. 3, 1910.

In the treatment of monazite sand with sulphuric acid, a muddy liquor is obtained, which can easily be poured off from the heavy residue of unattacked sand, and which deposits a sediment when left to stand. If a small quantity of a barium compound be present in, or be added to the mineral, before or during the treatment with sulphuric acid, the barium sulphate carries down with it the mesothorium present in the mineral. The "crude mesothorium product" so obtained, is converted into chloride, and the barium chloride, carrying the mesothorium, is fractionally crystallised, as in the manufacture of radium, the mesothorium being concentrated in the less soluble fraction. —O. R.

Radioactive materials suitable for rendering solid bodies, gases, or liquids radioactive. C. Schmidt, Freienwalde, Germany. Eng. Pat. 778, Jan. 11, 1911. Under Int. Conv., Jan. 12, 1910.

A radio-active substance is mixed with clay, loam, or similar material, and the mixture is moulded to the desired shape and burnt; it is stated that radio-active, highly porous articles may be produced in this way, from which the active compound is not removed by washing. If more porous products are desired, charcoal or sawdust may be added to the mixture. The products may be used as stoppers or lids for bottles or other receptacles. To render the walls of bottles, etc., radio-active, they are coated with a suitable binding agent, washed with a solution of a radio-active substance, and heated.—T. F. B.

Zinc sulphate; Manufacture of ——. W. McCowan, London. Eng. Pat. 561, Jan. 9, 1911.

A solution containing zinc sulphate is evaporated at a temperature above 100° C. This causes the salt to separate in the monohydrate form.—F. Sodn.

Ammonia; Catalytic agents for use in the manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pats. 5833, 5834, and 5836 of 1911; dates of appl., Aug. 16, 1910.

The iron (see Fr. Pat. 425,099 of 1910; this J., 1911, 1012) may be replaced by cobalt. To prepare the catalytic agent, iron or cobalt, or a compound, and a "promoter," are heated together to produce a mixture of oxides, which is then treated with hydrogen free from a "contact poison."—T. F. B.

Ammonia; Manufacture of —— *and catalytic agents for use in its manufacture.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 5835 of 1911; date of Appl., Aug. 16, 1910.

In Eng. Pat. 19,249 of 1910 (see Fr. Pat. 425,099 of 1910; this J., 1911, 1012) the principal catalysts specified were members of the iron group of metals, to which were added small quantities of foreign substances to act as promoters of the catalytic action, care being taken to exclude certain bodies (*e.g.*, sulphur, phosphorus, and arsenic and their compounds), which act as "contact poisons." In the present patent the prime catalyst may be an alkali metal, an alkaline-earth metal, a member of the group manganese, tungsten, molybdenum, and osmium, or a rare metal such as cerium, tantalum, niobium, or the like. The "promoters" are of the same nature as in the previous patent, namely oxides or other compounds of the alkali metals, and to the "contact poisons" first specified (*loc. cit.*) are added easily fusible and easily reducible metals, such as tin and lead. It may be advisable to pass the gases through two separate quantities of catalytic mass, the first absorbing any "contact poison" the gases may contain, and the second serving for the actual catalysis; or if desired, purifying tubes containing other substances which will absorb the "poison," may be employed.—O. R.

Cream of tartar; Manufacture of ——. J. B. Moszczenski, New York, Assignor to Tartar Chem. Co., Jersey City, N.J. U.S. Pat. 1,000,433, Aug. 15, 1911.

Material containing potassium bitartrate is made into a paste with water and treated with lime, or other base which will yield potassium tartrate solution and an insoluble tartrate as residue; tartaric acid is then separated from the latter (for instance, with sulphuric acid), and the solutions of potassium tartrate and tartaric acid, after decolourising, are mixed together.—F. Sodn.

Nitric oxide [and nitric acid]; Process of making ——. F. Häusser, Kaiserslautern, Germany. U.S. Pat. 1,000,732, Aug. 15, 1911.

A sufficiently high temperature for the formation of nitric oxide is produced by the ignition of a mixture of nitrogen, oxygen, and a combustible gas or vapour, compressed to a definite pressure in an ignition chamber, the temperature being maintained for a sufficient time to allow the nitric oxide to be formed, and then suddenly lowered (for instance, by passing the gaseous products into a cooled receptacle) to a point below that at which nitric oxide is decomposed. The nitric oxide is next converted into dilute nitric acid which is concentrated by utilising the waste heat of the exhaust gases.—F. Sodn.

Composition of matter containing: (1) alumina, magnesia, and boric oxide; (2) beryllia and alumina; and (3) method of treating electrometallurgical products [abrasives or refractory materials]. T. B. Allen, Assignor to Carborundum Co., Niagara Falls, N.Y. U.S. Pats. 1,001,570—1,001,572, Aug. 22, 1911.

(1) ALUMINA, magnesia, and boric oxide, with or without carbon, are electrically heated to obtain a crystalline product from which the reduced impurities may be separated. (2) Alumina, beryllia, and carbon, or other reducing agent, are electrically fused so as to obtain a crystalline product from which the reduced impurities may be separated. The content of beryllia does not exceed 18 per cent. or that represented by the formula BeO,Al_2O_3. (3) Abrasive or refractory compositions, such as crystalline fused preparations containing alumina, are heated with chloride of sodium or other alkali or alkaline earth metal, in order to form chlorides of the impurities, which are then removed, and the product is mixed with a binding agent.—H. H. S.

Magnesia: Process of extracting —— from its natural or artificial saline solutions. J. J. T. Schloesing. Fr. Pats. 426,874 and 426,875, May 14, 1910.

(1) SALINE solutions containing magnesium salts are treated with lime at about 100° C., with agitation, and after dilution with water, the mixture is allowed to settle, the clear liquor is decanted off, and the magnesia, which has been precipitated, is separated by filter-presses. Either slaked lime or quicklime may be used, preferably in the powdered form, or calcined dolomite may be employed, in which case the magnesia present remains unchanged and joins the magnesia obtained by precipitation. If the liquid to be treated contains an appreciable amount of sulphates in solution, these must first be eliminated in the form of calcium sulphate, by treating the liquid with the equivalent quantity of calcium chloride and removing the precipitate, before proceeding with the separation of the magnesia. (2) Lime or calcined dolomite in the anhydrous form only is used for precipitating the magnesia, and the solution to be treated is first saturated with certain salts, especially sodium chloride. When the concentration of magnesium salts in the liquid to be treated exceeds a certain degree, it is necessary to prevent the solidification of oxychlorides, which might take place, either by diluting the solution with water, or by heating to 100° C.—O. R.

Hydrogen peroxide; Process of manufacturing ——. V. E. J. Durafort and A. E. G. Bertin. Fr. Pat. 427,406, March 15, 1911.

WATER is boiled to expel all contained gases, allowed to cool out of contact with air, and subjected to the simultaneous action of oxygen under pressure and of an electric current, the voltage of which is not high enough to produce electrolysis. It is claimed that hydrogen peroxide of any desired strength may thus be prepared, the purer the water used, the nearer the resulting product approaching the theoretical maximum of 475 volumes. Instead of weak electric currents, actinic rays, such as those emanating from a quartz mercury-vapour lamp, may be used. —O. R.

Potassium chloride; Process for obtaining ——. A. Wernicke. Ger. Pat. 235,751, April 24, 1909.

THE crystals separated in the usual way in a continuous crystallising apparatus are washed directly and continuously on the counter-current principle, whereby the depression of temperature produced by the mixing of the washing liquor ("*Decklauge*") with the mother-liquor adhering to the crystals leads to a further separation and recovery of potassium chloride.—A. S.

Sodium chloride; Process for obtaining —— from its solutions. E. Gerstner. Ger. Pat. 236,373, Nov. 26, 1908.

THE claim is for the evaporation and crystallisation of the salt solution alternately in a vacuum evaporator and in an open evaporating pan. It is known that vacuum evaporators yield a specifically heavy salt and open evaporators a specifically light salt; by combining the two methods a salt of medium specific gravity is obtained. In the apparatus described, the vacuum evaporator is connected below with a tube which extends downwards and dips into the solution contained in an open evaporating pan, in a similar manner to a barometer-tube. The fresh salt solution may be introduced either into the vacuum evaporator or into the open pan. The solution in the latter is returned to the vacuum evaporator through a separate pipe by means of a pump.—A. S.

Hydrosulphites; Process for the preparation of anhydrous ——. Badische Anilin und Soda Fabrik. Ger. Pat. 237,164, Dec. 10, 1909.

THE hydrosulphites are dried in a vacuum, and when the drying is complete, the vacuum is broken by admission of dried air or other gas containing oxygen.—A. S.

Hydrosulphites; Process for the preparation of stable crystalline, anhydrous ——. Badische Anilin und Soda Fabrik. Ger. Pat. 237,165, Dec. 28, 1909. Addition to Ger. Pat. 220,718, Dec. 5, 1908.

ACCORDING to the chief patent (see Fr. Pat. 400,174 of 1909; this J., 1909, 1034), hydrosulphites were dehydrated by heating in a vacuum at 100° C. until all the water was expelled. According to the present patent the process is conducted in such a way that a portion of the hydrosulphite is decomposed. This may be effected by working under only a moderate vacuum at first; by using a higher temperature and a longer period of heating; or by passing a current of heated inert gas over the salt. The decomposed salt serves to protect the undecomposed hydrosulphite from the action of the air.—A. S.

Nitrogen and hydrogen; Industrial preparation of a mixture of ——. Soc. Générale des Nitrures. Fr. Pat. 427,834, March 28, 1911. Under Int. Conv., Sept. 1, 1910.

THE patent is based on the fact that carbon monoxide is absorbed by slaked lime or soda-lime with the evolution of an equal volume of hydrogen (see Merz and Weith, Ber., 1880, **13**, 718). By passing producer-gas, water-gas, or mixtures of the two, in different proportions, over slaked lime or soda-lime heated a little above a dark red heat, mixtures of varying proportions of nitrogen and hydrogen can be obtained.—O. R.

Oxygen and nitrogen from the air; Process for obtaining —— by means of alkali manganate or permanganate. G. Kassner. Ger. Pat. 237,232, Oct. 25, 1910. Addition to Ger. Pat. 233,383, May 29, 1910.

THE alkali metaplumbate used in the process described in the chief patent (this J., 1911, 621) is replaced, partly or wholly, by oxides of tin, zirconium, antimony, titanium, or the like, or by the alkali compounds of these oxides.—A. S.

Hydrogen; Process for the manufacture of ——. W. Näher and K. Müller. Ger. Pat. 237,283, Sept. 30, 1910.

SUPERHEATED steam is blown into a generator filled with coke, which has been heated to about 1000° C. and exhausted, and the water-gas produced, mixed with superheated steam, is passed over a contact mass of rhodium- or palladium-asbestos at 800° C. The resulting hydrogen is freed from the accompanying carbon dioxide in the usual manner.—A. S.

Hydrochloric acid or hydrobromic acid; Process for making —— from chlorine and bromine. F. Westhausser, Plieningen, Germany. Eng. Pat. 21,128, Sept. 10, 1910.

SEE Fr. Pat. 418,731 of 1910; this J., 1911, 84.—T. F. B.

Ammonia; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pats. 19,249, 19,250, and 19,251, Aug. 16, 1910.

SEE Fr. Pat. 425,099 of 1910; this J., 1911, 1012.—T. F. B.

Nitrogen oxides; Manufacture of ——. F. Häusser, Nürnberg, Germany. Eng. Pat. 20,777, Sept. 6, 1910.

See Fr. Pat. 420,112 of 1910; this J., 1911, 360.—T. F. B.

Condenser for acid vapour. F. Moore and J. A. Hall, Victoria, B.C., Canada. Eng. Pat. 28,892, Dec. 12, 1910.

See U.S. Pat. 986,846 of 1911; this J., 1911, 488.—T. F. B.

Ammonium chloride and sulphites of calcium, strontium, barium, magnesium, zinc, or iron; Process for the preparation of ——. R. Friedrich, Gloesa, Germany. Eng. Pat. 6684, March 17, 1911.

See Addition of March 17, 1911, to Fr. Pat. 402,872 of 1909; this J., 1911, 1057.—T. F. B.

Alkali peroxide; Process of making a dense, stable composition containing ——. E. Thomann, Zürich, Switzerland. U.S. Pat. 1,000,701, Aug. 15, 1911.

See Eng. Pat. 30,185 of 1910; this J., 1911, 1072.—T. F. B.

Cupric oxide; Process of making salts of hydrated ——. C. R. Linkmeyer, Bremen, Germany. U.S. Pat. 1,000,827, Aug. 15, 1911.

See Fr. Pat. 410,882 of 1909; this J., 1910, 811.—T. F. B.

Lime; Apparatus for slaking ——. W. Schulthess, Paris. U.S. Pat. 1,001,310, Aug. 22, 1911.

See Fr. Pat. 390,357 of 1908; this J., 1908, 1018.—T. F. B.

Zinc sulphide; Manufacture of ——. J. Koetschet and J. C. A. Meyer, Lyons, Assignors to Soc. Chim. des Usines du Rhône, ancien. Gilliard, P. Monnet, et Cartier, Paris. U.S. Pat. 1,001,415, Aug. 22, 1911.

See Eng. Pat. 23,645 of 1909; this J., 1910, 166.—T. F. B.

Radium compounds; Process of extracting ——. F. Ulzer and R. Sommer, Vienna. U.S. Pat. 1,001,480, Aug. 22, 1911.

See Eng. Pat. 19,820 of 1909; this J., 1910, 1156.—T. F. B.

Treatment and purification of ammoniacal liquors or waste liquors resulting therefrom. Eng. Pat. 19,074. *See* IIb.

Production of ammonium sulphate from distillation gases. Ger. Pat. 235,157. *See* IIb.

VIII.—GLASS; CERAMICS.

Patents.

Glass-furnace. P. J. Paquet, Jeannette, Pa. U.S. Pat. 1,000,546, Aug. 15, 1911.

The furnace comprises a melting chamber in communication with a gathering chamber, and a "nose" embodying a collecting chamber, with passages for the travel of the molten glass between the latter and the gathering chamber. The "nose" is further provided with means for temporarily arresting the travel of gathering rings and with openings at the top to enable an operator to remove a batch of glass from any ring. Gas burners may be carried by the partitions forming the passages to heat the glass as it travels through the latter. Skimming openings allowing of the entrance to the collecting chamber of a means for shifting the gathering rings are provided in the front wall of the "nose."—H. H. S.

Kilns for burning pottery or other material; Externally heated ——. H. W. Woodall, Lytchett Matravers, Dorset. Eng. Pat. 19,428, Aug. 18, 1910.

Four or more kilns, fired by generator-gas, are used in series. Heating gases pass up both sides of the kiln in alternate flues, over the top and down the other side and under the kiln to a collecting chamber. The air for combustion is heated by the waste gases. Dampers and regulators control the admission of furnace gases, of air, and of heat.—H. H. S.

Kilns; Gas fired, continuous ——. P. Schwarz, Crook, Durham. Eng. Pat. 24,924, Oct. 27, 1910.

In "Ring" or "Hoffman" kilns in which the heat is generated by rows of vertical gas burners spaced round the kiln, space is economised and the cutting action of pointed flames acting directly on the goods being fired is avoided by building cross walls on each side of each row of burners. The cross walls are built of green firebricks to economise space and the front wall of each pair is stopped short of the bottom to allow a gas passage beneath and the back wall at its upper portion to allow the gases to pass over it. The air for combustion, after being preheated by passing over the burned goods in the sections that are cooling, passes beneath the front wall, up the burner space between the walls, over the back wall and the hot products of combustion pass diagonally downwards through the goods to the space below the next front wall and so on.—W. H. C.

Kilns for bricks and the like. F. P. R. Lancel, Oisemant, France. Eng. Pat. 2865, Feb. 4, 1911.

Equal heating throughout the kiln is achieved by placing the openings for the flues carrying off the hot combustion gases on the outer wall near the bottom of the kiln. The flues are regulated by adjustable dampers, and the arches of chambers of the kiln are provided with peep holes which are covered by bell-shaped dampers. (Reference is directed to Eng. Pat. 26,085 of 1902.)—H. H. S.

Mottled enamel; Method of making ——. J. H. Danver, Beaver, Pa., Assignor to U.S. Sanitary Manufacturing Co., Pittsburg, Pa. U.S. Pat. 1,001,511, Aug. 22, 1911.

Glasses coloured by different metallic oxides are subsequently ground and mixed.—H. H. S.

Clay, kaolin, and ceramic masses; Process of treating ——. G. Keppeler, Darmstadt, and A. Spangenberg, Merzig, Germany. U.S. Pat. 1,001,413, Aug. 22, 1911.

See Fr. Pat. 387,803 of 1908; this J., 1908, 857.—T. F. B.

Improvements in glass tubing to facilitate the flow of liquids therein. Eng. Pat. 6227. *See* XXIII.

IX.—BUILDING MATERIALS.

Portland cement; Physical and chemical properties of ——. *Part III.* W. C. Reibling and F. D. Reyes. Philippine J. Sci., 1911, **6**, 207—250. (See also this J., 1911, 748.)

The paper contains a detailed study of the setting properties of Portland cement, and their variations during storage and seasoning, with the object of finding some means of controlling the changes in time of set. The variation in setting properties has been studied in connection with the quantity and condition of the free lime. The fundamental cause of changes in the setting properties of cement is probably the change in condition of the free lime, which is present in all fresh commercial cements. The authors suggest a preliminary study of the time of set of the cement when all its lime is present as calcium oxide, and of the effect of varying amounts of plaster of Paris on the set of the cement in this condition. This may be followed by a similar study of the cement when all the lime is present as hydroxide. In this way the manufacturer can obtain information not only as to whether the product of his kiln is capable of practical control, but also as to the minimum amount of plaster of Paris retarder which is required. Emphasis is laid on the necessity for careful packing and preservation of the cement not only for control of its set, but also for the preservation of its strength.—W. H. P.

Iron oxide in cement; Rapid determination of ——. A. Golubinzeff. Chem.-Zeit., 1911, **35**, 961—962.

Two grms. of the cement are placed in an Erlenmeyer flask, covered with 10 c.c. of distilled water, and allowed to stand for 10 minutes. Then 75 c.c. of water and 100 c.c. of *N*/1 hydrochloric acid are added; and solution is effected by shaking and by gentle warming. Traces of hydrogen sulphide are eliminated by warming for a few minutes. The iron is then reduced by sulphur dioxide, which is afterwards driven off by a stream of carbon dioxide. The connection with the exit tube for the sulphur dioxide is then cut off, without, however, stopping the carbon dioxide current. 8—10 c.c. of a previously prepared solution of manganese sulphate (strength unnoted) are added and the whole is then titrated with *N*/10 permanganate. The process takes 45—60 minutes.—H. H. S.

Gypsum mortar; Setting of —— *on occasional moistening.* H. Burchartz. Tonind.-Zeit., 1911, **35**, 1278—1280.

Mortar, prepared from 1 of lime to 3 of sand, can be made to set more quickly by periodic damping with water. Comparisons of the tensile and compressive strengths, and of the carbonic acid content were made of treated and untreated mortar with the following results:—

Tensile strength in kilos. per sq. cm.

	1 mth.	3 mths.	6 mths.	1 year.	2 years.	5 years.
Not moistened	1·4	1·8	2·1	2·1	2·1	2·4
Moistened ...	2·2	3·3	4·4	4·1	4·2	4·5

Compression strength in kilos. per sq. cm.

Not moistened	5	6	8	11	11	12
Moistened ...	8	9	12	17	20	22

Carbon dioxide, percentage.

Not moistened	4·3	4·6	5·0	4·8	4·7	4·8
Moistened ...	4·9	6·0	6·4	6·7	6·7	6·7

Water of combination, percentage.

Not moistened	2·2	1·6	1·4	1·2	1·3	1·3
Moistened ...	2·0	1·0	0·9	0·6	0·6	0·6

The treatment consisted in soaking in water for 5 minutes every week up to 6 months, then for 2 hours every month up to 1 year, and subsequently for 24 hours every month up to 5 years.—H. H. S.

Patents.

Wood; Impregnating ——. E. C. R. Marks, London. From F. L. Middleton, Washington, D.C., U.S.A. Eng. Pat. 19,172, Aug. 15, 1910.

A preservative solution, such as one of zinc chloride and aluminium sulphate, is forced into the wood at a temperature, say 55° C., which is below that at which the albumin of the wood-cells coagulates. The temperature is then raised above that point, say to 70° C.—H. H. S.

Wood; Process of preserving ——. Höntsch und Co. Ger. Pat. 237,150, June 2, 1910.

The wood is impregnated with a solution of rosin in acetone oil. Acetone oil is stated to be very efficient as a preservative for wood and to have no injurious action on plants.—A. S.

"Xylolith"; Process of manufacturing ——. A. Fraass. Fr. Pat. 427,546, March 20, 1911. Under Int. Conv., April 6, 1910.

In the manufacture of "xylolith" from mixtures of sawdust, asbestos, talc, pigments, and the like, with "magnesite" and magnesium chloride, it is specified that the "magnesite" should be added last, after all the other ingredients have been thoroughly incorporated with the magnesium chloride solution. If oils or greases are to be used, these should be emulsified with the magnesium chloride solution in the presence of talc or asbestos, but the other ingredients added afterwards.—O. R.

Cement concrete; Process for mixing and preparing hydraulic —— *and product thereof.* L. W. Page, Washington, D.C. U.S. Pat. 1,000,545, Aug. 15, 1911.

Non-volatile mineral oil is added, in quantity not exceeding 25 per cent. of the cement, to the usual mixture of cement, sand, aggregate and water before it has begun to set.—H. H. S.

Cement; Process of making ——. C. Ellis, Larchmont, N.Y., Assignor to Ellis-Foster Co. U.S. Pat. 1,001,582, Aug. 22, 1911.

Granular cement materials are calcined in a travelling stream, in a rotary inclined kiln or kiln-section by heated flame gases and admixed aqueous vapour. The mass is then treated with a limited amount of water—the vapour of which may be used as above—re-ground and clinkered, the gases from the clinkering kiln going to the calcining kiln section.—H. H. S.

Volcanic or other fusible rock; Process for the manufacture of industrial and other objects from ——. F. Ribbe, Mauriac, France. Eng. Pat. 19,808, Aug. 24, 1910.

See Fr. Pat. 418,624 of 1910; this J., 1911, 88.—T. F. B.

Cement; Magnesia ——. R. Eggenhöffner, Genoa, Italy. U.S. Pat. 1,000,386, Aug. 15, 1911.

See Fr. Pat. 392,328 of 1908; this J., 1908, 1206.—T.F.B.

Concrete composition. J. M. Rauhoff, Assignor to Ironite Company, Chicago. U.S. Pat. 1,000,944, Aug. 15, 1911.

See Fr. Pat. 422,857 of 1910; this J., 1911, 688.—T.F.B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Cast iron turnings; Remelting of —— *in the cupola and the application of the product as an iron alloy.* C. Emmel. Stahl u. Eisen, 1911, 31, 1413—1414.

A product containing 2·51 per cent. of carbon, 0·80 of silicon, 0·22 of manganese, 0·56 of phosphorus, and 0·154 of sulphur was obtained by melting iron turnings in a cupola. Ten per cent. of this was added to a series of four similar irons containing as a mean 1·96 per cent. of silicon, 0·52 of manganese, 0·55 of phosphorus, 0·086 of sulphur, and having a breaking strain of 32·7 kilos. per sq. mm. and a bending test of 11·7 mm. The resulting metal contained 1·64 per cent. of silicon, 0·54 of manganese, 0·65 of phosphorus, 0·093 of sulphur, and had a breaking strain of 42·1 kilos. per sq. mm., and a bending test of 14·8 mm. The results of a five per cent. addition are also given, and it is shown that the high sulphur content of the iron turnings does not have any prejudicial effect upon the mechanical tests of the final alloys which are improved in both cases. Instances are given in which the application of the process might be of advantage.—A. H. C.

Steel; Heat treatment of ——. H. Hanemann. Stahl u. Eisen, 1911, **31**, 1365—1373.

Pieces of steel in the form of wire, 0·5 cm. in diameter and 20 cm. long, and containing from 0·99 to 1·56 per cent. of carbon, were heated to temperatures varying from 750° C. to 1150° C. and quenched either in water or in a lead-tin bath at 300° C. The highest tenacity was obtained by quenching at the higher temperature. The results of the mechanical tests of the hardened steels after tempering in rape oil at temperatures varying from 100° C. to 650° C. are tabulated, and show that it is not possible to obtain the same results by direct quenching in oil or in a lead-tin bath as by quenching in water and subsequently tempering. In order to determine the influence of time on tempering, *i.e.*, whether heating at 500° C. for a few seconds would produce the same structure as heating at 100° C. for many hours, pieces of steel containing 0·87 per cent. of carbon were heated to varying temperatures for different periods of time, and then examined for scratch hardness, loss of weight in a one per cent. acid solution, the amount of carbide, and microscopically. The results are tabulated and it is concluded that hardened steel tends always to change into α-iron and free cementite. Although proceeding imperceptibly at ordinary temperatures the change takes only a few seconds at 650° C., and several hours at 100° C. The velocity of the rate of change lessens as completion is approached.—A. H. C.

Steel melting; Report on the present position of electric ——. A. McWilliam. Sect. B., Brit. Assoc., Portsmouth, 1911.

In a statement showing the more important types of electric furnace in use at the present time, the principles of construction and operation of the Stassano, Héroult, Girod, Keller, Grönwall, Nathusius, Kjellin and Röchling-Rodenhauser furnaces are briefly summarised. The loss in melting is given as about 1½ per cent. for the Kjellin, from 4 to 5 per cent. for the Röchling-Rodenhauser, and from 7 to 8 per cent. for arc furnaces. Connected with the electric steel melting industry there were, in June, 1910, about 118 furnaces of all types, of which 70 were in actual use, 10 not working and 38 in course of erection; 77 were of the arc type, 29 of these being Héroult, 17 Girod, 13 Stassano and 6 Keller furnaces, while 9 were unclassified and three were producers of pig-iron. Of the Héroult furnaces, the total capacity per charge of those working was about 80 tons, and of those in course of erection about 50 tons; the corresponding figures for the Girod furnaces were 38 and 26 tons, for the Keller furnaces 13 and 5 tons, and for all others 20 and 13 tons respectively. Of the induction furnaces, the number of Kjellin furnaces erected was 14 with a total capacity, per charge, of 35 tons; the Röchling-Rodenhauser furnaces numbered 15 with a capacity of 30 tons in work, 1 ton not in work, and 17 tons being erected; and the capacity of all others was about 18 tons in work. Thus the total capacity of the arc furnaces was about 250 tons, and of the induction furnaces 100 tons, making a grand total of 350 tons per charge for all electric steel melting furnaces. Whereas in June, 1910, there were 29 Héroult furnaces with a total capacity of 130 tons, in June, 1911, there were 43 furnaces with a total capacity of about 242 tons. The combined output of electric steel in Germany, the United States and Austria-Hungary increased from 49,000 tons in 1909 to 112,000 in 1910; the output for other countries is not published, but the author considers that the corresponding figures for Sweden, France and Belgium would show a similar increase, and is of opinion that this progress will be more than maintained in the present year. The electric furnace is used either for the direct melting of steel scrap or as a refiner for steel produced in other furnaces; of the 44 Héroult furnaces in operation or in course of erection, 21 are used for the direct melting of scrap, while 20 are charged from the basic open-hearth, 1 from a Talbot furnace and 2 from converters. Electric furnaces are now being employed to replace crucibles; for foundries; for the production of tyre and axle steel and steel of Swedish Bessemer quality; for the manufacture of weldless tubes; for melting turnings, especially those of high-speed steels; and in connection with Talbot furnaces. Tables are given showing the distribution of electric steel-melting furnaces throughout the world, together with the capacity of each and the kind of work for which it is used.—W. E. F. P.

Corrosion of steel; Influence of carbon and other elements on the ——. Corrosion Committee (J. O. Arnold, W. E. S. Turner, W. P. Wynne, A. McWilliam, M. C. Chappell, and F. Hodson). Brit. Assoc., Sect. B., Portsmouth, 1911.

Experiments were carried out with a series of pure iron-carbon alloys containing from 0·1 to 0·96 per cent. of carbon. Corrodibility was measured by determining loss of weight of specimens immersed in 700 c.c. of sea-water for thirteen weeks. The alloys were used: (1) As rolled; (2) Normalised; (3) Annealed: (4), (5) Hardened and tempered at (*a*) 400° C., and (*b*) 500° C., (6) Hardened. In the rolled, normalised, and annealed specimens the corrodibility rises to a maximum at saturation point (0·89 per cent. of carbon) and then decreases on the appearance of cementite in the steel. In the hardened and tempered specimens the corrodibility rises continuously from 0·1 to 0·96 per cent. of carbon. The finer the division of the carbide in the pearlite, the greater the liability to corrosion when immersed in sea-water. Determinations of the solution pressures of the steels after prolonged immersion in sea-water were made, but no definite results have been obtained as yet. The solubility in acids was also examined; 1 per cent. solutions of hydrochloric and sulphuric acids were found to give remarkably similar results. In the normalised, rolled, and annealed specimens, the solubility increases rapidly from 0·1 up to 0·22 per cent. of carbon, after which it falls to a minimum at about 0·40 per cent. of carbon. A maximum is again reached at about 0·60 per cent. of carbon, after which the solubility slowly decreases up to 0·96 per cent. In tempered steels, the solubility increases with the carbon content, except that between 0·30 and 0·55 per cent., it remains practically constant. The conversion of the pearlite to hardenite decreases its solubility in acids as compared with all varieties of pearlite. The solution pressures in 1 per cent. sulphuric acid were determined. Two maxima were found; at 0·22 per cent. of carbon and at saturation point respectively, in the annealed, rolled, and normalised specimens, taking E.M.F. and carbon percentage as co-ordinates. In the case of the tempered steels, a minimum occurred at about 0·45 per cent. of carbon, and a maximum at saturation point. The hardened steels were consistently electro-negative to the other steels. It appears impossible to specify any composition or treatment offering the best resistance to attack under all circumstances.—R. W. N.

Copper, iron and nickel; Solubility of hydrogen in ——. A. Sieverts. Z. physik. Chem., 1911, **77**, 591—613. (See also this J., 1910, 571, 1161.)

Exhaustive data are given of the solubilities of hydrogen in the three metals at pressures up to 1·5 atmospheres, and temperatures from 400° to 1600° C. It is shown in the case of nickel that the amount of gas absorbed by the metal under given conditions of temperature and pressure is independent of the amount of metallic surface. The hydrogen-containing metals are therefore true solutions. At constant temperature the solubility both in solid and liquid metals is proportional to the square root of the gas pressure, the quotient $\frac{\sqrt{\quad}}{\quad}$ (where *m* is the mass of gas absorbed by 100 grms. of metal) being remarkably constant for values of *p* above 10 mm. At constant pressure the solubility increases with temperature, and shows a sudden increase at the melting points of all three metals. The transition from β- to γ-iron is also marked by a rapid increase in solubility between 850° and 900° C. This discontinuity though very marked is not so sudden as that at the melting point. The transition from α- to β-iron is not accompanied by any change in solubility. In the liquid metals the solubility continues to increase with rise of temperature, probably more rapidly than in the solid state. On solidifying in an atmosphere of hydrogen all three metals "spit." Copper gives off about twice its volume of hydrogen (at 1084° C. and 760 mm.), iron about 7 times its volume (at 1510° C. and 760 mm.) and nickel about 12 times its volume (at 1450° C. and 760 mm.). The regulus contains cavities in which hydrogen may be retained. It is only, however, after very rapid cooling that any considerable quantity of the absorbed hydrogen can be retained at ordinary temperatures.—W. H. P.

Silver-zinc-lead ; The ternary system ——. *A contribution to the theory of Parkes' process.* R. Kremann and F. Hofmeier. Monatsh. Chem., 1911, **32**, 563—595.

An account is given of a thermal and microscopic study of ternary alloys of silver, zinc, and lead. The three binary systems have been investigated previously (Spring, this J., 1896, 814 ; Petrenko, this J., 1906, 318 ; 1907, 615). The ternary system, lead-zinc-silver, can be divided into the five systems : (1) $Pb-Zn-Ag_2Zn_5$, (2) $Pb-Ag_2Zn_5-Ag_2Zn_3$, (3) $Pb-Ag_2Zn_3-AgZn$, (4) $Pb-AgZn-Ag_3Zn_2$, (5) $Pb-Ag_3Zn_2-Ag$, of which only the first corresponds to conditions prevailing in Parkes' desilverising process. An examination of this system showed that the ternary eutectic curve connects the two points representing the Pb-Zn eutectic (310° C.) and the $Pb-Ag_2Zn_5$ eutectic (320° C.) ; owing to the small difference of temperature between these two points, only an eutectic point can be actually observed with the ternary alloys instead of an interval of eutectic crystallisation. Zinc and the compound, Ag_2Zn_5, form two series of mixed crystals, and this is the case also in the ternary alloys. In the case of the latter, the mixed crystals rich in zinc separate primarily from melts in which the ratio of silver to zinc is 1 : 99 or 2 : 98, whilst the mixed crystals rich in silver separate from melts in which the ratio is 10 : 90, 17 : 83, or 30 : 70 ; equilibrium between the two kinds of crystals seems to be established at a ratio of silver to zinc of 3·5 : 96·5. The concentration of lead seems to have little effect, indicating that even in the fused state, the chief quantity of the silver is present in the zinc layer. In discussing the Parkes' process, it is pointed out that after the addition of the zinc, mixed crystals of zinc and Ag_2Zn_5 begin to separate, and as the zinc crusts in practice contain a relatively large amount of lead, it is evident that separation goes on until the curve representing eutectic crystallisation of lead and $Zn-Ag_2Zn_5$ mixed crystals rich in zinc is reached. When the zinc crusts are afterwards submitted to the liquation process, the eutectic curve mentioned is followed until all the lead is melted, when the residual zinc crust is skimmed off, the lead being returned to the first stage of the desilverising process in order to recover its silver content.—A. S.

Ternary alloys ; Electromotive behaviour of ——. *The system : zinc-silver-lead.* R. Kremann and F. Hofmeier. Monats. Chem., 1911, **32**, 597—608.

The authors measured the potential of binary alloys of silver and zinc and ternary alloys of silver, zinc, and lead against *N*/1 zinc sulphate solution as compared with the potential of zinc against the same solution. It was found that with all ternary alloys where it was possible to measure the zinc-silver potential, this corresponded with the potential observed with pure zinc-silver alloys, whilst in cases where it was not possible to measure this potential, the potential corresponding to pure lead was observed. These results show that lead when alloyed with silver and zinc does not form ternary mixed crystals. (See also preceding abstract.)—A. S.

Silver-tin-lead ; The ternary system ——. N. Parravano. Gaz. chim. ital., 1911, **41**, I., 813—832.

The author has made a thermal and micrographic study of ternary alloys of silver, tin, and lead. The binary systems of which the ternary one is composed have been studied previously (see Petrenko, this J., 1907, 615 ; Rosenhain and Tucker, this J., 1908, 1156). It was found that all the ternary alloys are composed of the four solid phases, mixed crystals of silver and tin, mixed crystals of lead and tin, the compound, Ag_3Sn, and crystals of tin. The system contains two non-variant points, one of which at about 300° C., is a transformation point, whilst the other, at about 175° C., is an eutectic point ; the ternary eutectic contains 63·4 per cent. of tin, 35·6 of lead, and 1 of silver. The transformation point is very near the binary lead-silver eutectic point, and the ternary eutectic point is very near the binary tin-lead eutectic point. The paper is accompanied by 23 microphotographs.—A. S.

Lead bronzes and brasses ; Analysis of ——. Q. Sestini. L'Ind. Chim., 1911, **11**, 229—231.

For the analysis of lead bronzes and brasses, the best method is to attack the alloy with nitric acid, thus obtaining the tin in the form of metastannic acid. In the nitric acid solution the copper and lead are determined simultaneously by electrolysis, the former as metal and the latter as dioxide, and in the residual solution the iron is precipitated by ammonia, and the zinc determined electrolytically. The author has simplified Classen's procedure (this J., 1894, 547) for the simultaneous electrolytic determination of copper and lead. Electrodes of the form described by Hollard (this J., 1900, 562) are used, viz., a wire gauze cylinder of iridio-platinum as cathode, and an anode consisting of a platinum basket in which a spiral of platinum wire is disposed centrally, but in order to increase the surface of the anode, pieces of sheet platinum which have been previously rubbed with fine emery, are fixed to it. The electrolysis of the solution, strongly acid with nitric acid, is conducted at 70° C. ; after 1 hour, during which time most of the lead is deposited as dioxide on the anode, the beaker containing the solution is removed, and a sufficient quantity of ammonia solution (determined previously by experiment) is added so as to leave the solution with an acidity corresponding to 5 c.c. of nitric acid of sp. gr. 1·4. The beaker is then replaced and electrolysis continued until the copper is completely deposited.—A. S.

Passivity of metals. E. Grave. Z. physik. Chem., 1911, **77**, 513—576.

A metal in the passive condition, according to the usually accepted hypothesis, exhibits an abnormally low osmotic solution pressure. The primary cause of solution pressure being the emission of ions by the metal itself, the difference between the active and passive conditions of a metal is due to a greater or smaller velocity of the ion emission. The pure metal may be considered active, and the passive state attributed to the presence of some retarding catalyst which diminishes the rate of the ion-formation, or conversely, the pure metal may be considered passive, and the active state attributed to the presence of an accelerating catalyst. The author has carried out experiments with iron and nickel to decide between the two theories and to identify the catalyst. If the first theory be accepted, then the retarding catalyst must be either a common impurity in the commercial metal, or else some substance which can invariably be formed during the passivifying process (hydrogen peroxide, ozone or oxygen). The untenability of this view is established by the following results : (1) There is no difference between pure and commercial specimens of iron and nickel, as far as the processes of activifying and passivifying are concerned. (2) Neither hydrogen peroxide nor ozone is capable of actually producing passivity although they both render the metal less electropositive and hydrogen peroxide exercises a preserving effect on a passive potential. (3) There is no analogy or similarity between the variations of potential in the passage from the passive to the active state, and those observed in an oxygen polarisation. If the converse theory be considered, the most probable accelerating catalyst is hydrogen, which is always present in iron. If iron or nickel is heated in air, in nitrogen or *in vacuo* it becomes passive owing to the evolution of its hydrogen, while on heating in hydrogen it becomes more active. Both these effects are greater as the temperature is further raised, although at very high temperatures they diminish again. Molecular hydrogen, however, has no effect on the potential of iron or nickel rods. Before they can be activified the hydrogen must be ionised (by means of an electrical discharge or otherwise). Ionised nitrogen has a passivifying influence under similar conditions. It is also shown that when iron or nickel is rendered passive by heating, a distinct discharge of positive hydrogen ions takes place, which is greater if the iron has previously been saturated with ionised hydrogen. It is thus highly probable that pure iron and nickel must be considered passive, and that they only become active in the presence of hydrogen ions which act as catalysts in the process of formation of ions of the metal. It is shown that hydrogen ions possess the power of diffusing in iron so that exposure of any one point to their influence may result in the activifying of other portions of the metal. This method of representing passivity affords simple explanations for all the phenomena of the passivifying and activifying processes.—W. H. P.

Magnesium and cadmium; Conductivity and hardness of alloys of ——. G. G. Urazow. J. Russ. Phys.-Chem. Soc., 1911, 43, 752—771.

The electrical conductivity and hardness of alloys of magnesium and cadmium confirm Grube's view (this J., 1906, 430) that, at ordinary temperatures, these alloys contain two series of solid solutions: (1) of the compound β-CdMg, and (2) of α-CdMg in their components. With the compound α-CdMg correspond a maximum of conductivity and a minimum of hardness. The following temperature-coefficients of electrical resistance have been determined: Mg, 0·00438; Cd, 0·00425, α-CdMg. 0·00586. The conductivity and hardness curves show breaks corresponding with the conversion of solid solutions of the one type into those of the other. The limits within which these solid solutions are formed are 0—20 and 85·2—100 atom. per cent. of cadmium for the β-compound and 22·5—80 atom. per cent. of cadmium for α-CdMg.—T. H. P.

Electric iron and steel furnaces; The world's ——. Monit. des Interêts Matériels. Min. and Eng. World, Aug. 26, 1911. [T.R.]

The total number of electric furnaces in existence or in course of construction, for treating iron and steel, is 120. Divided into the classes of arc furnaces, induction furnaces, and combination arc-resistance furnaces, these are as follows:—

	Active.	Idle.	Building.	Totals.
Arc furnaces	51	7	25	83
Induction furnaces	21	4	10	35
Combined arc-resistance ..	2	—	—	2
Totals	74	11	35	120

A further table shows these furnaces classified according to system:—

	Active.	Idle.	Building.	Totals.
Arc furnaces—				
Héroult	19	—	15	34
Girod	14	—	4	18
Stassano	5	7	1	13
Keller	4	—	2	6
Chaplet	4	—	1	5
Aktiebolaget Elektrometall	2	—	2	4
Hickman (own system) ..	1	—	—	1
Scott-Anderson (own system)	1	—	—	1
Firminy	1	—	—	1
Induction furnaces—				
Kjellin..................	10	—	—	31
Röchling-Rodenhauser .	10	1	8	
Kjellin-Colby	2	—	—	
Frick	1	—	—	1
Hiorth	1	—	—	1
Chatillon-Commentry	1	—	—	1
Schneider	1	—	—	1
Combined arc and resistance furnaces—				
Nathusius	2	—	—	2
Totals ...	79	8	33	120

Minerol production of New South Wales. Board of Trade J., Aug. 31, 1911. [T.R.]

The following statistics of the mineral production of the State of New South Wales during the years 1909 and 1910 are taken from the annual report for 1910 of the Department of Mines of that State:—

Minerals.	1909.		1910.	
	Quantity.	Value.	Quantity.	Value.
		£		£
Alunite ....Tons	3,500	8,791	1,136	2,840
Antimony (metal and ore) .... ,,	95	711	97	1,450*
Bismuth (metal and ore) .... ,,	9	1,624	6	2,004
Coal .... ,,	7,019,879	2,618,596	8,173,508	3,009,657
Cobalt .... ,,	—	—	9	55
Coke .... ,,	204,274	137,194	282,337	189,069
Copper (ingots, matte and ore) (*a*) ,,	6,966	424,737	12,890	486,257
Diamonds ....Carats	5,474	3,959	3,606	2,881
Gold ....Oz. fine	204,709	869,546	188,857	802,211
Iron (pig) .....Tons	29,762 (*b*)	106,357	40,487	161,948
Iron "oxide".. ,,	4,900	4,948	1,351	714
Ironstone flux . ,,	4,339	3,471	1,648	1,321
Lead (pig, &c.) (*c*) ,,	15,476	186,073	21,195	248,561
Lime .... ,,	25,849	24,283	30,113	30,189
Limestone flux (*d*) ,,	45,078	13,851	56,938	16,946
Marble (*e*)	—	1,700	—	2,134
Molybdenite ...Tons	28	3,249	47	5,667
Noble opal	—	61,800	—	66,200
Platinum ....Oz.	440	1,720	332	1,418
Portland cement....	—	202,200	—	251,110
Silver (ingots and matte) (*f*) ....Oz.	1,718,000	168,974	1,773,913	175,775
Silver-lead, ore, concentrates, etc..Tons	269,306	1,484,641	317,697	1,685,704
Shale (oil) ..... ,,	48,718	23,617	68,293	33,896
Scheelite ...... ,,	193	14,618	151	15,747
Stone (building,etc.)(*g*)	—	378	—	2,792
Stone (grindstones) (*g*)	—	192	—	325
Tin (ingots and ore) (*h*) .....Tons	1,943	211,029	1,868	228,156
Wolfram ...... ,,	127	11,249	166	16,258
Zinc (spelter and concentrates) ,,	373,906	1,041,280	468,627	1,289,634
Sundry minerals and ores	—	4,905	—	5,550
Total value	—	7,635,693	—	8,736,469

* Value enhanced by gold contents.

(*a*) Exclusive of the copper produced in the State during the year from ore imported for treatment from other States of the Commonwealth. (*b*) Including iron made from scrap. (*c*) Contents of silver-lead bullion, by average assay, produced in the State. See also silver-lead. (*d*) Value at smelting works. (*e*) Value at quarries of quantity disposed of. (*f*) The bulk of the silver is contained in the concentrates, etc., despatched from the Broken Hill Field and treated outside the State. (*g*) Quantity exported only. (*h*) Exclusive of tin refined in the State from imported ores.

Absorption and dispersion in metallic vapours. [*Preparation of rubidium and caesium.*] P. V. Bevan. Brit. Assoc., Sect. B., Portsmouth, 1911.

Hackspill (see this J., 1911, 808) prepared rubidium and cæsium by heating the chlorides of the metals with calcium. By using lithium instead of calcium, the metals are obtained in a purer condition, lithium being less volatile than calcium.—A. S.

Use of sulphur monochloride in the determination and analysis of rare earth minerals. Hicks. *See* XXIII.

Patents.

Furnaces. J. Salessky, Moscow. Eng. Pat. 14,510, June 15, 1910.

The present invention permits of the establishment of oxidising conditions coupled with higher temperatures. The combustion air is admitted to the fuel chamber by openings placed about half-way down; part of the combustion is caused to take place upwards, the gases being drawn away by openings at the top, whereby a very hot zone is produced the gas derived from which is burnt with excess of air below the central openings. The waste gases may be used for air-preheating or preliminary heating of the material to be treated; preheating of the air may also take place in jacket-chambers surrounding the chambers. (Reference is directed to Eng. Pat. 2899 of 1880.)—B. G. McL.

Furnaces; Crucible ——. T. Hill, Walsall, Staffs. Eng. Pat. 23,664, Oct. 12, 1910.

THE furnace is employed for smelting metals, a crucible being disposed within an annular casing of refractory material, thus forming an annular coke space between the crucible and the casing. An inclined pipe, for tapping off the molten metal, passes from the lower portion of the crucible across the coke chamber and through the casing. A blast-pipe, or series of tuyères, communicates with the lower part of the coke space, or the crucible may be supported on a perforated fire-brick and metal floor, communicating with a chamber below into which air is delivered through a blast-pipe.—B. N.

Zinc blende and other sulphide ores; Roasting of ——. R. G. M. Liebig. Ger. Pat. 237,034, June 11, 1910.

To completely desulphurise zinc blende, it is necessary to apply additional heat towards the end of the roasting. According to the present patent, highly-heated air is led directly over the ore.—A. S.

Metals; Electro-deposition of ——. A. Rodeck, Milan, Italy. Eng. Pat. 13,808, June 9, 1911. Under Int. Conv., June 10, 1910.

BETWEEN the anodes and cathodes there are placed bodies of suitable material, which are mechanically moved so as to serve as the transferring mechanism. The material is conducting, or is made conductive at the operating surface, and is provided with a porous, permeable, non-conducting coating serving as the carrier of the electrolyte. Fig. 1 shows the arrangement for electroplating flat sheets, the transfer mechanism being in the form of a coated metallic strip, *b*, which passes over rollers, taking metal from the stationary anode, *a*, and delivering it to the cathode, *k*. Figs. 2 and 3 show an arrangement for coating tubes inside and out. The transferring mechanism for the outside of the tubes, *r*, is a cylindrical rotating roller, w^1, which transfers metal from the anodes, a^1, and also causes the tubes to rotate on their own axes. For coating the insides of the tubes, the transferring mechanism is a cord, wire, rope or the like, w^2, covered with the carrier of the electrolyte, and passing over the anodes, a^2, and through the interiors of the tubes, *r*.—B. N.

Fig. 1

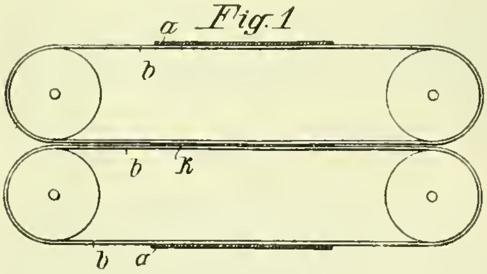
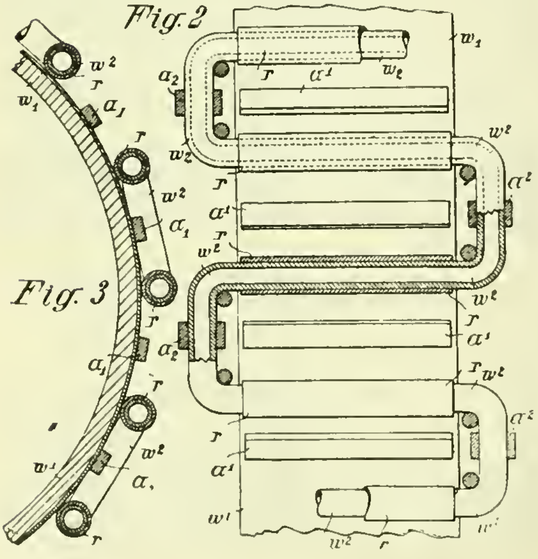


Fig. 2

Fig. 3



Metals from their ores [electrolytically]; Extracting —— *and apparatus therefor.* H. W. Lake, London. From Universal Ore Reduction Co., Phœnix, Ariz., U.S.A. Eng. Pat. 28,589, Dec. 8, 1910.

THE metal, such as gold, is separated from the powdered ore by keeping the latter in suspension in the electrolyte in an electrolytic cell provided with anode and cathode plates between which the liquid and powder are caused to circulate freely and continuously at a temperature not below 150° F. This agitation is produced by a heated vapour or gas, which at the same time aids the electrolytic action. The cathode consists of a metal easily melted or capable of being disintegrated by heat. —B. N.

Ores, residues, etc.; Process and apparatus for the lixiviation of —— *by moistening with liquid and blowing gases through.* W. Günther. Ger. Pat. 237,153, Nov. 5, 1910.

THE lixiviation is effected on a water-tight surface, on which the material is disposed in the form of large heaps; and at intervals air is drawn down through the heaps in order to transmit heat from the upper to the lower layers. The material may be dried and heated before lixiviation is commenced, in order that the heaps may be readily penetrated by the undiluted solvent liquor. Oxygen- and halogen-carriers may be added, and in order to increase the sulphur-content of the material, pyrites or iron sulphate may also be added, or sulphur dioxide or hydrogen sulphide, together with air, may be blown through the heaps. Passages or conduits are provided below or alongside the water-tight surface for the introduction of gases, etc., and the water-tight surface may be constructed of arched sections, each provided with a separate liquor-discharge. A system of tubes may also be disposed on the water-tight surface for the introduction of gases. Shafts are provided for the removal of the residues after lixiviation.—A. S.

Iron and steel; Manufacture of ——. M. J. Davidsen, Paris. Eng. Pat. 29,710, Dec. 21, 1910.

SEE Fr. Pat. 418,581 of 1910; this J., 1911, 92.—T. F. B.

Electrolytic iron; Process for manufacture of metal bands, wire, etc., from ——. W. Pfanhauser, Leipzig, Germany. U.S. Pat. 1,001,770, Aug. 29, 1911.

SEE Eng. Pat. 22,204 of 1910; this J., 1911, 290.—T.F.B.

Aluminium alloys; Process of making ——. J. G. and W. F. Mellen, Mount Vernon, N.Y., U.S.A. Eng. Pat. 3361, Feb. 9, 1911. Under Int. Conv., Feb. 14, 1910.

SEE U.S. Pat. 982,218 of 1911; this J., 1911, 220.—T.F.B.

Concentrating-amalgamator. R. Luckenbach, Colwyn, Pa. U.S. Pat. 1,001,057, Aug. 22, 1911.

SEE Eng. Pat. 3124 of 1911; this J., 1911, 961.—T. F. B.

Metals and alloys; Process for the treatment of ——. G. Bryant, Finsbury Park, and C. H. Ivinson, Ilford. U.S. Pat. 1,002,133, Aug. 29, 1911.

SEE Eng. Pat. 1404 of 1909; this J., 1910, 284.—T. F. B.

Pulp-agitating apparatus. U.S. Pat. 1,000,689. *See* I.

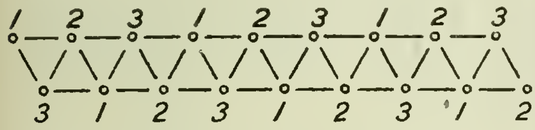
XI.—ELECTRO-CHEMISTRY.

Electro-analysis. Report to Brit. Assoc. *See* XXIII.

PATENTS.

Electrodes for electric furnaces. M. Ruthenburg, London. Eng. Pat. 28,536, Dec. 8, 1910.

IN the electric furnaces in which polyphase current is employed, and in which several groups of electrodes are used, the latter are so disposed and connected that there is an even distribution of current, each electrode co-operating with those of neighbouring groups. In the figure, the numerals indicate the phases to which the electrodes, represented by circles, are connected, and the lines show the way in which the electrodes co-operate. As illustrations of other arrangements, the two rows of electrodes may be in the form of two concentric circles, or three rows of electrodes may be employed.—B. N.



Furnace; [Electric] Resistance —— with great coefficient of efficiency for obtaining rapid reactions. V. Popp. Fr. Pat. 427,324, Feb. 23, 1911.

THE furnace (Figs. 1 and 2) comprises a block, A, in the centre of which is arranged a cavity containing the resister, B, the crucibles, C, and the electrodes, D, E and F. The resister, of suitable conductive material, may be in the form of a single block, in several pieces, or in grains, and the crucibles are suspended above the resister, so as not to be in contact with it, by means of flanges, on the upper edges of the crucibles, which rest on the side walls of the furnace. Alternative forms are described in which the crucibles rest on shoulder-pieces in the walls, or are separated from the resister by a plate, conductive to heat but only feebly so to electricity. The electrodes are in three pieces, the conductivity of the plate, D, and of the grains of material, E, being about equal, but much greater than that of the resister, whilst the metallic plate, F, is of still greater conductivity. In another arrangement the crucibles, of greater conductivity than that of the resister, are in direct contact with the latter. In the form shown in Fig. 3 the resister is in contact with opposite faces and the base of each crucible, the current entering at the composite electrode at I and leaving at K and L.
—B. N.

FIG.1.

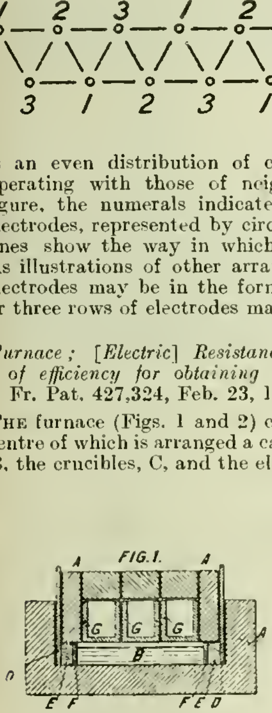


FIG.3.

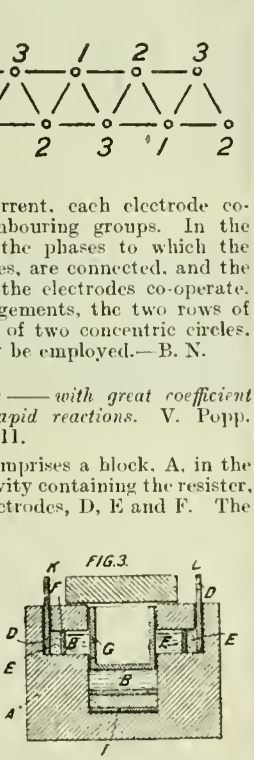
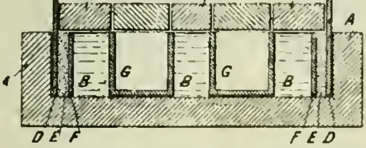


FIG.2.



Cells; Voltaic ——. S. Benkö, Budapest, Hungary. Eng. Pat. 10,156, April 26, 1911.

A LIQUID, containing the exciting and depolarising electrolyte in a highly concentrated state, is forced under, or without, pressure into the pores of the negative electrode, until the latter is thoroughly impregnated. Water is introduced, with or without the employment of pressure, into the chamber in the cell which contains the soluble or positive electrode, and the supply of water is regulated, *e.g.*, by altering the cross-sectional area of the pipe connecting the water-containing vessel and the chamber containing the positive electrode. The water, coming into contact with the wall of the negative electrode, dissolves out the exciting electrolyte by osmotic action. The vessel for the depolarising and exciting liquid may be formed by, and between, the outer wall of the negative electrode and a surrounding casing, whilst the vessel for the water is constituted by the negative electrode itself.—B. N.

Depolarisers for galvanic cells or batteries. Chem. Fabrik Griesheim-Elektron, Frankfort-on-the-Maine, Germany. Eng. Pat. 11,906, May 17, 1911. Under Int. Conv., Oct. 10, 1910.

IN cells of the Leclanché type, an acid manganite is used as the depolariser. Such a substance will combine with the bases formed during the working of the cell, but is not capable of liberating acid from the salts of the electrolyte.
—B. N.

Electrolytic apparatus. J. W. Kenevel, Philadelphia, Pa., Assignor to W. H. Mitchel, Media, Pa., F. W. Tussey, Camden, N.J., and J. R. Bonine, Philadelphia, Pa. U.S. Pat. 1,000,608, Aug. 15, 1911.

THE apparatus comprises a chamber having a porcelain lining, with inlet and outlet pipes disposed on opposite sides. The chamber has several sections, each section being provided with a hood, the latter supporting by conducting means a set of electrodes in each section. Each group of electrodes comprises co-acting parallel plates, "the plates of the several groups being staggered relatively."—B. N.

Protecting-glaze; Process of applying —— to carbon electrodes. J. L. K. Snyder, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,000,761, Aug. 15, 1911.

THE surface of a "green unbaked carbon electrode" is covered with a paste, comprising a binder and a chemical, such as will produce under the influence of the "curing heat" a slag-forming protective coating. The electrode covered with the paste is then subjected to the required temperature.—B. N.

Electric arcs; Process for the production of horizontal or nearly horizontal —— for gas reactions. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 235,429, May 15, 1910. Addition to Ger. Pat. 228,422, May 8, 1909 (this J., 1910, 1462).

INSTEAD of the two series of gas currents meeting above the arc as mentioned in an earlier addition to the chief patent (see Eng. Pat. 5934 of 1910; this J., 1911, 371), it is now proposed to use only one, the other being replaced by currents of liquid (*e.g.* water) or by a metal wire screen.
—A. S.

Furnace; Electrical ——. H. Nathusius, Friedenshütte, Germany. U.S. Pat. 1,000,838, Aug. 15, 1911.

SEE Addition of June 4, 1909, to Fr. Pat. 388,668 of 1908; this J., 1910, 221.—T. F. B.

Furnace ; Electric ——. A. Helfenstein. Vienna. U.S. Pat. 1,000,805, Aug. 15. 1911.

See Fr. Pat. 418,567 of 1910 ; this J., 1911. 94.—T. F. B.

Furnace ; Electric ——. L. Yngström, Assignor to Stora Kopparbergs Bergslags Aktiebolag, Falun, Sweden. U.S. Pat. 1,001,915. Aug. 29. 1911.

See Fr. Pat. 415,548 of 1910 ; this J., 1910, 1317.—T.F.B.

Electrolytic cell. H. S. Hatfield. Hove. U.S. Pat. 1,001,589, Aug. 22, 1911.

See Eng. Pat. 22,920 of 1906 ; this J., 1908, 232.—T. F. B.

XII.—FATS ; OILS ; WAXES.

Soya bean oil. H. Matthes and A. Dahle. Arch. Pharm., 1911, **249**, 424—435.

Soya bean oil contains 94—95 per cent. of fatty acids (present as glycerol esters) of which about 15 per cent. consist of saturated acids (palmitic acid) and about 80 per cent. of liquid unsaturated fatty acids. The latter were found to consist of about 70 per cent. of oleic acid, about 24 per cent. of linolic acid and about 6 per cent. of linolenic acid. Samples of the oils labelled " purified " and " unpurified " had the following characters respectively :—Sp. gr. at 15° C., 0·9260, 0·9265 ; solidif. pt., —11·5° C., —12° C. ; refractive index at 40° C., 1·4680, 1·4680 ; acid value, 5·7, 1·71 ; saponification value, 192·3, 194·3 ; iodine value (Hübl, after 18 hours action), 131·3, 132·6 ; Reichert-Meissl value, 0·75, 0·75 ; Polenske value, 0·78, 1·08 ; elaïdin reaction, positive. Exposure of the oil for six months (in daylight) to moist air increased the acid value, but lowered the iodine value. Pure oxygen both in the absence and presence of moisture had no influence on the iodine value. (See also this J., 1905, 897.)—A. Sbld.

Soya beans ; The phytosterol of ——. H. Matthes and A. Dahle. Arch. Pharm., 1911, **249**, 436—444.

The unsaponifiable portion of soya bean oil amounts to about 0·7 per cent., which is easily separated into a crystalline portion (about 55 per cent.) and a liquid portion (about 45 per cent.), by means of petroleum ether (b. p. 50° C.) in which the latter is soluble. The crystalline portion consists of two substances (*a*), about 2·4 per cent. of a phytosterol, melting at 169° C., which has two double linkages and is strongly lævo-rotatory. It is identical with the stigmasterol isolated from Calabar beans by Windaus and Hauth (this J., 1907, 69) ; (*b*), about 97 per cent. of a lævo-rotatory phytosterol with one double linkage and melting at 139° C. The liquid portion of the unsaponifiable portion of soya bean oil consists of unsaturated oxygenated compounds, which give the phytosterol reaction. Elementary analysis gave the same proportion of carbon and hydrogen as in the case of phytosterol (*b*). Experiments made to separate the phytosterol-like constituent of the liquid portion by Windaus' method with digitonin were unsuccessful. (See also Keimatsu, this J., 1911, 1021.)—A. Sbld.

Fatty oils ; Iodine value of ——. E. J. Parry. Chem. and Druggist, Sept. 23, 1911, 53.

In the new edition of the German Pharmacopœia it is stated that two hours are sufficient time for complete absorption of iodine by Hübl's method, except in the case of linseed and codliver oils (18 hours). The author points out that a period of at least 6 hours is required, even in the case of non-drying oils, and that the use of the shorter time accounts for the low results obtained by continental chemists.—C. A. M.

Lipase resistant to heat. N. L. Söhngen. Koninkl. Akad. van Wetensch. Amsterdam, Wisk. en Natk. Afd., 1911, **20**, 126—130. Chem. Zentr., 1911, **2**, 631. (See also this J., 1911, 140, 812.)

Whilst the lipolytic enzyme obtained from *Bacterium lipolyticum, B. fluorescens non-liquefaciens, B. Stutzeri, Oidium lactis aërogenes, Aspergillus niger, Penicillium glaucum*, and *Cladosporium butyri* is destroyed on heating to 80° C., a lipase which can be heated for 5 minutes at 100° C. without decomposition, can be obtained from cultures of *B. fluorescens liquefaciens, B. punctatum, B. pyocyaneous*, and *B. liquefaciens albus*. This lipase is more sensitive to acids than ordinary lipase is.—A. S.

Fatty acids ; Reaction of certain unsaturated —— *with formaldehyde.* S. Fokin. J. Russ. Phys.-Chem. Soc., 1911, **43**, 809—819.

The products obtained by the condensation of oleic, elaïdic, and undecylic acids with formaldehyde in presence of sulphuric acid have been studied. It is found that, if the reaction be carried out at low temperatures, the products obtained are more definite and non-polymerised. The products obtained with oleic and elaïdic acids seem to be identical and consist of three compounds having acid characters : (1) crystalline, m. p. 112°—114°, solidifying at 102°—97° C., of the formula $C_{21}H_{40}O_4$; (2) soluble in light petroleum and having the formula $C_{24}H_{42}O_5$; (3) insoluble in light petroleum and having the formula $C_{23}H_{40}O_5$. Various derivatives of each of these compounds were prepared and cyclic structural formulæ have been suggested for them. With undecylic acid, the principal product, which is soluble in ether, has the formula $C_{16}H_{30}O_5$.—T. H. P.

Cottonseed products in Egypt. Oil, Paint, and Drug Rep., Aug. 28, 1911. [T.R.]

There are in Egypt about 200 presses used for pressing cottonseed. About one-third of the total cotton-seed crop is retained in the country for resowing and crushing. Of the cake, by far the greater part goes to the United Kingdom, very little being used in Egypt. Of the oil probably 80 per cent. is used in Egypt as edible oil, or is exported to the Turkish possessions. The following table gives the exports of Egyptian cottonseed products for the last two years :—

Year.	Exports.					Impts.
	Cake.		Soap.		Oil.	Oil.
	Tons.	£E.	Kilos.	£E.	£E.	£E.
1909...	75,604	241,925	187,645	5,401	17,756	45,387
1910...	62,030	283,111	172,520	4,088	22,976	17,713

Value of cottonseed exported from Alexandria during the years 1908–10.

Country.	£E. 1908.	£E. 1909.	£E. 1910.
United Kingdom	2,086,643	1,868,549	1,417,746
Brit. possessions	92	97	72
France....................	150,416	130,489	97,743
Germany..................	172,415	416,978	636,096
Other countries	59,561	15,770	6,523
Totals	2,469,128	2,431,883	2,158,380

Value of cottonseed cake exported from Alexandria during the years 1908–10.

Country.	£E. 1908.	£E. 1909.	£E. 1910.
United Kingdom	214,700	240,044	279,350
France....................	168	1,650	2,965
Germany..................	—	163	796
Totals, including other countries	215,765	241,925	283,111

Value of cottonseed oil exported from Alexandria during the years 1908–10.

Country.	£E. 1908.	£E. 1909.	£E. 1910.
United Kingdom	1,452	2,357	3,130
Turkey	4,590	9,456	17,472
Other countries	1,864	4,912	2,022
Totals	7,906	16,725	22,624

Patents.

Waxes, fats, and oily substances ; Apparatus for obtaining ——. S. Wijnberg, Amsterdam. Eng. Pat. 25,669, Nov. 4, 1910.

A suitable solvent is boiled in a still and the vapours pass upwards into a condenser ; the condensed liquid flows from the condenser into a vessel containing the material to be extracted, the solution of the fat, etc., being next passed through a chamber filled with refining material such as fullers' earth, bone-black, or the like, and conducted thence back into the still. The solution of the fat, etc., may be conducted directly from the extraction chamber to the still, and arrangements are provided for distilling the solvent remaining in the refining material.—W. P. S.

Oil ; Method of extracting —— *and manufacturing oil cakes.* K. Oga, Tokyo. Eng. Pat. 4262, Feb. 20, 1911.

The oil-containing material is exposed to a current of hot air, which is maintained at a temperature (70° to 80° C.) insufficient to coagulate albuminous substances, and is then expressed in any suitable manner. The residual oil cake is said to contain less oil than that obtained by any other method, and, owing to the albuminous substances being present in a soluble form, to be more digestible. This oil cake may also be used in the preparation of washing powders and the like.—C. A. M.

Oil-bearing material ; Apparatus for and method of cooking ——. A. W. French, Piqua, Ohio. U.S. Pat. 1,000,675, Aug. 15, 1911.

The material is heated in a series of closed chambers arranged in descending order and provided with means for automatically regulating the supply, for preventing the contents rising to the top, and for the suction of a current of air at a regulated temperature over the material in at least one part of the apparatus.—C. A. M.

Fatty acids ; Process of raising the melting-points of ——. A. Solomonoff, Assignor to The Will and Baumer Co., Syracuse, N.Y. U.S. Pat. 1,002,186, Aug. 29, 1911.

In order to raise the melting-points of fatty acids, thereby rendering them harder and amorphous, they are powdered or granulated and mixed with anhydrous ammonia or other anhydrous alkali and with an anhydrous alkali (ammonium) salt.—T. F. B.

Fatty-acid compounds ; Art of producing ——. J. W. Blagden, Mannheim, and R. Müller, Eilenburg, Assignors to C. F. Boehringer und Söhne, Mannheim-Waldhof, Germany. U.S. Pat. 1,000,487, Aug. 15, 1911.

See Fr. Pat. 383,531 of 1907 ; this J., 1908, 326.—T. F. B.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Bologna luminous stones. Vanino and Zumbusch. *See* VII.

Patents.

Yellow pigments from ilmenite or titaniferous iron ores ; Manufacture of ——. A. J. Boult, London. From A/S Norske Titanfarververker, Christiania, Norway. Eng. Pat. 10,368, April 28, 1911.

Light yellow pigments that will form durable rust-preventing paints are obtained by mixing the finely divided ore with sulphuric acid and subsequently heating the mass to decompose the sulphates. Various shades of colour may be produced by carrying out the calcination in the presence of air, sulphur dioxide, or other gases, whilst the temperature has also an influence upon the colour.—C. A. M.

White lead paste obtained by precipitation ; Process for the treatment of ——. Dr. Genthe und Co., Ges. m. b. H. Ger. Pat. 236,331, June 27, 1909.

The wet paste is kept for some time at a temperature below 100° C. After this treatment the white lead can be mixed to the required consistence with the normal quantity of oil, whereas without such treatment it would require a much larger quantity of oil than white lead prepared by the chamber process.—A. S.

Resins ; Manufacture of products resembling —— *by the condensation of phenols with formaldehyde.* Knoll und Co. First Addition, dated March 14, 1911 (under Int. Conv., March 14, 1910), to Fr. Pat. 395,657, Jan. 2, 1908 (see Eng. Pat. 28,009 of 1907 ; this J., 1908, 908).

The products obtained by proceeding according to the details of the principal patent often have a deep colour. This may be prevented by using excess of formaldehyde. Examples :—(1) 100 parts of phenol, 200 parts of 40 per cent. formaldehyde and 2 parts of sodium carbonate, are heated in a vessel provided with a reflux condenser for 1—1½ hours. The viscous mass obtained is heated in appropriate moulds at 70° to 90° C. until it is coagulated into the form of a clear infusible mass. (2) 100 parts of phenol, 100 parts of 40 per cent. formaldehyde and 5 parts of sodium sulphite are heated to boiling for 15 minutes. About 50 per cent. of the water present is distilled off *in vacuo*, 70 parts of formaldehyde solution are added, and the heating continued for half an hour. The intermediate product thus obtained coagulates to a clear mass when heated at about 80° C. with or without the addition of accelerators. (3) 100 parts of phenol, 80 parts of 40 per cent. formaldehyde and 10 parts of ammonium chloride are heated until an oil separates. 100 parts of formaldehyde solution are added to the oil and the mixture heated to boiling until a sample coagulates to a tenacious mass when poured into water. On heating this mass in moulds the infusible product is obtained.—E. W. L.

Condensation products of phenols and aldehydes ; Process for hardening ——. Knoll und Co. First Addition. dated March 14, 1911 (under Int. Conv., March 14, 1910), to Fr. Pat. 397,051, Dec. 3, 1908 (this J., 1909, 803).

In the process, described in the principal patent, for accelerating the formation of the final insoluble, infusible resinous products obtained by the condensation of phenols and aldehydes, it is found that a further addition of aldehyde beyond that stated results in a considerable reduction of the colour of the final product. For example, 110 parts of phenol, 100 parts of 40 per cent. formaldehyde and 5 parts of sodium carbonate are heated until all the carbon dioxide is given off ; 50 to 60 parts of water are then distilled off *in vacuo* from the product, and the "resol" thus obtained is mixed with 75 parts of potato starch. The mass is cooled and 100 parts of a mixture of 1 part of fuming hydrochloric acid and 4 parts of 40 per cent. formaldehyde added, after which it is placed in moulds and heated for about 15 minutes at 60° to 80° C. The product is washed with dilute sodium carbonate solution.—E. W. L.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; A large yield of —— [*from Hevea Braziliensis*]. R. H. Lock and M. K. Bamber. India-Rubber J., 1911, **42**, 653—655.

Full particulars are given of the results obtained on tapping an old *Hevea* tree at Heneratgoda, Ceylon. The tree was one of the original seedlings sent out from Kew in 1876, and had not been seriously tapped before these experiments started. It is growing in very poor "cabooky" soil, and at a distance of 15 feet from each of two other trees. ["Cabook" is the name given to a clay ironstone of Ceylon.] The girth at the end of 1908 was 13 feet at 6 inches, 8 ft. 6 in. at 36 inches, and 9 ft. 5 in. at 72 inches from the ground. Tapping, on a V-system, was commenced on Dec. 7, 1908, and in 9 days the yield increased from 32 grms. to 165 grms. Between this date and January, 1911, the tree was tapped 600 times at an average interval of 1·3 days, each tapping consisting of a paring of about 1/15 in., followed by a single application of a sharp-pointed pricker. The total yield for the 600 tappings was 174 lb. of dry rubber in 25 months, or an average of nearly 7 lb. per month. Tables are given showing the results of tapping for each month of the 25, together with particulars of rainfall and concentration of latex. No close correspondence between yield and rainfall is shown, but there appears to be a definite relation between rainfall and concentration. The seasonal variations shown are highly irregular, but there is some indication of increased yield towards the end of the year, as assumed by planters on the western side of Ceylon. The authors make the interesting calculation that the yield of latex was at least eighteen times the volume of the latex tubes in the bark removed, and that in one year the amount of rubber removed was greater than could be contained at any one time in the whole laticiferous system of the tree, and yet an even greater quantity was obtained the following year. On the average there was 3 per cent. more of rubber in the latex when the tree was not tapped the day before. —E. W. L.

Rubber [*; Plantation* ——.] C. Böhringer. Tropenpflanzer, 1911, **15**, 493—496.

There are too many uncertain factors in the agricultural situation to permit of an accurate forecast of the future supply of rubber. Already there are instances of fully developed plantations showing a falling off in output which cannot be due to lack of labour. The following figures are given for rubber exported from Ceylon during the period Jan. 1 to June 26, 1911, and during the corresponding periods of the three previous years: 1911, 2,270,565 lb.; 1910, 1,087,620 lb.; 1909, 407,677 lb.; 1908, 306,805 lb. At least one-third of these quantities came from the Federated Malay States. During the same period of the years 1911 and 1910 respectively, the following amounts were shipped from Ceylon to various parts of the world: England, 1,190,006 lb., 551,279 lb.; Belgium, 174,888 lb., 20,472 lb.; France, 117 lb., nil; Germany, 8590 lb., 8121 lb.; Holland, 100 lb., nil; Italy, 3597 lb., 841 lb.; Victoria, 12,619 lb., nil; New South Wales, 4095 lb., nil; United States, 845,941 lb., 499,996 lb.; Canada, 9971 lb., 1911 lb.; India, 85 lb., nil; Japan, 20,556 lb., nil. Prices varied during the 1911 period between M.3.10 and M.6 (3s. and 5s. 10½d.) and during the corresponding 1910 period between M.8 and M.12.50 (7s. 10d. and 12s. 3d.).—E. W. L.

Raw rubber; Preventing —— *from becoming "tacky."* E. Fickendey. Z. Chem. Ind. Kolloide, 1911, **9**, 81—83.

That the production of tackiness in raw rubber is an effect of oxidation is shown by the following experiment. Pieces of raw rubber were placed in glass tubes filled with air, hydrogen, nitrogen, carbon dioxide, and oxygen respectively, and exposed to sunlight. After some weeks, the rubber in the tubes containing hydrogen, nitrogen, and carbon dioxide was unaltered, but that in the tubes containing oxygen and air had become sticky. Absorption of oxygen had taken place and the rubber had increased in weight; no carbon dioxide was produced. Rubber can be kept unaltered under water, but under hydrogen peroxide it soon becomes sticky on exposure to light. If a piece of the sticky rubber be placed in contact with a piece of sound rubber, and preserved with exclusion of oxygen, the sound rubber remains unaffected. The author has found that if tannin be added to the rubber latex, the rubber to a great extent, is preserved from becoming tacky, the tannin being more easily oxidisable than the rubber and thus preserving the latter. For *Ficus* latex, coagulation may be effected by addition of 2—3 per cent. of tannin in aqueous solution; for *Hevea* latex, 2—3 per cent. of tannin is added, and coagulation effected with acetic acid; for *Kickxia* latex, 5—10 per cent. of tannin is added, and coagulation completed by addition of 10—15 c.c. of formalin per litre. A defect of the method is that the rubber becomes coloured brown in consequence of oxidation of the tannin.—A. S.

Rubber; Chemistry of ——. *II. Physico-chemical investigation of extraction of resin.* D. Spence and J. H. Scott. Z. Chem. Ind. Kolloide, 1911, **9**, 83—85.

The course of the extraction of resin from rubber by means of acetone was followed quantitatively and the curve representing the results was found to be a typical adsorption isotherm. It was observed that the resin extracted at first was soft and sticky, whilst that removed later was a soft, amorphous, dry and dense resin. Curves constructed from the authors' results and those of Zilchert (this J., 1911, 436) for a number of different kinds of rubber are given.—A. S.

Rubber exports from Ceylon. Board of Trade J., Sept. 7, 1911. [T.R.]

The following statistics of the exports of rubber of domestic production from Ceylon during the twelve months ended June, 1910 and 1911, have been extracted from official returns issued by the Ceylon Government:—

	Year ended 30th June.	
	1910.	1911.
	Cwt.	Cwt.
United Kingdom	14,089	25,786
United States	7,356	18,864
Other countries	919	3,815
Total exports of rubber of domestic production	22,365	48,465

Caoutchouc in vulcanised rubber goods; Applicability of bromine-derivative methods to the determination of ——. W. Esch. Chem.-Zeit., 1911, **35**, 971—972. (See also this J., 1909, 1149; 1910, 1465; and 1911, 98, 142, 224.)

The various attempts which have been made to apply the bromine-derivative method to the analysis of vulcanised rubber are all based on the following assumptions: (1) 136 parts of caoutchouc combine with 319·7 parts of bromine or with 64 parts of sulphur; (2) if 136 parts of caoutchouc have already combined with 32 parts of sulphur as the result of vulcanisation, only 159·85 parts of bromine can be fixed by the vulcanised material; (3) the whole of the chemically combined sulphur remains unaffected during the bromination process; (4) if the amounts of combined sulphur and bromine be deducted from the amount of the bromine derivative of the vulcanised rubber, the amount of actual caoutchouc is obtained. The detailed results of the analyses of 24 samples of rubber are given, which show that these assumptions are entirely erroneous. If the bromine-derivative be weighed and the amounts of combined sulphur and bromine deducted, the percentage of caoutchouc thus obtained may be as much as 15 per cent. too low or 23 per cent. too high. If on the other hand, the percentage of caoutchouc is calculated from the content of combined sulphur and bromine in the bromine-derivative, the result may be from 7 per cent. too low to 24 per cent. too high. It is pointed out that since the combined sulphur of vulcanised rubber is oxidised to a notable extent by such a mild oxidising agent as atmospheric oxygen, it is inconceivable that it should be quite unaffected by such a powerful oxidising agent as bromine solution.—A. S.

Patents.

Rubber or gums; Extracting —— from rubber vines, shrubs, bulbs or the like. R. Bridge, Castleton. Eng. Pat. 3049, Feb. 7, 1911.

The vines, etc., are subjected to preliminary crushing, sifting and washing to facilitate the final separation of the rubber from the bark by rollers. Various modifications of apparatus for this purpose are claimed.—C. A. M.

Rubber; Process of extracting resins from crude ——. A. Schleiffer. Fr. Pat. 427,173, March 13, 1911. Under Int. Conv., March 24, 1910.

The crude rubber, such as Jelutong, is heated for from four to eight hours at 60° to 100° C. with four to five times its weight of a phenol (*e.g.* cresol), and a small quantity of water. The rubber is removed, pressed and washed to free it from adherent resin solution, whilst the resins are removed from their solution in the phenol by the addition of alkali. The phenol is subsequently recovered by addition of acid. For example, 100 kilos. of Jelutong (containing 60 per cent. of moisture) are heated at 70° C. for 6 hours with 450 kilos. of crude o-cresol and 15 kilos. of water, the mixture being kept in agitation. The rubber is skimmed off, pressed, and washed, and the liquors are dealt with as described.—E. W. L.

Waste rubber, ebonite, vulcanite or the like; Manufacture of articles from ——. H. H. Tarver, Branstone, Staffs. Eng. Pat. 19,739, Aug. 24, 1910.

A substance, such as camphor, which is vapourised at or below the temperature of vulcanisation, is mixed in a powdered or other solid form with waste rubber, ebonite, vulcanite or the like, so as to displace, by means of vapour, the air from the interstices of the mass to be moulded. —B. N.

XV.—LEATHER; BONE; HORN; GLUE.

Hides; Preservation and disinfection of —— and a new method of sterilisation of anthrax spores. B. Kohnstein. Collegium, 1911, 297—304.

Hides which have been preserved by simple drying are very liable to be defective unless the process is conducted with great care. If the temperature is too high, the hide becomes horny and very difficult to soften and at temperatures above 40° C. the gelatigenous tissue may become fluid and yield a brittle mass of glue when completely dry. When dried by artificial heat the smoke from the fire, if allowed access to the hides, will have a kind of tanning action upon them in the same way as it has in the old Indian method of tanning. The effects of excessive cold when used as a preservative may be as bad as those of over-heating and frozen skins always produce a loose porous leather. Freshly ignited sodium sulphate and dry alum withdraw water from the hide and are very good preservatives, but the heat developed during hydration may injure the hide; alum is objectionable also on account of its tanning effect on the skin. Of organic compounds, picric acid was formerly much used in the East Indies as a preservative on the grain side of kips. Another process much used on East Indian kips is to coat the flesh side with clay containing sodium sulphate, followed by drying. Common salt remains the most efficient and cheapest of preservatives. The treatment with salt is frequently followed, especially in South America and Africa, by drying when the hides are to be transported a long distance. All varieties of salt are not equally efficient in withdrawing water or preventing putrefaction. Finely-powdered sea-salt is more hygroscopic than rock-salt, but when it has withdrawn a quantity of water it will flow away from the hide more quickly than the latter. If the salt is applied too late or in insufficient quantity, or after putrefaction has once begun, defects are apparent on the hides, especially if used for the finer sorts of leather. The first appearances of faulty preservation with salt consist of blue, bluish-grey, red or brown markings on the grain side. These spots degenerate later and the grain is eaten through. From the same cause, blood-red colourations are seen on South American hides and are visible also on the flesh side. Salt is denatured by the addition among other things of tar-oil, petroleum or sodium carbonate. The lessening of the hygroscopic properties of salt by the surrounding petroleum or crude oil is the cause of the defects described above. A skin, if brought into the lime pit while still containing salt, loses much of its coriin substance as Knapp and Reimer have shown. Alkaline salt solution dissolves coriin. A hide which has begun to putrefy or has not had sufficient salt evolves ammonia in the sweating process owing to decomposition of the amino-compounds. The fat in the hide is saponified and the hide becomes slimy. If the hide is laid in this condition on a rusty iron body, blue black markings are produced. The iron of the blood is, by the saponified fat and the ammoniacal salt solution, changed as in the above example partly into iron soap and partly to a brown-red precipitate. This explanation agrees with the work of Abt, who found that the hæmoglobin of the blood was the origin of the brown-red salt stains. The pigment-cells embedded in the epidermis and grain also exercise a great influence on producing the brown and blue-green stains after insufficient salting. Melanine, which is contained in the pigment-cells, contains 7—10 per cent. of sulphur and more iron, and from the high percentage of iron it may be concluded that it is a derivative from the blood colouring matter. The coloured stains are removed by the acid pickle and good results were obtained by using a mixture of salt and formic acid, previously recommended by Seymour-Jones. A solution of naphthalene in butyric acid is also an effective denaturing mixture and preserves the dry salted hides from the attacks of insects. The most dangerous of the pathogenic bacteria met with in the leather industry is the anthrax bacillus. The action of the bacillus results in the liquefaction of albumin and the formation of poisonous texalbumins, but besides its harmful action on the hide fibre it is dangerous to human life. It has been suggested to use, for the disinfection of anthrax, sulphur fumes ["Schwefeldampf"], formaldehyde, mercuric chloride, and finally a mixture of mercuric chloride and formic acid by Seymour-Jones. The author suggested a mixture of mercuric chloride and hydrochloric acid at the same time as the last method was proposed. Mercuric chloride is, however, unsuitable on account of its cost and poisonous character and is also very difficult to wash out of the hide especially after the latter has been in a sulphide-lime, when a black precipitate of metallic appearance is produced in the hide. Even in white limes there is enough sulphur derived from the hair to bring about the the same reaction. Leather treated thus is only suitable for black goods. The Schattenfroh-Kohnstein anthrax-sterilisation method consists in treatment with 2 per cent. of hydrochloric acid and 10 per cent. of salt.—D. J. L.

Tannins; Qualitative tests for various ——. J. Schneider and A. Seiwerth. Collegium, 1911, 282—288.

The colours produced by extracts of various tanning materials on cotton which had been previously treated with solutions of 27 salts of various metals were examined, the extracts being used (1) direct, (2) after reduction with sodium hydrosulphite, and (3) after addition of a trace of caustic soda, followed by oxidation in a stream of air for two hours. It was found that the colouration depended, not only on the metal, but also on the form in which the latter is fixed by the fibre. The following metals form no coloured compounds with the fixed constituents of the extracts: beryllium, magnesium, calcium, strontium, barium, thallium, antimony, molybdenum, tungsten, while the colour produced with zinc, cadmium, mercury, tin, and lead is weak and not characteristic. The extracts behave as polygenetic dyestuffs with compounds of iron, aluminium, copper, titanium, zirconium, cerium, thorium, vanadium, bismuth, chromium, uranium, nickel, and cobalt. After reduction of the extract with hydrosulphite, brighter colours are produced with catechu, rhatany root, myrobalans, valonia and Chinese galls on aluminium, with quebracho on aluminium, lead, cerium, and bismuth, and with maletto on aluminium, titanium, zirconium and bismuth. After oxidation darker colours are produced with catechu on nickel, with rhatany root on copper, titanium, zirconium, bismuth and chromium, with quebracho on aluminium, bismuth and zirconium, with pine bark on titanium, zirconium, and bismuth, with sumac on aluminium and copper, and with mangrove and maletto on titanium and zirconium. The various tanning materials of commerce give somewhat varying results according to their origin, variety and age, and certain materials give the same colour with every mordant. A list of the colours produced by various materials with the salts of aluminium, titanium, ziconium, and bismuth is given. Investigations were carried out on 23 materials on the lines of the spectrum-analytical work of J. Formánek. (Die qualitative Spektralanalyse anorg. und org. Körper. 2. Aufl. Berlin, 1905. Unters. u. Nachweis organ. Farbstoffe auf spektroskop. Wege. 2. Aufl. unter Mitwirkg. von E. Grandmougin. Berlin, 1908.) Infusions of the raw materials and extracts were made, on the water bath, with water, alcohol, amyl alcohol and acetone. The fluid extracts of commerce were diluted with alcohol, evaporated on the water-bath to dryness and the residue extracted with alcohol, amyl alcohol and acetone. The absorption bands varied in position with the dilution and the extracts showed, on dilution, a diminishing general absorption in addition to the bands. Aqueous solutions, in the case of most materials, are cloudy and give no characteristic spectrum. Absorption bands shown by quebracho and mangrove vanish on the addition of acid. A list of the position of the characteristic absorption bands produced by solutions of various materials dissolved in alcohol, amyl alcohol and acetone is given. Many of the solutions in alcohol show bands similar to those found for chlorophyll by Formánek, quebracho being the only notable exception. Commercial extracts show, in most cases, different bands from those produced by freshly-made extracts of the same materials. From the results obtained, the authors are of opinion that, with the exception of oak- and chestnut-extract, the examination of the absorption-spectrum of materials is a practical method of testing.—D. J. L.

Tanning material; Cerium salts from monazite residues as ——. W. Eitner. Gerber, 1911, **37**, 199—201, 213—215.

The possibility of the utilisation of the residues from monazite as a tanning material has already been suggested by Garelli (this J., 1907, 978) and Parenzo (Collegium, 1910, 121—124; this J., 1910, 579). The author has made experiments with cerium salts from monazite residues, using cerous carbonate and ceric sulphate, representing salts of tri- and quadri-valent cerium. The action of the cerous salts might be expected to resemble that of aluminium salts, in which the valency of the metal is the same. The results obtained were not in accordance with those of Garelli and Parenzo. Since cerous carbonate is insoluble in water it was dissolved by sulphuric acid to a salt corresponding to aluminium sulphate and later also into the double salt corresponding to alum. The cerous sulphate must be made very acid before solution is possible, with the result that a great swelling effect is produced in the skin, and much salt must be added to restrain this. The effect produced on the skin when dried out was very little different from that of an ordinary pickling process, and when the skin was freed from salt by washing it was left practically in a raw condition. With the double salt the result was still worse as this has a less solubility than the sulphate. An ox-hide placed in the yellow solution of ceric sulphate was quickly coloured through and became very hard. On drying out a hard horny product was obtained which was midway in character between raw-hide and leather and quite useless. After placing in a 40° B. quebracho liquor for three weeks, a very full and well-tanned sole-leather resulted which was very hard and stiff and without elasticity. Cerous carbonate, which is soluble in hydrochloric acid apparently in great quantity on account of its small density, was dissolved in that acid in sufficient quantity to form the salt $CeCl_3$ and its effect upon ox-hide and calf-skin tried. The skins were acted upon in a remarkable way, being transformed into a kind of rind resembling rubber in elasticity and softness. This property remained after drying out and might be utilised in the manufacture of leather for special purposes such as automobile tyres. The effect is not altered if salt be added to the bath to restrain the influence of the strongly-acid chloride, the rubber-like properties showing markedly after the salt has been washed out. An attempt was made to make the chloride less acid by further addition of the carbonate until the oxide began to precipitate; the solution still reacted strongly acid and evolved carbon dioxide from the carbonate. From such a solution Garelli stated that he obtained a fine white and soft glacé leather. Salt, flour and egg-yolk were mixed with the solution and a sheep skin was treated with it. A great difference was noticed from the effect produced when alum is used, the "feeding" material being taken up with difficulty by the skin and the skin retaining its pelty character to a great extent. After drying out, however, the skins were found to feel fuller than is usual with glacé leather at this stage. The final product was not a glacé leather but one that might be used for the making of bellows. The goods could not be given an after-tanning with alum as none was taken up, showing that the hide-substance had been strongly acted upon by the cerium salt. Ox-hides and calf-skins which had previously been treated with the cerium chloride solution could be placed in quebracho liquors of a strength up to 25°—30° Barkometer without any injury to the grain. The vegetable tannin solution penetrated very quickly and a leather of very fine quality was thereby produced. The cerium salt acts in this case as a mordant for the tannin in a similar way as a mordant for a dye, but very little difference in colour is produced. Acetate and formate of cerium were prepared from solution of the carbonate and a somewhat less rubbery product was the result of their action on skin, but the leather produced was worthless. Ceric sulphate, prepared by solution of the dioxide in sulphuric acid, had an action on skin, if the solution was not too acid, more similar to that of a vegetable tannin and myrobalans in particular than that of a mineral tannage. Concentrated baths of this salt had to be employed as precipitation takes place on dilution, so the grain was liable to be damaged. The leather produced is of a yellow colour and resembles a vegetable-tanned rather than a mineral-tanned product and is not stiff or hard in spite of the previous swelling. It is easily torn, however, and the grain is liable to break. Since the cerium residues are in the form of impure carbonate and the purer technical salt must be manufactured from them, the price of material appears to be much too high to permit of its use for the purposes of the tanner. Ceric sulphate, on account of its properties as an oxidising agent, is used in the manufacture of varnish where its price would not be prohibitive. Its catalytic properties might be utilised in the manufacture of chamois leather by adding small quantities during the fulling of the goods with oil.—D. J. L.

Gum kino; Some reactions of ——. J. L. Simonsen. Chem. Soc. Trans., 1911, **99**, 1530—1535.

On methylation, the gum kino obtained from *Pterocarpus Marsupium* yields an amorphous methyl ether which does not melt at 300° C., is readily soluble in most organic solvents, and dissolves in concentrated sulphuric acid with a purple-red colour. Its molecular weight is at least twice that corresponding to the formula, $C_{15}H_{11}O_4(O{\cdot}CH_3)_3$, found from analysis. Acetylkino, $C_{15}H_{11}O_4(O{\cdot}CO{\cdot}CH_3)_3$, was obtained as a pale brown powder which is readily soluble in most solvents. According to Etti (Ber., 1878, **11**, 1879), kinoin, as well as "kino red," is formed on heating kino with dilute hydrochloric acid, but the author has not obtained any kinoin from the reaction-product; in some cases, the reaction-product was found to contain a small quantity of catechol, but this compound is always present in small quantity in crude gum kino itself. On treatment, in the cold, with potassium permanganate in presence of sodium carbonate, kino methyl ether yields veratric acid as sole product of oxidation. The product obtained by heating kino with fused potassium hydroxide contains protocatechuic acid and catechol, but, contrary to the statement of Hlasiwetz (Annalen, 1865, **134**, 122) it does not appear to contain any trace of phloroglucinol. On oxidation with cold dilute nitric acid, kino or "kino red" yields oxalic acid and ammonium quadroxalate; to prevent this reaction from becoming too vigorous, the reaction mixture must be cooled in running water.—L. E.

Chrome leather; Analysis of ——. *II.* W. Fahrion. Collegium, 1911, 310—311.

Grasser (this J., 1911, 969) has criticised a method proposed by the author for the analysis of chrome leather (this J., 1911, 818), and states that chromium salts of different basicity can produce the maximum tanning effect and also that hydrochloric acid is used instead of sulphuric acid in many cases. The author was well aware of the latter fact and especially stated that hydrochloric acid was present in traces only in the samples of leather examined by him. But if it were present in greater quantity it would be no obstacle as it could be determined in the usual way and its neutralisation value with respect to chromium oxide brought into the calculation, provided always that the alcoholic caustic alkali solution was free from chlorides or allowance made for the quantity present. It is admitted that the proportion of chromium oxide to acid may be different in various samples of chrome leather of equally good quality, but in the course of time an upper and lower limit to this proportion will no doubt be established. Grasser recommends instead a method proposed by him (this J., 1910, 1216) in which the leather is treated with $N/1$ hydrochloric or sulphuric acid, instead of with alkali, the equivalent amount of alkali then added and finally the free acid titrated. No confirmatory results are given by him and no blank experiment with hide-powder to show that hide-substance on decomposition with acid would produce neutral bodies only. This condition is essential to the success of the method but is probably not fulfilled. Gelatin and hide-substance are well-known to be polyanhydrides of amino-acids and contain in a masked form not only acid carboxyl groups but also basic groups containing nitrogen. During hydrolysis both kinds of groups are set free but not in such equal proportions that they neutralise each other. The author has shown (Chem.-Zeit., 1902, 676) that skin by decomposition with alkali yields acid bodies and that the acidity produced rises with the extent of the decomposition. A sample of white hide-powder, after warming with alcoholic potash for 10 minutes, had a saponification value of 44; after 12 hours warming the number had increased to 204·9. A similar effect would probably be produced during the decomposition by acid and, on that account, the author considers Grasser's method unreliable.
—D. J. L.

Gum arabic-gelatin; Investigation of the system ——. F. W. Tiebackx. Z. Chem. Ind. Kolloide, 1911, **9**, 61—65. (See this J., 1911, 561, 700.)

A sol containing 0·5 per cent. of gelatin and 0·5 per cent. of gum arabic is rendered turbid by $0{\cdot}002N$ hydrochloric acid, and on further addition of acid is precipitated; on still further addition of acid the precipitate passes gradually to a turbidity and finally a clear solution is again obtained when the acid concentration becomes about $0{\cdot}01N$. By warming and by increasing the concentration of the gelatin and gum, the zone in which precipitation occurs is restricted, until at a concentration of rather more than 2 per cent. each of gelatin and gum at 80° C., precipitation (flocculation) no longer takes place. If the proportion of gum be increased, turbidity is again produced, but disappears on further increasing the concentration of gelatin plus gum. If salts be added to the sols rendered turbid by addition of acid, they tend to render the sols clear again by displacing the acid, and in presence of salts, higher concentrations of acid are required to produce turbidity. In the light of the results obtained with gelatin-gum sols, the author discusses the varying effects of acids, alkalis, and salts on enzymes according to their concentration, and the coagulation of proteins by heat.—A. S.

Patents.

Tanning; Rapid process of ——. Chem.-Tech. Studienges., Hersfeld, Ges. m. b. H. Fr. Pat. 427,614, March 21, 1911.

The hides, prepared by the usual processes, are freed from most of the water contained in them by means of alcohol. They are first plunged in 50—60 per cent. alcohol for 24 hrs.; the adherent liquid is then removed and the hides are plunged successively (for 24 hrs. each) into 70 per cent., 80 per cent., 90 per cent. and 96 per cent. alcohol, and if necessary in alcohol of still higher strengths. Six to eight changes are generally sufficient. The hides are then dried at 40° C. and plunged into a tanning liquor consisting of a solution in 96 per cent. alcohol of one of the ordinary tanning extracts. After this alcoholic tanning (which takes a few hours only) it is well to proceed to a second tanning for about 24 hrs. with an aqueous extract of a tanning solution of oak or pine bark. The alcohol is recovered, in the process of drying, by distillation *in vacuo*.—E. W. L.

Hides; Process of colouring ——. J. Le Roy. Fr. Pat. 427,770, June 2, 1910.

The hides are dried and sized and again allowed to dry. They are then covered with a layer of colour composed of a mixture of pigment, in the form of paste or of powder, and hide-glue. This is applied with a brush and the hides are allowed to dry. To give a polish the hides are varnished with a casein- or spirit-varnish, after which they may be glazed.—E. W. L.

XVI.—SOILS; FERTILISERS.

Nitrolim [crude calcium cyanamide]; Analysis of ——. H. Kappen. Chem.-Zeit., 1911, **35**, 950—952.

A number of experiments, carried out with the view of investigating Monnier's statement (this J., 1911, 821) that the Kjeldahl method yields low figures for the total nitrogen in nitrolim, gave results which do not confirm those found by Monnier. The results found by the Kjeldahl method were in agreement with those yielded by the salicylic acid process. Further, the fact that nitrolim contains a substance which is oxidised by hydrogen peroxide with the formation of nitric and nitrous acids does not appear to be due to the presence of an unknown nitrogenous compound. Perotti's method was found to be trustworthy for the determination of cyanamide and dicyandiamide nitrogen. (See also this J., 1911, 912.)
—W. P. S.

Influence of common salt on the germination of beet seed. Wassiliew and Pomaski. *See* XVII.

Patents.

Superphosphate chambers; Arrangement and working of ——. H. P. C. Freudenthal, Hamburg, Germany. Eng. Pat. 24,500, Oct. 21, 1910.

See Fr. Pat. 422,875 of 1910; this J., 1911, 701.—T. F. B.

Ammonium-phosphate fertiliser. N. Caro, Berlin, and T. E. Scheele, Emmerich, Germany. U.S. Pat. 1,001,350, Aug. 22, 1911.

See Fr. Pat. 397,282 of 1908; this J., 1909, 724.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Beet seed; Influence of common salt upon the germination of ——. E. M. Wassiliew and A. Pomaski. Westnik S. Pr., 1911, **3**, 78; Centr. Zuckerind., 1911, **19**, 1610.

Briem (this J., 1909, 949) has found that a moderate application of common salt to the soil has a favourable effect upon the cultivation of the sugar beet, and the authors have applied this observation to the germination of the beet seed. Three series of germination tests in sand at 19° C. were carried out, and in these the seeds used were as follows: (1) previously immersed in a saturated solution of common salt for 6 hours; (2) previously immersed in a saturated solution of common salt for 24 hours; and (3) untreated, serving as the control test. It was found that impregnation with common salt undoubtedly accelerates the germination of the seed during the first 7 days; but that after this period the untreated seed has a slight advantage over that immersed for 6 hours; whereas in the case of the seed immersed for 24 hours, distinctly inferior results were obtained. On the 5th day the sprouts counted in the three tests were: (1) 81, (2) 96, (3) 28; on the 7th day: (1) 167, (2) 120, (3) 114; and on the 9th day: (1) 169, (2) 125, (3) 179. —J. P. O.

Sucrose; Density of liquid —— and of its solutions in water. F. Schwers. Chem. Soc. Trans., 1911, **99**, 1478—1486.

It is found that if finely powdered sucrose is heated under an inert liquid such as paraffin (b. pt. about 190° C.), it may be melted without charring. Using this method, the author has determined the density of liquid sucrose at temperatures ranging from 115° to —15° C.; with decreasing temperature, the liquid becomes more viscous and ultimately hard like glass. The densities compared with water at 4° C., are 1·51966 at —14·55° C. and 1·45846 at 114·70° C. Between 35° and 115° C. the dilatation of liquid sucrose is almost regular and about four times that of solid sucrose, but at lower temperatures, it diminishes rapidly though regularly; no density maximum is attained, however, at the lowest temperature employed. When a liquid is heated, its volume is increased owing to the increased energy of the molecules, and is decreased by dissociation of physical aggregates. Water is the only liquid known for which the second of these actions exceeds the first (between 0° and 4° C.) but the author's work shows that liquid sucrose approaches very nearly to water in this respect, and it is perhaps quite similar at temperatures lower than —15° C. A comparison of the observed densities of aqueous solutions of sucrose of various concentrations (10—70 per cent.), and at various temperatures, with the theoretical densities calculated from that of liquid sucrose, shows that all the solutions exhibit volume contraction. The curves showing the relation between temperature of the sucrose solution and volume contraction are very similar for all the concentrations; the general form of the curves shows a diminution of contraction up to nearly 50° C., after which the contraction first remains nearly constant, then increases and finally begins to decrease again at about 80° C. The form of the curves is not very different from that of the system, glycerol+water, in spite of the fact that sucrose contains so many hydroxyl groups.—L. E.

Investigation of the system gum arabic-gelatin. Tiebackx. *See* XV.

Patents.

Sugar and the like; Apparatus for boiling and cooling ——. W. Boyd, Dundee. Eng. Pat. 16,498, July 11, 1910.

Syrup of high density is boiled by passing through a system of steam-heated tubes. The boiled syrup passes to the upper part of the cylindrical surface of a rotating drum which is flanged at each side and cooled internally by circulating water. When the syrup has been carried round by the drum to the bottom, it is removed by a scraper and passed through a creaming and re-heating machine to a depositing trough. To prevent the syrup from adhering to the drum and the scraper, a thin film of water is maintained on the outside of the drum and on the scraper. The water may be applied by an absorbent roller partly immersed in water, and another similar roller bearing on the first roller and on the drum; squeegees are provided to remove excess of water from the drum. —L. E.

Sugar juices; Extraction of —— from sacchariferous plants, and the treatment of the resulting products. H. A. J. Manoury. Fr. Pat. 426,798, Jan. 23, 1911.

In extracting sugar from sacchariferous plants the operation is the more economical the more concentrated the juices obtained, since the more concentrated the juice, the higher is its purity. Hence in extracting sugar from the beetroot, it is proposed to collect two kinds of juice from the diffusion battery: the one concentrated, and the other dilute. Of these, the first is used for sugar extraction, while the other may be mixed with molasses and fermented.—J. P. O.

Beetroot; Method of extracting the juices of the ——. H. A. J. Manoury. Fr. Pat. 427,417, March 16, 1911.

Fine beetroot pulp is treated in filter-presses, in which, in order to obtain the necessary pressure, metallic cloth, or plate perforated with very fine holes, is used in place of the filtering material in general use.—J. P. O.

Starch; Process of manufacturing ——. E. O. Eckland, Keokuk, Iowa. U.S. Pat. 1,000,726, Aug. 15, 1911.

Grains, tubers, or other starch-bearing materials are immersed for a predetermined period in water saturated with ozone; additional ozone is supplied during the process so as to keep the water saturated with the gas. The grains, etc., are then ground, the germ is removed, and the material is reduced to a pulp from which the starch-milk is separated.—W. P. S.

XVIII.—FERMENTATION INDUSTRIES.

Yeast; Top-fermentation —— and acidity. P. Petit. Brasserie et Malterie, 1911; Woch. Brau., 1911, **28**, 395—397. (See this J., 1911, 146.)

In preparing a solution of phosphoric acid for treating yeast, acid of 63° Baumé is used; acid of 45° B. may be used, but it is not so pure, and phosphoric anhydride should never be used since it does not act in the same way, and is much dearer. One method of treatment consists in diluting the washed dough-like yeast with 3—4 times its weight of water containing 50—300 grms. of phosphoric acid per hectolitre, the yeast then being allowed to subside, freed from the supernatant liquid, and used for pitching. The requisite quantity of phosphoric acid, which depends on the nature of the water (*loc. cit.*), must be determined experimentally; in the case of top-fermentation yeasts, it is seldom less than 100—150 grms. per hl. A better method of treatment consists in mixing the dough-like yeast with 1—2·5 times its weight of water containing 1·4—2·5 grms. of acid per litre; after the lapse of 30—40 minutes, the whole is used for pitching, there being no necessity to wait for the subsidence of the yeast. When this method is used, the requisite quantity of phosphoric acid must also be determined experimentally; since, however, the quantity of acid is less and the time of contact is shorter than in the former method, no ill effect is likely to result from its use. Again, the addition of the small quantity of phosphoric acid to the wort, involved in the second method, is a valuable means for increasing the acidity of worts which are deficient in this respect; an increased wort acidity often results in a higher attenuation and greater stability of the beer. —L. E.

Yeasts and mould fungi; Fermentability of acid. beer, and wort dextrins by various ——. P. Lindner and O. Mohr. Woch. Brau., 1911, **28**, 393—395. (See this J., 1900, 761; 1901, 141; 1911, 301.)

THE authors have investigated the fermentative action of yeasts and moulds on the following dextrins:—Acid dextrin ($[\alpha]_D=194^\circ$), obtained by the action of dilute hydrochloric acid on soluble starch, and purified by repeated precipitation with alcohol; three beer dextrins ($[\alpha]_D=153^\circ$, 156°, and 189° respectively) prepared by different methods from light beer; wort dextrin ($[\alpha]_D=156^\circ$); Kahlbaum's acid dextrin ($[\alpha]_D=181^\circ$). It is found that distillery (Race II.), pressed, and wine yeasts, continuously cultivated on wort-agar during the past 11 years, have mostly lost the power, previously exhibited, of fermenting Kahlbaum's acid dextrin (this J., 1901, 141). Only *Sacch. capsularis* and the mould fungi (*Monilia variabilis*, *Sachsia suaveolens*, *Amylomyces Rouxii*, *Amylomyces* β) ferment the dextrins vigorously, *Sachsia suaveolens* being the least active; in respect of these organisms, the various dextrins do not differ much in fermentability. The tropical yeasts, *Schizosacch. Pombe* and *Schizosacch. octosporus*, exert a moderate fermentative action on the dextrins and are more active at 32° C. than at a lower temperature; *Schizosacch. mellacei* only acts readily on Kahlbaum's acid dextrin. *Sacch. pastorianus I.* and *Sacch. ellipsoideus I.* ferment some of the dextrins to a slight extent, but with the distillery, pressed, and wine yeasts, the results are mostly negative. Top- and bottom-fermentation beer yeasts ferment the dextrins more generally, though only slightly; wort dextrin is seldom quite unaffected by these yeasts (most of which were recent, pure cultures from various breweries). The work, as a whole, shows that broadly speaking, the dextrins do not differ much in respect of fermentability. —L. E.

Phosphatese; Mode of action of ——. *I.* H. Euler and S. Kullberg. Z. physiol. Chem., 1911, **74**, 15—28.

IF sugar is fermented, in presence of phosphates, with yeast juice or extract of dried yeast, carbohydrate-phosphoric acid esters are formed, which, according to various workers (*cp.* Lebedeff, this J., 1911, 973) play the part of intermediate products. The authors find that the enzyme —phosphatese—which effects this synthesis is much more readily adsorbed than invertase from neutral solution by kaolin, and it is destroyed to a much greater extent than invertase on precipitation with alcohol (it is proposed to use the termination "ese" to distinguish those enzymes which effect syntheses.) It is also found that, under the experimental conditions employed, yeast extract does not decompose the phosphoric acid ester formed in the first instance. Phosphatese is most active in slightly alkaline solution. Its rate of action at 30° C. is found to be 1·75 times that at 20° C. It is less resistant to heat than invertase; the phosphatese-activity of yeast extract is found to be reduced to about ⅓ of its original value on heating the extract for half an hour at 60° C. Experiments in which phosphate solution was added directly to mixtures of yeast extract and dextrose (*i.e.*, before any of the sugar had been fermented), show that unaltered dextrose does not react with phosphate or only slowly. The ester obtained by treating a partially fermented solution of dextrose or lævulose with phosphate is optically inactive, and no optically active product is obtained on decomposing the ester with acids or alkalis. The ester is formed from a substance which is produced and decomposed again in the action of yeast on dextrose; the same substance appears to be formed, and with the same velocity, from dextrose, lævulose and sucrose. It is also found that *Aspergillus niger* (cultivated in sucrose-yeast water) and ripe oats contain phosphatese. The authors suggest that two enzymes may be concerned in the ester-formation, *viz.*, one enzyme which converts the sugar into the ester-forming carbohydrate, and a second enzyme—the phosphatese proper—which synthesises the ester from the carbohydrate and phosphate ions. The latter enzyme also appears to effect the ester-formation directly in the case of certain carbohydrates.—L. E.

Ozone in the brewery. L. v. Vetter and E. Moufang. Woch. Brau., 1911, **28**, 377—382.

THE authors discuss the application of ozone to the ventilation of breweries and the sterilisation of materials and plant. The air entering fermentation rooms should be ozonised to only a small extent; a content of 0·3—0·8 mgrm. per cubic metre is sufficient. It is preferable to ozonise the whole of the air to this extent, rather than to ozonise a part strongly and then mix it with the remainder. For the refrigerating room a rather higher percentage of ozone (1 mgrm. per cub. metre) is advisable. The sterilisation of brewing apparatus, etc., is carried out effectively by means of comparatively small quantities of highly ozonised air. A generator suitable for such purposes has been devised by the authors and is described. It is movable on wheels, and contains a pump, filter and drying apparatus for the air, and everything necessary to transform a continuous current into a high-tension alternating current. By making various adjustments it is possible, when the air passes through at the rate of 12 cub. metres per hour, to ozonise it to the extent of 0·098, 0·213, 0·389, 0·450 or 0·711 grm. per cub. metre. It is not practicable to generate the whole of the ozone required for a building at one point and then distribute it, for unknown losses occur on distribution and for most purposes the ozone must be used quantitatively, *i.e.*, within certain limits of concentration. Yeast may be freed from many foreign organisms and weak cells, by means of ozonised air. The conclusions previously published as to the best concentration of ozone (see this J., 1911, 232) were drawn from laboratory experiments and have since been revised. Eighty kilos. of pressed yeast are treated for ½ hour with air, containing 0·45 grm. of ozone per cub. metre, at the rate of 12 cub. metres per hour. The yeast is stirred up with water in an iron reservoir and the ozonised air is forced through a perforated coiled tube at the bottom. Filter-pulp may be sterilised, after a thorough washing with water. It is treated like the yeast, but for 1 hour, with air containing 0·711 grm. per cub. metre; 8·5 grms. of ozone suffice for sterilising about 18 kilos. of filter pulp. Racking apparatus, filters, pipes, etc., should be cleaned mechanically as thoroughly as possible, and then treated for about 1 hour with a total of 7—8 grms. of ozone. Cloths and yeast-bags may be very conveniently sterilised after a preliminary cleansing. Bottles are blown out for three minutes with air containing 0·7 grm. of ozone per cub. metre.—J. H. L.

Dextrin in beer; Determination of ——. E. Pozzi-Escot. Bull. Assoc. Chim. Sucr., 1911, **29**, 72—73.

FOR determining dextrin in beer, various workers recommend precipitation with alcohol; the precipitate is collected on a tared filter, dried and weighed, and from the weight thus found, the weight of albumin, determined by another analysis, and of ash, are deducted. The precipitate, however, is often mucilaginous and difficult to filter, and the author recommends the following modified method: Fifty c.c. of the beer are concentrated to 4—5 c.c. in a tared glass tube of 110—125 c.c. capacity. The dextrin is precipitated by gradual addition of alcohol of 98—99 per cent., with stirring; 100 c.c. of alcohol are then added and the whole is centrifuged. The alcohol is decanted off, the residue being taken up with a little water, and precipitated again. The precipitate is washed finally with a little acetone or ether, dried, first at 80°—90° C., and then *in vacuo* over sulphuric acid, and weighed. If it is desired to determine the nitrogen-content of the precipitate, the latter may be treated directly in the tube with fuming sulphuric acid.—L. E.

Government Laboratory; Report of the Principal Chemist of the —— on the work of the Laborotory for the year ended March 31, 1911. [Cd. 5828.]

THE total number of analyses and examinations made in the two branches of the Government Laboratory during the year ended March 31, 1911, was 186,044, against 170,033 for the preceding year. Including the samples examined at the Testing and Chemical Stations, the total number of analyses and examinations for the year was 349.277.

Arsenic in beer, etc. 638 samples of beer, wort, and materials used by brewers have been tested for the presence of arsenic. Of these, 41 were found to contain arsenic in excess of the limits laid down by the Royal Commission on Arsenical Poisoning, namely, the equivalent of one-hundredth of a grain of arsenious oxide per pound in the case of solids, or per gallon in the case of liquids. Of the 83 samples of malt examined, 6 exceeded the limit. the amount varying from one-ninetieth to one-fifteenth of a grain per pound. Of 171 samples of glucose, invert sugar, caramel, etc., none exceeded the limit. In those cases in which the proportion of arsenic present in the wort was distinctly above the limit allowed by the Royal Commission, steps were at once taken to prevent the contaminated article from being sent into consumption, and in all cases efforts were made to trace the source of the contamination and to prevent its occurrence in future. The origin was in almost all cases found to be the fuel used in drying the malt on the kiln; on this being replaced by purer material, subsequent samples showed that the resulting malt and beer brewed therefrom were practically free from arsenic. In addition to the above, 107 samples of mineral acids, chemicals, drugs, vinegar, etc., were also tested for this impurity.

Denatured and duty-free spirit for manufacturing purposes. 799 samples of wood naphtha, representing 301,775 gallons, submitted for approval for methylating purposes, were examined, all of which were approved.

The quantities of each kind of methylated spirit sent into consumption by the makers during the past three years were :—

	1911.	1910.	1909.
	Bulk gallons.	Bulk gallons.	Bulk gallons.
Industrial methylated spirit for manufacturing purposes	2,877,429	2,404,019	2,542,910
Mineralized methylated spirit, mainly for domestic use..	1,688,313	1,558,393	1,628,190
Total of both kinds..	4,565,742	3,962,412	4,171,100

The industrial spirit issued to manufacturers was 473,410 gallons in excess of that delivered during 1910, and the mineralised spirit, used mainly for burning and other domestic purposes, showed an increase of 129,920 gallons. This increase is partly due to the stocks of manufacturers and retailers having been allowed to get very low during the financial year ending on March 31, 1910, but mainly to the improved conditions of trade in the past financial year. During the year 503 applications connected with the use of methylated spirit have been referred to this Department, making a total of 2868 since the introduction of industrial methylated spirit in October, 1906. For the preparation of mineralised methylated spirit 214 samples of mineral naphtha, representing 6413 gallons were examined, and all were approved. 83 samples of "petroleum ether," representing 3310 gallons, were examined, and all except two samples, representing 81 gallons, were found suitable for mixing with industrial methylated spirits used in certain manufacturing operations where additional revenue protection is required. The use of pure duty-free ethyl and methyl alcohols in the science laboratories of universities, colleges, etc., shows an increase compared with 1910 and previous years, and there has been a very considerable increase in the quantity of specially denatured alcohol used for manufacturing purposes. This is mainly due to sanction having been given to the use of specially denatured ethyl alcohol in the manufacture of certain explosives, and to a somewhat increased use of methyl alcohol. Practically the whole of the alcohol used for manufacturing purposes, except 44.004 proof gallons of methyl alcohol, which is not made in this country, was of British manufacture. The quantities of British and foreign spirits issued duty free during the years ending March 31, 1911, 1910, and 1909, under the provisions of the Finance Act, 1902, were :—

—	1911.			1910.			1909.		
	Proof gallons.			Proof gallons.			Proof gallons.		
	British.	Foreign.	Total.	British.	Foreign.	Total.	British.	Foreign.	Total.
Universities, colleges, etc...	1,146	4,047	5,193	1,173	3,778	4,951	989	3,826	4,815
Manufacturers	544,420	78,362	622,782	475,515	44,303	519,818	418,057	20,981	439,038
Total	545,560	82,409	627,975	476,688	48,081	524,769	419,046	24,807	443,853

The total quantity of foreign spirit used for manufacturing purposes during the year ended March 31, 1911, was equivalent to 78,362 proof gallons, or about 47,000 bulk gallons. Practically the whole of this foreign spirit is methyl alcohol.

The total quantity of spirit expressed in proof gallons issued duty-free for all purposes during the years ended March 31, 1911, 1910, and 1909, was as follows :—

	1911.	1910.	1909.
	Proof gallons.	Proof gallons.	Proof gallons.
In mineralized methylated spirit for domestic use ...	2,407,578	2,302,091	2,395,306
In industrial methylated spirit for manufacturing purposes	4,323,452	3,859,158	3,884,739
In spirit otherwise denatured for manufacturing purposes.	622.782	519,818	439,038
For use in science laboratories at universities, colleges, etc.	5,193	4,951	4,815
Total	7,359,005	6,686,018	6,723,898

NOTE.—The quantities shown in the above table include both home-made and imported spirit.

A few instances were found where methylated spirit was being used for purposes not in themselves illegal, but for which the requisite authorisation had not been obtained. In these instances the traders were cautioned against a repetition of the irregularity. Thirteen cases of unlicensed sale of methylated spirit were dealt with, proceedings being taken and penalties recovered in most instances. Twenty samples of preparations authorised to be made with industrial alcohol have been analysed during the past year. No cause for complaint was found in respect of most of the samples. A few, however, were not in accordance with the requirements, and the traders were cautioned against further disregard of the restrictions imposed. The result is not unsatisfactory, as the irregularities in question were not in any case suggestive of intentional fraud, but rather of carelessness or of an imperfect sense of responsibility.

The following return of the quantities of industrial methylated spirit used in manufacturing operations and for other purposes in the United Kingdom during the years ended March 31, 1910 and 1911, has been prepared from official returns made by manufacturers and other users.

Nature of manufacturing operations or other purposes for which the industrial methylated spirit is used.	Quantity used.	
	1911. Gallons.	1910. Gallons.
Manufacture of finish for sale	369,283	337,787
,, varnishes, polishes, or lacquers for sale ...	940,186	811,252
,, stains, paints, enamels, etc. for sale	61,176	31,244
,, varnishes, finish, stains, polishes, lacquers, etc., or for polishing purposes in manufacturers' own workshops	294,343	231,032
,, felt and other hats ...	123,430	121,340
,, celluloid, xylonite and similar substances ..	24,003	24,194
,, oil-cloths, leather-cloths, pegamoid and similar substances	151,184	141,663
,, linoleum and similar substances	948	807
,, smokeless powders, fulminates and other explosives	20,327	11,487
,, soap	144,884	144,636
,, electric lamp filaments	13,151	11,346
,, electric cables	4,762	3,564
,, incandescent mantles..	18,176	18,351
,, ether	192,878	166,167
,, chloroform	9,627	11,038
,, ethyl chloride and bromide	747	716
,, solid medicinal extracts	56,720	39,831
,, alkaloids and fine chemicals	22,868	15,788
,, embrocations, liniments, and lotions.........	32,230	44,641
,, surgical dressings	8,461	15,309
,, capsules and other medicinal appliances	1,846	1,361
,, hair washes	19,770	14,719
,, cattle medicines	2,324	1,863
,, plant washes, insecticides, and sheep dips	9,630	12,981
,, aniline and other dyes—solids	874	4,639
,, aniline and other dyes—solutions	4,382	
,, fireworks and matches.	5,207	4,796
,, photographic plates and papers, and other photographic purposes	42,294	42,077
,, steel pens	3,264	3,180
,, silk, crape, and embroidery	9,698	6,606
,, artificial flowers, etc...	4,435	5,444
,, rubber	1,223	1,469
,, artificial silk	—	—
,, ships' compasses, spirit levels, etc.	952	632
,, inks	2,558	417
,, collodion	8,302	—
,, disinfectants	220	—
For dyeing and cleaning operations in laundries and dye works	46,992	42,011
,, textile printing	11,115	6,480
,, preservation of specimens in museums and hospitals	6,850	8,400
,, educational and sceintific purposes in colleges and schools	6,150	6,160
,, analytical and scientific purposes in the laboratories of analysts, works, chemists, etc.	4,836	5,107
,, hospitals, asylums and infirmaries.	43,662	41,700
,, electrotyping and printing.........	553	452
,, miscellaneous manufactures	8,573	3,887
,, Admiralty dockyards and War Office arsenals and workshops, chiefly for varnishes and polishes.	13,541	4,439
Total	2,748,635	2,401,013

Fermentation of strongly sulphured must; Advantages of pure yeast in the ——. R. Haid. Allgem. Wein-Zeit., 1911, No. 27. Chem. Zentr., 1911, 2, 711—712.

Culture yeasts are more resistant to sulphurous acid than wild yeasts, and can hence be used for the fermentation of strongly sulphured musts. Whilst in the case of must allowed to ferment spontaneously, fermentation was prevented by 150 mgrms. of sulphurous acid (in the form of sodium bisulphite) per litre, quantities of 200 mgrms. or more (according to the race of yeast used) of sulphurous acid per litre only retarded fermentation, when the must was sown with 1 per cent. of pure yeast, and when fermentation once started it proceeded regularly and with the normal velocity.—A. S.

Wine; The nitrate content of ——. J. Tillmans. Z. Unters. Nahr. Genussm., 1911, 22, 201—207.

Wines contain certain constituents which prevent nitrates being detected by means of the diphenylamine-sulphuric acid reaction; if however, the wine be mixed with animal charcoal and then evaporated, these interfering substances are removed, and the test may be applied. Ten c.c. of the wine are mixed with 0·2 c.c. of a saturated solution of sodium chloride, a small quantity of animal charcoal is added, and the mixture is evaporated nearly to dryness. One c.c. of glacial acetic acid is added to the residue, the whole is diluted to a volume of 10 c.c., allowed to settle, and a portion of the clear supernatant solution is then tested with the reagent. The author finds that practically all natural wines contain nitrates, some having as much as 18·75 mgrms. of N_2O_5 per litre. The detection of nitrates in wine does not, therefore, indicate the presence of added water.—W. P. S.

Alcohol industry of the Philippine Islands. Part I. H. D. Gibbs. Philippine J. Sci., 1911, 6, 99—143 and 147—206.

The paper is a study of some of the palm trees of the Philippines with special reference to the saps and their uses, especially in the manufacture of alcoholic liquors. Ninety-three per cent. of the total amount of alcohol and alcoholic beverages produced in the Philippines during the last fiscal year was distilled from the fermented saps of palm trees. Over 90 million litres of sap were fermented and distilled at 68 distilleries and 9,700,000 proof litres [U.S. proof density 0·7939 at 60° F.] of alcoholic beverages were produced. All this was consumed locally mainly by the native population. In addition to this a great deal of fermented sap (4 to 16 per cent. of alcohol) was consumed without distillation, and therefore without taxation. It is probable that the sap of the nipa palm is the cheapest source of alcohol in the world, the raw material costing only 1·35d. per litre of 90 per cent. alcohol. In addition to this the ease with which fermentation takes place reduces the cost of preparation considerably. The three species of palms which are extensively utilised for the sap are the nipa (*Nipa fructicans*), the cocoanut (*Cocos nucifera*) and the buri (*Corypha elata*). The fresh or fermented saps are called by the natives *tuba*, the fermented saps yielding by distillation the drink locally known as *bino*, *vino*, or *alak*. The fresh sap has the following characters, on the average :—Density at 15° C., 1·07 ; solids, 17·5 per cent. ; ash, 0·46 ; sucrose, 16·5 ; acidity and reducing sugars, traces ; nitrogenous compounds and undetermined, 0·54 per cent. The saps as they exude from the trees contain no sugar other than sucrose, but inversion and fermentation commence almost immediately. The nipa, which is the most important alcohol-producing palm, grows only along the mouths of tidal rivers, where it comes into daily contact with brackish water. It is plentifully distributed in the Philippines both wild and in a state of semi-cultivation. The sap is not collected till the fifth year, when after fruiting, the fruit stalk is cut across near its top, and each day subsequently a thin slice is removed to keep the wound fresh. The *tuba* is collected in bamboo joints, the process being facilitated by the fact that the nipa is a low stemless palm. The yield of sap varies greatly, but the author believes that a plant gives under present condition an average daily yield of 0·58 litre, or 43 litres during the season, being a total yield of 87,000 litres per hectare per annum. Probably this could be greatly increased by improved methods of cultivation and tapping. The vessels for collection are never thoroughly cleaned, and the methods of transport are primitive, so that when the *tuba* reaches the distillery much of the fermentable sugar is lost. Assuming 14 per cent. of sucrose in the sap, 7·6 per cent. by volume of alcohol should be obtained, whereas the average is only 5·6. In the distilleries the methods are capable of considerable improvement. The fermentation is usually allowed to proceed too far, with considerable loss of alcohol. The process, however, is really very rapid, and with improved methods there is little doubt that the nipa palm may be exploited very profitably as a source of alcohol. The cocoanut palm being cultivated for a number of other purposes, is not used as a source of alcohol to the same extent as the nipa. The cost of collecting the sap is much greater, the inflorescence being at a considerable distance from the ground. The product after distillation (known as *vino de coco*) is rather popular, but although the yield of sap per tree is considerable, and although the tree flowers all the year round, it is not such a profitable source of alcohol as the nipa. The buri palm is abundant throughout the Philippines at low altitudes, and is of considerable value to the native who makes extensive use of its leaves for hats, bags, thatch, etc. The tree can only be tapped for one year, as it completes its life history with its one flowering season. This, together with the difficulties of tapping, transport, etc., prevents the buri from being considered a promising source of alcohol. The sugar palm (*Arenga saccharifera*) is also tapped for its sap to some extent. The buri and the sugar palms, however, are more valuable to the natives as a source of starch (sago), which is secreted in their trunks in considerable quantity. Vinegar and sugar are manufactured to some extent from the saps of all the palms. In the manufacture of sugar the processes of inversion and fermentation are prevented by collecting the sap in vessels containing lime. The author has investigated the fresh palm saps with a view to detecting mannitol or mannose, but has been unable to find appreciable quantities, except after fermentation.—W. H. P.

PATENTS.

Beer; Brewing of ——. E. W. Kuhn, London. Eng. Pat. 18,696, Aug. 8, 1910.

AN extract of amylase is added to the cold wort or the fermenting beer in order to transform the insoluble dextrins into soluble dextrins; this action of the enzyme is intensified when the wort is fermented in closed vessels under high pressure. The extract of amylase is prepared by drying germinated malt under reduced pressure at a temperature not exceeding 40° C., grinding the dry malt and sifting it to remove the husk. The flour obtained is then macerated with water at a temperature of 40° C., 1 litre of water being used for every 200 grms. of the malt flour, and the mixture is stirred for a few hours. After filtration, the liquid is heated to 80° C. for 1 minute (this heating destroys the cytase, maltase, and dextrinase, but does not affect the amylase), cooled rapidly, and again filtered. The solution is then concentrated by freezing it, most of the water being thus eliminated in the form of ice. When kept in closed vessels at a temperature near freezing point, the solution retains its activity for about 1 week.—W. P. S.

Beer and other alcoholic beverages; Carbonating ——. H. G. Smart, Portsmouth. Eng. Pat. 26,571, Nov. 16, 1910.

A CHAMBER, fitted on the exit of a draw-off tap or of a beer engine, is provided, at its outlet, with a filter consisting of two plates with sheets of gauze wire or other straining material placed between. The beverage and carbon dioxide admitted to the chamber, pass through the gauze wire, whereby adequate carbonation is insured, and thence to the outlet. In the case of the draw-off tap, the admission of carbon dioxide to the chamber is controlled by a port in the plug of the tap; an additional port serves to admit a small quantity of gas after the supply of liquid and main supply of gas have been cut off, and thus to clear the chamber of liquid each time the tap is shut off.—L. E.

Distillery vinasse; Method of extracting different useful products contained in ——. G. P. Guignard and H. L. A. M. Watrigant. Fr. Pat. 427,560, May 30, 1910.

FOR the purpose of extracting glycerin and fat from grain and beetroot vinasse, the desiccated material is treated with a mixture of absolute alcohol and acetone, of absolute alcohol and carbon tetrachloride, or with a mixture of these three solvents. Organic acids, such as succinic, tartaric, or citric acid, may be separated previous to desiccation by treatment with ferric hydroxide, lime, or baryta. In the case of beetroot vinasse, in order to separate the alkali salts, the insoluble residue left after treatment with the solvent may be treated with the minimum amount of water to effect solution, and the resulting liquid saturated with carbon dioxide.—J. P. O.

XIXA.—FOODS.

Wheaten flour; Some points concerning the treatment of ——. A. E. Humphries. Brit. Assoc., Sect. B, Portsmouth, 1911.

THE capacity of flour for making large, well-aerated loaves does not depend upon any one factor; a flour with a high protein-content is not necessarily a "strong" flour, and, although more than sufficient gas may be produced at all stages of the panary fermentation, it may yield small loaves. Whilst it is generally believed that yeast can obtain all the mineral matter it requires from flour, there are cases in which the addition of mineral phosphates increases the yield of gas in panary fermentation. The author mentions an instance where the mere addition of water, made at a time substantially prior to dough-making, increased the strength of the flour to a considerable extent. As a result of an investigation of the changes produced in flour it was found that, during the process of baking, a large proportion of the organically combined phosphorus is converted into inorganic compounds. As millers have to produce flours of uniform quality from wheats of widely diverse nature, the author is of opinion that some treatment of wheat or flour might be allowed. In order that the permission to add water, diastatic bodies, nitrogenous yeast foods, or salts natural to wheat, should not be abused, a Board of Reference should be established to which all such processes and additions should be submitted and to which bakers and millers should be responsible in such matters.—W. P. S.

Castor seeds; Detection of poisonous constituents of —— *in cattle-foods.* W. Mooser. Landw. Vers.-Stat., 1911, **75**, 107—134. Chem. Zentr., 1911, **2**, 638—639.

THE anti-ricin serum prepared in the usual manner by the intravenous injection of ricin into goats, is stated to be a reagent by means of which the poisonous constituents of castor seeds can be detected with certainty in cattle-foods: other substances than ricin also give a precipitate with the serum, for instance the arachin isolated by the author from arachis meal, but these are soluble in alcohol, in which ricin is insoluble, and so can be separated from the latter. In applying the method, 10 grms. of the cattle-food are warmed at 37° C. for 24 hours with 100 c.c. of glycerol, the mixture is filtered, and the glycerin solution is added to about ten times its volume of a mixture of equal volumes of alcohol and ether. The precipitate is filtered off, washed first with alcohol and then with ether, dried at 37° C. and triturated with about 20 c.c. of a 10 per cent. solution of sodium chloride. A further 100 c.c. of sodium chloride solution is added to the mixture while in a thermostat, the whole is made up to 200 c.c., and filtered. On a layer of 1 c.c. of the clear filtrate is superposed a layer of 0·1 c.c. of the anti-ricin serum, and the whole is kept in the thermostat for several hours; in presence of ricin a turbidity or precipitate is produced. Non-poisonous constituents of castor seed do not give the test. The author is unable to confirm Miessner's statement that the poisonous principle of castor seeds is rendered inactive by the action of moist heat at 90° C., and is destroyed by dry heat at 130° C.—A. S.

Proteins ; Analysis of —— by determination of the chemical groups characteristic of the different amino-acids. D. D. Van Slyke. J. Biol. Chem., 1911, 10, 15—55.

Methods are described for following the course of protein hydrolysis and detecting the time at which it is complete, and for determining the ammonia (amino-nitrogen), arginine, histidine, lysine, cystine, amino-nitrogen not precipitated by phosphotungstic acid (the group of ordinary primary amino-acids, leucine, alanine, etc.), and the non-amino-nitrogen not precipitated by phosphotungstic acid (proline, oxyproline, one-half the tryptophane nitrogen). The hydrolysis is performed by boiling 3 grms. of the protein with 20 parts of 20 per cent. hydrochloric acid under a reflux condenser ; at intervals of 6 or 8 hours, portions of the solution are withdrawn, note being made of the quantity taken, and the amino-nitrogen is determined (see this J., 1911, 771). The hydrolysis is complete when the amino-nitrogen becomes constant. The analysis of the products of the hydrolysis is based, not on the isolation of the amino-acids, but on determinations of their characteristic chemical groups, the general outline of the method being as follows : After the removal of the ammonia by distillation under reduced pressure with calcium hydroxide, the arginine, histidine, lysine, and cystine are precipitated with phosphotungstic acid. The precipitate is re-dissolved and a determination of the amino-nitrogen of this fraction at once divides it into pairs, lysine and cystine containing only amino-nitrogen ; and arginine and histidine containing respectively three-fourths and two-thirds of their nitrogen in other forms. Of the first pair, the cystine is given by the sulphur-content, the lysine by subtracting the cystine from the sum of the two. Of the second pair, the arginine is determined by decomposing it with alkali, which drives off one-half its nitrogen as ammonia, and the histidine is obtained by difference. In the filtrate from the phosphotungstic acid precipitate the amino-acids are divided into two sub-fractions : (1) the acids containing only primary amino-nitrogen (leucine, alanine, etc.) ; (2) those containing nitrogen in pyrrolidine (proline, oxyproline) or indole (tryptophane) rings. It is necessary that the protein under examination shall be free from nitrogenous impurities, such as purine bases. The results of hydrolyses of various proteins are given in the following table, the figures expressing percentages of the total nitrogen of the protein :—

	Gliadin.	Edestin.	Hair (Dog).	Gelatin.	Fibrin.	Hæmo-cyanin.	Ox Hæmoglobin.
Nitrogen as :—							
Ammonia ...	25·52	9·99	10·05	2·25	8·32	5·95	5·2
Melanine ...	0·86	1·98	7·42	0·07	3·17	1·65	3·6
Cystine	1·25	1·49	6·60	0	0·99	0·80	0
Arginine	5·71	27·05	15·33	14·70	13·86	15·73	7·7
Histidine....	5·20	5·75	3·48	4·48	4·83	13·23	12·7
Lysine	0·75	3·86	5·37	6·32	11·51	8·49	10·9
Amino-nitrogen of the filtrate....	51·98	47·55	47·5	56·30	54·30	51·30	57·0
Non-amino-nitrogen of the filtrate	8·50	1·70	3·1	14·90	2·70	3·80	2·9
	99·77	99·37	98·85	99·02	99·58	100·95	100·0

Comparison of the amounts of amino-acids of the different groups present in proteins with the amounts found in previous hydrolyses indicates that the losses of isolation have fallen chiefly on the primary mono-*a*-amino-acids, containing all their nitrogen in the $CH(NH_2)$-COOH group. So far as can be judged from the analyses available, the presence of unknown amino-acids outside this group seems improbable.—W. P. S.

Patents.

Dry milk ; Manufacture of ——. Swiss Dry Milk Co., Glockenthal, Switzerland. Eng. Pat. 887, Jan. 12, 1911. Under Int. Conv., Dec. 26, 1910.

Milk is concentrated under reduced pressure at a temperature of from 50° to 60° C., until from 85 to 86 per cent. of the water has been removed. It is then exposed for 4 seconds in the form of a layer from 3 to 10 mm. in depth upon a surface heated to a temperature of 105° C. From 9 to 10 per cent. of the water still remaining in the concentrated milk is thus removed ; the resulting milk powder is sterile and the albumin contained in it is not coagulated. —W. P. S.

Milk ; Process of desiccating ——. C. Ellis, Montclair, N.J., Assignor to Ellis-Foster Co. U.S. Pat. 999,707, Aug. 1, 1911.

Milk is partially concentrated under reduced pressure and through it is passed a jet of dry and warm air under pressure. The particles of milk thus suspended in the air-current are subjected to the action of further jets of air to dry the milk completely and obtain it in a pulverulent condition.—J. C. C.

Acid milk powder. L. C. Merrell, Assignor to Merrell-Soule Co., Syracuse, N.Y. U.S. Pat. 1,000,686, Aug. 15, 1911.

A milk powder containing from 1·25 to 3·5 per cent. of lactic acid and completely soluble in water.—W. P. S.

Milk ; Process for pasteurising atomised ——. O. Lobeck. Ger. Pat. 237,042, March 18, 1909.

A portion of the milk to be pasteurised is submitted to pressure, and is then used to atomise the remainder of the milk ; the fine spray is then heated indirectly to the temperature necessary for pasteurisation. The milk may be atomised by forcing it under pressure, through suitable capillary orifices.—T. F. B.

Flour from grain ; Apparatus for the manufacture of ——. S. Steinmetz and Steinmetz Patent-Müllerei Ges. m. b. H., Mannheim, Germany. Eng. Pat. 10,121, April 26, 1911.

The grain is washed, dried in a centrifugal machine, and immediately passed into a husking machine consisting of a cylinder in which is a rotating drum. The inner side of the cylinder and the outside of the drum are provided with ribs or other projections by means of which the husk is rubbed off the grain. The cylinder is provided with a heating jacket. The grain is then conducted into a second cylinder containing a rotating drum fitted with beaters, by which any remaining husk is removed from the grains ; this cylinder is also provided with a heating jacket. The husks are removed from the cylinders through exhaust pipes, whilst the grain leaves the second cylinder through a pipe which conducts it to a mill. During the grinding process the grain may be subjected to a further heating. By thus drying, and even roasting, the grain and bran, the former acquires a crumbly, brittle condition so that it is readily ground to flour.—W. P. S.

(1) *Fruit extract and* (2) *peach extract and process of making same ; and* (3) *process of making strawberry and raspberry extract.* E. G. Resseneourt, Assignor to E. H. Chamberlain, St. Louis, Mo. U.S. Pats. 1,001,554—1,001,556, Aug. 22, 1911.

(1) Equal quantities of fruit and sugar are crushed together, a quantity of "cologne spirit" amounting to one-half of the volume of the mixture is added, and the whole is distilled at a temperature of about 200° F., until the volume is reduced by one-half. The residue is then strained and the liquid is added to the distillate. (2) The fruit is crushed with sugar, "cologne spirit," muscatel wine, and peach spirit are added, and the mixture is distilled at a temperature of about 200° F., until the volume is reduced by one-half. The residue is then strained and the liquid is added to the distillate together

with the liquid obtained by crushing the peach skins and treating them with "cologne spirit." (3) The fruit is crushed with sugar, "cologne spirit," angelica wine, and grape spirit are added, and the mixture is distilled at a temperature of 200° F. until the volume is reduced by one-half. The residue is then strained and the liquid added to the distillate.—W. P. S.

Chocolate, cocoa, and products having a cocoa base ; Process of manufacture of ——. F. W. Hildesheim, Molenbeek, Belgium. Eng. Pat. 19,637. Aug. 22, 1910.

See Fr. Pat. 419,659 of 1910 ; this J., 1911, 236.—T. F. B.

Extracting oil and manufacturing oil cakes. Eng. Pat. 4262. *See* XII.

XIXb.—WATER PURIFICATION ; SANITATION.

Nitrites in water ; Determination of ——. G. Blanc. J. Pharm. Chim., 1911, **4**, 205—212.

The author has examined two methods which have been used for the determination of nitrites in water supplies. Trommsdorff's method (Z. anal. Chem., 8, 358), which depends on the liberation of iodine from zinc iodide by the action of nitrous acid, was found to be quite untrustworthy owing to the fact that the oxygen of the atmosphere enters into the reaction and causes the continual liberation of small quantities of iodine. Griess' method, however, yields accurate results ; in this process, the nitrite solution is treated with metaphenylenediamine and dilute sulphuric acid. The brown colouration produced (Bismarck Brown) is quite stable and is directly proportional to the quantity of nitrite present.—W. P. S.

Patents.

Liquids ; Apparatus for treating —— by means of ultra-violet rays. V. Henri, A. Helbronner, and M. von Recklinghausen, Paris. Eng. Pat. 18,768, Aug. 9, 1910.

Arrangements are described for varying the rate of flow of a liquid in different parts of a conduit while the liquid is being subjected to the action of ultra-violet rays. The portion of the liquid passing near the lamp may be caused to flow more rapidly than the more remote portions by placing suitable baffle-plates in the conduit ; these plates may have V-shaped pieces cut out of their upper edges or they may be perforated with holes of different sizes, the larger holes being at the top of the plates and the smaller ones at the bottom.—W. P. S.

Refuse ; Furnaces for dealing with towns' ——. D. Adamson, Denton, Lancs. Eng. Pat. 21,514, Sept. 16, 1910.

A converter of cylindrical shape is mounted on trunnions and provided with an air-supply which is so regulated that the gases resulting from the combustion of the refuse placed in the converter may be of a combustible nature ; in this case the gases are collected and used as fuel. On the other hand, the supply of air may be such that the combustion of the gases is completed in the converter. The fluid slag collecting at the bottom of the converter may be removed from time to time by tilting the converter ; it may be discharged into moulds, or into water if desired to convert it into sand for mortar-making.—W. P. S.

Oxygen for respiration in mines and other places ; Apparatus for supplying ——. J. Harger, Gateacre, Lancs. Eng. Pat. 4177, Feb. 18, 1911.

The oxygen is generated from an "oxygeniferous stick," such as is described in Eng. Pat. 17,628 of 1910 (this J., 1911, 1014), contained in a metal tube which is surrounded by a covering, and the space between the tube and the cover is packed with wire coated with a suitable chemical for absorbing carbon dioxide. The oxygen passes from the generator through a filter and is collected in a gas-bag carried on the back of the person using the apparatus. A metal absorption box, shaped so as to fit over the shoulders, is packed with wood-wool, shavings, or wire and this packing is coated with sodium hydroxide, a hot concentrated solution of the latter being poured into the box and the liquid portion drawn off after cooling. A flexible tube connects the mouth-piece of the apparatus to a cross tube containing two valves so that the expired air is allowed to pass into one end of the absorption box whilst the inspired air is drawn from a point near the other end of the absorption box, oxygen from the gas-bag entering this end of the box. A quantity of permanganate and calcium chloride may also be placed in the absorption box. A small form of the apparatus is also described for use in laboratories, etc.—W. P. S.

Disinfectant ; Process of making a ——. E. Leonhardt, Bärwinkel, Assignor to Gebr. Heyl und Co., A.-G., Charlottenburg, Germany. U.S. Pat. 1,001,964, Aug. 29, 1911.

See Eng. Pat. 23.230 of 1909 ; this J., 1910, 1328.—T.F.B.

Treatment and purification of ammoniacal liquors or waste liquors resulting therefrom. Eng. Pat. 19,074. *See* IIb.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

Pareira root ; Alkaloids of ——. M. Scholtz. Arch. Pharm., 1911, **249**, 408—418.

The author has previously extracted from Pareira root (*Chondrodendron tomentosum*) the alkaloid, bebeerine $C_{16}H_{14}O(OH)(OCH_3)N{\cdot}CH_3$, (Arch. Pharm., 1898, 530 ; 1899, 199 ; this J., 1906, 1171). A new alkaloid, chondrodine, $C_{16}H_{13}O(OH)_2(OCH_3)N{\cdot}CH_3$, has now been isolated. It is a whitish-yellow amorphous powder melting at 218°—220° C., and soluble in dilute acids and sodium hydroxide ; from a solution in the latter it is precipitated by ammonium chloride. It is insoluble in ether, acetone, and chloroform, slightly soluble in alcohol, and readily soluble in aniline. It is purified by solution in aniline and precipitation with alcohol. Like bebeerine it is very easily oxidised. It is lævo-rotatory $[a]_D = -75°$. The hydrochloride is obtained as a resin-like mass on evaporating a hydrochloric acid solution of the alkaloid but yellow crystals (m. p. 274°—275°C.) of the hydrochloride gradually separate from a solution of the alkaloid in alcoholic hydrochloric acid to which ether has been added until a turbidity is caused. The preparation and properties of several salts and derivatives, also of methyl and ethyl-bebeerineiodomethylate and ethylbebeerine, are described. The greater part of the alkaloidal constituents of Pareira root is still chemically unidentified owing to its tendency to resinify.
—A. Sbld.

Alkaloidal periodides ; The formation of certain ——. W. C. Holmes. Philippine J. Sci., 1911, **6**, 253—275.

The alkaloids morphine, codeine, and heroine, have a remarkable affinity for iodine, with which they will combine readily in the absence of any solvent, in solutions in organic solvents, and in aqueous solutions. The reaction takes place either with the free alkaloid or with its mineral acid salts, and with or without the presence of potassium iodide. Neither in aqueous solutions, nor in the absence of solvent is there any indication of the formation of a definite compound or compounds. The reaction is apparently dependent on the relative concentration of the iodine. It is not possible to recover the entire amount of "free" iodine which has combined with the alkaloid by titration with thiosulphate. It is therefore considered that the periodides of the alkaloids, formed in aqueous solution, differ in mode of formation and in constitution from the comparatively simple compounds demanded by the commonly accepted theory of periodides.—W. H. P.

Volatile oils and perfumery plants ; Production of —— in the United States. F. Rabak. U.S. Dept. of Agric., Bureau of Plant Industry, Bull. No. 195, Dec. 9, 1910.

The industry of essential oils and perfumery products is described, with special reference to the possibility of extending it in the United States. The subject is treated under the following headings :—Aroma of plants ; extraction of aroma ; handling of volatile oils ; growth and harvesting of perfume plants ; volatile oil plants of the United States ; commercial aspect of the industry. At the present time by far the larger portion of essential oils and perfumery products consumed in the United States is imported, as is shown in the following tables :—

Value of free imports into United States of volatile and distilled oils for the years ending June 30, 1903 *to* 1908, *inclusive.*

Source.	1903.	1904.	1905.	1906.	1907.	1908.
	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.
Europe	1,253,360	1,318,606	1,387,268	1,617,796	2,227,530	2,215,265
North America	2,747	1,315	16,389	5,713	2,431	5,996
South America	2,364	4,052	2,205	750	4,969	14,886
Asia	191,730	252,729	176,563	308,781	407,008	314,688
Oceania	129	—	—	—	—	—
Africa	—	290	24	—	304	—
Totals	1,450,330	1,576,992	1,582,449	1,933,040	2,642,242	2,550,835

Value of dutiable imports into United States of volatile and distilled oils for the years ending June 30, 1903 *to* 1908, *inclusive.*

Source.	1903.	1904.	1905.	1906.	1907.	1908.
	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.
Europe	590,493	745,013	865,008	850,989	987,919	1,028,630
North America	14,444	12,210	4,994	12,794	18,879	15,678
South America	—	—	—	15	—	415
Asia	86,768	41,214	54,296	38,361	32,572	22,441
Oceania	14,296	20,958	24,343	15,529	17,123	19,308
Africa	—	361	3,003	12,227	3,485	8,134
Totals	706,001	819,756	951,644	929,915	1,059,978	1,094,606

With the exception of peppermint oil, comparatively small quantities of essential oils are distilled in and exported from the United States. For the year ending June 30, 1908, the value of the exports of peppermint oil amounted to 357,555 dols., and of all other essential oils, 214,765 dollars. Besides peppermint, spearmint and wormwood are grown somewhat extensively in the United States for industrial purposes, and some other plants on a smaller scale. It is considered probable that most of the plants grown in Southern Europe and elsewhere for the production of essential oils could be cultivated satisfactorily in some part or other of the United States, and an extensive industry might be built up. In the case of citrus fruits, the Sicilian methods of expression by hand would be impracticable owing to the cost of labour, but an oil of fair quality would be obtainable by the distillation of waste lemons and those unfit for sale ; and an oil of high citral content, suitable for flavouring purposes, could be obtained by distillation of the prunings of lemon trees. In California the *Eucalyptus globulus* is grown extensively for ornamental purposes and for timber, and the waste leaves and branches which accumulate when the tree is cut are not fully utilised. It is suggested that a distilling plant could be installed profitably at places where a considerable number of the trees are felled : 2 tons of leaves and twigs will yield 3—4 galls. of oil at a cost of about 3 dols. per gallon for distillation. Attention is drawn to the large number of odoriferous plants which have not yet been investigated. Certain plants growing wild, *e.g.*, *Erigeron canadensis* (this J., 1905, 1321 ; 1906, 113), have been utilised to a limited extent in the United States for the production of oils, and it is pointed out that oils of superior quality might be obtained if the plants were cultivated. The results of experiments on the influence of the growth of the plant and other conditions on the yield and character of essential oils are given (see this J., 1911, 981) —A. S.

Essential oil of Bupleurum fructicosum (Linn.). L. Francesconi and G. Sanna. Gaz. chim. ital., 1911, **41**, I., 796—813. (See this J., 1911, 921.)

The oil contains small quantities of an ester and an alcohol, but consists mainly of a new terpene, which is a colourless, mobile liquid of sp. gr. 0·8416 at 14° C., optical rotation, +35·7 at 17° C., b. pt. 167°—169° C., refractive index, 1·4862. The terpene is soluble in the common organic solvents and when heated at 200° C. polymerises to a white amorphous solid melting at 90°—100° C. It belongs to the same class as limonene, dipentene, etc., its molecule containing two double linkages. Its nitrosochloride melts at 97°—102° C., with decomposition.—A. S.

Essential oils ; Application of miscibility curves to the analysis of ——. E. Louise. J. Pharm. Chim., 1911, **4**, 193—197.

The method and apparatus described previously by the author (this J., 1907, 932 ; 1909, 892 ; 1910, 438 ; 1911, 556, 965) may be applied, with slight modification, to the analysis of essential oils. Two c.c. of the standard petroleum oil, 2 c.c. of the essential oil, and varying quantities (from 5 to 30 c.c.) of the standard aniline are used ; the miscibility point for each addition of aniline is determined by heating the mixture in the bath until a clear solution is obtained, then removing the test-tube from the bath and noting the temperature at which a turbidity forms as the mixture cools. The miscibility curves of lavender oil and terebene are sufficiently distinct from one another to allow the presence of the latter to be detected in the former, but spike-lavender oil cannot be detected with certainty in lavender oil by means of the method. The curves for neroli oil and petitgrain oil are about 3° C. apart, whilst those for French, Japanese, and American peppermint oils are parallel but separated from one another by about 1° C.—W. P. S.

Hydro-aromatic substances ; The study of ——. Report of Committee, Brit. Assoc., 1911, Sect. B. E. Divers, A. W. Crossley, W. H. Perkin, M. O. Forster, and H. R. Le Sueur.

The correctness of the constitutional formulæ, assigned by Tiemann to the two cyclic hydrocarbons produced by the action of 60 per cent. sulphuric acid on geraniolene (see this J., 1898, 598, 599; 1901, 384, 385), is proved by the following synthesis. When 1·1-dimethylcyclohexanone was treated with an ethereal solution of magnesium methyl iodide and the product decomposed with water, trimethylcyclohexanol was obtained; fuming hydrobromic acid converts this into 3-bromo-1·1·3-trimethylcyclohexane, which, when treated with alcoholic potassium hydroxide, is converted into the same mixture of hydrocarbons described by Tiemann.—T. F. B.

Soluble silver oxide. T. W. Schaefer. Boston Med. and Surg. Journ., July 20, 1911, 92. Pharm. J., 1911, **87**, 351.

Silver hydroxide is formed when an alcoholic solution of potassium hydroxide is added to an alcoholic solution of silver nitrate at a low temperature. Silver oxide is soluble in much distilled water, *e.g.*, about 1 grm. in 3 litres, forming a perfectly transparent and quite stable solution of silver hydroxide. This solution of silver hydroxide has a strongly metallic taste, and is, like thallium hydroxide, strongly alkaline; it precipitates from many metallic salts the oxides and hydroxides of the respective metals, while it decomposes easily a solution of sodium chloride with the formation of sodium hydroxide and insoluble silver chloride. This form of a silver preparation is suggested for therapeutic use.

Patents.

Citrus fruits; Machine for extracting essential oils from ——. W. A. D. Allport and T. J. W. C. Davenport, Roseau, Dominica, B.W.I. U.S. Pat. 1,002,020, Aug. 29, 1911.

A suitable feeding apparatus feeds the fruits singly to the lower end of an inclined travelling belt, the lower run of which is close to and parallel with a puncturing device; in this way the skins of the fruits are punctured as they ascend on the belt, and the oil is pressed from them by the pressure between the belt and the puncturing arrangement. The oil falls into a trough which is situated below the belt, whilst the fruits pass down an incline, adjacent to the upper end of the belt, on which jets of water are playing to remove the oil adhering to the surface of the fruits.—T. F. B.

Iron preparation easily soluble in water and in alcohol; Process for obtaining an ——. E. Laves. Ger. Pat. 236,989, July 23, 1910. Addition to Ger. Pat. 173,013, Nov. 4, 1904 (see this J., 1907, 33).

In place of using ferric saccharate as in the principal patent, it is now proposed to employ ferric dextrinate, or a mixture of ferric hydroxide and dextrin, to obtain the preparation with ferric albuminate. The concentrated solutions obtained may be evaporated to dryness *in vacuo*, when products are produced which are soluble in water without the aid of caustic soda.—T. F. B.

Iodo-lecithin; Process for producing stable preparations from ——. Chem. Fabr. Gedeon Richter. Ger. Pat. 237,029, Feb. 21, 1911.

Iodo-lecithin is mixed with dry albumin or other albuminous substance which is capable of combining with iodine. Preparations produced in this way lose none of their iodine, since the small quantities of iodine or hydriodic acid formed by the decomposition of the iodo-lecithin are at once taken up by the albuminous substance.—T. F. B.

Erythrene and its homologues; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 27,555, Nov. 26, 1910.

See Fr. Pat. 425,967 of 1911; this J., 1911, 968.—T. F. B.

Camphene; Process for converting pinene into ——. L. Montaland, Villetaneuse, France. U.S. Pat. 999,667, Aug. 1, 1911.

See Fr. Pat. 412,668 of 1909; this J., 1910, 1036.—T. F. B.

Perfume mixture; Solid —— *containing artificial musk.* A. Stapler, Charlottenburg, Germany. U.S. Pat. 1,000,852, Aug. 15, 1911.

See Fr. Pat. 406,577 of 1909; this J., 1910, 516.—T. F. B.

Lecithin; Process for the extraction of —— *from the seeds of lupines and other pulses.* H. C. Buer, Bonn, Germany. U.S. Pat. 1,001,247, Aug. 22, 1911.

See Ger. Pat. 210,013 of 1908; this J., 1909, 675.—T. F. B.

Organic mercury compound. M. Engelmann, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,001,829, Aug. 29, 1911.

See Fr. Pat. 414,563 of 1910; this J., 1910, 1227.—T.F.B.

Methoxymethylsantalol. M. Dohrn and A. Thiele, Assignors to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 1,001,933, Aug. 29, 1911.

See Eng. Pat. 2344 of 1911; this J., 1911, 648.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Gelatin; Changes in the swelling properties of —— *in photographic processes.* Lüppo-Cramer. Z. Chem. Ind. Kolloide, 1911, **9**, 22—25.

It is known that when drops of water fall on a negative during drying, the spots affected frequently become lighter: that this is due to the action of water on the gelatin, may be shown by allowing drops of water to remain for a few minutes on a film of gelatin supported on glass, when a permanent deformation of the gelatin will take place, which cannot be remedied by prolonged treatment of the whole film with water; the spots first treated with water will be in higher relief than the surrounding portions. This property of gelatin is important in the manufacture of photographic plates, the portions at the edges being often rendered useless through uneven drying, since they assume a higher relief as soon as they are wetted. Trivelli (Phot. Korr., 1911, 29, 182) has shown that silver bromide- and silver iodide-gelatin plates assume a relief-like appearance after prolonged exposure to light followed by soaking in water; he attributes this to the "tanning" action of the liberated halogen on the gelatin. These experiments were confirmed, and similar results, but in different degrees, were obtained with silver chloride, silver phosphate, silver oxalate, silver citrate, silver cyanide, silver thiocyanate, mercuric and mercurous iodides, and lead iodide, emulsified with gelatin. The experiments with silver halide emulsions were repeated successfully with dried plates and in a dry atmosphere, showing that the relief-effect was not produced by moisture. The production of these reliefs by other than halide compounds is not explained by the "tanning" theory. Further, Trivelli states that the "tanning action" of silver bromide-gelatin may be prevented by impregnating the plates with a halogen-absorber, *e.g.*, silver nitrate; but Trivelli used solutions of so great a strength that secondary reactions were highly probable. The present author finds, indeed, that neither silver nitrate nor silver nitrite prevents the formation of the reliefs, when used at moderate dilutions, on any silver halide-gelatin emulsion. It is possible that these results may be due to the alteration by light of the molecular structure of the emulsified compounds accompanied by change of volume (as is known to happen in the case of silver iodide), and the coagulation of the gelatin adsorbed by them.—T. F. B.

Dry plates; The present state of microscopic research with regard to ——. W. Scheffer. Phot. J., 1911, **51**, 276—281.

When grains of silver bromide from a dry plate which has been exposed to light, are suspended in water and treated with a very dilute developer, it is possible, with the aid of the microscope, to see that some of the grains are projecting fine filaments, which remain in connection with the original grain. These filaments are the first visible traces of development. Some of the grains are surrounded by a nebulous halo, from which the filaments project, whilst others show no trace of filaments. On further development, the grains having filaments increase in size and the filaments become thicker, whilst the grains which have no filaments gradually disappear; it is considered that these grains act as nourishment for the developed grains. When the silver bromide has been over-exposed, there is an excess of the developed grains and an insufficiency of the nourishing grains, the result being an over-production of black grains throughout. A microscopical examination of sections of under-exposed or under-developed films shows that the black developed grains only exist in the upper layers of the film: with increased exposure or development, the black grains are found to extend throughout the thickness of the film. A similar effect is produced by reduction with persulphate and with Farmer's reducer: the former acts on the whole thickness of the film, *i.e.*, its velocity of diffusion is rapid whilst its velocity of action is comparatively slow. On the other hand, Farmer's reducer only affects the upper layers of the film, the deeper layers being untouched, owing to its velocity of action being rapid when compared with its velocity of diffusion. It thus follows that persulphate reduces the size of every grain, whilst Farmer's reducer only affects those at or near the surface, hence the increase of contrast.—T. F. B.

Patents.

Colours; Photographic reproduction of ——. E. C. G. Caille, Villeneuve sur Yonne, France. Eng. Pat. 19,601, Aug. 22, 1910. Under Int. Conv., Aug. 23, 1909. Addition to Eng. Pat. 15,050 of 1908, dated July 16, 1907.

See Addition of Aug. 23, 1909, to Fr. Pat. 389,977 of 1907; this J., 1910, 1410.—T. F. B.

Photographic plate; Collodion silver bromide instantaneous —— *and its method of manufacture.* L. Enjolras, Paris. Eng. Pat. 7201, March 22, 1911. Under Int. Conv., March 24, 1910.

See Fr. Pat. 424,906 of 1910; this J., 1911, 924.—T. F. B.

Photometers. Eng. Pat. 11,111. *See* IIB.

XXII.—EXPLOSIVES; MATCHES.

Explosives Act; Report by the Chief Inspector of Explosives for Victoria (R. J. Lewis) on the working of the —— *during the year* 1910.

Reference is made to complaints of bad fumes from explosives when being used in Victoria. The three different factors which control the production of fumes are:—(1) The composition and character of the explosives, which are constant for each authorised explosive. (2) The nature of the ground in which the shots are fired. (3) Method of preparing and tamping the charges. The ground in which the shots are fired influences the products of combustion owing to the presence of substances such as graphitic shales, sulphides, etc., which react with the oxygen of the explosive, causing the formation of carbon monoxide and other objectionable gases. The second factor is an entirely personal one, and, in spite of instructions given to mining inspectors, managers, etc., it is probably the most fruitful cause of bad fumes. Even if the explosive has more than sufficient oxygen for complete combustion, the influence of the ground or the personal equation could readily upset the balance and produce bad fumes. Experiments were made with a "fume destroyer," containing a large percentage of available oxygen, made up in the form of cartridges, which were inserted on top of the blasting charge. The results of the trial appear to indicate the liberation of oxygen from the "fume destroyer" and a counteraction of the formation of carbon monoxide. The advantage of an oxygen carrier of this nature is that, to suit the varying conditions met with in mining, a greater or less quantity can be added. A further improvement is suggested in the employment of a plastic mass in place of the solid cartridges, and the omission of the carbonaceous binding and paraffin waterproofing, which both reduce the available oxygen. Attention is drawn to the danger of using a dirty tamping rod. A hard-wood tamping rod was being withdrawn from a bore-hole containing blasting powder. The bore-hole had been opened out at the bottom with "rack-a-rock" (a chlorate explosive) some time prior to the accident and the cartridge had been cut open to enable the charge to be pressed into the bottom of the hole. The tamping rod and sides of the hole thus obtained a liberal coating of "rack-a-rock," and as the weather was very hot at the time, and the rod was apparently left in the sun beside the hole, this coating had been in a highly sensitive state. After charging the hole with some 14 lb. of blasting powder, which would leave a train of powder dust, this tamping rod was taken to ascertain the height of the powder in the hole. As the rod was being withdrawn, and the end was apparently some feet above the surface of the powder, an explosion occurred. Experiments were carried out with a piece of the tamping-rod, the end of which was smeared with "rack-a-rock" and heated to 100° F. A fine coating of powder was dusted on to a bluestone step. By striking the step with a very light glancing blow with a piece of tamping rod the powder dust could be readily fired.

The importation of explosives into the State of Victoria for the years 1909 and 1910 was as follows:—

Name of explosive.	1910.	1909.
	lb.	lb.
Gelignite	790,550	1,144,500
Gelatin dynamite	194,300	170,900
Blasting gelatin	62,750	120,250
Bobbinite	5,000	—
Cheddite	25,000	5,000
Excellite	20,000	—
Lignin dynamite	5,000	2,000
Monobel	42,900	250
Rippite	5,000	9,000
Samsonite	7,500	—
Powder, fuse	115,000	75,000
Powder, blasting	234,225	217,250
Powder, sporting	28,260	34,350
	1,535,485	1,778,500
Detonators (number)	3,827,000	2,870,000
,, (lb.)	19,135	14,450

The number of samples examined in the laboratory was 1097. Of these 520 were gelignite, 194 were gelatin dynamite, and 143 were blasting gelatin. With the exception of one consignment of 3000 lb., the whole of the blasting gelatin imported was of a satisfactory nature. Three shipments of gelatin dynamite, totalling 46,000 lb., were condemned on account of exudation, but on sorting over, 31,800 lb. were obtained free from exudation and passed into consumption. The whole of the gelignite imported during the year was of a satisfactory nature. There were, under licence, six factories and 277 magazines. Twelve Government magazines are available for public use. Sixteen "rack-a-rock" licences were issued during the year. In the Government magazine reserve there was a total of 39 magazines owned by the trade.—G. W. McD.

Patents.

Nitro bodies strips; Method of treating ——. W. A. Brownrigg, Boston, Mass., Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,000,663, Aug. 15, 1911.

The interior of a shell containing nitro-compounds is subjected to pressure (by means of air or otherwise) sufficient to cause the body of the shell to expand, and the explosive is then "set" while under pressure.—C. A. M.

Smoke-producing mixture for shells; Process for preparing a ——. W. Schnitzler. Ger. Pat. 235,830, Oct. 23, 1910.

The mixture consists of a red colouring matter (40 parts), red lead (25), ammonium nitrate (8), and sugar (10 parts). A suitable colouring matter is that obtained from diazotised paranitraniline and β-naphthol in alkaline solution, in presence of Turkey-red oil. When the shell bursts, a strong evolution of red smoke takes place, which affords a means of controlling or improving the aim.—A. S.

XXIII.—ANALYTICAL PROCESSES.

Sulphur monochloride; Use of —— in the determination and analysis of rare earth minerals. W. B. Hicks. J. Amer. Chem. Soc., 1911, **33**, 1492—1496.

Minerals such as fergusonite, eschynite, and samarskite are very conveniently decomposed for analysis by heating in a current of sulphur monochloride. Columbium, tantalum, titanium, and tungsten, with most of the iron, pass over as volatile chlorides, and the rare earths are left in the boat as non-volatile chlorides or oxychlorides. The chief difficulty of the method is the further manipulation of the volatile chloride mixed with excess of the sulphur monochloride. The most convenient method is to pass it into dilute nitric acid, and then remove the precipitated sulphur by means of ammonium hydroxide and hydrogen sulphide. In the course of the work the author has shown the absence of scandium, and the presence of 2 or 3 per cent. of thorium in fergusonite. —W. H. P.

Electroanalysis. F. S. Kipping, F. M. Perkin, G. T. Beilby, T. M. Lowry, W. J. Pope, and H. J. S. Sand. Report to Sect. B., Brit. Assoc., Portsmouth, 1911.

F. M. Perkin has devised an apparatus of fused quartz for use in the electrolytic determination of both the anion and cation of alkali salts (see this J., 1907, 644, 1145), which presents advantages over the glass apparatus hitherto used. The inner cell has quartz rods fused on to it and to the inner wall of the outer basin. The apparatus is unattacked by alkalis and can be heated to redness for cleaning purposes.—A. S.

Hydrogen in organic compounds; Determination of active ——. B. Oddo. Gaz. chim. ital., 1911, **41**, 1, 709—716.

Instead of measuring the volume of gas produced by the action of alkylmagnesium iodide on organic compounds (see Hibbert and Sudborough, this J., 1904, 77; Zerewitinoff, this J., 1907, 646; 1908, 839; 1911, 147), the author works gravimetrically. The apparatus consists essentially of two small flasks connected by a piece of glass tubing, one of which is provided with an outlet tube connected with a set of bulbs containing sulphuric acid. This latter flask contains a solution of ethylmagnesium iodide in isoamyl ether, whilst the other contains a weighed quantity of the substance under examination dissolved in anhydrous pyridine or other suitable solvent (isoamyl ether, anisol, toluene, or petroleum spirit of b. pt. 140°—150° C.). The entire apparatus is weighed and then connected with a tube containing caustic potash and calcium chloride and a bottle containing an alkaline solution of pyrogallol, and suction is applied so as to produce a partial vacuum. On discontinuing the suction, some of the solution of ethylmagnesium iodide flows into the other flask; the ethane liberated by the reaction is removed by suction, and these operations are repeated until no further evolution of gas occurs. The apparatus is then again weighed and from the difference between the two weights, the amount of active hydrogen is calculated. Results obtained by the method with a number of substances are tabulated.—A. S.

Specifications for the purchase of fuel oil. *See* IIa.

Preparation and analysis of pure potassium ferrocyanide. Schröder. *See* VII.

Action of salicylic acid upon the metallic acids. [*Detection of titanium and its separation from other metals.*] Müller. *See* VII.

Determination of iron oxide in cement. Golubinzeff. *See* IX.

Analysis of lead bronzes and brasses. Sestini. *See* X.

Iodine value of fatty oils. Parry. *See* XII.

Applicability of bromine-derivative methods to the determination of caoutchouc in vulcanised rubber goods. Esch. *See* XIV.

Qualitative tests for various tannins. Schneider and Seiwerth. *See* XV.

Analysis of chrome leather. Fahrion. *See* XV.

Analysis of nitrolim. Kappen. *See* XVI.

Determination of dextrin in beer. Pozzi-Escot. *See* XVIII.

Detection of poisonous constituents of castor seeds in cattle-foods. Mooser. *See* XIXa.

Analysis of proteins by determination of the chemical groups characteristic of the different amino-acids. Van Slyke. *See* XIXa.

Determination of nitrites in water. Blanc. *See* XIXb.

Application of miscibility curves to analysis of essential oils. Louise. *See* XX.

Patents.

Inflammable or explosive gases or dust; Apparatus for the detection and localisation of the presence of ——. W. Rosenhain, Kingston Hill, Surrey. Eng. Pats. 21,375, Sept. 14, 1910, and 7492, March 25, 1911.

A small internal-combustion engine is provided with an independent supply of gaseous or liquid fuel and with means for supplying to the engine at will either pure air, or air from the atmosphere under test. The presence of inflammable matter in the air causes an increase in the speed of the engine which may be observed directly or may be indicated by a dynamometer, or by a dynamo and a lamp or voltmeter, or by a fan and pressure gauge. There may be a water seal to prevent the transmission of a flame back along the suction pipe. When the apparatus is placed in the atmosphere to be tested, as in a submarine, the supply of pure air is taken from a reservoir.—A. T. L.

Glass tubing; Impts. in —— to facilitate the flow of liquids therein. H. S. Hatfield, Jena, Germany. Eng. Pat. 6227, March 13, 1911.

The tubing is intended especially for use in measuring apparatus wherein it is necessary for a non-wetting liquid, *e.g.*, mercury, to flow in one direction, and a wetting liquid, *e.g.*, water, or a gas, to flow in the opposite direction. The bore of the tubing, *a*, instead of being circular has a cross-section as shown in Fig. 1, 2, or 3, the portion, *c*, being so narrow that the mercury, *b*, which flows freely through the main channel, is prevented by its surface tension from entering the narrow part, *c*, which is thus left open for the passage of the wetting liquid, or gas. The same effect is obtained by fusing a metallic wire longitudinally along the bore as indicated in Fig. 4.

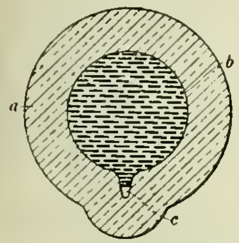


Fig. 1

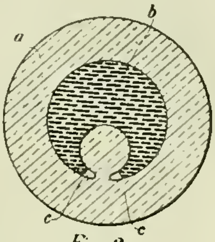


Fig. 2

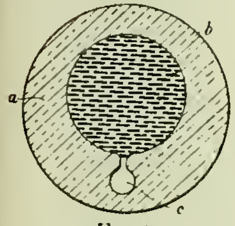


Fig. 3

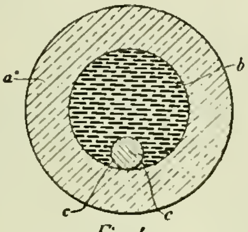
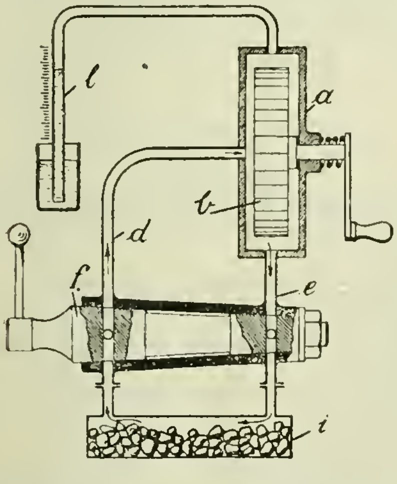


Fig. 4

Gas-analysis apparatus. Drägerwerk H. und B. Dräger. Ger. Pat. 236,730, Nov. 6, 1910.

The casing, *a*, of a fan, *b*, is connected, by means of the tubes, *d*, *e*, with an absorption chamber, *i*. By manipulation of the cock, *f*, the fan-casing can be placed in communication with the surrounding atmosphere or with the absorption chamber, and the sample of gas can be circulated through the apparatus. The diminution of volume caused by absorption of one constituent produces a partial vacuum, the amount of which is indicated by the height to which the liquid rises in the tube, *l*.—A. S.



Machine for testing [strength of] materials. B. Schiller, Vienna. Eng. Pat. 6762, March 17, 1911. Under Int. Conv., March 18, 1910.

A stationary cylinder and a ram, provided with a head-piece, are fitted in a U-shaped frame, a gripping-head being mounted at the upper end of the frame. Two pillars are connected rigidly with the head-piece of the ram and pass through the frame, the top of the pillars carrying a bridge-piece on which is fitted a second gripping-head. When the ram is forced out of the cylinder, a trial piece of material held between the two gripping-heads is subjected to tension, whilst another trial piece placed between the head-piece and the lower gripping-head is at the same time subjected to compression.—W. P. S.

Photometers. Eng. Pat. 11,111. *See* IIb.

XXIV.—MISCELLANEOUS ABSTRACTS.

Oxidising action of dilute nitric acid in sunlight. A. Benrath. J. prakt. Chem., 1911, **84**, 324—328.

Nitric acid, containing ferric nitrate, in the presence of sunlight, oxidises aliphatic acids to aldehydes and ketones, formaldehyde being finally produced, and nitrous acid acts on ketones of the type, CH_3.CO.R, with the formation of hydrogen cyanide and formaldehyde. The red colouration of the solutions is taken as evidence that the aldehydes are converted into hydroxamic acids, in accordance with the reaction discovered by Baudisch (Ber., 1911, **44**, 1009). The author's experiments are considered to support the suggestion made by Schimper and Baudisch, that the assimilation of nitrogen by plants is probably a photo-chemical reaction.—F. Sodn.

Trade Report.

India; Trade of —— during the year ended March 31, 1911. Chamber of Comm. J., Sept., 1911. [T.R.]

The total value of chemicals imported into India in 1910–11 was £584,100, as compared with £536,400 in the previous year. Bleaching materials advanced from £25,700 to £26,200, and calcium carbide from £7,400 to £7,700. Potassium cyanide fell from £20,400 to £19,000, while disinfectants rose from £21,200 to £23,700, and caustic soda from £52,700 to £56,100. Bicarbonate of soda declined from £32,300 to £27,900, while "soda, other sorts," increased from £73,300 to £91,300. Sulphuric acid rose from 74,440 cwt. and £46,700 to 79,772 cwt. and £49,300. The total imports of drugs and medicines were £569,000, as against £601,300 in the previous year. The imports of aniline and alizarin dyestuffs advanced from 13,775,957 lb. to 15,072,340 lb. in quantity, and from £581,300 to £684,700 in value. These products come chiefly from Germany. The imports of mineral oils were valued at £2,258,700, as against £2,097,000 in 1909–10. Of the total 70 per cent. was kerosene, which amounted to 56·6 million gallons, with a value of £1,589,900. Imports of coal declined from 428,535 tons, valued at £484,100, to 334,269 tons, valued at £381,500. The United Kingdom does 77 per cent. of the whole trade.

The total value of the exports of Indian merchandise was £136,580,000, as against £123,000,000 in 1909–10, an advance of 11·04 per cent. The total is the largest on record. The total exports of Indian metals increased from 525,989 tons to 602,283 tons, the quantity of manganese rising from 500,344 tons to 572,979 tons. The exports of saltpetre fell from 358,232 cwt. to 327,657 cwt.; while borax declined from 5976 cwt. to 5232 cwt. As to opium the exports declined from 56,191 chests in 1909–10 to 43,921 chests in 1910–11; the area under poppy has been still further reduced. Indigo exports fell from 18,061 cwt. in 1909–10 to 16,939 cwt. in 1910–11. Myrobalans rose from 1,467,104 cwt. to 1,658,895 cwt., cutch from 40,712 cwt. to 90,988 cwt., and turmeric declined from 79,934 cwt. to 71,847 cwt. A substantial increase has again taken place in oils (animal, essential, mineral and vegetable), which reached £1,067,200 in place of £805,700 in 1909–10. Coal exports advanced from 758,828 tons to 889,601 tons.

Books Received.

Annual Report of the Division of Mineral Resources and Statistics on the Mineral Production of Canada during 1909. By J. McLeish, Department of Mines. Government Printing Bureau, Ottawa.

Large 8vo volume containing 291 pages of subject matter subdivided under the following headings :—Summary of production, exports, and imports. Smelter production. Copper. Gold. Iron. Lead. Nickel. Silver. Zinc. Miscellaneous metallic ores. Abrasive materials. Asbestos. Chromite. Coal. Coke. Graphite. Gypsum. Manganese. Mica. Mineral Pigments. Mineral water. Natural gas. Peat. Petroleum. Phosphate. Pyrites. Salt. Miscellaneous non-metallic ores. Cement. Clay products. Lime. Sand-lime brick. Sands and gravels. Slate. Stone.

Report of the Principal Chemist of the Government Laboratory upon the Work of the Laboratory for the year ended 31st March, 1911. [Cd. 5,828.] Wyman and Sons, Fetter Lane, E.C. Price 3d. *See under* XVIII.

A Treatise on Chemistry. By The Right Honourable Sir H. E. Roscoe, F.R.S., and C. Schorlemmer, F.R.S. Volume I. The Non-metallic Elements. New edition, completely revised by Sir H. E. Roscoe assisted by Dr. J. C. Cain. Macmillan and Co., Ltd., St. Martin's Street, London. 1911. Price 21s. net.

8vo volume, containing frontispiece portrait of Dalton. 943 pages of subject-matter, with 226 illustrations. and an alphabetical index. The subject-matter is arranged and classified under the following heads :—I. Historical introduction. II. General principles of the science, including properties of matter. of gases. and of solutions. Experimental methods of determining molecular weights. Chemical nomenclature, etc. II. The non-metallic elements. Nature of flame. The gas industry. Silicon. The gases of the Helium group. Helium, Neon, Argon, Krypton, Xenon, Niton. III. Comparison of metrical with English measures, etc.

A Handbook of Organic Analysis, Qualitative and Quantitative. By Hans Thacher Clarke, Lecturer on Stereochemistry in University College, London. With introduction by J. Norman Collie, Ph.D., LL.D., F.R.S. Edward Arnold. 41 and 43. Maddox Street, London, W. 1911. Price 5s. net.

8vo volume, containing 253 pages of subject-matter, with twenty-three illustrations. and alphabetical indexes : (*a*) of substances to correspond with Chapter IV., containing classified tables of the commoner organic compounds and (*b*) a general alphabetical index. The subject-matter is classified as follows : I. Preliminary investigation. II. Examination for radicles. III. Separation of mixtures of organic compounds. IV. Classified tables of common organic compounds, including examination of alkaloids, and of dyestuffs and colouring matters. V. Quantitative determination of constituent elements. VI. Quantitative determination of radicles. VII. Determination of some physical properties.

Lines in the Arc Spectra of Elements, arranged in the Order of their Wave Lengths. From wavelength 7950 to wavelength 2200. Compiled by F. Stanley. Adam Hilger, Limited, 75a, Camden Road, London, N.W. 1911. Price 12s. 6d. cloth ; 15s. 6d. half-morocco.

8vo volume, containing 139 pages of alternately arranged tabulated wavelengths, and blank pages for notes. There is on page 1, a list of chemical elements with symbols, atomic weights. and range of wavelengths, as included in the tables following. The wavelengths are given in Angström units to the nearest unit in the fifth significant figure. It is stated that "the wavelength values are taken from the most recent and reliable measurements at present available."

Laboratoriumsbuch für die Industrie der Oele und Fette. Von Dr. J. Marcusson. Wilhelm Knapp's Verlag, Halle a. S. 1911. Price M. 6.60.

Large 8vo volume, containing 135 pages of subject-matter, with 21 illustrations and 20 tables. This work is divided into three parts. Part I. General Properties of Oils, Fats, and Waxes. (*a*) Occurrence and extraction. (*b*) Classification. (*c*) Chemical composition. (*d*) Chemical changes of oils, fats, and waxes. (*e*) Physical and chemical properties of salts of the fatty acids. Part II. Analysis of Oils, Fats, and Waxes. (*a*) Physical tests. (*b*) Chemical tests. (Preliminary, quantitative reactions for distinguishing, also qualitative reactions for distinguishing. Determination of single constituents of fats and waxes, etc.) Part III. Technical Products Prepared from Fats and Waxes. (*a*) Candles. (*b*) Wool oils and oleines. (*c*) Soaps. (*d*) Varnishes. (*e*) Lacquers. (*f*) Oil colours. (*g*) Blown or oxidised oils. (*h*) Lubricants.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

Patent Specifications may be purchased at the Sale Branch of the Patent Office, Quality Court, Chancery Lane, London, W.C., fifteen days after the date on which acceptance of the complete specification is advertised. The price is 8d. each.

I.—GENERAL PLANT ; MACHINERY.

Applications.

19,372. Kopper. Regulating and reversing apparatus for regenerative gas furnaces. [Addition to No. 30,294 of 1909.]* Aug. 30.

19,425. Hunt (Hunt). Filter press. Aug. 31.

19,536. Maerz. Regenerative furnaces.* Sept. 1.

19,540. Pemberton. Apparatus for proportioning and mixing solutions for purifying liquids. Sept. 2.

19,542. Haslett. Sterilising the inside of casks. Sept. 2.

19,633. Bomhard. Process and apparatus for cleaning gases.* Sept. 4.

19,761. Breda Ges. Process for purifying liquids from salts dissolved therein. [Ger. Appl., Sept. 8, 1910.]* Sept. 5.

19,832. Marchant and Marchant. Centrifugal separators. Sept. 6.

19,965. Hale. *See under* VII.

20,054. Bowers. Kilns or ovens. Sept. 9.

Complete Specifications Accepted.

22,474 (1910). Morton. Machines for beating, mixing, or incorporating substances. Sept. 6.

5710 (1911). Bishop and Tomkins. Calcining furnaces. Sept. 6.

7023 (1911). Watson and Billetop. Apparatus for heating or cooling fluids. Sept. 6.

8573 (1911). Royston (Pearlman). Rotary furnaces. Sept. 13.

9125 (1911). Evans (Elektrochem. Werke). Working medium for refrigerating machines and apparatus. Sept. 13.

9599 (1911). Thompson. Mixing and drying machines. Sept. 6.

15,439 (1911). Wilbuschewitsch. Preparation and regeneration of catalysts. Sept. 6.

II.—FUEL; GAS; MINERAL OILS AND WAXES; DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

19,330. Rigby and Testrup. Wet carbonising of peat, etc. Aug. 29.

19,500. Boehm. *See under* VII.

19,633. Bomhard. *See under* I.

19,815. Scharrer and Lüdecke. *See under* X.

19,914. Scharrer and Lüdecke. *See under* X.

19,960. Jordy and Harting. Method of generating gas.* Sept. 7.

Complete Specification Accepted.

17,480 (1911). Houskeeper. Preparation of filaments for electric incandescent lamps. Sept. 13.

III.—TAR AND TAR PRODUCTS.

Application.

19,325. Johnson (Badische Anilin und Soda Fabrik). Manufacture of condensation products of the anthraquinone series. Aug. 29.

Complete Specification Accepted.

29.721 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of chlor-aralkylcarboxylic acids. Sept. 13.

IV.—COLOURING MATTERS AND DYES.

Applications.

19,224. Newton (Bayer und Co.). Manufacture of an azo dye. Aug. 28.

20,072. Kalle und Co. Manufacture of *o*-oxyazo colouring matters. [Ger. Appl., Dec. 9, 1910.]* Sept. 9.

20,073. Kalle und Co. Manufacture of *o*-oxyazo colouring matters. [Addition to Eng. Pat. 20,072 of 1911. Ger. Appl., March 21, 1911.]* Sept. 9.

Complete Specifications Accepted.

24,920 (1909). Meister, Lucius, und Brüning. Manufacture of dyestuffs of the anthraquinone series. Sept. 6.

13,225 (1910). Wechsler. Manufacture of organic colouring matter from carbohydrates, etc. Sept. 6.

25,291 (1910). Newton (Bayer und Co.). Manufacture of mordant dyestuffs of the triphenylmethane series dyeing from an acid bath. Sept. 13.

489 (1911). Ransford (Cassella und Co.). *See under* VI.

2732 (1911). Meister, Lucius, und Brüning. Manufacture of brown vat dyestuffs. Sept. 13.

4065 (1911). Meister, Lucius, und Brüning. Manufacture of vat dyestuffs of the anthraquinone series containing sulphur. Sept. 13.

9116 (1911). Meister, Lucius, und Brüning. Manufacture of vat dyestuffs. Sept. 13.

11.422 (1911). Soc. Chem. Ind. in Basle, and others. Manufacture of sulphurised vat dyestuffs of the anthracene series. Sept. 6.

V.—FIBRES: TEXTILES; CELLULOSE; PAPER.

Applications.

19,250. Loebbecke. Manufacture of absorbent paper, board, or the like.* Aug. 28.

19,450. Loewe. Apparatus for making artificial silk or for coating or glossing textile fibres. [Addition to No. 18,086 of 1909. Fr. Appl., Aug. 31, 1910.]* Aug. 31.

19,606. Dunkerley and Walker. Purification, for manufacturing purposes, of wool contaminated with pitch, etc. Sept. 4.

19,718. Turner. *See under* XIX.

Complete Specifications Accepted.

20,122 (1910). White. Drying machines for yarns, fabrics, etc. Sept. 6.

3363 (1911). Kreissl and Seibert. Process for obtaining vegetable fibres. Sept. 6.

3973 (1911). Ellis (Chem. Fabr. von Heyden). Production of artificial silk and other formed materials from fatty acid esters of cellulose. Sept. 13.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

19,288. Marsh. Bleach chamber.* Aug. 29.

19,433. Fincato. Apparatus for cleaning and washing woollen and other yarns.* Aug. 31.

19,450. Loewe. *See under* V.

Complete Specifications Accepted.

27,404 (1910). Johnson (Badische Anilin und Soda Fabrik). Production of discharge effects on fibre. Sept. 6.

28,277 (1910). Niblett, and Electrolytic Apparatus Synd. Apparatus for producing bleaching solution. Sept. 6.

489 (1911). Ransford (Cassella und Co.). Manufacture of bisulphite compounds of carbazole dyestuffs and their use for printing. Sept. 13.

3241 (1911). Meister, Lucius, und Brüning. Dyeing with certain vat dyestuffs. Sept. 13.

5571 (1911). Bürmann. Printing wall-papers, etc. Sept. 6.

5874 (1911). Bratkowski, De Lange, and Pusch. Apparatus for measuring and regulating the concentration of dye-liquors. Sept. 6.

8097 (1911). Schmidlin and Speirs. Kiers or vessels for boiling, bleaching, or like treatment of textiles. Sept. 13.

8288 (1911). Fenny (Bemberg). Width dyeing piece goods in a short bath. Sept. 13.

8424 (1911). Jaumandreu. Vats for treating textiles in the form of threads, cords, hanks, and fabrics. Sept. 13.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

19,353. Woltereck. Manufacture of sulphuric acid. Aug. 30.

19,380. Webster, and International Salt Co., Ltd. Manufacture of salt. Aug. 30.

19,500. Boehm. Production of oxy-hydrogen gas. Sept. 1.

19,518. Meister, Lucius, und Brüning. Electrolytic treatment of nitric acid. [Ger. Appl., Dec. 24, 1910.]* Sept. 1.

19,965. Hale. Apparatus for use in recovering corrosive acids from their absorbents. Sept. 7.

20,063. Perry. Manufacture of sulphuric acid. Sept. 9.

20,066. Jacquier. Precipitation of metallic salts in solution. Sept. 9.

Complete Specifications Accepted.

24,379 (1910). Hale and Scott. Recovery of nitric acid from kieselguhr and other inert absorbent. Sept. 6.

24,607 (1910) and 9682 (1911). Nobel's Explosives Co., and Cross. Production of oxides of nitrogen. Sept. 13.

24,922 (1910). County Chemical Co., and Hill. Calcium carbide cartridges or blocks. Sept. 6.

26,992 (1910). Lloyd, Ledoux, and Simon-Carves Bye-Product Coke Oven Co. Production of ammonium chloride. Sept. 13.

28,277 (1910). Niblett and others. *See under* VI.

14,420 (1911). Rosenheim, Meyer, and Koppel. Production of hypophosphoric acid and hypophosphates. Sept. 13.

VIII.—GLASS; CERAMICS.

Applications.

19,492. Billon-Daguerre. Soldering quartziferous bodies to other bodies. [Fr. Appl., Sept. 2, 1910.]* Sept. 1.

19,643. Voelker and Meurer. Method and apparatus for forming quarz bodies fused by means of electric resistance furnaces.* Sept. 4.

Complete Specification Accepted.

20,141 (1910). Pilkington. Apparatus for drawing glass. Sept. 6.

IX.—BUILDING MATERIALS.

Applications.

19,442. Lassam and Thom. Production of a silicate-of-lime stone. Aug. 31.

19,484. Smith. Manufacture and use of certain building materials. Sept. 1.

20,075. Chem. Fabr. Lindenhof C. Weyl und Co. Manufacture of plastic masses from pitch for road-making, etc. [Ger. Appl., Sept. 27, 1910.]* Sept. 9.

20,076. Schallenberg. Cement-setting and waterproof compositions. Sept. 9.

Complete Specifications Accepted.

27,130 (1910). Rauhoff. Manufacture of cement and concrete products. Sept. 13.

29,176 (1910). Bohn. Clay-cleansing apparatus. Sept. 6.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

19,241. Ashcroft. Separation of metals from their compounds. Aug. 28.

19,257. Ashcroft. Separation of metals from zinc-bearing ores or compounds. Aug. 28.

19,359. Holloway. Ore dressing. Aug. 30.

19,360. Marino. Electrolytic coating of iron, steel, or other metals with zinc or zinc alloys. Aug. 30.

19,361. Marino. Metallisation of wood, etc. Aug. 30.

19,381. Tschernoff and Sendzikowski. Metallurgical furnaces. Aug. 30.

19,458. Vickers, Ltd., and Benthall. Manufacture of armour plates and other steel articles. Aug. 31.

19,587. Roitzheim. Extraction of zinc from zinc ore. Sept. 2.

19,640. Deuts.-Luxembergische Bergwerks u. Hütten A.-G., and Vögler. Production of high-grade steel and slag rich in soluble phosphoric acid.* Sept. 4.

19,815. Scharrer and Lüdecke. Manufacture of tungsten and incandescence bodies therefrom. Sept. 6.

19,868. Johnson (Bontempi Rust Proofing Co.). Rust-proofing metals such as iron and steel.* Sept. 6.

19,914. Scharrer and Lüdecke. Manufacture of tungsten and incandescence bodies therefrom. Sept. 7.

19,923. Testrup and Rigby. Metallurgical operations. Sept. 7.

19,973. Thierry. Metallurgy of zinc.* Sept. 7.

20,012. Marino. Superficially metallising cast-iron, wood, gypsum, paper, etc., for the purpose of electrolytically depositing metals or alloys.* Sept. 8.

Complete Specifications Accepted.

13,503, 13,504, 15,173, and 15,174 (1910). Richardson. Manufacture and treatment of steel. Sept. 13.

20,046 (1910). Emanuel. Manufacture of sodium. Sept. 6.

20,133 (1910). Savelsberg. Means for sintering iron and other ores and metalliferous compounds. Sept. 6.

20,594 (1910). Levoz. Apparatus for the electrical production of steel. Sept. 13.

23,675 (1910). Kuttner. Method of forming insulating layers of oxides on metallic coils. Sept. 13.

1819 (1911). Thompson (Akt.-Ges. Mix und Genest). Pickling aluminium and its alloys prior to galvanising or coating with other metals. Sept. 13.

5811 (1911). Burgess. Coating metal with metal. Sept. 13.

XI.—ELECTRO-CHEMISTRY.

Applications.

19,305. Queneau. Electric furnaces.* Aug. 29.

19,518. Meister, Lucius, und Brüning. *See under* VII.

20,033. Boureoud. Electric furnaces. Sept. 8.

Complete Specifications Accepted.

29,715 (1910). Serpek. Revolving electric furnaces. Sept. 13.

419 (1911). Helberger. Electric furnaces. Sept. 13.

XII.—FATS; OILS; WAXES.

Applications.

19,239. Tanne and Fluss. Soap and its method of manufacture. Aug. 28.

19,924. Chem. Fabr. Dr. R. Scheuble und Dr. A. Hochstetter. *See under* XX.

20,061. Hawkins. Process and apparatus for the extraction of vegetable oils. Sept. 9.

Complete Specifications Accepted.

12,855 (1910). Harold and Cottee (Mislin). *See under* XVII.

20,649 (1910). Richter und Richter, and von Orth. Purifying and bleaching wax of all kinds. Sept. 13.

20,650 (1910). Richter und Richter, and von Orth. Bleaching semi-solid fats of all kinds. Sept. 13.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

19,426. Pope. Manufacture of lead pigments. Aug. 31.

19,927. Earles, Robertson, Mote, and Cartwright. Turpentine substitute.* Sept. 7.

Complete Specification Accepted.

20,655 (1910). Freymuth. Treatment of lac. Sept. 13.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

19,784. Freudweiler. Process and apparatus for converting latex into sheets of crude rubber.* Sept. 5.

19,788. Markley and Mellinger. Process and apparatus for converting latex into sheets of crude rubber.* Sept. 5.

19,919. Newton (Bayer und Co.). Manufacture of erythrene and isoprene. Sept. 7.

Complete Specifications Accepted.

19,730 (1910). Da Costa and Bridge. Method and means for coagulating and otherwise treating rubber latex. Sept. 6.

975 (1911). Newton (Bayer und Co.). Manufacture of isoprene. Sept. 13.

6444 and 6445 (1911). Schleiffer. Extraction of resins from raw indiarubber. Sept. 13.

XV.—LEATHER; BONE; HORN; GLUE.

Complete Specifications Accepted.

12,566 (1911). Von Girsewald. Manufacture of glue and the like. Sept. 13.

15,761 (1911). Reidel. Artificial leather. Sept. 13.

18,770 (1911). Röhm. Treatment of hides and skins for the manufacture of leather. Sept. 13.

XVI.—SOILS; FERTILISERS.

Application.

19,962. Muller, and Veifa Werke Verein. Elektrotechn. Institute. Method and apparatus for electrically treating plants and the like. [Ger. Appl., June 20, 1911.]* Sept. 7.

XVII.—SUGARS; STARCHES; GUMS.

Application.

19,858. Everard and Severus. Manufacture of sugar.* Sept. 6.

Complete Specification Accepted.

12,855 (1910). Harold and Cottee (Mislin). Production of milk-sugar, casein, fat, albumen, and phosphates. Sept. 6.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

19,379. Effront and Boidin. Manufacture of pressed yeast. [Belg. Appl., Feb. 15, 1911.]* Aug. 30.

20,056. Marriott. Pasteurising stout, beer, and other fermented alcoholic liquors in bulk. Sept. 9.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

19,535. Wilson. Manufacture of margarine. Sept. 1.

19,540. Pemberton. *See under* I.

19,718. Turner. Machines for straining waste liquids or trade effluents and recovering the fibres or fibrous substances contained therein. Sept. 5.

19,761. Breda. *See under* I.

19,838. Marks (Siemens und Halske A.-G.). Process for ozonising water.* Sept. 6.

19,839. Herschell (Latzel und Kutscha). Method of cleansing sand filters, etc.* Sept. 6.

Complete Specifications Accepted.

12,855 (1910). Harold and Cottee (Mislin). *See under* XVII.

18,050 (1910). Heys (Reinhardt). Flour milling. Sept. 6.

20,436 (1910). Henri, Helbronner, and von Recklinghausen. Apparatus for treating liquids with ultra-violet rays. Sept. 13.

21,165 (1910). Murray. Insecticides. Sept. 13.

10,233 (1911). Von Skorzewski. Increasing the disinfecting effect of the smoke of vegetable cakes. Sept. 13.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

19,319. Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of glycerophosphoric acid. Aug. 29.

19,366. Newton (Bayer und Co.). Manufacture of pharmaceutical products. Aug. 30.

19,919. Newton (Bayer und Co.). *See under* XIV.

19,924. Chem. Fabr. Dr. R. Scheuble und Dr. A. Hochstetter. Production of carbonates of glycerine. [Austrian Appl., Sept. 7, 1910.]* Sept. 7.

Complete Specifications Accepted.

29,901 (1910). Newton (Bayer und Co.). Manufacture of salts of hydrastinine. Sept. 6.

3847 (1911). Imray (Meister, Lucius, und Brüning). Manufacture of derivatives of oxyarylarsinic acids. Sept. 13.

XXII.—EXPLOSIVES; MATCHES.

Application.

19,577. Fairweather (Dynamit A.-G. vorm. A. Nobel und Co.). Explosives.* Sept. 2.

Complete Specifications Accepted.

7719 (1911). Dymond (Satanite Powder Co.). Manufacture of material for explosives. Sept. 6.

8517 (1911). Boult (Dynamit A.-G. vorm. A. Nobel und Co.). Process for filling projectiles and explosive charges. Sept. 6.

13,549 (1911). Ceipek. Safety explosives. Sept. 13.

XXIII.—ANALYTICAL PROCESSES.

Application.

19,663. Barry. Method and apparatus for ascertaining and indicating the presence of gases other than those ordinarily contained in the atmosphere. Sept. 4.

Complete Specifications Accepted.

21,076 (1910). Hume. Method of and means for use in chemical analysis. Sept. 13.

27,254 (1910). Arndt. Apparatus for testing air or other gas by their action in changing the colour of a liquid reagent. Sept. 6.

1059 (1911). Presser. Selenium photometer. Sept. 6.

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Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows :—
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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Heat-insulating materials: the relation between surface temperature and efficiency. C. R. Darling. Engineering, 1911, **92**, 395—396.

The measurement of the surface temperature of a heat-insulating lagging is of little value in ascertaining the efficiency of the material, unless account be also taken of the radiating power of the surface. Although for the same surface more heat will be radiated the higher the temperature, a smooth metallic surface may be hotter than a rough unprepared surface, yet radiate less heat. The common test of making a hole in the lagging and placing the bulb of a thermometer therein, with introduction of mercury in order to ensure good contact, is stated to be quite incapable of yielding useful results. For measuring the surface temperature of the lagging, the use of thermo-couples is much to be preferred. Comparative experiments made on a heated pipe with a lagging 2 in. thick, of asbestos cloth, in which small thermo-couples were inserted at intervals of ¼ in., demonstrated the advantage of painting the surface of the lagging with aluminium paint. The painted surface was hotter than the untreated surface, but the temperature-gradient from inside to outside was less steep with the former than with the latter, and the actual quantity of heat lost was 7 per cent. less under the conditions of the test.—A. S.

Patents.

Tunnel kilns or furnaces. A. Ramen, Helsingborg, Sweden. Eng. Pat. 20,240, Aug. 30, 1910.

In a tunnel kiln or furnace having a movable hearth, the cooling chamber is connected with the combustion chamber by one or more water-cooled channels in which pipes for the introduction of gas and air are situated. The pipes can be adjusted in the channels in such a manner as to act as injectors, and air is drawn from the cooling chamber into the combustion chamber and simultaneously mixed with the combustible gas, the introduction of air being thus regulated over the whole width of the furnace.—W. E. F. P.

Tunnel kilns or furnaces; Method of working ——, for burning bricks of ore, clay and the like. A. Ramen, Helsingborg, Sweden. Eng. Pat. 20,247, Aug. 30, 1910.

As a substitute for the atmospheric air and boiler steam usually employed in the manufacture of the gas with which the kilns are fired, the gases containing the steam from the drying and baking of the material are mixed with the hot air from the lower cooling channel of the kiln and blown into the gas generator.—W. E. F. P.

Beating, mixing, or incorporating substances; Machines for ——. J. Morton, Wishaw, N.B. Eng. Pat. 22,474, Sept. 28, 1910.

Beating and mixing machines of the type wherein the beaters are supported upon the projecting ends of the spindles serving to rotate them, are fitted with suspension hangers or frames having widened hollow bosses with slot cut on the lower side, so that they can be lowered on to the spindle heads from above. The widened bosses serve to take the wear, and the projecting ends engage with recesses cut in the central bosses of the beaters which rotate thereon.—H. H.

Mixing and drying machines. R. T. R. Thompson, Leith. Eng. Pat. 9599, April 20, 1911.

A mixing and drying apparatus comprises a series of superposed vats having double bottoms to receive heating elements, each vat being fitted with agitators driven by a common shaft. The vats communicate with one another solely through discharge openings located in the sides thereof and fitted with doors, which open into shoots by means of which the material to be dried can be passed down through the successive chambers.—H. H.

Dryers; Direct-heat and rotary-disc ——. W. R. Macklind, Mineral Point, Mo. U.S. Pats. 1,001,659, and 1,001,660, Aug. 29, 1911.

(1). The apparatus comprises a cylindrical tower in which rotate a number of trays mounted upon a central hollow shaft through which hot water is circulated, the arrangement being such that the material to be dried passes downwards from tray to tray, being discharged from each tray by centrifugal force. (2). The apparatus comprises a cylindrical vessel in which rotate a number of flat hollow trays mounted upon a central hollow shaft through which hot water is circulated, plugs being situated in the shaft to deflect the water into each tray successively. The material to be dried is fed from tray to tray by spiral screw conveyors.—H. H.

Centrifugal separator. W. R. Macklind, Mineral Point, Mo. U.S. Pat. 1,001,661, Aug. 29, 1911.

The material to be separated passes through an annular space formed between an inner cylindrical drum, through which a heating medium is circulated, and an outer cylindrical casing having perforations through which the centrifugalised liquid passes. Both drum and casing are rotated upon their common vertical axis. The inner drum carries a spiral conveyor-blade which forces the material axially through the apparatus at the same time that it is being subjected to centrifugal force radially. —H. H.

Desiccation in vacuo; Continuous apparatus for ——. E. C. A. Fleurent, A. Ravautte, and Soc. Anon. des Établissements Egrot. Fr. Pat. 428,374, April 11, 1911.

The material to be treated is fed through a rotary valve, which forms an air-lock and prevents loss of vacuum, into a jacketed cylindrical drying chamber, connected with a vacuum pump, and through which the material is moved, from one end to the other, by a rotary scraper. The dried material is discharged through a similar valve to the one by which it entered, and a rotary star-shaped dust-filter is interposed between the vacuum chamber and the pump.—W. H. C.

Extracting devices for use in the treatment of finely divided or powdered material. K. Schirm, Leipzig-Plagwitz, Germany. Eng. Pat. 28,707, Dec. 9, 1910.

A VESSEL for extracting finely divided substances with solvents is fitted with a removable sieve-bottom carrying a number of vertical perforated pipes through which the solvent is introduced. The sieve is supported upon the flange of a closing member which is bolted upon the bottom of the extracting vessel. A second sieve, provided with a layer of filtering material, may be fitted below the first. The fresh solvent is introduced into an annular space between the closing member and the bottom of the extracting vessel, and thence passes into the space between the sieves, and up through the perforated pipes. The extract is drawn off from below the lower sieve.—H. H.

Recording the speed and delivery of gases; Apparatus for ——. M. Bouffart, Herstal-lez-Liege, Belgium. Eng. Pat. 993, Jan. 13, 1911.

THE speed of a gas flowing through a duct is recorded by means of a bell-shaped float working in conjunction with a Pitot tube, one arm of the tube being connected with the space above the float and the other with that below. The float has such a contour that its rise and fall are directly proportional to the variation of the speed of the gas.—H. H.

Centrifugal apparatus for the separation of solids from gases. Maschinenfabr. Buckau A.-G. Ger. Pat. 237,540, April 19, 1910.

THE apparatus consists essentially of a drum rotating rapidly in the upper part of a casing. The gas passes through the drum and the solid particles are expelled, by the centrifugal force, through perforations in the periphery of the drum into the surrounding casing. The drum is mounted eccentrically in the casing, so that there is only a narrow space between it and the casing on the side where the drum is ascending, and a wider space on the opposite side. In the lower part of the casing two plates are disposed tangentially to the drum and are connected by plates arranged like the tiles on a roof; this device acts as a baffle and tends to prevent the air in the lower portion of the casing from being carried round by the rotating drum.—A. S.

Emulsifying apparatus. H. N. Brawner, jun., Washington, D.C. U.S. Pat. 1,002,127, Aug. 29, 1911.

THE liquid is forced into a cylinder containing a hollow plug which is held by screw pressure against its seating in the cylinder, the arrangement being such that the liquid can only find outlet by passing between the end of the plug, which is flat, and its seating. An emulsifying action is thereby produced.—H. H.

Filter-press; Continuous ——. F. Verbièse and E. Darras-Verbièse. Fr. Pat. 427,901, June 7, 1910.

THE material to be filtered is fed into a vessel having a conical bottom and within which a number of hollow filter-plates are arranged upon a vertical or horizontal, hollow shaft. Between each pair of plates a scraper is arranged to remove the deposited solids. The filter-plates may be rotated and the scrapers fixed, or *vice versa.* The filtrate is discharged through the hollow shaft, and the solids from the bottom of the cone, into which they are forced by a screw.—W. H. C.

Elevating or discharging liquids; Methods and apparatus for ——. H. A. Humphrey. Fr. Pat. 428,296, April 8, 1911. Under Int. Conv., Sept. 20, 1910.

IN pumps in which liquids are raised by the force of an explosion of a gaseous mixture, the outward flow of the liquid is utilised to draw a fresh charge of explosive mixture into the combustion chamber, and the return flow of the liquid is utilised to first drive out the products of the explosion, and then to compress the explosive charge drawn in during the outward flow. In order to prevent the fresh charge from mixing with the products of combustion, the upper portion of the combustion chamber has an annular form, with the inlet valves for the explosive mixture at its upper part and the outlet valves for the products of combustion at the lower part of the annulus. —W. H. C.

Multiple evaporator. W. Rusiecki. Fr. Pat. 428,107, April 4, 1911.

A SERIES of dome-shaped vessels, R_1, R_2, R_3, are arranged stepwise as shown in the figures. The liquid to be evaporated enters the lowest vessel through the valve, d_1, and passes upwards from vessel to vessel by the pipes, e_1, d_2, e_2, d_3, etc.; the concentrated liquid being discharged finally from e_4. The heating tubes are arranged as shown, the lowest set being supplied with steam from an external source; this enters the end, M_1, and is discharged from N_1. The vapour given off in R_1, passes over the baffle, P_1, and enters the tubes of the vessel, R_2, which open directly into the vapour space of R_1. The condensed water is withdrawn through the openings, b_1, b_2, etc., by a pump and any air is discharged through c_1, c_2, etc. The uppermost vessel is connected with a vacuum pump by a pipe passing from the opening, O (Fig. 2). In order to utilise the heat of the vapour efficiently, the length of the heating tubes is decreased from the lowest vessel, in which the greatest pressure and consequently the highest temperature exists, upwards, but in order to keep the same heating surface, as the length is decreased, the number of the tubes is proportionally increased.—W. H. C.

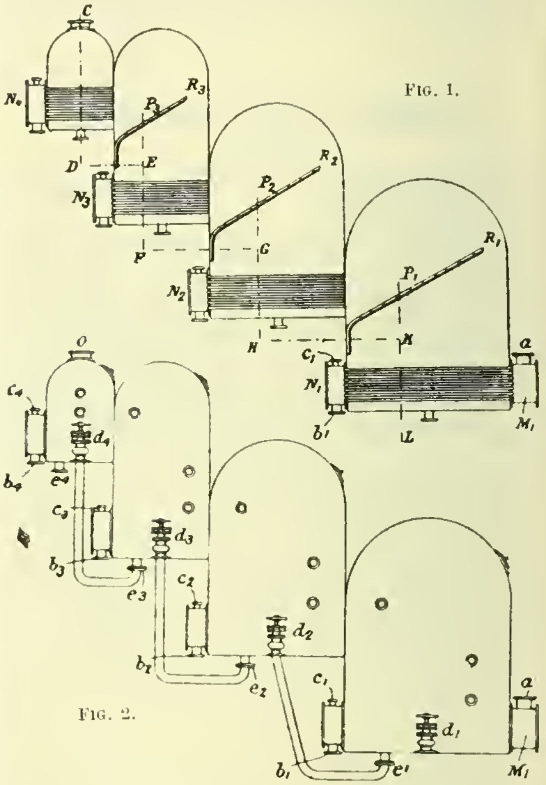


FIG. 1.
FIG. 2.

Liquids of different specific gravity; Apparatus for the separation of partially or completely immiscible ——. Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Ger. Pat. 237,539, April 1, 1909.

THE separating chamber is provided with a series of baffle-plates or partitions extending the full width of the chamber and inclined in the direction of flow of the liquid. The upper edges of the partitions lie in a horizontal plane below the level of the liquid, but the distance between the lower edges and the bottom of the chamber increases from plate to plate in the direction of flow of the liquid. In a modified form of the apparatus, each partition is formed of two plates inclined one to the other, and leaving at the angle an opening; the width of the openings becomes progressively smaller in the direction of flow of the liquid, the object being to obtain an efficient separation of the lighter liquid, the heavier liquid, and the intermediate turbid layer.—A. S.

Centrifugal apparatus. W. J. Gee, Assignor to Hydraulic Separating and Grading Co., Ltd., London. U.S. Pat. 1,002,257, Sept. 5, 1911.

See Eng. Pat. 21,421 of 1909; this J., 1910, 1239.—T. F. B.

Drying air by refrigeration; Apparatus for ——. J. Gayley, New York. U.S. Pat. 1,002,576, Sept. 5, 1911.

See Fr. Pat. 404,060 of 1909; this J., 1910, 95.—T. F. B.

Drying air; Method of ——. J. Gayley, New York. U.S. Pats. 1,002,577 and 1,002,578, Sept. 5, 1911.

See Eng. Pats. 13,553 and 13,555 of 1909; this J., 1910, 220 and 337.—T. F. B.

Solvent vapours; Apparatus for recovering —— *from air, etc.* A. Collard, Molenbeek, Belgium. U.S. Pat. 1,003,089, Sept. 12, 1911.

See Fr. Pat. 410,555 of 1909; this J., 1910, 810.—T. F. B.

Steam obtained by pouring molten slag into water; Process for purifying ——. Bell Bros., Ltd., and W. L. Johnson. Fr. Pat. 427,867, March 29, 1911.

See Eng. Pat. 7518 of 1911; this J., 1911, 1020.—T. F. B.

Raising or forcing liquids; Methods and apparatus for ——. H. A. Humphrey. Fr. Pat. 428,075, April 3, 1911. Under Int. Conv., Aug. 22, 1910.

See Eng. Pat. 19,617 of 1910; this J., 1911, 1099.—T.F.B.

Tunnel kiln. A. Ramén. Fr. Pat. 428,132, April 5, 1911.

See Eng. Pat. 20,240 of 1910; preceding.—T. F. B.

Tunnel kilns; Process for working ——. A. Ramén. Fr. Pat. 428,133, April 5, 1911.

See Eng. Pat. 20,247 of 1910; preceding.—T. F. B.

Extinguishing fires of all kinds; Product and method of using it for ——. E. M. Davidson. Fr. Pat. 428,315, April 10, 1911.

See Eng. Pat. 12,233 of 1910; this J., 1911, 272.—T. F. B.

Utilising waste heat from blast-furnaces and the like. Eng. Pat. 6296. *See* X.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Naphthalene in crude coal-gas; Determination of ——. A. Wein. J. Gasbeleucht., 1911, 54, 891—892.

About 40 or 50 litres of the gas are drawn by a filter pump through a solution of picric acid contained in a set of three washing flasks which are kept cool during the absorption. The gas passes from the last flask through a cotton-wool filter and through a flask containing concentrated sulphuric acid, and thence to the meter and the filter pump. About 700 c.c. of picric acid solution containing 12 grms. per litre are used; the volume becomes reduced to 600 c.c. in the washing flasks. The connection between the first and second flask is provided with a by-pass so that after 20—25 litres of gas have passed, the gas can be admitted direct to the second flask. When sufficient gas has passed, air is drawn through to sweep out all naphthalene from the tubes. The flasks are next closed and heated for half an hour to 40° C. in a water-bath. After cooling, the whole of the precipitate, consisting of naphthalene picrate contaminated with tar and ammonia, is collected on a filter, and placed, together with the filter paper, in an Erlenmeyer flask with 500 c.c. of water, which is acidified with sulphuric acid to fix the ammonia. The whole is boiled gently for an hour to decompose the naphthalene picrate and the naphthalene is drawn with a current of air through flasks containing a picric acid solution of known strength. These flasks are then closed and heated on a water-bath at 40° C., and after cooling, the naphthalene picrate is filtered off and the picric acid in the filtrate is determined volumetrically. For this determination 50 c.c. of solution are mixed with 10 to 12 c.c. of a solution containing 100 grms. of potassium iodide and 30 grms. of potassium iodate per litre, and the iodine, liberated according to the equation:—

$$KIO_3+5KI+6C_6H_2(NO_2)_3OH= \\ 6C_6H_2(NO_2)_3OK+3H_2O+6I,$$

is titrated with sodium thiosulphate.—A. T. L.

Natural gas in the Galician petroleum oil field; First pipe system for ——. K. Feldmann. Petroleum, 1911, 6, 2232—2235.

Until about two years ago the natural gas emitted from the borings for petroleum oil in the Boryslaw-Tustanowice oil fields was, for the most part, allowed to escape into the air. But recently, in addition to using the gas for heating and power purposes upon the oil fields, a pipe system has been constructed for conveying the superfluous gas to the refinery at Drohobycz, 8½ kilom. distant. The gas is colourless and has a faint odour of petroleum spirit. Samples issuing from different borings had the following composition:—Heavy hydrocarbons, C_nH_{2n}, 8·7 and 8·8; light hydrocarbons (methane), 86·5 and 83·1; oxygen, 1·0 and 1·7; and nitrogen 3·8 and 6·4 per cent. by vol. (corresponding to 5 and 8 per cent. of air) respectively. The sp. gr. was about 0·75, and the average heating capacity of several samples was 10,835 cals. per cubic metre. The amount of gas required for the refinery at Drohobycz is 5000 to 5500 cubic metres per hour, and steel pipes have been laid to convey double that quantity under a pressure of about 1·8 atmosphere, which is produced by means of rotary pumps driven by gas engines or steam. The different pipes from the borings come together at Kamilla in Tustanowice, and it is proposed eventually to establish here a central power station, provided that the present borings continue to produce gas. At this point the gas is freed from moisture before entering the main pipe. The pressure is registered by a meter and another apparatus records the percentage of air, so as to prevent distribution of an explosive mixture (1 : 10). A small addition of mercaptan is also made with the object of rendering an escape of gas perceptible by its odour. The main is made of steel pipes 425 mm. in diameter and 8 m. long and with walls 6 mm. thick, and is covered with a layer of jute. In the trench the pipe is covered with tarred and untarred rope, then molten lead is poured in and the whole is covered with 1·2 metres of earth. The pipes are tested in the works up to a pressure of 10 atmos. and the finished pipe line is tested up to a pressure of 4 atmos.—C. A. M.

Sulphuric acid; Recovered —— *in the refining of mineral oil.* J. Hausman. Petroleum, 1911, 6, 2301—2303.

Petroleum refined with sulphuric acid recovered from waste acids, gives a bad caustic soda-test, an amount of alkali largely in excess of the theoretical being required. In order to establish the cause of this, the author treated three samples of the same petroleum with pure sulphuric acid in which were dissolved respectively: (1) asphaltum obtained from recovered acid, (2) toluenesulphonic acid, and (3) sulphonic acids obtained from recovered acid. In the first two cases the resulting oils gave good caustic soda-tests, but in the third an excess of 60 per cent. over the theoretical amount of caustic soda was required.

Analyses of recovered acids showed that they contained about 2 per cent. of sulphonic acids. The nature of the latter could not be ascertained, but their mean molecular weight was found to be 158 or 79 according as the acids are di- or mono-basic.—T. St.

Determination of ferrocyanides and thiocyanates [in gas liquors]. Ronnet. *See* VII.

Patents.

Fuel; Artificial ——. T. Hodgkinson, Blackpool. Eng. Pat. 27,334, Nov. 24, 1910.

Waste paper is pulped or is finely divided in the presence of water and is then mixed with coke-breeze or coal-dust and also with vegetable or fruit refuse such as is present in household or other refuse. The materials may be in about equal proportions, and the quantity of water is such as to form a moist mass, resembling soil. This is mixed warm with 10 per cent. of Trinidad pitch and 10 per cent. of gas-tar, and is pressed into blocks. For a poorer fuel, more coal or coke dust may be used, and sawdust may be mixed in if desired.—A. T. L.

Agglomeration of pulverulent materials, ores, coal, etc. [by means of waste sulphite-cellulose lyes]. A. Nicolle. First Addition, dated June 15, 1910, to Fr. Pat. 425,991, April 20, 1910 (this J., 1911, 951).

The waste lyes from the manufacture of paper pulp by the sulphite process, are subjected to oxidation by means of air, whereby sulphites are oxidised to sulphates, which react with the lime present to give a precipitate of calcium sulphate; lime may be added if required, whilst, if excess of lime be present, it is precipitated by addition of an acid (sulphuric or oxalic acid, etc.) yielding a sparingly soluble calcium salt. The calcium lignosulphonate liquor is decanted from the precipitate and evaporated to a syrupy consistence as described in the chief patent. The effect of the salts of iron, chromium, or cerium, in rendering the lignosulphonate insoluble, is augmented by addition of a small quantity of gelatin.—A. S.

Gas retorts; Charging ——. G. M. Gill and A. Middleton, London. Eng. Pat. 2392, Jan. 30, 1911.

A machine for charging horizontal retorts is provided with a hood which rests on the mouthpiece of the retort whilst charging and directs the escaping dust and smoke into a vertical chimney also carried by the machine. This chimney is telescopic, the upper part being fixed to the hopper of the machine, so that the lower part can be brought to a suitable level in charging different tiers of retorts.—A. T. L.

Vertical retort gas apparatus. J. H. Taussig, Philadelphia, Pa. U.S. Pat. 999,349, Aug. 1, 1911.

The hinged doors of vertical gas retorts are operated by quadrants mounted on the door spindles and having ropes attached which are fixed at the other end to clamping devices for holding the doors in the closed position. The clamps consist of long rods which pass vertically through screw clamps and are attached at the bottom ends to the top ends of the ropes. The rods are raised by means of a travelling hoist which can be brought vertically over any one of them.—H. H.

Oven; Chamber —— *for the distillation of coal.* J. E. Auburtin. Fr. Pat. 428,066, April 3, 1911.

The coal is heated in large vertical chambers or ovens which are charged from the top and are discharged through the bottom by gravity alone. The furnace differs from an ordinary vertical-retort furnace in the size of the coking chambers and in the longer period required for coking, which may be 24 hours. The ovens are built of refractory blocks grooved and tongued so as to form a gas-tight structure independent of the structure of the furnace, and the walls of the ovens are stayed by blocks which are built into them and extend across the intervening space to the wall of an adjacent oven.—A. T. L.

Coke ovens and gas retorts; Process for removing deposits of graphite from ——. A. Klönne. Ger. Pat. 237,145, July 23, 1910.

Water in a state of fine division is injected on to the graphite, the oven or retort being closed. The water is vaporised by the incandescent coke and it is stated that the graphite is rapidly loosened and oxidised, with the production of water-gas. An advantage of the process is that it can be carried out without shutting down the oven or retort.—A. S.

Gas-producer apparatus. J. A. Herrick, New York. U.S. Pat. 1,001,953, Aug. 29, 1911.

The producer has a fixed upper portion and a rotating body portion arranged above a water-trough. The blast is admitted at the top as well as at the bottom of the fuel column. The fixed upper portion has a rotating cover-plate, which carries a depending annular water-cooled wall forming a revolving chamber for the raw fuel. —A. T. L.

Bituminous fuels such as peat and lignite; Process for the conversion of —— *into gas and coke.* M. Ziegler. Fr. Pat. 428,342, April 10, 1911.

Vertical producer chambers and coking or drying chambers are arranged alternately side by side in series, and have valved outlets leading to a common gas main. The producer chambers have additional outlets at about the middle of their height leading to heating flues in the walls of the coking chambers and thence to the interior of the coking chambers. The apparatus is intended for use when the demand for gas is variable, as for example with gas engines. When the demand is normal, the producer chambers deliver gas direct into the main, but when the demand is reduced, the gas outlet valves are partially closed, and the outlet valves of the coking chambers are opened. Some of the gas then passes through the heating flues and through the coking chambers, its heat being thus used in drying and coking the fuel. The coking chambers are discharged at intervals through doors at their lower ends.—A. T. L.

Bituminous fuels, such as peat, lignite, and the like; Process for the treatment of —— *with the production alternately of gas and coke.* P. Wangemann. Ger. Pat. 237,144, Dec. 31, 1909.

A series of gas-producing and coking chambers arranged alternately is used. The gases from the incandescent zone of the gas-producing chambers are used for heating the coking chambers, and the distillation gases produced in the coking chambers are carried over into the gas-producing chambers.—A. S.

Water-gas producer. Berlin-Anhaltische Maschinenbau-Akt.-Ges. Ger. Pat. 237,026, Feb. 1, 1911.

The producer has an ash-pit which revolves, together with the grate, around a vertical axis, and a mechanical conveyor projects into the ash-pit for the purpose of removing the clinker and ashes.—A. S.

Coal gas and like gases; Purification of ——. E. V. Evans, London. Eng. Pat. 29,673, Dec. 21, 1910.

The sulphur in the gas is converted into hydrogen sulphide by passing the gas, previously brought to a temperature of 360° C. or higher, over a catalytic material at 450° C. In a suitable form of apparatus the gas passes through a set of vertical tubes arranged within a furnace chamber, and thence to a single tube containing pieces of firebrick which have been saturated with a solution of a nickel salt and then dried. The catalyser is regenerated, when it becomes inactive, by allowing a natural draught of air through the tube.—A. T. L.

Gas-purifier and gas-cleaning apparatus. J. P. Dovel, North Birmingham, Ala. U.S. Pats. 1,001,738 and 1,001,740, Aug. 29, 1911.

(1). The apparatus comprises a horizontal cylindrical vessel, with a shallow stream of water flowing through it.

The vessel is divided into inlet and outlet compartments by a longitudinal partition, which reaches nearly to the surface of the water. The wall of the outlet compartment is sharply inclined so that the gas, in sweeping under the partition, drives the water in a thin sheet up the side of the vessel. (2). In the apparatus just described, a horizontal pipe is arranged in the outlet compartment so as to discharge a thin stream of liquid against the wall just above the normal line of the displaced sheet of water.—A. T. L.

Gas washer. J. P. Dovel, Assignor to J. J. Shannon, Birmingham, Ala. U.S. Pat. 1,001,739, Aug. 29, 1911.

The washer comprises a lower hopper-shaped part, with a discharge orifice at the bottom for dust, etc., and an upper conical part with a gas-inlet connection at the top. The upper edge of the lower part is in the form of an inclined trough through which water flows. The upper part has an inner wall reaching nearly to the surface of the water, so that the gas passes over the surface of the water in the trough into the annular chamber between the inner and outer walls of the upper part of the washer, and so to the gas outlet.—A. T. L.

Gas-washer. N. Latta, Assignor to Allis-Chalmers Co., Milwaukee, Wis. U.S. Pat. 1,002,810, Sept. 5, 1911.

The apparatus comprises a cylindrical casing within which rotates a perforated drum divided transversely by a partition into two compartments. A number of beaters project from the drum into the peripheral space between it and the casing. As the gas enters at one side of the drum it meets a spray of liquid and then passes through the perforated walls of the drum into the annular space between the drum and the casing, returning through the other half of the drum to the outlet which contains a fan for withdrawing it by suction.—H. H.

Sulphur; Extraction of —— from purifying materials used in gas manufacture and from other waste products. H. Gouthière et Cie. and P. Ducancel. Fr. Pat. 427,892, June 7, 1910.

The process consists in extracting the sulphur by means of a solution of ammonium, potassium, sodium, barium or calcium sulphide, and decomposing the solution of polysulphides by heat, or by means of carbon dioxide and lime, so as to separate the sulphur and recover the sulphide and the regenerated purifying material. When sodium sulphide is used, the insoluble residue, separated by filtration, constitutes the regenerated purifying material; the solution of polysulphides is treated with carbon dioxide so as to form free sulphur, hydrogen sulphide and sodium carbonate; the sulphur is filtered off, and sodium sulphide is recovered from the hydrogen sulphide and sodium carbonate, after first converting the latter into caustic soda by means of lime. According to a second example of the process, spent oxide is extracted with a cold solution of ammonium hydrogen sulphide and filtered. The solution is distilled, so as to recover the ammonium sulphide. The residue from the distillation contains free sulphur, which is filtered off. The residue from the extraction contains the iron chiefly as sulphide. This is oxidised by air and treated with milk of lime, forming calcium sulphide which is decomposed by carbon dioxide. The hydrogen sulphide which is liberated is absorbed in ammonium sulphide solution so as to form ammonium hydrogen sulphide. If the spent oxide contain cyanogen compounds, ammoniacal ammonium sulphide is used for the extraction. The sulphide is recovered by distillation as before, and the cyanogen compounds are left in solution and are separated from the precipitated sulphur by filtration.—A. T. L.

Refining petroleum; Apparatus for ——. M. J. Trumble, Assignor to Trumble Refining Co., Los Angeles, Cal. U.S. Pat. 1,002,474, Sept. 5, 1911.

The apparatus comprises a series of compartments each supplied with an overflow to the succeeding compartment at such a height that the petroleum sinks from level to level as it passes through the compartments. The petroleum is heated by steam coils in the compartments and the distillate is condensed in a single condenser chamber extending over the top of the compartments and communicating with each one. The oil vapour from a fire still may be condensed by passing it through a pipe having a water jacket and the condensed petroleum passed direct into the first refining compartment.—H. H.

Petroleum; Treatment of ——. J. A. Dubbs, Santa Monica, Cal. U.S. Pat. 1,002,570, Sept. 5, 1911.

The petroleum is caused "to drop *in vacuo* in the presence of ascending currents of combustion gases" which carry off the lighter products, leaving an asphaltic residue which collects at the bottom of the treating chamber. The size of the drops is varied according to the temperature of the gases and the nature of the products required.—H. H.

Hydrocarbons [petroleum, etc.]; Process for purifying ——. H. Neumann. Fr. Pat. 428,471, April 14, 1911.

The impurities in mineral oils, turpentine oil, and other hydrocarbon mixtures are said to be separated in solid form when the substances are treated with a coal-tar dye, dissolved or suspended in water, or with an aqueous solution of an aromatic base, preferably a poly-amino compound. An acid or a base may be added to the dye solution and an acid to the solution of the base. It is advisable to submit the hydrocarbon mixture to a preliminary treatment with an oxidising agent (*e.g.*, a permanganate solution of less than one per cent. strength), to facilitate the separation of the impurities. After the treatment with a base, the mixture may be treated with an aromatic sulphonic acid, *e.g.*, benzenesulphonic acid, resorcinoldisulphonic acid, naphthalene-β-monosulphonic acid, or naphthalene-1.3.5.-trisulphonic acid. The following bases are said to be suitable for the purpose: Triaminobenzene, triaminotoluene, and tetra-aminodiphenyl. As regards the colouring matters employed, those which possess marked acidic or basic properties (according to whether the impurities are basic or acid in character) are to be preferred. *Example.*—A petroleum fraction distilling between 120° and 270° C., is mixed with an equal volume of a 0·01 per cent. solution of rosaniline hydrochloride at the ordinary temperature: the dyestuff solution gradually becomes lighter, and violet flakes separate from the mineral oil, forming an intermediate layer on standing.—T. F. B.

Water-proofing composition for porous substances [from mineral wax]. E. E. Blackman, Lincoln, Nebr., U.S.A. Eng. Pat. 19,714, Aug. 23, 1910.

The composition consists of 70 per cent. of gasoline or other solvent such as naphtha, benzine, or turpentine, 20 per cent. of ozokerite or other mineral wax, 5 per cent. of mineral oil such as crude petroleum or paraffin oil, and 5 per cent. of powdered steatite. The wax is melted and the mineral oil and the steatite are mixed in, forming a mass which will keep indefinitely and which is mixed with the solvent when required. The composition is suitable for waterproofing artificial stone, brick, wood, stucco plaster casts and other porous or capillary substances.
—A. T. L.

Briquetting and pressing material; Process of ——. A. Rónay. Assignor to Allgem. Briketierungs-Ges. m. b. H., Berlin. U.S. Pat. 1,002,453, Sept. 5, 1911.

See Eng. Pat. 16,500 of 1909; this J., 1910, 678.—T. F. B.

Combustion; Powder for accelerating ——. A. C. and W. J. Robinson. Fr. Pat. 428,650, April 18, 1911.

See Eng. Pat. 8701 of 1911; this J., 1911, 1105.—T. F. B.

Gas retorts; Continuously-working vertical ——. H. W. Woodall and A. M. Duckham. Fr. Pat. 427,992, March 31, 1911. Under Int. Conv., April 1, 1910.

See Eng. Pat. 7919 of 1910; this J., 1911, 735.—T. F. B.

Vertical [gas] retorts; Heating ——. H. W. Woodall and A. M. Duckham. Fr. Pat. 428,144, April 5, 1911. Under Int. Conv., April 19, 1910.

See Eng. Pat. 9494 of 1910; this J., 1911, 609.—T. F. B.

Retort furnaces with horizontal flues for making coke and illuminating gas. Stettiner Chamotte-Fabrik A.-G. vorm. Didier. Fr. Pat. 428,561, March 17, 1911. Under Int. Conv., Sept. 12, 1910.

See Eng. Pat. 6924 of 1911; this J., 1911, 1042.—T. F. B.

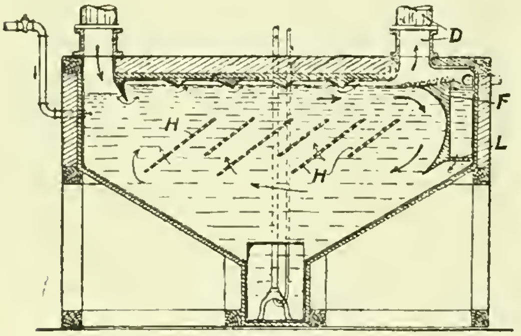
Oil-testing machine [for lubricants]. Eng. Pat. 7616. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Saturator for obtaining ammonium sulphate from coal distillation gases. W. Müller. Ger. Pat. 237,609, April 17, 1910.

The side wall, F, of the saturator, nearest to the gas outlet, D, is made concave, in order to facilitate circulation of the liquid; to the same end, a number of perforated plates, H, H, are placed diagonally across the saturator. Between the concave side wall and the casing of the saturator is a space which serves as a foam collector, the bottom of which consists of a perforated plate, L. The circulating devices prevent entirely the formation of deposits of salt on the top and walls of the saturator.
—T. F. B.



Incandescence mantles; Process of manufacturing ——, *and new product resulting therefrom.* L. Lefebvre. Fr. Pat. 428,300, June 17, 1910.

The textile support of the mantle is treated—either before, during, or after impregnation with the salts of the rare earths—with a carbohydrate (or other analogous compound) and mercury thiocyanate. On heating, the threads of the treated material swell and a porous form of carbon is produced within the fabric; it is claimed that after the elimination of the carbon by combustion, the resulting skeleton is very strong and durable.—W. E. F. P.

Incandescence lamps; Process of preparing organo-metallic compounds specially employed in the manufacture of filaments for ——. Comp. Française pour l'Exploit. des Proc. Thomson-Houston. Second Addition, dated Jan. 25, 1911, to Fr. Pat. 410,562, Nov. 30, 1909 (this J., 1910, 618, 942).

Sulphuric acid is employed, instead of hydrochloric acid, as the electrolyte for effecting the decomposition of the colloidal organo-metallic compound.—W. E. F. P.

[Electric lamps] Process of lighting based on the action of the electric current upon phosphorescent materials (radio-active or not) in an atmosphere of rarefied gas. Banque du Radium. Fr. Pat. 428,629, June 25, 1910.

The lower half of a spherical globe, containing a rarefied gas, is internally coated with the phosphorescent material; and through the upper portion a pair of sharply-converging electrodes—composed of a radio-active substance—extend downwards, their lower ends being about 4 cm. apart. It is claimed that by this arrangement the use of a transformer is obviated, the tension of the current required being only a few volts.—W. E. F. P.

Pyrophoric masses [alloys]. Treibacher Chem. Werke Ges. m. b. H. Ger. Pat. 237,173, Aug. 17, 1909. Addition to Ger. Pat. 231,595, April 6, 1909.

See Fr. Pat. 407,117 of 1909 and addition thereto; this J., 1910, 574, 636. The sparking properties of the alloys may be modified by addition of calcium, magnesium, aluminium, barium, and strontium; the hardness and density by antimony, beryllium, lead, cadmium, silver, chromium, iron, cobalt, copper, manganese, molybdenum, mercury, nickel, platinum, silicon, titanium, uranium, vanadium, bismuth, tungsten, zinc, tin, and zirconium; and the alloys may be rendered more easily oxidisable by addition of heavy metals, oxides of the rare earth metals and of heavy metals, and oxygenated salts. Alkali metals, carbon, sulphur, phosphorus, arsenic, and salts such as chlorides prejudicially affect the durability of the alloys.—A. S.

III.—TAR AND TAR PRODUCTS.

German tar distilling industry; Census of ——. Board of Trade J., Sept. 21, 1911. [T.R.]

A supplement to the official "Nachrichten für Handel und Industrie" (Berlin) gives the general results of the census of production in the German coal tar, water-gas tar, and oil-gas tar distilling industry for 1908. The following are the principal totals:—

	Quantity.	Value.
	Tons.	£
Wages and salaries of 2,997 persons employed	—	181,000
Materials worked up:—		
Tar	799,000	914,000
Semi-manufactured products of tar distillation	44,000	183,000
Ammonia in ammoniacal liquor	830	22,000
Total value	—	1,119,000
Goods produced:—		
Pitch	396,200	638,500
Refined tar	82,400	151,300
Heavy coal tar oils (carbolic, creosote, naphthalene, and other oils)	244,000	491,000
Naphthalene:—		
Crude	19,400	45,300
Refined	16,400	88,100
Anthracene, crude and refined	4,000	31,800
Pyridine bases	380	12,500
Phenols, cresols:—		
Phenol (crystallised carbolic acid)	1,000	42,100
Cresol (90—100 per cent. carbolic acid)	2,000	19,100
Crude phenol for sale	570	4,800
Benzol, crude and refined	13,000	108,400
Toluol, crude and refined	2,600	38,200
Xylol, solvent naphtha, and heavy benzols, crude and refined	4,600	39,000
Other products	4,100	13,600
Ammoniacal liquor, concentrated	116	1,500
Ammonium sulphate	1,150	14,600
Ammonia solution	900	20,600
Ammonium chloride	58	1 200
Total value	—	1,761,600

Note.—The figures in the above table do not include particulars relating to lignite tar, schist tar, and peat tar distillation.

The capacity of the German tar products industry is greater than appears from the results of the actual production. The productive capacity was not fully used owing to lack of profits and to difficulties of sale. Further, the products under consideration were in part produced also by other works. The figures returned, consequently, do not represent the total home production of the abovementioned products.

PATENTS.

Triphenylmethane dyestuffs ; Chrome ——. [*Preparation of pentachlorobenzaldehyde*]. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 428,369, April 11, 1911. Under Int. Conv., April 18 and 21, 1910.

PENTACHLOROBENZALDEHYDE, of m. pt. 197°—199° C., is prepared by treating pentachlorobenzylidine chloride with concentrated or fuming sulphuric acid. It is converted into triphenylmethane dyestuffs as described in Ger. Pat. 234,519 of 1910 (this J., 1911, 796).—T. F. B.

Pentachlorobenzaldehyde. M. Weiler, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 998,140, July 18, 1911.

SEE Fr. Pat. 428,369 of 1911 ; preceding.—T. F. B.

Process for purifying hydrocarbons. Fr. Pat. 428,471. *See* IIA.

IV.—COLOURING MATTERS AND DYES.

PATENTS.

Dyestuffs of the anthraquinone series ; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 24,920, Oct. 29, 1909. Under Int. Conv., Feb. 1, 1909.

SEE U.S. Pat. 958,325 of 1910 ; this J., 1910, 749. Arylated β-anthraquinonylureas are also obtained by treating β-anthraquinonylurea chloride with aniline, toluidine, naphthylamine, etc.—T. F. B.

Vat [anthracene] dyestuffs ; Production of red ——. Badische Anilin und Soda Fabrik. Sixth Addition, dated April 1, 1911 (under Int. Conv., Jan. 25, 1911), to Fr. Pat. 365,920, May 4, 1906.

THE new dyestuffs are produced by the action of dehydrating agents on the condensation products obtained from amino-anthraquinones and their derivatives and halogen derivatives of ketones, diketones, diarylmethanes, and diarylsulphones (see fourth and fifth Additions, this J., 1910, 267 and 1197). *Example.* 25 kilos. of the condensation product from α-amino-anthraquinone and dibromofluorenone, are heated at 160°—165° C. with 375 kilos. of concentrated sulphuric acid until the transformation is complete ; the mixture is diluted, boiled, filtered, washed, and dried. With alkaline reducing agents the product gives reddish-brown vats from which cotton is dyed red-brown shades, changing to fast yellowish-brown on washing and drying. Similar products, all of which are probably allied to acridine in constitution, are obtained from di-1-anthraquinonyl-*p.p'*-diaminobenzophenone, or from the condensation products of α-amino-anthraquinone with 4.4'-dichlorobenzil, dibromophenanthrenequinone, 4.4'-dichlorodiphenylsulphone, or dichlorodiphenylmethane.—T. F. B.

Condensation products of the anthraquinone series. Badische Anilin und Soda Fabrik. Fr. Pat. 428,338, April 10, 1911. Under Int. Conv., Sept. 29, 1910.

A NEW series of anthraquinone derivatives, which may serve as vat dyestuffs, is obtained by the interaction of an anthraquinone-aldehyde with an anthraquinone-hydrazine, with or without a solvent or diluent ; the reaction is usually very rapid. The product obtained from 1-chloro-anthraquinone-2-aldehyde and anthraquinone-2-hydrazine dyes cotton deep claret shades from the vat, whilst that from 1-hydroxy-4-bromo-anthraquinone-2-aldehyde and anthraquinone-2-hydrazine dyes violet shades. Ten other products, dyeing cotton red or violet shades, are described in the specification.—T. F. B.

Vat dyestuffs of the anthraquinone series ; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pats. 237,236, June 8, 1910, and 237,546, Nov. 11, 1910.

(1) ARYL-1-AMINOANTHRAQUINONE-2-CARBOXYLIC acids, obtained by the action of arylamines on 1-nitro-anthraquinone-2-carboxylic acid, are treated with condensing agents either directly, or after their conversion into a derivative, such as the corresponding acid chloride. The products, which are acridones, give highly coloured vats from which cotton is dyed fast bright shades. (2) The condensation products from 1-nitro- or 1-halogen-anthraquinone-2-carboxylic acids and amino derivatives of diarylketone-o-carboxylic acids, are treated with dehydrating agents until the products are insoluble in alkalis. Fast vat dyestuffs result.—T. F. B.

Indophenols ; Process for preparing halogen derivatives of —— *from carbazoles, and of [sulphide] dyestuffs therefrom.* L. Cassella und Co. Fr. Pat. 427,900, June 7, 1910.

HALOGEN derivatives of indophenols may be obtained either by condensing *p*-nitrosophenol with halogen derivatives of carbazole or N-alkylcarbazole, or by condensing halogen derivatives of *p*-nitrosophenol with carbazole or an N-alkylcarbazole. If these compounds are converted into sulphide dyestuffs by means of alkali polysulphides (*e.g.*, the tetra- or pentasulphide) in the usual manner, the dyes obtained are mostly easily soluble in alkali sulphides, and dye cotton from such solutions in shades varying from dark blue to greenish-blue. When polysulphides containing high percentages of sulphur are employed (*e.g.*, 19 to 24 kilos. of sulphur to 24 kilos. of crystallised sodium sulphide), and if alcohol or other solvent of the indophenol or leuco-indophenol be present, the dyes obtained are soluble with difficulty in dilute alkali sulphide solutions, but can be reduced by alkali hydrosulphites, giving vats in which cotton is dyed pure blue to indigo blue shades, fast to light, washing, and chlorine.—T. F. B.

2-Amino-5-naphthol-7-sulphonic acid ; Process for producing substitution products of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 428,138, April 5, 1911. Under Int. Conv., April 19, 1910.

THE chlorides or bromides of nitrobenzoic acids are condensed with aminobenzoyl-2-amino-5-naphthol-7-sulphonic acids, and the products are reduced to form aminobenzoylaminobenzoylaminonaphtholsulphonic acids, which can be diazotised and combined on the fibre or developed with nitranilines. (See Ger. Pat. 230,595 of 1910 ; this J., 1911, 350.)—T. F. B.

Mordant dyestuffs of the triphenylmethane series dyeing from an acid bath ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 25,291, Oct. 31, 1910.

SEE Fr. Pat. 424,723 of 1911 ; this J., 1911, 738.—T. F. B.

Vat [anthracene] dye ; Blue ——. M. Buff, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 998,156, July 18, 1911.

SEE Ger. Pat. 236,407 of 1910 ; this J., 1911, 1047.—T.F.B.

[Anthracene] dyestuffs ; Process for producing vat ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 428,700, April 19, 1911. Under Int. Conv., April 27, 1910.

SEE Ger. Pat. 236,407 of 1910 ; this J., 1911, 1047.—T.F.B.

Azo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 428,101, April 4, 1911. Under Int. Conv., April 11, 1910.

See Ger. Pat. 230,595 of 1910; this J., 1911, 350.—T. F. B.

Azo dyestuffs on the fibre; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 428,163, April 6, 1911. Under Int. Conv., April 14, 1910.

See Eng. Pat. 12,139 of 1910; this J., 1911, 280.—T. F. B.

Trisazo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 428,289, April 8, 1911. Under Int. Conv., April 20, 1910.

See Eng. Pat. 974 of 1911; this J., 1911, 1109.—T. F. B.

Azo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 428,410, April 12, 1911. Under Int. Conv., April 20, 1910.

See Eng. Pat. 30,284 of 1910; this J., 1911, 1006.—T. F. B.

Vat dyestuffs; Manufacture of brown ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 2732, Feb. 2, 1911. Under Int. Conv., Feb. 4, 1910. Addition to Eng. Pat. 16,584, July 19, 1907.

See Ger. Pat. 234,058 of 1910; this J., 1911, 738.—T. F. B.

Vat dyestuffs of the anthraquinone series containing sulphur; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 4065, Feb. 17, 1911. Under Int. Conv., March 5, 1910.

See Fr. Pat. 425,742 of 1911; this J., 1911, 947.—T. F. B.

Vat dyestuffs; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Second Addition, dated Jan. 19, 1911 (under Int. Conv., Feb. 4, 1910), to Fr. Pat. 390,484, July 29, 1907.

See Ger. Pat. 234,058 of 1910; this J., 1911, 738.—T. F. B.

Vat dyestuffs; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 428,111, April 4, 1911. Under Int. Conv., April 24 and June 16, 1910.

See Eng. Pat. 9257 of 1911; this J., 1911, 1110.—T. F. B.

Monoazo dye. H. Jaesschin, Berlin, and O. Kaltwasser, Dessau, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,003,266, Sept. 12, 1911.

See Eng. Pat. 9003 of 1911; this J., 1911, 796.—T. F. B.

Anthracene dye and process of making same. R. Just and H. Wolff, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,003,268, Sept. 12, 1911.

See Ger. Pat. 218,162 of 1909; this J., 1910, 482.—T. F. B.

Condensation products of the anthraquinone series. Badische Anilin und Soda Fabrik. Fr. Pat. 428,645, April 18, 1911.

See Ger. Pat. 236,857 of 1910; this J., 1911, 1048.—T.F.B.

[*Azo*] *dyestuffs dyeing cotton directly; Process for preparing* ——. L. Cassella und Co. Fr. Pat. 428,447, June 21, 1910.

See Eng. Pat. 15,646 of 1910; this J., 1911, 948.—T. F. B.

Chrome triphenylmethane dyestuffs. [*Preparation of pentachlorobenzaldehyde.*] Fr. Pat. 428,369. *See* III.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Straw pulp; Manufacture of —— *in Russia.* E. Altmann. Chem.-Zeit., 1911, **35**, 979.

The author describes a straw-cellulose mill which has been working in East Russia near the Volga since November, 1910. Straw is obtained in abundance in the neighbourhood, and is purchased at the rate of 1 M. per 100 kilos. (10s. per ton), which represents merely its fuel value. The straw is chopped in a cutting machine with rotary knives and the chopped straw is elevated to a reciprocating sieve to remove the dust, whilst a blast of air drives the straw on to a moving band. The heavier particles fall short of the band into a threshing machine in which the grain is recovered; the amount of grain is about 1 per cent. The straw is digested with caustic soda under a pressure of 6 atmospheres for 3½ hours. Steam is generated in Cornish boilers fired with crude petroleum sprayed underneath. When the digestion is finished, the steam is blown off and the digester is filled with dilute washings from the washing tanks. The contents are then discharged under a pressure of about 4 lb. per sq. in. through a large pipe into washing tanks provided with copper sieve bottoms. The lye is drained off from these tanks to the evaporating plant and replaced by water which subsequently serves for washing the stuff in the digester; later washings are run to waste. The washed straw is diluted and pumped over sand tables; it is then concentrated on a revolving sieve and passed to the breaking engines in which it is made ready for bleaching. Bleaching is effected in large concrete troughs with propellers, subsequently being completed in vats. A little acid is added when the stuff is pumped up to the presse-pate machine. The recovery plant comprises a quadruple effect evaporator in which the lye is concentrated from 6° to 32° B. The thick lye is burnt in a rotary soda furnace from which the black ash falls automatically into a fusion furnace, in which it is mixed with sodium sulphate and heated to fusion. A blast of air is introduced into the fusion furnace through a tube provided with a platinum nozzle. The recovery of soda amounts to about 80 per cent. The furnaces are lined with Finnish soapstone to which the melted soda ash does not adhere.

—J. F. B.

Sulphate wood pulp; Chemical processes in the manufacture of ——. P. Klason and B. Segerfelt. Papierfabrikant, 1911, **9**, 1093—1099.

The sulphate process possesses the advantage over the sulphite process in that the organic matters removed from the wood can be utilised for the regeneration of the chemicals employed, without any additional fuel; there are no liquid waste products to be disposed of. An analysis of regenerated soda-ash showed: sodium carbonate, 61·73; sulphide, 21·5; sulphite and thiosulphate, 7·33; hydroxide, 3·50; silicate, 1·22; sulphate, 2·78; ferric oxide, 0·04; insoluble and loss, 1·90. The composition of the lye charged into the vertical rotary boilers so far as active alkali is concerned, is about 90—100 grms. of hydroxide, 25—30 grms. of sulphide, and 10 grms. of carbonate per litre; such a lye has a density of 16°—20° Bé. The proportion of alkali used, calculated as hydroxide, is about 20 per cent. of the dry weight of the wood. The temperature of digestion ranges from 150° to 170° C. and the time from 3 to 6 hours. The yield of cellulose ranges from 44 to 50 per cent., according to the variety of wood, and is at least 10 per cent. higher than the yield obtained with caustic soda alone. The most serious obstacle to the general development of the sulphate process is the production of malodorous methyl mercaptan and methyl disulphide. Of these the mercaptan is by far the worse; the proportion of mercaptan varies according to the conditions of boiling; a high proportion of alkali reduces the quantity of mercaptan, tending to convert it into disulphide; thus in the manufacture of high-boiled "easy bleaching" pulp, about 100 grms. of mercaptan are obtained per ton of dry wood; but in making a low-boiled "strong" pulp with a reduced proportion of alkali, the quantity may be ten times as great. Under equal conditions, pine wood yields about twice as much mercaptan as spruce wood. The authors have made a detailed investigation of the organic matters contained in the black lye from the digesters. The concentrated lye was saturated with carbon dioxide and heated at 110°—120° C.; the precipitated alkali-lignin was thus coagulated. A further quantity of free lignin was obtained on acidifying the filtrate; this fraction contained the fatty acids and resins, which were extracted by chloroform. Formic and acetic acids were obtained from the filtrate by distillation. The residue was treated for the separation of lactones and lactonic (saccharinic) acids. Calculated on 1000 grms. of organic substance, the results are summarised as follow:—lignin, 542·9 grms.; fatty and resin acids, 24·7 grms.; formic acid, 36·9 grms.; acetic acid, 51·6 grms.; lactonic acids, 303·4 grms. Of the sulphur originally present as alkali sulphide, 51·8 per cent. was combined with lignin, 15 per cent. expelled as volatile organic compounds, 16·8 per cent. remained after digestion as alkali sulphide, but rapidly changed on storage, whilst 16·4 per cent. was unaccounted for, probably oxidised. In the digestion of wood by the sulphate process, the gummy carbohydrates are converted into saccharinic acids; the gums also probably account for the formic and acetic acids, the latter possibly being derived from the pentosans. The lignin molecule is split up into similar derivatives of lower molecular weight, two free hydroxyls being opened out per molecule of lignin ($C_{39}H_{40}O_{12}$), in virtue of which the products become soluble in the alkali. At the same time the lignin combines with sulphur and it loses about one-fifth of its methoxyl, this group being hydrolysed with formation of methyl alcohol and its sulphur derivatives. Meta- and para-saccharinic acids have been characterised as well as a new form of isosaccharinic(sapin-) acid which constitutes the main component of this fraction. The combination of about one-half of the sulphur with the lignin and the reaction between the methyl alcohol and the alkali sulphide suggest that this portion of the lye only gradually becomes caustic as the digestion proceeds; hence the cellulose fibre is protected from the too drastic action of a strong caustic lye. Nevertheless, it is not desirable to employ more than 25 per cent. of the total alkali in the form of sulphide, since the production of mercaptan would tend thereby to be increased.—J. F. B.

Sulphate cellulose; Titration of the digester-liquor in the manufacture of ——. B. Lindquist. Papierfabrikant, 1911, 9, 1127.

The "white liquor" used for the digestion of wood in the sulphate process contains mainly sodium hydroxide, sodium sulphide and sodium carbonate. The proportion of sulphide depends on the quantity of sulphate added to the "ash" in the regeneration process, and this proportion is, therefore, known and constant. But the proportions of hydroxide and carbonate depend on the efficiency of the causticising process, the carbonate being practically inoperative in the digestion of the wood. The usual method of titration, with sulphuric acid in presence of rosolic acid as indicator, titrates the whole of the hydroxide and carbonate and half of the sulphide. It therefore fails to indicate the degree of causticisation and the effective (caustic) value of the liquor for the digestion of the wood. The author recommends a simple method by which this defect may be remedied. A little barium chloride is added to the measured quantity of liquor to be titrated, thus precipitating the carbonate; phenolphthalein is added and the liquid is titrated with $N/2$ hydrochloric acid. The number so obtained represents the equivalent of the whole of the hydroxide and half of the sulphide, and since the proportion of the latter is constant and known, the effective alkali in the liquor may be readily calculated with an error not exceeding 0·5 per cent.—J. F. B.

Patents.

Yarns, fabrics and the like; Drying machines for ——. J. F. White, Bradford. Eng. Pat. 20,122, Aug. 29, 1910.

The invention relates to drying machines for yarns, fabrics, slivers or fibres of the type in which the material to be dried is passed over heated rotating cylinders with perforated peripheries, through which air is forced outwards so as to pass through the material to dry it. According to this specification, bars are fixed on the periphery of the cylinder, parallel to its axis, at suitable intervals. The material is supported on these bars, which hold it at a definite distance from the perforated walls of the cylinder and allow the escaping hot air to circulate about all parts of the material before passing away. Flanges at the ends of the cylinder prevent the material from working off at the sides.—J. F. B.

Wool and woollen materials; Process for destroying cotton, vegetable fibres and silk in ——, *and apparatus therefor.* W. Crowther, Leeds. Eng. Pat. 22,101, Sept. 23, 1910.

The material is treated with silicon tetrafluoride vapour and steam, which attack and disintegrate cotton, vegetable impurities, such as burrs, and silk fibres, whilst leaving the wool practically unchanged. The apparatus consists of a rotary steam-jacketed cylinder of iron plate, the plate used for constructing the inner cylinder being extended and curled round inside, and furnished with a toothed edge, so that when the vessel revolves, the projecting plate digs into the material, scooping it up and opening it out. The vessel is mounted on a hollow shaft, one end being arranged for the admission of steam and the other for the admission of silicon tetrafluoride vapour. When the cylinder is charged, the air is pumped out by a vacuum pump and silicon tetrafluoride vapour is admitted so as to replace the air. The vessel is heated and revolved with the admission of steam until the foreign fibres are disintegrated. The gaseous contents of the vessel are discharged into a second similar vessel from which the air has been exhausted, and the residual acid is neutralised by the admission of ammonia vapour. The entire process is a dry one and is applicable either for the treatment of mixed rags or of raw wool.—J. F. B.

Fabrics; Manufacture of artificial ——. M. Ratignier and H. Pervilhac et Cie. First Addition, dated March 17, 1911, to Fr. Pat. 384,934, Feb. 19, 1907 (see Eng. Pat. 13,518 of 1907; this J., 1907, 1196).

The solution of cellulose or similar substance is applied to the engraved roller (*loc. cit.*) by means of a "doctor," pressing against the roll, forming with it a trough in which the cellulose solution lies, and permitting only of the passage of sufficient of the solution to fill the depressions in the engraved roll. The lower part of the roll is immersed in a trough containing a coagulating liquid in which the cellulose spread by the "doctor" is solidified, the tissue being detached from the roll as it emerges from the bath and wound up on a reel. The roll, freed from its deposit of cellulose, subsequently passes beneath a spray of water, which cleanses it, and the excess of water is removed by a suction drying apparatus before the trough of cellulose solution is again reached.—J. F. B.

Cellulose esters; Manufacture of ——. H. Danzer. Fr. Pat. 428,554, June 23, 1910.

The solubility of the esters of cellulose is increased by a special process of hydrolysis characterised by a chemical reaction which produces water. Any compound having an alcoholic function may be used for this purpose. If ethyl alcohol be employed for the treatment of cellulose acetate, 300 parts of the alcohol are introduced per 100 parts of cellulose into the acetylation mixture; the alcohol reacts with the acetic acid on warming, giving ethyl acetate and water; the water in the nascent condition brings about the special hydrolysis of the cellulose acetate, with an increase of its solubility.—J. F. B.

Paper; Manufacture of ——. W. Curtis jun., Palmer, N.Y. Assignor to International Paper Co., New York. U.S. Pat. 1,001,822, Aug. 22, 1911.

A method is described for producing a practically uniform quality of paper as the output of several papermaking machines by providing a main stuff-chest sufficiently large to contain a dominating supply of paper stock, supplying all the paper machines or their respective chests in proportion to their output. The dominating supply of stock in the main chest is replenished at intervals from a source of supply of large volume, *e.g.*, a mixing chest, so that any fluctuations in the uniformity of the original supply of stock become compensated by the large mass of stock in the main stuff-chest and in the mixing chest.—J. F. B.

Paper pulp [from resinous woods]; Manufacture of ——. B. F. A. Saylor. Fr. Pat. 428,678. April 19, 1911.

THE invention relates to a process and apparatus for obtaining turpentine, rosin and pulp from resinous woods or wood wastes. The apparatus consists of a vertical jacketed cylinder provided with a false bottom. Valves are fitted for the admission of steam into the jacket and into the interior of the digester, both at the top and below the false bottom. The top of the cylinder can be connected with a still-head and condenser for the recovery of the volatile oil of turpentine, whilst the bottom of the cylinder is provided with a valve discharging into a turpentine still for recovering rosin and oil of turpentine. The cylinder is charged with chips of resinous wood together with about 1250 grms. of caustic soda per cub. m. of charge. The cylinder is then gently heated by the admission of steam into the jacket and below the false bottom. At the same time the air is exhausted from the interior of the digester by means of an air pump, being finally completely replaced by steam. When all the air is exhausted, steam is admitted through all the valves, the pressure being rapidly increased to 5—7 atmospheres. After about an hour the valve connecting with the still-head is opened and oil of turpentine is distilled off. This operation lasts for 2 hours. Meanwhile the fluid resin or turpentine has collected below the false bottom and is finally drawn off into the turpentine-still below. Subsequently caustic soda lye of a density of 15° Bé. is admitted to the digester and the wood is converted into pulp by digestion under about 8 atmospheres' pressure. A further quantity of resin collects below the false bottom and is discharged at convenient intervals by momentarily opening the valve leading to the rosin-still. Digestion, recovery of the soda and cleansing of the pulp are completed in the usual manner.—J. F. B.

Vegetable fibres; Process for obtaining ——. F. Kreissl and C. Seibert, Vienna. Eng. Pat. 3363, Feb. 9, 1911. Under Int. Conv., Feb. 16, 1910.

SEE Fr. Pat. 425,955 of 1911; this J., 1911, 950.—T. F. B.

Artificial silk and other formed material from fatty acid esters of cellulose; Process for the production of ——. G. B. Ellis, London. From Chem. Fabr. von Heyden A.-G., Radebeul, Saxony. Eng. Pat. 3973, Feb. 16, 1911.

SEE Fr. Pat. 426,436 of 1911; this J., 1911, 950.—T. F. B.

Cellulosic films; Manufacture of ——. E. Brandenberger, Thaon-les-Vosges, France. U.S. Pat. 1,002,634, Sept. 5, 1911.

SEE Eng. Pat. 15,281 of 1909; this J., 1910, 83.—T. F. B.

Formic esters of cellulose or their solutions in formic acid; Use of lactic acid to convert —— into solid plastic solutions. Verein. Glanzstoff-Fabriken A.-G. Fr. Pat. 428,069, April 3, 1911. Under Int. Conv., May 18, 1910.

SEE Eng. Pat. 8313 of 1911; this J., 1911, 1050.—T. F. B.

Agglomeration of pulverulent materials, ores, coal, etc. [by means of waste sulphite cellulose lyes]. Addition to Fr. Pat. 425,991. *See* IIA.

Use of ethyl or methyl butyrate for gelatinising or dissolving nitrocellulose. Fr. Pat. 428,664. *See* XXII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

PATENTS.

Preparing, bleaching, weighting and dyeing fabrics; Process and apparatus for ——. Färberei und Appretur Schusterinsel. G. m. b. H. Fr. Pat. 427,913, Feb. 21, 1911.

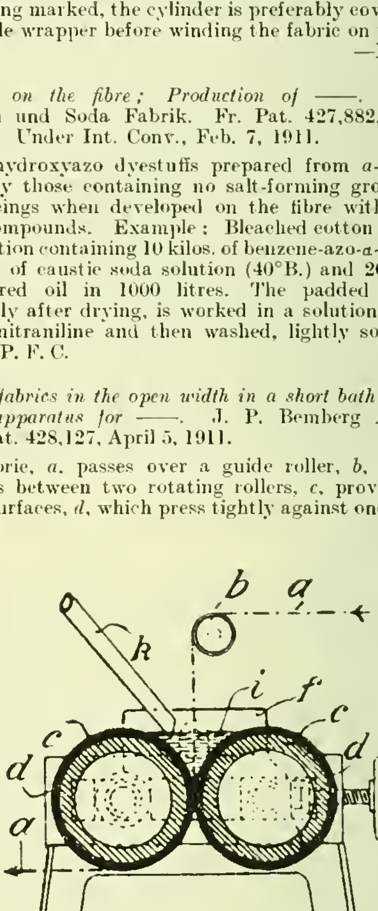
THE material to be treated is carefully wound without tension around a hollow perforated cylinder which is then horizontally arranged inside a vat containing the necessary liquor. One end of this cylinder is closed and the other end is provided with a conical opening which, when the cylinder is placed in position, fits tightly over the corresponding conical end of a pipe communicating with a circulating pump. Another pipe connects this pump with the bottom of the vat, so that when the apparatus is working, the liquor is circulated through the material wound on the cylinder. In order to prevent the end of the fabric from being marked, the cylinder is preferably covered with a suitable wrapper before winding the fabric on to it. —P. F. C.

Dyeings on the fibre; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 427,882, Mar. 29, 1911. Under Int. Conv., Feb. 7, 1911.

THE *p*-hydroxyazo dyestuffs prepared from *a*-naphthol, especially those containing no salt-forming groups, give fast dyeings when developed on the fibre with suitable diazo compounds. Example: Bleached cotton is padded in a solution containing 10 kilos. of benzene-azo-*a*-naphthol, 10 litres of caustic soda solution (40°B.) and 20 litres of Turkey-red oil in 1000 litres. The padded material, preferably after drying, is worked in a solution of diazotised *p*-nitraniline and then washed, lightly soaped and dried.—P. F. C.

Dyeing fabrics in the open width in a short bath; Process and apparatus for ——. J. P. Bemberg Akt. Ges. Fr. Pat. 428,127, April 5, 1911.

THE fabric, *a*, passes over a guide roller, *b*, and then descends between two rotating rollers, *c*, provided with elastic surfaces, *d*, which press tightly against one another.



Two plates, *f*, are arranged vertically at the ends of the rollers so as to convert the space, *i*, between them into a trough into which the dye-liquor can be run from a reservoir through a pipe, *k*. After passing down between the rollers, *c*, the fabric, *a*, may be dried at once if the dyestuff employed is a substantive dyestuff, or, if it be a vat dyestuff, the material may be exposed to air or treated in any other suitable manner in order to oxidise the leuco-compound.—P. F. C.

Bobbin-spools for facilitating the even dyeing of cross-wound bobbins ("bobines Soleil"). Hubaux Frères. Fr. Pat. 428,546. Mar. 9. 1911.

The surface of the bobbin-spool, around which the yarn is wound, is cut out so as to form channels. During the dyeing operation the dye-liquor flows along these channels, coming into contact with the interior as well as the exterior of the bobbin of yarn, and thus enabling a uniform dyeing to be obtained.—P. F. C.

Mercerising cotton, preferably in the form of hanks; Process for ——. P. Hahn. Fr. Pat. 428,406. April 12, 1911.

See U.S. Pat. 994,076 of 1911; this J., 1911, 799.—T. F. B.

Dyeing with certain vat dyestuffs and the manufacture of materials therefor. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 3241, Feb. 8, 1911. Under Int. Conv., Feb. 28, 1910.

See Fr. Pat. 425,486 of 1911; this J., 1911, 889.—T. F. B.

Dye-liquors; Apparatus for measuring and regulating the concentration of ——. W. Bratkowski, Berlin, P. A. Z. de Lange, Sudende, and R. Pusch, Schöneberg, Germany. Eng. Pat. 5874, March 8, 1911. Under Int. Conv., March 12, 1910.

See Fr. Pat. 427,128 of 1911; this J., 1911, 1052.—T. F. B.

Dye liquors; Apparatus for measuring and regulating the concentration of ——. W. Bratkowski, Berlin. U.S. Pat. 1,002,635, Sept. 5, 1911.

See Fr. Pat. 427,128 of 1911; this J., 1911, 1052.—T.F.B.

Width-dyeing of piece-goods in a short bath; Process and apparatus for ——. C. J. Feeny, London. From J. P. Bemberg A.-G., Barmen-Rittershausen, Germany. Eng. Pat. 8288, April 3, 1911.

See Fr. Pat. 428,127 of 1911; preceding.—T. F. B.

Dyeing acetylcellulose; Art of ——. E. Knoevenagel, Heidelberg, Germany. U.S. Pat. 1,002,408, Sept. 5, 1911.

See Fr. Pat. 383,636 of 1907; this J., 1908, 332 —T. F. B.

Discharge effects on fibre; Production of ——, *and pastes to be used therein.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 27,404, Nov. 24, 1910. Addition to Eng. Pat. 30,505, Dec. 30, 1909.

See Par. 3 of Addition of Nov. 18, 1910, to Fr. Pat. 414,937 of 1910; this J., 1911, 617.—T. F. B.

Soaps for washing or bleaching. Eng. Pat. 19,494. *See* XII.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sale of acids regulations. London Gazette, Sept. 29. 1911.

The new regulations for the sale of mineral acids have now come into force. Sulphuric acid, nitric acid, and hydrochloric acid, must only be sold by retail in bottles, distinguishable by touch from ordinary bottles and bearing on a label the name and address of the seller together with the words "Poisonous" and "Not to be taken." The regulations have been made by the Privy Council with the object of preventing accidents through the misuse of these acids. During 1909, 99 deaths were caused by hydrochloric acid, seven by nitric acid, and seven by sulphuric acid. Besides these fatal cases, numerous accidents are frequently occurring, many of which are due to acids being contained in an ordinary bottle improperly labelled. Henceforth, any person who sells any of the acids in question without observing the new requirements, will be liable to a fine of £5. Ammonia will also be subject to the above regulations in four months' time.

Hydrocyanic acid; Formation of —— *in the high tension electric discharge.* A. V. Lipinski. Z. Elektrochem., 1911, **17**, 761—764.

Gruskiewicz in 1903 (this J., 1903, 216) obtained small amounts of hydrocyanic acid by passing sparks through a mixture of carbon monoxide, hydrogen, and nitrogen. The author gives reasons for thinking that methane was first formed, and that this alone reacted with nitrogen; and he has carried out experiments with mixtures of methane, nitrogen, and hydrogen (hydrogen and excess of nitrogen being used as diluents, to prevent formation of carbon). The most suitable mixture was found to be 20 volumes of methane, 70 of nitrogen, and 10 of hydrogen, which yielded 19 of hydrocyanic acid, a practically complete conversion of the methane into hydrocyanic acid.
—J. T. D.

Chlorides in bromides; Determination of ——. O. Herting. Z. Allgem. Oesterr. Apoth.-Ver., 1911, **49**, 373.

Three grms. of the salt (potassium or sodium bromide) are heated with about 6 grms. of lead peroxide (previously purified by warming with nitric acid) and 50 c.c. of 50 per cent. acetic acid, with occasional shaking, until evolution of bromine ceases and the mixture is becoming syrupy; it is then allowed to cool, taken up with water, and filtered, after which the chloride is determined in the filtrate by adding about 20 c.c. of concentrated nitric acid and 15 c.c. of $N/10$ silver nitrate, the excess of which is titrated with thiocyanate. In the case of ammonium bromide, 1·5 grms. of salt, 12 grms. of lead peroxide, and 70 c.c. of acetic acid are used. The chlorine content of cadmium and zinc bromides and of free bromine is similarly determined. The results are accurate to 0·1 per cent.
—F. Sodn.

Potassium permanganate. E. Schütz. Z. angew. Chem., 1911, **24**, 1628—1631.

Powdered pyrolusite (96 kilos. of 50 per cent. ore) is placed in an iron basin, 95 litres of potash lye (sp. gr. 1·5) are slowly added with stirring, and the mixture is heated till the mass is completely dry. The stirring is stopped from time to time, and any large lumps are broken down with a wooden hammer (the formation of these lumps is an indication of the favourable working of the process). The operation needs 100 kilos. of coal, lasts 12—14 hours, and results usually in decomposition of 60—65 per cent. of a natural ore, or 40—45 per cent. of "regenerated ore" (see below). The product is ground in a ball mill, and is then transferred to pressure-heaters, *i.e.*, double-walled cast-iron basins with the interspace filled with lead. These are heated from below to 260°—270° C.; they are provided with stirrers and with a circular pipe welded on to the lid, through holes in which, corresponding with holes in the lid, compressed air is admitted, preferably heated also to 260°—270° C. This operation, which increases the yield of manganate, lasts 10—12 hours for 300 kilos. of substance. The mass is now dissolved in the filtered liquors and wash-waters from the electrolysis and crystallisation of a previous batch, at a temperature of about 40° C., in a vessel provided with stirrers; potassium manganate and hydroxide go into solution, and a certain amount of manganese peroxide (known as "regenerated ore") is formed. This is separated by sedimentation, the liquid drawn off through filters, and the deposit washed. The clear solution (sp. gr. about 1·4) is electrolysed in cylindrical iron vessels with conical bottoms fitted with iron stopcocks, nickel anodes and iron cathodes, which are fastened by glass and cement to the bottom of the vessel, being used. Each cell holds 960 litres, and is filled to within 20 cm. of the rim. The liquor is preferably warmed to about 30° C., and a current of 30—40 ampères per sq. dcm. used, the voltage being 2·5—2·7. The operation continues for 10—11 hours, and the end is judged by the red colour of a sample on a glass rod. The whole contents, including any crystals, are now poured into cooling cylinders, and cooled—in winter by cold water, in summer by water and ice; the salt is separated from the mother liquor centrifugally, and washed in the centrifuge. The salt is then dried *in vacuo*, and carefully passed through a small ball-mill to break up portions that have caked in drying. In this way a salt of 99 per cent. purity is obtained. When the mother-liquor (which goes into the process again) has accumulated as much as 10 per cent. of carbonate, it must be causticised; it is concentrated to sp. gr. 1·32, any separated permanganate or manganese peroxide removed, the liquor diluted to sp. gr. 1·1, causticised with lime, and again concentrated to sp. gr. 1·5. Illustrations of the apparatus employed are given. Two modern patents may be noticed, one by the Farbenfabrik vorm. F. Bayer und Co., for treating the strongly alkaline manganate solution with ozone (compare this J., 1907, 877), the other by O. Dieffenbach (see this J., 1908, 685), in which manganese peroxide is suspended in potassium hydroxide solution of sp. gr. 1·3—1·4, a little manganate or permanganate added, and the whole, heated and continuously agitated, in the anode compartment of an electrolytic cell. The permanganate and dioxide form manganate, which is oxidised by the current, reacts on more peroxide, and so on.—J. T. D.

Ferrocyanides and thiocyanates; Determination of —— [*in gas liquors*]. L. Ronnet. Ann. Chim. Analyt., 1911, **16**, 336—337.

A KNOWN volume of the gas liquor is strongly acidified with hydrochloric acid and a slight excess of a hot ferric chloride solution added; the mixture (containing Prussian blue and ferric thiocyanate) is digested on the water bath for ½ hour, filtered, and the precipitated washed with boiling water until the filtrate is neutral and colourless. *Ferrocyanides.*—The filter with the precipitate is digested with 10 per cent. potassium hydroxide solution for 12—16 hours (according to the quantity of precipitate) with frequent shaking, and the solution made up to a known volume with water, and filtered through a dried filter. An aliquot portion is acidified with a slight excess of 10 per cent. sulphuric acid, and the tepid solution titrated with $N/10$ permanganate until a permanent pink colour is obtained (1 c.c. of permanganate corresponding to 0·0422 grm. of crystallised potassium ferrocyanide or 0·02866 grm. of anhydrous Prussian blue). *Thiocyanates.*—The filtrate from the Prussian blue is made up to a known volume, an aliquot portion is decolourised with a slight excess of sodium bisulphite solution and the mixture heated for a few moments on the water bath; a slight excess of copper sulphate solution (1 in 10) is added, the mixture heated on the water bath for 30 min., and filtered. The precipitate is washed with boiling water until the washings are free from copper. The filter and precipitate are then treated with ammonia (1 in 3) and the resulting solution acidified with dilute sulphuric acid. The warm liquid is then titrated with $N/10$ permanganate (1 c.c.=0·001616 grm. of potassium thiocyanate, or 0·001266 grm. of the ammonium salt or 0·00175 grm. of the calcium salt).—A. SBLD.

Melting-points of minerals; Recent determinations of —— *by the gas-thermometer.* A. L. Day and R. B. Sosman. Z. anorg. Chem., 1911, **72**, 1—10.

THE following table gives the revised melting-points of various minerals and eutectics as obtained by a nitrogen thermometer, or otherwise, with needful corrections, in the Geophysical Laboratory of the Carnegie Inst., Washington. Asterisks denote the gas-thermometer figures.

Substance.	Formula.	Transformation.	Temperature.	Observers.
Quartz	SiO_2	α- into β-, and back	575°	Wright & Larsen.
Sillimanite	Al_2SiO_5	Melting	1816°	Shepherd & Rankin.
α-Magnesium metasilicate	$MgSiO_3$	,,	1554°	Allen, Wright & Clement
,, ,,	,,	,,	1557°	Allen & White.
Pseudowollastonite	$CaSiO_3$	,,	1540°	,,
α-Calcium orthosilicate	Ca_2SiO_4	,,	2130°	Day & Shepherd.
Eutectic	77% $CaSiO_3$, 23% SiO_2	,,	1426°	,,
,,	66% $CaSiO_3$, 34% Ca_2SiO_4	,,	1440°	,,
,,	93% Ca_2SiO_4, 7% CaO	,,	2065°	,,
Tricalcium aluminate	3 CaO, Al_2O_3	Dissoc. into CaO and melt	1537°	Shepherd & Rankin.
5 : 3, CaO : Al_2O_3	5 CaO, 3 Al_2O_3	Melting	1382°	,,
Calcium aluminate	CaO, Al_2O_3	,,	1592°	,,
3 : 5, CaO : Al_2O_3	3 CaO, 5 Al_2O_3	Dissoc. into Al_2O_3 and melt	1700°	,,
Eutectic	9%, 3 CaO, Al_2O_3 91%, 5 CaO, 3 Al_2O_3	Melting	1378°	,,
,,	94%, 5 CaO, 3 Al_2O_3 6%, CaO, Al_2O_3	,,	1378°	,,
Diopside	$MgSiO_3$, $CaSiO_3$	,,	1391°*	Day & Sosman.
,,	,,	,,	1391°	Allen & White.
Eutectic	95·5% (62% diopside and 38% α-$MgSiO_3$) 4·5% (4% diopside and 96% α-$MgSiO_3$)	,,	1385°	,,
,,	60% diopside, 40% α-$CaSiO_3$	,,	1357°	,,
Anorthite	$CaSiO_3$, Al_2SiO_5	,,	1552°	Day & Allen.
,,	,,	,,	1550°*	Day & Sosman.
Bytownite	$Albite_1$. $Anorthite_5$	,,	1516°	Day & Allen
Labradorite	$Albite_1$. $Anorthite_2$	,,	1477°	,,
Andesine-Labradorite	$Albite_1$. $Anorthite_1$	,,	1430°	,,
Andesine	$Albite_2$. $Anorthite_1$	,,	1375°	,,
Calcium carbonate	$CaCO_3$	Dissoc. press. 1 atm.	898°	Johnston.
Borax	$Na_2B_4O_7$	Melting	741°	Day & Allen.
Sodium chloride	NaCl	,,	800°	White.
Sodium sulphate	Na_2SO_4	,,	884°	,,

A bibliography of the subject is given.—H. H. S.

Aluminium nitride, alumina, and nitric acid. G. L. Bourgerel. Monit. Scient., 1911, 561—575.

BY heating a mixture of bauxite and carbon in an electric furnace in a stream of nitrogen, a nitride of aluminium is obtained containing about 24 per cent. of nitrogen, which by treatment with sodium hydroxide solution yields ammonia and sodium aluminate. From the latter, alumina can be obtained, for the manufacture of aluminium, and the ammonia can be oxidised to form nitric acid. The author considers in detail this process as a source of nitric acid or nitrates, and points out that only a small fraction of the total amount used in France could be so produced;

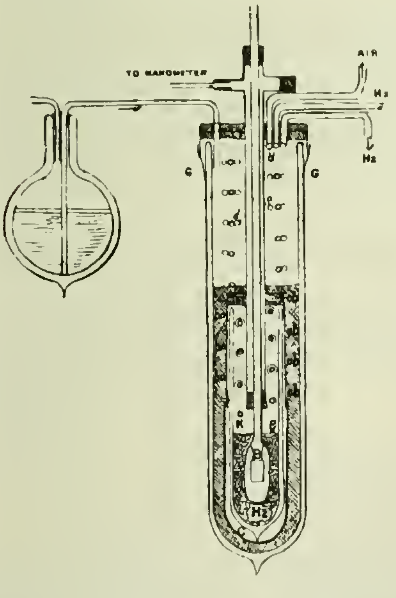
as an adjunct to the aluminium industry, unless with an enormous and unremunerative over-production of aluminium; and that the cost of producing it in this way, if the aluminium compounds simultaneously formed were to be disregarded, would be greater than the present price of sodium nitrate, or than the price at which it can be produced by direct electro-thermic synthesis. Detailed calculations in regard to this latter process lead to the result that at present 166 kilos. of nitrogen can be fixed, or 744 kilos. of nitric acid produced per kilowatt-year; and that at an estimated cost of 70 fr. per horse-power-year in France, there is a prospect of the industry developing so as to compete with or supplement the nitride process and supply the whole need of the country. The paper contains a classified bibliography of patents bearing on the electrothermic synthesis of nitric acid.—J. T. D.

Uranium nitrate; Reaction of acetic anhydride on ——. L. Vanino. Chem.-Zeit., 1911, **35**, 1005—1006.

Acetic anhydride, if pure, does not react on uranium nitrate, but if it contains a trace of acetic acid, or if a trace of another acid be added, violent reaction occurs, copious fumes of nitrogen peroxide escape, and if the anhydride be present in sufficient excess, the whole of the nitrate is converted into anhydrous uranium acetate. This is no doubt due to the reaction of the acetic anhydride on the small quantity of nitric acid first liberated, and the successive, though rapid, liberation and destruction of further quantities of nitric acid. Thorium nitrate reacts similarly but less violently with acetic anhydride, lead or thallium nitrate not at all.—J. T. D.

Hydrogen; Apparatus for liquefying ——. W. Nernst. Z. Elektrochem., 1911, **17**, 735—737.

The apparatus works on Linde's principle, with preliminary cooling by means of liquid air. It is so arranged that many experiments can be carried out in the apparatus itself, without transferring the liquefied hydrogen: to this end the liquefying chamber is closed airtight, and a special small vacuum vessel provided for the collection of the liquid. The compressed hydrogen enters by the middle tube, shown thickened in the sections of the spirals, then enters the bath of liquid air, through which it passes in a great number of windings (*b*) of very fine spiral copper tube, thence into the sheet brass vessel, (*c*) in 26 windings, where it expands, cools, and liquefies. After passing at V a valve (not shown in the figure) and expanding nearly to atmospheric pressure, it leaves, through a similar number of windings, to utilise its low temperature as far as possible, by the tube shown. The evaporated air also leaves by a third spiral tube (*d*), to utilise its cold. The axial tube with cross pieces (one to a manometer, the other fitted with a cork which will yield in case of rise of pressure through any stoppages) is of German silver, and is $2\frac{1}{2}$ cm. wide. It permits of the entry of, for example, the little apparatus shown, for specific heat determinations. The brass vessel can be separated into two halves, to allow the little vacuum vessel shown to be placed in position. With a passage of 2—3 cb. m. of hydrogen gas per hour the hourly yield of liquid is 300—400 c.c., or about 10 per cent., and the consumption of liquid air about 0·3 litre. The apparatus, when used, is first warmed, and hydrogen from a compressor or cylinder passed through till all is quite dry. Then liquid air is passed in from the vacuum vessel on the left till the brass vessel is covered, and the apparatus left to itself till the whole has reached the temperature of liquid air. Hydrogen at 150 atmospheres is now passed in, and after about 10 minutes, liquefaction begins. If needed, the hydrogen can be transferred by a siphon vacuum-tube with a gauze filter on the end to stop any accidental frozen air. Very pure hydrogen must be used; with a cylinder, it is possible to work till the pressure is reduced from 150 to 70 atmospheres—with a compressor, practically all the hydrogen can of course be utilised, whilst with a cylinder nine-tenths of it is lost. —J. T. D.



Graphite; Analysis of ——. F. Mayer. Chem.-Zeit., 1911, **35**, 1024—1025.

The quantity of graphitic carbon in commercial graphite can be accurately and conveniently ascertained by determining the calorific value of the sample. For this purpose, 0·6 grm. of the graphite is mixed thoroughly with 0·4 grm. of benzoic acid and the mixture is pressed into the form of a tablet; the latter is then placed in an asbestos capsule and the calorific value is determined in a Berthelot bomb apparatus. The addition of the benzoic acid ensures the complete combustion of the graphitic carbon. In calculating the result an allowance is made for the benzoic acid, the heat of combustion of which is 6322 calories; 1 kilo. of graphitic carbon yields 7900 calories. Should the graphite contain sulphur, a correction must be made for its quantity; the sulphuric acid resulting from the combustion of the sulphur is absorbed by the 10 c.c. of water which is placed in the bomb and is titrated at the end of the experiment, and for each c.c. of $N/10$ solution required for the titration, 7·06 calories are deducted. —W. P. S.

Report of Commission on the pollution of the rivers Wipper and Unstrut by waste liquors from potassium chloride works. Beckurts and others. *See* XIXb.

Patents.

Sulphuric acid in lead chambers; Manufacture of ——. H. Rabe. Ger. Pat. 217,561, July 24, 1909.

In order to induce or promote the double spiral motion of the gases in the chambers, in accordance with Abraham's theory, the gases are introduced horizontally or vertically in the path of travel of the two spirals (see this J., 1910, 149). The motion of the gases in the required directions is aided by injecting simultaneously cooled sulphuric acid of a lower strength than chamber acid, which has been atomised by means of gases withdrawn from a suitable part of the chamber system.—A. S.

Gases or vapours; Effecting catalytic reactions between ——. W. A. Phillips and J. G. Bulteel, London. Eng. Pat. 23,045, Oct. 5, 1910.

The gases or vapours are caused to carry the catalyst in a very fine state of subdivision through a reaction chamber and the products of the reaction are then separated from the catalyst; this is passed through a revivifying chamber, and then returned to be used over again. The process is described as applied to the production of oxides of nitrogen and nitric acid by heating air and steam in the presence of iron oxide. The reaction chamber is preferably packed with iron rods which act as baffles. The gases produced in the reaction are led through a filter packed with asbestos, and the iron oxide thus separated falls through a hot pipe where it meets a current of hot air and is revivified before it is carried again to the reaction chamber.—H. H.

Sulphate of ammonia; Process for converting sulphite of ammonia into ——. K. Burkheiser, Hamburg. Eng. Pat. 12,227, May 20, 1911. Under Int. Conv., May 21, 1910.

Ammonium sulphite is oxidised by means of air, and the ammonium sulphate produced is separated from unchanged sulphite by subliming the latter. The sulphite, or a mixture of this and sulphate, is charged into a tubular body, which is fitted with a longitudinal screw conveyor and is provided with a cooling jacket at the end nearest the charging hopper and a heating jacket at the other end. A current of air is sucked through the apparatus, in the opposite direction to the moving material, and carries the vaporised sulphite to the cool end, where it is condensed and collected by the conveyor, to be continuously returned to the air current for renewed oxidation, the ammonium sulphate being discharged at the heated end of the apparatus. Any sulphite carried off by the air current is retained in a tank of liquid through which the air finally passes. In an alternative apparatus, the charging hopper is placed centrally between the cooled and heated parts of the tubular body, and the conveyor is fitted with right and left handed spirals, so that, instead of complete oxidation being effected, the condensed sulphite is carried away from the sulphate to the liquor tank and is mixed with the mother lye.—F. Sodn.

Ammonium sulphate; Process of manufacture of ——. Soc. Industr. de Prod. Chimiques. First Addition, dated June 24, 1910, to Fr. Pat. 427,065, May 18, 1910 (this J., 1911, 1057).

The use of concentrated solutions is specified.—F. Sodn.

Sal-ammoniac [galvanisers'] skimmings; Treatment of ——. G. Rigg, Palmerton, Pa. U.S. Pat. 1,002,317, Sept. 5, 1911.

Sal-ammoniac skimmings are treated for the recovery of the chlorides and the production of a residue suitable for the making of spelter by heating to a temperature above the boiling point of zinc chloride, so as to volatilise the zinc and ammonium chlorides. The zinc chloride is condensed to the liquid state by receiving the vapours in a condenser which is maintained at a temperature above the melting point and below the boiling point of zinc chloride (but preferably nearer the latter) and above the condensing point of ammonium chloride, the vapours being kept out of contact with moist air and products of combustion. The ammonium chloride fumes are recovered by absorption.—F. Sodn.

Calcium cyanamide; Apparatus for producing ——. F. S. Washburn, Nashville, Tenn., Assignor to American Cyanamid Co., Baltimore, Md. U.S. Pat. 999,071, July 25, 1911.

The retort, in which the reaction is effected, is provided with an inner foraminous vessel (preferably of wire cloth), provided with a central passage, also of perforated material. This inner vessel holds the carbide; it is lined with corrugated paper or other combustible material to prevent the substance, which should be finely divided, from passing through the walls, and is supported on brackets so as to maintain a space (into which nitrogen is admitted) between it and the retort wall. The carbide is heated by a resistance or other suitable means. Free circulation of the nitrogen is assured, and a more uniform product, in larger yield than heretofore, is said to be obtained.
—F. Sodn.

Calcium nitrate; Process of transformation of sodium [or potassium] nitrate into ——. J. Braunschild and B. Chapiro. Fr. Pat. 428,014, June 11, 1910.

Sodium nitrate solution is treated with ammonium carbonate (or ammonia) and carbonic acid, or with ammonium bicarbonate, so as to produce ammonium nitrate solution and a deposit of sodium bicarbonate, and the ammonium nitrate is treated with lime or calcium carbonate, thus forming calcium nitrate solution, which is concentrated, and ammonia or ammonium carbonate, which is used again. In the first part of the process, some sodium nitrate remains undecomposed, and this may either be removed by crystallisation, before the treatment with lime, or be allowed to remain, so as to give finally a mixture of sodium and calcium nitrates, which is claimed as a manure. Claim is also made for a product containing, in addition, ammonium phosphate or sulphate produced by neutralising any ammonia not driven off.—F. Sodn.

Oxalates; Manufacture of ——. C. Ellis, Larchmont, N.Y., Assignor to Ligno Chem. Co., New York. U.S. Pat. 1,001,937, Aug. 29, 1911.

A mixture of alkali and woody fibre constituents or other oxalate-forming materials is maintained at the temperature required for the formation of oxalate until conversion is complete, preferably by passing the mixture in a continuous layer through a heated zone or succession of zones at appropriate temperatures, and, whilst preventing free access of air, allowing regulated jets of air or oxygen to impinge upon portions of the stream of material. Moisture may be supplied during the heating.—F. Sodn.

Calcium metaphosphate or pyrophosphate and ammonia; Process of producing ——. F. W. Frerichs, St. Louis, Mo. U.S. Pats. 1,002,143 and 1,002,198, Aug. 29, 1911.

A mixture of calcium phosphate (1 mol.) and ammonium sulphate (2 mols or 1 mol.) is roasted at a temperature which is gradually raised from the normal to above 650° F., until most of the ammonia has been liberated and most of the calcium phosphate has been converted into metaphosphate or pyrophosphate respectively.—F. Sodn.

Phosphate rock; Apparatus for washing and recovering fines from ——. H. D. Ruhm, Assignor to Ruhm Phosphate Mining Co., Mountpleasant, Tenn. U.S. Pat. 1,002,182, Aug. 29, 1911.

The apparatus comprises a crusher, a screening device, a dryer, and a "hydraulic classifier," and also means for delivering coarse material from the screen to the dryer and the fines to the classifier, and for returning the heavier material from the latter to the coarse material from the screen in the dryer.—F. Sodn.

Phosphate rock; Method of treating ——. C. N. Meriwether, Trenton, Ky. U.S. Pat. 1,002,297, Sept. 5, 1911.

A pulverised mixture of rock and basic iron oxide (*e.g.*, iron ore or a mixture of ore and iron) is heated to a temperature below the fusion point, the mixture being preferably agitated. The phosphoric acid is thus rendered soluble.
—F. Sodn.

Oxidation of nitrogen; Electrical ——. C. Ellis, Montclair, N.J., Assignor to Ellis-Foster Co. U.S. Pat. 1,002,249, Sept. 5, 1911.

A current of oxygen and nitrogen (air, for instance), preferably preheated and of constant moisture content, is passed concentrically about, and in a plane or planes substantially at right angles to, the normal axis of an elongated electric arc, which is magnetically deviated, so as to revolve in the gaseous current at a speed slightly less than that of the current.—F. Sodn.

Peroxides of the alkaline earth metals; Process of manufacture of ——. F. Bergius. Fr. Pat. 427,866, March 29, 1911. Under Int. Conv., April 18, 1910.

An alkaline earth oxide (such as barium oxide) is dissolved in fused sodium hydroxide or other suitable indifferent solvent and heated in a current of air or oxygen until completely oxidised. The peroxide is then isolated by dissolving away the solvent with an inert liquid, such as alcohol, which may be recovered by distillation. In some

cases (*e.g.*, with calcium), it is preferable to use compressed oxygen, in order to prevent dissociation of the peroxide.
—F. Sodn.

Sodium perborate from borax; Process for preparing —— by aid of hydrogen peroxide. Konsort. f. Elektrochem. Ind. G. m. b. H. Ger. Pat. 237,608, June 29, 1910.

When hydrogen peroxide is added to a solution containing borax and sodium carbonate, carbon dioxide is evolved and sodium perborate separates slowly, in the form of large crystals. The reaction may be carried out by adding solid borax and solid sodium carbonate to hydrogen peroxide solution.—T. F. B.

Oxyhalogen compounds; Process for the electrolytic production of ——. Centralstelle für Wissenschaftlich-technische Untersuch., Ges. m. b. H. Fr. Pat. 428,529, Feb. 17, 1911.

The tendency for the electrolyte to become alkaline during the electrolytic production of oxyhalogen compounds is overcome by carrying out the process in a closed cell and passing the evolved gases through a substance which absorbs chlorine and readily parts with it again, this substance (preferably carbon tetrachloride) being contained in a vessel which communicates also with the lower part of the electrolytic cell, so that a layer of the substance is formed below the electrolyte, from which the dissolved chlorine passes by diffusion back into the electrolyte again. The auxiliary vessel is provided with a cooling jacket and, if necessary, a reflux condenser. A neutral saturated solution of sodium chloride, containing 0·2 per cent. of chromate, may serve as the electrolyte, 20—30 per cent. by volume of carbon tetrachloride, saturated with chlorine, being added; the current yield, down to 0·5 per cent. of chloride, is approximately theoretical.—F. Sodn.

Alkali hydrosulphites; Process for preparing solid ——. H. Schulze. Ger. Pat. 237,449, Sept. 18, 1909.

When strongly cooled solutions of magnesium hydrosulphite and alkali chloride are mixed together, in the molecular proportion of two to one, solid alkali hydrosulphite separates. If the proportion of alkali chloride is raised above this limit, a double compound is produced.
—T. F. B.

Halogen-oxygen compounds; Method of producing —— by electrolysis. M. Pier, Schlachtensee, Germany, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 998,982, July 25, 1911.

See Fr. Pat. 428,529; preceding.—F. Sodn.

Emery ore; Method of treating ——. F. J. Tone, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 1,002,608, Sept. 5, 1911.

See Fr. Pat. 416,643 of 1910; this J., 1910, 1464.—T. F. B.

Aluminium nitride; Process for making ——. O. Serpek. Fr. Pat. 427,109, May 19, 1910.

See Eng. Pat. 13,086 of 1910; this J., 1911, 421.—T. F. B.

Nitric oxide [and nitrogen peroxide]; Process for producing pure ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 428,657, April 18, 1911. Under Int. Conv., Oct. 31, 1910.

See Eng. Pat. 10,522 of 1911; this J., 1911, 955.—T. F. B.

Extraction of sulphur from purifying materials used in gas manufacture and from other waste products. Fr. Pat. 427,892. *See* IIa.

Producing sulphur dioxide [and Portland cement] by decomposition of plaster. Fr. Pat. 428,019. *See* IX.

VIII.—GLASS; CERAMICS.

Silicate melts; Determination of the absolute value of the viscosity of ——. C. Doelter and H. Sirk. Monatsh. Chem., 1911, **32**, 643—653.

The material used for experiment was an artificial reproduction of an American diopside of the composition: silica, 52·79; alumina, 1·45; ferric oxide, 0·62; ferrous oxide, 5·02; lime, 24·91; magnesia, 16·09 per cent. The melt was slowly cooled and crystals of 2—3 mm. were obtained, with $C\gamma=38^\circ$, as in diopside. No glass was present in the melt. The method used was founded on that of K. Arndt in determining the viscosity of borates and phosphates and their mixtures (Z. Elektrochem., 1907, **13**, 578). It depends on the fall of a suspended platinum ball through the melt. The viscosities found were as follows, in C.G.S. units—

Temperature	1300° C.	1295° C.	1290° C.	1282° C.	1280° C
Viscosity	33	39	77	106	106

The experiments are being extended to lower temperatures, as it appears there is an extraordinary increase of viscosity between 1220° and 1240° C. which may be due to contact with the platinum.—H. H. S.

Glasses; Surface tension of molten ——. E. W. Tillotson, jun. J. Ind. Eng. Chem., 1911, **3**, 631—637.

The method used by the author is an adaptation of that of Quincke, a fibre of the glass being lowered vertically into a horizontal blast-flame and the weight of the drops which fall determined. It was found that the weight of the drop can be calculated by means of the formula: $W=\alpha D+\beta D^2$, where D is the diameter of the fibre in mm., W is the weight of the drop in mgrms., and α and β are constants varying respectively with the surface tension and the cohesion of the glass. The surface tension in dynes per cm. (T) may be calculated by means of the formula $T=\frac{9{\cdot}8\alpha}{\pi}$. Results obtained with a number of silicate and borate glasses are given in curve-diagrams and tables. In the case of the silicate glasses, the surface tension does not vary very greatly for glasses of different composition; it appears to increase with the silica content and to be decreased by lead and boric oxides. The borate glasses have a lower surface tension than silicate glasses, and the curve representing the surface tension of lead borate glasses as a function of their composition has breaks at points corresponding with the different lead borates.—A. S.

Recent determinations of melting points of minerals by the gas thermometer. Day and Sosman. *See* VII.

Patents.

Silica glass; Manufacture of ——. H. A. Kent, Bounds Green, Assignor to The Silica Synd., Ltd., London. U.S. Pat. 1,003,271, Sept. 12, 1911.

See Eng. Pat. 10,930 of 1910; this J., 1910, 1382.—T. F. B.

Mica sheets; Apparatus for preparing ——. M. Meirowsky, Cologne-Lindenthal, Germany. U.S. Pat. 1,003,368, Sept. 12, 1911.

See Eng. Pat. 3874 of 1911; this J., 1911, 805.—T. F. B.

IX.—BUILDING MATERIALS.

Patents.

Roads; Processes and compositions for making ——. E. A. Paterson, Port Arthur, Canada. Eng. Pat. 2984, Feb. 6, 1911.

A mixture of calcium sucrate and alkali silicate, in proportion to form calcium silicate, is added, preferably in solution, to limestone or a combination of limestone and a stone containing aluminium phosphate, so as to make a binding agent for use in the construction of roads, or for making paving blocks, or, in conjunction with a bituminous compound, for imparting smoothness and elasticity to a road surface.—F. SODN.

Sulphur dioxide [and Portland cement]; Process of producing —— by decomposition of plaster [calcium sulphate]. L. P. Basset. Fr. Pat. 428,019, June 11, 1910.

A MIXTURE of calcium sulphate and clay, in such proportions as to give sulphur dioxide and a residue of Portland cement, is heated to bright redness, the decomposition being facilitated, if desired, by adding sufficient carbon to convert a quarter of the sulphate into sulphide which then reacts with the remaining sulphate. Other substances may be added to the mixture to impart special qualities to the cement. The waste heat is utilised in drying the materials. —F. SODN.

Cement and concrete products; Manufacture of ——. J. M. Rauhoff, Chicago, U.S.A. Eng. Pat. 27,130, Nov. 22, 1910.

SEE Fr. Pat. 422,857 of 1910; this J., 1911, 688.—T. F. B.

Portland or other cement; Manufacture of ——. T. Holden. Fr. Pat. 428,457, April 13, 1911.

SEE Eng. Pat. 4358 of 1910; this J., 1911, 544.—T. F. B.

Calcining furnaces [for plaster] and the like. W. A. Bishop and C. Tomkins, Newark, N.J., U.S.A. Eng. Pat. 5710, March 7, 1911.

SEE U.S. Pat. 986,350 of 1911; this J., 1911, 426.—T. F. B.

Wood, such as telegraph posts; Process for impregnating ——. S. Haltenberger and E. Berdenich. Fr. Pat. 428,347, April 10, 1911. Under Int. Conv., Aug. 11, 1910.

SEE Eng. Pat. 24,483 of 1910; this J., 1911, 285.—T. F. B.

Method of working tunnel kilns for burning bricks of ore, clay, and the like. Eng. Pat. 20,247. *See* I.

Waterproofing composition for porous substances. Eng. Pat. 19,714. *See* IIA.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Ferromanganese; Melting of —— and de-oxidation [of steel] by means of molten ferromanganese. J. Bronn and W. Schemmann. Stahl u. Eisen, 1911, 31, 1375—1376.

THE use of molten ferromanganese is attended with many advantages, notably a considerable saving of manganese. These advantages have, however, been more than counterbalanced by the loss of manganese by volatilisation when ferromanganese is melted in cupola, reverberatory, or ordinary arc electric furnaces. With a special furnace constructed to permit the use of arcs of low potential difference (between the electrode and metal bath), however, ferromanganese can be heated considerably above its melting point without loss of manganese (see following abstract). Satisfactory results have also been obtained with a small Röchling-Rodenhauser induction furnace. The molten ferromanganese is added to the steel as it is being poured from the converter into the casting ladle, and is distributed so uniformly that no difference in manganese content could be detected in the first and last castings from a charge of 23 tons; only about 35 per cent. of the usual amount of manganese is required.—A. S.

Ferromanganese; Remelting in the electric furnace and the use of liquid ——. F. Schroeder. Stahl u. Eisen, 1911, 31, 1457—1462. (See preceding abstract.)

A SECTIONAL diagram with the details of an electric furnace in which the ferro-manganese is melted is given. The charge is kept melted by the use of a low potential current and is withdrawn as required. The original alloy contained an average of 80·29 per cent. of manganese and when melted contained 80·22 per cent. as a mean of thirty-seven analyses, showing that there was no loss of manganese by volatilisation. The quality of the steel was greatly improved owing to the better incorporation of the alloy, and a table is given showing the economy experienced in its use.—A. H. C.

Iron and steel; The marked influence of copper in ——, on the acid corrosion test. W. H. Walker. Met. and Chem. Eng., 1911, **9**, 453.

THE rate at which iron or steel is attacked by acid is no criterion as to its purity, since the commercial metal frequently contains small quantities of copper which, as Breuil has shown (J. Iron and Steel Inst., 1907), greatly reduces its tendency to dissolve. In the examination of a number of specially prepared samples, to some of which about 0·2 per cent. of copper was added during manufacture, the test-pieces were subjected to the action of 20 per cent. sulphuric acid for 3 hours. It was found that whereas the loss on each of the copper-free specimens was about 0·22 grm., the amount dissolved from those containing copper varied between 0·0095 and 0·0075 grm. —W. E. F. P.

Carbon in steel; Determination of —— by combustion under pressure. P. Mahler and E. Goutal. Comptes rend., 1911, **155**, 549—551.

THE metal is burnt in oxygen under pressure in a bomb of one litre capacity. The bomb is not enamelled, but a porcelain vessel may be placed within when it is desired to collect any products of combustion (*e.g.*, sulphuric acid). The sample is placed in a small capsule of refractory earth, free from calcium carbonate, and suspended by copper wires. Ignition is effected by passing an electric current through a very fine iron wire. The cover carries the electrode and two needle valves; one of the latter is connected with a copper tube extending nearly to the bottom of the combustion chamber. The apparatus is completed by tubes for the rapid absorption of the gases. The carbon dioxide is absorbed by a known volume of barium hydroxide solution whose strength is determined before and after absorption by titration with standard oxalic acid and phenolphtalein. For silicon steel, nickel steel and extra hard steel the authors recommend admixture of the metal with an equal weight of litharge to ensure complete combustion. From thirteen examples of results by this method, compared with the works' assays, it appears that agreement is quite satisfactory, the authors' results being somewhat higher in the case of special steels. The advantages claimed for this method are that skilled attention is reduced to a minimum and that large quantities may be taken for assay.—B. M. V.

Manganese in vanadium- and chrome-vanadium steels; Determination of ——. J. R. Cain. J. Ind. Eng. Chem., 1911, 3, 630—631.

ONE or two grams of the steel are dissolved in sulphuric acid (10 per cent. by vol.), and the chromium and vanadium are precipitated by cadmium carbonate as described previously (this J., 1911, 958). The filtrate is treated with 25 c.c. of concentrated nitric acid, boiled until nitrous fumes are no longer evolved, cooled, and the manganese determined by the bismuthate method. The process is preferable to that of Watters (this J., 1911, 689) for steels containing vanadium. The bismuthate method gives high results for manganese when performed with a solution containing chromium or vanadium.—A. S.

Ferro-boron; Analysis of ——. R. S. Davis. Met. and Chem. Eng., 1911, **9**, 459.

FOR the determination of the boron, manganese and iron, 0·5 grm. of the powdered sample is fused with a mixture of potassium nitrate and sodium carbonate in a platinum crucible; the melt is boiled with just enough water to effect disintegration, a little sodium peroxide is added during the boiling to precipitate the manganese, and the mixture is then filtered. The filtrate, containing the boron, is acidified with hydrochloric acid, a moderate excess of calcium carbonate is added and the mixture boiled for 10 min. (under a reflux condenser) to expel all carbon dioxide. After filtration, the liquid is cooled to room temperature and titrated to a pink colour with $N/10$ sodium hydroxide and phenolphthalein. 1 grm. of mannitol is then added and the titration with the alkali is continued until a permanent pink tint—unaffected by any further addition of mannitol—is produced. 1 c.c. of $N/10$ sodium hydroxide is equivalent to 0·0011 grm. of boron. Iron and manganese, the latter by the bismuthate method, are determined in the insoluble residue from the fusion. Silica and carbon are determined in separate portions of the sample by the usual methods.—W. E. F. P.

[*Gold*]. *Cyanide process; The counter-current method of continuous agitation, decantation and dilution applied to the* ——. J. E. Rothwell. Met. and Chem. Eng., 1911, **9**, 439—441.

In the counter-current system of continuous treatment, the solvent lowest in metal value and highest in free cyanide is applied to ore from which the bulk of the gold has already been extracted, and is then used for successive ore charges of gradually increasing gold content until, finally, the highest grade of solution is in contact with the ore at its maximum value. The solution is then separated and passed to the precipitation apparatus from which the barren solvent is returned to the mill system to be again gradually brought to a point approaching saturation by the same cycle of operations. As compared with the present method of operation, the chief advantages claimed for the new system are as follow:—(1) The dissolved values are recovered at the point farthest removed from the discharge of the tailings, thus rendering it impossible for values to be lost by imperfect washing. (2) Although the amount of solution carried in the circuit is less than in the present method, any unit of ore is in contact with a larger volume of solution. (3) A minimum of solution of constant maximum value is sent to the precipitation department, thus obviating the necessity for two or more circuits for precipitation purposes. (4) There is no accumulation of solutions from which the values have to be precipitated and the liquid thrown away. (5) For a given tonnage capacity the equipment, and the power required for its operation, are smaller than at present. (6) The whole system is controlled from a central point at which the exact flow at all times is registered and recorded. (7) Efficient chemical control is easily possible. (8) The labour required is reduced to a minimum.
—W. E. F. P.

[*Gold*] *Slime; Experiments in the treatment of accumulated ore* —— *by air-lift agitation.* J. E. R. Adendorff. J. Chem., Met., and Min. Soc., South Africa, 1911, **12**, 6—13.

Accumulated acid ore slime consumes more cyanide than neutral slime, and the residue contains more gold. The experiments described were intended to determine the best method of treating such slimes. The chief cyanicides met with are free sulphuric acid and partly oxidised iron-sulphur compounds. During treatment the latter absorb a large amount of oxygen, and interfere with the solution of the gold. Experiments were made, both by bottle tests and by aeration tests in a small "Brown" or Pachuca vat, to determine the influence of varying alkalinity, the action of lead acetate, and the strength of the cyanide solution. The results, which are given in the form of tables and diagrams, tend to show that success in treating accumulated acid ore slime depends on maintaining a high alkalinity during the first three hours of aeration. Lime should be added to the slime before treating with cyanide solution. The addition of lead acetate tends to improve the extraction. The oxidation and neutralisation of the cyanicides in the slime is essential. During the discussion it was pointed out that accumulated slime should receive a preliminary aeration in alkaline water before the addition of cyanide.—R. W. N.

[*Gold.*] *Mill concentrate; Notes on the treatment of* ——. R. Lindsay. J. Chem., Met., and Min. Soc., South Africa, 1911, **12**, 2—6.

The refractory and varying nature of mill concentrate has been the cause of the varied methods of treatment adopted at different mills. The present paper describes, with the aid of a flow-diagram, the procedure adopted at the Geldenhuis Deep. The concentrate treated here results from the daily scrape from three mills, and the big barrel residues. It is ground in barrels, and cleaned over a copper plate in the usual way. The coarser portion is then passed through a tube-mill, after which it flows into a "batea" which acts as an effective trap, mercury and amalgam being caught by it. The finely-ground material is then cyanided in a Crosse tank which has been adapted for the purpose. The gold goes rapidly into solution, as the material is very fine (90 per cent.—200-mesh), and a charge assaying 250 dwt. of fine gold per ton is reduced to under 30 dwt. after one hour's agitation. The usual practice is to aerate for 12 hours, before washing with 0·02 per cent. cyanide solution. After this latter has acted for 12 hours the undissolved gold in the concentrate is down to 6 dwt. per ton, while the cyanide solution has a gold value of 56 dwt. per ton. Washing with simultaneous decantation on the Crosse principle is then proceeded with, requiring 12 hours. At the end of the treatment the concentrate residue assays 4 dwt. per ton, and the solution 0·08 dwt. per ton. The cyanide consumption is 2·75 lb. of 120 per cent. cyanide. This high figure is due to the refractory nature of the material treated. The air consumption is 7 cb. ft. per minute. The cost per ton is 26s., but this could be reduced considerably: through having to utilise existing appliances the transport expenses are unduly high.—R. W. N.

[*Gold.*] *Zinc-dust precipitation.* C. W. Merrill. Eng. and Min. J., 1911, **92**, 407.

The use of zinc-dust as a precipitant for the preciou metals is increasing. Most of the recent mills in Mexico are equipped with the Merrill process, and five installation are either at work or in course of construction in South Africa. Figures are quoted which show that the consumption of zinc is lower and the grade of precipitate higher when using zinc-dust than when using zinc shavings Contact with the atmosphere is avoided, and this condition is maintained until the precipitate has been separated from the solution. A minimum consumption of chemicals is ensured, the time of contact between the zinc-dust and the cyanide solution being kept as short as is consistent with efficient precipitation. The chances of loss of precipitate are much lessened, the product being collected in a heavy filter-press. All of the precipitated metals in the mill can at any time be converted into bullion, whereas with the shavings process much is carried over in the boxes, and an accurate check is impossible.—R. W. N.

Blast-furnace smelting with oil. E. Jacobs. Eng. and Min. J., 1911, **92**, 434.

Quoting from a report by T. Kiddie, the author gives the results of a trial smelting of copper ore in a blast-furnace using oil as fuel. The ore was obtained from the Boundary District, British Columbia, and the flux was composed of iron ore mixed with the slag from a previous operation. The rate of smelting being 110 tons per 24 hours, the average consumption of oil was 14·6 galls. per ton of material smelted—a cost for oil of 43·8 cents per ton of ore.—W. E. F. P.

Brass foundry products; Corrosion of ——. W. Vaughan. Trans. Amer. Brass Founders' Assoc., 1911, **5**, 18—31.

Reference is made to the investigations of B. E. Curry (this J., 1906, 1104), A. T. Lincoln (this J., 1908, 167 and 946) and W. S. Rowland (this J., 1908, 410) upon the electrolytic corrosion of various copper alloys (brasses and bronzes) in solutions of sodium sulphate, sodium nitrate and sodium chloride; and some of the results obtained by these workers are summarised and compared. In an investigation by the author upon the corrosion of condenser tubes, nine different kinds of tubes—25 of each kind—were installed in a surface condenser employing salt water for cooling purposes; the other tubes of the condenser, some 3400 in number, were composed of "Admiralty metal" (untinned) containing 70 per cent. of copper, 29 of zinc and 1 of tin. The tubes installed were of the following percentage compositions: (1) "Admiralty metal," tinned; (2) Copper 60 and zinc 40, untinned; (3) Like (2) but tinned with pure tin; (4) Like (2) but "tinned" with a mixture of 2 parts of tin and 1 of lead; (5) Pure copper, untinned: (6) Pure copper, tinned; (7) Copper 85 and nickel 15; (8) Copper 66 and zinc 33, untinned; (9) Like (8) but tinned. At the conclusion of the trial it was found that the tubes which failed comprised one of class (1), all of classes (5) and (6), and four of class (9), none of classes (2), (3), (4), (7) or (8) being affected. In all cases the failure was occasioned by severe pitting and the formation of grooves along the length of the tubes, which were also found to be perforated in many instances. The "Admiralty metal" was found to resist corrosion better than the other brasses; and the high percentage of failures with tinned tubes was attributed to electrolytic action between the metal of the tube and the tin coating at places where the latter was defective. These results are in general agreement with those obtained by Curry, Lincoln and Rowland, and the author considers that accurate indications of the relative corrosion of copper alloys are afforded by the electrolytic corrosion method of testing in the laboratory.—W. E. F. P.

Brass ; Corrosion of —— with special reference to condenser tubes. P. T. Brühl. Inst. of Metals, Sept., 1911. [Advance proof.]

Four classes of corrosion of brass may be considered to take place:—I. *Corrosion proper*, the metal being uniformly removed over the whole surface. II. *Dezincification*, the metal becoming locally rich in copper; this is usually only superficial. III. *Pitting*, due to galvanic action between the deposit on, and the metal of, the tube; this is the most serious form of corrosion. IV. *Erosion*, due to the stream of water; this is small and usually uniform. From experiments with plates of brass in sea water it was found that the effect of a high temperature of annealing, of quenching and of rolling was to increase the rate of corrosion, which was also the effect of increased temperature of the sea water, of bubbling air through the water, of the addition of (separately) 0·5 per cent. of ammonia or of hydrochloric acid, while the addition of 0·5 per cent. of caustic potash reduced the rate of corrosion. In the case of brass with a finely crystalline structure (annealed at 700° C. for 10 mins.) as compared with one with a coarse structure (annealed for 3 hours), and of Muntz metal compared with copper, the rate of corrosion was at first more rapid with the former, but later with the latter respectively, and the reasons for this behaviour are discussed. Bilge water or water containing decaying organic matter such as sewage or swamp water has a very corrosive effect. The corrosion due to the use of other than a pure mineral oil for engine lubrication would be irregular as the oil would condense on the tubes in globules. The author found some slight differences of potential along the length of condenser tubes, but insufficient to account for any corrosion more than a more or less uniform one, but there is no doubt that stray currents from external sources sometimes do damage which might be avoided by connecting the circulating water inlet and outlet, the air-pump suction and the condenser tube plates by a large uninsulated cable in order to "short-circuit" the condenser. By means of a potentiometer certain corrosion products were arranged in the electrochemical scale, the electrolyte being sea water, viz.:—Brass, zinc oxide, zinc oxychloride, iron oxide, cuprous oxide, cupric oxide, iron hydroxide, basic zinc carbonate, coke, basic copper carbonate, tin oxide. With regard to pitting, the author considers that one cause is the presence of mechanical defects such as "spills" which, when the condenser is out of use, allow a pool of water to remain on the tube to which air has free access. Another cause is the presence of certain substances (*e.g.* ferric hydroxide and carbon) strongly electronegative to brass, and on account of the harmful action of ferric hydroxide the author recommends that the inlet pipe and condenser covers be made of brass. For the prevention of corrosion the author discusses several surface coatings but does not consider any of them of economic importance. The aim of future investigation should rather be directed to finding alloys of brass and one or more other metals possessing inherently the necessary mechanical and incorrodible properties. The protective action of the 1 per cent. of tin usually specified by the Admiralty seems to be due to the inert character of the tin oxide produced. Some experiments were made to study the influence of lead, tin, aluminium and nickel on brass, the proportion of copper to zinc being kept at about 75 : 25; it was found that nickel and small quantities of lead are injurious; tin up to 1 per cent., large quantities of lead, and aluminium are useful in diminishing corrosion, aluminium especially so. The author has confirmed the assertion of Cohen and others that the presence of both oxygen and carbon dioxide is necessary for corrosion to take place.—B. M. V.

Copper and tin alloys ; Volume changes in ——. J. L. Haughton and T. Turner. Inst. of Metals, September, 1911. [Advance proof.]

Copper containing 0·004 per cent. of lead, 0·023 of iron, and neither tin, antimony, nor sulphur, and tin containing 99·9 per cent. of tin were used to prepare a series of thirty-five alloys ranging in steps of about five per cent., with some special intermediate ones. The alloys were cast in T-shaped sand moulds with suitable pins, one of which was fastened to the moulding box and the other to an extensometer. A thermo-couple was inserted at the head of the casting and by means of a special chronographic arrangement simultaneous readings of the pyrometer and the extensometer by one observer were rendered possible. A curve showing the volume and temperature changes of the alloys during solidification and while cooling is given. The expansion curve and crystallisation intervals are plotted on one diagram and show a close relationship, the nature of which is stated not to be at all clear, at about ten, forty, and sixty per cent. of tin, while a marked divergence exists for alloys lying between twenty-five and thirty-five per cent. of tin, there being a very marked maximum in the volume change at thirty per cent. of tin. The volume changes of the solid alloys in relation to the equilibrium diagram are also discussed. A curve of the specific gravities of the alloys is given, and the hardness curve as determined by the sclerescope is shown not to agree with the theory of Kurnakow aud Schemtchusny (this J., 1909, 93). Six microphotographs illustrate the paper and a bibliography is given. The following method was used in the analysis of the alloys:—0·5 grm. of the finely powdered alloy was treated with 5 c.c. of bromine and then 20 c.c. of water were added. After gently warming, the solution was diluted to 50 c.c. and then boiled on a water-bath until all the bromine was expelled and the tin precipitated. The precipitate was collected, dried and weighed as stannic oxide after ignition. The filtrate after boiling down to a small bulk was neutralised and titrated with sodium thiosulphate and potassium iodide for the copper. This method was found necessary owing to the insolubility of many of the alloys in nitric acid.—A. H. C.

Electric tin smelting. J. Härdén. Met. and Chem. Eng., 1911, **9**, 453—457.

Preliminary tests on 20 lb. charges of ore having shown the feasibility of the economic production of tin by electric smelting, further trials on a commercial scale were conducted in a shaft furnace of special design and employing an alternating current. No direct arc was allowed to be formed as this caused great variations in the working of the furnace and in the yield of metal. The charge formed a conical heap in the hearth, covering the reacting zone and permitting the water-jacketed carbon electrodes

to "burn free," thereby producing round the ends of the latter a small space filled with incandescent gas which acted as a resistance and in which the reaction took place. Precautions were taken to prevent the escape of volatilised metal, and only about 0·5 per cent., or less, of tin was lost in this manner; while tap holes were provided at different levels for discharging metal and slag separately. At the commencement of a campaign, which usually occupied 10—12 days, a charge of about 14 kilos. of culm for each 100 kilos. of ore was gradually fed into the preheated furnace, while a current of about 1000 amp. per phase at 60 volts was turned on. As the reaction proceeded the current was gradually altered to the working condition of 2500 amp. at 40 volts, which was steadily maintained during the whole run. The first tapping of metal was made 30 minutes after charging, the first slag being drawn about 90 minutes later. At regular intervals reagents were added with the object of preventing the formation of "hard-head" by causing the sulphides and arsenides of iron to combine with the slag. With suitably blended ores it was found that the metal issuing from the tap hole contained about 98 per cent. of tin; in one campaign of 10 days, during which only Bolivian ore containing 49·5 per cent. of tin and about 15 of iron was smelted, a total yield of 92 per cent. of the tin in the ore was obtained, and on some days the yield reached 97 per cent. The refining of the metal was conducted in large iron pots heated from below and from the sides, air being blown through by means of an air-pump to which a perforated iron pipe was attached; metal of 99·75 per cent. purity was thus obtained. As regards output, power consumption and loss in slag, it was found that a slag containing as little as 0·25 per cent. of tin could easily be produced; but as the output of tin was then only 6 to 8 cwt. per day and the power consumption 3000 kilowatt-hours per ton of metal, the production of such slag was not economical. On the other hand the furnace could be so operated as to increase the output to 1 ton 11 cwt. per day with a power consumption of 1300 kilowatt hours per ton of metal; but the slag produced then contained 17—19 per cent. of tin. Only one furnace being available, it was found most economical to operate the furnace so as to obtain a yield of 96 to 98 per cent. of the metal in the ore, and the power consumption was consequently high. In a typical run extending over 8 days, during which nearly 10 tons of 57 per cent. ore were treated, the net yield of metal was 98·75 per cent., while the power consumption and the electrode consumption were respectively 2220 kilowatt hours, and 28 lb., per ton of metal produced. The author concludes that a considerable saving in tin can be effected by means of electric smelting, and is of opinion that, with two furnaces of suitable capacity working in series, the first producing metal continuously and rapidly and the second receiving the rich molten slag from the first (for the production of solder by treatment with lead ore), the power consumption should not exceed 1400 kilowatt-hours per ton of tin obtained.
—W. E. F. P.

White metal; Rapid and accurate method for the analysis of ——. J. C. Beneker. J. Ind. Eng. Chem., 1911, **3**, 637—638.

0·5 grm. of fine drillings is dissolved in a mixture of 25 c.c. of hydrochloric acid and 5 c.c. of nitric acid (or 25 c.c. of hydrochloric acid saturated with bromine), the solution is heated on the water-bath, and 1 grm. of tartaric acid added. After diluting with hot water to 400 c.c., excess of caustic soda solution is added, followed by excess (about 20 c.c.) of a 10 per cent. solution of sodium sulphide, made by adding a 10 per cent. solution of sodium hydroxide to an equal volume of the same solution which has been saturated with hydrogen sulphide (see Rössing, this J., 1902, 191). The precipitate is washed twice by decantation and several times on the filter with a hot dilute solution of sodium sulphide. The residue consists of the sulphides of copper, lead, iron, and zinc: the lead is determined as sulphate and the other metals as usual. The filtrate, containing tin and antimony, is treated with a slight excess of hydrochloric acid, and warmed on the water-bath for 1 hour. The precipitate is filtered off, washed, and the paper and precipitate treated in an Erlenmeyer flask with a measured excess of $N/10$ iodine solution, 30—50 c.c. of concentrated hydrochloric acid, and 2 grms. of tartaric acid. The flask is fitted with a rubber stopper carrying a small swan-neck thistle-tube to condense any iodine vapours, and the contents are heated nearly to boiling for a few minutes, whereby the tin is converted into stannic iodide and the antimony into the tri-iodide. After cooling, the excess of iodine is titrated with thiosulphate; the iodine consumed corresponds to the tin plus antimony. The solution is now neutralised with sodium carbonate, excess of powdered sodium bicarbonate added, and the antimony determined by Mohr's method (titration with $N/10$ iodine solution). If the volume of iodine solution used be multiplied by 3/2 and the product deducted from the volume of iodine solution consumed in the previous operation, the volume of iodine solution corresponding with the tin is obtained.—A. S.

Lead; Bichromate-iodide method for ——. R. T. Wilder. Eng. and Min. J., 1911, **92**, 390.

The following modification of Low's method (this J., 1896, 280), gives good results, and was devised to obviate the errors caused by the presence of calcium sulphate or salts of iron. The washed sulphate precipitate from 0·5 grm. of ore is dissolved in 50 c.c. of water containing a few grams of sodium acetate and 1 c.c. of acetic acid. After warming to dissolve the lead sulphate, an excess of standard bichromate solution is run in from a burette and the whole made up to 200 c.c. After filtering (three filter-papers folded as one are necessary), 100 c.c. of the filtrate are treated with a few c.c. of sulphuric acid and a slight excess of potassium iodide, and the titration with standard thiosulphate carried out in the usual manner, with starch as an indicator.
—R. W. N.

Wulfenite [*lead molybdate*] *ores; Analysis of* ——. R. S. Davis. Met. and Chem. Eng., 1911, **9**, 458—459.

The following method was devised for the analysis of the wulfenite ores of the South-western States and Mexico, which usually contain tungsten and vanadium in addition to the normal constituents. For the determination of *lead, molybdenum* and *vanadium*, 1 grm. of the sample is heated with 10 c.c. of hydrochloric acid and 5 c.c. of nitric acid, 10 c.c. of sulphuric acid being then added and the mixture evaporated till sulphuric anhydride fumes appear. After cooling, diluting, boiling and filtering, the insoluble residue is treated with hot ammonium acetate to dissolve the lead sulphate, which is then titrated with standard ammonium molybdate. Into the original filtrate, contained in a pressure bottle, hydrogen sulphide is passed for 15 min., after which the bottle is closed and heated for 20 min. in a bath of boiling water. The sulphide precipitate is filtered off and dissolved in nitric acid, this solution being then evaporated to dryness and heated gently to expel all sulphuric acid. The dry residue is warmed with 5 c.c. of ammonia solution, to dissolve the molybdic anhydride, the solution being then filtered if necessary. (If copper is present, the ammonia is replaced by potassium hydroxide, the insoluble cupric oxide being separated by filtration for the estimation of the copper.) The solution is acidified with acetic acid, boiled, and precipitated with an excess of lead acetate. The lead molybdate is filtered off, washed with hot ammonium acetate, to remove lead sulphate, and then with hot water; it is finally weighed after gentle ignition and contains 26·15 per cent. of molybdenum. The filtrate from the sulphide precipitation (which is green or blue if vanadium is present) is boiled to remove hydrogen sulphide, and sufficient standard permanganate is added to impart a pink colour to the liquid—the amount required showing approximately the quantity of iron plus vanadium present. An excess of permanganate is then added and the liquid is boiled for at least 5 min., when sufficient ferrous ammonium sulphate is added to dissolve the precipitated manganese dioxide and make the solution clear. After boiling and then cooling to 70° C., permanganate is added until a pink colour persists, ferrous ammonium sulphate being then added until a drop of the liquid gives an immediate blue colour with ferricyanide solution. An addition of permanganate is then made until a drop of the liquid gives no blue colour with ferricyanide in 30 seconds, at which stage the reading of the burette is taken and the addition of permanganate continued until a pink colour persists for 1 min. The iron value of the permanganate multiplied by 0·916 gives the value in terms of vanadium. *Tungsten* and *silica* are determined in another 1 grm. sample by treatment with hydrochloric acid and evaporation to dryness. The residue is extracted with boiling dilute hydrochloric acid and filtered, the insoluble portion containing the tungsten as trioxide together with the silica. The former is extracted with dilute ammonia and determined by evaporation and ignition in the usual manner: the latter is determined by evaporation with hydrofluoric and sulphuric acids after the extraction of the tungsten trioxide.—W. E. F. P.

Aluminium-zinc alloys. W. Rosenhain and S. L. Archbutt. Inst. of Metals, Sept., 1911. [Advance proof.] Roy. Soc. Proc., 1911, A, **85**, 389—392.

THE equilibrium diagram as determined by the authors differs from that given by previous investigators, as it shows two horizontal lines of heat evolution at 443° C. and 256° C., which the authors conclude are due to the formation and decomposition respectively of the compound, Al_2Zn_3 (about 78 per cent. of zinc) which the authors call β. It is shown that the eutectic line ends (for alloys that have attained equilibrium) and that the maximum heat evolution at 256° C. also occurs at this concentration. The β compound will not dissolve zinc, but forms an unbroken series of solid solutions with aluminium. The liquidus curve has an undoubted small break at the temperature of 443° C. and a concentration of about 85 per cent. of zinc. The position of the solidus curve has been confirmed by quenching experiments.—B. M. V.

Alloys; Electrical conductivity and constitution of——. W. M. Guertler. Inst. of Metals, Sept., 1911. [Advance proof.]

IN order to determine the relationship between concentration, temperature, and any given property it is necessary to employ a co-ordinate system in three dimensions. The concentration and temperature being taken as a base, co-ordinates can be erected which are proportional to the numerical values of the property. The property of electrical conductivity has a great advantage over other properties such as "total heat" or "relative temperature coefficients" since it is shown in the paper that this accentuates the difference between homogeneous and heterogeneous systems in a marked degree. A typical diagram is given having the temperature, concentration, and resistance of the solid solution as co-ordinates, and the author has investigated the alloys of iron with up to 20 per cent. of gold, and curves are given for bismuth-thallium and copper-antimony alloys. The author then suggests the procedure necessary in order to investigate the constitution of binary alloys by this three dimensional method.—A. H. C.

[*Alloys.*] *Solid solutions; Nature of*——. C. A. Edwards. Inst. of Metals, Sept., 1911. [Advance proof.]

THE author's view that solid solutions of metals or intermetallic compounds are intimate crystalline mixtures in which the crystals are sufficiently large to retain their identity (this J., 1911, 134), has been criticised on the ground that it is opposed to the phase rule. In the present paper the nature of solutions in general—gaseous, liquid, and solid—is discussed, and it is pointed out that the phase rule in its present form is based on the assumption that solutions are homogeneous, and hence cannot be used to determine the internal nature of a solution. The author adheres to his former view and states that only with this conception of the nature of solid solutions is it possible to explain satisfactorily the discontinuity in the mechanical properties of the a-brasses which occurs at 470° C. (see Bengough and Hudson, this J., 1908, 43, 654; 1910, 1163).—A. S.

Mercury production in 1910. Ch. of Comm. J., Oct., 1911, and Board of Trade J., Sept. 28, 1911. [T.R.]

THE world's production of mercury in 1910 was 3399 metric tons, against 3304 tons in 1909, 3296 tons in 1908, and 3307 tons in 1907. Spain is the largest producer, furnishing nearly a third of the total world's supply from the famous Almaden mines. The United States, Austria-Hungary, and Italy have in turn held second place, the first-named ranking third in 1910. American imports of mercury for domestic use are now nominal, having been in 1910 only 667 lb. valued at $381, although the values in the preceding three years varied from $6000 to $8000. The exports of mercury in 1910 was 144,237 lb. valued at $91,077, against 510,141 lb. valued at $266,243, in 1909. The chief market is now Canada, followed by Mexico. Prices of mercury in 1910 averaged $46·51 a flask of 75 lb. in San Francisco for domestic use and $44·51 for export; the average price in New York was $47·06. In London the highest price was £9 15s. per bottle of 34·5 kilos., and the lowest £8. Prices have greatly improved in the last few years. The production of mercury in Mexico is estimated at some 200 metric tons per annum. The export in the year ended 30th June, 1910, amounted to 103 metric tons, valued at 297,326 pesos (about £30,350), of which 84 tons, valued at 253,616 pesos (about £25,900) were shipped to the United Kingdom. In the State of San Luiz Potosi, where formerly a large proportion of the mercury output was obtained, the production has fallen off in the past five years by more than half. The reduction is not, it is stated, due to the mines being worked out, but to the fact that the industry seems to have been neglected by foreign capital.

According to the report of the U.S. Geological Survey, of the 19 mines producing mercury in the United States, fifteen are in California, two in Nevada, and two in Texas. The production in 1910 was 20,601 flasks of 75 lb. each of a value of $958,153. Although the production of California increased in 1910, the output from Oregon decreased to nothing, as that of Arizona did in 1909, the small Nevada production fell off considerably, and the output from Texas decreased. In no State, except possibly in Nevada, can an increased output be expected for 1911, the present outlook being for a total production for the United States not exceeding 20,000 flasks.

ERRATUM.

This Journal, Sept. 30, page 1119, col. 2, line 15 from bottom, the quotient is: "$\frac{\sqrt{p}}{m}$"

Recent determinations of melting points of minerals by the gas thermometer. Day and Sosman. *See* VII.

Determination of the absolute value of the viscosity of silicate melts. Doelter and Sirk. *See* VIII.

PATENTS.

Iron and other ores and metalliferous compounds; Method of sintering——. J. Savelsberg, Papenburg on the Ems, Germany. Eng. Pat. 20,133, Aug. 29, 1910. Under Int. Conv., Feb. 24, 1910.

THE mixture of ore and fuel is moistened with a solution of sulphate of iron or other salt, or with a suitable acid, before being ignited and subjected to the action of an air blast.—W. E. F. P.

[*Iron and steel*] *Metal; Process for welding*——. W. M. Whitney, Winchendon, Mass. Eng. Pat. 6328, March 14, 1911.

THE process has for its object the welding together of metals differing in hardness and fusibility, such as the welding of tungsten steel to wrought iron or soft steel in the manufacture of high speed tools. Restricted areas of the tungsten steel are successively heated to the welding temperature (by means of a blowpipe or otherwise) and coated with molten iron or steel of lower melting point. The wrought iron or soft steel, heated to its welding temperature is then applied, the union of the metals being finally completed by the application of pressure.
—W. E. F. P.

Iron and manganese; Process for treatment of pulverulent ores of——. Soc. Anon. des Ciments Portland Artificiels de Buda. Fr. Pat. 428,366, April 11, 1911. Under Int. Conv., April 23, 1910.

THE ore is supplied continuously to the upper end of an inclined, cylindrical, rotary furnace (fired from the

discharge end) and a stream of granular fuel, so adjusted as to fall upon the ore when the latter has attained a suitable temperature, is projected into the furnace from the lower end. By the combustion of the grains of fuel, localised centres of agglomeration are formed around which solid, porous masses of the ore are produced.
—W. E. F. P.

Blast furnaces, converters and the like; Method of supplying air to compressors for ——. J. Bronn and Rombacher Hüttenwerke, Rombach, Germany. Eng. Pat. 20,509, Sept. 2, 1910.

By means of suitable chimneys, the air is drawn from a point at least 25 m. above the ground. It is claimed that, in steel works, air taken from this height contains from 25 to 50 per cent. less moisture, and less carbon dioxide, than that drawn from the customary level.—W. E. F. P.

Waste heat; Means for utilising ——, *from blast furnaces and the like.* A. Sauer, Pittsburg, Pa., U.S.A. Eng. Pat. 6296, March 13, 1911.

The gases issuing from the furnace are drawn through a vertical, tubular water-heater by means of a suction device (actuated by steam and situated at the upper end of the heater) and then pass, mixed with the steam, to an air-cooled, tubular condenser. The lower part of the latter is connected with the entrance of the water-heater by a valved pipe, air being thus drawn through the vertical tubes of the condenser by the operation of the suction device.—W. E. F. P.

Metals [*Copper*] *from their ores; Process and apparatus for the extraction of* ——. H. S. Mackay. Fr. Pat. 428,521, Jan. 19, 1911. Under Int. Conv., Jan. 20, 1910.

The process consists broadly in lixiviating the ore with a solution containing a substance capable of converting the metal to be extracted into a soluble compound. Then on subjecting the resulting solution to electrolysis, the extracted metal is deposited and the solvent solution regenerated. As applied to the extraction of copper, a solution of sodium chloride is electrolysed, first using iron anodes and then insoluble anodes, and the resulting solution of ferric chloride, containing also small quantities of free chlorine and hydrochloric acid and other chlorine compounds, is used for the lixiviation of the ore. The copper is extracted as chloride and the ferric chloride is reduced to the ferrous compound. The copper is finally recovered by electrolysis, whereby the ferrous chloride is re-converted into ferric chloride for use over again. In the case of sulphide ores, sulphurous and sulphuric acids are produced in the lixiviation process and assist in extracting the copper. The apparatus comprises electrolytic vats for the preparation of the solvent solution and electrodeposition of the copper, and a lixiviating apparatus in which the ore and solution are mixed by a device similar to an air-lift agitator.—A. S.

Copper-zinc alloys having a high percentage of zinc. Allgem. Deutsches Metallwerk Ges. m. b. H., Berlin. Eng. Pat. 12,012, May 18, 1911. Under Int. Conv., Jan. 26, 1911.

The alloys contain at least 47 per cent. of zinc, and not more than 3 of lead or 0·5 of aluminium, the remainder being copper. In addition to being less expensive on account of their smaller copper content, such alloys are stated to possess greater strength and ductility than ordinary brasses.—W. E. F. P.

Zinc; Metallurgy of ——. F. L. Clerc, Boulder, Colo. U.S. Pat. 1,002,037, Aug. 29, 1911.

In an apparatus for the reduction of zinc oxide by carbon, a trapped body of quiescent, molten metal is established in the bottom of a retort and extends to an adjacent outer well. The mixture of zinc oxide and carbon is charged upon the surface of the molten metal within the retort, and, means being provided for heating the surface of the metal in the well, the heat necessary to effect the reduction is conveyed through the metal to the charge.—W. E. F. P.

Lead and zinc; Process for the separation of ——. J. Babé. Fr. Pat. 428,707, June 28, 1910.

The material is treated with a quantity of hydrogen sulphide or an alkali or alkaline-earth sulphide just sufficient to convert the lead into sulphide, and is then heated to 800°—900° C. with a volatile reducing agent, whereby, it is claimed, the lead is volatilised, whilst the zinc remains in the residue.—A. S.

Antifriction metal. W. Wyers, Norristown, Pa., Assignor to H. Kleinman, Conshohocken, Pa. U.S. Pat. 1,002,190, Aug. 29, 1911.

An alloy containing about 78 per cent. of zinc, 12 of copper, 7 of lead, 2 of iron and 1 of manganese.—W. E. F. P.

[*Gold and silver.*] (1) *Treating ores; and* (2) *Treating refractory sulphide ores.* J. E. Porter, Syracuse, N.Y., Assignor to The Just Mining and Extraction Co., Rochester, N.Y. U.S. Pats. 1,002,446 and 1,002,447, Sept. 5, 1911.

(1). The finely-divided ore is maintained in suspension in a cold or heated cyanide solution into which air in minute bubbles is introduced. Simultaneously, the dissolved values are separated from the mixture upon surfaces of metallic aluminium, by which means, it is claimed, the solvent is also regenerated. (2). The finely-divided ore is maintained in suspension in a heated cyanide solution into which air in minute bubbles is introduced, the conditions being such as to convert the sulphur of the ore into thiosulphate.—W. E. F. P.

Precious metals from antimonial sulphide ores; Process for extracting —— *by concentration in metallic antimony.* N. Baraboschkin. Ger. Pat. 237,532, March 25, 1910.

According to the character of the gangue, either the whole or a part of the ore is smelted so as to obtain antimony sulphide, and the residue (other than antimony sulphide) from this process, together with the dust from the dust chambers, and the remainder of the ore if only a portion has been worked up for sulphide, is smelted so as to obtain metallic antimony. It is stated that practically the whole of the precious metals becomes concentrated in the antimony. The metallic antimony is next heated in a reverberatory or muffle furnace until it is partly converted into oxide, then mixed with the antimony sulphide prepared previously, and smelted. The unoxidised portion of the antimony collects below the charge and contains practically the whole of the precious metals. The slag consists of a mixture of antimony trisulphide and antimony trioxide with compounds of other metals, and separates readily from the metallic antimony. Alternatively the antimony may be converted completely into oxide by the oxidising roasting process, and a suitable quantity of a reducing agent added to the mixture of antimony oxide and sulphide subjected to the concentrating smelting process.—A. S.

Ferruginous and plumbiferous by-products obtained in metallurgical works; Process for agglomerating ——, *with a view to their subsequent reduction.* A. Folliet-Mieusset. Fr. Pat. 428,570, March 24, 1911.

The patent relates more particularly to the treatment of the residues, cinders, etc., from zinc-lead smelting works, the preliminary agglomeration of the powdery material being effected by the heat developed during the oxidation of its metallic constituents. The material, mixed with calculated quantities of sand and lime to act as fluxes in the subsequent smelting (part of the lime being added as milk of lime to ensure the presence of about 6 per cent. of moisture in the mixture) is charged on to a bed of incandescent fuel through which air passes from below. Promoted by contact with the fuel, the oxidation extends in an upward direction through the charge, which is thus agglomerated. As soon as the surface of the first charge begins to glow, a further quantity of the mixture is added, this operation being repeated as often as the capacity of the furnace will permit. Suitable minerals, or other lead residues or products (such as carbonates, sulphates, scoriae, etc.) whether in the form of gravels, muds or powders, may be incorporated with the charge for agglomeration.—W. E. F. P.

Furnace; Rotary —— for reduction and refining of metals. E. G. Pearlman. Fr. Pat. 428,717, April 20, 1911.

A horizontal, cylindrical body, communicates at either end with a circular, annular chamber, the outline of the structure somewhat resembling that of an ordinary dumb-bell. The chamber at the feed end is of smaller diameter, and has a smaller opening, than the opposite chamber; and the furnace is fired (with gas) from the discharge end. —W. E. F. P.

Converter for the separation of volatile and non-volatile metals in complex ores. M. Collin. Fr. Pat. 428,708, June 28, 1910.

The converter has an elliptical or oval form, and the mouth is situated on the same side of the shorter axis of the ellipse as the tuyères. In the working position the shorter axis is vertical, and the mouth of the converter is at one side, with the tuyères directly below. The air is blown into the converter in an approximately horizontal direction and travels around the converter before reaching the mouth, thus preventing the mechanical projection of non-volatile materials through the latter.—A. S.

Steel; Apparatus for the electrical production of ——. T. Levoz, Heer, Belgium. Eng. Pat. 20,594, Sept. 3, 1910. Under Int. Conv., Sept. 4, 1909.

See Fr. Pat. 417,597 of 1909; this J., 1911, 32.—T. F. B.

Iron and steel and other metals; Method of electric production of ——. A. R. Lindblad, Ludvika, Sweden. U.S. Pat. 1,002,286, Sept. 5, 1911.

See Eng. Pat. 6088 of 1909; this J., 1909, 944.—T. F. B.

Iron ores; Gravity liquid separation of certain ——. F. I. du Pont, Wilmington, Del. U.S. Pat. 1,002,865, Sept. 12, 1911.

See Fr. Pat. 419,077 of 1910; this J., 1911, 120.—T. F. B.

Sodium; Manufacture of ——. P. A. Emanuel, Aiken, S.C., U.S.A. Eng. Pat. 20,046, Aug. 27, 1910. Under Int. Conv., Sept. 29, 1909.

See U.S. Pat. 957,755 of 1910; this J., 1910, 756.—T. F. B.

Aluminium and its alloys; Processes for pickling —— prior to galvanising or coating the same with other metals. W. P. Thompson, Liverpool. From Akt.-Ges. Mix und Genest Telephon- und Telegraphen-Werke, Schöneberg-Berlin. Eng. Pat. 1819, Jan. 24, 1911.

See Fr. Pat. 415,228 of 1910; this J., 1910, 1315.—T. F. B.

Furnaces [for reducing and refining metals]; Rotary ——. E. R. Royston, Liverpool. From E. G. Pearlman, Philadelphia, U.S.A. Eng. Pat. 8573, April 6, 1911.

See Fr. Pat. 428,717 of 1911; preceding.—T. F. B.

Zinc oxide from zinc ores and zinc residues; Production of ——. W. Hommel, Assignor to Metals Extraction Corporation, Ltd., London. U.S. Pat. 1,002,401, Sept. 5, 1911.

See Eng. Pat. 27,020 of 1909; this J., 1909, 427.—T. F. B.

Metals; Process for covering oxidisable —— with protective metallic coatings. The Lohmann Co. Fr. Pat. 427,861, March 29, 1911.

See U.S. Pat. 990,443 of 1911; this J., 1911, 629.—T. F. B.

Method of working tunnel kilns for burning bricks of ore, clay, and the like. Eng. Pat. 20,247. *See* I.

Agglomeration of pulverulent materials, ores, coal, etc. Addition to Fr. Pat. 425,991. *See* IIa.

Treatment of sal-ammoniac skimmings. U.S. Pat. 1,002,317. *See* VII.

XI.—ELECTRO-CHEMISTRY.

Patents.

Insulating compounds [from waste rubber]. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 176, Jan. 3, 1911.

A mixture of reclaimed or waste rubber and a drying oil, such as linseed oil, is heated to a temperature of about 540° to 575° F., an exothermic reaction between the materials being produced. The heating is discontinued, and the cement thus formed is mixed with asbestos, talc, and sulphur; the mass is pressed into the desired form and vulcanised.—B. N.

Electric osmose; Treating finely sub-divided substances by ——. B. Schwern, Frankfort-on-Maine, Germany. Eng. Pat. 11,626, May 13, 1911.

Finely sub-divided substances are treated by electric osmose, as, for example, in the removal of water from peat, an electrolyte being added at the pole towards which the solid particles migrate in such a manner that the intermixture occurs exclusively by electrolytic migration of ions, mechanical intermixture of the electrolyte with the substance being entirely avoided. The results of experiments, conducted with the apparatus described in Eng. Pat. 24,670 of 1904 (this J., 1905, 1072), are given, showing the removal of water from peat, with and without the addition of electrolyte, sodium sulphate solution being added at the anode without being allowed to mix with the peat. A saving of 20 per cent. in time, and 30 to 35 per cent. in electric energy is claimed.—B. N.

Anodes; Manufacture of manganese peroxide ——. Siemens und Halske A.-G., Berlin. Eng. Pat. 15,128, June 28, 1911. Under Int. Conv., June 29, 1910. Addition to Eng. Pat. 605, Jan. 9, 1909 (this J., 1909, 1145).

The anodes of manganese peroxide, manufactured as described in the main patent, are made more electrically conductive by embedding conductors in the form of rods or pieces of lead peroxide in the manganese nitrate, or by mixing manganese nitrate and crystalline manganese peroxide.—B. N.

Cell; Electrolytic ——. P. McDorman, Assignor to The National Laundry Machinery Co., Dayton, Ohio. U.S. Pat. 1,001,876, Aug. 29, 1911.

The apparatus comprises an outer vessel and an inner vessel mounted therein, with electrodes supported in the inner vessel so as to form compartments and connected with pole pieces mounted at the upper end of the inner vessel. The upper edges of the latter are provided with openings, in which are mounted tubes projecting outwardly and laterally into the outer vessel. Plates are supported along the upper edges of the sides of the inner vessel, the plates being provided with grooves which receive the tubes. The bottom of the inner vessel has an elongated opening, which communicates with a number of openings in a plate mounted below the base of the inner vessel. Both vessels are filled with liquid, the resistance of which in the outer vessel causes the current to pass through the electrodes. The compartments, formed by the electrodes, communicate with the various openings, so that a circulation of electrolyte may be obtained from the inner compartments through the upper tubes to the sides of the outer vessel, and back through the openings in the base of the inner vessel to the electrode compartments.—B. N.

Electric resistance furnaces. J. E. F. Trustee. Fr. Pat. 428,370, April 11, 1911.

The patent relates to furnaces of the type in which the walls of the crucible or melting pot are heated to incandescence by the passage of an electric current. In order to obtain the most intense heating in the crucible itself, its walls are made of a material of higher electrical resistance than the remainder of the actual furnace, and in order to maintain the voltage approximately constant, the crucible is lined with a material which becomes electrically conductive only at a high temperature. The furnace is enclosed in a metal casing, mounted on trunnions, the intervening space being filled with refractory insulating material. On either side of the furnace, carbon rods project through the casing; copper rings are fitted on the ends of the rods, and these rings are provided with projecting arms, which, when the furnace is in its working position, are in contact with the current leads, but break contact when the furnace is tilted for discharging its contents.—A. S.

Insulating layers of oxides on metallic coils; Method of forming ——. E. W. Küttner, Berlin. Eng. Pat. 23,675, Oct. 12, 1910. Under Int. Conv., Oct. 14, 1909.

See Fr. Pat. 420,269 of 1910; this J., 1911, 372.—T. F. B.

Furnace; Electric-resistance ——. A. Petersson, Odda, Norway. U.S. Pat. 1,002,444, Sept. 5, 1911.

See Eng. Pat. 8711 of 1910; this J., 1911, 138.—T. F. B.

Furnace; Electric ——. A. Helfenstein, Vienna. U.S. Pat. 1,002,843, Sept. 12, 1911.

See Fr. Pat. 409,020 of 1909; this J., 1910. 766.—T. F. B.

Electrode for electric furnaces. W. T. Gibbs, Buckingham, and R. A. Wotherspoon, Shawinigan Falls, Assignors to Shawinigan Carbide Co., Ltd., Montreal. U.S. Pat. 1,003,354, Sept. 12, 1911.

See Eng. Pat. 9633 of 1911; this J., 1911, 1070.—T. F. B.

Reduction operations carried out in electric furnaces; Method of utilising the gases resulting from ——, *and electric furnaces for carrying out the same.* A. Helfenstein, Vienna. U.S. Pat. 1,002,988, Sept. 12, 1911.

See Fr. Pat. 408,245 of 1909; this J., 1910, 638.—T. F. B.

Electric arcs; Process and apparatus for producing long stable ——. O. Schönherr, Christiania, and J. Hessberger, Christianssand, Norway, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,003,299, Sept. 12, 1911.

See Eng. Pat. 22,715 of 1909; this J., 1910, 1167.—T. F. B.

Aluminium nitride; Electric resistance furnace for making ——. O. Serpek. First Addition, dated June 1, 1910, to Fr. Pat. 427,066, May 18, 1910.

See Eng. Pat. 16,522 of 1910; this J., 1911, 361.—T.F.B.

Electrical oxidation of nitrogen. U.S. Pat. 1,002,249. *See* VII.

Electrolytic production of oxyhalogen compounds. Fr. Pat. 428,529. *See* VII.

XII.—FATS; OILS; WAXES.

Edible fats and oils; Use of metallic containers for ——. J. A. Emery. Reprint from Twenty-sixth Annual Report of Bureau of Animal Industry. U.S. Dept. of Agric., 1909, 265—282.

In testing the action of oils and fats upon different metals, thin sheets, 2·5 sq.cm. in area, of the respective metals were cleaned, dried, and weighed, then bent and completely immersed in a wide-mouthed glass bottle containing the fat, so that the edges rested upon the bottom of the bottle. The bottle was left at the ordinary temperature or placed in a box kept at 37° C. After the desired period of action (up to 6 weeks) the metal dissolved by the fat was separated by shaking the fat with dilute acid, and was determined in the aqueous layer. In the case of tin, however, it was found necessary to ignite the fat with a mixture of sodium carbonate and potassium nitrate and to determine the metal in the fused mass. Although as a general rule the solvent action of the fat increased with the rise in the acidity, notable exceptions were observed. Thus in the case of a sample of cottonseed oil very little action took place notwithstanding the fact that its relatively high acid value was trebled in the course of the experiment, whereas samples of maize oil, with an equal or lower acidity had a pronounced action upon the metals in every instance except one. Increase in temperature accelerated the solvent action, and in cases where a protective coating of insoluble metallic soap was formed at the ordinary temperature, the metals offered less resistance to the action of the fats as the temperature rose. The presence of oxygen also favoured the solution of the metals, portions not submerged in the fat being attacked to a greater extent than those below the surface. This difference was more marked in the case of oleic acid than in that of the oils and fats examined. The metals least attacked were aluminium, iron, and tin in the order mentioned, whereas zinc, copper, and lead were attacked fairly readily. In the author's opinion the last three metals should not be used for vessels intended for edible oils.—C. A. M.

Cod-liver oil [*and linseed oil*] *fatty acids.* A. Heiduschka and E. Rheinberger. Pharm. Zentralh., 1911, **52**, 837—838. Chem. Zentr., 1911, **2**, 772—773.

By treating tetrachlorotetraiodotherapic acid, $C_{17}H_{26}O_2(Cl\,I)_4$ (see this J., 1910, 639), with zinc and acetic acid, a brown oil was obtained which distilled unchanged *in vacuo* at 154° C. (the height of the outlet tube above the liquid in the distillation flask being 75 mm.) yielding a colourless oil. This oil had the iodine value 264·5, and it is probable that besides the removal of halogens, hydrogenation had taken place, with the formation of a compound of formula, $C_{17}H_{28}O_2$. Tetrachlorotetrabromotherapic acid can be obtained by the action of bromine on the chloroiodo-compound. On treating linseed oil fatty acids, dissolved in chloroform, with Hübl's iodine solution in a similar manner to that described for cod-liver oil fatty acids (*loc. cit.*), trichlorotri-iodolinolenic acid, $C_{18}H_{30}O_2(Cl\,I)_3$, is obtained; it forms white crystals, melting at 95° C., soluble in alcohol and chloroform.—A. S.

a-Linolenic acid; Preparation and properties of ——. E. Erdmann. Z. physiol. Chem., 1911, **74**, 179—197.

Further experiments are described in support of the author's view (this J., 1909, 530; 1910, 1258) that the liquid fatty acid obtained by reducing the hexabromide separated from linseed oil fatty acids consists of a mixture of two stereoisomeric linolenic acids (α- and β-), and is not, as claimed by Rollett (this J., 1911, 293) an individual acid yielding four distinct stereoisomeric addition-bromides. The α-linolenic acid has now been prepared in a pure condition by fractional crystallisation of the zinc salts of the linseed oil fatty acids from alcohol, in which zinc α-linolenate is extremely soluble. The free acid was also purified by recrystallisation from petroleum spirit at —80° C. From 16 to 18 per cent. of α-linolenic acid could thus be obtained from the fatty acids after separation of solid fatty acids. It was a colourless, fairly fluid oil with a sp. gr. of 0·9046 at 20°/4° C.; but after standing for a few days the sp. gr. became 0·9248 at 21°/4° C. Its molecular weight, 282, and its iodine value (269—278) were in close approximation to the theoretical values. The acid changes on keeping; after five weeks in an exsiccator, its sp. gr. had increased to 0·963 and its iodine value had fallen to 230. Various salts and halogen-addition compounds were also prepared. When brominated it yielded 99·8 per cent. of the theoretical amount of hexabromide. This result was not in accordance with the hypothesis of Rollett.—C. A. M.

Lipase of pancreas; Action of ——. S. Visco. Atti R. Accad. dei Lincei, Roma, 1911, [5], **20**, I., 780—787. Chem. Zentr., 1911, **2**, 974. (See also this J., 1903, 1094; 1909, 149; 1910, 287, 1259).

If hydrolysis ceases after a time when pancreas-lipase is allowed to act on a fat (almond oil), this is due to an alteration of the activity of the enzyme; further hydrolysis takes place if a fresh quantity of pancreatic juice be added, and sometimes, also, on addition of a fresh quantity of the fat. The hydrolysis of fat by fresh active pancreatic juice is accelerated, but not increased, by addition of bile. The hydrolysis is completed more rapidly if the pancreatic juice be added in successive portions; in this case, addition of bile does not accelerate the hydrolysis, but indeed sometimes retards it.—A. S.

Soaps; The rate of solution of —— *in water.* A. A. Shukoff and P. J. Schestakoff. Seifensieder-Zeit., 1911, **38**, 982—983.

The authors have found that accurate comparative determinations of the solubility of soaps in water can be made if the sample of soap is allowed to remain stationary in running water. The apparatus used consists of a glass tower as employed for drying gases, the cylindrical body of which is 20 cm. high and 4 cm. diameter. The cylinder is filled half-full of glass beads on the top of which a piece of wire gauze is placed. 1 grm. of the soap in the form of a cylinder 1·5 cm. diam. (conveniently cut with a cork borer) is introduced into the cylinder and a stream of water at a temperature of 45° C. is caused to flow in an upward direction through the cylinder at the rate of 200 c.c. per minute. The temperature is controlled by means of a thermometer carried along with an outlet tube in the cork which closes the cylinder. The time taken for the complete solution of the soap is noted. The results indicate that the rate of solution of soap depends chiefly upon the nature of the fats from which it is made and is but little affected by the water which it contains. A genuine tallow soap required over 8 hours for complete solution, whilst tallow soaps containing 20 per cent. of rosin and 10 per cent. of cocoanut oil dissolved in 147 and 127 minutes respectively. Compared with genuine curd soaps, soaps containing "runnings" give high values. In one case a soap made from tallow with 25 per cent. of cocoanut oil, dissolved when genuine, in 53 minutes, whilst the same soap "run" to 50 per cent. dissolved in 70 minutes.—J. A.

Fish oil as a paint vehicle. Toch. *See* XIII.

Improved Knorr's fat extraction apparatus. Walter and Goodrich. *See* XXIII.

Patents.

Oil from olives and other substances; Apparatus for extracting —— *by means of water.* J. Brun. Fr. Pat. 428,349, April 5, 1911.

Crushed olives are placed in a wire cage which is suspended in a tank containing water at a temperature of 40° C. Steam is admitted into the cage, and the oil which rises to the surface is drawn off into two filtering chambers and thence passes into washing tanks. The residues remaining in the wire cage are removed, dried, and used as manure or cattle food.—W. P. S.

Soaps suitable for washing and bleaching. R. Wolffenstein, Berlin. Eng. Pat. 19,494, Aug. 19, 1910.

Free fatty acids, such as palmitic and stearic acids, are mixed with sodium percarbonate or sodium perborate, and filling materials, such as soap, finely ground pumice-stone, or kieselguhr, are added. The composition is mixed with alcohol or water before being used. (Reference is directed to Eng. Pats. 16,823 of 1908 and 7295 of 1909; this J., 1908, 1028; 1909, 1249.)—W. P. S.

Soaps of every kind; Apparatus and process for making ——. L. Rivière. Fourth Addition, dated June 8, 1910, to Fr. Pat. 374,179, Jan. 12, 1907 (this J., 1907, 769, 881; 1909, 317, 992).

Antimony soaps containing from 40 to 50 per cent. of antimony sulphide may be employed for colouring toilet soaps as described in the original specification.—W. P. S.

Catalysts [for the reduction and oxidation of fats]: Process and apparatus for preparing and regenerating ——. M. Wilbuschewitsch, Nischninovgorod, Russia. Eng. Pat. 15,439 of 1911, date of appl., Dec. 24, 1910.

See Fr. Pat. 426,343 of 1910; this J., 1911, 966.—T. F. B.

Oil-testing machine [for lubricants]. Eng. Pat. 7616. *See* XXIII.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Colours; Action of light on artists' ——. A. Eibner. Chem.-Zeit., 1911, **35**, 753—755; 774—776; 786—788. (See also this J., 1906, 325, 980; 1908, 1073, 1120; 1909, 373, 482, 1245; 1910, 705; 1911, 224).

The author reviews previous researches on the bleaching action of light and discusses at length the catalytic action of zinc white in accelerating and increasing its action, not merely on organic dyestuffs and lakes, but on many mineral pigments. The bleaching was found to be greatest when the painted surfaces were exposed under glass and when a binding agent containing water or glycerin was used; with oil media the action is much less. With the pigments experimented on, the bleaching was greatest in the case of chrome yellow, zinc and cadmium yellow, and vermilion, slight in the case of ultramarine, Guignet's green and cobalt violet, whilst cobalt blue and green and the earth colours were unaltered. Zinc carbonate, silicate and sulphide exert a similar but reduced action, whilst precipitated and native barium sulphate, chalk, white lead and lithopone are without any such influence on the action of light.—A. Sbld.

Pigments ground in linseed oil; Effect of ——. H. A. Gardner. J. Ind. Eng. Chem., 1911, **3**, 628—629.

Pastes of raw linseed oil with different pigments were allowed to stand for 1 month, the oil was then extracted with petroleum spirit, and after expelling the solvent, was burned and the amount of ash determined. The results show that whilst lead and zinc pigments interact with the oil to a more or less marked extent, the so-called inert pigments (barytes, *blanc fixe*, silica, etc.) are practically without action. The acceleration of the drying of linseed oil when ground with "inert pigments" observed by Sabin (J. Ind. Eng. Chem., 1911, **3**, 84) was probably due merely to the physical action of the pigments in increasing the surface of oil exposed.—A. S.

Fish oil as a paint vehicle. M. Toch. J. Ind. Eng. Chem., 1911, **3**, 627—628.

For certain purposes linseed oil for use as a paint vehicle may be partly replaced by fish oils. The most suitable oil is menhaden oil, especially the "winter bleached" variety. This oil has little or no fishy odour and is said to give excellent results when used up to 75 per cent. in admixture with linseed oil, for the preparation of paints for exteriors. It is not suitable for preparing paints for interiors, owing to the evolution of noxious gases. The menhaden oil should be used with a tungate drier, which is soluble in the oil at temperatures above 100° C. Paints prepared with fish oils are considered specially suitable for use in places on the sea-coast and for application to hot surfaces, such as smoke stacks, boiler-fronts, etc.; for the latter purpose the fish-oil should be heated to 220° C. with litharge. Addition of properly neutralised fish oil prevents the hardening or setting which results when a large proportion of red lead is mixed with linseed oil (33 lb. per gallon); and also improves the quality of "baking japans." Fish oil has recently been used successfully in the manufacture of printing inks and enamel leather. The leather is stated to be more flexible than when prepared with linseed oil alone, but the fish oil produces an undesirable efflorescence or bloom, which however can be removed by means of petroleum spirit or petroleum spirit and oil of turpentine. For printing inks the oil is heated to over 200° C. and air injected, the resulting thick oil being subsequently mixed with a tungate drier.—A. S.

Turpentine oil; Analysis of ——. C. Blarez. Ann. Chim. Analyt., 1911, **16**, 328—336.

In analysing turpentine oil the author determines the density, rotatory power, temperature of miscibility with aniline (see this J., 1907, 932; 1909, 892; 1910, 438, 501) and refractive index of several fractions as well as of the original oil. 100 c.c. of the oil are distilled and four fractions of 20 c.c. are collected, the residue being taken as the fifth. As little as 2·5 per cent. of an adulterant can be detected when present alone or with several others. A series of determinations with a sample of French turpentine oil and mixtures containing 5 per cent. of various adulterants is given in a table.—A. Sbld.

Regulations for the smelting of materials containing lead, the manufacture of red or orange lead and of flaked litharge. Statutory Rules and Orders, 1911, No. 752. Wyman and Sons, Fetter Lane, E.C. Price 1d.

These regulations, based on the report of Dr. Collis [Cd. 5152], were issued in draft last February, and an amended draft was issued in May, 1911. The regulations apply to all works where the above-named processes are carried on, and came into force on Oct. 1, 1911.

Mineral pigments; Production of —— *in the United States.* U.S. Geol. Survey, 1910. [T.R.]

The production of various mineral pigments in the United States during 1908, 1909, and 1910, is shown in the following table :—

carbon dioxide, under substantially atmospheric pressure. In carrying out the process, hydration may be first effected in a gaseous current containing oxygen, in the presence of moisture, and the product then converted into basic carbonate by the prolonged action of oxygen and carbon dioxide, in the presence of moisture, at a temperature above atmospheric. The product is finally dried.
—F. Sodn.

White lead; Process of making ——. E. Euston, Assignor to Euston Lead Co., St. Louis, Mo. U.S. Pat. 1,002,380, Sept. 5, 1911.

"Over-carbonated lead" is converted into commercial white lead by agitating with an acid solution of normal lead acetate.—F. Sodn.

Protective coatings or varnishes. H. Peters, London. Eng. Pat. 14,293, June 13, 1910.

100 grms. of trinitrocellulose or triacetylcellulose are dissolved in 1·5 litres of methylated ether diluted with 2·5 litres of amyl alcohol. A small quantity of castor oil and about 25 grms. of amyl silicate or methyl silicate may be added to the mixture. Pliable and flexible articles which have been treated with the varnish may be softened by pressing them between heated metal plates or rollers, the surfaces of which are coated with oil. If an opaque varnish be desired, calcium or barium carbonate, or zinc sulphide, mixed with sodium-casein, methyl aldehyde, and glycerin, may be added.—W. P. S.

Oils and fats [for painting]; Industrial —— *and compounds obtained from them.* W. N. Blakeman. Fr. Pat. 428,499, April 11, 1911.

See U.S. Pats. 989,225 and 989,226 of 1911; this J., 1911, 756.—T. F. B.

Oils [for painting] and compounds obtained therefrom. W. N. Blakeman. Fr. Pat. 428,500, April 11, 1911.

See U.S. Pat. 989,227 of 1910; this J., 1911, 756.—T. F. B.

Process for purifying hydrocarbons. Fr. Pat. 428,471. *See* IIa.

Manufacture of paper pulp [and turpentine from resinous wood]. Fr. Pat. 428,678. *See* V.

Use of ethyl or methyl butyrate for gelatinising or dissolving nitrocellulose. Fr. Pat. 428,664. *See* XXII.

——	1908.		1909.		1910.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons of 2,000lb.	Dollars.	Tons of 2,000 lb.	Dollars.	Tons of 2,000 lb.	Dollars.
Ochre	14,696	140,439	12,458	125,349	11,711	112,445
Umber and sienna	1,212	30,705	1,276	33,472	1,015	26,700
Metallic paint	14,022	156,694	20,722	201,905	29,422	184,869
Mortar colours	7,856	72,881	10,820	108,126	9,960	107,780
Slate and shale, ground	12,617	93,181	14,944	98,176	16,515	96,001
Total	50,403	493,900	60.220	567,028	68,623	527,795

There was a general decrease in 1910 in the price per ton at the point of production of all the pigments. Metallic paint and ground slate and shale show increases in quantity, and all the other minerals decreases.

Patents.

White lead; Continuous process of making —— *and apparatus therefor.* C. Ellis, Montclair, N.J., Assignor to Ellis-Foster Co. U.S. Pat. 1,002,246, Sept. 5, 1911.

Lead is melted and converted into a finely-divided form (preferably by raising it to a temperature about 400° C. above its melting point and treating it with a jet of heated air under high pressure, whereby filamentous lead, coated with a catalytic oxide, is produced), and the product is subjected in a "continuously, integrally, and progressively advancing stream" to the action of air, moisture, and

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Patents.

Rubber; Process of extracting resins from crude ——. A. Schleiffer. First Addition, dated March 13, 1911 (under Int. Conv., March 25, 1910), to Fr. Pat. 427,173, March 13, 1911 (this J., 1911, 1127).

The employment of pyridine for the extraction of the resins from rubbers—such as jelutong—containing high percentages of resins is impossible when such rubbers contain much moisture, the penetration of the mass by the solvent being insufficient. By the addition of phenol or cresol, however, this difficulty is removed. For example, 100 kilos. of jelutong containing about 60 per cent. of moisture are heated for 5 hours at 80°—85° C.

with 500 kilos. of pyridine bases (b. p. 136°—240° C.), 15 kilos. of water and 15 kilos. of crude o-cresol. The purified rubber is removed from the surface of the liquid, pressed, and freed from solvent by washing in appropriate machines.—E. W. L.

Rubber; Process for coagulating latices containing ——. H. Hamet and L. Monnier. Fr. Pat. 428,701, April 19, 1911.

The latex is forced from a vessel by means of a hand (or other) air-pump, through a tube, ending in an atomising-jet within the domed lid of a coagulating chamber, and simultaneously a jet of steam, or of hot water, or acid or formaldehyde solution, delivered from a second vessel, and similarly atomised, is caused to impinge upon the latex-spray. The coagulating vessel is provided with a perforated false bottom, by means of which the coagulated rubber is strained off from the serum and added liquid, and upon which the rubber can if necessary be washed before being removed, pressed and dried. The coagulating chamber has an uptake for the escape of vapours.—E. W. L.

Indiarubber; Process of extracting resins from raw ——. A. Schleiffer, Vienna. Eng. Pat. 6444, March 14, 1911. Under Int. Conv., March 24, 1910.

See Fr. Pat. 427,173 of 1911; this J., 1911, 1127.—T. F. B.

Indiarubber; Process of extracting resins from raw ——. A. Schleiffer, Vienna. Eng. Pat. 6445, March 14, 1911. Under Int. Conv., March 25, 1911. Addition to Eng. Pat. 6444 of 1911, dated March 24, 1910.

See Addition to Fr. Pat. 427,173 of 1911; preceding.—T. F. B.

Rubber or gutta-percha; Purifying ——. W. Elsner and O. Meyer, Hanover, Germany. U.S. Pat. 1,003,244, Sept. 12, 1911.

See Eng. Pat. 9588 of 1910; this J., 1910, 1121.—T. F. B.

Rubber; Treatment [curing] of ——. R. Derry. Fr. Pat. 427,879, March 29, 1911.

See Eng. Pat. 6858 of 1911; this J., 1911, 817.—T. F. B.

Rubber; Process for making artificial ——, *and articles prepared therefrom.* Rubber Substitute (1910), Ltd. Fr. Pat. 428,433, April 13, 1911. Under Int. Conv., April 20, 1910.

See Eng. Pat. 9636 of 1910; this J., 1911, 437.—T. F. B.

Insulating compounds [from waste rubber]. Eng. Pat. 176. *See* XI.

XV.—LEATHER; BONE; HORN; GLUE.

Vegetable tannins; Qualitative reactions of ——. E. Stiasny and C. D. Wilkinson. Collegium, 1911, 318—324, 325—332.

The work was carried out with a view to identify a single tanning material in the form of its extract or liquor, to prove the purity or otherwise of any extract and to determine the components of any mixtures of vegetable tannin solutions. The tannin solutions were made in three different strengths, 3·5—4·5 grms. per litre, one-tenth of this strength, and 6—8 times the same. Observations of the effects of reagents in known concentrations were made immediately after addition, during the first few hours, and again after standing overnight. 34 different tannin solutions were tested with sodium chloride, ammonium chloride, ammonium acetate, tartar emetic, lead acetate, bromine, copper sulphate and ammonia, ammonium sulphide, and formaldehyde. The tests of precipitation with saturated solutions of sodium and ammonium chloride and with ammonium sulphide were eliminated as valueless. *Lead acetate test.* All tannins are precipitated by this agent so completely that the filtrate gives no colour with iron alum. Valonia, mimosa, mangrove, oakwood, chestnut, myrobalans, algarobilla, divi-divi and gallotannic acid give no colouration if excess of caustic soda be added to the filtrate. Quebracho, ulmo and sumac give a yellowish colour. The substance in quebracho which yields the yellow colour is extracted by shaking out the aqueous solution with ethyl acetate. *Solubility of the lead precipitate in acetic acid.* The lead precipitate from quebracho, mangrove, ulmo, mimosa, and gambier is entirely soluble in acetic acid. If the test be made by adding 10 c.c. of acetic acid to 5 c.c. of the tannin solution and then 5 c.c. of 10 per cent. lead acetate solution, no precipitate is produced with catechol tannins provided they are not sulphited. Pyrogallol tannins give a lead precipitate insoluble or partially soluble in acetic acid. The precipitates from oakwood, chestnut and valonia are insoluble; those from sumac, myrobalans, divi-divi, algarobilla and gallotannic acid are partially soluble. A table is given showing the colouration produced on treating the filtrate from the lead acetate and acetic acid precipitate of many tannins, with iron alum alone and with the addition of sodium acetate. In most cases the addition of solid sodium acetate after iron alum turns a green colour to a distinct violet; with gambier, however, the green colour persists and the lower layer near the solid sodium acetate appears bright blue. A copious precipitation is produced on adding acetic acid and sodium acetate to pistacia and on adding iron to the filtrate both a green and a violet colouration are produced, showing that the material contains a mixture of various tannins. The behaviour of wood pulp extract (an extract prepared from sulphite cellulose waste lyes) towards lead acetate is different from that of tanning liquors. A test for its presence is to add to 5 c.c. of the tannin solution, 5 c.c. of 10 per cent. lead acetate solution, and an excess of 10—20 per cent. caustic soda solution to the clear filtrate; if the solution remain colourless, no wood pulp extract is present; 10—20 per cent. of wood pulp extract will give a distinct yellow colour, but a slight yellow colour may be due to the presence of quebracho, sumac, or pistacia. In this case the test is repeated with basic lead acetate, when any yellow colour will be due to wood pulp extract only. The test is most valuable for the detection of wood pulp extract in chestnut extracts, and, in the absence of any precipitate in the formaldehyde test, is conclusive. Catechol tannins in mixtures with oakwood, chestnut and valonia extracts are detected by the green colour produced by adding iron alum to the filtrate from the precipitate produced on adding lead acetate. The test, however, is not very delicate and shows not less than 10—15 per cent. of the catechol tannin. The presence of myrobalans in oakwood, chestnut and valonia is shown by the violet colour produced on adding iron alum to the filtrate from the acetic acid—lead acetate precipitate, the pure extracts remaining colourless after such treatment. *Tartar emetic test.* 10 c.c. of 4 per cent. tartar emetic solution are added to 5 c.c. of the tannin solution. Quebracho, mangrove and ulmo give no precipitate, gambier gives a turbidity, and chestnut, mimosa, myrobalans, sumac, valonia, pistacia, divi-divi and algarobilla more or less complete precipitation. The filtrates from these precipitates give a green colour with iron alum, in the case of pyrogallol tannins, due to the presence of tartaric acid. Wood pulp extract is not precipitated by tartar emetic and mimosa behaves as a pyrogallol tannin. All tannins are precipitated by a mixture of tartar emetic and sodium chloride. Oakwood is completely precipitated and wood pulp extract gives no precipitate. *Ammonium acetate test.* The test is best performed with strong tannin solution (25—30 grms. per litre). Catechol tannins such as quebracho, mangrove, ulmo, mimosa, gambier and pistacia give no precipitate, but the solutions become clearer than before. If salts of aluminium be present, much precipitate is formed. Chestnut and oakwood give a copious precipitate, while valonia, myrobalans, algarobilla and divi-divi are gradually precipitated and sumac after standing overnight. Wood pulp extract alone gives no precipitate but when mixed with any tannin, precipitates immediately. The test is useful as a negative test for wood pulp extract in the presence of catechol tannin; if no precipitate appears, no wood pulp extract is present. *Copper* *sulphate-ammonia test* (Procter, Lab. Book, p. 150). The test should be performed in very dilute solutions (0·3—0·4 grm. per litre) and consists in adding to 2—3 c.c. of the tannin solution 3—5 drops of 1 per cent. copper sulphate solution and 3 c.c. of 5 per cent. ammonia. Quebracho, mangrove, ulmo, gambier and pistacia give no precipitate; chestnut, oakwood and sumac an immediate precipitate; mimosa, algarobilla and divi-divi give a precipitate on standing; myrobalans and wood-pulp extract give no precipitate. *Eitner-Philip test.* 2—3 drops of strong sulphuric acid are added to 25 c.c. of tannin solution (25 grms. per litre) and after boiling for 1—2 minutes and cooling, 5 grms. of sodium chloride are added, and after standing for 5—10 minutes the mixture is filtered. The filtrate is tested by adding 2—3 c.c. to 25 c.c. of water with 10—15 drops of yellow ammonium sulphide. Quebracho, mangrove, ulmo and gambier give no precipitate. Mimosa, chestnut, oakwood, myrobalans, sumac, divi-divi, algarobilla and pistacia give a precipitate. *Formaldehyde test.* 50 c.c. of the tannin solution (3—4 grms. per litre) are boiled for half an hour under a reflux condenser with 5 c.c. of strong hydrochloric acid and 10 c.c. of formaldehyde (40 per cent.). The appearance of a precipitate during boiling is looked for and the filtrate is tested (1) with iron alum and sodium acetate and (2) with excess of caustic soda. A table is given of the results of these tests with various tannins. Catechol tannins are completely precipitated, while pyrogallol tannins give none or only a slight precipitate. 5 per cent. or even less of a pyrogallol tannin is detected by the iron test on the filtrate. Wood pulp extract behaves like a pyrogallol tannin but gives no iron test. *Bromine test* (Procter, Lab. Book, p. 149). 5—10 drops of bromine water are added to 2—3 c.c. of tannin solution. Catechol tannins give a precipitate while pyrogallol tannins do not. The delicacy of the test is very different with different catechol tannins and the presence of wood-pulp extract prevents or diminishes the precipitation. *Solubility tests.* The solubility of different tannins in organic solvents was tested by shaking out the aqueous solutions with an immiscible solvent or by precipitating the aqueous solution by adding a solvent miscible with water. *Extraction with ethyl acetate.* 25 c.c. of the tannin solution (3·5—4·5 grms. per litre) were shaken in a small separating funnel with 25 c.c. of ethyl acetate, the aqueous layer was run into another funnel and again extracted with 25 c.c. of ethyl acetate. The process was repeated till no further colour was extracted. 20 c.c. of the aqueous layer were then evaporated, the residue dried and its weight compared with that of the residue from the same volume of original solution. The amount extracted by ethyl acetate differs widely with various tannins and the method is of special interest for the differentiation of catechol tannins, *e.g.*, quebracho and mangrove. The sulphiting of quebracho extract lessens the amount of matter soluble in ethyl acetate. Wood pulp extract is very sparingly soluble in ethyl acetate. An analysis was made to determine the percentage of tannins and non-tannins shaken out by ethyl acetate in the case of quebracho extract. 90·56 per cent. of the tannin, 43·90 per cent. of non-tannins and 77·7 per cent. of the soluble matter was soluble in ethyl acetate. Another solubility test was made by adding alcohol to the aqueous solution. 10 c.c. of the tannin solution (25—30 grms. per litre) were placed in a 100 c.c. flask and 95 per cent. alcohol added to the mark. After shaking and standing one hour the precipitate was filtered off and 50 c.c. of the filtrate evaporated. The percentage of matter soluble in alcohol on that of the original soluble matter was thus determined. Tables of the solubility in ethyl acetate and the alcohol precipitation figure for many tanning materials are given. A pure unsulphited quebracho extract should have an ethyl acetate figure of 70—80 per cent. and an alcohol figure of less than 3 per cent. The presence of wood-pulp extract diminishes the first and increases the latter figure considerably. If therefore an unsulphited quebracho extract contains no pyrogallol tannins (by the formaldehyde test) and gives a low ethyl acetate and a high alcohol figure, the presence of wood pulp extract is inferred. If the alcohol figure is unchanged and neither wood-pulp extract nor pyrogallol tannins are present and the ethyl acetate figure is lowered, mangrove or another catechol tannin is present. Myrobalans in admixture with oakwood or chestnut is detected by the increase of the ethyl acetate figure and a diminution of the alcohol figure. The presence of pistacia in sumac lowers the ethyl acetate figure and increases the alcohol figure. *Iodine values of tannins.* The method of Hinrichsen and Kedesdy (this J., 1909, 831) was adopted as follows: 25 c.c. of the tannin solution (containing about 0·1 grm. of tannin was treated with 20 c.c. of iodine solution (about $N/3$) and 2 grms. of sodium bicarbonate, allowed to stand overnight and the iodine titrated with thiosulphate. The same test was made on 30 c.c. of the non-tannin solution, corresponding to 25 c.c. of the tannin solution. From this was calculated the weight of iodine taken up by (a) 1 grm. of "solubles," (b) 1 grm. of non-tannins, and (c) 1 grm. of tannin. It was found that different tanning materials did not differ widely in their iodine values, so that the test is not of much value. Quebracho, mangrove, ulmo, gambier, and pistacia gave precipitates with iodine and sodium bicarbonate, while oakwood, chestnut, mimosa, myrobalans, sumac and wood-pulp extract remained clear. The iodised solutions of all tannins no longer give tannin reactions, which shows that iodine reacts with the hydroxyl groups and is in accordance with Boettinger's statement that acetylated tannins do not take up any iodine. The iodine values of some tannins after boiling with alkali and acidifying with acetic acid was determined, but no definite relation between this value and the original iodine value was found.—D. J. L.

Tannins; The qualitative analysis of the ——. U. J. Thuau and P. de Korsak. Collegium, 1911, 258—260, 262—265.

The colour tests for various tannins are unsatisfactory as the colourations produced by many reagents with various tannins are almost identical and very difficult to distinguish one from another even when the pure materials are used. In the case of mixtures of tanning materials the method is inapplicable. The formaldehyde method of Stiasny (this J., 1906, 275; 1908, 1124) and Jean (this J., 1907, 213, 702) is the only exact method of dividing the tannins into the two groups of catechol and pyrogallol tannins. The authors confirm the results obtained by Stiasny in the application of the test to various tanning materials. Jean has proposed to make the test quantitative and states that the weight of the precipitate after washing and drying at 105° C. represents very closely the weight of catechol tannin present. Stiasny, on the other hand, has found that in the presence of pyrogallol tannins the formaldehyde-catechol tannin contains a large amount of the former. The authors confirm this statement and have investigated the test in connection with some decolourised extracts. A chestnut extract decolourised with blood gave a slight precipitate, while a similar extract which had been decolourised with lead carbonate gave a precipitate weighing 12 per cent. of the extract used. A non-decolourised extract from chestnut wood gave no precipitate. The extracts boiled alone gave no precipitate but with hydrochloric acid a precipitate was produced equal in weight to that obtained in the complete reaction with formaldehyde. In the case of the extract decolourised with blood, the precipitate was ascribed to albumin, coagulated by the acid; with the material decolourised by lead carbonate it was assumed that lead chloride was precipitated and carried down tannin. It is necessary therefore, before assuming the presence of catechol tannin in chestnut extract, to try the effect of boiling with the hydrochloric acid alone, and if the weight of precipitate so produced is nearly equal to that of the formaldehyde precipitate, it is due to the decolourising process and the extract contains pyrogallol tannins only. The test was carried out on a number of extracts and tanning materials. No precipitate was produced with chestnut extract and sumac, except that due to the acid alone, or with valonia and myrobalans. A slight precipitate was produced on cooling the latter. Partial precipitation occurred with oak and gallic and pyrogallic acids. Complete precipitation took place with quebracho, mangrove and pyrocatechol. The test cannot be used to detect the adulteration of an extract if the tannin added is of the same nature; for example no indication is given of the presence of mangrove in quebracho or myrobalans, or sumac and valonia in chestnut. To detect mangrove in quebracho, the authors propose to add strong sulphuric acid to the extract and boil until precipitation is complete. Silver nitrate is added after filtration and in the presence of mangrove a white precipitate is produced, pure quebracho remaining clear. The action of silver nitrate solution on various materials was tried after the tannin had been precipitated by lead acetate and the excess of the latter with sodium sulphate. It is shown how the presence of other materials in quebracho or chestnut extract may be shown by means of the tests described.—D. J. L.

Tannins; Qualitative analysis of the——. L. Pollak. Collegium, 1911, 313—314.

Thuau and de Korsak (see preceding abstract) have proposed the use of silver nitrate for the detection of various tannins, especially that of mangrove in the presence of quebracho, but give no particulars of the nature of the silver precipitate. The author proposes, as a test for mangrove, the large amount of chlorides which invariably accompany it. The salt is derived from the sea water in which the tree grows, and passes, in great quantity, into the extract. Quebracho contains traces only of chlorine, while myrobalans contain none. It should be possible to make the method quantitative for the extract manufactured in the same works, but a varying amount of chlorine in the water and the addition of hydrochloric acid in the sulphiting process would render the quantitative test useless for extracts of various origins. The white precipitate obtained by Thuau and de Korsak on adding silver nitrate to a solution of mangrove extract is thus simply silver chloride and the test might lead to quite erroneous results in the hands of one inexperienced in extract manufacture. The white precipitate obtained with other extracts was also only due to the presence of chlorides in varying amounts.—D. J. L.

Mangrove in tanning extracts; The Thuau-de Korsak method for the identification of——. L. Allen and M. Auerbach. Collegium, 1911, 333—334.

The authors confirm the results of the test for mangrove in quebracho extracts proposed by Thuau and de Korsak (see above). The white precipitate produced by the addition of silver nitrate to the extract after boiling with sulphuric acid and filtering is simply due to chlorides. The test may be simplified by adding the silver nitrate to the solution of the ash of the extract or better to that of the "total solids" obtained during the analysis. The authors had discovered several years ago, in the examination of a consignment of mangrove damaged by sea-water, that mangrove wood normally contains much chloride. The fact that natural waters used in extract manufacture contain sodium chloride in greater or less quantity vitiates the test. An extract prepared from quebracho wood with tap-water gave the Thuau-de Korsak reaction; no reaction however was obtained when distilled water was used. Thuau and de Korsak had thus apparently used only extracts prepared by themselves for which distilled water had been used. A guaranteed pure quebracho extract gave a positive result and a negative result was obtained with a mixture of quebracho and mangrove when the boiling with sulphuric acid was prolonged so that all the hydrochloric acid was driven off. The presence of salt in natural waters leads to erroneous results with the test in a similar manner to that in which lately the presence of much magnesium in the water used in an extract works caused the oak-extract made there to be reported from a laboratory as being weighted with magnesium sulphate.—D. J. L.

Hides, skins and leather; Determination of free sulphuric acid in——. B. Kohnstein. Collegium, 1911, 314—317.

The process devised by the author consists in the use of magnesium bicarbonate made by dissolving magnesium carbonate in water containing carbon dioxide and the formation from this of magnesium sulphate by free sulphuric acid. Calcium sulphate in the leather does not interact with the magnesium bicarbonate at the low temperature employed. The method is as follows. The hide or leather is cut into fine threads of 3 mm. long and 1 mm. wide. About 30 grms. are placed in a tap funnel closed by a well-fitting glass stopper and the solution of magnesium bicarbonate added. In order to prevent the finely-divided precipitate of magnesium carbonate from settling on the surface of the leather, a stream of pure washed carbon dioxide is passed continuously through the mixture. The liquid is then run off through the tap into a 250 c.c. measuring flask and the process repeated three or four times and the liquid adjusted to the mark. The greater part of the accompanying organic matter washed out of the leather is removed by warming the liquid and driving off the carbon dioxide. The magnesium carbonate which is thus precipitated carries down the organic matter with it. With strongly coloured liquids rich in tannin, about 3 grms. of freshly ignited magnesia are added before filtration. The solution is then filtered and an aliquot part evaporated and ignited. The residue is moistened with water containing dissolved carbon dioxide and the process repeated except for the strong ignition. The residue is dissolved in distilled water, the magnesium carbonate filtered off and the magnesium sulphate in solution determined in the usual manner. Figures are given for the sulphuric acid found in samples of hide and leather by the method and show good agreement with the amounts of acid actually added to the samples.—D. J. L.

Gelatin; Determination of——. W. Greifenhagen, J. König, and A. Scholl. Biochem. Zeits., 1911, **35**, 217—227.

The authors have investigated various methods which have been proposed for the determination of gelatin in the presence of albumoses and peptones. Mercuric chloride does not precipitate gelatin in neutral solution, but precipitates proteoses, although not quantitatively; for the qualitative detection of gelatin, in a mixture containing also albumoses and peptone, the gelatin and albumoses are precipitated together by means of zinc sulphate and the precipitate is re-dissolved in water. This solution is now treated with mercuric chloride; should the precipitate which forms contain approximately as much nitrogen as the zinc sulphate precipitate, gelatin is absent. If, however, the nitrogen contents differ largely, gelatin is probably present. In the latter case, the presence of gelatin may be confirmed by precipitating a solution of the zinc sulphate precipitate with mercuric iodide dissolved in alcohol or acetone; if this precipitate have a higher nitrogen content than did the zinc sulphate precipitate, gelatin is present. The separation of gelatin from proteoses by these precipitants is only approximately quantitative. Determinations of gelatin by means of formaldehyde are untrustworthy, and the method proposed by Vamvakas (this J., 1907, 491) does not separate gelatin from proteoses, both these substances being precipitated quantitatively by Nessler's reagent in tartaric acid solution. Trichloracetic acid in large excess yields a turbidity with dilute solutions of gelatin and precipitates proteoses partially.—W. P. S.

Patents.

Tanning; Recovery of chromium salts employed in——. H. A. Voedisch and P. Kreismann. Fr. Pat. 428,711, April 19, 1911.

Chrome-tanned leather, leather scraps, etc., are steeped in a solution of sodium, potassium, or calcium hydroxide or ammonia for about a fortnight, after which they are washed in a bath of water for about a day. The material is then immersed in an acid bath (acetic, nitric, hydrochloric, sulphuric, or sulphurous acid) for two or three days. The chromium salts are recovered by mixing the alkaline with the acid liquors, decanting from the precipitate formed, and collecting and drying the latter.
—E. W. L.

Hides ; Process for treating ——. D. Reddan, Fitzroy, Victoria. U.S. Pat. 1,003,205, Sept. 12, 1911.

See Eng. Pat. 10,201 of 1908 ; this J., 1909, 665.—T. F. B.

XVI.—SOILS ; FERTILISERS.

Soil nitrogen ; Studies in organic ——. E. C. Lathrop and B. E. Brown. J. Ind. Eng. Chem., 1911, 3, 657—660.

The authors' experiments were made with five soils, of the type known as Haggerstown loam, collected from plots of the Pennsylvania State College Experiment Station. The soils had been under continuous cropping since 1881 and had received the following treatments :—(A) 10 tons of manure every other year ; (B) dried blood equivalent to 7 lb. of nitrogen, dissolved bone-black equivalent to 48 lb. of phosphoric anhydride, and potassium chloride equivalent to 100 lb. of potassium oxide, applied every other year ; (C) 6 tons of manure every other year and 2 tons of burnt limestone every four years ; (D) 2 tons of burnt limestone every four years ; (E) no manurial treatment. The experimental results obtained are shown in the three following tables.

I. *Amounts of organic and inorganic nitrogen in the soils studied.*

Soil.	Parts per million of oven-dried soil.				Per cent. of total nitrogen in soil.		
	Total nitrogen.	Ammonia nitrogen.	Nitric nitrogen.	Organic nitrogen.	Ammonia nitrogen.	Nitric nitrogen.	Organic nitrogen.
A	1317·5	28·4	1·88	1287·2	2·15	0·14	97·71
B	1240·0	25·6	2·06	1213·4	2·06	0·16	97·78
C	1280·0	20·6	1·88	1257·5	1·61	0·15	98·24
D	1052·5	16·9	1·74	1033·9	1·61	0·16	98·23
E	1000·0	16·4	2·30	981·7	1·64	0·23	98·02

II. *Percentages of total nitrogen separated as ammonia, and rendered soluble by steam digestion of soil at* 2, 4, 6, 8, *and* 10 *atmospheres pressure.*

Soil.	Ammonia nitrogen.					Soluble nitrogen.					
	2 atm.	4 atm.	6 atm.	8 atm.	10 atm.	2 atm.	4 atm.	6 atm.	8 atm.	10 atm.	Nitrogen insol. at 10 atm.
A	0·97	5·87	7·71	10·68	11·80	14·47	21·41	23·50	34·21	44·44	55·56
B	2·31	5·62	9·85	10·97	14·45	13·67	20·01	23·82	28·30	39·09	60·91
C	3·80	5·42	5·73	6·88	11·59	12·08	18·61	19·72	25·08	38·33	61·67
D	3·12	3·12	3·12	3·78	7·83	10 42	13·67	16·10	22·86	37·49	62·51
E	3·32	6·11	11·08	13·18	15·64	8·55	19·75	21·09	22·55	46·77	53·23

III. *Classification of nitrogen in decomposition products formed by digestion of the soils with hydrochloric acid of sp. gr.* 1·115.

Soil.	Per cent. of total nitrogen in soil.						
	Nitrogen insol. in acid.	Nitrogen sol. in acid.	Ammonia nitrogen.	Diamino-acid nitrogen.	Monoamino-acid nitrogen.	Sol. " humin" nitrogen.	Total" humin" nitrogen.
A	26·29	73·71	21·64	12·97	8·63	28·32	54·61
B	28·28	71·72	19·98	5·82	29·04	14·46	42·74
C	28·02	71·98	18·39	9·04	17·48	25·36	53·38
D	29·09	70·91	16·32	8·21	12·80	31·77	60·86
E	29·40	70·60	16·05	8·82	17·80	26·39	55·79

—A. S.

Humus solutions ; Electrolysis of ——. *Improved method for the determination of humus* [*in soils*]. J. B. Rather. Texas Agric. Expt. Stat., Bull. No. 139, May, 1910. Pp. 15.

The term humus is used to indicate that portion of the organic matter of the soil which is dissolved by ammonia after the removal of lime and magnesia by washing with dilute hydrochloric acid. It is found that electrolysis removes most of the suspended clay from humus solutions and also precipitates some of the humus. More clay is removed by electrolysis than by the method of Mooers and Hampton (J. Amer. Chem. Soc., 1908, **30**, 800), in which the ammoniacal extract is repeatedly evaporated. The amount of clay removed by electrolysis is intermediate between that precipitated by solutions of ammonium chloride containing respectively 1 and 2 parts per 1000. Electrolysis does not complete the precipitation of a solution partly precipitated by ammonium chloride. When free ammonia is present, nitric nitrogen is produced on electrolysis. In the presence of 1 grm. of ammonium chloride per litre, only very little humus is precipitated by the current in neutral solution ; both humus and clay are precipitated. Hydrochloric acid does not precipitate all the humus. Electrolysis was found useless for the quantitative removal of clay or estimation of humus. The clay may be precipitated, however, by ammonium carbonate or carbon dioxide, and both these reagents disappear on evaporating and drying the residue. Mere evaporation and solution does not remove the clay completely—the use of ammonium carbonate renders precipitation more complete and quickens the operation.—E. F. A.

Lysimeter experiments [nitrification in soils]. S. S. Peck. Report of Work of Expt. Stat., Hawaiian Sugar Planters Assoc., Bull. No. 37, 1910, Pp. 38.

THE experiments were made to study (1) the effect of various forms of lime on the formation of nitric nitrogen in an acid upland soil from a wet district; and (2) the effect of various fertiliser salts alone and in combination on the formation of nitric nitrogen in a lowland soil from a dry district. The soil was placed in lysimeters (small metal pots or tanks from which drainage water can be collected), twelve being used for each soil. The tests are classified according to the nitric nitrogen produced by the various treatments, but it is understood that they do not represent and cannot supplant actual trials in the field. Working on the upland soil, rich in organic matter, poor in soluble lime and potash, and acid to litmus, it is concluded that calcium added either as oxide, carbonate or sulphate increases the nitrification both of the soil nitrogen and of that added as ammonium sulphate. It also increases the amounts of lime and potash soluble in water and recovered in the drainage. Calcium sulphate was the most effective form. The water-soluble calcium appeared to be of greater importance in controlling nitrification than the acidity of the soil. The use of phosphoric acid and potassium sulphate produced some increase in the nitrification of ammonium sulphate. Working on a lowland soil containing a moderate amount of organic matter, rich in soluble calcium salts, and alkaline to litmus, the best results in the nitrification of soil nitrogen were obtained after using double superphosphate or tricalcium phosphate, but a decrease in nitrification followed the use of these fertilisers when nitrogen as ammonium sulphate was added. Caustic lime greatly depressed the nitric nitrogen produced from ammonium sulphate. Equal applications of nitrogen as sodium nitrate and calcium nitrate produced no differences in the amount of nitric nitrogen in the drainage in the two cases, but both nitrates yielded less nitric nitrogen than was obtained from an equivalent amount of ammonium sulphate, and similarly less soluble calcium was present in the drainage from the nitrate applications than from the ammonium sulphate. In this case there was no relation between the amount of soluble calcium and the extent of nitrification.
—E. F. A.

Nitrogenous manures; The hygroscopic properties of certain ——. H. von Feilitzen and I. Lugner. Chem.-Zeit., 1911, **35**, 985—986.

THE results are recorded of a number of experiments in which quantities of calcium nitrate, nitrolim (crude calcium cyanamide), and mixtures of these two substances, were exposed to the ordinary atmosphere and to an atmosphere saturated with moisture, and the amounts of water absorbed during one month's exposure determined. From the ordinary atmosphere, nitrolim absorbed 5·2 per cent. of its weight of water, and calcium nitrate 12·4 per cent.; a mixture of equal parts by weight of calcium nitrate and nitrolim absorbed 37·8 per cent., whilst a mixture of 1 part of the former with 2 parts of the latter absorbed 32·8 per cent. of water. From an atmosphere saturated with moisture, a mixture of equal parts of calcium nitrate and nitrolim absorbed 96·2 per cent., and a mixture of 1 part of nitrate with 2 parts of nitrolim absorbed 78·1 per cent. of water. The addition of nitrolim to calcium nitrate does not, therefore, diminish the hygroscopic properties of the latter; the nitrate appears to act as a carrier of moisture from the atmosphere to the calcium oxide present in the nitrolim.—W. P. S.

PATENTS.

Soil of fields, gardens, and woods; Material for improving the ——. Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Ger. Pat. 237,583, June 29, 1910.

THE residues, soluble in alkali, or their salt-like compounds, remaining after distilling wood tar or wood tar oils by aid of air, oxygen, or ozonised air, may be used for improving soils poor in humus; they may be applied in the form of powder or solution, and may be mixed with other fertilisers or dressings. Their properties are analogous in many ways to those of humic acid. Since they contain a proportion of colloidal substances, they also assist in retaining mineral salts in the upper layers of the soil.
—T. F. B.

Transformation of sodium nitrate into calcium nitrate. Fr. Pat. 428,014. *See* VII.

Process for disinfecting and destroying fungi and insects. Ger. Pat. 237,408. *See* XIXB.

XVII.—SUGARS; STARCHES; GUMS.

Sugar production of the world. [H.C. 281.] Board of Trade J., Sept. 28, 1911. [T.R.]

THE total estimated production of sugar in the world last year was 15,267,244 tons, as compared with 14,644,526 in 1907. Last year 8,660,463 tons of cane sugar was produced, of which 2,884,477 tons was grown in the British Empire, while 6,606,781 tons of beet sugar was produced, the bulk in Europe. Germany produced 2,004,653 tons of beet sugar, Russia 1,255,345 tons, and Austria-Hungary 1,225,589 tons. The United Kingdom last year imported 17,620,990 cwt. of unrefined sugar, as against 16,302,906 cwt. in 1909, and 16,883,107 cwt. of refined sugar, as against 18,887,438 cwt. in 1909. Last year England consumed 1,673,204 tons of sugar, or 82·43 lb. per person; Germany, 1,564,076 tons, or 77·05 lb. per head; Netherlands, 1,116,012 tons, or 38·61 lb. per head; France, 594,637 tons, or 34·13 lb. per head; United States, 3,285,771 tons, or 79·90 lb. per head.

Sugar beets; Possibility of the absorption of arsenic by ——. H. Remmler. Chem.-Zeit., 1911, 35, 977—979.

IN order to destroy the horse-beetle (*Silpha atrata*) on growing beets the suggestion has been made to spray the young plants with a mixture of Schweinfurt green, lime and water in the proportion of 1 kilo. of the arsenic compound in 100 litres of water per Prussian Morgen (0·63 acre). The question has been raised whether the leaves, at the time of the harvest, retain sufficient arsenic to produce poisonous symptoms when used as food for cattle. In order to investigate this point, experimental plots were sprayed in one case with the mixture in the above proportions and in another case with an excessive proportion of Schweinfurt green, such that the existing vegetation was killed and was only renewed later in the season. At the time of the harvest the beets were washed and sampled, whilst vigorous leaves from the central portions of the plants were selected for examination. For the estimation of the arsenic absorbed, 1 kilo. of each sample was digested with hydrochloric acid and potassium chlorate to destroy the organic matter, any carbon which separated out being filtered off and oxidised by fusion with alkali nitrates. The solutions were partly evaporated and the arsenic was removed from the faintly acid extracts by adding aluminium sulphate and precipitating with ammonia; the whole of the arsenic was carried down with the precipitated aluminium hydroxide. This precipitate was dissolved in hydrochloric acid and the solution used for charging the Marsh apparatus. One kilo. of the beets which had been sprayed at the rate of 1 kilo. of Schweinfurt green per Morgen gave a mirror corresponding to about 0·005 mgrm. of arsenious acid; 500 grms. of the leaves from these beets gave no mirror. One kilo. of the beets which had received excessive treatment showed about 0·08 mgrm. of arsenious acid, and 1 kilo. of their leaves showed 0·25 mgrm. Hence it is concluded that beets are capable of absorbing arsenic when sprayed with Schweinfurt green, and that the quantity of arsenic absorbed increases with the proportion of insecticide employed. But the experiments also show that if the

proportion used be as low as that prescribed above for exterminating the horse-beetle, no poisonous results are to be feared from the use of the leaves as cattle fodder. Against the suggestion that arsenic might find its way into the sugar, it is pointed out that lime is a powerful absorbent of arsenic, which would therefore be carried down in the defecation process; moreover the defecation lime may itself contain more arsenic than could possibly be introduced by the beets treated as above described.
—J. F. B.

Sucrose and its decomposition products; Behaviour of —— on heating. J. E. Duschsky. Z. Ver. deut. Zuckerind., 1911, 855—879. (*Cf.* also this J., 1911, 145 and 760.)

In the first part of his investigation on the partial decomposition of sugar during the concentration of juices and syrups in the effect and pans, the author studied the behaviour of solutions of dextrose and lævulose (this J., 1911, 971). A number of experiments have now been made with solutions of sucrose, under different conditions of concentration, temperature, and time. (1) In the first series, by heating solutions of sucrose in distilled water, of concentrations from 71—83 per cent., in glass vessels, at temperatures from 80°—100° C., it was found that only a slight decomposition takes place, even after 18 hours, the decrease of polarisation, and increase in the cupric-reducing power and colour being inappreciable. When, however, higher temperatures are used, a marked decomposition occurs at 110° C., and this becomes considerable at 130° C. The products of decomposition of sucrose under these conditions do not consist of dextrose and lævulose, the primary products of the destruction of sucrose in aqueous solution (*cf.* this J., 1911, 971), since the sum of the reducing sugars formed and the sucrose by Clerget differs appreciably from the initial polarisation, especially when heating is carried out at 120°—130° C. (2) In the second series of experiments, the conditions were similar, except that the solutions were rendered alkaline by the addition of 0·02 per cent. (of the weight of sugar) of calcium oxide. It was then observed that at 100° C. practically no decomposition occurs after 18 hours' heating; while at 100°—130° C. the amount of sucrose destroyed is small, so long as the alkalinity of the solution is maintained. The effect of the concentration on the decomposition cannot be defined, being too irregular. In addition to his experiments on the nature and amount of the decomposition of sucrose in solution, the author has extended Herzfeld's work on the loss of sucrose in solution taking place in one hour at temperatures from 80°—135° C., with an alkalinity of 0·10—0·20 per cent. of calcium oxide, using, however, concentrations from 50—75 per cent., and summarsies his results in a number of tables that show not only the decrease of sucrose, but also the fall in the alkalinity. In discussing the practical application of these results to the calculation of the losses occurring during evaporation, it is pointed out that they can be used in the way recommended by Claassen, provided due account be taken of the variation in the concentration during boiling, of the temperature in the effect, and of the circulation of the mass.—J. P. O.

"*Eponite*"; *Results of decolourisation* [*of sugar juice*] *experiments with* ——. H. C. Prinsen-Geerligs. Archief Suikerind. Nederl.-Ind. (Java), 1911, 19, 1085—1086. Intern. Sugar J., 1911, 13, 496.

An examination has been made of the decolourising carbon "Eponite," which has been suggested as a possible substitute for animal charcoal in the sugar refinery (*cf.* Strohmer, this J., 1911, 146). From experiments on the large scale in the refinery, it was found that, taking the total cost of decolourising with animal charcoal as 1·0, then that with "Eponite" is 1·7, and with "Blankit" 2·0. Apart from the disadvantage of its high cost, "Eponite" is unsuitable for use in practice because being in a very finely divided state it passes to a greater or smaller extent through all filtering materials. Consequently there appears in the juice or syrup a black cloudiness which exerts a highly detrimental influence on the colour of the finished product.—J. P. O.

Nitrates; The presence and determinotion of —— in beet and cane molasses. H. Pellet and C. Müller. Intern. Sugar J., 1911, 13, 493—495.

Although the nitrogen compounds of beet molasses have been investigated by different workers, the presence of these compounds in the cane product has not so far received attention. For determining the nitric nitrogen in cane molasses, Schlösing's method gives very satisfactory results, provided the following preliminary treatment to separate the nitrates from the greater part of the foreign matter be applied: 20 grms. of the cane molasses and 40 grms. of pulverised pumice are well mixed together in a nickel dish and dried in the water-oven. After reducing the residue to a powder, exactly one-half (corresponding to 10 grms. of the sample) is introduced into a 300 c.c. flask, together with 200 c.c. of 80 per cent. alcohol. When this mixture has stood for 12 hours, it is filtered, and 100 c.c. of the filtrate are evaporated to dryness on the water-bath in a round-bottomed flask. This flask is then connected with the Schlösing apparatus, and the nitric nitrogen determined in the ordinary way. Satisfactory results are likewise obtainable by the Pozzi-Escot procedure (Bull. Assoc. Chim. Sucr. 1909, 27, 457), in which the nitrates in 10 grms. of sample are reduced to (ammonia by aluminium cuttings and mercuric chloride solution), and this titrated against a 3·5 per cent. solution of sulphuric acid, 1 c.c. of which = 0·001 grm. of nitrogen. Comparable results are obtainable by these two methods, and the figures found indicate that the nitrates, calculated as potassium nitrate, averaged 0·47 per cent. for the past two campaigns. This value, calculated on the cane itself, becomes 0·02 per cent., whereas in the beet an appreciably higher amount than this, viz., 0·045—0·060 per cent., is generally found.
—J. P. O.

Malic acid [*and tartaric acid*]; *Polarimetric method for the determination of —— and its application to* [*sugar*] *cane and maple products.* P. A. Yoder. J. Ind. Eng. Chem., 1911, 3, 563—574.

The method is based on the increase of the rotatory power of malic and tartaric acids produced by uranium compounds (Walden, Ber., 1897, 30, 2889). A solution of malic acid (1 grm. per 100 c.c.), converted into its uranium compound by addition of uranyl acetate in the proportion of 1·25 atoms of uranium to 1 mol. of malic acid, has a rotatory power at 20° C. of —29·7° Ventzke for white light (Welsbach gas light) or —28·9° for sodium light. The influence of acids, alkalis, and salts on the rotatory power is described. Mineral acids have a great influence, but organic acids, other than optically active dicarboxylic hydroxy-acids, have little effect within certain limits; sugars (sucrose, dextrose, and lævulose) have no effect. The rotatory power decreases 0·03° V. for a rise of temperature of 1° C. In the case of tartaric acid the rotatory power, at 27·5° C., of a solution containing 1 grm. per 100 c.c., after conversion into the uranium compound, is +26·1° Ventzke. For the separation of malic acid from maple and sugar-cane products, 50 grms. of syrup (or 33·33 grms. of sugar and 16·66 c.c. of water) are neutralised with $N/1$ or $2N$ alkali; the requisite quantity of alkali being determined previously and being diluted to 15 c.c. before addition to the syrup. After well mixing, 10 c.c. of lead acetate solution of sp. gr. 1·25 and 150 c.c. of neutral 95 per cent. alcohol are added, and the whole is shaken well and allowed to stand for 3 hours, after which the clear supernatant liquid is decanted through a suction filter of diam. not less than 7 cm. The precipitate is transferred to the filter, washed with 75 per cent. alcohol, and then returned with the filter to the precipitation flask, heated with water, and the lead precipitated with hydrogen sulphide. The filtered solution is concentrated to 30 c.c., and diluted to 50 c.c. In an aliquot portion, *e.g.* 20 c.c., of this solution the rotatory power is determined before and after addition of 0·7 grm. of uranyl acetate, in the latter case readings being taken after small additions of either $2N$ potassium hydroxide or $2N$ acetic acid until the maximum rotation is obtained. The percentage (grms. per 100 c.c.) of malic acid is calculated by means of the formula (1) for white light or (2) for sodium light ; P and P′ are the rotatory powers before and after addition of uranyl acetate :—

$$(1)\quad \frac{(P'-P)\times[1+0{\cdot}001(t-20)]}{-29{\cdot}6\times\frac{1}{2}L}$$

$$(2)\quad \frac{(P'-P)\times[1+0{\cdot}001(t-20)]}{-28{\cdot}8\times\frac{1}{2}L}$$

In the process of separating malic acid, barium acetate may be used in place of lead acetate, and is preferable in the case of sugar-cane products, as sulphuric and phosphoric acids are also removed thereby. In 6 samples of cane and maple syrups the malic acid content ranged from 0·01 to 0·53 grm. per 100 c.c. (0·01—0·04 for cane syrups and 0·25—0·53 for maple syrups). The above method can be applied to the determination of malic acid and tartaric acid in mixtures, if another value, *e.g.*, total acidity, be determined in addition to rotatory power. If 100 c.c. of a solution contain *x* grms. of malic acid and *y* grms. of tartaric acid ; has a total acidity corresponding to *n* c.c. of *N*/1 alkali ; and shows an increase in rotatory power (at 27·5° C.) in a 20 cm. tube of *m*° Ventzke in presence of an uranium compound, then :

$$n=\frac{x}{0{\cdot}06703}+\frac{y}{0{\cdot}07503}\text{, and } m=25{\cdot}16y-29{\cdot}27x,$$

(the change in the rotatory powers of malic acid and tartaric acid due to the uranium compound being taken as —29·27° and +25·16° respectively). Combination of the two equations gives :

$$x=0{\cdot}03287n-0{\cdot}01741m.$$
$$y=0{\cdot}03824n+0{\cdot}01949m.$$

—A. S.

Sugar cane juice ; Notes on the determination of acids in ——. P. A. Yoder. J. Ind. Eng. Chem., 1911, **3**, 640—646.

A DETAILED description of attempts to determine approximately the different acids present in Louisiana sugar cane juice is given, the method consisting broadly in converting the acids into lead salts in a neutral solution containing 50 per cent. of alcohol, decomposing the lead salts, converting the acids into calcium salts, separating the latter into fractions according to their varying solubility in alcohol of different concentrations and in water, and then examining the different fractions. Malic acid, liberated from the calcium salt, was determined polarimetrically (see preceding abstract). Of the quantity of acids precipitated originally as lead salts, only about one-half was accounted for as follows, the figures representing grms. of acid per 100 c.c. of sugar cane juice :—sulphuric acid (as SO_3), 0·00051 ; phosphoric acid (P_2O_5), 0·00314 ; oxalic acid, 0·00004 ; malic acid, 0·00077 ; aconitic acid, about 0·05 ; no tartaric, succinic, or citric acid could be detected. More sulphuric acid was present than indicated, but the total quantity was not determined. The results show that aconitic acid is the predominating acid in Louisiana cane juice ; this acid passes almost entirely into the molasses in the process of sugar manufacture. It is pointed out that the statement in text-books that citric acid is the only one of the natural organic plant acids having a calcium salt less soluble in hot than in cold water, is incorrect. Calcium aconitate shows a greater difference of solubility in hot and cold water respectively than calcium citrate does.—A. S.

Levan in sugar ; Occurrence of ——. W. G. Taggart. J. Ind. Eng. Chem., 1911, **3**, 646—647.

IN experiments on the bacterial decomposition of sugars (this J., 1911, 503) it was found that levan (see this J., 1902, 1381) was produced by the action of certain bacteria. The levan can be isolated by inoculating the sugar solution with yeast, and, when most of the sugar has fermented, precipitating the levan by alcohol made slightly alkaline with sodium hydroxide. After the levan has been dissolved and re-precipitated several times, it agrees in properties with the substance isolated by Greig Smith and Steel (this J., 1902, 1381). The presence of levan interferes with the Clerget method, the invertase method (this J., 1911, 62) and the Andrlik urea method (this J., 1907, 540).—A. S.

Carbohydrates ; Determination of —— *by oxidation with potassium permanganate in alkaline solution.* W. Greifenhagen, J. König, and A. Scholl. Biochem. Zeits., 1911, **35**, 169—193.

IT is shown that all sugars, likewise polyhydric alcohols, their aldehydes and ketones, and polysaccharides are quantitatively oxidised to oxalic acid and carbon dioxide when their solutions are boiled with an alkaline solution of potassium permanganate. By using a standardised solution of permanganate and titrating the excess of the latter after the oxidised solution has been acidified, the amount of sugar, etc., present may be calculated from the quantity of oxygen consumed. In the case of glycol and erythrol the proportion of oxalic acid to carbon dioxide is such as can only be explained by the assumption that polymerisation takes places in the strongly alkaline solution during, or before, the oxidation. Formic acid could not be detected in the products of the oxidation.

—W. P. S.

Carbohydrate phosphoric acid esters and glycerophosphoric acid ; Further investigations on the artificial preparation of ——. C. Neuberg and E. Kretschmer. Biochem. Zeits., 1911, **36**, 5—14. (Cp. Neuberg and Pollak, this J., 1910, 291, 967.)

d-Galactose-phosphoric acid.—The method of preparation is essentially the same as that used for dextrose-phosphoric acid (*loc. cit.*, 967) ; the solution of phosphorus oxychloride was added drop by drop with vigorous stirring. The calcium galactose-phosphate, $C_6H_{11}O_9PCa+H_2O$, must be repeatedly precipitated with alcohol to free it from calcium chloride. It is a light, white powder, easily soluble in water when freshly precipitated, but only partially so after being dried to constant weight. The fresh solution reduces hot Fehling's solution strongly, and does not react with magnesia mixture or ammonium molybdate, repeated evaporation with nitric acid being necessary to set free the phosphoric acid. The compound is readily fermented, and apparently more readily than galactose, by beer yeast, the fermentation being probably accelerated by the organic phosphoric acid compound. The compound loses 1 mol. of water when dried *in vacuo* at 110° C. *Laevulose-phosphoric acid.*—With the same method of preparation, lævulose yields a product which tenaciously retains calcium chloride and closely approximates in composition to the formula, $2C_6H_{11}O_9PCa+CaCl_2+5H_2O$; lactose and maltose also yield products which cannot be freed from calcium chloride. By the partial hydrolysis of sucrose-phosphoric acid, however, lævulose-phosphoric acid is formed, the fission of the dextrose and lævulose residues being more rapid than the liberation of phosphoric acid. For this, a solution of 5 grms. of calcium sucrose-phosphate in 100 c.c. of water was heated with 10 c.c. of hydrochloric acid of sp. gr. 1·12 for 15 minutes on the water-bath; the product, whilst still warm, was treated with excess of calcium carbonate, the calcium lævulose-phosphate, $C_6H_{11}O_9PCa+H_2O$, being finally isolated and purified by repeated precipitation with alcohol. This substance reduces Fehling's solution strongly on warming, gives a positive result with Seliwanoff's test, and is readily fermented by beer yeast. *Glycerophosphoric acid.*—An aqueous solution of glycerol was treated with phosphorus oxychloride in presence of calcium carbonate ; the product was filtered, and concentrated *in vacuo* at 35°—40° C., the calcium glycerophosphate, $C_3H_7O_6PCa+H_2O$, being precipitated as an oil by acetone, converted into a flocculent precipitate by boiling with alcohol, and purified by re-precipitation with alcohol. This method of preparation is not difficult but is not preferable to that of synthesis from glycerol and phosphoric anhydride. The compound, like that prepared in the ordinary way (cp. Neuberg and Tir, this J., 1911, 705) evolves carbon dioxide in abundance on treatment with beer yeast. Inositol yields a phosphoric acid ester on treatment with phosphorus oxychloride in presence of sodium hydroxide, but the authors have not succeeded in freeing the product from calcium phosphate.

—L. E.

Caramel; Colourimetric test for ——. F. A. Upsher Smith. Amer. J. Pharm., 1911, **83**, 411—412.

As a colour standard for caramel, the coloured solution prepared by adding Nessler's reagent to a solution of an ammonium salt is recommended. As an arbitrary value for the colour intensity of caramel, the author terms a caramel "100 per cent.," which has such a colouration that 10 c.c. of its 0·1 per cent. solution when treated with 2 c.c. of the Nessler reagent and diluted to 50 c.c. matches the standard colour obtained by mixing together 10 c.c. of a solution containing 0·0417 grm. of ammonium oxalate in a litre, 38 c.c. of water, and 2 c.c. of Nessler solution.—J. P. O.

Determination of starch. Greifenhagen and others. *See* XIXa.

Patents.

Sugar juices; Purification of crude beet and cane —— with hydrosulphites. L. Descamps. Fr. Pat. 427,890, March 29, 1911.

The crude juice is treated with a hydrosulphite, *e.g.*, calcium hydrosulphite, or with a hydrosulphite-aldehyde, in order to decompose the viscous substances present in the juice and thus diminish the amount of lime required to insure rapid filtration. The hydrosulphite may be added to the juice in the measuring back, when the latter is filled to about one-fourth, the amount added being, in the case of crude beet juice, 5—10 grms. per hectolitre. As the treatment is continued the proportion of lime used prior to the first carbonatation, is reduced as far as is consistent with rapid filtration, *e.g.*, to 1 per cent.—L. E.

Sugar; Process for making ——. Henning Process Sugar Extraction Co. Fr. Pat. 428,086, April 4, 1911.

See U.S. Pat. 991,505 of 1911; this J., 1911, 761.—T. F. B.

Mucilages. The Gum Tragasol Supply Co., Ltd. Fr. Pat. 427,918, Feb. 27, 1911.

See Eng. Pat. 5018 of 1910; this J., 1911, 439.—T. F. B.

Production of milk-sugar, casein, fat, albumin, and phosphates. Eng. Pat. 12,855. *See* XIXa.

Sulphitating and desulphitating saccharine juices. Addition to Fr. Pat. 361,869. *See* XVIII.

XVIII.—FERMENTATION INDUSTRIES.

Yeast; Treatment of —— with phosphoric acid. E. Moufang. Woch. Brau., 1911, **28**, 410—414, 423—424. (See this J., 1910, 103, 506; 1911, 1130.)

The treatment of yeast with phosphoric acid has not always given good results under practical conditions. The author gives the results of experiments in which phosphoric acid and phosphates were used under various conditions of time and concentration. The action of the treatment is three-fold, *viz.*, mechanical (removal of foreign matter), disinfecting, and physiological (stimulating). In respect of behaviour towards phosphoric acid and phosphates, yeasts may be classed as "acid" or "basic," and the state of a yeast in respect of acidity should generally determine the question as to whether the yeast is to be treated with free phosphoric acid or a salt. A solution of phosphate (secondary potassium phosphate) should be used for treating yeasts obtained from very acid media and yeasts that show a specific tendency to acid-formation, though for disinfecting purposes, the yeast may first be washed with a solution of the free acid. Yeasts obtained from feebly acid media, yeasts of high protein-content, and yeasts that have been washed with alkaline water are best treated with a solution of phosphoric acid or primary phosphate. In general, 6—24 hours treatment with a solution of 0·3—0·5 per cent. concentration, is sufficient. The neutralisation of the acid solution, subsequent to the treatment, may be effected with alkali, or tertiary potassium phosphate (in quantity sufficient to form the secondary phosphate); lime should not be used for neutralisation.—L. E.

Yeast fermentation without sugar. III, IV, and V. C. Neuberg and L. Karczag. Biochem. Zeits., 1911, **36**, 60—67, 68—75, 76—81. (Cp. this J., 1911, 379, 705.)

III. It has already been shown that a number of substances, presenting no manifest relation to the carbohydrates, readily yield carbon dioxide on treatment with yeast (*loc. cit.*). Further proof of fermentation is now adduced; in experiments with the potassium salts of pyruvic and *d*-tartaric acids and sodium glycerophosphate, it is found that the liberation of carbon dioxide is coupled with decomposition of the substance. This result also shows that fermentation without sugar has nothing to do with the increase in auto-fermentation observed by Harden and Paine on treating yeast with molar (1 grm.-mol. per litre) solutions of sodium chloride or ammonium sulphate (this J., 1911, 641); moreover the concentration of fermentable substance used by the authors was much less than molar, and of the degree stated to be inactive in respect of auto-fermentation. Again, the authors find that, in general, the auto-fermentation of yeast is decreased by various substances (including sodium chloride and ammonium sulphate in molar concentration); they point out, however, that the difference between their results and those of Harden and Paine may be due to differences in the nature of the yeasts employed.

IV. Carboxylase, a new enzyme of yeast.—Previous attempts to ferment free pyruvic acid were unsuccessful (this J., 1911, 379), but it is now found that this may be effected with pure culture yeast of high fermenting power, or with rather larger quantities of ordinary pressed yeast. Besides carbon dioxide, acetaldehyde is formed, the fermentation proceeding according to the equation, $CH_3CO.COOH = CO_2 + CH_3CHO$. That the formation of acetaldehyde by the action of yeast on the potassium salt of pyruvic acid is not directly observable is due to the condensation of this substance by the potassium carbonate formed at the same time. Since acetaldehyde is strongly toxic to protoplasm, it is only formed abundantly from pyruvic acid when the concentration of the latter is low (1 per cent. or less is best). Free oxalacetic acid is fermented in accordance with the equation,

$$COOH.CH_2.CO.COOH = 2CO_2 + CH_3CHO,$$

though of course it is possible that in the first instance the oxalacetic acid loses 1 molecule of carbon dioxide with formation of pyruvic acid. The above-described decompositions can be effected with preparations such as "Hefanol" in presence of toluene, but not with boiled yeast, and they must therefore be due to enzyme action. The authors assign the name "*carboxylase*" to the enzyme concerned. This enzyme is present in all the yeasts examined (eight), and with regard to its rate of action, it is found that a 1 per cent. solution of pyruvic acid is fermented as rapidly as a 1 per cent. solution of dextrose. The action of carboxylase on the salts of pyruvic and oxalacetic acids is notable in that a carbonate is formed, and this is the first observed instance of the production of a "fixed alkali" (potassium carbonate) from a neutral salt (potassium pyruvate) by a fermentation process; the product of the action of yeast on potassium pyruvate is distinctly alkaline.

V. Characterisation of carboxylase.—Since the occurrence of carboxylases is perhaps not confined to yeasts, the authors give the name "*yeast-carboxylase*" to the enzyme of yeast. In earlier experiments with alkali salts of pyruvic acid, a "period of incubation" was observed (this J., 1911, 379); this finds a purely chemical explanation in that the carbon dioxide formed at first is fixed as alkali carbonate and bicarbonate, the latter then being decomposed with evolution of gas. It might be expected that much less gaseous carbon dioxide would be formed from the alkali salts than from free pyruvic and oxalacetic acids, but such is not the case if the fermentation is continued for 12—24 hours, since the alkali formed converts the acetaldehyde into less toxic products and the fermentation continues for a longer time. Carboxylase is much more sensitive to free pyruvic acid than to its salts; whereas, both the free acid and the potassium salt are fermented by "Hefanol" in presence of toluene, only the potassium salt is fermented by fresh yeast killed with toluene or chloroform. The fact that salts of pyruvic acid are fermented by fresh yeast in presence of toluene or chloroform, sharply distinguishes carboxylase from zymase, since in presence of these antiseptics, the yeast shows no zymase-activity.—L. E.

Whisky; Detection of substitution of spirits [inferior spirits or alcohol] for aged ——. A. B. Adams. J. Ind. Eng. Chem., 1911, **3**, 647—655.

In the United States new whisky is usually stored in Government bonded warehouses for ageing. The barrels are stamped at entry and when withdrawn, and it is illegal to change the contents of a stamped barrel unless the stamp marks are destroyed. A practice has, however, prevailed of disposing of a part or the whole of the contents of a stamped barrel and re-filling either with inferior whiskey or with diluted and artificially coloured and flavoured alcohol. The view of the U.S. Government that such substitution can be detected by chemical examination has been disputed and in order to obtain a legal decision on the question, a test-case (U.S. *vs.* Nine Barrels of Whisky) was brought. In the present paper a description is given of the evidence brought forward to show that when whiskey is stored in charred oak barrels, the changes produced are regular and comparable in samples of the same age and from the same distillery but from different barrels, except with respect to depth (not composition) of colour and amount of aldehydes, especially furfural. Hence, substitution can be detected by comparison of the chemical composition of the suspected sample with a sample of whiskey of about the same age and from the same distillery as indicated on the stamp marks of the barrel containing the suspected whisky. This contention was upheld by the jury. The most important factors in such a comparison are the proportions of acids and esters, and the character of the colour (proportions insoluble in water and soluble in amyl alcohol respectively), but the proportions of solids, higher alcohols, aldehydes, and furfural, also afford useful evidence. A. S.

Wine production in certain European countries. Board of Trade J., Sept. 28, 1911. [T.R.]

A supplement, dated 16th September, to the "Bulletin of Agricultural Statistics," issued by the International Institute of Agriculture at Rome, contains the following statistics of the estimated production of wine in Spain, Hungary, Italy, Luxemburg, and Switzerland in 1911, together with definitive figures for the preceding year, and average figures for the ten years 1901–10:—

——	Average, 1901–10.	1910. (Definitive.)	1911. (Estimated.)
	Hectolitres.	Hectolitres.	Hectolitres.
Spain	16,550,747	11,283,433	16,754,000
Hungary	4,006,715	2,764,026	4,000,000
Italy	41,738,825	29,293,240	45,000,000
Luxemburg	52,745*	27,949	110,000
Switzerland	942,330	408,755	876,000

* Average for 1906–10.
Hectolitre = 22 Imperial gallons.

Carbohydrate phosphoric acid esters and glycero-phosphoric acid. Neuberg and Kretschmer. *See* XVII.

Patents.

Saccharine juices; Process for sulphitating and desulphitating ——, and its application to various fermentation industries. E. A. Barbet. Eighth Addition, dated June 17, 1910, to Fr. Pat. 361,869, Oct. 27, 1905 (this J., 1906, 1229; 1907, 109, 708, 1250; 1908, 826, 953; 1909, 1156).

A quantity of grape juice, amounting to about one-tenth of the total to be treated, is sulphitated to a very high degree, viz., to the extent of 8—10 grms. of sulphur dioxide per litre. Part of the treated juice is poured on to freshly gathered grapes, whereby the latter are immediately sterilised, and the remainder is added to the grapes just before pressing. The sulphur dioxide employed is obtained by burning sulphur. If available, a desulphitating apparatus may be used for effecting the super-sulphitation, the purified sulphur dioxide being aspirated through the column in place of air; otherwise, a more primitive apparatus consisting of a tier of carboys is used, the juice descending from carboy to carboy by gravity, and the gas being aspirated in the opposite direction by a hand-pump.—L. E.

Musts, fermented beverages such as wine, beer, cider, etc., spirits and liqueurs; Treatment of —— with nitrogen. F. L. J. P. F. and P. Malvezin. Fr. Pat. 427,947, Mar. 30, 1911.

The chief objects of this process are to precipitate undesirable substances such as tannin and albumin, to remove some micro-organisms by entrainment with the precipitate, to inhibit the growth of aerobic organisms and the action of oxidising enzymes by the substitution of nitrogen for oxygen in the liquid, and to aid in the maturation of wines, etc. The must or beverage is treated either by passing gaseous nitrogen directly through the liquid, or with nitrogen in a suitable solvent or combination. The treatment may be carried out in conjunction with processes of filtration, pasteurisation, sterilisation, or refrigeration. —L. E.

Oxidation of liquids; Apparatus for ——, and process for artificial maturation of wines and improvement of fermentable liquids. W. Saint-Martin. Fr. Pats. 428,010 and 428,011, June 11, 1910.

(1) The apparatus includes a chamber in which the finely divided liquid is subjected to the action of compressed oxygen or ozone. The oxygen is introduced into the chamber through a pipe which may be provided with a washing device and with an ozoniser. The liquid is introduced, under high pressure, through a pipe which divides into two branches with very small orifices, the emerging jets of liquid being directed towards each other and perpendicularly on to a spraying device situated between the two branches. This device comprises two concave conical surfaces united at their bases and terminating in very fine points situated in the axis of, and very close to the orifices above mentioned. The conical surfaces are grooved radially, the width and depth of the grooves increasing from the apex to the base of the surface; the liquid is thus uniformly distributed in the form of a very fine spray throughout the chamber. (2) The liquid such as wine, beer, milk, etc., charged with oxygen as above described, is intimately mixed with carbon dioxide. The apparatus used consists of a column or bottle fitted with two tubes, the lower ends of which are bent towards each other. The liquid and gas are forced through these tubes, under pressure, and are thoroughly mixed on emerging therefrom.—L. E.

Alcoholic liquids; Process and means for distilling —— in vacuo. G. Rouaix. Fr. Pat. 428,012, June 11, 1910.

The process comprises two operations, in the first of which the alcoholic liquid is converted into an intermediate product termed "brouillis," the latter being converted into the finished alcohol in the second operation. Save in a few details, the plants for both operations are identical. Throughout the distillation, as perfect a vacuum as possible is maintained in the distilling vessels and columns, and in the various backs, recipients, and coolers, the flavour of the products being improved thereby. Means are provided for returning the distillate, when desired, to the distilling vessels or columns, with a view to increasing the alcohol-content of the final product, and provision is made for collecting the head and tail products in a separate receiver with a view to re-distillation.—L. E.

Alcohols, wood spirit, and other volatile products; New improvements in the construction of continuous rectifiers for ——. E. A. Barbet. Fr. Pat. 428,299, June 17, 1910.

To avoid deposition of calcium salts on the plates, etc., of the purifying column, the dilution of the phlegm is effected with the condensed water from the steam coil or pipe used for heating the purifying and rectifying columns. The phlegm and hot water are passed in opposite directions through a heat interchanger before being mixed together. The heating of the phlegm is thus rendered gradual, and vaporisation is limited to the head products. A thermometer situated on the second plate above the inlet for the diluted phlegm, in the purifying column, serves as an indicator in regulating the degree of dilution. One of the caps at the periphery of each plate in the purifying column is provided with an arm which passes through a stuffing-box outside the column, so that the cap may be raised, and the plate thus put out of action. With this device the alcoholic concentration at the top of the column may be limited to the required degree (91—92 per cent.) for an efficient expulsion of head products, by cutting out one or more plates, and these products may also be expelled at one of the plates instead of at the cooler exit; again, the application of this device to distilling columns renders possible the alteration of the alcohol-content of the product. To neutralise the acidity of the vapours of the phlegm and thus prevent formation of esters, a solution of sodium hydroxide of 4°—5° Baumé is run on to the top and second plates, passing from the latter plate through a pipe to the bottom of the column. —L. E.

XIXa.—FOODS.

Condensed milks, with special reference to their use as infants' foods. F. J. H. Coutts. Report to the Local Government Board No. 56, Aug., 1911. Pp. 64.

The report deals in turn very fully with the history and methods of preparation, composition, distribution and uses of condensed milk, particularly in connection with infant feeding; and great stress is laid on the injurious results following the use of machine-skimmed condensed milk. Allusion is made as to the accuracy and effect of the statements on labels and advertisements. It is suggested that tins of condensed skimmed milk might be required to bear in letters of prescribed size the words "*skimmed milk—unfit for infants.*" The use of preservatives, with the exception of sugar, should be prohibited entirely. Preservatives are most frequently found in full cream milks, containing a very small proportion of sucrose, imported from Italy or France. It would be advantageous to be able to enforce the withdrawal from sale or use of all tins labelled or advertised in a false or misleading manner, and also to prevent the circulation of such advertisements. Tins should bear a declaration, "*this milk contains not less than —— per cent. of milk fat,*" this plan being thought preferable to that of fixing a low minimum and requiring this to be maintained in all cases. The declaration of added substances on the label should be more explicit than at present. It is desirable to mark the tins so as to indicate the manufacturer or person responsible, and also approximately the date of canning.—E. F. A.

Butter-fat; Effect of feeding with cocoanut cake and linseed cake on the composition of ——. H. T. Cranfield. Analyst, 1911, **36,** 445—449.

Results of an investigation as to the effect of feeding cows on cocoanut and linseed cakes are recorded. The feeding with cocoanut cake produced a butter which gave a refractometer reading below the normal, namely 43° at 35° C., whilst the Polenske value was very high (3·7); the Reichert-Meissl value was, however, quite normal. Feeding with linseed cake influenced the butter as regards the Polenske value, butters from this source giving figures as low as 1·5, whilst a distinct rise was noticeable in the refractometer reading. The butter obtained from cows fed on cocoanut cake was of good quality and possessed better keeping properties than butter yielded by cows fed on linseed or cottonseed cakes.—W. P. S.

Feeding stuffs; Determination of fat in —— by means of trichloroethylene. R. Neumann. Chem.-Zeit., 1911, **35,** 1025—1026.

Trichloroethylene is recommended as a solvent in the determination of fat in feeding stuffs. Five grms. of the substance, such as oil-cake, etc., are shaken for 30 minutes in a flask with exactly 100 c.c. of the solvent; the solution is then filtered, 50 c.c. of the filtrate are evaporated in a weighed flask, the residue of oil or fat is dried at 100° C., and weighed. The results obtained agree well with those yielded by the ordinary extraction process with ether. (See also this J., 1910, 718, 884.)—W. P. S.

Starch [in feeding-stuffs, etc.]; Determination of ——. W. Greifenhagen, J. König, and A. Scholl. Biochem. Zeits., 1911, **35,** 194—216.

The polarimetric methods described by Lintner (this J., 1907, 281), and Ewers (this J., 1908, 238), were found to yield results sufficiently accurate for all practical purposes, such, for instance, as the determination of added starch in cocoa or cinnamon. In Lintner's method the different starches exhibit nearly the same specific rotation, and an average value of +202° may be used in their determination. When Ewer's method is employed, the rotation varies somewhat, but for maize, rice, wheat, rye, barley, and oat starches the mean specific rotation may be taken as +183·3°. In the analysis of feeding-stuffs and other products containing starch, it is recommended that the substance should be washed with cold water, alcohol, and ether before the starch is determined in order to remove other optically-active ingredients; cellulose, hemi-cellulose, and pentosans do not interfere with the accuracy of the results obtained by either of the methods. Lintner's method is the more suitable for the determination of starch in cocoa and cinnamon, whilst Ewer's method is preferable in the case of pepper. Cinnamon should be extracted with hot alcohol before the starch is determined. —W. P. S.

Pentosans and methylpentosans; Determination of —— in cereals and wood fungi. M. Ishida and B. Tollens. J. Landw., 1911, **59,** 59—67. Chem. Zentr., 1911, **2,** 794—795.

An apparatus is described for the separation of the phloroglucides of furfural and methylfurfural (see this J., 1905, 212) by extraction with alcohol. It consists essentially of a glass tube shaped liked the lower part of a Soxhlet extractor; this receives the Gooch crucible containing the mixed phloroglucides, and is itself placed in a wider tube fitted below to a distilling flask containing alcohol and above to a reflux condenser. On two successive extractions in this way, furfuralphloroglucide lost only 3—4 mgrms., whilst methylfurfuralphloroglucide was completely dissolved with the exception of 1—2 mgrms.; in the analysis there will thus be a partial compensation of errors. The content of (I) pentosans and (II) methylpentosans in different kinds of cereals and wood fungi are shown in the following table, the figures having been calculated with the aid of the tables of Kröber (J. Landw., **48,** 357; see this J., 1901, 396; 1902, 875) and Mayer and Tollens (J. Landw., **55,** 261; see this J., 1907, 781).

Cereals.	I.	II.
	per cent.	per cent.
Horse-tooth maize	4·60	0·94
Göttingen wheat	6·93	1·72
,, rye	8·41	1·69
Pfauen barley	9·04	1·96
Göttingen oats	12·39	1·52

Wood fungi.	I.	II.
	per cent.	per cent.
Polyporus fomentarius	2·58	1·74
,, *pinicola*	5·11	2·21
,, *hirsutus*	4·62	2·08
,, *fulvus*	4·10	1·01
Daedalea quercina	3·05	1·17

—A. S.

Use of metallic containers for edible fats and oils. Emery. *See* XII.

Determination of gelatin. Greifenhagen and others. *See* XV.

Patents.

Milk-sugar, casein, fat, albumin, and phosphates; Process for the production of ——. F. C. Harold, London, and S. M. Cottee, Lismore, New South Wales. From E. Mislin, Prague, Bohemia. Eng. Pat. 12,855, May 26, 1910.

Dry milk is treated with suitable solvents to remove the fat, then mixed with water, and filtered; the casein thus separated is dried. The filtrate is passed through a "decolouring battery" and saturated with carbon dioxide, whereby the albumin is separated. The liquid portion is next concentrated under reduced pressure until "massecuite" is formed; this is subjected to centrifugal action to convert it into such a condition that the sugar can be obtained directly in a refined condition. The resulting mother-liquid is mixed with its own volume of alcohol and boiled down in a closed vessel provided with a rectifying column. The salts (phosphates) dissolve whilst the milk-sugar remains; these salts may be recovered by distilling the alcohol.—W. P. S.

Dry milk; Making ——. C. H. Campbell, New York. U.S. Pat. 1,002,496, Sept. 5, 1911.

Partially concentrated milk is spread in a succession of films, one upon another, on a roller; these films are dried sufficiently to form a thick body of solidified milk which is then cut up into small particles (turnings) by a suitable apparatus; the particles dry readily and crumble to a powder.—W. P. S.

Food products from soya beans. Y. Y. Li. Fr. Pat. 428,718, April 20, 1911.

Soya "cheese" (obtained by coagulating soya "milk") is cooked and then mixed with condiments, meat, etc. —W. P. S.

Soya bean chocolate. Y. Y. Li. Fr. Pat. 428,719, April 20, 1911.

Soya beans are roasted in the presence of cacao beans, and then ground to a powder, or roasted soya beans are moistened and exposed to the vapours arising from cacao beans while the latter are being roasted. Decorticated soya beans may also be mixed with cacao butter, then roasted, and ground to a powder.—W. P. S.

XIXb—WATER PURIFICATION; SANITATION.

Potassium chloride works; Report of Commission on the pollution of the rivers Wipper and Unstrut by waste liquors from ——. Beckurts, Orth and Spitta. Papierfabrikant, 1911, **9**, 1149—1151.

The waste liquors from the recovery of potassium chloride from carnallite, $MgCl_2,KCl,6H_2O$, contain on the average: magnesium chloride, 349·2 grms.; magnesium sulphate, 32·5 grms.; potassium chloride, 15·5 grms.; sodium chloride, 10·1 grms. per litre. The sp. gr. of the liquor is 1·300—1·313; the average quantity of waste liquor is 50 cub. m. per 100 tons of carnallite treated; fifteen potassium chloride works discharge their liquors into the two rivers mentioned, the concessions providing that the original hardness of the water (20°—40°) shall not be increased beyond a certain limit (37·5°—60°). Under present circumstances, these concessions are not utilised to the full extent, but the prescribed degree of hardness is exceeded over a portion of the year. The contamination extends below the two rivers mentioned, and affects the mills situated on the river Saal. The mills affected comprise sugar factories, breweries and paper mills. The questions of the effect of magnesium chloride in the boiler feed waters and the effect of magnesium salts on the sizing of paper appear to be the most urgent. The Commission considers that a reduction of the maximum permissible degree of hardness may ultimately be justified, but that present action should be confined to the equalisation of the pollution. This involves the provision of storage basins for the liquors and some means for distributing the discharge over the entire width of the rivers. Observations on these lines are being carried out, and an apparatus has been devised for automatically recording the degree of contamination of the water by measurements of its electrical conductivity. Chemical analysis will also be utilised, the soap method being rejected in favour of the Wartha-Pfeifer method of alkalimetric titration described in this J., 1903, 320.—J. F. B.

Shellfish contamination from sewage-polluted waters. G. W. Stiles, jun. U.S. Dept. Agric., Bureau of Chem., Bull. No. 136, April 19, 1911.

This investigation was undertaken to determine the nature and extent of the danger to the public health and to the shellfish industry from the rearing of oysters and clams in waters polluted by sewage. It was found that the shellfish collected from polluted beds contained many sewage bacteria, whereas those from beds apparently pure were free from those bacteria. The sea-water also from beds suspected to be polluted contained sewage bacteria, the numbers being greater in the deep water than in the surface water. The liquid in the oyster shell contains many more bacteria than does an equal volume of the body of the oyster. The keeping of oysters in water of doubtful purity before marketing is dangerous on account of the easy entry of bacteria into the shell; and the water in these places should be pure and of the same salinity as the water in which the oysters were reared. Even oysters obtained from pure beds may be contaminated by preparation in insanitary marketing establishments, and these places should be provided with sterilising apparatus for all utensils used. The steaming of oysters for 15 minutes at boiling point destroys all polluting bacteria, but as this is never done for so long a time in practice, cooking cannot be relied upon to remove contamination. —J. H. J.

Nicotine; Determination of —— *in nicotine solutions an tobacco extracts.* R. M. Chapin. U.S. Dept. Agric. Bureau of Animal Industry, Bull. No. 133, April 1 1911, pp. 22.

The silicotungstate method of estimating nicotine in sheep dips, tobacco extracts, etc., suggested by Bertrand and Javillier (this J., 1909, 326) has been elaborated for gravimetric work. It is claimed to be technically practical, accurate and convenient and more accurate and economical than the Kissling method hitherto employed. The following directions are given: An amount of the nicotine preparation, which will contain from 1 to 2 grms. of nicotine is washed with water into a 500 c.c. flask, and 1 to 1½ grms. of paraffin, a few small pieces of pumice and 5 to 10 c.c. of sodium hydroxide solution (1 to 2) are added. The mixture is distilled in a rapid current of steam, the vapours being passed into 10 c.c. of dilute hydrochloric acid in a capacious flask. The heat is regulated so that the volume of the liquid in the distillation flask is reduced as far as practicable without bumping or undue separation of insoluble matter, and the distillation is continued until a few c.c. of the distillate, collected separately, give no opalescence with a drop of silicotungstic acid solution and a drop of dilute hydrochloric acid (1 to 4). The residue in the distillation flask should be alkaline to phenolphthalein. The distillate is made up to a convenient volume, well mixed and filtered through a large dry filter, a liberal first portion of the filtrate being discarded, and a portion tested with methyl orange to assure its acidity. An aliquot portion containing about 0·1 grm. of nicotine, is mixed with 3 c.c. of hydrochloric acid (1 to 4) for every 100 c.c. of liquid and 1 c.c. of a 12 per cent. solution of silicotungstic acid is added for each 0·01 grm. of nicotine supposed to be present. This corresponds to an excess of 17 per cent. over the amount theoretically necessary. After mixing thoroughly and allowing to stand for 18 hours, or stirring continuously for 1 hour if speed is essential, the crystalline precipitate is filtered off on a "quantitative" paper and washed with cold water containing 1 c.c. of strong hydrochloric acid per litre until the washings show no more opalescence when tested with a few drops of nicotine distillate. The wet paper and precipitate are transferred to a weighed platinum crucible, dried, carbonised, the carbon burnt off at as low a temperature as possible, the heat being increased gradually, and the residue ignited for 5 minutes over a blast lamp. The weight of the residue multiplied by 0·114 gives the weight of the nicotine in the aliquot part taken for precipitation.—E. F. A.

Patents.

Refuse destructor furnaces. H. E. Hughes, N. R. Stirling, and J. H. Thwaites, London. Eng. Pat. 2264, Jan. 28, 1911.

In a furnace constructed on the continuous grate system, the grate-cells are separated from each other by perforated air-cooled troughs; the under sides of these troughs are open to the ash-pits and are consequently cooled, whilst air passes from the ash-pits through the perforations, and aids in the combustion of the fuel on the grates. The arch-bars and supporting jamb-blocks of the firing and clinkering openings to the grate-cells are constructed of hollow castings provided with perforations facing away from the clinkering doors; these hollow castings are in communication with the ash-pits, so that a portion of the air used to force the draught passes through the interior of the castings and keeps them reasonably cool, whilst a small supply of hot air passes through the perforations and ensures perfect combustion above the fire.—W. P. S.

Pasteurising apparatus. F. Gettelman, Milwaukee, Wis., U.S.A. Eng. Pat. 8399, April 4, 1911.

A series of four vats or baths are arranged one above the other in a suitable casing, the temperature of the water in these baths, from the top bath to the bottom one, being maintained at 122° F., 149° F., 140° F., and 122° F., respectively. The bottles of liquid to be sterilised are introduced through an opening in the outer casing and placed in carriers fitted to an endless band which conveys the carriers and their contents successively through the water in the baths, beginning at the top bath, until the circuit has been completed. An arrangement of pulleys and guide-wheels is provided for operating the endless band and the carriers are so mounted that the bottles are always in a vertical position.—W. P. S.

Water and other liquids; Apparatus for the sterilisation of —— [by ultra-violet rays]. V. Henri, A. Helbronner, and M. von Recklinghausen. First Addition, dated June 11, 1910, to Fr. Pat. 403,947, June 11, 1909 (this J., 1910, 107).

The lamp which is employed is enclosed in a chamber constructed of material which will transmit ultra-violet rays and from which the air is exhausted. This chamber has two widened portions for receiving the ends of the lamp, whilst its central part is tubular and may be of circular, triangular, or hexagonal cross-section. The water may be treated under pressure by passing it through a tank provided with baffle-plates which direct the current of water around the chamber containing the lamp.
—W. P. S.

Liquids; Apparatus for the sterilisation of —— [by ultra-violet rays]. V. Henri, A. Helbronner, and M. von Recklinghausen. First Addition, dated June 11, 1910, to Fr. Pat. 424,369, March 12, 1910 (this J., 1911, 978).

The lamp employed may be contained in a chamber shaped so as to receive the wide ends of the lamp, the central portion of the vessel being tubular and capable of transmitting ultra-violet rays. This tubular portion may also be of hexagonal or triangular cross-section. The lamp may be arranged in a tubular chamber fitted in a tank containing partitions which direct the current of liquid below and then above the lamp.—W. P. S.

Liquids; Apparatus for sterilising —— by means of ultra-violet rays. Banque du Radium. Fr. Pat. 428,666, June 27, 1910.

The liquid is admitted tangentially and under pressure into a shallow cylindrical vessel, round the sides of which it flows rapidly and then escapes downwards through a central opening. A lamp capable of emitting ultra-violet rays is situated in an opening at the upper side of the vessel.—W. P. S.

Charcoal; Manufacture of highly active —— for use as a clarifying medium. Richter und Richter. Fr. Pat. 428,540, Mar. 4, 1911. Under Int. Conv., Mar. 5, 1910.

Finely divided purifying materials, such as spongy iron, or kaolin, which have been used for the clarification of waters containing organic matter, such as certain natural waters and the effluents from dyeworks, breweries, tanyards, and dairies, are heated to a temperature at which the impurities undergo decomposition, whilst the material remains in the powdered condition. In this way the particles become coated with charcoal in a very active state, and the material can be used again and the process repeated several times.—A. T. L.

Disinfecting and destroying fungi and insects; Process for ——. Chem. Fabr. Flörsheim, Dr. H. Noerdlinger. Ger. Pat. 237,408, June 1, 1910.

Heptyl and octyl alcohols, especially those in which the hydroxyl group is attached to the first or second carbon atom, possess powerful antiseptic properties, and may be used as disinfectants, insecticides, or fungicides. They may be applied in solution in the lower alcohols or other suitable solvents, or emulsified by means of soap solution, etc.—T. F. B.

Smoke of vegetable cakes; Process for increasing the disinfecting effect of the ——. W. von Skorzewski, Labischin, Germany. Eng. Pat. 10,233, April 27, 1911.

See Ger. Pat. 228,263 of 1910; this J., 1910, 1407.—T.F.B.

Water; Purification of ——. E. E. M. Payne, Assignor to W. H. Staynes, Leicester. U.S. Pat. 1,002,603, Sept. 5, 1911.

See Eng. Pat. 6935 of 1909; this J., 1909, 1161.—T. F. B.

Water; Process for softening —— and for eliminating iron and manganese. J. D. Riedel, Akt.-Ges. Fr. Pat. 427,997, April 1, 1911. Under Int. Conv., May 10, 1910.

See Eng. Pat. 26,094 of 1910; this J., 1911, 442.—W. P. S.

Liquids; Apparatus for treating —— with ultra-violet rays. V. Henri, A. Helbronner, and M. von Recklinghausen. Fr. Pat. 428,170, April 6, 1911. Under Int. Conv., May 27, 1910.

See Eng. Pat. 12,948 of 1910; this J., 1911, 828.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Codeine methylbromide. Eucodin. K. Schuster. Z. Allgem. österr. Apoth.-Ver., 1911, **49**, 295.

This substance with the formula, $C_{18}H_{21}O_3N(CH_3)Br$, is prepared by evaporating to dryness with a metallic bromide, an aqueous solution of the dimethyl sulphate addition product of codeine, and then extracting with alcohol, acetone, or methyl alcohol. It forms a white, odourless powder, with a sweetish-bitter taste, easily soluble in water, with difficulty in alcohol, and almost insoluble in ether and chloroform. It melts at about 260° C. Eucodin dissolves in concentrated sulphuric acid with evolution of hydrobromic acid. A trace of eucodin added to a mixture of 2 or 3 drops of 40 per cent. formaldehyde solution with 3 c.c. of strong sulphuric acid. produces a brownish violet colouration, changing to blackish-green. 0·2 grm. of codeine methyl bromide added to a solution of 0·15 grm. of hexamethylenetetramine in 3 c.c. of strong sulphuric acid, yields a violet colour soon changing to blackish-blue. Fröhde's reagent (a freshly-prepared solution of 0·01 grm. of sodium molybdate in 1 c.c. of concentrated sulphuric acid), gives a brown colour, soon turning dirty green, on warming yellow, and finally yellowish-brown. The solution of the compound should be neutral and free from sulphate. Absence of morphine is proved by adding a little of the solution to a very dilute solution of ferric chloride and a ferricyanide, when a blue colour should not be immediately produced. No ash should be left on ignition, and addition of silver nitrate and titration of the excess with ammonium thiocyanate should indicate 20 per cent. of bromine.

Arecoline; Reactions of ——. C. Reichard. Pharm. Zentralh., 1911, **52**, 711—716. Chem. Zentr., 1911, **2**, 800.

In his experiments on the reactions of arecoline, $C_8H_{13}O_2N$, the author used the hydrobromide of the alkaloid: this is a white crystalline salt melting at about 167° C., soluble in water and alcohol. From its behaviour with a large number of different reagents, the following tests are recommended for its identification. With an aqueous solution of potassium ferrocyanide it gives a blue colour after a few hours, changing after 12—14 hours to green; with potassium ferricyanide a green colour is produced. On treating the dry residue with hydrochloric acid, the ferrocyanide salt is coloured an intense blue and the ferricyanide an intense dark green with blue effects. With a concentrated solution of cobalt nitrate, arecoline hydrobromide gives, after warming, a yellowish hygroscopic mass. With crystallised picric acid and a drop of a concentrated solution of potassium cyanide, the mixture, yellow at first, gradually becomes reddish-brown and brown flocks separate.—A. S.

Sparteine; Reaction for ——. A Jorissen. J. Pharm. Chim., 1911, **4**, 251—252.

A few milligrammes of sparteine sulphate are dissolved in water and a slight excess of sodium hydroxide solution is added. The turbid liquid is shaken up with 10 c.c. of ether, and after the liquids have separated, the ethereal layer is poured off into a dry test-tube. About 10—20 mgrms. of dry sulphur are added and the whole shaken vigorously for a minute. Hydrogen sulphide is then passed through, which causes a voluminous bright red precipitate, disappearing on the addition of water. Tested in the same way, coniine gives a yellowish-red turbidity, but this alkaloid can be readily distinguished from sparteine by other tests. The following is a somewhat less sensitive test for sparteine: 10 mgrms. of the sulphate are placed on filter paper, moistened with yellow ammonium sulphide, and allowed to dry at the ordinary temperature. As the drying proceeds, a brown spot appears on the paper.—F. Shdn.

[*Chrysophanhydroanthrone*]. *Powder from the Japanese wood, "Tagayasan."* K. Iwakawa. Arch. exp. Pathol. u. Pharmak., 1911, **65**, 315—324. Chem. Zentr., 1911, **2**, 970.

In cavities in Japanese Tagayasan wood, from *Cassia Siamea*, is a yellow powder, which gradually becomes brown to violet on exposure to air, and consists, to the extent of about 73 per cent., of chrysophanhydroanthrone, $C_{15}H_{12}O_3$. This latter compound melts at 206° C., and is similar in properties to chrysarobin, from which, however, it differs in crystalline form (well-defined rhombic crystals). It is suggested that chrysophanhydroanthrone might be useful as a substitute for chrysarobin for therapeutic purposes.—A. S.

Antipyrine; Compound of —— *with ferric chloride, obtained with ferrous chloride.* C. Astre and J. Vidal. Bull. Soc. Chim., 1911, **9**, 836—839.

The authors have previously obtained a stannic compound of antipyrine from a hydrochloric acid solution of the latter and stannous chloride or metallic tin (this J., 1911, 571). A ferric compound has been obtained as follows:—20 c.c. of hydrochloric acid and 20 grms. of antipyrine are added to 10 c.c. of a ferrous chloride solution (containing 476·25 grms. of ferrous chloride per litre) obtained by dissolving wire nails in hydrochloric acid of 21° B., and the mixture is kept in a filled stoppered flask for 4 days. The resulting red liquid no longer gives a reaction for ferrous iron. On evaporating the liquid on a water-bath, a greenish-yellow syrupy liquid is obtained which after several washings with ether, yields on drying on porous plates *in vacuo* over solid potassium hydroxide, small greenish-yellow crystals, melting at 121°—122° C., and having the composition, $(C_{11}H_{12}N_2O)_9.FeCl_3.9HCl$. The product dissolves in water, giving a red solution; it is slightly soluble in carbon bisulphide, acetone and chloroform, almost insoluble in ether and benzene, but soluble in alcohol. It dissolves in concentrated mineral acids. Its aqueous solution gives the characteristic reactions of ferric salts; it is reduced to the ferrous state by sodium nitrite, hydrogen sulphide and sulphur dioxide, but not by zinc and acetic acid. The compound is distinct from the already known ferripyrine obtained with ferric chloride (see this J., 1895, 595; 1902, 187.)—A. Sɴʟᴅ.

Lemon oil; Adulteration of ——. E. J. Parry. Perfumery and Essential Oil Rec., 1911, **2**, 209—210.

A considerable amount of lemon oil received recently in England has an optical rotatory power of +50° to +54° and citral-content (hydroxylamine method), 3·3—4·1 per cent. By fractional distillation the author separated a portion which had the sp. gr. 0·8625, refractive index 1·4738, and optical rotation +40° 30′; and yielded a nitrosochloride melting at 102° C. (pinene nitrosochloride melts at 103° C.). The characters of this fraction agree with those of so-called Greek turpentine oil from *Pinus halapensis*, and it is probable that the lemon oil in question was adulterated with from 10 to 35 per cent. of the turpentine oil.—A. S.

Java citronella oil; Determination of "geraniol" in ——. T. H. Durrans. Perfumery and Essential Oil Rec., 1911, **2**, 201—202.

The suggested standard method for the determination of "geraniol" in Ceylon citronella oil (this J., 1911, 1086) does not give accurate results when applied to Java oils, which contain about 90 per cent. of "geraniol" as compared with the 60 per cent. found in Ceylon oils. The following modified method is applicable to both kinds of citronella oil. 10 c.c. of the oil are mixed with 20 c.c. of acetic anhydride and 3 grms. of anhydrous sodium acetate and boiled for 2 hours under a reflux condenser. After cooling, 50 c.c. of water are added through the condenser, the mixture is heated for 15 minutes on the steam bath, cooled, washed with cold water (or brine), then with a 1 per cent. solution of sodium carbonate until neutral, and finally with water. The acetylated oil is then dried with anhydrous sodium sulphate, and 2·5 to 5 grms. are saponified by boiling for 2 hours with 50 c.c. of $N/1$ alcoholic potassium hydroxide, the excess of alkali being titrated back as usual.—A. S.

Borneol; Catalysis of —— *and catalytic hydrogenation of camphor.* J. Aloy and V. Brustier. Bull. Soc. Chim., 1911, **9**, 733—735.

By passing borneol vapour slowly over finely-divided copper heated to from 230° to 350° C., camphor is produced at 300° C. the transformation is practically quantitative; at 420° C. and higher temperatures terpenes are produced. Attempts to effect hydrogenation of camphor in presence of finely divided nickel proved unsuccessful, but camphoroxime was readily hydrogenised in this way at 180°—200° C., dibornylamine, with smaller quantities of bornylamine and camphylamine being obtained.—A. S.

Lactic acid ; Analysis of ——. W. Klapproth. Chem. Zeit., 1911, **35**, 1026—1027.

The following procedure is recommended for determining the lactic acid and lactic anhydride in samples of lactic acid. One grm. of the sample is diluted with 20 c.c. of water free from dissolved carbon dioxide and the solution is titrated with *N*/1 sodium hydroxide solution, phenolphthalein being used as the indicator. An excess of 1 c.c. of the alkali solution is then added and the mixture is heated for 5 minutes on a boiling water bath ; should the sample contain more than 50 per cent. of lactic acid, 3 c.c. of the alkali solution must be added. The solution is now titrated with *N*/1 sulphuric acid, an excess of 1 c.c. of the latter is added, and, after a further heating for 2 minutes, the excess of acid is titrated with *N*/1 sodium hydroxide solution. The first titration with sodium hydroxide gives the lactic acid *plus* one-half of the lactic anhydride present, whilst the quantity of alkali used subsequently, after allowing for the sulphuric acid added, corresponds with the remaining one-half of the anhydride. —W. P. S.

Formic acid ; Anhydrous ——. J. B. Garner, B. Saxton and H. O. Parker. Amer. Chem. J., 1911, **46**, 236—240.

Distillation of formic acid under reduced pressure (120 mm.) at 50° C. over anhydrous copper sulphate is found to be the most satisfactory and efficient method of obtaining the anhydrous acid. Beginning with an acid having a melting point of 7·26° C., the first distillation yielded an acid melting at 8° C., the second gave one with a melting point of 8·21° C., and the third an acid melting at 8·31° C. The fourth, fifth and sixth distillations all yielded an acid melting at 8·35° C. ; analysis of this product showed it to be the pure anhydrous acid.—A. Seld.

Carbohydrate phosphoric acid esters and glycerophosphoric acid. Neuberg and Kretschmer. *See* XVII.

Patents.

Monocinnamic ester of glycerin. J. Callsen. Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 999,955, Aug. 8, 1911.

The monocinnamic ester of glycerin, prepared according to Ger. Pat. 235,357 of 1910 (this J., 1911, 1088), is a yellowish oil soluble in alcohol, ether, and chloroform.—T. F. B.

Monocinnamic ester of glycol. P. Schickler and H. Hahl, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,000,040, Aug. 8, 1911.

Glycol monocinnamic ester, prepared as described in Ger. Pat. 235,357 of 1910 (this J., 1911, 1088), is a colourless oil of b. pt. 190°—195° C. under a pressure of 11 mm. —T. F. B.

Lecithin and its halogen derivatives with ferrous halides ; Process for preparing compounds, soluble with difficulty in water, from ——. Chem. Fabr. Gedeon Richter. Ger. Pat. 237,394, Sept. 16, 1910.

Alcoholic solutions of lecithin, bromolecithin, or iodolecithin are mixed with alcoholic solutions of ferrous bromide or iodide, preferably in excess, and the precipitated mass is cooled with ice, washed with alcohol, and dried in a vacuum. The red-brown compounds produced in this way, resemble bromo- and iodo-lecithin in their therapeutic properties, whilst their iron content is of value in many cases.—T. F. B.

Hydrastinine ; Manufacture of salts of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 29,901, Dec. 23, 1910.

See Ger. Pat. 234,850 of 1910 ; this J., 1911, 923.—T. F. B.

Amino-oxyarylarsenoxides and process of making same. P. Ehrlich and A. Bertheim, Frankfort, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,002,243, Sept. 5, 1911.

ee Eng. Pat. 24,480 of 1910 ; this J., 1911, 48.—T. F. B.

Beta-gamma-dimethylerythrene ; Process of producing ——. F. Hofmann and K. Meisenburg. Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,002,399 and 1,002,400, Sept. 5, 1911.

See Eng. Pat. 13,677 of 1910 ; this J., 1911, 307.—T. F. B.

Albuminous preparations ; Method of producing non-hygroscopic ——. F. Quade, Assignor to J. A. Wülfing, Berlin. U.S. Pat. 1,003,151, Sept. 12, 1911.

See Ger. Pat. 217,553 of 1909 ; this J., 1910, 452.—T. F. B.

Albumose-silver compound ; Alkaline ——. *Albumose-silver-ammonio product.* G. Wichmann, Assignor to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pats. 1,002,547 and 1,002,548, Sept. 5, 1911.

See Fr. Pat. 400,627 of 1909 and Addition thereto ; this J., 1909, 1062 ; 1911, 49.—T. F. B.

Ortho-dioxyphenylethanolmethylamine ; Hydrochloride of —— in a crystallised form. F. Flaecher, Höchst on Maine, Germany, Assignor to H. A. Metz and Co., New York. U.S. Pat. 1,002,909, Sept. 12, 1910.

See Ger. Pat. 202,169 of 1907 ; this J., 1908, 1177.—T.F.B.

Digestive medicine. R. Ehrmann, Charlottenburg. Assignor to J. A. Wülfing, Berlin. U.S. Pat. 1,003,347, Sept. 12, 1911.

See Eng. Pat. 14,016 of 1910 ; this J., 1910, 1177.—T.F.B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Colloid chemistry and photography. X. An Ostwald-ripening of silver. Lüppo-Cramer. Z. Chem. Ind. Kolloide, 1911, **9**, 73—76.

When solutions containing gelatin, silver nitrate, and colloidal silver are reduced by means of solutions of quinol to which small quantities of phosphoric acid are added, the results obtained are quite different from those when phosphoric acid is absent (see this J., 1911, 446) ; for instance, green sols are now changed to yellowish red, yellowish-red to ruby red, red to violet, and violet to blue ; all the intermediate shades are produced by varying the amount of acid added, thus, by adding large quantities, yellowish-red sols become blue. Phosphoric acid is without action on the reduced sols. Citric acid acts in an analogous manner to phosphoric acid, though not so energetically. Sulphuric, nitric, acetic, and tartaric acids produce no similar effects. Since the gradual change of colour from yellow to blue is accompanied by an increase in the size of the silver particle, the results described above are most probably due to an "Ostwald-ripening" of the silver, *i.e.*, an increase in the size of the larger particles at the expense of the smaller. If silver nitrate is reduced in gelatin solution by quinol, without addition of colloidal silver, the addition of very small quantities of sulphuric, nitric, acetic, tartaric, and even citric acid considerably delays the reduction to blue-green sols, whilst increasing additions of the acid still further retard the reaction. In a similar experiment with phosphoric acid, the addition of amounts up to a certain limit increases the speed of the reduction, whilst further amounts again reduce it. These peculiarities only occur when gelatin is present. When aqueous solutions of silver nitrate are reduced by quinol solutions containing increasing amounts of phosphoric acid, the velocity of the reaction is progressively reduced. It might, therefore, be concluded that in presence of gelatin phosphoric acid does not accelerate the actual reduction, but only facilitates the union of the silver sub-microns to visible complexes, *i.e.*, the ripening of the grains. In carrying out all the above experiments, the gelatin should be very thoroughly washed before use, since small traces of sodium chloride have a very considerable retarding action on the change in colour and in size of particle, owing to its solvent action.—T. F. B.

Patents.

Negatives for photo-engraving and other similar photographic reproductions ; Process of making black and white ——. Z. J. Gold, Stella, and W. M. Newton, Granby, Mo. U.S. Pat. 1.002,386, Sept. 5, 1911.

Black and white negatives suitable for photo-engraving, etc., are obtained by developing an "extra-fast portrait" dry plate, after exposure, with a developer composed of distilled water, 6 oz.; quinol, 24 grs.; sodium sulphite crystals, 180 grs.; potassium carbonate, 120 grs.; sugar, ¼ teaspoonful; "hydrosulphite of soda," 48 grs. The fixing bath consists of water, 128 oz.; sulphuric acid, 2 drms.; sodium sulphite, 1½ oz.; chrome alum, 1¼ oz.; "hydrosulphite of soda," 2 lb.—T. F. B.

Photographic silver images ; Use of quinones for reducing ——. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Fr. Pat. 428,190, June 14, 1910.

This process consists in the use of quinones, especially benzoquinone, its homologues soluble in water, and the salts of its sulphonic acids, for reducing photographic silver images; the action of these products resembles that of ammonium persulphate. The following solution is given:—Quinone, 5 grms.; sulphuric acid, 20 c.c., water, 1000 c.c. (see also this J., 1910, 1228).—T. F. B.

Radiography ; Sensitive plate for use in ——. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Fr. Pat. 428,559, June 23, 1910.

The use of phosphorescent screens in taking photographs by means of X-rays has not been successful, owing to the tendency to obtain double images with the slightest movement of the screen. It is now proposed, in order to obviate the use of these screens, to incorporate the phosphorescent substance with the emulsion itself; thus calcium sulphide or tungstate may be used in a very fine state of subdivision.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Accident which occurred at the British South African Explosives Company's Factory No. 1, Modderfontein, on Thursday, 23rd February, 1911 ; Report of an inquiry held by Major A. B. Denne, Chief Inspector of Explosives (Transvaal and Natal), into the circumstances attending an ——.

Two buildings, the washing house and a shelter, were struck by portions of the same flash of lightning, and a third building, the nitrating house, exploded at an interval estimated to be from 2—5 minutes later. The washing house contained 5053 lb., and the nitrating and separating house 3872 lb. of nitroglycerin. Owing to the damage done to the nitrating house by the explosion, it would appear probable that the explosion in this building took place owing to something having fallen into the nitrater and separator through the glass windows or through the top of the fume pipe. This started the decomposition of the nitroglycerin, with evolution of oxides of nitrogen, and after a short interval the whole charge in the separator exploded. Major Denne concludes that nothing could have saved the separator from exploding, as its contents, owing to the damage done to the apparatus, could not have been discharged into the drowning tank. He considers that the management had adopted the best known means of protecting the factory from lightning, and that, as the flash which struck the buildings was of the "overflow" type, no existing form of protection could have been a safeguard. The system consisted of two horned platinum-pointed conductors, 12 metres high, which were erected at opposite corners of the mound. At the two other corners were iron posts, five metres high, and the four posts at this height were connected by bare copper cable. Diagonally across the building was copper wire of 14 S.W.G., whilst the whole building was covered with a meshwork of wire at the height mentioned. The system was connected throughout the factory and also to frequent "earths," where it must always have been moist, and, further, to all available field tramlines.—G. W. McD.

Patents.

Filling projectiles and explosive charges of all kinds by means of a funnel adapted for heating. A. J. Boult, London. From Dynamit-Akt.-Ges. vorm. A. Nobel und Co., Hamburg, Germany. Eng. Pat. 8517, April 5, 1911. Addition to Eng. Pat. 262, Jan. 4, 1911.

A funnel for filling projectiles with molten explosives is provided with water jackets so that the molten explosive may be caused to cool slowly, thus avoiding danger due to the existence of air bubbles. A cylinder projecting from the lower end of the funnel into the explosive for the purpose of forming a space therein for the subsequent reception of the detonating charge is similarly heated. —H. H.

High explosive. J. A. Gregorini. Fr. Pat. 427,902, Jan. 10, 1911. Under Int. Conv., Jan. 17, 1910.

The explosive consists of 90 per cent. of a mixture of ammonium nitrate (80 parts), potassium nitrate (5), and powdered aluminium (15 parts), and 10 per cent. of a jelly consisting of mononitrotoluene (75 parts), glycerin (5), collodion cotton (15), and potassium permanganate (5 parts). The potassium permanganate may be replaced by ammonium perchlorate.—G. W. McD.

Nitrocellulose ; Use of ethyl or methyl butyrate for gelatinising and dissolving ——. The British and Continental Camphor Co., Ltd. Fr. Pat. 428,664, June 27, 1910.

The solvents mentioned above are claimed in place of amyl acetate for gelatinising nitrocellulose in the manufacture of smokeless powders and for dissolving it in the manufacture of varnishes, etc.—G. W. McD.

Explosives ; Process for making material for ——. G. C. Dymond, Liverpool. From Satanite Powder Co., Los Angeles, Cal., U.S.A. Eng. Pat. 7719, March 28, 1911.

See U.S. Pat. 989,519 of 1911; this J., 1911, 650.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Indicator ; New —— *for volumetric [alkali- and acidimetric] analysis.* R. Mellet. Monit. Scient. 1911, 576—578.

The author describes the preparation of this indicator (6-sulpho-β-naphtholazo-*m*-hydroxybenzoic acid, see this J., 1910, 1274), starting from 4-amino-*m*-hydroxybenzoic acid (prepared from the corresponding nitro-acid by means of stannous chloride in hydrochloric acid). 10 grms. of the hydrochloride of the amino-acid are dissolved in a little water, 10 c.c. of hydrochloric acid (sp. gr. 1·19) are added, the mixture is cooled in ice, and a solution of 3·8 grms. of sodium nitrite in 25 c.c. of water is added gradually, drop by drop. A fine yellow uncrystallisable powder is precipitated. This is allowed to remain for a quarter of an hour, and is then poured, with the liquid from which it was deposited, into a warm liquid formed from 45 c.c. of 20 per cent. sodium hydroxide solution, 11·2 grms. of sodium β-naphthol-6-sulphonate, and enough water to form a solution. The whole is shaken at intervals during 2 hours, and the violet liquid is then poured into 2½ litres of alcohol contained in a capacious flask, and well shaken. The precipitated product is filtered off and washed first with alcohol, then with ether. This is the trisodium salt of the acid. For use as an indicator, a 1 per cent. solution is made, and $N/10$ hydrochloric acid added till the colour changes to red. Liquids to be titrated should be strongly coloured with it, and the change in either direction can then be used.—J. T. D.

Manganese; Determination of —— as monoxide, mangano-manganic oxide, and sesquioxide. P. N. Raikow and P. Tischkow. Chem.-Zeit., 1911, **35**, 1013—1015.

An investigation into the conditions under which manganese can be accurately determined as the monoxide, as mangano-manganic oxide, and as the sesquioxide respectively, has shown that these oxides are readily prepared in a state of purity. Manganous oxide is obtained as a pale green homogeneous product by igniting the higher oxides for a few minutes in a strong current of hydrogen, the pure sesquioxide is obtained by heating either of the other oxides to dull redness in a current of oxygen, and the oxide, Mn_3O_4, by strongly igniting, either the monoxide in air, or the sesquioxide in a current of dry carbon dioxide. The determination of manganese as the monoxide or as mangano-manganic oxide, which are readily converted into each other for purposes of control, is specially recommended.—F. Sodn.

Fat extraction apparatus; Improved Knorr's ——. H. L. Walter and C. E. Goodrich. U.S. Dept. Agric., Bureau of Chem., Circular 69, March 14, 1911.

Condensation of ether in the space between the extraction tube and the mouth of the flask is prevented by having two holes ⅛ in. in diameter on opposite sides of the neck of the flask about ¼ in. above the top of the mercury in the trough. The use of the spring, TBCD, of brass wire, shown in Fig. 1, prevents the sample rising in the tube through the expansion of air and ether vapour, and also compresses the material, so that the solvent percolates more slowly and effects more thorough extraction. The length of B should be about 50 mm., D, 40 mm., whilst the loop C should have a diameter of 15 mm. With the modifications described it is advantageous to use the form of tube shown in Fig. 2, in which the perforated metal disc and wire may be of platinum, or for most purposes, of nickel. Advantages claimed for this tube over the old form are cheapness, greater strength, and the ease with which the extracted material may be removed. —C. A. M.

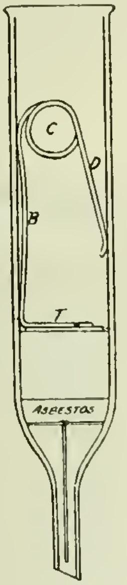


Fig. 1.

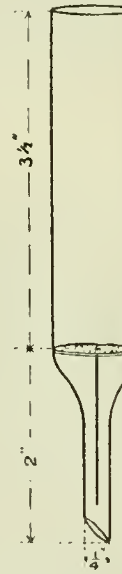


Fig. 2.

Aluminium, chromium and iron; Precipitation of —— by ammonium nitrite. E. Schirm. Chem.-Zeit., 1911, **35**, 979—980.

In the method previously described (this J., 1911, 510) the presence of more than 2 per cent. of ammonium salts interferes with the precipitation, but if the precipitation be completed as described *loc. cit.*, the precipitate, although voluminous, filters more rapidly than a precipitate formed by ammonia alone. If sodium nitrite be employed instead of ammonium nitrite, the presence of ammonium salts may be neglected, since these are decomposed by interaction with the sodium nitrite. Sodium nitrite, however, interferes with the subsequent determination of the alkalis, but it would appear that the difficulty in both directions may be surmounted by employing the nitrites of organic quarternary ammonium bases; the author proposes to use trimethylphenylammonium nitrite. The metals of the ammonium sulphide group, zinc, nickel and cobalt, are not precipitated by ammonium nitrite; manganese is partially precipitated in the absence of ammonium salts, but not if ammonium salts be present. The author has sought to effect a separation of aluminium, chromium and iron from zinc and manganese, by the nitrite method, adding a little ammonium sulphate (less than 3 grms. per 250 c.c.) before precipitating the triad metal. The results were partially successful in the case of manganese, the figures for the latter being about 2 per cent. too low owing to co-precipitation, whilst those for the triad metal were correspondingly too high. For accurate results a double precipitation is necessary. In this case also the use of the nitrite of an organic ammonium base would probably be an improvement. The separation of the triad metals from zinc by the nitrite method appears to be impossible; the precipitates always contain a large proportion of the zinc in the form of aluminate, chromite or ferrite. —J. F. B.

Determination of naphthalene in crude coal-gas. Wein. *See* IIa.

Titration of the digester-liquor in the manufacture of sulphate cellulose. Lindquist. *See* V.

Determination of chlorides in bromides. Herting. *See* VII.

Determination of ferrocyanides and thiocyanates [in gas liquors]. Ronnet. *See* VII.

Analysis of graphite. Mayer. *See* VII.

Determination of carbon in steel by combustion under pressure. Mahler and Goutal. *See* X.

Determination of manganese in vanadium- and chrome-vanadium steels. Cain. *See* X.

Analysis of ferroboron. Davis. *See* X.

Rapid and accurate method for the analysis of white metals. Bencker. *See* X.

Bichromate-iodide method for lead. Wilder. *See* X.

Analysis of wulfenite [lead molybdate] ores. Davis. *See* X.

Analysis of oil of turpentine. Blarez. *See* XIII.

Qualitative reactions of vegetable tannins. Stiasny and Wilkinson. *See* XV.

Qualitative analysis of the tannins. Thuau and De Korsak. *See* XV.

Thuau and De Korsak's method for the identification of mangrove in tanning extracts. Allen and Auerbach. *See* XV.

Qualitative analysis of the tannins. Pollak. *See* XV.

Determination of free sulphuric acid in hides, skins, and leather. Kohnstein. *See* XV.

Determination of humus [in soils]. Rather. *See* XVI.

Determination of gelatin. Greifenhagen and others. *See* XV.

Presence and determination of nitrates in beet and cane molasses. Pellet and Müller. *See* XVII.

Polarimetric method for the determination of malic acid [and tartaric acid] and its application to [sugar] cane and maple products. Yoder. *See* XVII.

Determination of carbohydrates by oxidation with potassium permanganate in alkaline solution. Greifenhagen and others. *See* XVII.

Colourimetric test for caramel. Upsher Smith. *See* XVII.

Detection of substitution of spirits for aged whisky. Adams. *See* XVIII.

Determination of fat in feeding stuffs by means of trichloroethylene. Neumann. *See* XIXa.

Determination of starch. Greifenhagen and others. *See* XIXa.

Determination of pentosans and methylpentosans in cereals and wood fungi. Ishida and Tollens. *See* XIXa.

Determination of nicotine in nicotine solutions and tobacco extracts. Chapin. *See* XIXb.

Reactions of arecoline. Reichard. *See* XX.

Reaction for sparteine. Jorissen. *See* XX.

Determination of "geraniol" in Java citronella oil Durrans. *See* XX.

Analysis of lactic acid. Klappreth. *See* XX.

Patents.

Oil-testing machine [for lubricants]. Oelwerke Stern-Sonneborn, Hamburg, Germany. Eng. Pat. 7616, March 27, 1911. Under Int. Conv., April 6, 1910.

A rotating surface is mounted under a loosely-mounted friction surface so that motion is transmitted to the latter through the oil which is filled into annular spaces between the two surfaces. An oscillatory rotary motion as well as a continuous rotary motion may be given to the lower surface. The friction surfaces are surrounded by a casing and means are provided for heating the oil while it is being tested, for applying a variable load to the loosely-mounted surface, and for cooling the lower surface, as desired. A thermometer gives the temperature of the oil between the two surfaces, and the temperatures and friction tests are recorded by means of a suitable apparatus. —W. P. S.

Testing air or other gases by their action in changing the colour of a liquid reagent; Apparatus for ——. M. Arndt, Aachen, Germany. Eng. Pat. 27,254, Nov. 23, 1910. Under Int. Conv., Nov. 23, 1909.

See Fr. Pat. 422,883 of 1910; this J., 1911, 714.—T. F. B.

Photometer; Selenium ——. E. Presser, Berlin. Eng. Pat. 1059, Jan. 14, 1911.

See Fr. Pat. 425,854 of 1911; this J., 1911, 946.—T. F. B.

Photometer; Selenium ——. Ges. f. Elektrotechnische Industrie. Fr. Pat. 428,068, April 3, 1911.

See Eng. Pat. 11,111 of 1911; this J., 1911, 1106.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Silicates; Artificial rock-forming ——. E. Baur. Z. Elektrochem., 1911, **17**, 739—741.

The author has obtained microscopic crystals of various rock-forming silicates, by placing the finely powdered constituents in a strong steel cylinder with water, closing, and heating to 300°—500° C. for a day or more; in this way are obtained quartz, felspars (orthoclase, albite, oligoclase), felspar-substitutes (potassium faujasite, analcime, potassium nepheline hydrate), micas (andalusite, pyrophyllite, muscovite), and some calcium silicates (stilbite, gyrolite, pectolite, potassium pectolite). No calcium aluminium silicates (garnet, anorthite, etc.) could be formed by this method. The author points out specially the mica minerals he has produced, which he considers to be characteristic constituents of "contact rocks," *i.e.*, rocks formed by the alteration of already existing rocks through intrusive outbursts.—J. T. D.

Decomposition of organic compounds [by micro-organisms and enzymes]; Electrical effects accompanying the ——. M. C. Potter. Proc. Roy. Soc., 1911, **84B**, 260—276.

It is shown experimentally that the disintegration of organic compounds by micro-organisms is accompanied by the liberation of electrical energy. The instances studied were the action of yeast upon dextrose, the hydrolysis of sucrose by invertase and by sulphuric acid, the hydrolysis of starch by diastase and the growth of *B. coli communis* in a nutrient medium. A special type of galvanic cell with platinum electrodes was employed to investigate the difference of potential: the electrical charges set free in the vital processes were collected and transferred to a condenser. The charge corresponded to an E.M.F. of 0·3 to 0·5 volt between the fermenting and non-fermenting fluids or during hydrolysis. The electrical effects measured express the activity of the micro-organism or enzyme; they are influenced by temperature, concentration of the pabulum and the number of organisms present, and they only take place between the limits of temperature favourable to enzymic activity. A voltage of the order of 0·3 to 0·5 was never exceeded in any of the experiments made with micro-organisms.—E. F. A.

Books Received.

Die Polarimetrie der Erdoele. Ihre Geschichte und gegenwärtige Entwickelung, sowie ihre Bedeutung für die Erdoelgeologie und andere Zweige der Naturwissenschaft. Von M. A. Rakusin. Verlag für Fachliteratur Ges. m. b. H. Berlin and Vienna. 1910. Price M. 16.

This 8vo volume, containing 390 pages of subject matter, is divided into the following sections:—Part I. (1). Historical development of the polarimetry of petroleum. (2). The purely chemical results of the polarimetry of petroleum. (3). The chemical analytical results. (4). The physico-chemical results. (5). The purely physical results. (6). The importance of polarimetry for the technology of petroleum. (7). Relations of polarimetry to other methods of investigation of petroleum. (8). Attempt at a physico-chemical geology of petroleum. Part II. (1). Methods used in the polarimetry of petroleum. (2) Special optical examination of liquid petroleums of different origin. (3). Optical examination of solid petroleums of different origin. (4) Summary of results.

Sugar Beet. Some facts and some illusions. A study in Rural Therapeutics. By J. W. Robertson-Scott. ("Home Counties"). H. Cox, "Field" Office, Windsor House, Bream's Buildings, London, E.C. 1911. Price 6s. net.

8vo volume containing 410 pages of subject matter, with 100 illustrations and an alphabetical index. The subject matter is classified as follows:—(1). Proposals for a beet sugar industry. (2). At a beet sugar factory. (3). How beet sugar making began and grew. (4). How "Beta Vulgaris" rose in the world. (5). The first factories and apostles. (6). The years of the prospectuses. (7). Sun, rain, soils, and sugar. (8). The crops that were talked about. (9). The crops that were raised in East Anglia. (10). How sugar beet ought to be grown: rotations and deep ploughing. (11). Seed and seeding. (12). The year's operations. (13). Cost of the crop per acre here and abroad. (14). Problem of cutting down the cost. (15). The beet sugar industry at close quarters. (16). The return in cash. (17). The return in kind. (18). The further return, (19). A panegyric on beet, by T. G. Palmer. (20). The worst that can be said against beet growing and a beet sugar industry, by F. J. Lloyd. (21). Cane *versus* beet. (22). A non-party account of some political matters. (23). The conclusion of the whole matter: the prospect for the farmer. (24). Factory prospects. (25). The problem of State help. An additional chapter, by R. N. Dowling. Appendix.

Die Bedeutung der Kolloide für die Technik. Allgemeinverständlich dargestellt von Prof. Dr. K. Arndt. Zweite verbesserte Auflage. Verlag von T. Steinkopff, Dresden. 1911. Price M. 1.50.

Small paper-covered volume containing 46 pages of subject matter arranged under the following headings:—Definition of the term "colloid"; Colloidal solutions; Colloidal solutions of metals; Flocculation of colloidal solutions; Reversible and irreversible changes of state; Disperse systems; Suspension- and emulsion-colloids; Ruby glass; Milk-glass, troostite, phosphorus; Colloids in mineralogy; Silver and gold mirrors; Preparation of tungsten lamps; Colloids in ceramics and cements; Colloids as adhesives; Colloids for absorption of liquids; Dehydration of peat by electro-osmose; Colloids as diaphragms and filters; Adsorption; Lake-formation; Dyeing; Tanning; Soap-making; Brewing; Lubricating greases; Sewage purification; Colloids and agriculture.

Ueber Farbe und Dispersitätsgrad kolloider Lösungen. Von Wo. Ostwald. Kolloidchemische Beihefte. Band II. Heft 12. Verlag von T. Steinkopff. Dresden. 1911. Price M. 1.

Small paper-covered volume containing 79 pages of subject matter and 5 illustrations.

Einführung in die Kolloidchemie. Ein Abriss der Kolloidchemie für Lehrer, Fabriksleiter, Aerzte, und Studiernde. Von Prof. Dr. V. Pöschl. Dritte verbesserte Auflage. Verlag von T. Steinkopff. Dresden. 1911. Price M. 2.

Small paper-covered volume containing 77 pages of subject matter and alphabetical indexes of authors' names and of subjects. The subject matter is classified as follows: (1). General characteristics; nomenclature. (2). Properties of colloidal solutions. (3). Relation of colloidal solutions to true solutions and suspensions. (4). Dispersoids and their classification. (5). Preparation of colloidal solutions. (6). Methods of investigation; ultramicroscopy. (7) Modern views of the nature of the colloidal state. (8). Importance of colloid chemistry for other sciences. (9) Importance of colloid chemistry for chemical industry and technology. (10). Literature.

Handbuch der Mineralchemie. Herausgegeben von Hofrat Prof. Dr. C. Doelter. Vier Bände. Bd. I. (2). Verlag von T. Steinkopff. Dresden. 1911. Price M. 6.50.

This 8vo volume of 160 pages forms Part 2 of Vol. I of the entire work (see this J., 1911, 928). It contains sections on:—sodium carbonate and its hydrates; technical applications of sodium carbonate minerals; analysis of double and triple salts of sodium carbonate; potassium and ammonium carbonates; analysis of magnesium and calcium carbonates; formation, occurrence, and utilisation of magnesite; hydrates of magnesium carbonate; and calcium carbonate.

Subject List of Works on Chemistry (including Alchemy, Electrochemistry and Radioactivity) in the Library of the Patent Office [Patent Office Library: Subject Lists, New Series, ZC—ZQ.] Published at the Patent Office, 25, Southampton Buildings, London, W.C. 1911. Price 6d.

This volume supersedes Patent Office Library Series No. 6 (this J., 1901, 945). It includes works on chemistry of all kinds, analysis, alchemy, chemistry of metals and non-metals, theory of solutions, electrochemistry, electrothermic apparatus and processes, colloids, organic compounds, alkaloids, and bio-chemistry.

Report to His Majesty's Secretary of State for the Home Department on the Draft Regulations proposed to be made for the Manufacture of Patent Fuel (Briquettes), with addition of Pitch. By A. H. Lush. [Cd. 5878.] Wyman & Sons, Fetter Lane, E.C. Price 1½d.

Sugar. [H.C. 281.] Wyman & Sons, Fetter Lane, E.C. Price 3d.

This return (in continuation of Parliamentary Paper No. 334, of Session 1907) shows, as far as possible, for each of the years 1907, 1908, 1909, and 1910, the estimated production of cane and beet sugar in the various producing countries of the world; the imports and exports of raw and refined sugar, distinguishing beet and other sorts, into and from the United Kingdom, France, Germany, Austria-Hungary, Belgium, Holland, the United States, Canada, and Australia, from and to the principal countries of origin and destination; the total consumption and consumption per head of the population of each of the above-named countries, and the exports of sugar of domestic production from each of the principal British Colonies and Possessions, together with the average declared import value of raw and refined sugar for the United Kingdom. (See also page 1176.)

*New Books.

Arrhenius, S.: Das Hauptgesetz der Adsorptionserscheinungen. [SA. aus: "Meddelanden från k. vetenskapsakad, Nobelinst."] (44 S.) 8°. Uppsala. 1911. Berlin, R. Friedländer & Sohn. M. 1.20.

Arrhenius, S.: Ueber die Energieverhältnisse bei Dampfbildung u. elektrolytische Dissoziation. [SA. aus: "Meddelanden från k. vetenskapsakad. Nobelinst."] (38 S.) 8°. Uppsala. 1911. Berlin. R. Friedländer & Sohn. M. 1.20.

Besana, C.: Fabbricazione del burro. 16°., p. 59. Casale. 1911. Lire 1.

Carena, A.: L'industria dei laterizi. 8° fig., p. xii., 218, con 7 tavole. Torino. 1911. Lire 10.

Carena, G.: Nuovo vocabolario di arti e mestieri, riveduto ed arricchito da copiosi articoli per cura del prof. Ernesto Sergent. Nuova edizione con l'aggiunta di un indice analitico-alfabetico. 16°. p. 408. Milano. 1911. Lire 3.

Chamot, E. M., and H. W. *Redfield*: The analysis of water for household and municipal purposes. c. 3+130 p. 8°. Ithaca, N.Y., Taylor & Carpenter. 1911. $1.25.

Craveri, M.: Sull'impiego dei concimi fosfatici e potassici nella moderna agricoltura. 8°, p. 32, con 12 tavole. Bologna. 1911. 50 cent.

Darapsky, L.: Filterkatalyse bei der Enteisenung v. Grundwässern. [SA. aus: "Gesundheit."] (46 S. m. 8 Fig.) 8°. Leipzig, F. Leineweber. 1911. M. 1.

Doelter, C.: Die Einwirkung v. Kathodenstrahlen auf einige Mineralien u. die Natur der Mineralfärbungen. [SA. aus: "Sitzungsber. d. k. Akad d. Wiss."] (20 S.) gr. 8°. Wien, A. Hölder. 1911. 60 Pf.

Doelter, C.: Über die elektrische Leitfähigkeit u. das Verhalten des Diamanten bei hohen Temperaturen. [SA. aus: "Sitzungsber d. k. Akad. d. Wiss."] (24 S. m 6 Fig.) gr. 8°. Wien, A. Hölder. 1911. M. 1.

Duchesne, A.: Recherches sur les propriétés de la vapeur d'eau surchauffée, 33 fig., in-4°. Paris. 1911. 6 fr.

Dümmler, K.: Handbuch der Ziegel-Fabrikation. Die Herstellg. der gesamten keram. Baumaterialien, wie Ziegel, Terrakotten, Röhren, Platten, Kacheln, feuerfeste Waren u. s. w. 2., stark verm. u. verb. Aufl. (In 6 Abtlgn.) Mit üb. 600 Abbildgn. im Text. 1. Abtlg. Die Rohmaterialien der Ziegel- u. Tonwarenfabrikation, deren Gewinng. u. Vorbereitg. (132 S. m. 86 Abbildgn.) Lex. 8°. Halle, W. Knapp. 1911. M. 8.

Euler, H., u. S. *Kullberg*: Über den Temperaturkoeffizienten der Zersetzung v. Invertase. [SA. aus: "Arkiv f. kemi, mineral. och geol."] (8 S. m. 1 eingedr. Kurve.) 8°. Uppsala. 1911. Berlin, R. Friedländer & Sohn. 60 Pf.

Fayol, A.: La production du caoutchouc. in-8°. Paris. 1911. 0 fr. 50.

Froid (le) industriel et ses applications par l'Institut du Mois scientifique et industriel. 2e édit. rev., 28 fig., in-8°. Paris. 1911. 2 fr. 75.

Hägglund, E.: Affinitätsmessungen in alkoholischen u. wässrigalkoholischen Lösungen. [SA. aus: "Arkiv f. kemi, mineral. och geol."] (31 S. m. 2 eingedr. Kurven.) 8°. Uppsala. 1911. Berlin, R. Friedländer & Sohn. M. 1.

Humphrys, N. H.: The Construction and Management of Small Gasworks. With a Section on Actual Costs and Capacity of Recently Erected Works by J. H. Brearley. Cr. 8vo. pp. 268. J. Allan & Co. London. 1911. Net 7s. 6d.

Iltis, Dr.: Ueber das Vorkommen u. die Entstehung des Kautschuks bei den Kautschukmisteln. [SA. aus: "Sitzungsber. d. k. Akad. d. Wiss."] (48 S. m. 3 (2 Doppel-] Taf.) gr. 8°. Wien, A. Hölder. 1911. M. 2.80.

Jahresberichte üb. die Leistungen der chemischen Technologie m. besond. Berücksicht. der Elektrochemie u. Gewerbestatistik f. d. J. 1910. 56. Jahrg. od. neue Folge 41. Jahrg. Bearb. v. Prof. Dr. Ferd. Fischer. (Jahrg. 1—25 von R. v. Wagner.) 2 Abtlgn. gr. 8°. Leipzig, J. A. Barth. 1911. je M. 15; cloth, M. 16.50.

Knapen, A.: L'humidité dans les constructions et procédés nouveaux pour y remédier. 76 fig., 1 pl., in-8°. Paris. 1911. 2 fr. 50.

Kohlrausch, Frdr.: Gesammelte Abhandlungen. Hrsg. v. Wilh. Hallwachs, Adf. Heydweiller, Karl Strecker, Otto Wiener. 2. (Schluss-) Bd. Elektrolyte. Elektrolytische Leitg., Leitvermöger u. Polarisation, Physik der Lösgn. Mit e. Lebensbild des Verf. v. A. Heydweiller. Mit 1 Bildnis des Verf., 5 Taf. u. 84 Fig. im Text. (LXXII, 1305 S.) gr. 8°. Leipzig, J. A. Barth. 1911. M. 30; half mor. M. 32.

Melmer, Dr. R.: Ein Beitrag zur Bestimmung der Wärmeleitungsfähigkeit v. Fettstoffen, Erden, Sanden u. dgl. [SA. aus: "Sitzungsber. d. k. Akad. d. Wiss."] (13 S. m. 1 Fig.) gr. 8°. Wien, A. Hölder. 1911. 55 Pf.

Mennicke, Dr. H., Die Metallurgie des Wolframs m. besond. Berücksicht. der Elektrometallurgie sowie der Verbindungen u. Legierungen des Wolframs samt seinen Verwendungen. Praktisches Handbuch. (416 S. m. 9 Abbildgn). Lex. 8°. Berlin, M. Krayn. 1911. M. 15; cloth M. 17.

Nicou, P.: Les ressources de la France en minerais de fer, 6 fig., 5 cartes, in-8°. Paris. 1911. 6 fr.

Ulzer, Prof. F.: Chemisch-technische Mitteilungen der Versuchsanstalten an der k. k. Staatsgewerbeschule Wien XVII. 1. Heft. (III. 75 S. m. Fig.) gr. 8°. Wien, F. Deuticke. 1911. M. 2.50.

Warburg, E.: Ueber den Energieumsatz bei photochemischen Vorgängen in Gasen. [SA. aus: "Sitzungsber. d. preuss. Akad. d. Wiss."] (S. 746—754 m. 2 Fig.) Lex. 8°. Berlin, G. Reimer. 1911. 50 Pf.

Wickersheimer, M. E.: Essai théorique et pratique sur la vaporisation. Méthode pour augmenter le rendement des générateurs à vapeur, 3e. édit. ref. et augm., in-8°. Paris. 1911. 3 fr. 50.

ERRATUM.

This J., Sept. 15, 1911, page 1094, col. 2, under "New Books," the publishers of "Physico-Chemical Tables, etc., by J. Castell-Evans, are C. Griffin and Co., London.

*Dissertations.

[Prices vary, ranging between two and three shillings.]

Goebell, H.: I. Ueber die Bildung von lakmusartigen Farbstoffen aus Amidoorcin. II. Ueber eine eigenartige Oxydation des Orcins. Erlangen. 1911. 32 S. 8°.

Goldacker, P.: Synthese von merkurierten α-Anilidofettsäuren. Berlin. 1910. 37 S. 8°.

Maennel, K.: Ueber die spezifischen Wärmen einiger Salzlösungen bei tiefen Temperaturen. Halle. 1911. 73 S. 8°.

Ostermaier, H.: Reduktion von Naphtalin- und Naphtolkarbonsäuren zu Aldehyden mittels Natriumamalgam und Borsäure. Giessen. 1910. 27 S. 8°.

Pfeiffer, K.: Einwirkung von Ammoniak und Schwefelwasserstoff auf Quecksilberchlorid, -bromid, -jodid, -cyanid in Methylal. Giessen. 1911. 47 S. 8°.

Reich, P.: Reaktionen der Strychninonsäure und d. Strychninolons. Berlin. 1911. 38 S. 8°.

Rother, J.: Ueber den Einfluss von Substituenten auf die Merkurierbarkeit einiger Derivate des Amidobenzols. Berlin. 1911. 65 S. 8°.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding lists can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

Patent Specifications may be purchased at the Sale Branch of the Patent Office, Quality Court, Chancery Lane, London, W.C., fifteen days after the date on which acceptance of the complete specification is advertised. The price is 8d. each.

1.—GENERAL PLANT; MACHINERY.

APPLICATIONS.

20,112. Christenson. Centrifugal machines. [U.S. Appl., Sept. 12, 1910.]* Sept. 11.

20,144. Reynolds. Reversible regenerative gas furnaces. Sept. 11.

20,146. Abresch. Band press for drying purposes.* Sept. 11.

20,435. Knox. Muffle kilns, ovens, etc. Sept. 15.

20,757. Carter. Means for separating liquid impurities from gases. Sept. 20.

20,890. Royston. Furnaces. Sept. 21.

20,927. Gasser. Column apparatus for distilling, cooling, heating, etc. [Ger. Appl., March 3, 1911.]* Sept. 21.

21,057. Smith. Furnaces. Sept. 23.

21,332. Browne and Masson. *See under* XIX.

21,350. Bunzel, and Bayerische A.-G. f. Chem. und Landwirtschaftlich-Chem. Fabrik. Causing masses of material to be permeated by gases. Sept. 27.

21,467. Fairweather (Isolirstoff). Drying ovens and the like.* Sept. 29.

21,588. Govan. Evaporating, smelting, and fusing furnaces. [Divided Appl. on No. 19,806 of 1911.] Sept. 30.

21,589. Govan. Utilisation of waste gases. [Divided Appl. on No. 19,806 of 1911.] Sept. 30.

21,605. Cole. Apparatus for washing or purifying and cooling air and gases. Sept. 30.

21,609. Humphrey. Methods and apparatus for raising or forcing liquids. Sept. 30.

Complete Specifications Accepted.

22,915 (1910). Eddy. Apparatus for indicating and recording the character of smoke. Oct. 4.

23,189 (1910). Walker, Sharp, and Stevens. Shaking barrels. Oct. 4.

23,749 (1910). Jager. Evaporating or concentrating under vacuum and apparatus therefor. Sept. 27.

26,480 (1910). Wollaston. Filters. Sept. 20.

30,194 (1910). Johnson (Badische Anilin und Soda Fabrik). *See under* XI.

142 (1911). Johnson (Badische Anilin und Soda Fabrik). *See under* XI.

3605 (1911). Dexter. Drying machines having steam heated cylinders. Oct. 4.

4515 (1911). Chevalet. Distilling apparatus. Sept. 27.

7391 (1911). Crolbois. Apparatus for continuous evaporation, concentration, desulphurising, and distilling of liquids *in vacuo*. Sept. 27.

9228 (1911). Gobbi. Filters or strainers. Oct. 4.

10,259 (1911). Schwabacher. Apparatus for bringing gases into contact with liquids. Sept. 20.

15,808 (1911). Wilbuschewitsch. Nozzles for mixing. Sept. 20.

18,330 (1911). Loring. Apparatus for treating granular or pulverulent materials with liquids. Sept. 27.

II.—FUEL; GAS; MINERAL OILS AND WAXES; DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

20,145. Abresch. Process for drying raw peat.* Sept. 11.

20,193. Baynes and Malcomess. Apparatus for extracting tar and other impurities from gases. Sept. 12.

20,223. Hurwitz. Incandescence bodies for electric glow-lamps. [Ger. Appl., Jan. 30, 1911.]* Sept. 12.

20,296. Scharrer and Lüdecke. *See under* X.

20,312. Hoering. Fuel blocks or briquettes. [Ger. Appl., Feb. 3, 1911.]* Sept. 13.

20,437. Scoular. Production of tungsten filaments. Sept. 15.

20,514. Pickering. Combined tar tower and retorthouse governor. Sept. 16.

20,633. Von Kerpely. Gas producers.* Sept. 18.

20,641. Nixon. Combustibles.* Sept. 18.

20,856. Heckel. Agglutination of coal dust, etc.* Sept. 21.

20,938. Hunt (Duff). Recovery of ammonia and byproducts in gas producers.* Sept. 22.

20,980. Diehl and Faber. Manufacture of neutral coke. [Addition to No. 6622 of 1910.]* Sept. 22.

21,059. Armstrong and Mordan. Apparatus for solidifying hydrocarbon oils.* Sept. 23.

21,098. Farnham. Gas producers. Sept. 25.

21,192. Furse. Manufacture of fuel briquettes, etc., from peat, lignite, and waste products.* Sept. 26.

21,315. Zdanowich. Manufacture of incandescence gas mantles. Sept. 27.

21,363. Southey. Production of gaseous fuel. Sept. 27.

21,374. Rollason. Manufacture of gas. Sept. 28.

21,561. Coppée Co., Ltd., and Coppée. By-product installations for use with coke ovens. Sept. 30.

Complete Specifications Accepted.

21,210 (1910). Mueller. Treatment and recovery of byproducts from distillation gases. Sept. 20.

21,391 (1910). Roberts and Roberts. Generation of gas from steam and combustibles. Sept. 27.

21,409 (1910). Rotermund. *See under* VII.

21,737 (1910). Stewart, Stewart, and Bethell. Arrangement and combination of gas producers and gas regenerative furnaces. Sept. 20.

22,500 (1910). Wachs- u. Oel-Werke Boyen und Hoepfner, and von Boyen. Process for refining crude mineral wax. Oct. 4.

28,662 (1910). Jones. Means for quenching the coked product of coke ovens or gas retorts. Oct. 4.

29,935 (1910). Coke Oven Construction Co., and Marr. Recovery of by-products formed during the dry distillation of coal. Sept. 4.

2042 (1911). Wolf. *See under* VII.

3950 (1911). Weissmann. Electric illuminating bodies. Sept. 27.

7664 (1911). Boult (Putsch). Coke or like ovens. Sept. 20.

7754 (1911). Zschocke. Purifying and cooling hot gases. Sept. 20.

8996 (1911). Ludecke and others. *See under* XI.

9099 (1911). Wilson. Gas producers. Sept. 20.

9471 (1911). Comp. d'Agglomères d'Anthracite Pur, and Besson. Manufacture of composite fuel. Oct. 4.

9646 (1911). Forward. Manufacture of asphalt from petroleum residuum or from crude petroleum. Oct. 4.

14,841 (1911). Phillips and Phillips. Manufacture of coal briquettes. Sept. 27.

15,034 (1911). Mueller. *See under* VII.

III.—TAR AND TAR PRODUCTS.

Applications.

20,622. Ullmann. Manufacture of halogen-naphthanthraquinones. [Ger. Appl., Oct. 25, 1910.]* Sept. 18.

20,741. Blichfeldt. *See under* XX.

21,203. Flemming. Halogenphenol alkali salts and process for making the same.* Sept. 26.

Complete Specifications Accepted.

29,720 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of chlor-aralkylsulphonic acids. Oct. 4.

29,722 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of aldehydes of the anthraquinone series. Sept. 27.

8007 (1911). Weil. Apparatus for distilling tar. Sept. 27.

IV.—COLOURING MATTERS AND DYES.

Applications.

20,197. Holliday and Sons, Ltd., Turner, and Dean. Manufacture of black colouring matters. Sept. 12.

20,453. Ullmann. Manufacture of vat dyestuffs of the anthraquinone series. [Ger. Appl., Oct. 17, 1910.]* Sept. 15.

20,608. Newton (Bayer und Co.). Manufacture of black cotton dyestuffs. Sept. 18.

Complete Specifications Accepted.

21,199 (1910). Newton (Bayer und Co.). Manufacture of azo dyestuffs. Sept. 20.

22,138 and 27,051 (1910). Ransford (Cassella und Co.). Manufacture of indophenolic compounds and dyestuffs therefrom. Sept. 27.

24,883 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Sept. 20.

28,781 (1910). Newton (Bayer und Co.). Manufacture of vat dyestuffs of the anthraquinone series. Oct. 4.

2354 (1911). Newton (Bayer und Co.). Manufacture of alizarin. Oct. 4.

2615 (1911). Act.-Ges. f. Anilinfabr. Manufacture of polyazo dyestuffs. Oct. 4.

8474 (1911). Read Holliday and Sons, Turner, and Dean. Manufacture of black colouring matters. Sept. 27.

13,619 (1911). Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of a monoazo colouring matter especially for making pigment colours. Sept. 27.

V.—FIBRES; TEXTILES; CELLULOSE PAPER.

Applications.

20,119. Brandenberger. Manufacture of cellulose films. Fr. Appl., Nov. 15, 1910.]* Sept. 11.

20,189. Sommer. Preparation of rosin solutions for use in paper-making.* Sept. 12.

20,220. Howard. Production of mechanical wood-pulp. [U.S. Appl., Sept. 12, 1910.]* Sept. 12.

20,648. Castle. Product for use in textile and other manufactures. Sept. 18.

20,975. Dreyfus. Manufacture of celluloids. [Fr. Appl., July 15, 1911.]* Sept. 22.

20,976. Dreyfus. Manufacture of uninflammable celluloid plastic masses. [Fr. Appl., July 6, 1911.]* Sept. 22.

20,977. Dreyfus. Manufacture of derivatives of cellulose and their transformation products. [Fr. Appl., July 5, 1911.]* Sept. 22.

20,978. Dreyfus. Manufacture of cellulose esters soluble in chloroform. [Fr. Appl., July 7, 1911.]* Sept. 22.

20,979. Dreyfus. Manufacture of solutions of cellulose esters for making films, etc. [Fr. Appl., July 15, 1911.]* Sept. 22.

21,327. Hoering. *See under* IX.

21,328. Hoering. Manufacture of a raw material for cellulose and paper manufacture.* Sept. 27.

21,426. Leduc Heitz et Cie. *See under* XIII.

21,603. Vigreux and Pelgeais. Rotary purifiers for paper pulp, etc. [Fr. Appl., Oct. 20, 1910.]* Sept. 30.

Complete Specifications Accepted.

4869 (1910). Blitz. Treatment of flax, hemp, rhea, ramie, etc., to obtain fibres. Oct. 4.

26,800 (1910). Sowden. Wool and other fibre dying machines. Sept. 27.

27,303 (1910). De St. René and Tissier. Process for making yarn from kapok and similar vegetable fibre. Sept. 27.

4409 (1911). Feuillette. Process for steeping or retting flax, hemp, etc. Sept. 20.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

20,291. Cross and Taylor. Apparatus for dyeing and padding fabrics, etc. Sept. 13.

20,295. Higgins. Soluble liquid blue. Sept. 13.

20,297. Hoyle and Milne-Smith. Waterproof fabric and method of making same. Sept. 13.

20,656. Petzold. Removing the lye from fabrics after mercerisation. [Ger. Appl., Sept. 27, 1910.]* Sept. 18.

20,961. Windrath. Dyeing and impregnating yarn skeins in a circulating dyeing bath.* Sept. 22.

21,028. Sunderland and Johnstone. Method of bleaching or cleansing textile vegetable fibres. Sept. 23.

21,036. Bolton. Mordanting and dyeing textile fibres. Sept. 23.

Complete Specifications Accepted.

2700 (1911). Johnson (Badische Anilin und Soda Fabrik). Production of brown shades on fibrous materials. Oct. 4.

7057 (1911). Dörr. Process of dyeing vegetable fibre. Sept. 20.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

20,242. Chem. Werke vorm. Dr. H. Byk. Manufacture of a stable preparation from hydrogen peroxide and urea. [Ger. Appl., March 31, 1911.]* Sept. 12.

20,420. De Ros. Production of compounds containing nitrogen and oxygen. Sept. 15.

20,486. Näher and Müller. Process of producing hydrogen. [Ger. Appl., Sept. 29, 1910.]* Sept. 15.

20,509. Walder. Direct and continuous decomposition of water into its gases. Sept. 16.

20,582. Auchinachie. Treatment of vanadium ore and production of vanadic acid. Sept. 18.

20,706. Webster, and International Salt Co., Ltd. Manufacture of salt. Sept. 19.

20,713. Rigg. Treatment of sal ammoniac skimmings. [U.S. Appl., Nov. 12, 1910.]* Sept. 19.

20,938. Hunt (Duff). *See under* II.

21,151. Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia and catalytic agents for use therein. Sept. 25.

21,227. Judd. Production of substances containing phosphorus. Sept. 26.

21,359. Johnson (Chem. Fabr. Griesheim-Elektron). Manufacture of zinc-sodium hydrosulphite. Sept. 27.

21,521. Crookes and Stroud. Production of metal colloids and organo-sols. Sept. 29.

21,528. Crookes and Stroud. *See under* XIX.

Complete Specifications Accepted.

16,765 (1910). Ashcroft. Production of cyanamides and cyanides of the alkali metals. Sept. 20.

19,778 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia and catalytic agents for use therein. Oct. 4.

21,409 (1910). Rotermund. Recovery of ammonia from coal and like gases. Sept. 20.

23,745 (1910). Crowther and Gidden. Manufacture of salt. Sept. 20.

25,386 (1910). Hale and Scott. Manufacture and concentration of nitric acid. Sept. 27.

27,558, 29,893 (1910), and 4268 (1911). Phillips and Bulteel. Method of obtaining oxides of nitrogen. Sept. 20.

1626 (1911). Chem. Werke vorm. Dr. H. Byk. Manufacture of calcium perborate. Oct. 4.

2042 (1911). Wolf. Manufacture of ammonium sulphite and sulphate from coke oven gases. Sept. 27.

7205 (1911). Ges. f. Linde's Eismaschinen. Separation of hydrogen from mixtures of gases. Oct. 4.

13,934 (1911). Nerking. Production of sulphocyanic acid compounds. Oct. 4.

14,121 and 14,122 (1911). Pauling. Absorption of nitrous gases. Sept. 27.

15,034 (1911). Mueller. Recovery of ammonium sulphate from distillation gases. Sept. 20.

15,432 (1911). Elektrochem. Werke. Production of solutions of nitrogen pentoxide in monohydrate of nitric acid. Oct. 4.

18,207 (1911). Lidholm. Production of ammonia from nitrolime. Oct. 4.

VIII.—GLASS; CERAMICS.

Complete Specifications Accepted.

21,687 (1910) and 4642 (1911). Jones, Jones, and Jones. Continuous kilns for burning pottery, bricks, etc. Sept. 20.

18,114 and 28,617 (1910). Dressler. Ovens for use in making tiles, pottery, etc. Oct. 4.

IX.—BUILDING MATERIALS.

Applications.

20,219. Pyke. Artificial stone. Sept. 12.

21,327. Hoering. Manufacture of artificial wood.* Sept. 27.

Complete Specifications Accepted.

21,687 (1910) and 4642 (1911). Jones. *See under* VIII.

8085 (1911). Owen. Manufacture of products of concrete, cement, etc. Oct. 4.

8086 (1911). Owen. Manufacture of products of concrete, cement, etc. Sept. 20.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

20,121. Bronn. Melting ferromanganese and other ferroalloys. [Ger. Appl., Nov. 4, 1910.]* Sept. 11.

20,143. Hutton. Rendering aluminium non-corrosive, ductile, malleable, and tough. Sept. 11.

20,204. Poulson. Treatment or renovation of foundry sand. Sept. 12.

20,239. Schmitz. Smelting vessels or drums. Sept. 12.

20,296. Scharrer and Lüdecke. Manufacture of tungsten and incandescence bodies therefrom. Sept. 13.

20,404. Boult (Cöln-Müsener Bergwerks Akt.-Ver.). Treatment of ores.* Sept. 14.

20,421. De Ros. Extraction of metals from their ores. Sept. 15.

20,431. Turner. Converter furnace for use in making iron, steel, and metallic alloys. Sept. 15.

20,455. Lauber and Neher. Manufacture of aluminium foil. [Swiss Appl., Oct. 27, 1910.]* Sept. 15.

20,456. Mitchell. Cleaning and polishing metals. Sept. 15.

20,582. Auchinachie. *See under* XII.

20,798. Rudge-Whitworth, Ltd., and Heathcote. Preparation and use of solutions for treating iron or steel to prevent oxidation or rust. Sept. 20.

20,913. Thierry. Metallurgy of zinc.* Sept. 21.

20,917. Simpson. Hardening steel surfaces. Sept. 21.

21,014. Thierry. Metallurgy of zinc.* Sept. 22.

21,066. Schoop. Applying deposits of metal or metallic compounds to surfaces. [Fr. Appl., Oct. 7, 1910.]* Sept. 23.

21,157. Lauber and Neher. Production of aluminium foil. [Ger. Appl., July 7, 1911.]* Sept. 25.

21,447. Elektrochem. Fabr. Kempen-Rhein. Treatment of tin and materials containing tin. [Ger. Appl., Sept. 29, 1910.]* Sept. 28.

21,522. Butlin. Treatment of iron and manufacture of steel. Sept. 29.

21,588. Govan. *See under* I.

21,593. Douvreleur. Production of copper by electrolysis. Sept. 30.

Complete Specifications Accepted.

14,431 (1910). Yost. Reduction of ores or blast-furnace fuel dust. Sept. 27.

17,010 (1910). Island. Separation of precious metals from ores. Sept. 20.

21,603 (1910). Ampère Ges., and Müller. Production of metals and alloys by smelting in electric furnaces. Sept 27.

21,856 (1910). Greenway. Concentration of ores. Sept. 27.

21,857 (1910). Greenway and Lavers. Concentration of ores. Sept. 27.

22,660 (1910). Poulson. Treating or renovating foundry sand. Oct. 4.

. 22,684 (1910). Pucillo. Treatment of aluminium. Oct. 4.

28,226 (1910). Cowper-Coles. Production of iron by electro-deposition. Oct. 4.

1703 (1911). Turke and Hofheimer. Recarburising means for regenerating superheated or burnt iron and steel. Oct. 4.

8155 (1911). Comp. d'Enterprises de Lavage de Minerais. Apparatus for separating ores. Oct. 4.

11,063 (1911). Kuehnrich. Steel. Sept. 27.

XI.—ELECTRO-CHEMISTRY.

Application.

21,600. Knowles. Apparatus for purifying electrolytic gases. [Divided Appl. on No. 27,264 of 1910.] Sept. 30.

Complete Specifications Accepted.

30,194 (1910). Johnson (Badische Anilin und Soda Fabrik). Apparatus for the electrical purification of gases. Sept. 27.

142 (1911). Johnson (Badische Anilin und Soda Fabrik). Electrical purification of gases. Oct. 4.

5734 (1911). Estelle. Anodes for use in the electrolytic treatment of alkaline salt solutions. Oct. 4.

8996 (1911). Ludecke, and Imperial Lamp Works (Brimsdown), Ltd. Electric furnaces for treating metal filaments. Oct. 4.

XII.—FATS; OILS; WAXES.

Applications.

20,313. Blangonnet. Process and apparatus for making soap.* Sept. 13.

20,329. Verein. Chem. Werke. Reduction of fats and unsaturated fatty acids. [Ger. Appl., Feb. 2, 1911.]* Sept. 13.

20,454. Wilbuschewitsch. Refining hydrogenised fats to produce edible fats. [Addition to No. 30,014 of 1910.]* Sept. 15.

20,741. Blichfeldt. *See under* XX.

20,928. Weiss. *See under* XX.

21,571. Bamberg. Hydrolysis. Sept. 30.

Complete Specification Accepted.

22,213 (1910). Grant. Manufacture of soap. Oct. 4.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

21,188. Pope. Manufacture of lead pigments. Sept. 26.

21,292. Sharpe. Manufacture of white lead. Sept. 27.

21,426. Leduc Heitz et Cie. Preparation and application of varnish having a base of cellulose ethers. [Belg. Appl., Oct. 7, 1910.]* Sept. 28.

21,503. Pittmann. Manufacture of varnish. Sept. 29.

Complete Specifications Accepted.

21,662 (1910) and 6662 (1911). Barton. Manufacture of white lead. Sept. 27.

13,527 (1911). Newton (Bayer und Co.). Manufacture of colouring-matter lakes. Oct. 4.

16,155 (1911). Cavanly. Buckles for use in making white lead, etc. Oct. 4.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

20,129. Ruhgummi-Verwertungs Ges. Rough rubber and process for making same. [Ger. Appl., Aug. 2, 1911.]* Sept. 11.

20,947. De Mello and Gimson. Manufacture of rubber substitute. Sept. 22.

21,304. Von Vargyas. Rubber substitute.* Sept. 27.

21,566 and 21,567. Golby (Moore Architectural and Engineering Co.). Process and apparatus for reclaiming rubber waste.* Sept. 30.

COMPLETE SPECIFICATIONS ACCEPTED.

21,074 (1910). Tarver. Manufacture of articles from waste rubber, etc. Sept. 20.

21,634 (1910). Da Costa and Bridge. Process and means for smoking and drying sheet rubber after coagulation. Sept. 27.

22,201 (1910). Norzagaray. Cleansing crude indiarubber. Oct. 4.

1723 (1911). Tolkien. Manufacture of a substitute for indiarubber. Oct. 4.

XV.—LEATHER; BONE; HORN; GLUE.

COMPLETE SPECIFICATIONS ACCEPTED.

23,466 (1910). Richter und Richter, and von Orth. Separation of colloidal substances from pseudo-solutions. Oct. 4.

16,527 (1911). Redlich. Clarifying tanning extract liquors, especially quebracho extract liquors. Sept. 27.

XVII.—SUGARS; STARCHES; GUMS.

APPLICATION.

21,204. Wynberg and Sauer. Manufacture of sugar.* Sept. 26.

XVIII.—FERMENTATION INDUSTRIES.

APPLICATION.

20,767. Hyde. Process and apparatus for brewing beer. Sept. 20.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

APPLICATIONS.

20,150. Durbrow. Extraction of micro-organisms and solids from water.* Sept. 11.

20,363. Neumann. Apparatus for refining chocolate masses. [Ger. Appl., Sept. 16, 1910.]* Sept. 14.

20,369. Thame. Manufacture of casein. Sept. 14.

20,454. Wilbuschewitsch. *See under* XII.

20,556. Linden. Chemical treatment of liquids, especially water. [Divided Appl. on 9258 of 1911.]* Sept. 16.

21,233. Conradt. Manufacture of edible chocolate. Sept. 26.

21,332. Browne and Masson. Sterilising and purifying liquids and regenerating perishable materials.* Sept. 27.

21,528. Crookes and Stroud. Sterilising and purifying food, drugs, and water by application of metal colloids or organo-sols. Sept. 29.

COMPLETE SPECIFICATIONS ACCEPTED.

21,478 (1910). Loring. Treatment of flour, semolina, or wheaten stock. Sept. 20.

21,537 (1910). Ashe. Treatment of milk. Sept. 20.

22,522 (1910). Neff and Brandes. Treatment of water. Oct. 4.

23,078 (1910). Henri, Helbronner, and von Recklinghausen. Apparatus for sterilising liquids by ultra-violet rays. Sept. 20.

5863 (1911). Gaebel. Manufacture of malt coffee. Oct. 4.

6178 (1911). Henri and others. Apparatus for sterilising liquids. Oct. 4.

11,789 (1911). Li. Non-fermented and sugared alimentary products of soja grains. Oct. 4.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

APPLICATIONS.

20,329. Verein. Chem. Werke. *See under* XII.

20,611. Immendorff and Kappen. Manufacture of urea. [Ger. Appl., Sept. 19, 1910.]* Sept. 18.

20,741. Blichfeldt. Reduction of organic bodies. Sept. 19.

20,928. Weiss. Cod-liver oil preparations.* Sept. 22.

20,991. Newton (Bayer und Co.). Production of pinacone. Sept. 22.

21,519. Johnson (Badische Anilin und Soda Fabrik). Manufacture of isoprene. Sept. 29.

21,610. Wolff und Co. Manufacture of compounds containing iron, albumin, phosphorus, and arsenic. [Addition to No. 16,048 of 1910. Ger. Appl., Jan. 13, 1911.]* Sept. 30.

COMPLETE SPECIFICATIONS ACCEPTED.

17,143 (1911). Witt. Method of moulding camphor. Sept. 27.

17,985 (1911). Soc. Chim. des Usines du Rhône. Manufacture of nitrophenylnitromethanes, their homologues and derivatives. Oct. 4.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATIONS.

20,251. Baugé, Dumez, and de Seauve. Colour photography and printing. [Fr. Appl., Sept. 13, 1910.]* Sept. 12.

20,610. Palmer. Manufacture of coloured grains and medium for colour photography, etc. Sept. 18.

20,880. Hamburger. Colour photography. Sept. 21.

COMPLETE SPECIFICATION ACCEPTED.

22,426 (1910). Fulton. Photographic sensitive surfaces. Oct. 4.

XXII.—EXPLOSIVES; MATCHES.

APPLICATIONS.

21,147. Claessen. Manufacture of smokeless nitrocellulose-nitroglycerine powders. [Ger. Appl., May 26, 1911.]* Sept. 25.

21,344. Fairweather (Claessen). Process for detonating explosive bodies.* Sept. 27.

XXIII.—ANALYTICAL PROCESSES.

APPLICATION.

20,692. Levy. Apparatus for estimating the percentage of combustible gas in a gaseous mixture.* Sept. 19.

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MR. T. STEEL IN THE CHAIR.

ON CERTAIN CHANGES IN THE COMPOSITION OF THE NITROGENOUS CONSTITUENTS OF MEAT EXTRACTS.

BY A. M. WRIGHT.

During the processes of manufacture of meat extract, considerable changes in the composition of the nitrogenous constituents take place. In the first place, the meat from which the extract is prepared is in contact with hot water for some time, and this in conjunction with the sarco-lactic acid and other flesh acids, and with the salts present in muscular tissue, causes a certain amount of hydrolysis to take place; the collagen of the muscle fibre on hydrolysis yields gelatin, and by further hydrolysis soluble gelatin and other gelatinoids; similar action on the albumen yields small amounts of albumoses. Secondly, during the concentration of the extract liquor by evaporation, further changes in composition take place; it is the examination of these changes that is the object of this investigation. An extract liquor having the following composition was concentrated (*a*) by the open pan evaporation and (*b*) under partial vacuum. Moisture, 95·02 per cent.; organic matter, 4·07 per cent.; mineral salts, 0·91 per cent.; acidity as lactic acid, 0·50 per cent.; total nitrogen, 0·488 per cent.; insoluble and coagulable proteids, 0·165 per cent.; proteoses, 0·838 per cent.; peptone-like bodies and polypeptides, nil; total meat bases, 0·886 per cent.; ammonia, 0·054 per cent. Calculating these results to a 20 per cent. moisture basis, in order to have results comparable with those of a concentrated extract of meat, the composition is shown in the following table:—

Calculated to 20 per cent. moisture, as in concentrated extract of meat.

	Extract liquor.	Concentrated in open pan.	Concentrated under partial vacuum.
Moisture	20·00	20·00	20·00
Organic matter	65·60	60·48	63·04
Mineral salts	14·40	19·52	16·96
Acidity as lactic acid	8·00	10·30	8·20
Total nitrogen	7·82	7·92	7·86
Insoluble and coagulable proteids	2·65	1·16	2·63
Proteoses	13·34	12·37	13·08
Peptone-like bodies and polypeptides	nil	8·69	0·31
Total meat bases	14·19	12·53	13·76
Ammonia	0·85	0·80	1·08

After concentration in the usual way by open pan evaporation for 48 hours at 212° F., the composition of the resulting extract (which contained 17·60 per cent. moisture) calculated to a 20 per cent. moisture basis, is shown in the second column of the foregoing table. It is apparent that some considerable change had taken place in the composition of the material.

A portion of the same original liquor was concentrated under a partial vacuum of 15 inches at 180° F. for 3½ hours, and the composition of the resulting extract (which contained 18·36 per cent. moisture) calculated to a 20 per cent. moisture content is shown in the third column of the table.

It is seen that when the liquor is evaporated under vacuum there is some change in the composition of the resulting extract; the proportion of the organic matter decreases, while the mineral salts increase; otherwise the composition of the vacuum-concentrated extract is very nearly that of the original liquor calculated to a 20 per cent. moisture basis, the acidity, insoluble and coagulable proteids, proteoses, and the total meat bases being present in about the same amounts in each case. In the original liquor there were no peptone-like bodies, whereas in the vacuum-concentrated extract there were found 0·31 per cent. of these substances. The extract concentrated in the open pan is very different in composition from either the original liquor or the vacuum extract; the proportion of the organic matter has decreased, and the mineral salts increased considerably; the total nitrogen remains about the same, but the forms in which the nitrogen is present have undergone considerable change, about three-fifths of the insoluble and coagulable proteids having been rendered soluble and become converted into other nitrogenous substances; there is a decrease in the amounts of proteoses and meat bases; while against these decreases there is found 8·69 per cent. of peptone-like bodies, which are absent in the original liquor, and present in the vacuum-concentrated extract to the extent of only 0·31 per cent.; the acidity has increased by over 2 per cent.

The peptone-like bodies and polypeptides are bitter in taste, and it is found that extracts containing relatively large amounts of these bodies have a decidedly bitter taste; samples containing 16·58 per cent., 12·02 per cent., 14·65 per cent., and 13·43 per cent. of peptone-like bodies were found to be bitter; while in samples containing 8·44 per cent., 8·60 per cent., 8·69 per cent., and 5·09 per cent. of these bodies, no bitter taste could be noticed.

As but very small amounts of peptone-like bodies are present in vacuum-concentrated extract, and but little change in the composition of the nitrogenous bodies is found, it is probable that the prolonged action of heat on the nitrogenous material in the presence of the normal flesh acids and salts, the amounts of which increase as the evaporation proceeds, is the cause of the marked change in composition found in the open pan concentrated extract. The so-called "burned" flavour, sometimes noticed in meat extracts, is doubtless due to the same cause, for in vacuum concentrated extract no such undesirable flavour is noted. For permission to publish these results the author desires to express his thanks to the Christchurch Meat Company, Limited, in whose chemical laboratory most of the work in connection with this investigation was carried out.

Discussion.

Mr. T. U. Walton, referring to the evidence of decomposition in the open pan, pointed out that a good deal had also occurred in the vacuum pan, for the total quantity of ash must be the same before and after concentration, and as its percentage proportion had increased considerably, this meant that relatively to ash there had been a disappearance of organic matter. Relatively to ash, one-sixth of the organic matter had been lost, even with vacuum concentration, and nearly one-third had been lost in the open pan. In the same way, though the proportion of total nitrogen was practically the same in all three analyses, yet when the ratio of this constituent to ash was calculated, it appeared that one-seventh of the nitrogen had been lost in the vacuum pan and one-fourth of it in the open pan. While the benefit of vacuum over open pan was very marked, there was evidently need for improving the vacuum much beyond 13 inches, and thus still further lowering the temperature during evaporation.

Mr. N. M. Thomas missed any reference in the paper to the alteration in nutritive value caused by the decomposition that had occurred.

Dr. R. Greig-Smith inquired where the increased proportion of peptones had come from? There were no insoluble albuminoids shown to account for the increase, and there seemed to be something lacking in the paper on that point.

Mr. L. Meggitt thought the comparison of results was better when analyses were calculated to dryness.

The Chairman pointed out that the author, in a recent paper, had dealt very fully with the question of nutritive values, showing that meat extracts were digestive stimulants and had no real nutritive value. He thought the ash increase, provided no salt had been added to the extract, must be due to hydrolysis of certain organic matters and consequent loss of water on evaporation. Probably the nitrogen, shown by Mr. Walton to have been lost, had been transformed into ammonia, which would then readily distil off.

The Author, in reply, wrote as follows:—No natural peptones were found in any of the materials examined; indeed, I have never found peptone nitrogen in any sample of meat extract, and for this reason I have recorded the nitrogen usually determined as, and attributed to peptones, as peptone-like bodies and polypeptides. It is probable that this nitrogen is in the form of the non-biuret-reacting polypeptides of Fischer (Trans. N. Z. Inst., 1910, **43**, 4), which are intermediate between peptones and the amino acids. As to how they are formed I cannot at present say; it is found, however, that in all meat juices and liquors before concentration they are absent, while in meat extract concentrated in the open pan they are always present. No salt was added to the extracts under consideration; the ash increase and loss of nitrogen is due to the hydrolysis of some of the organic constituents with consequent loss of water and nitrogen as ammonia during evaporation. During the open pan concentration there is always a noticeable amount of ammonia coming off, indicating the gradual breaking down of the more complex nitrogenous compounds into the simpler forms and finally to ammonia. The question of nutritive values has already been discussed in an earlier paper (Trans. N.Z. Inst., 1910, **43**, 1—6).

A MAGNESIAN STALAGMITIC GROWTH IN SEA WATER.

BY T. U. WALTON.

In an iron tank through which sea water was kept almost continually flowing for some months, for the purpose of cooling ammonia heated by pressure in a refrigerator, several columns of white mineral matter appeared at the surface of the water. The tank measured 8 ft. by 4 ft. by 4 ft. deep, and contained parallel rows of coils of $1\frac{3}{4}$ inch iron piping, several inches apart, through which the ammonia circulated. The upper row of coils was 6 inches below the surface of the water.

Sea water was pumped in from a large pipe at the bottom of one end of the tank, and overflowed at the top of the other end. When the tank was emptied, columns of mineral matter were found to have grown vertically from certain points on the coils, rising upwards like so many stalagmites, which they strongly resembled in appearance. The largest was 14 inches long by 2 inches in diameter at the base, increasing near the top to 3 inches. On one side was a cast of the three upper rows of cooling pipes, against which it had touched in its upward growth. A smaller one measured 9 or 10 inches in length by 2 to $2\frac{3}{4}$ inches in diameter, and there were several still smaller, about 5 to 6 inches long by $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter. Each was hollowed on the side next the cooling pipes, even where there was no evidence of contact with them.

Analysis shows the dry material to contain 88 per cent. of magnesium hydroxide, 8 per cent. of calcium carbonate, 0·9 per cent. of calcium sulphate and 2·8 per cent. of sodium chloride. When taken from the tank it held 44 per cent. water as determined at 100° C.

The starting point of each growth was a minute leak in the pipe containing the ammonia, which, being under considerable pressure, bubbled out into the sea water flowing past, precipitating some of the lime and magnesia salts.

Much of this precipitate was doubtless carried away in the flowing water, but some of it became attached to the pipe; and as the ammonia bubbles ascended, the direction of growth was upward, the columns being formed by the accretion of further precipitated matter to that previously deposited. Just as a stalagmite grows by continued deposit from evaporating water that has dropped on it, so these columns have grown by fresh deposit, drawn by ammonia from the passing sea water. They are, however, less dense and more brittle. The structure is cellular and non-crystalline, the outer surface in places being covered with spheroidal vesicles that are easily detached. Each of these is seen under the microscope to be an agglomeration of still smaller vesicles, the vesicular form being due to the pressure of the escaping ammonia gas.

Discussion.

Mr. F. W. Steel said he had had experience of a similar case in the manufacture of anhydrous ammonia. The conditions were similar, but the results were not so striking. In order to cool impure ammonia gas, which also contained sulphur and carbon dioxide as it left the stills, it was passed through a cooling tank exactly as described, at a pressure of several pounds per square inch. The cooling sea water often became heated to the boiling point, so that precipitation from any escaping ammonia was effected hot. The deposit formed in the shape of small tubes resembling marine growths on wharves. He had not analysed the material, but had no doubt it had a similar composition to that described in the paper.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Refrigerating machines; Steam ——. E. Josse. Z. ges. Kälteind., 1911, **18**, 137—141. (See also this J., 1910, 805.)

The author describes a new form of refrigerating machine constructed by himself and W. Gensecke. The steam from the evaporator is aspirated through a steam jet compressor and is condensed in a surface condenser under a vacuum of 28—29 inches. The water formed is expelled from the condenser through a jet pump driven by the refrigerating water, the motive power being supplied by an ordinary centrifugal pump. With an absolute pressure of steam of 0·004 atmosphere in the evaporator, the corresponding temperature attainable is —7° C. A lower temperature (—15° C.) can be obtained, however, by admitting a current of air into the evaporator, since, though it is not possible, under practical conditions, to reduce the pressure below 0·004 atmosphere, corresponding to the vapour tension of the steam. Since the air introduced must undergo compression, it is returned from the condenser to the evaporator in order to reduce the work of the compressor as much as possible. This device of introducing air also affords a convenient means of regulating the temperature. The steam consumption required for working the machine is rather higher than with other refrigerating systems; on the other hand, the machine is of very simple construction, and has no moving parts: the use of water as refrigerating liquid and the absence of any high pressure are further advantages.—L. E.

Patents.

Refrigerating machines and apparatus; Working medium for ——. W. E. Evans, London. From Elektrochem. Werke, G. m. b. H., Bitterfeld, Germany. Eng. Pat. 9125, Apr. 12, 1911.

The claim is for the use of ethane as the working medium. It is stated that temperatures down to —90° C. can be readily obtained.—A. T. L.

Nozzles for mixing. M. Wilbuschewitsch, Nischninovgorod, Russia. Eng. Pat. 15,808, Dec. 24, 1910.

Two materials, for example oil and a catalyst, are mixed by means of two co-axial nozzles arranged one within the other, each having a helical passage for imparting rotary motions in opposite directions to the two materials fed separately into the two nozzles. An intimate admixture of the materials at the common outlet is thus obtained.—H. H.

Filters. T. R. Wollaston, Manchester. Eng. Pat. 26,480, Nov. 15, 1910.

The filtering medium, such as broken quartz with fine sand above, is disposed in a number of long open chambers or troughs of U- or V-shaped cross-section, to which the liquid to be filtered is supplied from a conduit running past the ends of the troughs. Perforated pipes of inverted V-section run along the bottoms of the troughs and conduct the filtrate through three-way valves to siphons, by means of which it is drawn off. The action of the siphons is controlled, according to the level of liquid above the filters, by means of air inlet valves, operated by floats, which admit air to interrupt the action of the siphons if the level of liquid falls unduly. The other passages of the three-way valves serve to admit cleansing water in the reverse direction through the filters, and brushes carried on trolleys running along the top edges of the troughs serve to clean the upper layers of sand. Any one or more of the filters can be thrown out of action by closing the inlet valves which admit the liquid thereto.—H. H.

Gases; Purifying and cooling hot ——. H. Zschocke, Kaiserlautern, Germany. Eng. Pat. 7754, Mar. 28, 1911.

A process for the above purpose and for "gas mixtures containing mechanical impurities and mixed with vapours characterised by the fact that by the pressure of the gas generator and by the suction effect of a fan, the gases are first carried through a dust receptacle and a coarse filter, and then, by the pressure effect of the said fan, through a finer filter, a cooler, and a water separator, whereby reheating of the gas in front of the filter, is rendered entirely unnecessary."—H. H.

Gases into contact with liquids; Apparatus for bringing ——. H. Schwabacher, London. Eng. Pat. 10,259, Apr. 27, 1911.

The apparatus comprises a series of conical or pyramidal elements arranged vertically above one another within an outer cylindrical casing up which the gases to be treated are forced, meeting the descending treating liquid. A gutter or launder attached to the walls of the casing is arranged beneath each element to collect the descending liquid and conduct it to the centre of the element below through radial channels provided for the purpose. The radial channels may be horizontal for pure liquids or inclined for liquids containing solids in suspension.—H. H.

Precipitation treatment of liquid; Apparatus for ——. F. Ondra, Johannesburg. U.S. Pat. 1,003,781, Sept. 19, 1911.

The apparatus comprises two tall cylindrical vessels opening at the bottom into a common chamber adapted for the collection and removal of precipitate. The liquid to be treated enters at the top of one of the vessels, meets a current of the precipitating gas introduced through a perforated pipe at the foot thereof, and is finally drawn off from the top of the other vessel.—H. H.

Distilling apparatus. L. A. called F. Chevalet, Troyes, France. Eng. Pat. 4515, Feb. 22, 1911. Under Int. Conv., March 1, 1910.

See Fr. Pat. 413,237 of 1910; this J., 1910, 1093.—T. F. B.

Evaporation, concentration, desulphurisation, and distillation in vacuo of liquids; Apparatus for the continuous ——. J. J. A. Crolbois, Paris. Eng. Pat. 7391, March 24, 1911. Under Int. Conv., March 26, 1910.

See Fr. Pat. 424,990 of 1910; this J., 1911, 879.—T. F. B.

Evaporating apparatus. P. Kestner, Lille, France, Assignor to Kestner Evaporator Co., Philadelphia. U.S. Pat. 1,003,912, Sept. 19, 1911.

See Fr. Pat. 361,524 of 1905; this J., 1906, 874.—T. F. B.

Evaporating apparatus. F. Scheinemann, Berlin. U.S. Pat. 1,004,087, Sept. 26, 1911.

See Fr. Pat. 421,848 of 1910; this J., 1911, 407.—T. F. B.

Solid bodies; Apparatus for the treatment of —— with gases. W. Mathesius, Charlottenburg, Germany. U.S. Pat. 1,003,628, Sept. 19, 1911.

See Fr. Pat. 411,969 of 1910; this J., 1910, 997.—T. F. B.

Treating [roasting and agglomeration] materials; Process of ——. F. W. Yost, Chicago. U.S. Pats. 1,003,682, 1,003,683, and 1,003,684, Sept. 19, 1911.

See Fr. Pat. 417,037 of 1910 and First and Second Additions thereto; this J., 1910, 1393; 1911, 10.—T. F. B.

Conveying inflammable liquids; Apparatus for ——. C. Martini, Assignor to Martini und Hüneke Maschinenbau-Akt.-Ges., Berlin. U.S. Pat. 1,004,287, Sept. 26, 1911.

See Eng. Pat. 11,252 of 1911; this J., 1911, 878.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal; A constituent of —— [hexahydrofluorene]. A. Pictet and L. Ramseyer. Ber., 1911, **44**, 2486—2497. (See this J., 1911, 1041.)

Fuller details of the method of separation of hexahydrofluorene from coal, and of its properties, are given.—A. S.

Gaseous mixtures; Limits of explosibility in ——. E. P. Perman. Nature, Sept. 28, 1911, 416.

Using a glass tube of about 10 c.c. capacity, with a stopcock at each end, and a mercury gauge of small bore attached at the middle, the author has observed much wider limits of explosibility of mixtures of combustible gases with air than those usually given. The following results were obtained, ignition being effected by an incandescent platinum wire: methane, 2·5—24; coal gas, 4—28; and hydrogen, 3—75 per cent. Incidentally it was found that the gas produced by decomposing aluminium carbide with water contains 33 per cent. of hydrogen. —A. S.

Coal in British Columbia. Times Fin. Suppl., Oct. 14, 1911. [T.R.]

AN immense body of anthracite coal exists at the head waters of the Skeena, about 150 miles north of Hazelton, British Columbia. There are locations on it of eight years' standing. Serious development by three companies has been carried out this season. James McEvoy, formerly of the Geological Survey and later of Crow's Nest, reports that he has developed at least three workable seams of anthracite coal. The extent of the field is not yet known. Four hundred square miles have been staked out.

The following table shows the output for the year 1910 of the present producing fields :—

	Tons.
Vancouver Island	1,616,030
Nicola	146,218
Princeton	11,868
Crow's Nest Pass	1,365,119
Total	3,139,235

The total amount of coal produced in the world in 1909 amounted to 1,113,308,386 tons, the value of which is estimated at nearly £400,000,000. The following figures show the main sources from which the coal supply of the world is obtained :—

Countries.	1908.		1909.	
	Quantity.	Value.	Quantity.	Value.
	Metric tons.	£	Metric tons.	£
United States of America	377,250,000	109,305,000	418,038,000	113,043,000
Great Britain	265,726,000	116,599,000	268,007,000	106,275,000
Germany....	215,286,000	85,140,000	217,446,000	84,910,000
Austria-Hungary .	48,966,000	14,926,000	48,813,000	15,272,000
France......	37,384,000	23,694,000	37,840,000	23,037,000
Russia	25,059,000	not stated	24,455,000	not stated
Belgium	23,558,000	15,223,000	23,518,000	13,516,000

Determination of water in various substances [*coal*]. Zerewitinoff. *See* XXIII.

PATENTS.

Peat; Methods of gathering ——. K. I. Crossley and T. Rigby, Openshaw, Manchester. Eng. Pat. 13,391, June 2, 1910.

THE peat is cut from the bog by a dredger or other excavating machine, converted into pulp on the spot by a disintegrator, and then pumped with added water if necessary along a pipe line to the required spot. The excavator, disintegrator, and pump are carried on one or more pontoons floating in the bog and the pipe line, which also floats on the bog, has flexible joints.—A. T. L.

Combustion of fuel in furnaces; Method of and apparatus for promoting ——. G. Barker, Birmingham. From International Manufacturing Co., Wilmington, Del., U.S.A. Eng. Pat. 118, Jan. 3, 1911.

A RAPID current of heated air is injected horizontally into the gases rising from the fuel bed of a furnace, so as to oxidise the combustible gases and carbon particles and at the same time draw air through the fuel bed in quantity dependent upon the velocity of the injected air. The air to be injected, which is heated in two heating chambers arranged at the sides of the furnace, is projected into the furnace by means of a steam or compressed air jet at a velocity which may reach 4500 feet per minute, two nozzles with flat orifices being preferably employed for the purpose of spreading the moving body of air over the whole area of the grate. Ribs are arranged within the heating chambers and nozzles for the purpose of commingling the gases, conducting heat, and preventing buckling. (Reference is directed to Eng. Pats. 9218 of 1899; 11,297 of 1908; and 4426 of 1909.)—H. H.

Coke ovens. A. G. Boult, London. From A. Putsch, South Bethlehem, Pa. Eng. Pat. 7664, March 27, 1911.

THE heating flues in the walls of the ovens are of triangular cross-section, and may communicate in pairs at the end remote from the burners. The triangular flues are formed by the two lateral walls of adjacent ovens, and oblique walls which divide the intervening space into a series of equilateral triangles. They may be conveniently built up of Y-shaped bricks, of which the stems or bases are built into the lateral walls of the ovens, and the branches form the oblique dividing walls of the flues.—A. T. L.

Gas producers and gas regenerative furnaces; Arrangement and combination of ——. J. Stewart, Alfreton, W. Stewart, Motherwell, N.B., and R. P. Bethell, Walsall. Eng. Pat. 21,737, Sept. 19, 1910.

THE patent relates to the combination with a regenerative furnace of a two-chamber gas-producer of the type described in Eng. Pat. 26,858 of 1909 (this J., 1910, 1193). The two chambers of the producer are in communication at the lower part, and are provided at the top with blast inlets and gas outlets with interlocked valves, so that the direction of the currents through the producer can be reversed, one chamber working with down-draught while the other works with up-draught. In the combined apparatus, the producer is built independently of the furnace, and the gas outlets open into gas passages at opposite ends of the furnace, so that the direction of the gases through the furnace and regenerators is reversed automatically with the reversal of the currents in the producer.—A. T. L.

Gas producers. A. Wilson, Stafford. Eng. Pat. 9099, April 12, 1911.

IN producers of the kind having a central tuyère or grate for the admission of the blast, the lower portion of the producer wall is built up of segmental hollow metal blocks, through which cooling currents of air or water are passed so as to prevent the adhesion of clinker.—A. T. L.

Gas producer. S. B. Sheldon, South Bethlehem, Pa. U.S. Pat. 1,003,524, Sept. 19, 1911.

FUEL feed mechanism for a gas-producer comprises a hopper carried at a point between the centre and the circumference of the rotating water-sealed top-plate of the producer. The fuel is delivered from the body of the hopper to the discharge orifice by means of a rotating worm which is adjustable on its vertical shaft, and the fuel is discharged from the mouth of the hopper by a distributing member carried by the same shaft. The worm, the distributing member and the vertical shaft are hollow and water-cooled.—A. T. L.

Acetylene; Storage of ——. M. C. Whitaker and F. J. Metzger, Yonkers, N.Y., Assignors to H. E. Robinson, Brooklyn, N.Y. U.S. Pat. 1,003,559, Sept. 19, 1911.

ACETYLENE is stored in solution in acetone in a copper drum packed with porous material, and ammonium thiocyanate is added to the solution to prevent the formation of copper acetylide.—A. T. L.

Asphalt [*asphaltum*] *solutions; Apparatus for and method of treating* —— *for the production of asphalt cement and the recovery of the lighter products.* F. H. Dunham, Los Angeles, Cal. U.S. Pat. 1,003,040, Sept. 12, 1911.

ASPHALTUM is obtained from asphaltic oils by heating the oil to a temperature between 400° and 600° F. within an approximately horizontal cylindrical shell, the oil being then removed from the lower portion of the shell to an evaporating pan in the upper part. The oil is thus subjected to the temperature of that portion of the shell above the surface of the lower charge of oil. The uncondensed light vapours are carried off from the upper part of the shell, and the heavy vapours and the condensed products from the charge in the evaporating pan are led off from the middle portion of the shell.—B. N.

Combustible briquettes: Manufacture of ——. T. Rigby. Fr. Pat. 429,676, May 13, 1911. Under Int. Conv., May 14, 1910.

See Eng. Pat. 12.013 of 1910; this J., 1911, 1105.—T. F. B.

Gas for illuminating and other purposes and process for making it. G. A. Bronder. Fr. Pat. 428,752, April 21, 1911.

See U.S. Pat. 992,106 of 1911; this J., 1911, 735.—T. F. B.

Apparatus for the observation of gas caps and testing miner's safetylamps. Eng. Pat. 26,534. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION: HEATING; LIGHTING.

Incandescence mantles made from artificial silk. Nass. J. Gasbeleucht., 1911, **54**, 938—941. (Compare this J., 1911, 609.)

Mantles made from continuous fibres of artificial silk are now on the market. Micro-photographs show that in use the fibres remain distinct and unbroken, whilst the short fibres in mantles made from cotton or ramie become more or less untwisted from the original structure of the spun yarn. In accordance with this observation, it is found that the mantles made from artificial silk are the strongest and most durable in use. When tested on Drehschmidt's machine, which subjects the mantle to a recorded number of shocks or vibrations, a good ramie mantle will endure 500 to 1000 shocks before fracture when new, but only 100 shocks after 10 hours' use. The mantles made from artificial silk endured 6000 shocks without fracture when new, and supported a suspended weight of 20 grms., and after 500 hours' use they supported a weight of 15 grms. An artificial silk mantle was used for 7 weeks on a high-pressure burner, on which a ramie mantle lasted only 6 days.—A. T. L.

Incandescence mantles; Alkaline fixation of ——. H. Silbermann. Chem.-Zeit., 1911, **35**, 1037.

The mantle (whether of cotton, ramie, or artificial silk) is treated with a concentrated solution of sodium hydroxide (25°—30° B.), for half-an-hour, as far as possible in the absence of air, and, after passing between a pair of rolls, to free the shrunken material from the excess of alkali, is immersed for 15 minutes in a bath containing thorium and cerium salts; these react with the cellulose-alkali to form an insoluble hydrated oxide (quite free from nitrate), which is precipitated on the fibre, without a precipitate appearing in the liquor. The shrinking (mercerising) effect may be prevented, if desired, by adding glycerin, Turkey-red oil, or the like, to the alkali solution. A smaller proportion of oxides, per given weight of mantle material, is said to be fixed by this method than by the processes hitherto employed, and this without any diminution in illuminating power or resistance.—F. Sodn.

Patents.

Ammonia from coal and like gases; Recovery of ——. H. Rotermund, Düsseldorf, Germany. Eng. Pat. 21,409, Sept. 14, 1910.

The saturator is divided into two compartments by a vertical partition reaching nearly to the bottom. The coal gas, or the like, after leaving the tar extractor, is passed into the acid in the first compartment, and escapes through a pipe at the top of this compartment. Into the other compartment, hot air or hot combustion gases are blown in order to evaporate a certain quantity of water and thus keep the acid solution at a concentration at which solid ammonium sulphate will separate.—A. S.

Ammonium sulphate from distillation gases; Recovery of —— *and apparatus therefor.* W. Mueller, Essen-Ruhr, Germany. Eng. Pat. 15,034 of 1911, date of appl., Sept. 12, 1910.

The ammonium sulphate is made in the saturator described in Ger. Pat. 237,609 (this J., 1911, 1152), hot sulphuric acid being supplied both by means of a pipe and also in the form of a spray produced in the gas inlet pipe. A steam heating coil may be supplied in the side walls of the saturator.—T. F. B.

Wood: Process and apparatus for the carbonisation of ——. R. de Simard de Pitray. Fr. Pat. 429,644, May 12, 1911.

The wood is heated in a closed retort, mounted on trunnions on a wheeled trolley, the retort being connected, by a pipe at its lower end, with the usual coolers and condensers. A layer of inferior fuel, such as cheaper wood, or coke, is placed above the charge of wood and ignited before the retort is closed up. The combustion of this fuel is effected by blowing in air at the top of the retort, the charge of wood being heated by the combustion products passing down through it to the outlet.—A. T. L.

Daylight for colour-matching purposes; Apparatus for artificially producing ——. M. Weertz, Bradford. Eng. Pat. 4401, Feb. 21, 1911.

So-called "daylight lamps" for matching colours by artificial light are generally used in connection with an electric arc, but suffer from the disadvantage that the colour of the light varies with the length of the arc. The present specification relates to lamps designed for use with metal-filament electric light, incandescence gas light or petroleum. Coloured filters of blue and green glasses are provided, the blue being free from all red colouring matter and preferably pure cobalt glass, that known as "Coburg blue" or "Blériot blue" being most suitable. The green glass should have a grass-green colour, preferably the glass known as "nickel green." The actual proportions of blue and green will vary according to the source of light used: *e.g.*, an osram lamp will require more green than a tantalum lamp.—J. F. B.

Electric incandescent lamps; Process of repairing ——. W. G. Honskeeper, Philadelphia, U.S.A. Eng. Pat. 17,480, Aug. 1, 1911. Under Int. Conv., Aug. 5, 1910.

The patent relates to the process of preparing a metallic filament in continuous lengths as described in Eng. Pat. 7331 of 1910 (see Fr. Pat. 414.257 of 1910; this J., 1910, 1195), in which the filament is heated electrically by passing it through a series of terminals comprising drops of mercury held by surface tension in apertures of a series of plates. According to the invention, a polyphase alternating current is used for heating the filament and the terminals are connected so that currents of different phases pass through different sections of the length of the filament. In this way, while one part of the filament is at its hottest, another part is coldest, and the total length of the filament under treatment is constant, thus avoiding breakages due to expansion and contraction.—A. T. L.

Tungsten filaments; Process for making ——. Comp. Franç. pour l'Exploitation des Proc. Thomson-Houston. First Addition, dated March 22, 1911, to Fr. Pat. 421,012, Oct. 1, 1910 (see Eng. Pat. 23,499 of 1909, this J., 1911, 291).

In order to give a wave-like form to a filament, so as to permit of contraction during use, the filament is suspended between two clips in a glass tube through which a current of hydrogen is passed, the lower clip is adjusted so as to bend the filament and an electric current is passed, bringing the filament to a sufficient temperature to cause it to retain the curve without losing all its elasticity. The lower clip is readjusted and the process repeated until the desired form is attained.—A. T. L.

Metallic filaments for incandescence lamps; Manufacture of ——. W. Heinrich. Fr. Pat. 428,790, March 25, 1911.

The powdered metal is mixed with one-fifth of its weight of a special binding material, which is free from carbon, and is worked until the mass resembles caoutchouc. It is then squirted to a thread, and the filament is heated in a vacuum to 400° or 500° C. and afterwards to over 1000° C., so as to expel the binding agent. The latter is made by mixing 50 grms. of dry sulphur with 60 grms. of amorphous phosphorus and heating gently until combination takes place.—A. T. L.

Distillation gases; Treatment of and apparatus for recovery of by-products from ——. W. Mueller. Essen-Ruhr, Germany. Eng. Pat. 21,210, Sept. 12, 1910.

See Fr. Pat. 421,905 of 1910; this J., 1911, 530.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Toluene; Sulphonation of ——. A. F. Holleman and P. Caland. Ber., 1911, 44, 2504—2522.

As a preliminary to the study of the mechanism of the sulphonation of toluene, the three sulphonic acids and their chlorides were prepared in the pure state. The ortho and para acids can readily be obtained pure from the product of the sulphonation of toluene by separating the barium salts, but the best way of obtaining the para acid is from commercial sulphuryl chloride. The meta acid is obtained by oxidising *m*-thiocresol with permanganate. For the identification of the three acids in a sulphonation experiment, they were converted into the chlorides and from previously determined freezing point curves of mixtures of the three pure chlorides, the amounts of the respective acids could be ascertained. In the sulphonation all three acids are formed; as the temperature is raised, the amount of para and meta acids rises and that of the ortho acid sinks. The maximum amount of the para acid is formed at 75° C., but the relative proportions of the acids formed at 100° C. are about the same. No difference was observed by using 96 per cent. or 100 per cent. sulphuric acid, but the quantity of acid used has considerable influence; at all temperatures decrease in the amount of sulphuric acid led to increase in the amount of the para acid, but with a very large excess of sulphuric acid less para acid was formed at 0° C., no difference could be observed at 35° C., whilst at 75° C. and 100° C. the quantity was greater. By the use of chlorosulphonic acid instead of sulphuric acid, comparative experiments at 35° C. showed that with the former more para and meta acids and less ortho acid were produced than by the use of the latter. No difference was observed, moreover, by adding salts such as potassium, mercurous or silver sulphates to the sulphonation mixture. The authors find also that at 100° C., the ortho and para acids undergo mutual conversion one into the other.—J. C. C.

Barium oxide as reducing agent. Reduction of nitrobenzene to nitrosobenzene, azobenzene, aniline, phenazine, and ammonia. T. Zerewitinoff and I. Ostromisslensky. Ber., 1911, 44. 2402—2409.

On heating nitrobenzene and barium oxide to 208° C., small quantities of nitrosobenzene are formed. If nitrobenzene be allowed to drop (9—11 drops per minute) on to barium oxide (a layer about 60 cm. long gives the best results) heated to 225°—230° C., the reduction goes further, azobenzene, aniline, phenazine, and very small quantities of ammonia being formed: 100 grms. of nitrobenzene yield 28·4 grms. of azobenzene, 3·4 grms. of aniline, and 2·7 grms. of phenazine. Under similar conditions, but at somewhat higher temperatures, *o*-nitrotoluene yields *o*-toluidine, and *p*-nitrotoluene yields *p*-toluidine and azotoluene; *m*-dinitrobenzene is not reduced by barium oxide. If barium hydroxide be used in place of barium oxide, nitrobenzene is reduced to aniline and phenazine, but no nitrosobenzene or azobenzene can be detected. If the barium oxide be replaced by strontium oxide, lime, charcoal, or pumice, no reduction of nitrobenzene takes place, and it is stated that undoubtedly in the case of barium oxide, barium peroxide must be formed, according to the equations:—

$$C_6H_5NO_2+BaO=C_6H_5NO+BaO_2$$
$$2C_6H_5NO+2BaO=C_6H_5.N:N.C_6H_5+2BaO_2,$$

and then decomposed again.—A. S.

Thiophen; Simple method for the preparation of ——. W. Steinkopf. Chem.-Zeit., 1911, 35, 1098.

By passing acetylene over pyrites heated to about 300° C., a liquid is obtained containing about 40 per cent. of thiophen, together with other sulphur compounds. The acetylene is passed at the rate of 150 litres per hour through an iron pipe, through which the pyrites is moved by means of a screw conveyor. Marcasite or synthetic iron disulphide may be used instead of pyrites. The thiophen can be easily separated by fractional distillation from the accompanying substances. Among the latter was found a compound of b. pt. 36°—38° C., and probable formula, $C_4H_6S_3$, which has a penetrating, garlic-like odour, and on treatment with alkali loses a portion of its sulphur and yields a substance of relatively pleasant smell.—A. S.

Patents.

Tar; Apparatus for distilling ——. J. A. Weil, Stockton-on-Tees. Eng. Pat. 8007, March 30, 1911.

The apparatus, which is especially suitable for distilling producer-gas tar, consists of a settling tank in which the tar is kept hot by means of a steam coil, a still of inverted cone shape, on the inner surface of which is a shallow, V-shaped, helical trough, a closed tank into which the pitch flows from the bottom of the still, a condenser, an oil and water separator, water and oil receivers connected with the separator by valved pipes, and a vacuum pump connected both with the separator and with the pitch tank to maintain a diminished pressure throughout the apparatus. By thus causing the tar to flow over a helical path down the side of the still, it is stated that the trouble due to frothing, so usual with tars containing much water, is avoided.—T. F. B.

Benzene and homologous compounds; Process of recovering ——. A. Soly and E. Davier. First Addition, dated April 4, 1911, to Fr. Pat. 424,242, Nov. 24, 1910 (this J., 1911, 737).

The mixture of benzene or other vapours and air is forced through columns of water by a pump placed before the first of them, instead of being drawn through them by a pump placed at the end of the series.—A. T. L.

Chlor-aralkyl-carboxylic acids; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 29,721, Dec. 21, 1910.

Chloro-aralkylcarboxylic acid chlorides, containing chlorine in the alkyl group, can be converted into the corresponding chloro-aralkylcarboxylic acids by treatment with saponifying agents under such conditions that the acid chloride group is saponified whilst the chloromethyl group remains unattacked. *Example*: Thirty parts of benzyl chloride-*p*-carboxylic acid chloride (obtained by chlorinating *p*-toluic acid chloride with aid of heat) are introduced into 200 parts of 98 per cent. sulphuric acid, the temperature being kept between 0° and 5° C.; when evolution of hydrochloric acid has ceased, the solution is poured on ice and the benzyl chloride-*p*-carboxylic acid filtered off and washed with cold water. It is almost insoluble in cold water, and melts at 190°—192° C., with decomposition.—T. F. B.

Aldehydes of the anthraquinone series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 29,722, Dec. 21, 1910.

When ω-tetrahalogen-2.2′-dimethyl-1.1′-dianthraquinonyl (obtainable by chlorinating the corresponding dimethyl-dianthraquinonyl) is treated with concentrated or fuming sulphuric acid, with or without addition of boric acid, 1.1′-dianthraquinonyl-2.2′-dialdehyde is produced. Chloro-derivatives of this aldehyde are similarly obtained by treating chloro-derivatives of the ω-tetrahalogen-dimethyldianthraquinonyl. (Compare Eng. Pat. 16,632 of 1905; this J., 1906, 368.)—T. F. B.

4.4′-Dibromodiphenyldisulphide-2.2′-dicarboxylic acid and process of obtaining such bodies. E. Münch. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,003,289, Sept. 12, 1911.

When *o*-diazobenzoic acids are treated with thioantimoniates, diphenyldisulphide-2.2′-dicarboxylic acids are produced. The 4.4′-dibromodiphenyldisulphide-2.2′-dicarboxylic acid obtained from 2-diazo-5-bromobenzoic acid, is a colourless compound, of m. pt. 310° C., easily soluble in acetone, but soluble with difficulty in alcohol and glacial acetic acid, and soluble with great difficulty in boiling water.—T. F. B.

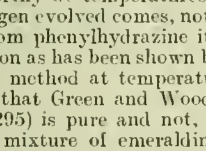
IV.—COLOURING MATTERS AND DYES.

Aniline Black and its intermediate products. A. G. Green and S. Wolff, Ber., 1911, **44**, 2570—2582.

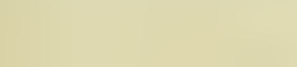
Willstätter and Cramer's method of reduction (this J., 1910, 1369) of the various compounds belonging to the Aniline Black series by means of phenylhydrazine is found not to be trustworthy at temperatures above 80—90° C., because the nitrogen evolved comes, not from the products examined but from phenylhydrazine itself, which undergoes auto-reduction as has been shown by various workers. Analyses by this method at temperatures not exceeding 80—90° C. show that Green and Woodhead's emeraldine (this J., 1910, 1295) is pure and not, as Willstätter and Cramer state, a mixture of emeraldine and nigraniline. The constitutions (so far as the number of quinonoid groups is concerned) of emeraldine and nigraniline previously assigned to these compounds (Green and Woodhead, *loc. cit.*) are confirmed, and Willstätter and Dorogi's "Bichromate Black" is shown to be identical with emeraldine. In an appendix the authors reply to the statements of Willstätter and Cramer (this J., 1911, 1006) regarding Green and Woodhead's "leucoemeraldine." As Willstätter and Cramer's conclusion was based on the reduction by phenylhydrazine at 150° C., the above experiments show it to be invalid. Other points raised by Willstätter and Cramer are also discussed.—J. C. C.

Isatoic acid with oxythionaphthene, indandione, and indanone; Products of condensation of ——. E. Noelting and A. Herzbaum. Ber., 1911, **44**, 2585—2590.

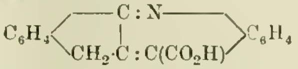
When a solution of isatin in sodium hydroxide (sodium isatoate) is warmed with an alkaline solution of oxythionaphthene, thioquindolinecarboxylic acid,



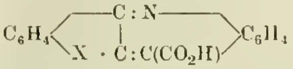
is produced. This dyes wool and silk from an acid bath in faint yellow shades and also dyes several of the various mordants on "Scheurer's strips" feebly. When heated above its melting point it yields thioquindoline. Indandione, when similarly condensed, furnishes quinolylenephenyleneketonecarboxylic acid,


$$C_6H_4\left<\begin{array}{l}\text{——C : N——}\\ \qquad\ |\\ \text{CO·C : C(CO}_2\text{H)}\end{array}\right>C_6H_4$$

which dyes the above-mentioned fibres only very feebly in yellow shades. The compound also loses carbon dioxide on heating. Indanone similarly leads to the production of quinolylenephenylenemethanecarboxylic acid,


$$C_6H_4\left<\begin{array}{l}\text{——C : N——}\\ \qquad\ |\\ \text{CH}_2\text{·C : C(CO}_2\text{H)}\end{array}\right>C_6H_4$$

which is pale yellow but has practically no affinity for fibres. Of the compounds of general formula,


$$C_6H_4\left<\begin{array}{l}\text{——C : N——}\\ \qquad\ |\\ \text{X · C : C(CO}_2\text{H)}\end{array}\right>C_6H_4$$

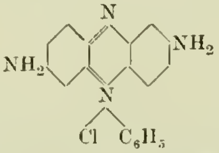
where X = NH (flavindine), S, CO, and CH_2, the colour of both the free acids and the salts and also the affinity for fibres and mordants diminishes from NH to CH_2 in the order given.—J. C. C.

Aposafranine; An isomeride of —— *and the third isomeride of phenosafranine.* F. Kehrmann and J. Riera y Punti. Ber., 1911, **44**, 2622—2627.

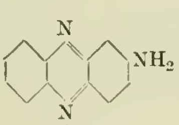
The new isomeride of phenosafranine, or 2 : 6-diaminophenylphenazonium is prepared as follows: Picryl chloride is warmed with 4-nitro-2-aminodiphenylamine in alcoholic solution yielding 2 : 4 : 6 : 5′-tetranitro-2′-phenylaminodiphenylamine,

$$C_6H_2(NO_2)_3·NH·C_6H_3(NO_2)·NH·C_6H_5,$$

which forms yellowish brown crystals decomposing above 174° C. When this is suspended in alcohol and treated with concentrated sodium hydroxide, 1 : 3 : 7-trinitro-10-phenyldihydrophenazine is produced; this forms black violet needles decomposing above 265° C. On reducing this to the triamino-compound and warming the alcoholic solution, ammonia is eliminated and, on the addition of sodium chloride, the chloride of the new dyestuff,



is obtained. This dyes tannin-mordanted cotton in dull greenish blue shades which are changed to red by dilute acids. On washing, however, the blue colour is restored. Alkalis and soap have no action on the tint. The diacetyl derivative of this dyes cotton in dull violet red shades and the monoacetyl derivative gives dull violet shades. When the latter is treated with alcohol and nitrous acid to remove the amino-group and the resulting compound freed from the acetyl group by hydrolysis the chloride of isoaposafranine

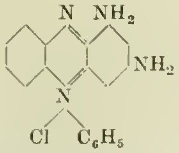


is formed. This could not be purified as its solutions are very unstable.—J. C. C.

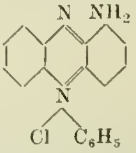
Aposafranine; A third isomeride of ——. F. Kehrmann and A. Masslenikoff. Ber., 1911, **44**, 2628—2631.

When isophenosafranine (I.) is acetylated, the remaining

I.



II.



amino-group removed by the diazo reaction and the product saponified, a new isomeride of aposafranine (II.) is produced. This is best obtained pure as the bromide, which dissolves in water with a greenish blue colour. —J. C. C.

[Synthesis of vat dyestuffs] Catalytic dehydrogenation and the formation of condensed nuclei by aluminium chloride. R. Scholl. Z. angew. Chem., 1911. **24.** 1844—1845.

In presence of anhydrous aluminium chloride the liberation of hydrogen from aromatic nuclei, which otherwise takes place only at temperatures approaching that of red heat, can be effected at temperatures near 100° C., and the reaction can then be used for purposes of synthesis. For example, α-naphthyl-phenyl-ketone when heated with aluminium chloride at 140° C. is converted into benzanthrone, the parent substance of the important vat dyestuffs Violanthrone and Isoviolanthrone discovered by Bally (this J., 1905, 192). A condensation of this type occurs generally with aromatic mono- or poly-ketones having at least one peri-position to a ketonic carbonyl group free. Violanthrone, prepared by Bally by melting benzanthrone with alkali, can also be obtained by heating 4·4′-dibenzoyl-1·1′-dinaphthyl with aluminium chloride. Heterocyclic rings can be condensed in a similar manner. Di-α-thenoylpyrene, for example, when heated with aluminium chloride, yields a thiophen-analogue of pyranthrone (this J., 1910, 266), a brownish-red substance having properties similar to those of vat dyestuffs of the anthraquinone series.—A. S.

"Melamazine" from hydrazine salt and dicyandiamide. K. A. Hofmann and O. Ehrhart. Ber., 1911. **44**, 2713—2717.

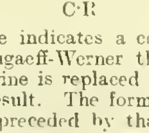
20 grms. of dicyandiamide were ground up with dry hydrazine hydrochloride prepared from 25 grms. of commercial hydrazine hydrate, and the mixture was heated on a sand-bath, until reaction took place, when the temperature rose to 280° C. The nearly white reaction product was boiled repeatedly with 1 per cent. hydrochloric acid (2 litres altogether) and then with dilute ammonia solution, the residue consisting of 14—15 grms. of a new compound, $(C_3N_3NH_2)_2(NH{\cdot}NH)_2.H_2O$, related to melam, to which the name "*melamazine*" has been given. The compound dissolves in alkali to a colourless solution; when exposed to the air, this soon acquires an intense bluish-violet colour, which is destroyed by reducing agents.

Unmordanted cotton can be dyed by impregnating it with the coloured alkaline solution and then treating with calcium chloride solution, but the colour changes to currant-red on treatment with acids, even acetic acid. A solution of melamazine in concentrated sulphuric acid gives colour reactions with oxidising agents: an intense yellowish red with nitrites or nitrates, changing to blue and then disappearing on warming; a transient reddish yellow with hydrogen peroxide; and a deep brownish red with chromic acid, changing to green, with evolution of nitrogen, on warming.

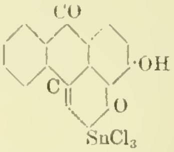
The authors also give the following simple method of preparing aminoguanidine nitrate: A mixture of 100 grms. of nitrolim (50 per cent. of calcium cyanamide), 65 grms. of hydrazine sulphate, and 400 c.c. of water is cooled with ice, ground for 12 hours in a mill and filtered. The filtrate is neutralised with nitric acid, and concentrated, whereupon aminoguanidine nitrate crystallises out: yield, about 40 grms.—A. S.

Colour-lakes. I. P. Pfeiffer. Ber., 1911. **44**, 2653—2662.

By heating hydroxyketones or hydroxyquinones, containing a hydroxy group in the ortho position to the carbonyl group with stannic chloride in anhydrous benzene solution, the author has obtained coloured substitution compounds of the general formula:



in which the dotted line indicates a co-ordinate linkage according to the Tschugaeff-Werner theory of valency. On hydrolysis the chlorine is replaced by hydroxyl, and the true colour lakes result. The formation of the substitution compound is preceded by that of an addition compound; in some cases this was isolated. The compounds prepared from o-hydroxyacetophenone (pale yellow), o-hydroxybenzophenone (bright yellow), resacetophenone (bright yellow), quinacetophenone (deep yellow), euxanthone (orange yellow), gallacetophenone or Alizarin Yellow C (deep yellow), and gallobenzophenone or Alizarin Yellow A (orange) are described. The Alizarin compound,



has a violet black colour, the dark colour being due in part to the strongly auxochrome effect of the meta-hydroxyl group, for the tin compound of o-hydroxyanthraquinone has a red colour. On careful hydrolysis of the violet-black compound at the ordinary temperature, the true orange red tin lake of alizarin is produced.—A. S.

Patents.

Vat dyestuffs: Manufacture of new ——. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 9116, April 12, 1911. Under Int. Conv., April 25, 1910.

The quinone-dianilides, when halogenated, furnish vat dyestuffs. Benzoquinonedianilide, $C_6H_2O_2(NH{\cdot}C_6H_5)_2$ is brominated in nitrobenzene solution at 170°—200° C. With hydrosulphite the vat obtained is faint yellow and dyes wool in deep yellow shades. The dyestuff produced by similarly brominating dichlorobenzoquinonedianilide dyes wool in yellow shades which are rather greener than those produced by the foregoing dyestuff.—J. C. C.

Sulphurised vat dyestuffs of the anthracene series; Manufacture of ——. Soc. Chem. Ind. in Basle, Switzerland, B. Mayer, and L. Weil, Basle, Switzerland. Eng. Pat. 11,422, May 11, 1911. Addition to Eng. Pat. 20,094, Sept. 24, 1908.

The blue green dyestuff described in the chief patent (this J., 1909, 361) may be produced in an improved manner by effecting the operation with the aid of diluents. It is obtained by heating 20 parts of methylbenzanthrone, 20 parts of sulphur and 100 parts of naphthalene for 30 hours in a reflux apparatus.—J. C. C.

Dyestuffs of the anthracene series and new intermediate products used for their manufacture; Production of ——. Soc. Chem. Ind. in Basle. First Addition, dated July 13, 1910, to Fr. Pat. 411,750, April 17, 1909 (this J., 1910, 939).

Brown to violet vat dyestuffs of the naphthanthraquinone series are produced by condensing halogenated naphthanthraquinones with the mono- or di-amino-derivatives of anthraquinone or naphthanthraquinone, or by condensing halogen derivatives of anthraquinone with the aminonaphthanthraquinones. Example 1: 30 parts of chloronaphthanthraquinone, 25 parts of 1-aminoanthraquinone, 20 parts of sodium acetate, 6 parts of copper chloride and 500 parts of nitrobenzene are boiled for 10—20 hours. The dyestuff, which crystallises out on cooling, dyes cotton from the vat in reddish brown shades. Example 2: The dyestuff similarly produced from chloronaphthanthraquinone and 1 : 5-diaminoanthraquinone produces violet brown shades on cotton. Example 3: Aminonaphthanthraquinone is similarly condensed with 4-bromo-1-anthrapyridone but in naphthalene solution. The dyestuff produced gives violet shades on cotton. —J. C. C.

Mordant dyestuff; Red —— and process of making same. C. De la Harpe and E. Bodmer, Assignors to The Firm of Dyeworks, formerly L. Durand, Huguenin & Co., Basel, Switzerland. U.S. Pat. 1,002,825, Sept. 12, 1911.

Red mordant dyestuffs are obtained by condensing an alkylamino- or dialkylamino-m-hydroxybenzoylbenzoic acid with a resorcinol-sulphonic acid.—J. C. C.

Mordant dyestuff; Violet —— and process of making same. C. De la Harpe and E. Bodmer, Basel. Assignors to The Firm of Dyeworks, formerly L. Durand, Huguenin & Co., Basel, Switzerland. U.S. Pat. 1,003,257, Sept. 12, 1911.

VIOLET mordant dyestuffs are obtained by condensing an alkylamino-*m*-hydroxybenzoylbenzoic acid with a pyrogallolsulphonic acid, and red dyestuffs having similar properties are prepared by condensing a dialkylamino-*m*-hydroxybenzoylbenzoic acid with the same sulphonic acid. —J. C. C.

Monoazo dye for wool. H. Polikier, Leipzig. Assignor to Act.-Ges. f. Anilinfabr., Berlin, Germany. U.S. Pat. 1,003,293, Sept. 12, 1911.

A MONOAZO dyestuff dyeing wool in yellow shades from an acid bath is obtained by combining diazotised 2 : 5-dichloroaniline with ethylbenzylanilinesulphonic acid. —J. C. C.

Monoazo dyestuffs for wool; Production of new ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 429,529, May 9, 1911. Under Int. Conv., June 15, 1910.

4-NITRODIAZOBENZENE-2-sulphonic acid is combined with a 1 : 3-diaminobenzene-5-sulphonic acid substituted in the 2 position by groups such as CH_3, OCH_3, OC_2H_5, Cl, SO_3H. When 2 : 6-diaminotoluene-4-sulphonic acid is used, the resulting dyestuff dyes wool from an acid bath in brownish red shades.—J. C. C.

Vat dyestuffs of the anthraquinone series and process of making them. Act.-Ges. f. Anilinfabr. Fr. Pat. 428,819, April 22, 1911. Under Int. Conv., May 12 and Aug. 11, 1910.

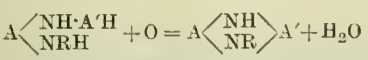
SEE Eng. Pat. 404 of 1911; this J., 1911, 351. These dyestuffs are also obtained by condensing bromo derivatives of anthraquinonylanthranilic acids, containing the bromine in the benzene nucleus, with an aminoanthraquinone or a derivative thereof, and treating the product with a dehydrating or condensing agent capable of forming an acridone ring.—T. F. B.

Dyestuffs of the diphenylnaphthylmethane series; Chrome ——. Farbenfabr. vorm. F. Bayer und Co. Second Addition, dated March 18, 1911 (under Int. Conv., March 29, 1910, and Feb. 11, 1911) to Fr. Pat. 404,800, July 6, 1909 (this J., 1910, 207).

DIHALOGENATED *m*-hydroxybenzaldehydes or their sulphonic acids are condensed with hydroxycarboxylic acids and the leuco compounds thus produced are oxidised to the dyestuffs. Example: A mixture of 17·5 kilos. of dichloro-*m*-hydroxybenzaldehyde, 32 kilos. of ortho-cresotic acid and 450 kilos. of sulphuric acid is heated at 20°—35° C. for several hours until the cresotic acid has disappeared. The leuco compound is filtered off and oxidised with sodium nitrite at 30°—35° C. The dyestuff gives orange red shades on wool which, on chroming, become blue.—J. C. C.

Vat dyestuffs of the anthracene series; Preparation of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 428,996, April 27, 1911. Under Int. Conv., Sept. 12, 1910.

o-AMINODIANTHRAQUINONYLAMINES, prepared by condensing aminoanthraquinones with halogenated *o*-aminoanthraquinones, are converted into vat dyestuffs when treated with oxidising agents. The reaction is represented by the following equation :—

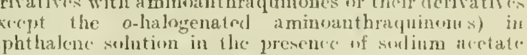


$$A\left\langle\begin{matrix}NH\cdot A'H\\ NRH\end{matrix}\right. + O = A\left\langle\begin{matrix}NH\\ NR\end{matrix}\right\rangle A' + H_2O$$

where A and A^1 are anthraquinone residues, the latter having a free ortho position with respect to the NH group, and R is hydrogen or an acyl, alkyl or aryl group. Indanthrene is produced from *o*-amino-*αβ*-dianthrimide by heating it with phenol and potassium hydroxide, or by treating it at the ordinary temperature with fuming sulphuric acid with or without the addition of manganese dioxide. *o*-Methylamino-*αβ*-dianthrimide when heated in nitrobenzene solution with sodium acetate yields methylindanthrene and hydroxy-*o*-methylamino-*αβ*-dianthrimide (prepared by condensing 1-methylamino-2-bromoanthraquinone with 1 : 4-hydroxyaminoanthraquinone) similarly furnishes hydroxymethylindanthrene which gives with alkaline hydrosulphite a brownish yellow vat dyeing cotton in greenish blue shades.—J. C. C.

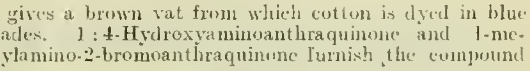
Anthraquinone derivatives [dyestuffs] containing nitrogen; Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 429,096, April 28, 1911. Under Int. Conv., Aug. 2, 1910.

o-AMINODIANTHRAQUINONYLAMINES are prepared by condensing *o*-halogenated aminoanthraquinones or their derivatives with aminoanthraquinones or their derivatives (except the *o*-halogenated aminoanthraquinones) in naphthalene solution in the presence of sodium acetate and copper. 1 : 4-Hydroxyaminoanthraquinone and 1-amino-2-bromoanthraquinone give a product of the formula



$$C_6H_4\left\langle\begin{matrix}CO\\ CO\end{matrix}\right\rangle C_6H_2(NH_2)\cdot NH\cdot C_6H_2(OH)\left\langle\begin{matrix}CO\\ CO\end{matrix}\right\rangle C_6H_4$$

It gives a brown vat from which cotton is dyed in blue shades. 1 : 4-Hydroxyaminoanthraquinone and 1-methylamino-2-bromoanthraquinone furnish the compound



$$C_6H_4\left\langle\begin{matrix}CO\\ CO\end{matrix}\right\rangle C_6H_2(NH\cdot CH_3)\cdot NH\cdot C_5H_2(OH)\left\langle\begin{matrix}CO\\ CO\end{matrix}\right\rangle C_6H_4$$

which dyes cotton from the vat in blue tints. The product of condensation of 2-amino-1 : 3-dibromoanthraquinone with 1 : 4-hydroxyaminoanthraquinone gives grey to olive green shades.—J. C. C.

Vat dyestuffs of the anthraquinone series containing sulphur; Production of ——. F. Ullmann. Fr. Pat. 429,584, May 10, 1911. Under Int. Conv., June 30, 1910.

HALOGEN derivatives of anthraquinonyl-thiosalicylic acids are heated to a high temperature with or without a solvent or diluent. Example 1: By heating anthraquinonyl-*α*-thiosalicylic acid in nitrobenzene solution together with phosphorus pentachloride, anthraquinonyl-1 : 2-thioxanthone, m. pt. 335° C., is obtained. This dyes cotton from the vat in clear orange shades. Example 2: Anthraquinonyl-*β*-thiosalicylic acid is heated with *p*-toluene-sulphonic acid and anthraquinonyl-2 : 1-thioxanthone, m. pt. 272° C. is produced. Example 3: Anthraquinonyl-1 : 5-dithiosalicylic acid when heated with nitrobenzene and phosphorus pentachloride (or with *p*-toluenesulphonyl chloride) furnishes anthraquinonyl-1 : 2 : 5 : 6-dithioxanthone which gives a blue vat dyeing cotton in blue shades.—J. C. C.

Indophenolic compounds; Manufacture of —— and of dyestuffs therefrom. R. B. Ransford, London. From L. Cassella und Co., Frankfort on Maine, Germany. Eng. Pat. 22,138, Sept. 23, 1910.

SEE Fr. Pat. 427,900 of 1910; this J., 1911, 1153.—T. F. B.

Colouring matters of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 24,883, Oct. 26, 1910.

SEE Fr. Pat. 428,338 of 1911; this J., 1911, 1153.—T. F. B.

Dianthraquinonyl-dialdehydes and process of making them. M. H. Isler, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,004,433, Sept. 26, 1911.

SEE Eng. Pat. 24,486 of 1910; this J., 1911, 1047.—T. F. B.

Anthracene compounds; Production of ——. Badische Anilin und Soda Fabrik. Fourth Addition, dated April 10, 1911 (under Int. Conv., Sept. 12 and 16 and Nov. 9, 1910), to Fr. Pat. 357,239, Aug. 25, 1905.

SEE Eng. Pat. 24,486 of 1910; this J., 1911, 1047.—T. F. B.

Diazotisable dyestuffs; Process for the production of green ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 428,877, April 24, 1911. Under Int. Conv., May 3, 1910.

See Eng. Pat. 25.292 of 1910; this J., 1911. 276.—T. F. B.

Disazo dyestuffs; Process for the production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 429,774. May 16, 1911. Under Int. Conv., June 15, 1910.

See Eng. Pat. 7422 of 1911; this J., 1911, 1109.—T. F. B.

Monoazo dyestuff especially suitable for preparing violet lakes; Manufacture of a ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 429,475. May 6, 1911. Under Int. Conv., Dec. 2, 1910.

See Eng. Pat. 12,009 of 1911: this J., 1911, 1006.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Silks; Studies on the composition of different varieties of ——. *XIII.* E. Abderhalden. Z. physiol. Chem., 1911, **74**, 427—428.

The author has examined the products of total hydrolysis of a specimen of anaph-silk. This yielded a relatively large proportion of tyrosine, together with considerable quantities of glycocoll and alanine; aspartic and glutamic acids were also identified, and traces of leucine and proline. This variety of silk possesses the same or a very similar composition to that of the other varieties of silk hitherto examined. Other silks have also been submitted to a preliminary examination, including *Bombyx mori* silks and Tussah silks of African origin; these gave results similar to those previously obtained from the respective types of ordinary origin. It would appear that all silks, derived from caterpillars, spiders and from *Pinna nobilis*, possess a certain similarity of composition. Tyrosine, alanine and glycocoll always preponderate, whilst the other constituent residues are very small in quantity. This similarity holds good for the most diverse species, although identity of composition does not exist.—J. F. B.

Textile fibres and artificial silks; Differentiation of —— *by means of "ruthenium red."* F. J. G. Beltzer. Monit. Scient., 1911, **1**, 633—641.

"Ruthenium red." $Ru_2(OH)_2Cl_4(NH_3)_7 + 3H_2O$, is soluble in water but insoluble in glycerin and alcohol; it is decolourised by mineral acids, but the colour is restored by alkalis; dilute organic acids are without effect. The solution is reduced by exposure to light, with formation of a dark precipitate of ruthenium sesquioxide. Ruthenium red is a useful microchemical stain, its insolubility in glycerin and in alcohol being of importance in preserving the stained objects. A solution of 0·01 grm. in 10 c.c. of water is employed. The object is mounted in a drop of the solution, and the degree of staining is observed immediately and again after 12 hours. Ruthenium red does not stain pure normal cellulose, but it stains oxycellulose, pectins, gums and mucilages. It does not stain the cuticles of leaves and stems, but it stains the cuticular membranes of certain pollen grains and of cotton fibres. Lignified tissues, fresh or preserved in alcohol, are not stained, but after treatment with alkalis or with sodium hypochlorite, they are stained a bright pink. Nitrogenous matters are stained irregularly; the chromatin of the nucleus is stained first, later the leucites and finally the protoplasm. Raw cotton is stained a faint pink, owing to the presence of the cuticle, etc. Raw flax, ramie, hemp, and jute are strongly, but irregularly, stained owing to the pectic substances. Wood cellulose and raw wood fibres are stained irregularly, bleached jute strongly, raw kapok fibres practically not at all. In testing chemically treated fibres all traces of acidity must be removed by washing with alkaline water. Wool is not stained, whilst silk is stained only slightly after 12 hours' contact. Ruthenium red may be employed for the identification of the various types of artificial silk. Denitrated collodion silk is stained a strong red and the pseudo-central canal becomes more readily perceptible. Cuprammonium silk prepared from cotton is scarcely stained, whilst viscose silk prepared from wood cellulose is coloured a strong pink. Ruthenium red affords a ready means for differentiating cuprammonium silk from viscose silk; methylene blue also dyes viscose silk more strongly than cuprammonium silk. Viscose silk exists commercially in two types: the Stearn silk, coagulated by ammonium sulphate, which is nearly cylindrical (without striations) and closely resembles in structure the cuprammonium silks; and the Müller silk, coagulated by sodium bisulphate, which is irregular in section, strongly striated, and possesses a pseudo-central canal, this peculiarity being due to the violent coagulating action of the free mineral acid. All the artificial silks are susceptible to a water-proofing process by treatment with formaldehyde; such "sthenosised" silks are characterised by their total resistance to ruthenium red, their resistance to sodium hydroxide of 25° Bé., and their powerful reducing action on permanganate. Cellulose-ester silks, *e.g.*, nitrated collodion silk and cellulose acetate silk are easily recognised by their chemical reactions; the former resists ruthenium red, the latter is slightly and irregularly stained. —J. F. B.

Sulphite-cellulose works; Contamination of water-supplies by waste lyes from ——. B. Reinitzer. Z. angew. Chem., 1911, **24**, 1851.

It is stated that by mixing together the waste digestion liquors and the residues from the bleaching process, both waste products are rendered innocuous to fish and can be safely discharged into a water-course. The method is said to have worked satisfactorily in practice for a long time.—A. S.

Parchment papers; Testing of imitation —— *for resistance to grease.* G. Schacht. Wochenbl. Papierfab., 1911, **42**, 3632—3634.

For testing "grease-proof" pergamyn or imitation parchment papers, two methods are in use: (1) the paper is required to show blisters when held just above the flame of a burning match; (2), when a little oil of turpentine is rubbed on the surface of the paper it should not penetrate sufficiently to leave a greasy mark on a sheet of white paper spread underneath. A certain amount of controversy has arisen between the advocates of these two methods, each suggesting that the other test is not quite reliable. There appears, however, to be little doubt that certain of these greaseproof papers fail to blister when heated, and yet are perfectly resistant to grease in ordinary use. Whether papers exist, which show blisters but are not completely greaseproof, is not so certain, but in any case the author considers that the turpentine test should be adopted and the blister test should be discarded. The blister test, if confirmed by the turpentine test, may be useful in the paper machine room as a rapid approximate test for the guidance of the machine foreman, who can if necessary make the adjustments which will increase the blistering properties of the paper when these are deficient. But the turpentine test is the ultimate test for grease resistance and logically should form the only basis on which this quality is judged.—J.F.B.

Incandescence mantles made from artificial silk. Nass. *See* IIb.

Patents.

Flax, hemp and the like; Process for steeping or retting ——. E. J. Feuillette, Boulogne, France. Eng. Pat. 4409, Feb. 21, 1911. Under Int. Conv., Feb. 25, 1910.

Flax, hemp, or other stems are packed in cages or "balloons," arranged in series, and are retted by a constant supply of water running at a constant speed and at a constant temperature. The balloons are arranged in a tank with a bottom sloping towards the middle, they can be raised or lowered in grooves cut in the sides of the tank and each one is separated from the others by vertical partitions which cause the water to circulate in a regular manner through the balloons. The circulation of the water is regulated at a speed of about 200 litres per 24 hours for 100 kilos. of material; it escapes automatically, and means are provided for reserving a supply of culture-water when the tank is emptied. Heavy matters, earth and slime, gravitate into a channel at the bottom, in which is an Archimedean screw which discharges them continuously. The gases produced are removed by a fan exhausting from the top of the vat. The balloons are shifted by means of a travelling crane, by which they may be reversed or their positions in the tank changed, in order to make the treatment perfectly uniform. The temperature of the steeping water is regulated by steam pipes.—J. F. B.

Floss and waste silk; Process for the destruction of hairs and other extraneous matter in ——. C. Seignol. Third Addition, dated July 9, 1910, to Fr. Pat. 416,063, July 28, 1909.

(1) The solutions of alkali sulphides used in the process described in the previous patents (this J., 1909, 1371 and 1911, 79 and 888) decompose on standing with the formation of the thiosulphate, carbonate, sulphate and hydroxide of sodium. Such solutions may be recuperated by saturating them with hydrogen sulphide. (2) An addition of oil, soap or sodium carbonate to the treating solution is occasionally beneficial, especially if the silk is dirty. (3) Instead of an alkali sulphide, a solution of the sulphide of an alkaline earth metal may be used.—P. F. C.

Artificial cotton; Process of preparing ——. J. Bourbon and P. Cassier. Fr. Pat. 429,679, May 13, 1911.

A viscous preparation of cellulose is poured into a rotating centrifugal apparatus of the same type as is used for obtaining sugar in the form of fine threads ("*sucre filé*"). This apparatus throws the cellulose out of the cage and into the surrounding vessel, where it collects in the form of a very fine loose cotton which can be spun in the ordinary way.—P. F. C.

Paper; Process of manufacturing [fibres resembling] ——. Knowlton Bros. Inc. Fr. Pat. 429,256, May 4, 1911.

Paper with a fancy surface is made on an endless wire machine by projecting jets of water, from a spray pipe above, on to the semi-formed pulp at a convenient part of the wire. The spray pipe receives an oscillating motion so that the "craters" of pulp produced by the impact of the water have an irregular form and distribution. The water may contain a dyestuff in solution. The web of pulp so formed may be pressed whilst moist in contact with a moist web of ordinary paper produced on a cylinder machine situated below, so that the ordinary paper (which may be coloured) serves as a backing or support to the web with fancy surface.—J. F. B.

Wall-paper; Manufacture of decorated —— in a single operation. H. Bürmann. Fr. Pat. 429,446, May 6. 1911.

Decorated wall-paper is manufactured in a single operation by printing first the design in an oil-colour pigment and then the background, whilst the oil-colour is still moist, in a pigment mixed with an aqueous medium, such as glue. The latter is applied by means of a plain roller extending across the whole width of the paper. The oil-colour design acts as a "resist" to the water-colour pigment.—J. F. B.

Peat; Manufacture of moulded or compressed articles from ——. R. Pearson and H. S. Stoneham, London. Eng. Pats. 1046, Jan. 14, and 3130, Feb. 7, 1911.

Wet peat is placed in a digester and heated by the introduction of steam at 50 lb. per sq. in., for 15 minutes or longer. The peat is now separated in a filter-press, the liquid being used again in the digester. The peat-cake is then dried in steam-heated pans, and ground to powder, and any fibrous portions are separated by screening. The powdered peat is mixed with one-third of its weight of powdered glue, and warmed and moistened by means of steam. The moist mass is then moulded in the desired form under a pressure depending on the density and hardness required. Pliable articles are made by adding glycerin before moulding. Finally, the articles are exposed to formaldehyde vapour in order to render the glue insoluble. The articles which may be made include boards or slabs, buttons, door-knobs, finger-plates, candlesticks, screws, etc. By using glycerin a material resembling leather can be obtained.—A. T. L.

Fibrous material; Treatment of —— and apparatus therefor. T. J. Hutchinson, Bury. U.S. Pat. 1,003,606, Sept. 19, 1911.

See Eng. Pat. 23,655 of 1908; this J., 1909, 208.—T. F. B.

Paper-pulp; Process for making ——. B. F. A. Saylor, Rome, Ga. U.S. Pat. 1,004,473, Sept. 26, 1911.

See Fr. Pat. 428,678 of 1911; this J., 1911, 1156.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Silk; A new method of dyeing ——. L. Paul. Z. angew. Chem. 1911, 24, 1857—1861.

When silk is treated with a solution of a diazo- or tetrazo-compound, the latter is absorbed and cannot be removed by washing. Corresponding azo dyestuffs are formed when the silk, treated in this manner, is brought into contact with components such as the naphthylamines or phenols and dyeings obtained thus are very fast to light and washing. The discovery of the process arose as a consequence of the isolation of new dyestuffs obtained from resorcinol by the action of sulphuric acid on it and observation of their action on silk. When resorcinol is treated with an amount of sulphuric acid insufficient for complete sulphonation, *i.e.*, so that a mixture of resorcinol and its sulphonic acid is produced, two dyestuffs are formed, namely, "Ri" which is a red powder and "FL" which is a strongly green fluorescent substance and dyes cotton in yellower shades than "Ri." These compounds readily combine with diazo- or tetrazo-compounds and, especially when previously dyed on silk, give, on development with tetrazodiphenyl, brown to bluish brown shades. β-Naphtholdisulphonic acid also condenses with resorcinol at 150° C. and forms a phenolic substance combining the properties of both resorcinol and β-naphthol. This compound, in common with many other phenols, is absorbed by the silk fibre and the silk thus treated forms various colours with different diazo compounds.—J. C. C.

Patents.

Vegetable fibres and yarns for carpets and similar fabrics; Dry process for degreasing —— before or after dyeing. Duquesne et Cie. Fr. Pat. 428,938, April 25. 1911.

Vegetable fibres, jute, flax, cotton, ramie, etc., either loose, combed or spun, are treated before or after dyeing with benzene or petroleum spirit in order to remove fats, waxes and resins. This treatment improves the material, rendering it not liable to attract dust, and fixing and brightening the colours.—J. F. B.

Kiers or vessels for use in subjecting textile materials to boiling, bleaching and like processes. J. Schmidlin and D. Speirs, Bolton. Eng. Pat. 8097, March 31, 1911.

This invention relates to open or closed kiers divided into two parts by a false bottom on which the material to be treated is arranged, the liquor being circulated through the material by delivering it into the space below the false bottom, then forcing it up a central passage (which extends almost the whole length of the kier) and allowing it to fall on to the material and descend through it to the lower part of the kier. In order to heat the liquor, a long closed steam coil is fitted inside the central passage and the steam is led into it at the upper end so as to make it travel through the coil in a direction opposite to the flow of the liquor up the passage.—P. F. C.

Vats for the treatment of textiles in the form of threads, cords, hanks and fabrics. F. Jaumandreu, Barcelona, Spain. Eng. Pat. 8424, Apr. 4, 1911.

In order to prevent the textile material from becoming stained by the scum which collects on the surface of the treating liquor, a shoot is arranged vertically at the exit end of the vat with its lower and wider end dipping so deeply into the liquor that the material may be withdrawn from the vat through the shoot without coming into contact with any surface impurities. One or two of the walls of the shoot are fitted with springs which press two opposite walls together and thus squeeze out some of the excess of liquor contained in the material as it passes up the shoot.—P.F.C.

Dyeing with mordant dyestuffs ; Process of ——. Comp. Parisienne de Couleurs d'Aniline. Fr. Pat. 428,894, July 1, 1910.

By adding bran to the dyebath, artificial alizarin can be made to dye shades on mordanted wool which are as fast to rubbing as those obtained with garancin.—P. F. C.

Carbazole dyestuffs and their use for printing purposes ; Manufacture of bisulphite compounds of ——. R. B. Ransford, London. From L. Cassella und Co., Frankfort on Maine, Germany. Eng. Pat. 489, Jan. 7, 1911.

The dyestuffs described in Eng. Pats. 2918, 9689 and 18,822 of 1909 (this J., 1909, 517 ; 1910, 481, 1100) and analogous derivatives of indophenols which are obtained from carbazole and its derivatives, alkylated or arylated to the nitrogen atom, or their substitution products, yield bisulphite compounds which are perfectly stable in neutral solutions. These compounds are well suited for printing and give shades of excellent fastness to washing, light and chlorine. Example : 100 kilos. of the dyestuff prepared as described in Eng. Pat. 9689 of 1909 (this J., 1909, 517) are suspended in 400 litres of water ; 300 kilos. of sodium bisulphite solution (35° B.) are then added and the whole is stirred for 6—12 hours. When the reaction is complete the mixture is filtered and the product is washed. The bisulphite compounds are insoluble and are best used in paste form. The addition of a reducing agent is unnecessary, the usual mordants such as chromium acetate being sufficient for fixing the colour with a short steaming. P. F. C.

Reserving unprepared silk in the hank form : Process of ——. J. Besson. Fr. Pat. 429,004, July 4, 1910.

The hanks are scoured in the cold, washed, then passed through a solution of sodium hydroxide and washed again. They are next treated with a solution of tannic acid, rinsed, then worked in a solution of tartar emetic and finally brightened or otherwise finished.—P. F. C.

Fabrics impermeable to gases ; Process for rendering ——. N. Hornstein. Fr. Pat. 429,166, July 9, 1910.

The surface of the fabric is treated with a solution of agar-agar in about 24 times its weight of water. The agar-agar is heated at 100° C. with the water for 3 or 4 hours, and the gelatinous mass is spread on the cloth whilst still very hot. After two or three coatings have thus been applied and dried, the coated surface of the cloth is treated with jets of steam which cause the agar-agar to penetrate more deeply into the fabric and make the surface of the coating perfectly uniform.—J. F. B.

Fabrics ; Process and apparatus for degreasing, boiling, washing, or otherwise treating ——. A. E. Roberts and J. B. Turner. Fr. Pat. 428,952, April 26, 1911. Under Int. Conv., May 2, 1910.

See Eng. Pat. 10,792 of 1910 ; this J., 1911, 679.—T.F.B.

Dyeing vegetable fibre ; Process of ——. G. C. Dörr, Frankfort on Maine, Germany. Eng. Pat. 7057, March 21, 1911. Under Int. Conv., April 1, 1910.

See Fr. Pat. 427,756 of 1911 ; this J., 1911, 1052.—T. F. B.

Dyeing hairs and furs : Process and compositions for ——. Act.-Ges. f. Anilinfabr. First Addition, dated July 5, 1910, to Fr. Pat. 413,877, March 21, 1910.

See Eng. Pat. 18,921 and Ger. Pat. 230,630 of 1910 ; this J., 1910, 1301 ; 1911, 355.—T. F. B.

Artificially producing daylight for colour-matching purposes. Eng. Pat. 4401. *See* IIb.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

"*Blue acid.*" J. Buraczewski and S. Zbijewski. Oesterr. Chem.-Zeit., 1911, **14**, 235—236.

The blue solution obtained by passing sulphur dioxide into a solution of nitrosylsulphuric acid in concentrated sulphuric acid (66° B.) is found to be decolourised by prolonged treatment with the gas (2—3 days), giving a solution which remains colourless when a current of pure dry carbon dioxide is passed through the liquid until it ceases to smell of sulphur dioxide, but which rapidly acquires a blue colour on subsequent exposure to air. The blue colour is also slowly restored (after some days) by allowing the solution to stand in a closed flask, in which case the odour of sulphur dioxide also returns. The authors conclude from these experiments that the blue acid is itself reduced by sulphur dioxide (compare Wentzki, this J., 1910, 1247 ; 1911, 418), the product being immediately oxidised by exposure to air and more slowly by sulphuric acid which is reduced to sulphur dioxide. By starting with solid nitrosylsulphuric acid, the reduction product has been obtained as a solid. Wentzki's formula for the blue acid (*loc. cit.*) is considered more in accordance with the facts than that of Raschig (this J., 1905, 923), and the reduction product is regarded, therefore, as hyponitrosylous sulphuric acid.
—F. Sodn.

Nitrogen hexoxide, NO_3. F. Raschig. Chem.-Zeit., 1911, **35**, 1096.

In 1907 (this J., 1907, 686), the author showed that when nitric oxide is oxidised by air or oxygen, the first products of the reaction are iso-nitrogen tetroxide, N_2O_4, and nitrogen hexoxide, NO_3, respectively ; these oxides yield almost exclusively nitrous acid (and oxygen) when dissolved in sulphuric acid or alkali. On further oxidation they are converted into iso-nitrogen pentoxide, N_2O_5, and nitrogen heptoxide, N_2O_7, respectively, which yield a mixture of nitrous and nitric acids (and oxygen) when dissolved in sulphuric acid or alkali. In confirmation of his earlier statements, the author now describes the formation of nitrogen hexoxide, NO_3, by passing dry nitric oxide gas into liquid oxygen or liquid air, contained in a Dewar vacuum vessel : greenish flocks of the new oxide first separate and finally a thick green paste is obtained, which the gas bubbles are unable to penetrate. Nitrogen hexoxide is very unstable, decomposing at temperatures little above the boiling point of oxygen, with production of deep blue liquid nitrogen trioxide, permeated by colourless crystals of nitrogen tetroxide (probably formed from the trioxide by a secondary reaction). The composition of the new oxide was determined by measuring the oxygen evolved during its decomposition, then dissolving the residue in concentrated sulphuric acid and determining the nitrogen content and degree of oxidation of the compounds formed (*loc. cit.*)—A. S.

Perborates ; Preparation of ——. F. H. Fuhrmann. Chem.-Zeit., 1911, **35**, 1022—1023, 1038—1039.

Sodium perborate is best manufactured by mixing the necessary materials (borax and hydrogen peroxide, etc.)

in small batches, which are then united and slowly cooled, with stirring, the concentration being so chosen that, after mixing, tho liquor is at about 25° C. and crystallisation of the perborate begins only after some time ; crystals are thus obtained which are comparatively large and stable. The introduction of catalytic metallic compounds into the liquor is avoided by employing wooden vats and stirrers, and all metal taps, pipes, etc., are well tinned. The product is best separated from the mother liquor centrifugally, and drying is effected by passing the material through an apparatus in which it meets a current of air, which may safely be heated to 50° C.—F. Sodn.

Autocatalysis and negative catalysis ; A case of simultaneous ——. [*Reaction between formic acid and nitrates.*] A. Quartaroli. Gaz. chim. ital., 1911, **41**, II., 64—69.

The reaction between formic acid and nitrates, resulting in the evolution of nitrous oxide and carbon dioxide (this J., 1911, 926), proceeds in two phases : first, production of nitrous anhydride, and then reduction of the latter to nitrous oxide. The reaction begins very slowly ; then the reaction-velocity increases rapidly to a maximum and afterwards again decreases. The reaction between nitrous anhydride and formic acid only becomes evident at about 40° C. ; if a mixture of a nitrate and formic acid be kept at 20° C., the solution becomes blue, owing to accumulation of nitrous anhydride, and the latter decomposes in the known manner into nitric oxide and nitrogen peroxide, instead of being reduced to nitrous oxide. The reaction between nitrates and formic acid appears to be a case of autocatalysis, the nitrous anhydride formed at first acting as a positive catalyser. Substances, such as chloric acid, hydrogen peroxide, potassium permanganate, and urea, which are capable of decomposing nitrous acid, retard the reaction, acting as negative catalysers.—A. S.

Magnesium and calcium chlorides ; Binary systems of —— *with the chlorides of potassium, sodium, silver, lead, copper (cuprous), zinc, tin (stannous), and cadmium.* O. Menge. Z. anorg. Chem., 1911, **72**, 162—218.

The author has made thermal analyses of the binary systems formed by magnesium and calcium chlorides with each other and separately with the various chlorides mentioned in the title. The results are represented graphically for each system and may be summarised as follows. Magnesium and calcium chlorides form no double salts with each other and neither of them forms any double salt with the chlorides of the heavy metals. The diagrams are similar for systems containing magnesium chloride on the one hand and calcium chloride on the other together with the chloride of a heavy metal. In the case of the alkalis, however, compounds are formed, and a difference is evident between the magnesium chloride and the calcium chloride. With potassium chloride magnesium chloride forms the double salts, $KCl,MgCl_2$ and $2KCl,MgCl_2$. With sodium chloride it forms $NaCl,MgCl_2$, and a second compound whose molecular composition cannot be stated with certainty, but which contains between 62·1 and 84·5 molecules per cent. of sodium chloride. Calcium chloride forms only one compound with potassium chloride, namely $KCl,CaCl_2$, while with sodium chloride the only compound is probably $CaCl_2,4NaCl$.—W. H. P.

Silicate melts ; Equilibrium in ——. C. Doelter. Z. Elektrochem., 1911, **17**, 795—799. (See also this J., 1906, 537 and 1908, 900 and 940.)

The author emphasises the necessity of remembering the great viscosity and small velocities of fusion and crystallisation in many silicate melts, as arguments against the direct application of the phase rule in studying their properties. The extreme slowness with which equilibrium is attained is illustrated by the difficulty of determining melting points and solidifying points. The thermal method is unsatisfactory owing to the slowness and smallness of the heat changes involved in fusion or solidification. More exact determinations are possible by optical methods, but it is essential to have an extremely fine powder and to change the temperature very slowly indeed, in order to obtain even approximate results. The velocity of fusion and that of crystallisation are both dependent on the viscosity, and the author divides silicates into three classes :—(1) Silicates with sharply defined melting points and comparatively high velocities of fusion and crystallisation. This group includes the silicates of lithium, sodium, lead, iron, zinc, and manganese. (2) Silicates with smaller velocity of fusion, and moderate rapidity of crystallisation such as anorthite, diopside, and calcium metasilicate. (3) Silicates whose fusion and crystallisation velocities are nearly nil, such as albite and orthoclase. It is clear that melting points of silicates of the second and third classes cannot be determined with great accuracy, and that overheating may give high results. The author by optical determinations obtains results about 150° C. lower than those of Day and his colleagues (see this J., 1910, 282), *e.g.*, labradorite about 1300° C. instead of 1463° C., anorthite 1370° C. instead of 1532° C., and calcium metasilicate 1380° C. instead of 1512° C. Since the determination of eutectic and other fixed points is attended by the same difficulties as the determination of melting points, it is clear that silicate melts cannot be treated like alloys from the point of view of the phase rule, without arriving at erroneous conclusions.—W. H. P.

Silicates ; Hydrothermal ——. E. Baur. Z. anorg. Chem., 1911, **72**, 119—161.

Hydrothermal silicates are those which are formed in the presence of water at high temperatures. With a view to determining the conditions of their formation, the author has submitted various mixtures of soluble or amorphous substances to temperatures of 350° and 450° C. for 20—24 hours in a sealed steel bomb heated in an electric tube furnace. The mixtures were made from two or more of the following substances :—hydrated silica and alumina, the aluminates of sodium, potassium and calcium, sodium and potassium silicates (water-glass), sodium-calcium and potassium-calcium silicate glasses, and cement. After heating, the bomb was quickly cooled, and the crystals found submitted to optical examination for identification. The mineral products obtained were quartz, opal, orthoclase, albite, oligoclase, analcite $(2SiO_2,AlO_2Na,aq.)$ andalusite (SiO_2,Al_2O_3) pyrophyllite $(2SiO_2.Al_2O_3.H_2O,)$ muscovite, desmin $(6SiO_2.Al_2O_3.Ca[Na_2]O,aq)$, gyrolite $(1{\cdot}5SiO_2,CaO,aq)$, sodium pectolite $(SiO_2.Ca[NaH]O)$, and potassium pectolite $(SiO_2.Ca[KH]O)$. There were also found crystals of a mineralogically unknown potassium fanjasite $(2{\cdot}5SiO_2{\cdot}AlO_2K,aq)$ analogous to the zeolite faujasite in which the alkali is soda or lime. Another product known as potassium nephelite hydrate (SiO_2,AlO_2K,aq) analogous to the mineral nephelite (which contains soda), although unknown mineralogically, has been previously obtained synthetically. The results are collected in tables and for the systems, soda-alumina-silica and potash-alumina-silica are expressed in triangular diagrams which show the region of stability of the various minerals. Calcium aluminium silicates were not formed in any quantity and probably require different conditions (*e.g.*, higher temperatures) for their formation.—W. H. P.

Lead silicates. P. Weiller. Chem.-Zeit., 1911, **35**, 1063—1065.

Thermal analysis of fusions of mixtures, in varying proportions, of lead oxide and silica, together with determinations of the specific gravity, refractive index, and temperature of reduction of the melts, resulted in the metasilicate $(PbO.SiO_2)$ being found to be the only well defined compound formed, though a more acid compound $(PbO.2SiO_2)$ was probably also formed. The existence of the orthosilicate or of a more basic compound could not be established. (Compare this J., 1909, 1124 ; 1910, 22.) —A. Seld.

Ferrous oxide in silicate rocks ; Determination of ——. M. Dittrich. Chem.-Zeit., 1911, **35**, 1093. (See also this J., 1910, 1054 ; 1911, 694.)

In the volumetric determination of ferrous oxide in silicate rocks, after the latter have been dissolved by heating with hydrofluoric and sulphuric acids, it is frequently difficult to determine the final point in the titration with permanganate, and this has been attributed hitherto to the presence of manganese. Experiments have shown, however, that manganese and hydrofluoric acid have little influence on the permanganate titration, and that the uncertainty of the final point is due to the presence of titanium in the titanous condition, which interacts with the ferric iron. This interaction can be retarded, and the end-point thus rendered sharper, by adding powdered silica and potassium sulphate to the solution before titration with permanganate.—A. S.

Nickel peroxide, particularly its behaviour in salt formation. C. Tubandt and W. Reidel. Z. anorg. Chem., 1911, **72**, 219—232.

The authors suggest that nickel dioxide or peroxide (NiO_2) is the only true higher oxide of nickel, and that Ni_2O_3 and other higher oxides are to be regarded as compounds of the dioxide, NiO_2, with the monoxide, NiO. They also hold that all experiments on the oxidation of nickelous salts which have been assumed to result in the formation of solutions containing salts of trivalent nickel, probably only produce colloidal solutions of the peroxide. With concentrated phosphoric acid nickel peroxide gives a green solution, which has a strong oxidising action even after separating the nickel (the nickel was separated by precipitation with a slight excess of potassium hydroxide solution and the filtrate acidified). The reactions indicate that the nickel peroxide has oxidised the phosphoric acid to monoperphosphoric acid (analogous to Caro's acid; see Schmidlin and Massini, Ber., 1910, **43**, 1162). With strong acids nickel peroxide forms no colloidal solutions, and if carefully purified substances are obtained no red colour is observed on treating the peroxide with potassium hydrogen sulphate solution. The authors believe that Benedict (J. Amer. Chem. Soc., 1906, **28**, 171) who held that a nickelic salt was produced under these circumstances, was using a specimen of nickel peroxide which was not free from manganese. Small quantities of manganese can readily be detected by oxidation to permanganate with sulphuric acid and nickel peroxide. With larger quantities of manganese the easily recognised manganic sulphate is formed. Although no nickelic salt is formed from nickel peroxide and potassium hydrogen sulphate (or sulphuric acid) an oxidising solution is produced, which is shown to contain Caro's acid. The oxidation of nickelous salts can also be effected electrolytically under suitable conditions, either by electrolysis of solutions containing potassium bicarbonate and a nickel salt, or by the anodic polarization of a nickel electrode in concentrated potassium bicarbonate solution. In either case the product is probably colloidal nickel peroxide. In the electrolysis of the alkaline double cyanide of nickel and potassium a red colour is formed at the cathode. The solution is however strongly reducing and probably contains the suboxide (Ni_3O).—W. H. P.

Cuprous iodide; Simplified method of analysis of ——. H. Bardt. Z. anal. Chem., 1911, **50**, 695—696.

About 5 grms. of substance are repeatedly treated by decantation with small quantities of dilute ammonia until the filtered liquid appears colourless. The residue is then washed until the washings are free from copper, and, from an aliquot part of the ammoniacal solution, after adding 5 grms. of tartaric acid and sufficient ammonia to introduce an excess of about 1—1·5 per cent., the copper is separated electrolytically; the metal is then redissolved from the washed cathode by means of acid, since there is a tendency to form a spongy deposit, and is again separated by electrolysis. Any copper remaining in the residue insoluble in ammonia is dissolved in nitric acid and deposited electrolytically. The iodine is determined by adding 20 c.c. of chloroform to the ammoniacal solution from which the copper has been deposited, acidifying the solution with dilute hydrochloric acid, shaking meanwhile, and then adding a considerable excess of hydrochloric acid and titrating with $N/10$ thiosulphate solution. —F. Sodn.

Vanadium pentoxide; Action of calcium fluoride on ——. W. Prandtl and H. Manz. Ber., 1911, **44**, 2582—2585.

When vanadium pentoxide is heated with calcium fluoride in a platinum crucible, a portion of the vanadium is volatilised as a fluoride or oxyfluoride. Ordinary processes of condensation, however, cause the deposition of only vanadium pentoxide. If the mixture is heated in a platinum tube, in a current of nitrogen and the product prevented from coming into contact with air, water vapour, or glass, a white sublimate is obtained which smells strongly of hydrofluoric acid. Its solution decolourises permanganate and therefore contains quadrivalent vanadium. Attempts to analyse the sublimate led to varying results, and to no definite formula.—W. H. P.

Radioactive substances; Concentration and isolation of —— *by fractional adsorption.* E. Ebler and M. Fellner. Ber., 1911, **44**, 2332—2338.

The authors suggest that the adsorption of radioactive substances in solution by means of gelatinous silicic acid is a suitable process for their fractional separation or isolation. The substance with a suitable quantity of water and of silicic acid (see this J., 1911, 953) is shaken in a sealed glass tube for some time, the temperature being raised if necessary. The silicic acid gel is then separated by filtration or in a centrifuge. The silicic acid is next volatilised as silicon fluoride, leaving the adsorbed substance as residue. In a series of experiments with barium-radium-chloride the activity of the adsorbed portion was from 11 to 35 times the activity of the non-adsorbed portion. The same satisfactory results were obtained in the adsorption of solutions containing radiolead, and uranium X.—W. H. P.

Ozone; Solubility of —— *in water.* E. Moufang. Woch. Brau., 1911, **28**, 434—436.

The solubility of ozone in distilled water ranges from about 10 mgrms. per litre at 2° C. to about 1·5 mgrms. per litre at 28° C. The solubility is much affected by the presence of foreign substances in the water; it is appreciably increased by addition of a small quantity of acid, and such an addition renders an aqueous solution of ozone more permanent. Alkalis decrease the solubility on the other hand, whilst neutral salts (*e.g.*, calcium sulphate) increase it.—L. E.

Barium oxide as reducing agent. Reduction of nitrobenzene. Zerewitinoff and Ostromisslensky. *See* III.

Patents.

Oleum [*fuming sulphuric acid*]; *Process of making* ——. J. J. Cox, Du Pont, Wash., Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,002,824, Sept. 12, 1911.

Sulphuric anhydride, at an initial temperature between 95° and 115° F., is passed through an absorbing tower down which the absorbing acid, which must be initially between the same limits of temperature and at least 43 times by weight the amount of sulphuric anhydride, is caused to flow. The acid flowing from the tower is cooled until it is again between the same limits of temperature as before, and is then re-circulated through the tower until it has attained the desired strength.—W. H. C.

Hypophosphoric acid and hypophosphates; Process for the [*electrolytic*] *production of* ——. A. Rosenheim, R. J. Meyer and I. Koppel, Berlin. Eng. Pat. 14,420, June 17, 1911. Under Int. Conv., June 21, 1910.

A current of electricity is passed between an anode of metal phosphide and a cathode of the same metal as that of the phosphide, in an electrolyte consisting of a 10 per cent. solution of sulphuric or formic acid, the potential difference between the electrodes being kept between 3 and 10 volts. Electrolytic oxidation occurs and hypophosphoric acid is produced with deposition of the metal on the cathode. The solution obtained is either used as such, or it is divided into two parts, one part being neutralised with sodium carbonate, and mixed with the other part, when the sparingly soluble acid sodium hypophosphate may be separated by crystallisation.—W. H. C.

Alkali carbonates; Economical process for the manufacture of ——. Dior Fils. Fr. Pat. 429,038, July 5, 1910.

The alkali aluminate obtained as by-product in the manufacture of sulphuric acid by the process described in Fr. Pat. 417,816 and First Addition thereto (this J., 1911, 26, 684) is converted into carbonate by treating it in solution, with the furnace gases rich in carbon dioxide from the muffle furnaces employed in the process. Alumina is obtained as a by-product.—F. Sodn.

Cyanamides and cyanides of the alkali metals; Production of ——. E. A. Ashcroft, London. Eng. Pat. 16,765, July 13, 1910.

Alkali cyanamides are produced by heating alkali amides with a stable form of cyanamide or any of its polymerides (dicyandiamide or tricyantriamide), the temperature being increased gradually to about 600° C. $4NaNH_2+(CN_2H_2)_2=2Na_2CN_2+4NH_3$. The ammonia is collected and used for producing a further quantity of alkali amide (see Fr. Pat. 421,851 of 1910; this J., 1911, 422). By adding carbon to the mixture and heating to 750°—850° C., or by heating the alkali cyanamide with carbon, alkali cyanides are produced.—A. S.

Ammonia; Manufacture of ——. L. P. Devaucelle. Fr. Pat. 429,140, April 29, 1911. Under Int. Conv., Jan. 27, 1911.

In the process of manufacture of ammonia by heating a mixture of an alkali or alkaline-earth oxide and carbon in nitrogen, and then decomposing the resulting cyanide with steam, it is proposed to use coke obtained from petroleum or coal tar, or retort carbon, or graphite as the source of carbon. The finely ground materials are mixed with pitch and moulded under strong pressure before introduction into the reaction chamber. Alkali or alkaline-earth carbonates, especially barium carbonate, may be used instead of the oxides. Instead of using carbon in the charge, naphthalene vapour may be mixed with the nitrogen.—A. S.

Ammonia; Process for the production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 429,696, May 13. 1911. Under Int. Conv., May 17, 1910.

The patent relates to the production of catalysts of high activity (for the production of ammonia from nitrogen and hydrogen) from materials containing injurious substances, such as sulphur, selenium, tellurium, phosphorus, arsenic, boron, etc., and their compounds. For example, "pure" commercial iron containing a small quantity of sulphur is burnt in a current of oxygen, and the resulting ferroso-ferric oxide is reduced to metal. Commercial oxide of iron may be mixed with 5 per cent. of potassium carbonate, heated in a current of air to about 1200° C., and the product reduced by hydrogen. Magnetic oxide of iron contaminated by pyrites may be converted into an active catalyst by oxidation and subsequent reduction, repeated several times. The catalysts prepared in this way may be treated as described in Fr. Pat. 425,099 of 1910 (this J., 1911, 1012) before use. (See also Eng. Pats. 5833 and 5835 of 1911; this J., 1911, 1115.)—A. S.

Salt suitable for use as a table salt; Manufacture of ——. H. W. Crowther, West Bromwich, and W. T. Gidden, Langley. Eng. Pat. 23,745, Oct. 13, 1910.

The salt is mixed with 0·5—3 per cent. of anhydrous sodium sulphate.—A. S.

Oxides of nitrogen; Process of and apparatus for producing ——. Nobel's Explosives Co., Ltd., Glasgow, and D. Cross, Stevenston, N.B. Eng. Pats. 24,607, Oct. 24. 1910, and 9682, April 21, 1911.

In order to increase the volume of gas that can be passed through the flame arc, the outer electrode is formed as an annular casing provided with ribs or projections to afford sparking points; and the other electrode has the form of a propeller or fan, from the points of the blades of which the sparks strike across to the outer electrode. The propeller is rotated and serves to propel and direct the current of air or of air and gas in a direction along the axis of the apparatus. This causes the rotating arc to be drawn out into a band of flame.—W. H. C.

Oxides of nitrogen; Method of obtaining ——. W. A. Phillips and J. G. Bulteel, London. Eng. Pats. 27,558, Nov. 26, 1910, 29,893, Dec. 23, 1910; and 4268, Feb. 20, 1911.

The process consists essentially in drawing air, or a mixture of oxygen and nitrogen, over the surface of that portion of a gas flame in which combustion is substantially complete, the velocity of the air current being greater than that of the flame gases. The flame is preferably spread out so as to form a larger surface. Two forms of apparatus are described. In the first, a gas flame is directed into the upper end of a hollow cone, having around the periphery of its base, small openings, through which small flame tips project. Opposite the base of the cone, at a short distance therefrom, is the flange of a pipe through which air is drawn at a velocity greater than that of the flame gases, but not sufficient to extinguish the small flames. In another form of apparatus, a number of bars, of triangular cross-section, are arranged side by side in a casing, so as to leave narrow passages between adjacent faces of the bars. Suction is applied to the interior of the casing and gas flames are directed on to the upper faces of the bars, the flames being at such a distance that the tips, in which combustion is practically complete, are drawn down into the spaces between the bars.—A. S.

Ammonium chloride; Production of ——. E. Lloyd, Sheffield, E. Ledoux and Simon-Carvés Bye-Product Coke Oven Construction and Working Co., Ltd., Manchester. Eng. Pat. 26,992, Nov. 21, 1910.

Merchantable ammonium chloride is produced from the impure solution of that salt recovered from coke oven gases, by evaporating the solution either to dryness, or so far that the salt crystallises out, and then calcining or roasting the solid salt obtained, until all the tarry matter has been rendered insoluble. The residual mass is then leached with water, and the solution, after being filtered, is evaporated to obtain the salt in a pure state.—W. H. C.

Alkaline compounds; Electrolytic process of treating ——. E. G. Ekstrom, Los Angeles, Cal. U.S. Pat. 1,003,041. Sept. 12, 1911.

Alkali hydroxides and their derivatives are obtained by the electrolysis of a complex alkali fluoride compound, such as sodium fluosilicate, with graphite electrodes separated by a diaphragm, or with a carbon anode and a metallic cathode, such as mercury.—B. N.

Copper sulphate; Process of manufacturing —— from cement-copper and precipitated sulphur. H. Gouthière et Cie. and P. Ducancel. Fr. Pat. 427 893, June 7, 1910.

Cement-copper, or precipitated copper, is intimately mixed with precipitated sulphur, such as is formed in the purification of coal-gas, and the mixture is heated to 200°—300° C. Reaction takes place between the copper, sulphur, and oxygen of the oxides of copper and iron present in the raw materials, with the formation of copper sulphate, and sufficient heat is evolved to render further external heating unnecessary. After a few hours the mass is cooled, lixiviated with the mother liquor of a previous operation, and copper sulphate of 98 to 99 per cent. purity is crystallised out from the solution. The residue of lixiviation is mixed with a fresh quantity of precipitated sulphur, and the treatment is repeated.—O. R.

Potassium alum; Process of manufacturing ——. H. Arsandaux. Fr. Pat. 428,227, June 15, 1910.

(1) Mica, especially muscovite, is heated to 170°—180° C. with sulphuric acid of 53° B. strength, and the product,

which contains the constituents of potassium alum with aluminium sulphate in excess, may either be crystallised to separate alum and aluminium sulphate, or may be treated with the requisite quantity of potassium sulphate so as to yield alum only. (2) The raw material is roasted with the calculated quantity of potassium bisulphate and subsequently treated with sulphuric acid, as in the first case. (3) The raw material is roasted with the calculated quantity of potassium carbonate, with the formation of orthosilicates, which are easily decomposed by dilute sulphuric acid with the formation of alum.—O. R.

Calcium sulphydrate solution ; Process of manufacture of ——. J. Delpech. Fr. Pat. 429,458, July 18, 1910.

Calcium sulphide, which must be carefully powdered, is suspended in water in a closed vessel and treated with sufficient of a mineral acid (such as sulphuric acid) to decompose half the sulphide, the mixture being agitated ; the hydrogen sulphide formed reacts with the rest of the sulphide to form a solution of calcium sulphydrate. When sulphuric acid is used, the calcium sulphate is filtered off and ignited with carbon, so as to furnish more sulphide.—F. Sodn.

Peroxidation of the alkali metals by oxygenated air ; (1) *Process for the* —— *and* (2) *for the rapid and more perfect peroxidation of the alkali metals [by pure oxygen].* Soc. Anon des Usines de Rioupéroux. Fr. Pats. 429,269 and 429,306, July 11 and 12, 1910.

(1) Oxygenated air (for instance, 2 parts of oxygen to 3 parts of air) or (2) pure oxygen is used, in place of air, in the manufacture of sodium or other alkali peroxide, any suitable apparatus being employed. Commercial liquid oxygen is mentioned as furnishing gas suitable for the purpose. The product is said to be more stable and more homogeneous than that hitherto produced, and the yield is higher.—F. Sodn.

Hydrogen peroxide ; Stable ——. O. Liebknecht, Frankfort-on-the-Maine, Germany, Assignor to The Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 1,002,854, Sept. 12, 1911.

The claim is for the addition of benzoic acid, or other compound containing a carboxyl group combined with an organic radical, to a solution of hydrogen peroxide.
—W. H. C.

Hydrogen ; Process and apparatus for the separation of —— *from gaseous mixtures containing it.* Ges. für Linde's Eismaschinen A.-G. Fr. Pat. 427,983, March 21, 1911. Under Int. Conv., May 6, 1910.

The strongly cooled, compressed gaseous mixture is passed through a heat interchanger, whereby it is separated into a gaseous portion, chiefly hydrogen, and a liquid portion, consisting mainly of impurities. The mixture passes into a receiver, which is provided with two separate systems for producing expansion ; the liquid portion of the mixture collects in the receiver and is expanded in the lower system, from which it passes into the interchanger in the space surrounding the tube, which conveys the original mixture into the receiver, and in the opposite direction to that of the gaseous current ; the gaseous portion is expanded in the upper system and passes into the interchanger in the space surrounding the tube which conveys the mixture expanding from the lower system. From the interchanger the expanded hydrogen is collected free from impurities, which are thus condensed by the cold produced by the agency of the above-mentioned expansions. A supplementary refrigerating appliance, containing liquid air or liquid nitrogen, is used in conjunction with the apparatus for the preliminary cooling of the gaseous mixture. (See also this J., 1911, 744.)—O. R.

Ammonium sulphite and ammonium sulphate from coke-oven gases ; Manufacture of ——. F. Wolf, Bochum, Germany. Eng. Pat. 2042, Jan. 26, 1911.

See U.S. Pat. 994,435 of 1911 ; this J., 1911, 803.—T. F. B.

Ammonium sulphite ; Process for converting —— *into ammonium sulphate.* K. Burkheiser. Fr. Pat. 429,708, May 13, 1911. Under Int. Conv., May 21, 1910.

See Eng. Pat. 12,227 of 1911 ; this J., 1911, 1160.—T. F. B.

Ammonia ; Process of making ——. E. Collett and M. Eckardt, Christiania, Norway. U.S. Pat. 1,003,433, Sept. 19, 1911.

See Fr. Pat. 412,768 of 1910 ; this J., 1910, 1010.—T. F. B.

Ammonia ; Apparatus for recovering ——. A. B. Duff, Pittsburg, Pa. U.S. Pat. 1,003,887, Sept. 19, 1911.

See Eng. Pat. 4372 of 1910 ; this J., 1910, 998.—T. F. B.

Ammonium carbonate ; Method of making ——. J. Bueb, Dessau, Germany. U.S. Pat. 1,004,361, Sept. 26, 1911.

See Eng. Pat. 22,586 of 1910 ; this J., 1911, 421.—T. F. B.

Sodium bichromate ; Process of making granular ——. R. Caspari, Assignor to R. Wedekind und Co., Uerdingen, Germany. U.S. Pat. 1,003,875, Sept. 19, 1911.

See Ger. Pat. 228,427 of 1910 ; this J., 1910, 1454.—T. F. B.

Recovery of ammonium sulphate from distillation gases. Eng. Pat. 15,034. *See* IIb.

Recovery of ammonia from coal and like gases. Eng. Pat. 21,409. *See* IIb.

VIII.—GLASS ; CERAMICS.

Stoneware ; Electroplating decorated ——. G. Strahl. Elektrochem. Zeits., 1911, 18, 173—4.

The difficulty in electroplating stoneware lies in producing on the latter a durable conducting layer. This may be effected by applying to the ware a mixture of birch oil, asphaltum, petroleum and "gold-graphite," and afterwards burning in a muffle at 200° C. Gold graphite is obtained by mixing 2 grms. of pure gold as chloride with 10 grms. of potassium cyanide and water, adding 1 grm. of pure graphite, and burning to 600° C. in a muffle. A mixture containing 12 parts of "gold-graphite" to 5 of petroleum is recommended. The final burning of the ware should be strongly reducing in order to form a carbon deposit in the outer layers of the pottery, this being said to promote the tenacity of the metallic deposit.
—H. H. S.

Equilibrium in silicate melts. Doelter. *See* VII.

Hydrothermal silicates. Baur. *See* VII.

Patents.

Glass ; Manufacture of ——. S. O. Richardson. Fr Pat. 429,485, May 8, 1911.

Glasses, such as crystal, which require manipulation in a pot or crucible in the hearth of the furnace, are first melted in a chamber closed against fire-gases and are then caused to flow evenly through a reducing atmosphere to the place where they are worked.—H. H. S.

Kilns for burning pottery, bricks, or the like ; Continuous ——. J. W., S., and T. E. Jones, Buckley. Eng. Pats. 21,687, Sept. 19, 1910, and 4642, Feb. 24, 1911.

Kilns in which a number of contiguous chambers are used are provided with means for directing the gases to the top of one chamber, whence they descend downwards through perforated floors to straight horizontal flues leading into the fireplace of the next chamber above the fire grates. Auxiliary air flues lead from the outer air into the parts of the fireplace furthest from the outer walls of the kiln.

The horizontal flues connecting the chambers are controlled by dampers formed of blocks of refractory material fixed in or on a metal frame with separate refractory distance pieces.—H. H. S.

Porcelain ; Process of firing ——. R. Frugier. Fr. Pat. 428,914, April 25, 1911.

The oven consists of two parts, the lower which is called the "laboratory," being used for the glost, and the upper, or "globe," for the biscuit. Connection is made between the two chambers after the glost is fired, the temperature of the globe being further sustained by a generator.—H. H. S.

Faience ; New composition for ——. A. H. Bracher. Fr. Pat. 429,258, May 4, 1911.

A non-shrinking and economical pottery ware is said to result from mixing 100—200 kilos. of clay, according to its nature, with a composition made from 740 kilos. of powdered glass, 530 of calcined gypsum and 620 of water. —H. H. S.

Abrasive or refractory products of alumina and magnesia. The Carborundum Co. Fr. Pat. 429,610, May 11, 1911.

The product is a crystalline substance composed principally of magnesia and alumina, in which the proportion of magnesia is less than that represented by the formula, MgO,Al_2O_3.—H. H. S.

Enamel ; Manufacture of white ——. Verein. Chem. Fabr. Landau, Kreidl, Heller und Co. Fr. Pat. 429,665, May 12, 1911. Under Int. Conv., June 8, 1910.

Oxide of zirconium is too expensive to use for rendering enamels opaque, and the silicate has insufficient covering power. But if a portion of the silica, either of the natural or of the artificial silicate, be removed by warming with alkali carbonates or hydroxides, the resulting product is said to yield a voluminous powder which is very effective for rendering enamels opaque.—H. H. S.

Glass sheets or plates and other articles ; Process for the production of a substitute for ——. B. Borzykowski, Charlottenburg, Germany. Eng. Pat. 21,719, Sept. 19, 1910.

See Fr. Pat. 420,745 of 1910 ; this J., 1911, 363.—T. F. B.

Alumina, magnesia, and boric anhydride ; Product, suitable for abrasive and other purposes, containing ——. The Carborundum Co. Fr. Pat. 429,611, May 11, 1911.

See U.S. Pat. 1,001,570 of 1911 ; this J., 1911, 1116.—T.F.B.

IX.—BUILDING MATERIALS.

Dinas bricks ; Causes of the expansion of ——. P. J. Holmquist. Tonind.-Zeit., 1911, 35, 1323—1327. (See also this J., 1901, 900 ; 1910, 951.)

The author is in agreement with Grum-Grzimailo (this J., 1911, 686) that the expansion of Dinas bricks is due to the conversion of the quartz grains into tridymite. The microscopic examination of a piece of Dinas brick, which has been exposed for a long while to the heat of a furnace, shows numerous crystals of tridymite in the ground mass (consisting, according to the amount of iron present, of a brown, red or yellow glass) surrounding the larger quartz grains. Apparently the quartz does not pass directly into tridymite, but is first converted into a vitreous-amorphous or molten condition of lower specific gravity than tridymite. In sections of Dinas bricks which have been completely melted down, owing either to prolonged heating or to a large amount of fluxing material, plates of tridymite are wanting, and in their place strongly refracting isometric crystals are found ; these are probably cristobalite, as this is stable at a higher temperature than tridymite. As a rule the quartz grains of Dinas bricks are penetrated by fine cracks, from which the vitrification starts, and the larger the number of cracks, the larger the number of small grains into which the crystal splits up, and the more rapid the increase in volume on heating. The difference in the behaviour of the quartz grains may be due to the presence in one case of α-quartz, which is formed below 575° C., and in another of β-quartz, which occurs in many sandstones and quartzites derived from volcanic rocks, and is less suitable for the production of Dinas bricks. The percentage composition of material suitable for making Dinas bricks should be about 97·5 silica, 1·5 of alumina, 0·5 of ferric oxide, and small amounts of alkalis and magnesia. The lime, added as a binding material, should not exceed 2 per cent. of the mixture. Microscopic examination of burnt Dinas bricks shows that there is practically no diffusion among the raw materials, unless the brick has been acutally melted. At a high temperature the lime added to the mass combines with silica to form the metasilicate (α- and β-wollastonite) in the ground mass of the brick, and probably with more silica forms an eutectic, melting at 1417° C. The presence of alumina should not lower the melting point of the brick, since it would combine with silica to form sillimanite, which forms with silica an eutectic, melting at about 1600° C. In conjunction with the lime and silica, however, the alumina might form anorthite ($CaO,Al_2O_3,2SiO_2$) which with more silica might yield fusible mixtures. In an ordinary good Dinas brick about ½ to ⅓ of the whole amount of quartz present has been converted into tridymite, and the change of the remainder takes place more or less slowly in the furnace, but probably other factors, such as porosity, the formation of fusible solutions, the change of the glass into tridymite, etc., tend to counteract the increase in volume. On the above lines, Dinas bricks can be divided into three kinds : (1) those in which the larger grains of unaltered raw material (quartzite or sandstone grains) are embedded in a ground mass of slag and vitrified quartz, (2) those in which the larger grains are embedded in a ground mass of slag and tridymite-aggregates, (3) those in which the quartz has been completely converted into tridymite.—W. C. H.

Portland cement mortar and concrete ; Properties of oil-mixed ——. L. W. Page. Proc. Amer. Soc. Civil Eng., 1911, 37, 994—1009.

The author has found that considerable quantities of mineral oil can be incorporated with wet Portland cement paste. In the present paper results of comparative tests on cement mortar and concrete, with and without addition of oil (petroleum residual oil or a "cut-back" oil asphaltum) are given. In most of the experiments, the amount of oil added was limited to 10 per cent. (of the weight of the cement), further additions having little effect on the water-resistant properties of the set material. The textile strength of 1 : 3 cement-sand mortar is only slightly affected by addition of oil ; the strength of the oil-mixed mortar is substantially greater after 28 days and after 6 months than after 7 days. The initial and final set are retarded by addition of oil, the times being increased by 90 per cent. and 60 per cent. respectively by addition of 10 per cent. of oil. The crushing strength of the mortar and of concrete prepared therewith is diminished by addition of oil. After 28 days the crushing strength of concrete prepared with oil-mixed mortar (10 per cent. of oil) is about 75 per cent. of that of plain concrete. After 1 year the crushing strengths of mortars prepared with and without oil (up to 10 per cent.) do not differ greatly. The toughness or resistance to impact, and the stiffness (initial modulus of elasticity) of concrete are but little affected by addition of oil. Oil-mixed mortar and concrete absorb much less water than similar products prepared without oil, and mortar containing 10 per cent. of oil is quite watertight under pressures as high as 40 lb. per sq. in. The oil-mixed mortar makes an effective waterproofing material when plastered on either side of porous concrete. For reinforced concrete, the strength of the bond is greatly diminished by addition of oil, when plain bars are used as reinforcement, but with deformed bars, the strength of bond is not seriously affected by addition of up to 10 per cent. of oil. The author grants permission to citizens of the United States to use the process (see U.S. Pat. 1,000,545 of 1911; this J., 1911, 1118) without payment of royalties.—A. S.

Patents.

Road making: Material for and method of ——. A. Hamblock, Andernach, and J. Henning, Oberlahnstein, Germany. Eng. Pat. 24,172, Oct. 18, 1910. Under Int. Conv., July 25, 1910.

A binding material is made of dry and slaked lime mixed with tufa ashes, trass, or other raw material containing a large percentage of soluble silicic acid. This is then mixed with the prepared stone material of the tar-macadam after heating and cleansing, but before the tarring. It may also be used in the wet by grouting in for binding and waterproofing the surface. The proportions given are: 7 parts by weight of damp tufa ashes, 2 of calcium oxide, and 1 of calcium hydroxide; and : 12 of trass, 3 of quicklime, and 5 of slaked lime.—H. H. S.

Concrete, cement and the like; Manufacture of products of ——. H. S. Owen, New York. Eng. Pat. 8086, March 31, 1911. Under Int. Conv., April 1, 1910. (See also Eng. Pat. 8085. March 31, 1911.)

Concrete bricks and similar ware are made in a mould of fusible material produced by chilling the walls of a mould-former and recessing a plastic mass of paraffin thereby, so that the former may then be removed; or the wax, in a receiving chamber, may be recessed by pressure of a mould-former.—H. H. S.

Kiln for cement and lime; Continuous ——. P. J. J. Telliez and A. F. E. Marette. Fr. Pat. 429,559, May 6, 1911.

The chimney draws the gases from the circular wall of the hearth by means of four conduits. A large quantity of air reaches the interior across walls and by a grill the bars of which are suspended vertically. The mouths of the kiln are closed by special apparatus.—H. H. S.

Plaster; Method of treating the surface of ——*, or of a mass made from a mixture of granular material and a binding medium.* M. Sachs, H. Pohlmann and P. Frank, Hamburg. Eng. Pat. 10,610, May 2, 1911.

The surface of the plaster, while still in a comparatively fresh state, is coated with a pasty mixture of hydrochloric acid and loam or clay to which a small percentage of soft soap has been added. The paste is subsequently removed by washing, the granular constituents of the plaster being thus exposed to view without impairing the cohesion of the material.—W. E. F. P.

Brick. J. B. Beshore, Assignor to G. C. Proctor and S. A. Williams, Harford County, Md. U.S. Pat. 1,003,693, Sept. 19, 1911.

The composition consists of: silica 58 parts, ferrous oxide 11, alumina 22, magnesia 1, alkali 2.—H. H. S.

Wood; Process for the preservation of ——. K. Koenman. Fr. Pat. 427,878, March 29, 1911.

Wood is treated for a period varying from 2 to 14 days with an ammonia solution of from 16 to 26 per cent. concentration, the ammoniacal liquors are drawn off, and the wood is subjected to 5 or 6 successive washing operations, until the wash-liquor is free from colour and smell, after which the wood may be dried by any of the ordinary methods.—O. R.

Basic silicates of lime; Process of increasing the binding power of ——. W. Schumacher, Osnabrück, Germany. U.S. Pat. 1,003,813, Sept. 19, 1911.

See Fr. Pat. 366,755 of 1906; this J., 1906, 1098.—T. F. B.

Stone; Artificial ——. R. E. Brand. Fr. Pat. 429,207. May 2, 1911.

See Eng. Pat. 11,509 of 1911; this J., 1911, 1016.—T. F. B.

Cement; Process of manufacturing ——. C. Daher, Marseilles, Assignor to J. et A. Pavin de Lafarge, Viviers, France. U.S. Pat. 1,004,380, Sept. 26, 1911.

See Fr. Pat. 401,493 of 1909; this J., 1909, 1132.—T. F. B.

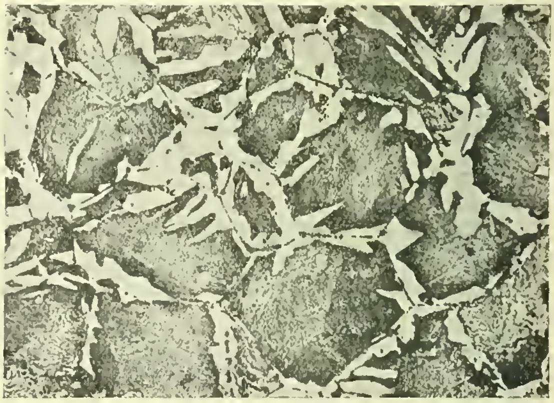
X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Blast furnace; The composition of the gases in the ——. M. Levin and H. Niedt. Metallurgie, 1911, **8**, 515—539, 556—581.

The results of a study of the gases within the blast-furnace begun by Bunsen in 1838 and carried on by various investigators until 1873 are graphically illustrated. The author has carried out a large number of experiments with a Silesian and a Rhenish blast furnace, full details of which are given, together with the quantities and analysis of the materials. The gases were extracted by a special apparatus from eleven zones in the furnace, and simultaneous records made of the temperature and the pressure of the gases at the zone where they were extracted. The gases were then analysed and the percentages of carbon monoxide, carbon dioxide, hydrogen, methane, and nitrogen determined. The results of thirty-four experiments with the Silesian and of eight with the Rhenish furnace are tabulated, the tables giving in addition the temperature and pressure of the gases and the percentage of the combined oxygen and carbon in the gases with reference to the nitrogen present. Taking the maximum amount of nitrogen at any zone the results of calculating the proportions of carbon monoxide, carbon dioxide, and the excess of oxygen in percentages of this nitrogen are then graphically illustrated and discussed, similar diagrams of the results of previous workers being given. It is shown that the results are very irregular, and the authors then average the results and give tables and curves showing the divergence of the results from the average in percentages of the average. These curves are fully discussed. The reactions between the iron oxide, carbon, and carbon monoxide, and the ratio of the carbon monoxide to the sum of the carbon monoxide and dioxide in relation to the reactions which take place in the furnace at various zones are then discussed at length.—A. H. C.

α-Iron; Crystallisation of ——. M. Ziegler. Rev. Mét., 1911, **8**, 655—672.

Above the temperature Ar3, steel is regarded by the author as a solid solution of carbon, and such impurities as oxides, silicates, phosphides, sulphides (FeS, MnS), and graphite in γ-iron, and as in solutions of a salt, centres of crystallisation start from suspended solid particles, so it is argued, by analogy, that in the case of steel a "temperature B," a little above Ar3 and like it varying according



to the carbon content of the steel, a separation of the impurities takes place. The rate of their separation determines whether they are all deposited between neighbouring crystals of γ-iron or penetrate individual crystals, while their quantity determines the thickness of the layer. In the same way the transformation of γ-iron into α-iron starts at the points of location of impurities, and the separation of ferrite (or cementite) continues until the residual solid solution contains 0·9 per cent. of carbon ; the latter then separates as mixed crystals, and it is only at the temperature Ar1 that the transformation is complete and pearlite formed (see fig.). These suggestions explain why slag and sulphide pools are always found principally in the ferrite or cementite envelopes surrounding the grains of pearlite in a steel and visible after polishing and etching, as well as the formation of the streaks in steel known as "ghosts" which are characterised by their high ferrite content and the accumulation of slag and sulphide pools in them. The manner in which these impurities between the crystals of α-iron affect the character and mechanical properties of the steel is discussed. The increase in size of grain as determined by the temperature above Ar3 to which the steel has been heated, is attributed to the enlargement of the initial crystals of γ-iron produced by the prolonged cooling before reaching Ar3, the edges of which containing the impurities persist as α-iron or ferrite on segregation below Ar3. The paper is illustrated by twenty-two microphotographs.—A. H. C.

Carbon and iron ; Temperature influences on ——. E. Adamson. Iron and Steel Inst. Oct., 1911. [Advance proof.]

Facts are quoted which show that carbon separates as free carbon in pig iron in the absence of silicon, and it is contended that in the manufacture of pig iron this separation primarily depends upon the temperature to which the iron is raised in the blast furnace. It is suggested that free carbon occurs in three conditions, (1) very fine graphite liberated at low temperatures and found in mottled irons, (2) graphite, which crystallises in a form not unlike that of frost on glass, and is produced by annealing white iron for a long period at a high temperature and in pig iron at a medium temperature, (3) the well-known large flake graphite found in soft irons and formed at high temperatures regardless of the constituents of the pig iron. None of these three forms are necessarily completely destroyed on fusion. The author believes that cooling curves of iron containing each of these three forms of free carbon would vary in the position and character of the critical points. The two extreme forms of carbon found in grey and white pig irons are given, and show in the case of a grey iron containing 3·62 per cent. of graphite, 0·58 of combined carbon, and 1·02 of silicon, arrests points at 1317° C., 1090° C., and 695° C., and in the case of a white iron containing a trace of graphite, 3·90 of combined carbon, and 1·04 of silicon arrests points at 1216° C., 1140° C., and 712° C. These curves are discussed and the author concludes that it is not possible to grade pig irons by their silicon content only, and that the fracture indication is quite as satisfactory as the silicon content since it appears that carbon and its various conditions is of primary importance.—A. H. C.

Steel ; Transformations of —— within the limits of the temperatures employed in heat treatment. L. Grenet. Iron and Steel Inst., Oct., 1911. [Advance proof.]

The author holds that the iron carbon alloys can be included in the general category of alloys, and no complications due to allotropic transformation of iron need be considered. He deduces in iron and steels two states only, the "hot stable state" and the "cold stable state," the transition from one to the other, accompanied by variations in all the known properties, being called the transformation. Variation in magnetic properties may occur in either state independently, and this change is not therefore considered as a transformation. The influence of special elements, including carbon, on the temperature of transformation may be represented on simple diagrams. Quenching as distinct from slow cooling may then be considered to act in two ways :—(1) By changing the nature of the constituents, and preventing wholly or partly the transformation on cooling. In this case the two states are physico-chemically different, and in the few instances in which such quenchings are known, the quenched state is often the softer. (2) By lowering the temperature of the transformation on cooling. This is the more usual case and the quenched metal is always harder. The facts observed in alloys of the most varied description may be expressed by the following general law. An alloy is harder in proportion as the transformation which has given rise to its constituents, has taken place at a lower temperature, and has been more rapid. It is also harder, and this is often much more important, in proportion as the maximum temperature since the last transformation has been lower and has been maintained for a shorter time. The real cause of hardening cannot be said to be known. The hardening produced by quenching may be due solely to fineness of structure.
—W. H. P.

Iron and manganese alloys ; The mechanical influence of carbon on ——. J. O. Arnold and F. K. Knowles. Iron and Steel Inst. Oct., 1911. [Advance proof.]

To show that the influence of carbon is very considerable but that the manganese is the dominating factor in the mechanical relations of iron, manganese, and carbon, the results of the mechanical and alternating tests which were applied to two series of steels, are tabulated. The steels contained from 0·02 to 0·04 per cent. of sulphur, 0·02 to 0·07 of phosphorus, 0·06 to 0·21 of silicon, and from 1·10 to 19·85 of manganese, the carbon of one series being about 0·85 per cent., and of the other below 0·10. The tests were carried out on 1 inch round bars, one series of which were quenched from 860° C. in cold water, and the other cooled from the same temperature during a period of about three days. The paper is illustrated by four microphotographs.—A. H. C.

Case-hardening of steel ; A new industrial process for ——. F. Giolitti. Iron and Steel Inst. Oct., 1911. [Advance proof.]

A bibliography is given of the researches on case-hardening by the author and others, and the fundamental facts discussed in them are summarised (see also this J., 1909, 205 ; 1910, 430 ; 1911, 1017). The author considers that a mixture of carbon monoxide and carbon is the best carburising agent, and enumerates its advantages. A description and a diagram of a vertical furnace specially adapted for the utilisation of these materials are given. Details and curves are then given of the carburisation of a steel containing 0·12 per cent. of carbon by first case-hardening it in this furnace for five hours, estimating the percentage of carbon in different layers, and then reheating in the carbon monoxide with only sufficient carbon to produce equilibrium for another period of five hours and again estimating the carbon in the various layers.—A. H. C.

Case-hardening by means of compressed gases. F. Giolitti and F. Carnevali. Iron and Steel Inst., Oct., 1911. [Advance proof.]

An apparatus is described by means of which steels were carburised, or case-hardened, by means of wood-charcoal traversed by a slow current of carbon dioxide passed through the mass under high pressure and whilst the mass is heated to known temperatures. A carbon steel containing 0·11 per cent. of carbon, nickel steels containing 2, 5, and 25 per cent. of nickel, a chromium steel containing 2·33 per cent. of chromium, and a steel containing 1·5 per cent. of chromium and 3·17 of nickel, were used and the results are tabulated. A number of cases of surface oxidation occurred ; these are discussed from the point of view of the equilibrium of Fe_3C,Fe,CO,CO_2 ; Fe_3C,FeO,CO,CO_2 ; Fe,FeO,CO,CO_2 ; FeO,Fe_3O_4,CO,CO_2 ; and C,CO,CO_2, of which five curves are given, and it is shown that the higher the temperature the wider the range of pressures within which case-hardening can take place without any oxidation of the metal. In the case of high percentage chromium steels it is shown that the oxidation which takes place even below atmospheric pressure can be avoided by reducing the pressure of the carburising mixture ($CO+CO_2$) by diluting it with nitrogen (air). —A. H. C.

Carborundum; Employment of —— in the manufacture of special steels. L. Baraduc-Muller. Rev. Mét., 1911, **8**, 673—707.

Silicon carbide reacts with the majority of metallic oxides at temperatures between 800° C. and 1400° C., and according to the equations: $SiC+MO=SiM+CO$; $2SiC+M_2O_3+C=2SiM+3CO$. with very little risk of carbon entering into the silicon alloy. A cast iron containing 1·65 per cent. of silicon. 3·04 of carbon, 1·30 of phosphorus, and 0·2 of manganese was melted and when at a temperature of 1450° C. briquettes containing 18·6 per cent. of carborundum, 69·5 of nickel oxide, 7·5 of charcoal, 0·4 of lime, and 4·0 of marl were added. A quantity of graphite separated out and an alloy was obtained containing 6·93 per cent. of silicon. 22·6 of nickel, 0·35 of carbon, 0·9 of phosphorus, and 0·2 of manganese. The loss of silicon and nickel amounted to 4·5 and 3·0 per cent. respectively. In a similar experiment using chromium oxide, an alloy containing 3·12 per cent. of chromium was obtained with a loss of 15 per cent. of the chromium used. A number of experiments were then carried out on the large scale in a Martin furnace, and the results are tabulated and discussed in detail and also the economic value of the process. Details are given of an apparatus for the production of the briquettes and their cost.—A. H. C.

Carbon; Rapid determination of total —— in iron, steel. and iron alloys. (Supplementary note.) H. De Nolly. Rev. Mét., 1911, **8**, 717—720.

In the application of this process (see this J., 1911, 688) it is found that the higher the carbon content the more incomplete is the combustion. This difficulty has been overcome by the addition to the alloy of an excess of extra pure steel of known carbon content (about 0·05 to 0·08 per cent.), and such substances as lead peroxide or bismuth tetroxide in order to facilitate the oxidation. The following table gives the quantities of materials best adapted to give accurate results:—

Iron alloy.	Weight taken.	Weight of lead peroxide.	Weight of pure steel.
	grm.	grm.	grm.
All cast irons	0·50	0·2	1·0
Ferro-chrome of 6 to 10 per cent. C.	0·25	0·2	2·0
Ferro-chrome of 1 to 5 per cent. C.	0·50	0·5	1·0
Ferro-manganese	0·25	0·2	1·0
Ferro-silicon	0·50	0·2	1·0
Ferro-molybdenum ...	0·50	0·5	1·0
Ferro-tungsten	0·50	0·1	1·0

A diagram is given of the complete apparatus necessary. —A. H. C.

Carbon in iron and steel; Determination of —— in the electric furnace. H. Augustin. Z. angew. Chem., 1911, **24**, 1800—1803.

The author recommends as a works method the determination of carbon in iron and steel by direct combustion in oxygen in an electrically heated furnace at about 1000° C. The method has been in use since 1905, and it is stated to be applicable to all kinds of iron and steel, including special steels, and to high-percentage alloys of iron with silicon. chromium, titanium, vanadium, tungsten, etc. The metal may be used in the form of powder or borings, or even in larger pieces. Ferrosilicon containing 50—90 per cent. of silicon. will not burn in oxygen at 1000° C., but any carbon present is oxidised in a short time. A cube of steel weighing 7 grms. required heating for 15 hours in oxygen at 1000° C. in order to oxidise the carbon completely: even after this time a core (0·5 grm.) of unburnt iron remained, but this was quite free from carbon. From 1 to 15 grms. of metal are taken for a determination, according to the carbon content and in order to ensure complete combustion, the exit end of the combustion tube is packed with a layer of copper oxide and a layer of lead chromate. The furnace comprises a thin-walled muffle. 550 mm. long, capable of just taking four combustion tubes of porcelain, glazed on both sides, of 16—18 mm. diameter: four determinations can thus be taken simultaneously. Two thermo-couples are arranged between the four tubes. The muffle is heated by two separate resistance coils of platinum; the portion of the combustion tube containing copper oxide is heated to 800° C. and that containing the sample is heated to 1000° C. The current of oxygen should not be passed too rapidly.—A. S.

Platinum assay. A. Steinmann. Schweiz. Woch. Chem. Pharm., 1911, **49**, 441—444, 453—457. Chem. Zentr., 1911, **2**, 1061—1062.

The method of parting the platinum-silver button (obtained in the assay of platinum) by means of concentrated sulphuric acid is inaccurate, because boiling concentrated sulphuric acid dissolves considerable quantities of platinum from platinum-silver alloys: the loss is usually 20—30 parts per 1000 parts of platinum, but may be as much as 50 parts. By using slightly diluted acid the silver can be extracted without loss of platinum. The following method is proposed. About 250 mgrms. of the platinum alloy are mixed with silver (at least 5 times the quantity of platinum present), copper (a quantity equal to that of the platinum), and lead, cupelled at as high a temperature as possible, and the residue fused for about 3—5 minutes. The resulting button is rolled to a thickness of 0·2 mm., and heated for ½ hour with diluted sulphuric acid (100 vols. of concentrated acid to 22 vols. of water) at a temperature not exceeding 240° C. The treatment with acid is repeated twice, and the residual platinum is washed, dried, and weighed.—A. S.

Aluminium zinc alloys. A. Portevin. Rev. Mét., 1911, **8**, 721—727.

Ten alloys of zinc and aluminium increasing by steps of ten per cent. of aluminium were cast in sand and the results of the mechanical tests, elasticity, hardness, shearing strain, and the thermo-electromotive force against copper, are tabulated and some curves given. The tensile strength shows a maximum at 60 per cent. of aluminium corresponding to the limit of solid solution as given by Ewen and Turner (this J., 1910, 1163), the hardness (Brinell) test shows a similar maximum at 60 per cent. of aluminium and a second less marked one between 10 and 30 per cent. The thermo-electric force increases with the aluminium content. The alloys were forged and then annealed for one hour at 300° C. and it is shown that the forging very greatly increases the tensile strength and elongation while the annealing effects a diminution of these properties, the yield point being greatly lowered.—A. H. C.

Arsenides of iron and manganese. S. Hilpert and T. Dieckmann. Ber., 1911, **44**, 2378—2385.

By heating powdered metallic manganese or iron with excess of arsenic in a sealed Jena glass tube to 600°—700° C. for about six hours, metallic arsenides are formed and can easily be separated mechanically in a state of purity. In this way iron gives a compound, $FeAs_2$, which is a silver grey powder (sp. gr. 7·38, m. p. about 1000° C.), showing no crystalline structure under the microscope. The arsenide is not soluble in hydrochloric acid, and only slowly in sulphuric and in nitric acids. It burns in air to arsenious oxide and ferric oxide. By heating the diarsenide in a current of hydrogen at 680° C., a loss in weight is observed until the compound, FeAs (sp. gr. 7·83, m. p. 1020° C.) is reached. This arsenide can also be produced by direct union of the calculated quantities of the elements heated in a sealed Jena glass tube. After long heating it shows a decided crystalline structure. In preparing manganese arsenide it is necessary to use the pure metal prepared from the amalgam, as the commercial aluminothermic product gives poor results. The only compound formed is MnAs, which is not crystalline and not soluble in hydrochloric acid. It is remarkable for its decided ferromagnetic properties, which however disappear reversibly between 40° and 50° C. On heating in hydrogen at 500° C. arsenic is lost, but no indication of the existence of another compound was observed. The magnetisability decreases in an irregular way as the arsenic content falls, but there is no break to indicate the formation of the compound, $MnAs_2$, the existence of which has been presumed to explain the variations in magnetic properties. The method given above is also available for the preparation of metallic phosphides in the pure state.—W. H. P.

Tantalum and tungsten; Absorption of hydrogen by ——. A. Sieverts and E. Bergner. Ber., 1911, **44**, 2394—2402.

The authors have measured the solubility of hydrogen and nitrogen in tantalum up to 1330° C. The solubility at constant pressure decreases as the temperature rises, and at constant temperature is proportional to the square root of the pressure (see this J., 1911, 1119, 1166). Heating in hydrogen produces a structural change in the metal, which becomes brittle and crystalline. The original condition is not restored by removal of the hydrogen but only by heating nearly to the melting point. Tantalum reacts with nitrogen slowly above 900° C. to form a nitride. Tungsten dissolves very little hydrogen and shows no tendency to react with nitrogen at temperatures up to 1500° C.—W. H. P.

Alkaline-earth metals; Producing —— by electrolysis of fused salts. M. Trautz. Chem.-Zeit., 1911, **35**, 1096.

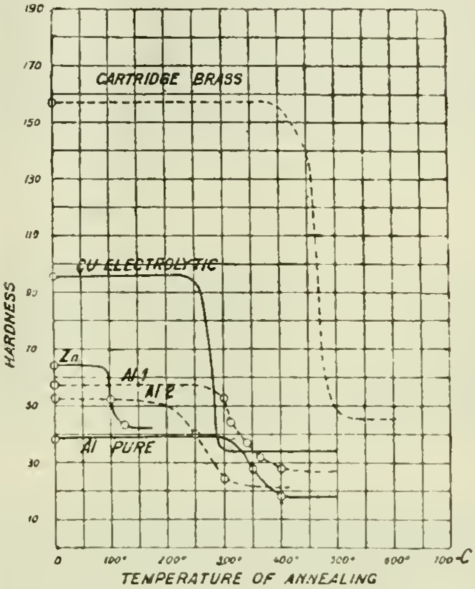
By electrolysis of a fused mixture of potassium and strontium chlorides (1 mol. : 2 mols.) the author has succeeded in obtaining balls of metallic strontium of up to 90 grms. weight in a single operation. In 44 electrolyses the average current yield was 34 per cent., and the metal obtained contained 96·99—97·68 per cent. of strontium, 0·3 of chlorine, 0·74—0·95 of potassium, and no hydrogen; it had the sp. gr. 2·5. In the electrolysis of fused salts, the current density is not of so much importance as the production of secondary reactions owing to the high temperature. Metallic barium has been obtained in an analogous manner, but all the difficulties incidental to its production have not yet been overcome.—A. S.

Electricity; Applications of —— in the metallurgical industry of Italy. R. Catani. Iron and Steel Inst., Oct. 1911. [Advance proof.]

The experiments of Stassano on the production of steel direct from the ore are first described, with full details of the composition of the ore, charcoal and flux used, a steel containing 0·1 per cent. each of carbon, manganese, and silicon being obtained with a consumption of 4187 kilowatt-hours per ton. In later trials (1908) an ore containing 48·09 per cent. of iron was crushed and briquetted with 25 per cent. of sodium silicate, a steel being produced containing 0·26 per cent. of carbon, 0·21 of manganese, 0·03 of silicon, 0·01 of phosphorus, and 0·04 of sulphur with a consumption of 4250 kilowatt-hours per ton. The production of steels from iron scrap, ferrosilicon, and ferromanganese in various types of furnaces is then described, the composition of the materials and the steel being tabulated. Working with a liquid steel from a 4-ton open-hearth furnace, and containing 0·08 per cent. of carbon, 0·03 of silicon, and 0·08 of manganese, and re-carburising with pig iron, a steel containing 0·6 per cent. of carbon, 0·025 of silicon, and 0·12 of manganese was obtained. Carcano working with pyrites residues in a powdery condition, containing 47·0 per cent. of iron, 12·25 of silicon, 18·8 of aluminium, and 2·6 of sulphur, and with a basic slag, produced an iron containing 0·058 per cent. of sulphur, 0·075 of phosphorus, 2·17 of manganese, and 4·46 of silicon. The author then discusses the production of ferro-silicon of which 628 tons were manufactured in 1909. By using an iron silicate ore and quartz, alloys were produced containing up to 25 per cent. of silicon. By using 1300 kilos. of an ore containing 75·5 per cent. of ferrous oxide, and 9 of silica with 2330 kilos. of quartz and 1000 kilos. of coke, an alloy containing 40 per cent. of silicon was obtained.—A. H. C.

Metals; Annealing of ——. M. Matweeff. Rev. Mét. 1911, **8**, 708—716.

Zinc, copper, brass, and aluminium bronze were hardened by hammering cold and then annealed at varying temperatures either in a bath of vaseline or in a current of hydrogen in a lead bath. They were then tested by the Brinell test using a glass ball 1 mm. in diameter under a pressure of five kilos. Curves are given (see fig.) showing the abrupt change in hardness with the temperature, which occurs at 100° C. for zinc, 300° C. for copper and silver, and 350° C. for aluminium. It is concluded that the presence of a second metal in an alloy, (1) alters the hardness of the annealed alloy; (2) alters the temperature of the commencement of softening which in the case of aluminium alloys is found to be lowered; (3) increases the limits of the temperature within which annealing may be effected. It is suggested that in the case of aluminium this method reveals the presence of impurities and will be of service in determining the cause of the liability to change which takes place in articles made of aluminium.—A. H. C.



Metals; Autogenous cutting and welding of ——. F. Carnevali. Iron and Steel Inst., October, 1911. [Advance proof.]

The advantages of the oxy-acetylene method of autogenous welding over the electrical, oxy-hydrogen, and thermit processes are pointed out, and the following conditions given for securing good results:—(1) The use of pure acetylene; (2) a properly designed blowpipe; (3) the provision of an absolutely neutral zone in the melting flame; (4) the use of pure small rods, of the same composition as the metal to be melted, for the cementing material; (5) the edges of the metal to be clean and at an angle to one another; (6) the use of deoxidising and fluxing powders; (7) rapidity in melting to prevent over-heating the adjacent parts. A series of experiments were carried out on bars cut from boiler plates of 7, 10, and 20 mm. thickness and having a carbon content of 0·23, 0·105, 0·11 per cent. respectively, from round bars of very pure mild steel containing 0·119 per cent. of carbon, and from a series of steels containing 0·48, 0·70, 1·09 per cent. of carbon. After the welds had been made they were either cooled in the air or underwent a special heat treatment and mechanical operations and then mechanical tests were made upon rough and also machined samples, the results being tabulated. The melted and unmelted regions were also microscopically examined before and after the tests and the changes in the structure and mechanical properties caused by welding were confirmed. It is shown:—(1) That the violent heating and sudden melting of the metal greatly alter its quality, and this alteration cannot be remedied by merely hammering the melted zone (which is often most injurious in the case of high carbon steels) but must be accompanied by proper thermal treatment such as annealing for 30—40 minutes. The rate of cooling has a remarkable influence on the mechanical properties, the slowest cooling being the best. (2) The alteration in chemical composition, *i.e.*, loss of carbon, silicon, and manganese by oxidation can be remedied by using a steel containing higher percentages of these more easily oxidised elements as a cementing material. A further series of experiments were carried out upon a pig iron containing 2·61 per cent. of graphite, 0·33 of combined carbon, 2·42 of silicon, 0·87 of manganese, 1·47 of phosphorus and 0·09 of sulphur, while the cementing material contained 4·5 per cent. of silicon, being otherwise similar in composition: the weld produced contained in the fused zone 1·54 per cent. of graphite, 0·67 of combined carbon, 3·70 of silicon, and 0·56 of manganese. The results show:—(1) That the rapid melting and cooling of the pig iron produce a fine compact structure in the melted zone, the composition and structure being modified by a loss of carbon and silicon; (2) The mechanical properties are not greatly influenced except that the hardness as shown by Brinell tests is greater. The paper is illustrated by twenty microphotographs which show the changes produced in the structure of the metal by the process.—A. H. C.

Basic slag; The phosphates in ——, from the Thomas-Gilchrist dephosphorisation process. V. A. Kroll. Iron and Steel Inst., Oct., 1911. [Advance proof.]

A critical historical account is given of the discovery of the phosphates in basic slag, and of the discussion of their formulæ. The author describes the following phosphates, giving them the names of their discoverers, and assigning probable formulæ (in some cases multiplied by three for purposes of comparison). Carnotite, $(3CaO,P_2O_5; 2CaO,SiO_2)_3$, flat prisms, probably monoclinic, sometimes also found as needles; only produced by slow cooling and selective crystallisation. Hilgenstockite, or tetraphosphate, $(3CaO{\cdot}P_2O_5; CaO)_3$, found as yellowish flattened prisms. This mineral is also really a fortuitous constituent of the slag. Steadite, probably $(3CaO,P_2O_5)_3; 2CaO,SiO_2; 2CaO$, brownish or light yellow prisms. The author emphasises the fact that these three phosphates each contain three molecules of tribasic phosphate along with three other molecules, which are calcium orthosilicate in carnotite, lime in hilgenstockite, and one of orthosilicate and two of lime in steadite. The phosphate is therefore tribasic in carnotite, tetrabasic in hilgenstockite, and intermediate between the two in steadite. He also describes a new phosphate, thomasite, with the fundamental formula $6CaO,P_2O_5; (2FeO,SiO_2)_2$ in which the ferrous silicate may be replaced in all proportions by manganese aluminate or ferrite. It will be observed that in this case the phosphoric acid is hexabasic and that the phosphate does not belong to the above series, but appears to be derived, in fact, from an octophosphate. The author believes thomasite, which occurs in the cryptocrystalline form in large quantities in all basic slags, to be of much greater importance than the other minerals in determining the properties of the slag, forming in fact the mother-mass of the slag itself. The paper is illustrated by photographs of all the phosphates.—W. H. P.

Output of certain minerals and metals in the world. "Mines and Quarries" Report for 1909. [T.R.]

The Colonial and Foreign section of the Mines and Quarries Report for the year 1909 contains a table showing the output of certain minerals and metals (contained in or obtained from ore raised) in the British Empire and in Foreign Countries during 1909, which may be summarised as follows:—

——		United Kingdom.	British Colonies, Dependencies, and Possessions.	Foreign Countries.	Total for the World.
Coal	Metric tons	268,007,257	37,751,869	807,549,260	1,113,308,386
Copper	,,	442	72,262	820,007	892,711
Fine gold	Kilos.	32	395,249	290,748	686,029
Iron	Metric tons	4,879,226	706,843	52,822,822	58,408,891
Lead	,,	22,823	204,468	826,346	1,053,637
Petroleum	,,	—	996,015	38,992,088	39,988,102
Salt	,,	1,851,995	1,506,615	13,860,956	17,219,566
Fine silver	Kilos.	4,421	1,366,199	4,972,251	6,342,971
Tin	Metric tons	5,282	60,049	51,267	116,598
Zinc	,,	3,879	151,066	701,047	855,992

It is important to note that the quantities of iron, and, indeed, the quantities of the other metals included in the above table, are those which are considered obtainable from the ores raised in the countries in question, and must not necessarily be taken as a measure of the metallurgical industries of those countries. The total value of the figures shown in the table may be roughly taken as representing about £865,000,000.

Diamonds and platinum in British Columbia. Rept. of Geol. Survey of Canada for 1910. [T.R.]

Diamonds have recently been discovered in a sample of chromite taken from the peridot of Olivine mountain, situated about 7 miles west of Tulameen village, British Columbia. This is the first recorded discovery of diamonds in Canada either in the solid rock or in placer. In one large sample of the rock which was worked down for diamonds, one or two particles of native gold, and several particles of native platinum were found accompanying the diamond residuum.

Results previously obtained in the course of a search for the original source of the platinum of the Tulameen district, showed that this mineral was often associated with the chromite in appreciable quantity, and in one sample as much as half an ounce to the ton was found. The chromite segregations, however, where they have been observed, are too small and too widely separated throughout the body of the rock to make the extraction of the platinum commercially profitable. The gold is in considerably less quantity than the platinum. The chromite consisted of two portions about equal in amount—one magnetic and the other non-magnetic.

Antidote [Adrenaline] for cyanide poisoning. Jona. *See* XIXb.

Patents.

Steel [armour plates]; Manufacture and treatment of ——. H. A. Richardson, London. Eng. Pats. 13,503, 13,504, 15,173 and 15,174, June 3, 1910.

The patents relate to the manufacture of armour plates from suitable steel alloys containing molybdenum and tungsten, singly or together. It is claimed that, by the ordinary process of cementation and unaided by differential heating, such plates acquire a glass-hard surface which is retained during subsequent heat treatments. In the first, third, and fourth specifications the steels employed contain respectively (1) 1·25 per cent. of molybdenum;

(2) 0·5 of molybdenum and 1·0 of tungsten, and (3) 2·5 of tungsten, in addition to 5 per cent. of nickel and 0·15 of carbon. After the surface has been carburised, a fibrous structure is imparted to the back portion of the plate by re-heating and rapidly cooling once or twice. The temperature of the first re-heating (about 910° C. in each case) is the minimum at which all the carbon in the uncarburised portion is taken up in solid solution, *i.e.*, the minimum temperature at which this portion of the plate will harden on quenching; the temperature of the second re-heating (about 800°, 750° and 700° C., respectively), although below that of the first, is above the minimum at which the carburised portion of the plate would remain hard if quenched or allowed to cool. The plates are quenched in water after the first re-heating and in oil after the second. In the second specification the steel employed contains 0·5 per cent. of molybdenum, 1·0 of tungsten, 4·0 of nickel and 0·3 of carbon; and it is claimed that a glass-hard surface is imparted to the plates by direct cementation without quenching.—W. E. F. P.

Magnetic iron oxide; Process of reducing hematite to ——. S. Lilja, Bayonne, N.J., Assignor to J. W. H. Hamilton, Staten Island, N.Y., and N. V. Hansell, Caldwell, N.J. U.S. Pat. 1,001,536, Aug. 22, 1911.

Non-magnetic iron oxide, such as hematite, is reduced to magnetic iron oxide by grinding it with a sulphur compound of iron or of iron oxide, such as pyrites or pyrrhotite, and heating the mixture to the reaction temperature, whereby a portion of its oxygen content is eliminated as sulphur dioxide.—A. H. C.

Iron alloy for electro-technical applications, and process for its preparation. W. Rübel. Fr. Pat. 429,758, May 16, 1911. Under Int. Conv., Feb. 2, 1911.

An alloy of iron and copper containing not more than 3 per cent. of the latter metal. In its preparation, the iron employed is practically free from phosphorus, silicon and manganese, the remaining impurities not exceeding 0·5 per cent.—W. E. F. P.

Ferro-metals; Method of treating —— [*with titanium*] A. J. Rossi, Niagara Falls, N.Y., Assignor to The Titanium Alloy Manufacturing Co., New York. U.S. Pat. 1,003,805, Sept. 19, 1911.

The addition to molten ferro-metals of titanium alloyed or associated with a ferro-metal, and of ferro-titanium to molten steel or iron is claimed, the proportion used being in all cases sufficient to combine with undesired substances and to leave substantially no titanium in the final product.—B. M. V.

Titanium and nickel alloy; Article composed of —— *and method of producing the same.* A. J. Rossi, Niagara Falls, N.Y., Assignor to The Titanium Alloy Manufacturing Co., New York. U.S. Pat. 1,003,806, Sept. 19, 1911.

An alloy of nickel and titanium is produced by adding titanic acid to a bath of molten nickel in the presence of a reducing agent (*e.g.*, aluminium), the temperature being raised sufficiently to cause reduction of the titanic acid by the aluminium.—B. M. V.

Copper ores; Concentration of ——. Minerals Separation Ltd., London. From H. H. Greenway, Melbourne. Eng. Pat. 18,943. Aug. 11, 1910. Addition to Eng. Pat. 26,852, Dec. 10, 1908 (this J., 1910, 342).

Water containing 0·01 per cent. of the weight of ore of an aromatic hydroxy compound such as phenol or cresol, or of a mixture containing them such as Stockholm tar, is agitated with the finely powdered ore in the proportion of three to four parts of water to one of ore so as to disseminate air throughout the mixture, which is thus agitated to form a froth, and this froth, floating on the surface of the water, contains the metallic sulphides substantially free from gangue. If metallic copper be present, this also separates with the sulphides. No acid is added to the water. The addition of a small quantity of alkali facilitates the formation of the froth.—A. H. C.

Ores; Separation of zinc, copper and other sulphide —— *by magnetic influence.* W. M. Martin, Redruth, Cornwall. Eng. Pat. 19,449, Aug. 19, 1910.

The mixed sulphides especially zinc and copper sulphides, either as an ore or concentrate, are first treated with a solution of an oxidising agent such as sodium nitrate equal to about one per cent. of the ore and then rapidly passed through a revolving calciner the temperature of which varies with the kind of ore. An insoluble oxidising agent such as manganese dioxide may be used. The superficially oxidised product is allowed to cool and then mixed with two per cent. of fine coal dust or hydrocarbon oil and again heated in the calciner in order to impart the magnetic property to the oxidised surface of the ferruginous particles. It is then passed through a magnetic separator of low power.—A. H. C.

Copper-zinc ores; Process for the treatment of sulphuretted —— *in a converter.* D. Korda, Assignor to Soc. Commerciale des Mines, Minerais et Metaux, Paris. U.S. Pat. 1,003,051, Sept. 12, 1911.

The sulphide ore, rich in zinc, is mixed with coke and melted in a converter provided with a lining containing a large proportion of coke. Compressed air, in blasts of progressively increasing pressure, is then injected into the molten mass to which a small quantity of pyrites, containing very little copper and zinc, is added just before the converter is tilted.—W. E. F. P.

Metal strips, foil, sheets or ribbons; Apparatus for making ——. E. H. Strange, London. Eng. Pat. 26,260, Nov. 11, 1910.

In an apparatus of the type in which the molten metal is supplied to the surface of a rotating drum, an even overflow of metal to the latter is maintained by means of a constant level arrangement. The tray from which the metal overflows to the drum is connected from below with a vessel to which a continuous supply of molten metal is maintained, this vessel being provided with an overflow at a suitable level. To ensure regularity in the supply of molten metal to the drum, a float or a fixed body, partly immersed, is suitably disposed within the tray.
—W. E. F. P.

[*Galvanising*] *Metal; Coating metal with* ——. C. F. Burgess, Madison, Wis., U.S.A. Eng. Pat. 5811, March 8, 1911. Under Int. Conv., April 2, 1910.

The metallic coating consists of an alloy of zinc with the metal under treatment and is applied by heating the articles in contact with the granular zinc alloy in any convenient manner. For coating iron and steel, an alloy approximating to the formula $FeZn_{10}$ (prepared from the dross obtained in the hot galvanising process) is employed, the heating being maintained for about two hours at a maximum temperature of 700°—800° F.
—W. E. F. P.

Precious metals; Process for separating —— *from ores.* J. S. Island, Toronto. Eng. Pat. 17,010, July 25, 1911. Addition to Eng. Pat. 13,488 of 1910 (see U.S. Pat. 965,714 of 1910; this J., 1910, 1062).

The silver chloride produced by the process described in the chief patent, after extraction of the salts of other precious metals with water, is leached with a solution of sodium thiosulphate or other suitable solvent.—B. M. V.

Nickel; Process for rendering finely divided catalytic —— *non-pyrophoric and stable.* E. C. Kayser, Assignor to The Procter and Gamble Co., Cincinnati, Ohio. U.S. Pat. 1,001,279, Aug. 22, 1911.

Finely divided nickel is produced from a nickel compound, which may be disseminated through a porous refractory and inert material, by subjecting it at a high temperature to the action of hydrogen, and it is then rendered non-pyrophoric by the action of carbon dioxide whilst still maintaining the temperature and finally cooling it in an atmosphere of carbon dioxide.—A. H. C.

Nickel sulphate solutions; Method of electrolysing ——. H. H. Dow, Midland, Mich., W. S. Gates and A. E. Schaefer, Worthington, Ontario, Assignors to The Ontario Nickel Co., Ltd., Worthington, Canada. U.S. Pat. 1,003,092, Sept. 12, 1911.

NICKEL is recovered by a continuous process from nickel sulphate solutions by electrolysing the liquid, then agitating the resulting acid electrolyte with an excess of a basic nickel precipitate in a vessel apart from the electrolytic cell, "for the purpose of refining and reducing the nickel." The mixture thus formed is settled, and the supernatant neutral electrolyte is separated and returned to the cell to be further electrolysed. The liquid is subsequently treated with the settled basic precipitate separated in the previous operation.—B. N.

Metals from the ores thereof: Process and apparatus for extracting ——. J. H. Robertson, New York, Assignor to Universal Ore Reduction Co., Phœnix, Ariz. U.S. Pat. 1,001,449, Aug. 22, 1911.

A SERIES of short-circuited plates are supported in a suitable tank and a solution containing the finely powdered ore is subjected to the electrolytic effect of the plates while being agitated by steam, whereby the metal is deposited upon one of the surfaces of the plates, whilst the tailings remain in the solution.—A. H. C.

Metal from solutions; Process of extracting ——. E. E. Slaughter, Clifton, Ariz., Assignor to W. L. Austin, Riverside, Cal. U.S. Pat. 1,001,466, Aug. 22, 1911.

WEAK solutions containing copper, such as mine waters, are subjected to the action of iron and carbon closely packed together and the resulting mass containing the precipitated copper is melted in a blast furnace.—A. H. C.

Lead; Process of refining and desilverizing ——. G. P. Hulst, Omaha, Nebr. U.S. Pat. 1,001,525, Aug. 22, 1911.

IMPURE lead or lead bullion is refined and desilverized by crystallizing a portion of the lead from the molten mass and separating the crystals by pressure in a suitable apparatus so arranged that the impure lead may be conducted away from the crystals.—A. H. C.

Separating ores; Apparatus for ——. T. Charlton, Chicago, Ill. U. S. Pat. 1,003,704, Sept. 19, 1911.

THE separation of the ore is effected in a series of upright separator units filled with liquid which may be of lower specific gravity than the ore and substantially non-circulating. The separator units are arranged to move so as to receive unseparated ore and discharge the different materials in the order of their specific gravities at different points. The separated materials may be delivered to a common point and a common mechanism provided for their removal.—B. M. V.

Aluminium articles; Process of treating —— for the formation of galvanic metallic coatings. C. Rümpler. First Addition, dated April 22, 1911, to Fr. Pat. 421,258, Oct. 8, 1910 (see U.S. Pat. 992,600 of 1911; this J., 1911, 753).

THE object is treated with boiling water after leaving each of the baths employed in the process, and at each stage in the deposition of the metallic coating.—W. E. F. P.

Furnace for roasting blende, pyrites, etc. E. C. Bracq. Second Addition, dated April 21, 1911, to Fr. Pat. 426,789, May 11, 1910 (this J., 1911, 1067).

PROVISION is made whereby the water-cooled rabble-arm of the furnace, in addition to moving along the hearth and rotating about its own axis, may be partly or completely withdrawn from contact with the ore at any point in its passage. The charge is advanced either up or down the helical hearth, and external heat is applied when necessary.—W. E. F. P.

Agglomeration of ferruginous and plumbiferous by-products; Process for —— with a view to their ultimate reduction. A. Folliet-Mieusset. First Addition, dated March 24, 1911, to Fr. Pat. 428,570, March 24, 1911 (this J., 1911, 1167).

SULPHIDE ores or products, such as galena, mattes, etc., are added to the charge in quantities corresponding to the amount of available iron oxide present; and a forced draught is employed for the furnace.—W. E. F. P.

Sulphide ores; Treatment of —— by flotation. O. Malkemus and C. Pletsch. Fr. Pat. 429,296, May 5, 1911. Under Int. Conv., Aug. 10, 1910.

A MIXTURE of the finely divided ore with oil is passed into a closed conical receptacle around the upper edge of which a channel is provided for effecting a peripheral discharge of the floated particles. A wide central conduit in which the pipe delivering the ore mixture is situated, extends through the cover to a point just above the conical base with which the receptacle is provided. An atmosphere of carbon dioxide is maintained within the vessel under a slightly reduced pressure, the gas being introduced through the conical base. By means of a bent pipe, extending down the central conduit and joining the ore-supply pipe, the carbon dioxide accumulating above the surface of the liquid (by the flotation of the particles of metallic sulphide) is continuously conveyed to the lower part of the vessel.—W. E. F. P.

Foundry sand; Treatment of ——. Poulson's Foundry Specialities Ltd. Fr. Pat. 429,355, Apr. 5, 1911.

THE treatment consists in the addition (to the used or unused sand) of aluminium sulphate or other aluminous compound, either alone or in conjunction with gelatinous silica or neutral sodium silicate. The aluminium sulphate is either dry-ground and mixed with the sand (water being afterwards added if necessary) or added in the form of an aqueous solution or paste.—W. E. F. P.

Radium; Treatment of complex ores containing ——. S. Radcliff. Fr. Pat. 429,368, Apr. 14, 1911. Under Int. Conv., Feb. 7, 1911.

THE powdered mineral is heated in a reverberatory furnace with 2½ times its weight of acid sodium sulphate, the decomposition being promoted, and the oxidation of the iron effected, by the addition of sodium chloride (from 10 to 15 per cent. of the weight of the ore) to the molten charge. When cold, the mass is powdered, agitated with water, and allowed to settle. From the decanted solution uranium, tantalum, niobium, cerium, thorium, etc., are recovered by ordinary processes; the bulk of the radium remains in the insoluble residue from which it is recovered by the usual means.—W. E. F. P.

Antimony and arsenic; Treatment of sulphide ores of ——, for the extraction of these metals and the separation of precious metals, if present. A. Trifonoff and D. Gardner. Fr. Pat. 429,411, Apr. 24, 1911.

THE ore is heated with sodium sulphate, carbon, iron sulphide (pyrites) and soda with the object of producing a fused mixture of the thio-salt and oxide of antimony (or arsenic) together with a slag containing the iron as ferrous silicate ($2FeO,SiO_2$). After separation from the slag, the mixed thio-salt and oxide is heated with metallic iron and carbon, the reduction being effected in accordance with the equation: $2Na_3SbS_4+Sb_2O_3+3C+5Fe=4Sb+3Na_2S+5FeS+3CO$. The sodium sulphide is leached out with water, the solution being employed for dissolving the sulphide of antimony (or arsenic) from low-grade ores for which fusion is not permissible; the solution of the thio-salt thus obtained is acidified with sulphuric acid, when, after the removal of the precipitated sulphide, a solution of sodium sulphate remains and is evaporated to dryness for use in a subsequent fusion of rich ore. When present in the rich ores, precious metals are concentrated in a small quantity of antimony or arsenic which is added, a little at a time, to the whole molten charge. In the case of low-grade ores, the precious metals remain in the leached residue from the sodium sulphide treatment and are recovered by any convenient method, *e.g.* by means of potassium cyanide.—W. E. F. P.

Tin; Process for the production of metallic ——. Z. Z. Metzl. Fr. Pat. 429,739, May 15, 1911.

Purified tin oxide (cassiterite) is reduced by means of metallic zinc (in the form of powder or shavings), the reaction being similar to that occurring in the aluminothermic process of reduction.—W. E. F. P.

Metals and alloys; Process of producing —— by smelting in electric furnaces. Ampère Ges. m. b. H., Berlin, and E. Müller, Stuttgart, Germany. Eng. Pat. 21,603, Sept. 16, 1910.

See Fr. Pat. 420,954 of 1910; this J., 1911, 431.—T. F. B.

Ores containing gold and silver; Apparatus for dressing ——. C. Giesecke, Brunswick, Germany. U.S. Pat. 1,003,595, Sept. 19, 1911.

See Eng. Pat. 3698 of 1910; this J., 1910, 1063.—T. F. B.

Metallic oxides; Process for the reduction of ——. W. Mathesius, Charlottenburg, Germany. U.S. Pat. 1,003,627, Sept. 19, 1911.

See Fr. Pat. 411,965 of 1910; this J., 1910, 1016.—T. F. B.

Metals; Process for the electrolytic deposition of ——. A. Rodeck, Milan, Italy. U.S. Pat. 1,003,799, Sept. 19, 1911.

See Eng. Pat. 13,808 of 1911; this J., 1911, 1122.—T.F.B.

Ores; Apparatus for concentrating ——. Minerals Separation, Ltd. Fr. Pat. 429,139, April 29, 1911.

See Eng. Pat. 6896 of 1910; this J., 1911, 494.—T. F. B.

Metals; Process for extracting —— by lixiviation. W. Günther. Fr. Pat. 429,319, March 21, 1911.

See Ger. Pat. 237,153 of 1910; this J., 1911, 1122.—T.F.B.

Copper-zinc alloys containing a high percentage of zinc. Allgemeines Deutsches Metallwerk Ges. m. b. H. Fr. Pat. 429,527, May 9, 1911. Under Int. Conv., Jan. 26, 1911.

See Eng. Pat. 12,012 of 1911; this J., 1911, 1167.—T.F.B.

Copper ores; Concentration of ——. Minerals Separation Ltd. Fr. Pat. 429,549, May 9, 1911. Under Int. Conv., Aug. 11, 1910.

See Eng. Pat. 18,943 of 1910; preceding.—T. F. B.

Ores; Method of treating mixed sulphide and oxide ——. C. E. Baker. Fr. Pat. 429,575, May 10, 1911. Under Int. Conv., May 19, 1910.

See U.S. Pat. 972,149 of 1910; this J., 1910, 1256.—T.F.B.

XI.—ELECTRO-CHEMISTRY.

Ozone; Formation of —— during alternating current electrolysis. E. H. Archibald and H. von Wartenberg. Z. Elektrochem., 1911, 17. 812—816.

The yield of ozone in the electrolysis of dilute sulphuric acid may be considerably increased when an alternating current is passed in addition to the direct current. The alternating current apparently acts as a depolariser, and reduces the anode potential to such an extent that the oxygen, separating primarily in the atomic state, is evolved in appreciable quantities in the form of ozone. With the higher potential of direct current electrolysis the atoms are converted to a much greater extent into oxygen molecules. The actual percentage of the anodic oxygen (direct current) which is evolved as ozone, depends on a number of factors. Increase in the concentration of the acid causes this percentage to increase to a maximum and then decrease. The maximum has a greater value the larger the anode. The ozone yield also increases at first as the ratio, alternating current strength : direct current strength, is increased until a maximum is reached, after which a decrease takeaplace. The maximum is more pronounced (*i.e.*, the curve is steeper) the greater the actual direct current, but its absolute value is smaller. The ozone yield can by this method be brought to a very high figure, *e.g.*, in one experiment, 37 per cent. of the oxygen produced by the direct current was evolved as ozone. This figure however does not represent the concentration in ozone of the anode gas which is largely diluted with electrolytic gas produced by the alternating current. It is possible to obtain however a mixture of gases from the anode containing as much as 12 per cent. of ozone. It is probable also that larger anodes (the largest issued by the authors was 0·333 sq. cm.) and greater current strengths would give even better yields.—W. H. P.

Electroplating decorated stoneware. Strahl. *See* VIII.

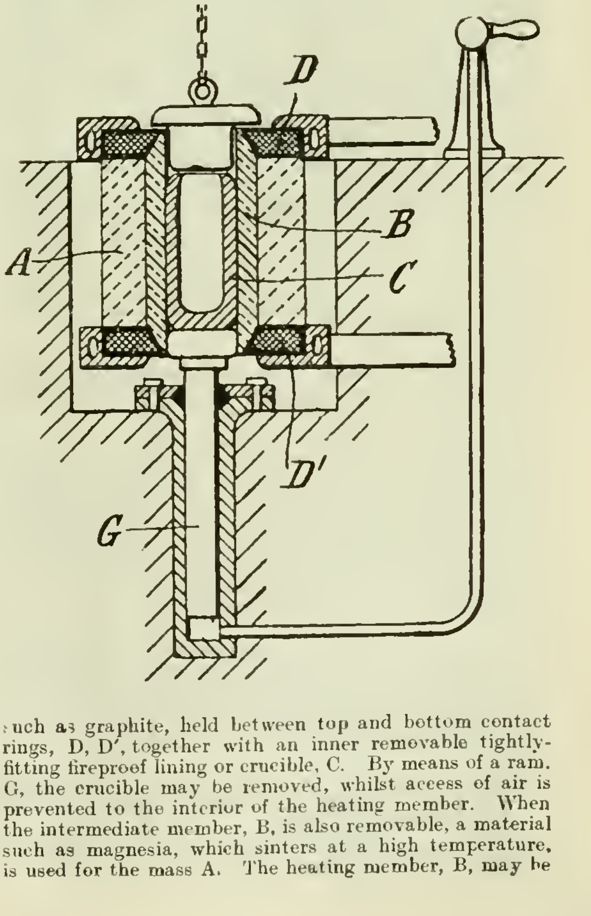
Ozone for water purification. See XIXb.

Ozone for air purification, etc. See XIXb.

Patents.

Furnaces; Electric ——. H. Helberger, Munich, Germany. Eng. Pat. 419, Jan. 6, 1911.

The furnace comprises an outer insulating mass, A, formed of a fireproof non-porous material, and an intermediate heating member, B, formed of oxidisable material such as graphite, held between top and bottom contact rings, D, D′, together with an inner removable tightly-fitting fireproof lining or crucible, C. By means of a ram, G, the crucible may be removed, whilst access of air is prevented to the interior of the heating member. When the intermediate member, B, is also removable, a material such as magnesia, which sinters at a high temperature, is used for the mass A. The heating member, B, may be



furnished with intermediate ribs, provided with contact rings for the employment of a three-phase current, or the heating member may be divided into a number of rings or sections, separated by contact rings, so that the temperature in different parts of the crucible may be varied. To obtain a good fit between the heating member and the crucible, the latter is charged with material and heated to the critical temperature at which it becomes soft, or the crucible may be made *in situ*. In the latter case, a metallic "liner," shaped to the internal form of the crucible required, is placed in position, and the space between the "liner" and heating member is rammed with metallic oxide. At a white heat the oxide sinters, and the metallic liner is melted, the crucible being then easily removed by the ram, G. (Reference is directed to Eng. Pats. 14,516 of 1893 and 5721 and 13,690 of 1905; this J., 1893, 934; 1906, 187, 543.)—B. N.

Furnaces [*for the manufacture of aluminium nitride*]; *Revolving electrical* ——. O. Serpek, Paris. Eng. Pat. 29,715, Dec. 21, 1910. Addition to Eng. Pat. 29,299, Aug. 11, 1910 (this J., 1911, 905).

The diametrical resistance in a revolving electrical furnace, for the manufacture of aluminium nitride, is made in three parts, the central portion having a smaller diameter and constituting the resistance proper. This portion may consist of a homogeneous bar of aluminium nitride and carbon, containing 60 to 80 per cent. of the former substance, or may be heterogeneous in character. In the latter case it may be formed of blocks or elements agglomerated together, or of different sections pressed together by a clamping device which allows of regulation of the pressure.—B. N.

Cell; Electrolytic ——. W. S. Heltzen, Davis, W. Va. U.S. Pat. 1,002,989, Sept. 12, 1911.

The side walls of the cell are provided with horizontal plates, which extend inwards, and have vertical flanges attached to them. The plates are provided with a number of openings, "intermediate their edges," and a "composition filling" on the inner faces of the side walls envelops practically one-half of the plates. A metallic strip rests squarely against the inner edges of the plates, thus bracing them, and a removable diaphragm is secured against the metallic strip. Means are provided for passing an electric current through the diaphragm, the metallic strip, and the contents of the cell. A feed pipe enters the cell at the upper edge and extends to the bottom, the lower end of the pipe being at an angle. An outlet pipe at the opposite end of the cell enters the end wall adjacent to the upper edge of the cell, means being provided for introducing an instrument for the removal of an obstruction from the end of the outlet pipe within the cell.—B. N.

Electrolytic apparatus. L. H. A. B. M. Hazard-Flamand, Boulogne, France, Assignor to International Oxygen Co. U.S. Pat. 1003,456, Sept. 19, 1911.

The apparatus comprises an outer electrode, an inner electrode, and an intermediate absorbent diaphragm, all of which are cup-shaped. A fluid seal is disposed about both sides of the top of the diaphragm, and is composed of an outer seal, and an inner seal consisting of two concentric troughs, one within the other. The electrolyte is fed into the inner trough, passes thence to the outer trough, and is delivered from the latter on both sides of the diaphragm.—B. M. V.

Gases; Impts. in, and apparatus for, the electrical purification of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 30,194, Dec. 29, 1910.

See Fr. Pat. 425,593 of 1911; this J., 1911, 906.—T. F. B.

Resistance-furnace; Continuously-operating high-temperature ——. V, Popp and A. Minet, Paris. U.S. Pat. 1,003,789, Sept. 19, 1911.

See Addition of May 6, 1910, to Fr. Pat. 409,244 of 1909; this J., 1911, 36.—T. F. B.

Electrodes for electric furnaces. The Shawinigan Carbide Co., Ltd. Fr. Pat. 428,863, April 24, 1911.

See Eng. Pat. 9633 of 1911; this J., 1911, 1070.—T. F. B.

[*Electrolytic*] *Production of hypophosphoric acid and hypophosphates.* Eng. Pat. 14,420. *See* VII.

Producing oxides of nitrogen. Eng. Pat. 24,607. *See* VII.

Electrolytic process of treating alkaline compounds. U.S. Pat. 1,003,041. *See* VII.

Lacquering, covering, or enamelling metal wires or bands. Fr. Pat. 429,528. *See* VIII.

XII.—FATS; OILS; WAXES.

Cocoanut palm; Culture of the ——. H. Zaepernick. Beihefte zum Tropenpflanzer, **1911, 12,** 509—611.

The author gives a detailed account of the cultivation of the cocoanut palm, including preparation of the soil and manuring; and also a chapter on the preparation of the copra.—A. S.

Propolis. K. Dieterich. Z. angew. Chem., **1911, 24,** 1854—1855.

Further investigation has shown that the crude propolis resin separated as described previously (this J., 1910, 1213) consists of about 20 per cent. of tannin substances, 1 per cent. of proporesene (insoluble in cold alcohol), 1 per cent. of α-proporesin (insoluble in ether), 4 per cent. of β-proporesin (insoluble in chloroform), traces of free resin-acid, 70 per cent. of pure propolis resin, which is probably a resinotannol ester of a resin acid, and 3·5 per cent. of oxidation products of the tannins, such as phlobaphenes, etc. The sintering and melting points of proporesene and α- and β-proporesin are respectively: 76° and about 83° C., 182° and about 187° C., and 88°—90° and 124°—125° C. The pure propolis resin is soluble in ether, alcohol and chloroform, but nearly insoluble in light petroleum, and only partly soluble in carbon bisulphide. Propolis contains small quantities of gum and of vanillin and other aldehydic substances, the latter being found mainly in the balsam. The author was unable to detect cinnamic acid in propolis balsam (compare Küstenmacher, this J., 1911, 293).—A. S.

Determination of small quantities of water in lard. Polenske. *See* XIXA.

Catalytic reductions. Skita. *See* XX.

Patents.

Wax of all kinds; Process for purifying and bleaching —— *and process for bleaching solid and semi-solid fats of all kinds.* Richter und Richter and L. von Orth, Berlin. Eng. Pats. 20,649, Sept. 5, 1910 (Under Int. Conv., Dec. 23, 1909) and 20,650, Sept. 5, 1910 (Under Int. Conv., May 10. 1910).

The wax or fat is treated in the melted condition, or in solution, with aluminium oxide obtained by exposing aluminium amalgam to moist air and converting the resulting hydroxide into oxide. The material may be filtered through a layer of the oxide, preferably heated, or it may be mixed with the oxide, which is subsequently separated by sedimentation or filtration.—C. A. M.

Nozzles for mixing. Eng. Pat. 15,808. *See* I.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Ink-forming substances ; Preparation of —— [*from benzene derivatives*]. A. Fiechter. Chem.-Zeit., 1911, **35**, 1066.

The author has previously shown that by heating certain benzene derivatives with sulphuric acid and sulphur, good yields of substances are obtained which form inks on dissolving in alkaline solutions (this J., 1911, 203). The product thus obtained from aniline can also be used for the preparation of polishes for leather, spirit lacquer for wood, metal and leather, and printers' ink.—A. Seld.

Patents.

Lac ; Treatment of ——. W. A. Freymuth, London. Eng. Pat. 20,655, Sept. 5, 1910.

The cleansed lac is pressed in a melted or semi-melted condition between two hot steel or metal plates, which are then drawn apart, with the result that the lac is drawn out into fine threads ("silk lac") which cool and solidify rapidly, may be immediately packed, and do not become "blocky." In the apparatus claimed for the process, means are provided for heating one or both plates to 50°—100° C., for moving one or both plates, and for removing the strands of lac.—C. A. M.

Metal surfaces ; Blacking or dressing for ——. D. R. Franklin, Assignor to S. Brixby and Co., New York. U.S. Pat. 1,001,381, Aug. 22, 1911.

A mixture containing either cobalt in a form capable of being changed into black oxide of cobalt by heating below 400° F. (210° C.) or an emulsion of a compound of cobalt capable of being similarly changed at a temperature of about 325° F. (163° C.) and a black filler such as graphite is used as a blacking or dressing for iron surfaces. —A. H. C.

Enamelling metal wires or bands ; Process and apparatus for lacquering, covering or ——. A. Costar, D. Bates, and British Insulated and Helsby Cables, Ltd. Fr. Pat. 429,528, May 9, 1911. Under Int. Conv., Nov. 10, 1910.

Metal wires (or bands) are provided with an insulating coating by passing them through a liquid enamel and then through tubes heated externally by gases going in the opposite direction to the metal. The wire may then be passed through a cooling chamber, and the process be repeated several times. The temperature of the tubes is regulated by admission of air. A regulator also equalises the amount of enamel on the wire as it passes through the tube, which, to prevent admission of air inside the tube, is made to plunge beneath the layer of the liquid enamel.—H. H. S.

Resins ; Solution of —— *and the process of manufacturing same.* A. Hesse, Wilmersdorf, Germany. U.S. Pat. 1,003,741, Sept. 19, 1911.

See Ger. Pat. 227,667 of 1909 ; this J., 1910, 1398.—T. F. B.

Printing ink and similar materials ; Manufacture of ——. R. C. Child. Fr. Pat. 429,449, May 6, 1911.

See Eng. Pat. 7722 of 1910 ; this J., 1911, 1023.—T. F. B.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

(*Parthenium argentatum Gray*) *Guayule rubber plant ; The constituents of* ——. P. Alexander. Ber., 1911, **44**, 2320—2328.

The average weight of a single Guayule plant (*Parthenium argentatum* Gray) is about 250 grms. The dry plant yields 8—10 per cent. of rubber substance. About 75 per cent. of this is a hydrocarbon with the composition $(C_5H_8)_n$. When the dry plant was exhausted with acetone, a dark-green extract was obtained, which consisted for the most part of hydrolysable constituents. An acid belonging to the cinnamic acid series was isolated ; it melted at 119° C. Phenylacetic acid, m. pt. 79° C., was obtained from rubber which had been produced by treating the plant with alkali. The acetone extract was subjected to prolonged distillation with steam, when a crystalline sesquiterpene alcohol, $C_{15}H_{24}O$, was obtained, melting at 127°—128° C. The plant contains 1·5—4·0 per cent. of an essential oil, having a characteristic odour suggestive of pepper. The oil is slightly lævo-rotatory and has the sp. gr. 0·8861 at 15° C. It consists entirely of hydrocarbons. Amongst these were pinene, and a sesquiterpene, boiling between 130° and 140° C. at 17 mm., with the sp. gr. 0·9349 at 15° C., and $[\alpha]_D = -21° 24'$ at 16° C. The oil obtained from plants which had been dried and stored for a number of years, gave indications of oxidation having taken place. The essential oil is a drawback as it prevents the proper vulcanisation of the rubber. For the extraction of the rubber, the alkali process is the most advantageous, since a considerable amount of the oil escapes during the heating. Young plants contain a smaller proportion of this oil.—F. Shdn.

Rubber ; Artificial ——. O. Silberrad. Gummi-Zeit., 1911, **25**, 1958—1960.

The author summarises the present position with regard to synthetic rubber and rubber-like compounds (see also this J., 1911, 1073). The reaction according to which isoprene is produced by passing turpentine vapour through a heated tube is one which is accompanied by a considerable increase in volume, and it has been found that by carrying out the process under reduced pressure an increase in the yield of isoprene is effected. Moreover the reduction of pressure is instrumental in limiting the extent of condensation of isoprene into dipentene, a change which is accompanied by diminution in volume. In considering the cost of manufacture of isoprene from turpentine the value of by-products must be taken into account. The product of the polymerisation of isoprene is described as similar to a soft *Castilloa* rubber. The author describes also a substance—pyrido-caoutchouc—analogous to caoutchouc, obtained by polymerising acroleinmethylamine, prepared by bringing methylamine, under suitable conditions, in contact with acrolein. Pyrido-caoutchouc has apparently the constitution :—

$$\underline{CH : CH.CH_2.N(CH_3).CH : CH.CH_2.N}(CH_3).$$—E. W. L.

Rubber goods ; Determination of antimony in ——. W. Schmitz. Gummi-Zeit., 1911, **25**, 1928—1930.

From 2 to 4 grms. of the finely rasped rubber are placed in a Kjeldahl flask of about 300 c.c. capacity, and covered with concentrated sulphuric acid (13—15 c.c. for each grm. of sample). A small drop of mercury is added (0·1 grm.) together with a piece of paraffin wax, the size of a pea, to prevent frothing. The flask is heated on a sand bath until the contents have become quite liquid and the lower layers begin to clear. It is then allowed to cool, 2 to 4 grms. of potassium sulphate are added and the flask is again heated for a few hours until the solution becomes colourless. The solution is allowed to cool and diluted with water, when the mercury separates as a turbidity. 1 to 2 grms. of potassium metabisulphite are added (to reduce the mercury to the metallic state) together with excess of tartaric acid, and the highly diluted solution heated until sulphur dioxide is no longer evolved. A few c.c. of dilute hydrochloric acid are added, the volume made up to 200 c.c., and the solution filtered through a dry filter. 195 c.c. are then titrated either with iodine and thiosulphate or with potassium bromate. (1) *The iodometric method* depends upon the following reaction : $2Sb_2O_3 + 8NaHCO_3 + 4I_2 = 2Sb_2O_5 + 8NaI + 8CO_2 + 4H_2O$. Rohmer's method (this J., 1901, 749) is recommended. The presence of tin affects the accuracy of this method. When potassium bromate is used, the solution of antimony trioxide, acidified with 10 per cent. hydrochloric acid, is titrated with $N/10$ potassium bromate, using methyl orange as indicator. The end point is reached when the pink colour is destroyed, and it is sharper if the titration be carried out hot. The presence of tin, and of large quantities of copper and iron, is detrimental.—E. W. L.

Patents.

Waste rubber or the like; Manufacture of articles from ——. H. H. Tarver, Branstone, Staffs. Eng. Pat. 21,074, Sept. 10, 1910.

More or less finely divided waste rubber is mixed with 2·5 per cent. of its weight of turpentine, or similar solvent, and is then heated for 15 minutes in a closed receptacle at 247° F.; the mass may now be rolled into sheets or pressed into moulds. Instead of adding the solvent to the waste rubber, the latter may treated with the vapour of the solvent, or the waste rubber, after the addition of turpentine, may be passed between heated rollers. Sulphur may also be added in order to produce hard rubber, vulcanite, etc.—W. P. S.

Rubber trees and similar plants; Process for treating the latex of ——. R. Rankin. Fr. Pat. 428,861, April 24, 1911. Under Int. Conv., April 25, 1910.

See Eng. Pat. 10,056 of 1910; this J., 1911, 968.—T. F. B.

Manufacture of isoprene. Eng. Pat. 975. *See* XX.

XV.—LEATHER; BONE; HORN; GLUE.

Tanning extracts; The microscopical examination of ——. G. Grasser. Collegium, 1911, 349—355.

Most of the commercial fluid tanning extracts deposit, on standing, an insoluble residue which, besides phlobaphenes, contains particles of resin and fragments of organised vegetable matter. Still more residue is deposited from solid extracts after dissolving and allowing to stand. The microscopical examination of this insoluble residue affords valuable information on the origin of the extract. Solid extracts were powdered and dissolved in hot water to a thin fluid extract. These solutions or the original fluid extract were placed in tall narrow cylinders and allowed to stand for several days. Some extracts, especially those which have been decolourised, contain very little insoluble matter and require longer standing. Settling may be accelerated by adding water until the solution becomes turbid, when all the impurities are carried down by the precipitated phlobaphenes and sparingly soluble tannins. The residue is removed from the solution and treated with 1 per cent. sodium carbonate solution in which all material except the organised vegetable matter is dissolved. This is again caused to separate by centrifuging, with or without the addition of more water. The alkali solution must not be too strong or allowed to act too long, or the vegetable organism will be swollen and destroyed. The matter is then cleared with a small quantity of a 0·25 per cent. oxalic acid solution, placed on a slide and examined under the microscope after covering with a cover glass. Many tanning materials show quite characteristic remains and should be easily identified by this method. Diagrams are given of the characteristic structures of the residues found in extracts made from quebracho, divi divi, myrobalans, mimosa and mangrove.—D. J. L.

Benzoyl chloride and potassium cyanide; Action of —— on benzoylhydroxybenzoic acids and on acylated hydroxybenzoyl-hydroxybenzoic acids. F. Francis and M. Nierenstein. Collegium, 1911, 335—345.

Francis and Davis (Chem. Soc. Trans., 1909, **95**, 1404) have shown that the action of acyl chlorides and potassium cyanide in aqueous solution upon aldehydes results in the formation of acylaldehyde-cyanhydrins:—

$$R{\cdot}CHO + AcCl + KCN = R.CH(OAc)CN + KCl.$$

The reaction with hydroxybenzoyloxybenzoic acids is of interest, as compounds are produced analogous to galloylgallic (digallic) acid isolated by Nierenstein from mixed tannins. The reaction is as follows:—

$$Ac{\cdot}O{\cdot}R{\cdot}CO{\cdot}O{\cdot}R_1.COOH + C_6H_5CO{\cdot}Cl + KCN = AcO{\cdot}R{\cdot}CO{\cdot}CN + C_6H_5{\cdot}CO{\cdot}O{\cdot}R_1{\cdot}COOH + KCl.$$

Thus *p*-carbethoxybenzoyl-*p*-hydroxybenzoic acid yields, by the action of benzoyl chloride and potassium cyanide, *p*-carbethoxybenzoylcyanide and *p*-benzoyloxybenzoic acid. The reaction proceeded as above with the following acids:—*m*-nitrobenzoyl-*m*-hydroxybenzoic acid, *m*-nitrobenzoyl-*p*-hydroxybenzoic acid, *m*-nitro-*p*-carbethoxybenzoyl-*p*-hydroxybenzoic acid, dicarbethoxyprotocatechuyl-*o*-nitrosalicylic acid, *p*-carbethoxybenzoyl-*p*-nitrosalicylic acid, pentacetylgalloylgallic acid. The reaction did not take place in the case of the following acids: benzoyl-*p*-hydroxybenzoic acid, *p*-carbethoxybenzoyl-*p*-hydroxybenzoic acid, *p*-carbethoxybenzoyl-*m*-hydroxybenzoic acid, dicarbomethoxyprotocatechuyl-*p*-hydroxybenzoic acid, dicarbomethoxy-*β*-resorcyl-*p*-hydroxy-*m*-nitrobenzoic acid. The use of the carb-alkyloxy-derivatives of the tannins for this reaction should yield valuable results as these derivatives have served so well in the isolation of digallic acid and ellagitannic acid by Nierenstein (Collegium, 1910, 213, 265). Some preliminary experiments with quebracho-tannic acid which is a derivative of resorcylic and isovanillic acid have given favourable results.—D. J. L.

Carbomethoxy-derivatives of phenolcarboxylic acids and their application in syntheses. V. [Preparation of crystallised digallic acid.] E. Fischer and K. Freudenberg. Annalen, 1911, **384**, 225—244.

The authors have succeeded in obtaining crystallised digallic acid by combining dicarbomethoxygallic acid and tricarbomethoxygalloyl chloride in alkaline solution and hydrolysing the resulting product. It melts at about 275° (corr. 282° C.), with decomposition, and is much less readily soluble than gallic acid in water; from warm water it crystallises in fine needles. It dissolves easily in methyl alcohol, less readily in ethyl alcohol and acetone. Diprotocatechuic acid, digentisinic acid, and di-*p*-resorcylic acid were prepared in an analogous manner. All four products (to which the general name "didepsides" is given) give characteristic colourations with ferric chloride solution, and precipitates with solutions of gelatin and of quinine acetate. The use of carbomethoxy-derivatives promises to be of value for the synthesis of tannins.—A. S.

Patents.

Leather; Artificial ——. E. Reidel, Mannheim, Germany. Eng. Pat. 15,761, July 6, 1911.

Animal fibres, prepared from tendons, sinews, and waste products by drying, pressing and shredding, are interwoven with filaments of hemp, tow, flax, jute, etc., into a mat. The mat is immersed in solutions of acids or alkalis to swell the fibres, pressed into a solid piece and subjected to the action of a tanning liquor and finally dried. Before the pressing, blood, globulin, or fibrin is incorporated with the material to make it of a firmer texture, and the flexibility is increased by addition of soap solution or an emulsion of ceresin or paraffin. —J. R. B.

Hides and skins; Treatment of —— for the manufacture of leather. O. Röhm, Darmstadt, Germany. Eng. Pat. 18,770, Aug. 21, 1911. Under Int. Conv., Dec. 22, 1910.

The use of tryptases for the removal of hair and dirt from hides and skins is claimed. The hides are immersed in a solution of a tryptase, *e.g.*, pancreas-tryptase for one or two days. A preliminary treatment with alkali is advantageous.—T. R. B.

Glue and the like; Manufacture of ——. Conway, Baron von Girsewald, Berlin. Eng. Pat. 12,566, May 24, 1911. Under Int. Conv., Jan. 17, 1911.

The crude materials from which the glue is made, *viz.*, bones, are subjected for a relatively short time to the action of steam at a comparatively high pressure, and afterwards by suddenly reducing the pressure to below that of the atmosphere and simultaneously admitting small quantities of steam, the temperature is caused to fall rapidly, so that injury to the glue is minimised. The action is more intense but shorter, and the product is of a finer quality than that obtained by long heating. Steam at a pressure of two and a half atmospheres is used at the outset of the operation, but for a period of only 10—15 minutes. The steam which is admitted into the chamber supplies the water required for the formation of the glue solution.—J. R. B.

Tanning drums ; Means for driving ——. G. B. M. Spigno, Genoa, Italy. Eng. Pat. 9253, April 13, 1911.

See Fr. Pat. 424,632 of 1911 ; this J., 1911, 759.—T. F. B.

Hides ; Process of bating ——. O. Röhm, Darmstadt, Germany. U.S. Pat. 1,003,124, Sept. 12, 1911.

See Eng. Pat. 18,770 of 1911 ; preceding.—T. F. B.

Glue and the like ; Process for finishing ——. H. Schimmel. Fr. Pat. 428,986, April 27, 1911. Under Int. Conv., May 31, 1910.

See Ger. Pat. 232,715 of 1910 ; this J., 1911, 638.—T. F. B.

Horn ; Process for preparing a substance resembling ——. A. Bartels. Second Addition, dated April 6, 1911, to Fr. Pat. 420,543, Sept. 19, 1910.

See Eng. Pat. 8318 of 1911 ; this J., 1911, 1023.—T. F. B.

Manufacture of moulded or compressed articles from peat. Eng. Pats. 1046 and 3130. *See* V.

XVI.—SOILS ; FERTILISERS.

"Norwegian saltpetre" [calcium nitrate] and "nitrolim" and "Stickstoffkalk" [crude calcium cyanamide] ; Analysis of ——. E. Dinslage. Chem.-Zeit., 1911, **35**, 1045—1046.

Calcium nitrate. The quantity of water present in this substance can be determined rapidly by heating a portion of the sample in a porcelain crucible over a small gas burner, care being taken that the temperature is not high enough to decompose the nitrate ; the results obtained agree well with those found by mixing the substance with sand and drying the mixture at 105° C. The nitric nitrogen may be determined by the usual methods and the nitrite by titration with permanganate. *Nitrolim* (crude calcium cyanide). The total nitrogen is determined most accurately by boiling 1 grm. of the substance with 30 c.c. of a mixture of equal volumes of sulphuric acid and water ; a drop of mercury is also added and the boiling is continued for 2 hours. The ammonia formed is then distilled in the usual way. When concentrated sulphuric acid is employed there is a tendency to loss of nitrogen. "*Stickstoffkalk.*" This substance is very similar to nitrolim but contains about 3·75 per cent. of chlorine and a quantity (about 6 per cent.) of tar oils. The methods employed for the analysis of nitrolim may be used for its analysis.—W. P. S.

Chlorine ; Function of —— *in the growth of plants.* P. Koenig. Z. angew. Chem., 1911, **24**, 1852—1853.

Comparative experiments during 1910 and 1911 with about 1000 buckwheat plants (in three generations) in soils and nutrient solutions, in some cases containing chlorides and in others not, have shown that chlorine is not an indispensable element for the growth of plants. Buckwheat can be grown, from germination up to seed production, in solutions free from chlorides. Up to a certain concentration, varying according to the kind of plant and character of soil, chlorides act as stimulants, but at higher concentrations they act as plant-poisons.—A. S.

Phosphates in basic slag. Kroll. *See* X.

Volumetric determination of precipitates of magnesium ammonium phosphate and ammonium phosphomolybdate. Hundeshagen. *See* XXIII.

Patents.

Superphosphate ; Process of making ——. R. Williams, Birmingham, Ala. U.S. Pat. 1,003,681, Sept. 19, 1911.

Ground phosphate rock is treated with a quantity of sulphuric acid just sufficient to convert the tri-calcium phosphate into soluble calcium phosphate. The acid is cooled to a low temperature before use, and the mixture of acid and phosphate is cooled during the process.—A. S.

Superphosphates ; Appliance for the treatment of materials such as ——. J. Parent. Fr. Pat. 427,949, March 30, 1911.

The superphosphate reaction chamber consists of a horizontal, cylindrical vessel provided with one removable end and a removable bottom plate, which forms the floor, and separates the cylinder from an underlying trough. When a suitable mass of superphosphate has been prepared in the cylinder, the movable end and the bottom plate are withdrawn, and a trolley carrying a rotating shaft, slightly inclined to the horizontal and fitted with a number of radial arms, carrying a series of knives, is made to proceed into the cylinder. The rotating knives disintegrate the mass of superphosphate and the fragments fall into the trough, below the chamber, where a travelling band conveys the material to a desired place. The shaft and the radial arms are preferably made hollow, so as to be able to convey air over the treated mass and thereby dry it.—O. R.

XVII.—SUGARS ; STARCHES ; GUMS.

Sugar ; Viscosity of solutions of ——. P. Orth. Bull. Assoc. Chim. Sucr., 1911, **29**, 137—148.

It is generally thought that the increase of viscosity is the principal cause of the gradual decrease in the rate of crystallisation of the massecuite in the sugar factory. The author has determined the viscosity, as compared with water at 20° C., of solutions of : (*a*) pure sugar ; (*b*) first massecuite ; and (*c*) the mother-liquor from second massecuite, using temperatures from 17° to 89° C. From the tabulated results, it is shown that with each of the three solutions examined, the increase of the viscosity with decrease of temperature is very rapid, especially when the temperature is high. The viscosity of the non-sugar is, on the average, 96 per cent. of that of pure sugar, and is slightly higher at the lower than at the higher temperatures and concentrations. It is incorrect to compare the viscosity of different factory products on the basis of the apparent dry substance, *i.e.*, on the degree Brix ; a correct comparison can only be made in terms of real dry substance, especially when the concentration is high. Mathematically, the viscosity of sugar solutions may be expressed by the equations : $\log.(\log. v) = 0{\cdot}069498 - 2 + 0{\cdot}03381935(x+Kn) - 0{\cdot}009818782t$; and $100K = 156{\cdot}89 - 0{\cdot}81586m + (0{\cdot}0187228m - 1{\cdot}38441)t$; in which v is the viscosity of the sugar solution, that of distilled water at 20° C. being $=1$; x the percentage of sugar, obtained by the double polarisation method ; $n =$ the percentage of non-sugar ; K is a coefficient corresponding to the viscosity of the non-sugar ; $m =$ the percentage of real dry substance ; and $t =$ the temperature of the solutions. Both of these equations are applicable to concentrations between 60 and 82 per cent. of dry substance, and temperatures from 20° to 90° C. ; but the equation for 100K only holds for the three sugar products examined.—J. P. O.

Glucose (starch syrup); The so-called "gallisin" [glucosin] occurring in commercial liquid ——. J. Gatterbauer. Z. Unters. Nahr. Genussm., 1911, **22**, 265—290.

The portion of starch syrup which is not readily fermentable consists of a small quantity of maltose and a new carbohydrate having the composition of a disaccharide; this substance is an isomeride of maltose, yields only dextrose on hydrolysis, and has been termed "glucosin." It is an amorphous substance and is obtained from completely fermented starch syrup as a thick, viscous syrup. Treatment with a mixture of absolute alcohol and ether converts it into a yellowish-white powder. When the powder has been completely freed from alcohol by drying under reduced pressure, it has a specific rotation of about +100°; it is converted by yeast-maltase and by emulsin into dextrose, and is fermented slowly by beer-yeast. Mineral acids and oxalic acid convert it into dextrose, but at high concentrations of the acids, the reaction is reversible. The phenylosazone of "glucosin" is red-brown in colour, readily soluble in hot water and in alcohol and melts at 97°—100° C.; its alcoholic solution is slightly dextro-rotatory. The *p*-nitrophenylosazone consists of a red, amorphous powder melting at 240° C., and yields a blue colouration when treated with sodium hydroxide. "Glucosin" forms esters with benzoyl chloride, *m*-nitrobenzoyl chloride, *p*-chlorobenzoyl chloride, and benzene sulphochloride. The formation of "glucosin" is due to the action of acids on dextrose during the manufacture of starch syrup.—W. P. S.

Glucose (starch syrup); Determination of sulphurous acid in liquid ——. O. Claassen. Chem.-Zeit., 1911, **35**. 1065—1066.

The author's experiments show that the usual addition of calcium carbonate to the glucose, before acidifying with phosphoric acid and distilling the sulphurous acid into a solution of iodine in potassium iodide is unnecessary; similar results were obtained by distillation carried out without evolution of carbon dioxide. It is also stated that acetic acid can be substituted for phosphoric acid without appreciably affecting the result.—A. Sbld.

Honey; The acids in ——. A. Heiduschka. Chem.-Zeit., 1911, **35**, 1104—1105.

The author has determined the volatile and other acids in a number of samples of honey. The formic acid was determined as described previously (this J., 1911, 565), and malic and lactic acids by a method similar to that used for the determination of the acids in wine (this J., 1907, 1155). Only traces of oxalic acid were present, and tartaric and succinic acids could not be detected with certainty. In eight samples of honey the amounts of the different acids found in 100 grms. were as follow, the figures representing c.c. of $N/10$ potassium hydroxide necessary for neutralisation:—total acids, 12·0—20·2; volatile acids, 1·6—1·9; formic acid by mercuric chloride method (*loc. cit.*) 0·46—1·37; formic acid by carbon monoxide method (*loc. cit.*), 0·41—1·20; lactic acid, 2·2—2·8; malic acid, 0·19—0·45; and phosphoric acid (grms. of phosphoric anhydride), 0·025—0·032.—A. S.

Determination of water in various substances [starch]. Zerewitinoff. *See* XXIII.

Patent.

[*Caramel*] *Organic colouring matter from carbohydrates and the like; Manufacture of* ——. M. Wechsler, London. Eng. Pat. 13,225, May 31, 1910.

Caramel or caramel substitute is prepared by heating a carbohydrate such as grape sugar to about 107° C., adding 7½ per cent. of ammonia solution (sp. gr. 0·880), raising the temperature to about 119° C. for about half an hour, then cooling to 107° C. and adding 4 per cent. of ammonia solution and raising to 119° C. for about 15 minutes, then cooling again to 107° C. and adding 3½ per cent. of ammonia solution and raising to the above temperature again for about 10 minutes.—J. C. C.

XVIII.—FERMENTATION INDUSTRIES.

Malts prepared from the same barley with different periods of flooring; Influence of the fineness of the grist and different mashing processes on the yield of extract from ——. C. Bleisch and H. Leberle. Z. ges. Brauw., 1911, **34**, 485—490.

The authors have determined the yields of extract obtainable both with coarse and fine grists, from 4½, 5½, 6½, and 7½ day malts; the mashing methods used were the ordinary laboratory method, and those involving peptonisation (the mash being allowed to stand for 1 hour at 57·5°—60° C.), digestion (the mixture of grist and water being allowed to stand overnight), and heating under pressure (15 minutes at 2 atmospheres). It is found that the maximum yield of extract is obtainable, not at the end of the normal flooring period (7 days) but one day earlier. The advantage of the shorter flooring, however, is less than it would seem, since, with inadequate means of draining the wort, it is often more difficult to filter the mash prepared from the shorter grown malt than that prepared from malt that has been floored for a longer time. Fine grinding is an important means of increasing the yield of extract from short-floored malt; the difference between the yields of extract obtainable from fine and coarse grist is considerable (*e.g.*, about 3·5 per cent. with 4½ day malt) with the ordinary method of mashing; the influence of fine grinding is less with the peptonisation method, still less with the digestion method and least with the pressure method. In general, of the methods used by the authors, that of heating under pressure is the best for obtaining the maximum yield of extract from short-floored malt, the yield being practically the same as that obtained from normal malt, without taking into account the reduced malting loss due to the short flooring. It is shown that (under German fiscal conditions) a saving of 2·5 per cent. in the malting loss is practically balanced by a loss of 1 per cent. of extract, though in this estimate no account is taken of the increased capacity of the malt floor and the saving of labour, due to the shorter flooring. The authors refer to the Kropff method of malting (Z. ges. Brauw., 1911, **34**, 209) in which the grain is floored for the normal time but, owing to the high content of carbon dioxide in the couches, the malting loss is reduced by 2·5 or 3 per cent.; floor-space and labour are also saved, and the process deserves investigation.—L. E.

Hops; Valuation of —— *by analysis.* E. Moufang and A. Scheer. Woch. Brau., 1911, **28**, 449—452.

The authors give the results of investigations on the determination of the extract of hops. A special straining vessel for holding the finely ground hops during mashing was used. This vessel, holding 20—25 grms. of material, is made of perforated sheet nickel, and is fitted with a vertical rod, the lower end of which is fixed to the bottom of the vessel. A perforated cover fits the interior of the vessel and is provided with a collar which slides on the rod. The cover thus serves to press the hops after extraction, and the vessel serves to stir the mashing water. It is found that the best results (*i.e.*, the maximum yields of extract) are obtained by mashing 20 grms. of the finely divided hops with 265 c.c. of water, at a temperature of 90° C. for 55—60 minutes; to allow for loss by evaporation, about 40 c.c. of water should be added during mashing. The amount of water used to make up the weight of the cooled mash must not exceed 3—5 grms., and it seems advantageous to add only enough water to complete the weight to the next gram. Prior to analysis, the hops should be freed from stalks and foreign impurities, and thoroughly divided. The limit of error in the determination is about 0·2—0·3 per cent. Analyses of a number of hops from various sources showed that the extract-contents ranged from 28·76 to 36·25 per cent., and corresponded closely with the price of the hops. In conjunction with the determination of extract, the aroma and colour of the hops may also be judged by the above method.—L. E.

Yeast; Behaviour of —— under practical conditions, in relation to its chemical and physiological properties. F. Schönfeld and W. Hirt. Woch. Brau., 1911, **28**, 421—422, 436—438.

The authors collate the results of investigations made by themselves and others, on the chemical composition, physical and physiological properties of the yeasts D and K of the *Versuchs- und Lehrbrauerei.* Yeast K possesses high attenuating power, and retains this characteristic very tenaciously; the attenuating power of yeast D is normally medium, but is easily altered under certain conditions. During the period covered by the investigations (1906—1911), the protein-content of yeast D ranged between 51·6 and 61·2, and that of yeast K between 55·4 and 64·9 per cent.; in each investigation, yeast K was found, on the average, to contain more protein than yeast D, the average difference, taking the investigations as a whole, being about 4 per cent. The ash-content of yeast D ranged between 6·2 and 8·4, and that of yeast K between 6·7 and 8·9 per cent.; in each investigation, yeast K was found, on the average, to contain more ash than yeast D, the average difference, taking the investigations as a whole, being about 0·8 per cent. In the case of yeast D, the total phosphoric acid-content ranged between 3·5 and 4·35, referred to dry substance, and between 51·3 and 59·91 per cent. referred to ash; in the case of yeast K, the corresponding values ranged between 3·9 and 5·29 and between 48·7 and 60·67 per cent. Referred to dry substance, the average phosphoric acid-content was higher with yeast K than with yeast D, in the investigations both individually and collectively; referred to ash, however, the phosphoric acid-content was higher sometimes with yeast K and sometimes with yeast D, being slightly greater, on the whole, with the latter yeast. In the investigations as a whole, yeast K proved to possess a higher specific gravity (of pressed yeast and of dry substance) than yeast D, though in one investigation the reverse was the case, and it was also found that the yeast of higher specific gravity subsided from suspension more readily than the other. The working power of yeast K was higher than that of yeast D; both yeasts showed a higher working power at 35° than at 40° C., and a higher working power at the latter temperature than at 30° C. It may be concluded, though not with absolute certainty, that the observed variations and differences in the chemical and physiological properties are due to special racial characteristics, and it is suggested, with a strong reservation, that the observed properties of the yeasts D and K are, in general, characteristic of yeasts of low and high attenuating powers respectively.—L. E.

Formic acid; Formation and fermentation of —— by yeast. H. Franzen. Chem.-Zeit., 1911, **35**, 1097.

In the fermentation of sugar by yeast, considerable quantities of formic acid are formed. Also, yeasts are able to ferment formic acid, added in the form of sodium formate, so that the amount of formic acid found in a solution after fermentation has proceeded for some time, represents the difference between the amounts formed and decomposed. The formation and decomposition of formic acid are enzymic processes, for they can be effected with expressed yeast juice. The author's results are in accord with Schade's view that formic acid is an intermediate product of alcoholic fermentation (this J., 1906, 112).—A. S.

The so-called "gallisin" [glucosin] in commercial starch syrup. Gatterbauer. *See* XVII.

XIXa.—FOODS.

Lard; Determination of small quantities of water in ——. E. Polenske. Untersuch. Nahr. Genussm. Kaiserl. Gesundheitsamte, 1911, 1, 30—36. Analyst, 1911, **36**, 497.

The following method is proposed for estimating the small quantities of moisture which are not infrequently present in refined lard; it depends on the fact that lard containing less than 0·45 per cent. of water melts to form a clear liquid when heated to a temperature of 95° C., but when cooled becomes turbid at a temperature varying with the proportion of water present. The semi-fluid lard is placed in a test-tube fitted with a cork carrying a thermometer and heated to a temperature of 52° C. by immersing the test tube in a water-bath; the tube is then removed from the bath and shaken until the temperature falls to 40° C.; if the lard is clear at 52° C., and does not become turbid at 40° C., it contains less than 0·15 per cent. of water. Should it become turbid at 40° C., its water-content lies between 0·15 and 0·2 per cent. If turbid at 52° C., the lard is heated to 95° C.; a turbidity at this temperature indicates the presence of more than 0·45 per cent. of water, and the amount must be estimated by heating the lard while a current of carbon dioxide is passed through it. Should the lard be clear at 95° C., it is gradually cooled until a turbidity appears, and the temperature noted, the quantity of water present being then ascertained by reference to the following figures:—0·45 per cent. of water, 95° C.; 0·40, 90·8° C.; 0·35, 85° C.; 0·30, 75·2° C.; 0·25, 64·5° C.; 0·20 per cent., 53° C. Of course, if the lard is not clear at a temperature of 95° C., it should be ascertained whether the turbidity is actually due to the presence of water.

Wheat flour; Method of determining the quality [bran-content] of ——. L. von Liebermann and V. Andriska. Z. Unters. Nahr. Genussm., 1911, **22**, 291—294.

When wheat flour is shaken with chloroform and the mixture is allowed to stand for a few hours, the flour forms a layer on the surface of the chloroform; the colour of this layer varies according to the quantity of bran present in the flour, and, by comparing the intensity of the colour with that obtained under similar conditions with portions of flour containing known amounts of bran, it is possible to determine the actual quantity of bran in the sample under examination. The comparison mixtures should contain from 0 to 2 per cent. of bran and are prepared from the finest white flour and finely ground bran free from starch. In carrying out the test, 1 grm. each of the flour and comparison mixtures are shaken in test-tubes with 10 c.c. of chloroform, and then set aside for an hour or so, and the colours compared, preferably from above.—W. P. S.

Ropiness in bread. E. Kayser and H. Delaval. Comptes rend., 1911, **153**, 576—578. (Compare Watkins, this J., 1906, 350.)

Ropiness in bread is due to bacteria of the genus *Mesentericus*, the spores of which are very resistant to chemical and physical reagents. They form rods 3—6 μ long and 0·4—0·6 μ thick, generally single but sometimes united in pairs, and resist steam for 30 minutes. The development on various culture media is described; on bread it is rapid, with abundant spore formation. The bread becomes yellowish brown, soft and viscous and acquires an objectionable odour. The bacillus saccharifies starch, with production of a red colouration, and formation of a liquid which is readily fermented by beer yeast. It prefers maltose as carbohydrate and asparagine and peptone as nitrogenous nutrients. With bread the products of action are ethyl alcohol, acetic and valeric acids and acetylmethylcarbinol. Practical trials show that the addition of lactic acid (1·9—2 grms.) per 1000 grms. of dough is enough with 30 minutes baking to prevent the germination of spores in a loaf of 250—500 grms. weight, and 45 minutes baking preserves a loaf of 1000 grms. The microbe originates in flour.—E. F. A.

Saccharin in foods; Prohibition of —— in the United States. Board of Trade J., Oct. 5, 1911. [T.R.]

Food Inspection Decisions (Nos. 135 and 138) notify that the Secretary of Agriculture will regard as adulterated under the Food and Drugs Act foods containing saccharin which, on and after the 1st January, 1912, are manufactured or offered for sale in the District of Columbia or the

Territories, or shipped in interstate or foreign commerce, or offered for importation into the United States of America.

Patents.

Meat; Preservation of ——. A. Coffino, Lisbon. Eng. Pat. 20,331, Aug. 31, 1910.

The meat is immersed for from 30 minutes to 2½ hours in a solution containing 0·35 per cent. of citric acid, 0·2 per cent. of acetic acid, or 0·25 per cent. of tannin, and is then dried in a current of air. Before use, the treated meat is soaked for 24 hours in a solution containing 1 per cent. of sodium bicarbonate.—W. P. S.

Flour, semolina, or wheaten stock; Method of treating —— [*with oil and water*]. F. H. Loring, London. Eng. Pat. 21,478, Sept. 15, 1910.

In order to correct for loss of water due to bleaching with nitrogen peroxide, flour is treated with a fine spray of an emulsion consisting of water and germ-oil or soya bean oil. The flour, etc., may be treated before or after the bleaching process, and the apparatus employed may be such as that described in Eng. Pat. 17,992 of 1909 (this J., 1910, 973).—W. P. S.

Flour or meal; Process of producing ——. C. Herendeen, Chicago, Ill. U.S. Pat. 1,002,990, Sept. 12, 1911.

Steam is injected into starch-containing cereals for a sufficient length of time to disrupt the starch cells, the resulting product being passed through blasts of air to dry it, and finally into grinders for producing a finished flour or meal of any fineness.—B. N.

Milk; Treatment [*souring*] *of* ——. J. S. Ashe, Dublin. Eng. Pat. 21,537, Sept. 16, 1910.

Sterilised or pasteurised milk is treated with a culture of lactic acid bacilli, 2 drachms of the culture being added to each pint of the milk, and the mixture is kept at 80° F. for 10 minutes, or until the milk contains 0·3 per cent. of lactic acid. The milk is next agitated for 10 minutes in a churn, then transferred to closed receptacles, and kept in an ice-chamber until required for consumption. (Reference is directed to Eng. Pats. 4304 of 1905; 14,249 of 1908; and 26,007 of 1909; this J., 1906, 231; 1909, 903; 1910, 647).—W. P. S.

Albumins from plants; Apparatus for extracting ——. J. Geistdörfer, Paris. U.S. Pat. 1,003,594, Sept. 19. 1911.

See Fr. Pat. 412,654 of 1910; this J., 1910, 1031.—T. F. B.

Alimentary albuminous products containing iron and phosphorus; Preparation of ——. W. Wolff und Co. Ges. m.b. H. Fr. Pat. 428,892, July 1, 1910.

See Eng. Pat. 16,048 of 1910; this J., 1911, 508.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

Ozone; Application of —— *to water purification.* Times Eng. Suppl., Sept. 20, 1911.

Although the direct treatment by ozone of water containing large amounts of impurities has proved unsuccessful, ozone is now extensively used on the Continent for rendering water potable after it has been treated in the ordinary manner by sand filters. The latest plant erected is that at the works supplying the Penkowja district of St. Petersburg, where the consumption amounts to 11,000,000 gallons per day. The water is first treated with aluminium sulphate, then passed through 38 sand filters at the rate of 1000 gallons per sq. metre of filtering surface per hour, and next passes to the 5 sterilisation towers for the treatment with ozonised air. There are 128 ozonisers of the Siemens und Halske type, each consisting of an inner metal cylinder separated by a slightly larger glass tube from an outer cylinder of tin-foil; the outer cylinder is surrounded by cooling water, and all external parts are connected with the earth. The air is freed from moisture by refrigeration, and is then ozonised so as to obtain a concentration of ozone of 2·5 grms. per cb. metre. The passage of the air through the ozonisers and sterilisation towers is effected by means of Otto emulsifiers, *i.e.*, water injectors worked by the water under treatment, using a head of about 13 ft. The sterilisation towers are kept filled with water, and the emulsion of ozonised air and water is discharged from the injector pipes near the bottom. The whole plant is electrically driven by two 150 h.-p.-steam engines, and the total costs of operation are stated to be 0·86d.—0·97d. per 1000 gallons. Similar plants have been installed at Wiesbaden (660,000 galls. per day), Hermannstadt (880,000 galls. per day), Wiborger, St. Petersburg (2,640,000 galls. per day), and Florence (1,100,000 galls. per day), and plants are also in course of erection at Paris, Chemnitz, and Rovigo. At St. Maur the de Frise apparatus is in use (see this J., 1909, 215), whilst at Chartres (1,325,000 galls. per day) and at Nice (10,000,000 galls. per day) the Otto system is employed (see this J., 1909, 742). The use of ozone for water purification has not been adopted by any public authority in the United Kingdom. In America, trials of the Vosmaer system have been made near Philadelphia on a large scale (1,000,000 galls. per day). This apparatus consists of a number of tubes grouped together on the feed-water heater principle and each containing one flat electrode and one pointed electrode resembling a comb, the electrodes being held apart by porcelain stems and forks. At Lindsay, Ontario, Canada, a Howard-Bridge ozonising plant with a capacity of 1,500,000 galls. per day has been in use.—A. S.

Ozone; Application of —— *to air purification and other uses.* Times Eng. Suppl., Sept. 27, 1911. (See this J., 1911, 305, 507.)

The disinfecting properties of ozone and its destructive action on organic matter, together with its easy production by electrical means, render it a valuable aid in maintaining hygienic conditions in rooms and buildings which are ventilated badly. Many forms of apparatus for producing the ozone, worked by current from the ordinary electric lighting mains, are in use. In one of the latest of these ozonisers used in this country, each complete element consists of a thin sheet of micanite covered on each side by a square of an aluminium alloy gauze of 40 meshes to the inch. Baffle-plates direct the air current over a series of three or four of these elements, when it is subjected to a discharge at 4500 volts. There is no sparking under these conditions, due to the large number of the rounded projections of the gauze from which the discharge occurs, there being 230,400 of these to each square foot of ozonising surface. It is necessary to ensure that there should be no sparking, because the oxides of nitrogen formed in a spark discharge act injuriously on the mucous membrane of the respiratory organs. Experiments indicate that ozone could be used in breweries for cleaning the casks and ventilating the tuns (see this J., 1911, 232, 1131). The method of bleaching flour by means of ozone has not developed, owing to the discovery that it was the oxides of nitrogen and the hydrogen peroxide in the ozonised air which yielded the results rather than the ozone itself. The ozonising process has been used for sterilising the atmosphere of meat stores; also for deodorising stale cream so as to render it fit for butter making (compare this J., 1911, 1082).—J. H. J.

Water; Sterilisation of —— *by ultra-violet rays.* G. Erlwein. J. Gasbeleucht., 1911, **54**, 955—959.

Comparative experiments were made on the efficiency of many forms of lamps for producing ultra-violet rays for sterilising water, but none were found to be satisfactory; nor did the admission of air with the water lead to the formation of ozone or increase the sterilising effect. The least consumption of energy was found to be given by a steriliser devised by the author, in which the quartz mercury lamp was suspended in the axis of a swinging cylinder through which the water passed with a tangential motion. When this method was compared with the ozonisation process, it was found that, to produce the same bactericidal effect on the whole of the water supply of Marseilles, the use of ultra-violet rays would require an installation of 540 kilowatts and the ozone method an installation of 100—109 kilowatts. A drawing is given of a particular form of ozonising apparatus made for domestic sterilisation purposes in which the energy consumed varies from 10 to 60 watt-hours according to the concentration of ozone required. The ozone method has the further advantage that a simple chemical test with iodide and starch applied to the treated water will show at once the efficiency of the process, instead of having to wait for some days for the result of a bacteriological cultivation test.—J. H. J.

Disinfection; Theory of ——. R. O. Herzog and R. Betzel. Z. physiol. Chem., 1911, **74**, 221—241.

Details of experiments are given in support of the theory of disinfection previously put forward (see this J., 1910, 1032) by the authors. Pressed yeast was selected as the organism to be acted on and was shaken with solutions of the disinfectant of known strength for some time, after which the mixture was centrifugalised and the strength of the disinfectant solution again determined. The disinfectants used were solutions of chloroform, silver nitrate, mercuric chloride, formaldehyde and phenol. In each case, except formaldehyde, the curves showing the relation between the logarithms of the amounts absorbed and not absorbed from solution in varying concentration were straight lines. With formaldehyde the amount absorbed is independent of the concentration. The removal of the disinfectant from solution by the yeast is due to adsorption and is the first phase of the disinfection process. It is followed by the second, the chemical action of the disinfectant on the yeast. The germicidal effect depends upon the concentration of the disinfectant solution.—J. H. J.

Cyanide poisoning; Antidote for —— [*Adrenaline*]. J. L. Jona. Eng. and Mining J., 1911, **92**, 625.

The usual antidote for cyanide poisoning is an alkaline iron solution (see this J., 1902, 935), but this is not efficacious unless administered within 5 minutes after the poison has been taken, and as its preparation takes at least 2—3 minutes, the author recommends for immediate use, 120 c.c. of a 1 : 10,000 solution of adrenaline. Adrenaline can be also used as an emergency reagent for the treatment of other forms of corrosive poisoning (strychnine, etc.). It retards the absorption of the poison and so gains time for the preparation of an antidote, and even itself acts as an antidote if the stomach be thoroughly washed out after its administration.—A. S.

Contamination of water supplies by waste lyes from sulphite-cellulose works. Reinitzer. *See* V.

Patents.

Liquids; Process of treating —— *with ultra-violet rays.* V. Henri and A. Helbronner, Paris, and M. von Recklinghausen, Bas Meudon, France. Eng. Pat. 20,436, Sept. 1, 1910. Addition to Eng. Pat. 2424 of 1910.

The liquid is passed through a chamber which is fitted with partitions and baffle-plates so that the liquid is caused to flow round a lamp fitted in a tubular compartment in the centre of the chamber. The lamp compartment may be constructed in two parts which are bolted together, the bolts being covered by the sides of the sterilising chamber (see also this J., 1911, 765).—W. P. S.

Water for boilers; Mechanical method of treatment of feed —— *for prevention of incrustation, corrosion, or pitting.* C. Haythorpe, London. Eng. Pat. 23,123, Oct. 6, 1910.

Hot feed-water for a boiler is passed through a closed chamber which is divided into a number of compartments by perforated zinc plates, the compartments being filled with crushed coke, or the like. The zinc plates and the carbon act as a galvanic couple, removing sulphates from the feed water and causing fat and grease to separate out. The carbon also acts as a filter. The metal plates may be made of an alloy of zinc and aluminium. The chamber is provided with a sludge cock, a removable lid, and an air-outlet or valve.—W. P. S.

Liquid [*disinfectant*] *for industrial purposes; Process for the production of a* —— *by the solution of certain metalloids and metals in water.* M. L. M. Robin. Fr. Pat. 429,151, May 1, 1911.

By the addition of water to an intimate mixture of 3 parts of iodine with 8 of mercury and 1 of arsenic, complete solution of all the constituents is effected, the liquid, it is claimed, being suitable for use as a purifying and disinfecting agent for certain purposes. The iodine is replaceable by another halogen, and the arsenic by iron and other metals; and it is claimed that, by the latter replacement, solutions suitable for the metallisation of stone, wood, glass and other surfaces are obtained—the surfaces in question being coated with the solution and subsequently heated to volatilise the halogen and mercury. —W. E. F. P.

Smoke arising from the combustion of vegetable briquettes; Process for increasing the disinfecting action of the ——. W. von Skorzewski. Fr. Pat. 429,417, April 27, 1911. Under Int. Conv., April 27, 1910.

See Ger. Pat. 228,263 of 1910; this J., 1910, 1407.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Caffeine in caffeine-sodium salicylate and similar preparations; Determination of ——. F. Lehmann and A. Müller. Apoth.-Zeit., 1911, **26**, 647—648.

The German Pharmacopœia method gives low results. The following method is recommended:—1 grm. of the substance is dissolved in 5 grms. of water, 40 grms. of chloroform and 5 c.c. of alkali solution (officinal solution of Ger. Pharmacopœia) are added and the whole is shaken vigorously for 5 minutes. 0·5 grm. of gum tragacanth is now added, and after again shaking, the mixture is allowed to stand for 5 minutes, and 35 grms. of the chloroform solution are decanted off, the chloroform evaporated, and the residual caffeine dried and weighed. The weight in grms. deducted from 35 gives the weight of chloroform in the 35 grms. of chloroform solution, and from this the weight of caffeine corresponding to 40 grms. of chloroform is calculated; this represents the weight of caffeine in 1 grm. of substance.—A. S.

Terpenes and essential oils. 107th Communication. Constitution and synthesis of pinolone and dihydropinolone (*acetyl-1-isopropyl-3-cyclopentane*). O. Wallach. Annalen, 1911, **384**, 193—208.

When the tribromo-derivative of pinol (this J., 1890, 1147) is reduced with zinc and acetic acid, the chief product is an unsaturated ketone (pinolone), $C_{10}H_{16}O$, which is an isomeride of pinol, and has an odour resembling that of amyl acetate. The constitution,

$$(CH_3)_2C : C(CH : CH_2).CH_2COCH_3,$$

was assigned to this ketone by Tiemann and Semmler (Ber., 1895, **28**, 2136), but the author now brings forward evidence to show that the compound is really an acetylisopropylcyclopentene. The dihydro-derivative of pinolone proved to be identical with acetyl-1-isopropyl-3-cyclopentane synthesised from 1·3-isopropylcyclopentanone.—A. S.

Nerol; The decomposition of —— and its constitution. A. Blumann and O. Zeitschel. Ber., 1911, **44**, 2590—2593.

When oxidised by means of permanganate and chromic acid, both nerol and geraniol yield the same products, viz., acetone, lævulinic acid, and oxalic acid. The constitution of nerol is confirmed (this J., 1906, 557); geraniol and nerol can be regarded as space-isomerides. —F. Shdn.

Catalytic reductions. A. Skita. Chem.-Zeit., 1911, **35**, 1098—1099.

In presence of a sufficient quantity of hydrochloric acid, reductions can be effected by hydrogen in a clear solution of palladium chloride just as readily as in a solution of colloidal palladium. So long as an unsaturated organic substance is present, a condition of equilibrium persists between the formation of palladium hydride and its decomposition, but when the reduction of the unsaturated substance is complete, palladium is precipitated. The method is said to have proved satisfactory technically. When reduced by this process, α-, β-, and pseudo-ionone yield di- and tetra-hydroionone; phenylacetaldehyde yields the corresponding alcohol, the chief constituent of rose oil; morphine, codeine, quinine, cinchonine, strychnine, and brucine each absorb two atomic proportions of hydrogen, whilst pyridine absorbs four or six atomic proportions. Liquid fats and oils and oleic acid are converted into completely saturated substances.—A. S.

Catalytic reduction in vacuo. N. Zelinsky. Ber., 1911, **44**, 2779—2780.

The author has found that the catalytic reduction of organic compounds by hydrogen in presence of nickel can be effected when the pressure is reduced to 75—80 mm. or even to 25—40 mm., and thus it may be possible to apply the process to high-boiling substances incapable of treatment at atmospheric pressure. In two experiments described, in which reduction was effected at a pressure between 70 and 80 mm., 1·3-dimethylcyclohexene-(3)-one-(5) yielded a mixture of 1·3-dimethylcyclohexanone-(5) and the corresponding alcohol, and isophorone yielded a mixture of dihydroisophorone and dihydroisophorol. —A. S.

α-Pinene; Catalytic isomerisation of ——. N. Zelinsky. Ber., 1911, **44**, 2782—2784.

Palladium black, prepared by the reduction of the subchloride, was suspended in ether and saturated with hydrogen. Pinene was then added and the passage of hydrogen continued. The isopinene thereby produced boiled at 158·5°—159·5° C., but the other physical constants resembled those of α-pinene. The hydropinene first formed in the reaction becomes dehydrogenated. If palladium black obtained by the reduction of palladium ammonium chloride be used, and the hydrogen passed through under slight pressure, hydropinene is formed, boiling at 167·5°—168° C. at 748 mm.—F. Shdn.

Diphenylmethane as an artificial perfume. J. Dupont. Amer. Perfumer, 1911, **6**, 167.

Diphenylmethane (m.pt. 27° C., b.pt. 261°—262° C.) possesses to a high degree the characteristic odour of geranium leaves, and is well suited for use as a substitute for, or adjunct to, geranium oil in the manufacture of perfumes and scented soaps.—A. S.

Chemical constitution and physiological action; The relation between ——. Substances with an unstable carbon-nitrogen linkage. H. Emde. Apoth.-Zeit., 1911, **26**, 785—786, 796—798, 804—806.

A number of examples are collected illustrating the increased physiological activity due to the presence of a double bond in carbon compounds. The influence of the double bond may vary according to its position in relation to the other atoms of the molecule. With regard to those compounds in which toxicity is associated with a double bond, there may be at the same time a "loosening" of the linkings of the molecule. Cinnamyltrimethylammonium chloride, $C_6H_5{\cdot}CH:CH{\cdot}CH_2{\cdot}N(CH_3)_3Cl$ is decomposed by sodium amalgam into phenylpropylene and trimethylamine. When the double bond in this compound is suppressed by the addition of hypochlorous acid or the elements of water, sodium amalgam then has no such decomposing action. The cleavage of a quaternary ammonium compound by the action of nascent hydrogen is an indication of the stability of the carbon-nitrogen linkage.—F. Shdn.

Allo- and isocinnamic acids in the melted and crystalline states; Transformations of ——. H. Stobbe. Ber., 1911, **44**, 2739—2754. (See this J., 1910, 111, 296, and 372.)

The three cinnamic acids melting at 68°, 58° and 42° C. respectively, each yield optically identical liquids when melted. This has been confirmed by measuring the refraction of the liquids (Ber., 1911, **44**, 2735). The liquid when cooled can be made to yield any one of the three acids by impregnation with a fragment of the required acid. Crystals of the acid melting at 42° C. are rapidly converted into allocinnamic acid melting at 68° C. by contact with the latter. The acid melting at 42° C. can be likewise converted into the acid melting at 58° C., and this, again, into the acid melting at 68° C. by contact only. The transformation of isocinnamic acid into allocinnamic acid takes place with the evolution of a slight amount of heat. The acid melting at 42° C. and that melting at 58° C. are both converted into allocinnamic acid by cooling to —80° or —180° C., the transformation of the first acid being more rapid than that of the second. A low temperature accelerates the transformation of the isocinnamic acids into allocinnamic acids, for they may be preserved at the ordinary temperature for indefinite periods. It is possible to obtain any one of the three acids from the melted acid without impregnation by over-cooling to the proper temperature. If larger quantities are over-cooled to temperatures between 0° and 20° C., allocinnamic acid is produced, but occasionally the acid melting at 42° C. is formed. When smaller quantities are dealt with in the same way, the acid melting at 42° C. is produced, rarely the acid melting at 68° C. By cooling the "melt" to —14° C. the isocinnamic acids melting at 42° or 58° C. are produced as a rule. If the "melt" is cooled to —80° or —180° C., a glassy mass forms, which changes, as the temperature rises, to the acid melting at 58° C., the acid melting at 68° C. being but rarely formed under these circumstances. From all the data known at present two opposing conclusions can be drawn. The first is that the three acids are three different forms of a trimorphous *cis*-cinnamic acid. The second is that there are two chemically different isomeric acids, the monomorphous allocinnamic acid, m.pt. 68° C., and the dimorphous isocinnamic acid, m.pts. 58° and 42° C. Further experiments are needed to decide between these two.—F. Shdn.

"Melamazine" from hydrazine salt and dicyandiamide. Hofmann and Ehrhart. *See* IV.

Constituents of (Parthenium argentatum) the Guayule rubber plant. Alexander. *See* XIV.

Patents.

Isoprene; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 975, Jan. 13, 1911.

Isopropenylmethylcarbinol, of the formula, $CH_3{\cdot}CH(OH){\cdot}C(CH_3):CH_2$, can be converted into isoprene by treating it with dehydrating agents, such as potassium bisulphate, mineral acids, zinc chloride, etc. The same hydrocarbon is obtained by the elimination of the elements of hydrogen halides (*e.g.*, by aid of quinoline, alcoholic alkali, etc.) from the corresponding halogen compounds, containing halogen in place of the hydroxyl group. The isopropenylmethylcarbinol may be prepared by heating the ammonium hydroxide derivative obtained from 2-methyl-3-hydroxybutyldimethylamine, $CH_3{\cdot}CH(OH){\cdot}CH(CH_3){\cdot}CH_2N(CH_3)_3OH$. —T. F. B.

[Hydr]oxyarylarsinic acids; Manufacture of derivatives of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 3847, Feb. 15, 1911.

New sulphur derivatives of hydroxyarylarsinic acids are obtained by treating nitro- or amino-hydroxyarylarsinic acids with alkali sulphides or with hydrogen sulphide. The products are of therapeutic value. *Example.* A solution of 23·3 grms. of 3-amino-4-hydroxyphenylarsinic acid in 60 c.c. of 2*N* caustic soda solution and 120 c.c. of water, is saturated with hydrogen sulphide; 60 c.c. of 2*N* acetic acid are then added and the precipitate is filtered after some time and washed with water. The product is freed from uncombined sulphur by extraction with carbon bisulphide and further purified by dissolving in methyl alcohol and precipitating by means of water.—T. F. B.

Bismuth salt of iodized resorcinsulphonic acid. O. B. May, Assignor to Morgenstern and Co., New York. U.S. Pat. 1,003,191, Sept. 12, 1911.

A soluble salt of iodoresorcinolsulphonic acid is treated with a solution of a bismuth salt, and the mixture is neutralised with a weak alkali. The product consists of a bismuth salt of the formula, $(C_6H_2(OH)_2ISO_3)_3Bi.3Bi(OH)_3$; it is an amorphous, slightly hygroscopic powder, partly decomposed by water, and dissolved with decomposition by hydrochloric acid; on being heated it loses iodine and then chars, finally leaving a residue of bismuth oxide.—T. F. B.

Camphene free from chlorine; Process for producing solid —— *from pinene hydrochloride.* L. Weitz. Fr. Pat. 429,445, May 6, 1911. Under Int. Conv., May 7, 1910.

Pinene hydrochloride is converted into solid camphene, free from chlorine, by heating it with zinc oxide in presence of an alkali hydroxide. For example, a mixture of 100 kilos. of zinc oxide, 25 kilos. of sodium hydroxide, and 100 kilos. of pinene hydrochloride is heated in a vessel provided with a reflux condenser, at 125°—150° C., until a sample distilled with steam furnishes camphene free from chlorine; the mixture is then worked up in the usual manner, camphene being obtained, in nearly theoretical yield, having a melting point of 40°—42° C.—T. F. B.

Camphor; Method of moulding ——. O. R. D. Witt. Hamburg, Germany. Eng. Pat. 17,143, July 26, 1911. Under Int. Conv., July 28, 1910.

See U.S. Pat. 995,510 of 1911; this J., 1911, 923.—T. F. B.

Camphor; Process for obtaining shaped, transparent ——. O. R. D. Witt. Fr. Pat. 429,597, May 10, 1911. Under Int. Conv., July 28, 1910.

See U.S. Pat. 995,510 of 1911; this J., 1911, 923.—T. F. B.

Ergot; Extract of ——. R. Tambach, Assignor to Knoll und Co., Ludwigshafen on Rhine, Germany. U.S. Pat. 1,004,499, Sept. 26, 1911.

See Eng. Pat. 27,038 of 1908; this J., 1909, 913.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Colloid chemistry and photography. XI. Growths and membrane masses of silver halides. Lüppo-Cramer. Z. Chem Ind. Kolloide, 1911, 9, 116—118.

In vessels used for collecting silver residues, in which the silver is precipitated by sodium chloride, the author has found that small filaments have formed on the mass of chloride, after long standing; they are from 3 to 4 cm. long, and dissolve readily in thiosulphate solutions. These filaments possibly correspond to the "membrane masses" which form when a silver nitrate solution is added carefully to solutions of gelatin and a halide; opalescent membranes of silver halide form where the silver solution comes in contact with the gelatin solution, and these gradually extend through the solution, producing cloud-like masses. If the mixtures in the tubes are shaken, the silver halide either coagulates into a mass, or takes the form of flocks, which are very difficult to emulsify: this is particularly noticeable with silver iodide emulsions. The formation of silver chloride and silver bromide membranes may be avoided by using ammoniacal silver hydroxide solutions as precipitants in place of the aqueous silver nitrate solutions. Without the use of ammonia, the silver halide remains transparent and opalescent for a long time, but in presence of ammonia a white turbidity is at once produced, which passes on shaking into an homogeneous, macroscopic emulsion. Whilst the ammonia acts as a ripening agent for the silver halide, its use in the preparation of photographic emulsions has the further advantage of preventing the formation of the membrane masses.—T. F. B.

Photohalides; Studies on the ——. *III. Absorption of dyestuffs, albuminoids, and other organic compounds by crystallised silver chloride.* W. Reinders. Z. physik. Chem., 1911, 77, 677—699.

Silver chloride, crystallised from ammoniacal solutions, absorbs a number of organic dyestuffs from very dilute solutions; in some cases the form of the crystals is unchanged, whilst in others they become arborescent. Quantitative measurements with Erythrosin showed that the ratio of the concentration of dyestuff in the crystals to its concentration in the solution increased with increasing concentrations of dyestuff, whilst in the case of Rose Bengal the ratio remained practically constant. Variations in the conditions of formation of the crystals in the dyestuff solution are without influence on the absorption. Not only dyestuffs, but a number of other compounds can be absorbed by crystalline silver chloride; when crystallised from solutions containing gelatin, gum arabic, casein, etc., the silver chloride is much more sensitive to light than when crystallised from aqueous ammoniacal solutions only. In the case of gelatin, this increased sensitiveness is apparent even when the solutions contain only 1 mgrm. of gelatin in 10 litres of water, and further increase results with increasing concentration of the solution. Analogous results are obtained by crystallisation in solutions of gum arabic, casein, and albumin, the lowest effective concentrations of which are 0·001—0·01 per cent., 0·00001—0·0001 per cent., and 0·00001—0·0001 per cent., respectively. Dextrin is absorbed by silver chloride, giving very slight increase in sensitiveness, and sucrose, glucose, agar, and tannin are absorbed, giving crystals with no increase of sensitiveness. The absorption of colloidal silver during the crystallisation of silver chloride from solutions containing colloidal silver, is considerably decreased and in some cases quite prevented in presence of gelatin, agar, or other compounds which are absorbed.—T. F. B.

Ammonium persulphate; Notes on the use of —— [*for photographic reduction*]. J. W. Dodgson. Phot. J., 1911, 51, 302—304.

Gelatin is oxidised by ammonium persulphate in presence of silver sulphate, in the same manner as when metallic silver is present (see this J., 1911, 982). When gelatin is treated with ammonium persulphate solution in presence of metallic silver, the greater part of the persulphate is used in oxidising the gelatin, only a very small percentage being used to dissolve the silver; the amount of ammonia remaining in the solution is somewhat greater than that employed, probably owing to the decomposition of amino-compounds in the gelatin. The reducing action of ammonium persulphate therefore appears to be due, firstly, to the solution of silver forming silver sulphate, and, secondly, to the oxidation of the gelatin and consequent removal of more silver by bringing a lower layer of the film into contact with the persulphate. This would explain why the persulphate acts more rapidly on the portions of the film containing more silver.—T. F. B.

PATENTS.

Films from cellulose acetate; Process for the continuous production of ——. G. Bonwitt. Ger. Pat. 237,151. July 16, 1908.

CELLULOSE acetate films are obtained by a continuous process if solutions of acetylcellulose are poured on endless bands and treated with suitable precipitating solutions. The resulting film is stated to be transparent.—T. F. B.

Photographic developers. Soc. Anon. des Mat. Col. et Prod. Chim. de St.-Denis. Fr. Pat. 429,380, July 13, 1910.

THE only diphenylamine derivative used as a developer till now has been the *p*.*p*′-dihydroxy-derivative (pyramidol). It has now been found that certain amino derivatives of diphenylamine act as developers in presence of alkali; these are, the *p*-amino-*p*′-hydroxy-, *o*.*p*-diamino-*p*′-hydroxy-, and *o*.′*p*.′*p*-triamino derivatives, and the use of these as developing agents in the form of their salts is claimed. The two last named compounds possess the property of developing in presence of alkali sulphites alone, the triaminodiphenylamine being the best in this respect. Solutions of this compound with sodium sulphite are stable, even in air, and are very sensitive to the restraining action of bromide.—T. F. B.

Quinones and their sulphonic acids; Use of —— for intensifying and toning silver images. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Fr. Pat. 429,390, July 16, 1910.

PHOTOGRAPHIC silver images are intensified by means of quinones and their sulphonic acids in presence of alkali chlorides or bromides. For example, when the plate or print is immersed in a solution of quinone, 0·5 grm., potassium bromide, 2·5 grms., water, 100 c.c., the image becomes reddish brown, and less actinic and more opaque than before; it is "cleared" by means of a dilute solution of ammonia. The results obtained are similar, as regards increased contrasts, to those produced by mercuric chloride. When quinonesulphonic acid is used in place of quinone, the concentration of the solution and its bromide content determine the colour of the image: thus, with increasing amounts of quinonesulphonic acid, colours from brownish-yellow to orange are produced: if the amount of bromide is increased the image becomes browner in colour, and assumes the appearance of the collodion image.—T. F. B.

Photographs in colours on paper; Process for obtaining —— by an indirect method. M. Poulot. Fr. Pat. 429,461, July 18, 1910.

A TRANSFER screen is prepared by coating a thin sheet of transparent paper on one side with a layer of gelatin sensitised with an iron salt and tartaric acid, and on the other side with a three-colour screen of gelatin sensitised with bichromate. This transfer screen is brought into contact with a sheet of photographic paper, the three-colour screen touching the sensitised surface of the paper. The whole is now exposed under a negative, made from the coloured original to be reproduced, the negative being in colours complementary to those of the original. After exposure, a sheet of wet blotting paper is laid on the surface of the transfer screen, whereby the parts of the gelatin, sensitised by iron, which have been affected by the light are removed in proportion to the amount of light received through the negative: in these parts the moisture also penetrates to the colour screen at the back of the transfer paper, rendering soluble all the gelatin particles except those of the colour complementary to that of the corresponding portion of the negative. On removing the transfer paper with its layer of gelatin sensitised by iron salts, there remains a reproduction of the original negative in points of coloured gelatin on a dark background; the print is finally toned in the usual manner.—T. F. B.

Colour photography; Manufacture of screens or coloured surfaces for ——. L. Dufay, Assignor to Soc. Anon. des Plaques et Produits Dufay, Chantilly, France. U.S. Pat. 1,003,720, Sept. 19, 1911.

SEE Eng. Pat. 18,744 of 1908; this J., 1909, 1055.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Chemicals for making explosives; Importation of —— into Turkey. Board of Trade J., Oct. 5, 1911. [T.R.]

THE Turkish Government have decided to prohibit the importation of saltpetre, potash, nitrate of soda, chlorate of soda, and similar chemicals for use in the production of explosives as from the 19th November next. From that date, therefore, the provisions of Articles 17 and 18 of the Law of the 20th May, 1905, respecting the chemical analysis of imported articles of consumption, will come into full operation.

(*Note.*—Articles 17 and 18 of this Law refer to the prohibition of the importation of chemicals for explosives, and their importation, with special authorisation, for use in medicine.)

PATENTS.

Safety explosives. N. Ceipek, Vienna. Eng. Pat. 13,549, June 6, 1911. Addition to Eng. Pat. 9743, April 21, 1911 (this J., 1911, 926).

NITRATED turmeric powder is substituted for the turmeric charcoal mentioned in the original patent. Ammonium nitrate (80—90 parts) and nitrated turmeric powder (10—20 parts) are dried and mixed in a drum mill. This mixture may be used as an explosive, or 86 parts of it may be mixed with trinitrotoluene (10 parts), and 4 parts of "gelatin" consisting of 0·17 part of collodion cotton and 3·83 parts of dinitrotoluene.—G. W. McD.

High explosives; Machine for manufacturing ——. A. Ellis, Philadelphia, Pa., Assignor to Kelly Manufacturing Co. U.S. Pat. 1,003,243, Sept. 12, 1911.

A NITRATING vessel is provided with rotating arms and a reservoir in which the acid is kept at the desired temperature. The solid particles to be nitrated are blown into the nitrating liquid by means of compressed air.
—G. W. McD.

Explosive of high stability; Safety —— and its manufacture. N. Ceipek. First Addition, dated April 21, 1911, to Fr. Pat. 381,484, Sept. 3, 1907.

SEE Eng. Pat. 9742 of 1911; this J., 1911, 926.—T. F. B.

Explosive; Safety ——. N. Ceipek. Fr. Pat. 428,748, April 21, 1911.

SEE Eng. Pat. 9743 of 1911; this J., 1911, 926.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Nickel and cobalt; Gravimetric determination of ——. L. Dede. Chem.-Zeit., 1911, **35**, 1077.

IN place of bromine, potassium or sodium persulphate can be used for the precipitation of nickel and cobalt with satisfactory results. The nickel or cobalt solution is treated in the cold with such an amount of a solution of sodium or potassium hydroxide that, when the persulphate solution is subsequently added, the alkali is only in slight excess. With fairly concentrated solutions, there is an immediate black precipitate which settles down well. Dilute solutions have to be set aside for several hours for the precipitation to be complete, especially in the presence of excess of alkali. The precipitate is ignited, reduced with hydrogen, and weighed as metal.—F. SHDN.

Magnesium ammonium phosphate and of ammonium phosphomolybdate; Volumetric determination of precipitates of ——. F. Hundeshagen. Z. öffentl. Chem., 1911, **16**, 283—294, 302—309, 322—324.

The precipitate of magnesium ammonium phosphate obtained in the usual manner in the analysis of phosphatic materials may be titrated as described below in order to ascertain the quantity of phosphoric acid present. After washing with dilute ammonia and then with 95 per cent. alcohol until all free ammonia has been removed, the precipitate is mixed with water, an excess of $N/10$ acid is added, and the excess titrated back with $N/10$ sodium carbonate solution, methyl orange being used as the indicator. Each c.c. of $N/10$ solution required for the neutralisation of the precipitate corresponds with 0·001552 grm. of phosphorus or 0·003552 grm. of phosphoric acid. The process may be used in the analysis of fertilisers, and it is not necessary to remove the silica before the determination is carried out, but allowance must be made for arsenic, if present. When the phosphoric acid has been precipitated with molybdic acid, the ammonium phospho-molybdate may be titrated, after being washed first with ammonium nitrate solution and then with potassium nitrate solution, with $N/1$ sodium hydroxide solution, using phenolphthalein as indicator. One c.c. of $N/1$ alkali solution is equivalent to 0·003078 grm. of phosphoric acid (P_2O_5); this figure is obtained by actual experiment and differs slightly from the theoretical quantity owing to the fact that the precipitate has not a composition corresponding exactly with ammonium phosphododecamolybdate.—W. P. S.

Water in various substances [coal and starch]; Determination of —— by means of organo-magnesium compounds. T. Zerewitinoff. Z. anal. Chem., 1911, **50**, 680—691.

Continuation of previous work on the determination of the active hydrogen in organic compounds by means of magnesium methyl iodide (this J., 1907, 646; 1908, 839; 1911, 107) has shown that the method may be extended to the determination of combined water or moisture in substances which contain no active hydrogen or which are insoluble in the solvent employed, the material being shaken with pyridine, in the presence of the reagent, and the percentage of water calculated from the volume of methane evolved; two molecules of methane are produced for each molecule of water present. The percentage of water in coal or starch, for instance, may be accurately determined in less than an hour, the superiority of the method over those hitherto available being specially apparent with coals containing a large proportion of readily volatile constituents. The reagent is prepared by mixing in a flask, fitted with a reflux condenser and calcium chloride tube, 6 grms. of magnesium, 35·5 grms. of dry redistilled methyl iodide, and 100 c.c. of commercial iso-amyl ether which has been boiled with sodium and redistilled, and adding some crystals of iodine; the mixture is warmed, if necessary, to start the reaction, and, when this is over, it is heated for 1—2 hours over the water-bath and, finally, excess of methyl iodide is carefully distilled off. The solution may be kept for a month or more in well-stoppered bottles. The determination may be carried out in an apparatus consisting of a special reaction flask, with side bulb, attached to a jacketed nitrometer. The substance (0·1—0·5 grm. of coal, for instance) is rinsed into the flask by means of pyridine (dried for several days over barium oxide), so that the total volume reaches 15 c.c., and 5 c.c. of the magnesium solution are introduced into the side bulb; the flask is then connected with the nitrometer and immersed in water for 10 minutes, to secure a constant temperature, after which the pressure in the flask is adjusted to that of the atmosphere, and the solutions are mixed, the flask being shaken until gas ceases to be evolved; the flask is then cooled, and, when no further contraction is observed (5—7 mins.), the volume of methane is at once read. The percentage of water $=0·04041\ V/S$, where V is the volume (c.c.) of gas at 0° C. and 760 mm., and S is the weight of substance (grms.); the vapour pressure of pyridine (16 mm. at 18° C.) must be deducted from the barometric reading.—F. Sodn.

Organic matter in toxicological analysis; Destruction of —— by means of bromine. G. Magnin. J. Pharm. Chim., 1911, **4**, 302—306.

Organic matter may be readily destroyed and a clear solution obtained for the detection of metallic poisons in toxicological analysis by heating the substance under examination with bromine in a flask on a water-bath. —W. P. S.

"Melamazine" from hydrazine salt and dicyandiamide. Hofmann and Ehrhart. *See* IV.

Differentiation of textile fibres and artificial silks by means of "ruthenium red." Beltzer. *See* V.

Testing of imitation parchment papers for resistance to grease. Schacht. *See* V.

Determination of ferrous oxide in silicate rocks. Dittrich. *See* VII.

Analysis of cuprous iodide. Bardt. *See* VII.

Determination of carbon in iron and steel in the electric furnace. Augustin. *See* X.

Determination of total carbon in iron, steel, and iron alloys. De Nolly. *See* X.

Platinum assay. Steinmann. *See* X.

Determination of small quantities of water in lard. Polenske. *See* XIXa.

Determination of antimony in rubber goods. Schmitz. *See* XIV.

Microscopical examination of tanning extracts. Grasser. *See* XV.

Analysis of calcium nitrate, nitrolim, and "Stickstoffkalk." Dinslage. *See* XVI.

Determination of sulphurous acid in liquid glucose (starch syrup). Claassen. *See* XVII.

Valuation of hops by analysis. Moufang and Scheer. *See* XVIII.

Determining the quality [bran content] of wheat flour. Von Liebermann and Andriska. *See* XIXa.

Determination of caffeine in caffeine-sodium salicylate. Lehmann and Müller. *See* XX.

Patents.

Chemical analysis; Method of and means for use in ——. J. G. Hume, Duns, N.B. Eng. Pat. 21,076, Sept. 10, 1910.

After charging a transparent capillary tube with the reagent the ends are fused. The ends of the tube are then broken to allow the fluid to be tested, to be introduced into the tube.—G. W. McD.

Gas caps; Apparatus for the observation of —— and testing miner's safety lamps. O. Oldham, Denton, Lancs. Eng. Pat. 26,534, Nov. 15, 1910.

The lamp to be tested is suspended in a glass chamber open at the bottom, and having a box at the upper end for mixing the gas and air before they enter the chamber. A motor-driven fan supplies the air, and the gas enters

through a series of standard gas nipples. Means are provided for varying the speed of the motor and the supply of air, and also for governing the gas pressure.
—G. W. McD.

Gas analysis apparatus; Automatic ——. A. Mertens. Fr. Pat. 429,721, May 15, 1911. Under Int. Conv., May 18, 1910.

SEE Ger. Pat. 234,983 of 1910; this J., 1911, 927.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Reduction and oxidation catalysis; Simultaneous ——. N. Zelinsky and N. Glinka. Ber., 1911, 44, 2305—2311.

AN attempt to prepare the methyl ester of *cis*-hexahydroterephthalic acid by reduction of methyl tetrahydrophthalate with hydrogen in presence of palladium black (prepared by reduction of palladium ammonium chloride with formic acid and potassium hydroxide) proved successful, but in addition to the hexahydro-compound, smaller quantities of methyl terephthalate were also invariably produced. The authors discuss the probable mechanism of this simultaneous formation of reduction and oxidation products, and accept Bach's view (Ber., 1909, 42, 4470) that palladium black is capable of inducing the formation of unstable oxyperhydride, OH_4, from water: this substance would decompose into hydrogen and oxygen, and would thus be capable of effecting simultaneously reduction and oxidation. In the authors' opinion, oxyperhydride may play a very important part in catalytic reduction processes. In support of this view it is pointed out Ipatiew, in his experiments on catalytic reduction under high pressure, found that the presence of oxygen in the catalytic agent (reduced nickel, etc.) had a favourable influence. In many cases, also, in reductions by Sabatier's method, nickel preparations obtained at low temperatures (200°—250° C.), and hence probably containing not inconsiderable quantities of oxygen, have proved specially active.—A. S.

Books Received.

MINES AND QUARRIES: GENERAL REPORT AND STATISTICS FOR 1909. PART IV. COLONIAL AND FOREIGN STATISTICS. [CD. 5.884.] Wyman and Sons, Fetter Lane, E.C. Price 1s. 7d.

THIS part of the Report includes statistics relating to persons employed, output, and accidents at mines and quarries in the British colonies and in foreign countries during 1909.

TECHNICAL METHODS OF CHEMICAL ANALYSIS. Edited by G. LUNGE, Ph.D., Dr. Ing. English Translation from the latest German Edition, adapted to English conditions of manufacture. Edited by C. A. KEANE, D.Sc., Ph.D. Vol. II. In two parts. Gurney and Jackson, 33, Paternoster Row, London. 1911. Price £3 3s. net.

Two royal 8vo volumes containing 1204 pages of subject-matter, with 149 illustrations; also a list of contributors to the German Edition and of revisers of the English translation, a list of abbreviated titles of journals, and alphabetical indexes of subjects and of authors' names. The subject-matter is classified as follows:—Part I. Iron: Analysis of ores, analysis of iron and steel. Metals other than iron: Silver, gold, platinum, mercury, copper, lead, bismuth, tin, arsenic, antimony, zinc, cadmium, nickel and cobalt, manganese, chromium, tungsten, uranium, vanadium, molybdenum, aluminium, thorium, tantalum. Metallic salts. Artificial manures, including directions for the examination of manufactured products and of the raw materials of manure manufacture concerned in international trade. Feeding stuffs, including directions for the examination of feeding stuffs occurring in international trade; and Fertilisers and Feeding Stuffs (Methods of Analysis) Regulations, 1908. Explosives. Matches and fireworks. Calcium carbide and acetylene. PART II. Illuminating gas and ammonia, including a section on incandescence mantles. Coal tar and tar products. Organic dyes, synthetic dyes, naturally occurring dyestuffs. In an appendix there is given a collection of the tables included in the text.

SPIRIT VARNISHES AND SPIRIT VARNISH MATERIALS. Vol. III. of THE MANUFACTURE OF VARNISHES AND KINDRED INDUSTRIES. Based on and including the "Drying Oils and Varnishes" of A. Livache. By J. G. MCINTOSH. Second, greatly enlarged edition. Scott, Greenwood and Son, 8, Broadway, Ludgate, London. 1911. Price 12s. 6d. net.

DEMY 8vo volume containing 464 pages of subject-matter, with 64 illustrations, also a general index and an index to recipes. The work is divided into five parts. PART I. SOLVENTS: (1) Characteristics of spirit varnish solvents; (2—5) Source, preparation, and use of various solvents. PART II. Oleo-resinous pine products—terpenes—camphors: (6). The oleo-resiniferous conifers; (7) Sources and methods of obtaining turpentine; (8) Distillation of turpentine; (9) Turpentine testing and turpentine substitutes; (10) Distillation and chemistry of rosin; (11) Rosin spirit and rosin oil; (12) Chemistry of the terpenes; (13) Wood tar, wood turpentine, wood creosote, etc. PART III. Spirit varnish resins and colouring matters: (14) Benzoin; (15) Dammar, kauri, etc.; (16) Dragon's blood; (17) Japanese, Chinese, and Burmese lacquers; (18) Manila copal; (19) Shellac; (20) Colours and stains. PART IV. Methods of manufacture; (21) Principles of spirit varnish manufacture; (22) Amber and asphaltum, collodion and celluloid spirit varnishes; (23) Copal and dammar spirit varnishes; (24) Indiarubber, insulating, mastic and matte spirit varnishes; (25) Rosin spirit varnishes; PART V. Analysis and testing; (26) Technical valuation; (27) Determination of resins and solvents in spirit varnishes.

LES MATIÈRES CELLULOSIQUES. Textiles Naturels et Artificiels. Pâtes à Papier et Papiers. Par F. J. G. BELTZER et J. PERSOZ. Manuels Pratiques d'Analyses Chimiques. Publiés sous la direction de F. Bordas et E. Roux. Librairie Polytechnique C. Beranger. Paris, 15, Rue des Saints-Pères. Liège, 21, Rue de la Régence. 1911. Price 7 fr. 50.

18MO volume containing 432 pages of subject-matter with 44 illustrations, also a bibliography and an index. It contains sections on: Celluloses and natural and artificial textiles. Classification of celluloses. Ordinary normal cellulose and their hydrates. Lignocelluloses. Pectocelluloses and mucocelluloses. Adipocelluloses and cutocelluloses. Paper pulps. Papers and paper testing.

LABORATORIUMSBUCH FÜR DIE ANORGANISCHE GROSSINDUSTRIE. Von Dr. C. v. HOHORST. Nebst einem Kapitel: KUNSTDÜNGERINDUSTRIE von M. ROSENBERG. Laboratoriumsbücher für die chemische und verwandte Industrien. Herausgegeben von L. Max Wohlgemuth. Band XIII. Verlag von W. Knapp, Halle a. S., Germany. 1910. Price M. 5.60.

SMALL 8vo volume with 115 pages of subject-matter and 25 illustrations; also an alphabetical index. It contains chapters on: Examination and valuation of fuels. Examination and purification of boiler feed-water. Sulphuric acid manufacture. Nitric acid manufacture. Hydrochloric acid and salt-cake manufacture. Bleaching powder manufacture by Deacon's process. Manufacture of ammonia-soda and caustic soda. Artificial manure industry. Examination of refractory and acid-proof materials.

Kolloidchemische Beihefte. Monographien zur reinen und angewandten Kolloidchemie. Herausgegeben von Dr. Wo. Ostwald. Band III. Heft 1—2. Verlag von T. Steinkopff. Dresden. 1911. Price M. 1.

This volume contains two monographs, one by R. E. Liesegang on the colloid-chemistry of histological silver stains, and the other by F. Emslander on the cause of the separation of albumin in bottled beer.

Grundzüge der Dispersoidchemie. Von Prof. Dr. P. P. von Weimarn. Verlag von T. Steinkopff, Dresden. 1911. Price M. 4.

Small paper-covered volume containing 121 pages of subject-matter, with 12 illustrations and indexes of authors' names and of subjects. The subject-matter is classified as follows: Introduction: The colloid condition as a general property of matter; classification and nomenclature. I. Properties of crystalline substances in different degrees of dispersion. II. The most important methods for obtaining a substance in different degrees of dispersion. III. Conditions of stability of suspensoids and suspensions. IV. The most important properties of high-molecular suspensides and emulsoids.

American Mineral Waters: The New England States. By W. W. Skinner. With a Chapter on Bacteriological Methods by G. W. Stiles, jun. U.S. Dept. of Agric., Bureau of Chemistry, Bull. No. 139 1911. Government Printing Office, Washington.

Turin Exhibition. Catalogue of Exhibits in British Chemical Industries Section. Eyre and Spottiswoode, Ltd., London. Printed for H.M. Stationery Office. 1911. Price 6d.

This small paper-covered volume contains descriptive articles on different branches of chemical industry, a description of the exhibits, an alphabetical list of exhibitors, and a plan of exhibits.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

Patent Specifications may be purchased at the Sale Branch of the Patent Office, Quality Court, Chancery Lane, London, W.C., fifteen days after the date on which acceptance of the complete specification is advertised. The price is 8d. each.

I.—GENERAL PLANT; MACHINERY.

Applications.

21,700. Friedmann. *See under* XVIII.

21,869. Smith. *See under* XI.

21,995. Feld. Apparatus for saturating or otherwise treating liquids with gases or vapours.* Oct. 5.

22,077. Sureties and Galbraith. Drying machine. Oct. 6.

22,326. Kayser. Evaporating and drying apparatus.* Oct. 10.

22,452. Ogle, and Mineral Concentrators, Ltd. Machinery for separating materials of different specific gravity. Oct. 11.

22,560. Chem. Fabr. Güstrow. Filter presses. [Ger. Appl., Oct. 19, 1910.]* Oct. 12.

22,670. Söderlund, Boberg, and Techno-Chemical Laboratories, Ltd. Evaporating, distilling, and similar installations. Oct. 14.

22,701. Runkel and Schulte. Mixing and grinding mills. Oct. 14.

Complete Specifications Accepted.

23,215 (1910). Burnett. *See under* II.

25,959 (1910). Johnson (Chem. Fabr. Griesheim-Elektron). Manufacture of nickel-lined articles such as apparatus for use in chemical manufactures. Oct. 18.

29,325 (1910). Laurie (Laurie). Filter. Oct. 18.

29,933 (1910). Bocking et Cie., and others. Process for cleaning furnace gases. Oct. 11.

1327 (1911). Mackey. Apparatus for treating liquids containing finely-divided matter in suspension. Oct. 18.

5179 (1911). Simon. Apparatus for separating lighter from heavier particles in mixtures, such as fine coal and sand. Oct. 18.

5901 (1911). Hatton and Sala. Apparatus for purifying or separating solids from liquids. Oct. 18.

13,990 (1911). Allgem. Ges. f. Chem. Industrie. Manufacture of a drying agent. Oct. 11.

15,291 (1911). Mueller. Filling for cooling towers. Oct. 18.

II.—FUEL; GAS; MINERAL OILS AND WAXES; DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

21,665. Farnham. Gas producers. Oct. 2.

22,214. Hart and Deschamps. Retorts for burning charcoal and analogous substances. [Australian Appl., March 14, 1911.]* Oct. 9.

22,224. Soucek. Manufacture of briquettes. Austrian Appl., July 5. 1911.]* Oct. 9.

22,357. Püning. *See under* VII.

22,424. Gripp. Manufacture of briquettes.* Oct. 11.

22,491. Papineau. Fuel for internal-combustion engines. Oct. 12.

22,501. Rigby and Testrup. Treatment of peat. Oct. 12.

22,531. Braun. Apparatus for extracting nitrogen and carbonic acid from combustion gases. Oct. 12.

22,696. Enke. Method of coking coal and the like.* Oct. 14.

Complete Specifications Accepted.

23,215 (1910). Burnett. Apparatus for extracting water from wet coal, peat, etc. Oct. 18.

23,549 (1910). Hutchins. Gas producers. Oct. 18.

23,550 (1910). Aarts. Manufacture of retorts or ovens for carbonising coal, etc. Oct. 18.

28,763 (1910). Carroll. Manufacture of carburetted water-gas. Oct. 11.

29,933 (1910). Bocking et Cie., and others. *See under* I.

763 (1911). Mackey. Coal-washing and the like. Oct. 18.

1544 (1911). Heraeus Ges., and Trenzen. Manufacture of metal filaments for electric lamps. Oct. 11.

5179 (1911). Simon. *See under* I.

6617 (1911). Ofenbau-Ges. Horizontal coke ovens or retorts. Oct. 11.

III.—TAR AND TAR PRODUCTS.

Applications.

21,710. Johnson (Badische Anilin und Soda Fabrik). Manufacture of amino-anthraquinones. Oct. 2.

21,717. Imray (Meister, Lucius, und Brüning). Manufacture of α-chloro-anthraquinones. Oct. 2.

21,777. Carron. Separation of the oils from the pitch of tar. Oct. 3.

24,042. Hutchinson. Instrument and method for testing tar. Oct. 6.

22,167. Lewkowitsch. *See under* XII.

22,361 and 22,362. Buchanan. *See under* XII.

Complete Specifications Accepted.

23,376 (1910). Moore. Recovery of by-products from coal tar, etc. Oct. 18.

23,467 (1910). Richter und Richter. Purification of hydrocarbons. Oct. 11.

2355 (1911). Newton (Bayer und Co.). Manufacture of 1-naphthol-2-sulphonic acid. Oct. 11.

IV.—COLOURING MATTERS AND DYES.

Applications.

21,727. Meister, Lucius, und Brüning. Manufacture of azo dyestuffs of the anthraquinone series. [Ger. Appl., Oct. 6, 1910.]* Oct. 2.

22,051. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring-matter containing sulphur. Oct. 6.

22,067. Soc. pour l'Ind. Chimique à Bâle. Manufacture of vat dyestuffs. [Fr. Appl., Oct. 28, 1910.]* Oct. 6.

22,069. Imray (Meister, Lucius, und Brüning). Manufacture of basic disazo dyestuffs.* Oct. 6.

22,455. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters. Oct. 11.

22,529. Newton (Bayer und Co.). Manufacture of developing dyestuffs. Oct. 12.

22,578. Read Holliday and Sons, and others. *See under* VI.

22,691. Imray (Meister, Lucius, und Brüning). Manufacture of brown azo dyestuffs.* Oct. 14.

Complete Specifications Accepted.

24,569 (1910). Imray (Meister, Lucius, und Brüning). Manufacture of violet-blue vat dyestuffs. Oct. 18.

25,461 (1910). Newton (Bayer und Co.). Manufacture of alkyl- and aryl-azimino-o-toluidines and of monoazo dyestuffs therefrom. Oct. 18.

26,249 (1910). Newton (Bayer und Co.). Manufacture of basic azo dyestuffs. Oct. 18.

1441 (1911). Newton (Bayer und Co.). Manufacture of compounds for producing dyes on the fibre. Oct. 18.

8203 (1911). Newton (Bayer und Co.). Manufacture of indigoid vat dyestuffs containing chlorine. Oct. 18.

8900 (1911). Imray (Soc. of Chem. Ind. in Basle). Manufacture of halogenated vat dyestuffs. Oct. 11.

11,421 (1911). Ullmann. Manufacture of vat dyestuffs of the anthraquinone series containing sulphur. Oct. 11.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

21,801. Schreckenbach. Treatment of raw and manufactured jute, hemp, flax, etc. [Ger. Appl., Nov. 29, 1910.]* Oct. 3.

21,841. Bradshaw. Method of retting flax, straw, and the like.* Oct. 4.

21,994. Newton (Hoesch und Co.). *See under* XVI.

22,237. Act.-Ges. f. Anilinfabr. Manufacture of cellulose derivatives. [Ger. Appl., Oct. 29, 1910.]* Oct. 9.

22,635. Ping and Schubert. Manufacture of filaments or threads from viscous liquids or solutions. Oct. 13.

Complete Specifications Accepted.

22,869 (1910). McInery (Peufaillit). Treatment of textile plants and vegetable matters to obtain fibres and paper pulp, applicable for degreasing wool and other animal fibres. Oct. 11.

27,878 (1910). Comp. Française des Applications de la Cellulose. Manufacture of cellulose products. Oct. 18.

28,192 (1910). Kay. Machines for washing wool and other fibrous substances. Oct. 18.

28,779 (1910). Comp. Française des Applications de la Cellulose. Preparation of cellulose solutions. Oct. 18.

406 (1911). Courtauld and Co., and Napper. Manufacture of threads, filaments, strips, or films of cellulose. Oct. 11.

1556 (1911). Newton (Bayer und Co.). Manufacture of dyed acidyl derivatives of cellulose. Oct. 18.

VI.—BLEACHING; DYEING; PRINTING FINISHING.

Applications.

21,880. Seaton-Snowdon. Rendering cotton and other fabrics permanently flame-proof and non-imflammable. Oct. 4.

22,534. Hahn. Method and arrangement for mercerising yarn in the form of skeins.* Oct. 12.

22,578. Read Holliday and Sons, Turner, and Dean. Production of compounds for dyeing animal fibres. Oct. 13.

Complete Specifications Accepted.

24,434 (1910). Ashworth. Dyeing indigo and other vat colours. Oct. 11.

1441 (1911). Newton (Bayer und Co.). *See under* IV.

1556 (1911). Newton (Bayer und Co.). *See under* V.

16,723 (1911). Ratignier, and Pervilhac et Cie. Producing an undulated or loosened surface on fabrics. Oct. 18.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

21,724. Hale. Recovery and concentration of nitric acid from kieselguhr or other absorbent. Oct. 2.

21,988. Lewit. Production of a compound containing sulphur and alkali. Oct. 5.

21,996. Feld. Apparatus for producing sulphurous acid from sulphur.* Oct. 5.

22,231. Scialoja. Manufacture of nitrogenous compounds from metallic carbides. [Ital. Appl., Oct. 8, 1910.]* Oct. 9.

22,357. Püning. Direct extraction of ammonia as sulphate, free from tar, from distillation gases. [Ger. Appl., Oct. 10, 1910.]* Oct. 10.

22,453. Johnson (Badische Anilin und Soda Fabrik). Manufacture of formaldehyde sulphoxylates. Oct. 11.

22,513. Webster, and International Salt Co., Ltd. Manufacture of salt. Oct. 12.

22,603. Webster, and International Salt Co., Ltd. Manufacture of salt. Oct. 13.

Complete Specifications Accepted.

22,615 (1910). Hof and Rinck. Treatment of impure products containing oxide or sulphate of lead. Oct. 11.

23,046 (1910). Phillips and Bulteel. Causing nitrogen to react to form ammonia. Oct. 11.

23 333 (1910). Mathon. Lime kilns. Oct. 18.

29,386 (1910). Collett and Eckardt. Manufacture of ammonium sulphate. Oct. 11.

11,701 (1911). Newton (Bayer und Co.). Manufacture of manganates. Oct. 11.

12,307 (1911). Kassner. Separation of oxygen and nitrogen from the atmosphere. Oct. 18.

15,189 (1911). Soc. Anon. des Usines de Riouperoux. Peroxidation of the alkali metals. Oct. 18.

VIII.—GLASS; CERAMICS.

Complete Specification Accepted.

2626 (1911). Schwerin. Manufacture of porous articles of refractory material. Oct. 18.

IX.—BUILDING MATERIALS.

Applications.

21,697. Rhodin. Manufacture of cement. Oct. 2.

21,818. Mathys (National Lumber Vulcanizing Co.). Process for treating wood.* Oct. 3.

22,612. Calthrop and Child. Production of artificial stone and the like. Oct. 13.

Complete Specification Accepted.

17,093 (1910). Owen. Utilisation of slate refuse to make artificial slates or tiles. Oct. 11.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

21,661. Rockey and Eldridge. Plating ferrous metals with copper or an alloy of copper.* Oct. 2.

21,761. Woltereck. Metallurgical processes. Oct. 3.

21,762. Woltereck. Recovery of tin from tin scrap. Oct. 3.

21,946. Foster. Blast furnaces. Oct. 5.

22,141. Marino and Marino. Electrolytic deposition of metals, particularly on iron and steel surfaces.* Oct. 7.

22,236. Soc. Electro-Métallurgique Française. Process for reducing oxides. [Fr. Appl., Oct. 10, 1910.]* Oct. 9.

22,323. Wright. Gold or silver reduction plant. Oct. 10.

22,416. Harrison (Zappert). Manufacture of steel armour plates. Oct. 11.

22,428. Hoover and Paterson. Agitating and aerating apparatus for treating pulp containing metals. Oct. 11.

22,511. Wigg and Peers. Recovery of zinc from the liquors resulting from the extraction of copper by the wet process. Oct. 12.

22,627. Turbo Amalgamator and Extraction Co., and Lockwood. Apparatus for extracting precious metals from pulp and solutions. Oct. 13.

Complete Specifications Accepted.

20,896 (1910) and 8035 (1911). Hardingham (Huntington). Means for separating zinc from ores, etc. Oct. 18.

22,792 (1910). Smith. Method of bessemerising copper matte. Oct. 11.

22,973 (1910). Greenway and Lavers. Concentration of ores. Oct. 11.

23,260 (1910). Mitchell. Apparatus for extracting metals from their ores. Oct. 18.

23,565 (1910). Edwards. Ore-roasting furnaces. Oct. 18.

24,052 (1910). Martin. Extraction of iron from its ores. Oct. 18.

28,592 (1910). Cowper-Coles. Apparatus for use in the electro-deposition of iron. Oct. 11.

1535 (1911). Wedge. Desulphurising ores or concentrates. Oct. 18.

XI.—ELECTRO-CHEMISTRY.

Applications.

21,869. Smith. Vacuum retort. Oct. 4.

21,987. British Thomson-Houston Co. (General Electric Co.). Insulating compositions. Oct. 5.

Complete Specification Accepted.

1609 (1911). Reid. Electric furnaces. Oct. 11.

XII.—FATS; OILS; WAXES.

Applications.

22,167. Lewkowitsch. Reduction of organic substances. Oct. 9.

22,361 and 22,362. Buchanan. Reduction of unsaturated organic substances. Oct. 11.

Complete Specifications Accepted.

24,981 (1910). Newton (Bayer und Co.). Manufacture of medicinal soaps. Oct. 11.

8147 (1911). Schlinck und Co. A.-G. Manufacture of solid fatty substances from oils. Oct. 18.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

21,667. Lender. Manufacture of binding agents for pigment colours, ground cork, etc., and of varnishes, lacquers, etc. [Ger. Appl., Jan. 3, 1911.]* Oct. 2.

22,122. Pigments, Ltd., and Thompson. Manufacture of pigments. Oct. 7.

Complete Specification Accepted.

22,615 (1910). Hof and Rinck. *See under* XIII.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

22,446. Reynaud. Manufacture of artificial india-rubber.* Oct. 11.

22,454. Johnson (Badische Anilin und Soda Fabrik). Manufacture of substances resembling caoutchouc. Oct. 11.

Complete Specification Accepted.

1704 (1911). Johnson (Badische Anilin und Soda Fabrik). Manufacture of isoprene. Oct. 18.

XVI.—SOILS; FERTILISERS.

Applications.

21,994. Newton (Hoesch und Co.). Manufacture of manure from waste sulphite liquor.* Oct. 5.

22,121. Hadfield and Co., Ltd., and Horton. Artificial manures. Oct. 7.

Complete Specification Accepted.

23,477 (1910). Voss. Fungicides, insecticides, etc. Oct. 18.

XVII.—SUGARS; STARCHES; GUMS.

Application.

22,059. Reese. Sugar. Oct. 6.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

21,700. Friedmann. Coating the inner surface of iron fermenting vats, storage vessels, coolers, etc. Oct. 2.

22,411. Maschinenbau A.-G. Golzern Grimma, and Zeckendorf. Recovery of alcohol in fermenting processes. [Ger. Appl., Nov. 4, 1910.]* Oct. 11.

22,663. Boult (Wahl-Henius Institute of Fermentology). Manufacture of fermented malt beverages. Oct. 14.

Complete Specifications Accepted.

20,521 (1910). Ransford (Soc. Franç. des Distilleries de l'Indo-Chine). Manufacture of wines of the saké type from rice, and other like wines from cereals. Oct. 11.

3338 (1911). Brüne. Malt and like kilns. Oct. 18.

7394 (1911). Watrigant. Recovery of nitrogen from certain residual liquids. Oct. 11.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

21,829. Helbronner and von Recklinghausen. Apparatus for sterilising liquids by ultra-violet rays. [Divided Appl. on No. 23,078 of 1910.]* Oct. 3.

22,609. Horne. Casein. Oct. 13.

Complete Specifications Accepted.

23,077 (1910). Henri and others. Apparatus for sterilising liquids by ultra-violet rays. Oct. 11.

28,353 (1910). Gans. Process for clarifying water and for purifying it from germs. Oct. 11.

4895 (1911). Henri and others. Apparatus for treating liquids with ultra-violet rays. Oct. 11.

7394 (1911). Watrigant. *See under* XVIII.

12,668 (1911). Dietrich. Baking powder. Oct. 11.

XX.—ORGANIC PRODUCTS: MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

21,981. Wellcome and Pyman. Manufacture of a berberine derivative. Oct. 5.

22,072. Jaspersen. Production of curative medicines. Oct. 6.

22,167. Lewkowitsch. *See under* XII.

22,361 and 22,362. Buchanan. *See under* XII.

22,611. Newton (Bayer und Co.). Manufacture of alkyl derivatives of morphine. Oct. 13.

22,614. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of bodies containing sulphur derived from ketodihydrobenzo-*p*-thiazine or its derivatives. Oct. 13.

Complete Specifications Accepted.

28,247 (1910). Newton (Bayer und Co.). Manufacture of cinnamic esters. Oct. 18.

1704 (1911). Johnson (Badische Anilin und Soda Fabrik). *See under* XIV.

9360 (1911). Meister, Lucius, und Brüning. Manufacture of a dimethylbenzylphenylammonium monosulphonic acid. Oct. 18.

XXII.—EXPLOSIVES; MATCHES.

Application.

22,311. Cocking, and Kynoch, Ltd. Explosives. Oct. 10.

Complete Specifications Accepted.

25,274 (1910). Pittius. Explosives. Oct. 11.

2834 (1911). Birmingham Metal and Munitions Co., and Barker. Manufacture and handling of propulsive explosives. Oct. 18.

11,495 (1911). Young. Fume destroying composition for use with blasting charges, cartridges, etc. Oct. 11.

XXIII.—ANALYTICAL PROCESSES.

Application.

22,042. Hutchinson. *See under* III.

Complete Specification Accepted.

659 (1911). Borchers. Apparatus for testing gases, steam, etc., and recording the solid and liquid admixtures therein. Oct. 18.

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Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Methyl chloride and air; Inflammability of mixtures of ——. Saposchnikoff. Z. ges. Schiess- und Sprengstoffw., 1911, 6, 304.

In view of suggestions for the use of methyl chloride in refrigerating machines, the author has examined the inflammability of mixtures of methyl chloride and air. A mixture of air (88 per cent.) and methyl chloride (12 per cent. by vol.), *i.e.*, in the proportions theoretically required to convert the carbon to carbon dioxide and the hydrogen to water burns with a greenish flame, without explosion, on applying a light. The above-named mixture is not exploded when guncotton is ignited in contact with it, nor by a red hot platinum wire. It is, however, exploded by electric sparks or a powder fuse. When the content of methyl chloride falls below 10 per cent. or is raised above 15 per cent., the mixture does not ignite.
—G. W. McD.

Patents.

Smoke; Apparatus for indicating and recording the character of ——. R. F. Eddy, Chicago, Ill. Eng. Pat. 22,915, Oct. 4, 1910.

The smoke is drawn by means of a pump through a condenser and drying vessel containing sulphuric acid and is then forced through a nozzle on to a revolving cylinder of paper mounted on a drum. The jet of the nozzle is elongated in the direction of movement of the paper, and ribs are provided on either side to prevent the smoke from spreading over the surface of the paper. The pump is of the fluid piston type, and is fitted with a pocket for the collection of solid matter carried in by the smoke. (Reference is directed to Eng. Pat. 12,726 of 1904).—H. H.

Shaking barrels and the like. G. T. Walker, Birmingham, F. C. Sharp and T. A. Stevens, Wolverhampton. Eng. Pat. 23,189, Oct. 7, 1910.

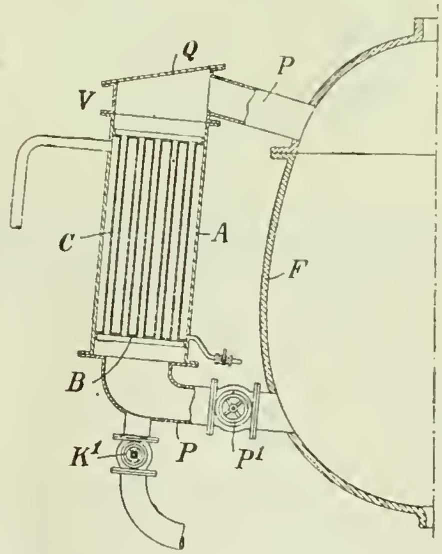
Shaking barrels, of hexagonal form, for instance, as used for drying, finishing or cleaning metallic articles, etc., are constructed of a number of wooden side pieces held together solely by external pressure. The side pieces are bevelled to fit against one another at the desired angle, and abut at the ends against cast iron end pieces, which are pressed towards one another by screwed plates mounted on a central bolt passing through the barrel, and have flanges projecting inwards at the corners of the side pieces beneath which are mounted clamping bars for holding the side pieces together. Metal side pieces may be similarly employed.—H. H.

Vacuum evaporation; Apparatus for multiple effect ——. H. H. Dow, Assignor to the Dow Chemical Co., Midland, Mich. U.S. Pat. 1,004,686, Oct. 3, 1911.

The apparatus comprises two open heating pans above which are mounted vacuum chambers having inlet pipes dipping into the liquid in the respective pans and discharge pipes for the separated crystals. The vacuum is maintained in the two chambers by a single pump connected with the second of the chambers, which is connected with the first by a pipe passing through the liquid in the second heating pan, so that a lower vacuum exists in the first chamber than in the second, while the steam given off in the first vacuum chamber serves to heat the liquid in the second pan. The liquid in the first pan is heated by an ordinary steam coil.—H. H.

Evaporating or concentrating under vacuum, and apparatus therefor. B. M. Jäger, Birkenhead, Cheshire. Eng. Pat. 23,749, Oct. 13, 1910.

The patent relates to apparatus of the type in which a heating chamber, A, is arranged within or is connected with the vacuum pan, F, the chamber A having tubes, C, through which the liquor circulates. The improvements comprise the provision of a charging cock, K^1, and a shut-off cock, P^1, by means of which the chamber, A, can be used as feed-heater when desired; and an upward extension, V, of the chamber, A, with connection, P, to the vacuum pan, and an inclined cover, Q, which enables the tubes to be cleaned and also acts as a guide and deflector for the liquid and liberates the bubbles, causing vapour to be given off freely. When the chamber, A, is within the pan, F, it is open at both ends, and a curved deflector is arranged over the upper end.—A. T. L.

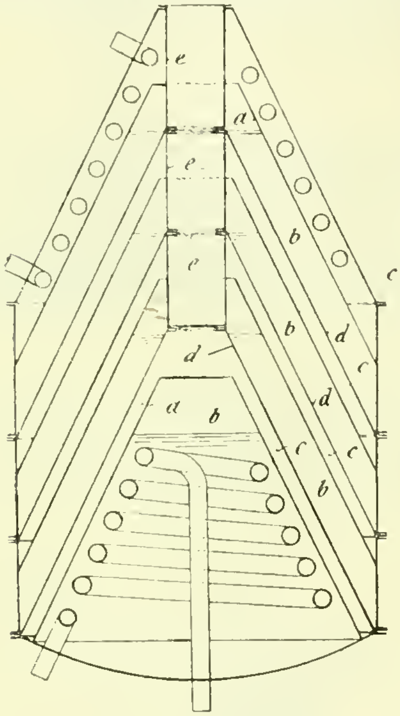


Evaporating liquids to dryness; Apparatus for ——. R. Joya. Fr. Pat. 429,564, May 10, 1911.

THE apparatus comprises a rotating wheel having deep hollow corrugations on its periphery which dip into the liquid to be evaporated and are then carried through a casing in which hot air is circulated. Hot air is also passed through the hollow corrugations. The dried residue is removed from the wheel by scrapers.—H. H.

Evaporation of liquids; Apparatus for the ——. O. Schmeiser. Ger. Pat. 238,136, Nov. 10, 1910.

THE evaporator is divided into a number of compartments, each consisting of an evaporating chamber, *b*, and a condensing chamber, *c*, the condensing chamber of one compartment being separated from the evaporating chamber of the next compartment by a hood-shaped partition. In order to reduce the height of the apparatus, the partitions, *d*, separating the different compartments, instead of being closed as was formerly the case, have an opening at the top, and these openings are closed by annular covers, *e*, accessible from outside. The covers, *e*, are preferably disposed obliquely to the walls, *a*, of the evaporating chambers.—A. S.



Charging hoppers for generators, furnaces, and kilns. A. Folliet-Mieusset. Liège, Belgium. Eng. Pat. 18,242, Jan. 28, 1911.

FUEL is charged to generators, shaft furnaces, and kilns, etc., through a hopper having a distributor formed in two parts, viz., the usual cone for distributing the fuel towards the periphery of the generator, and a hemispherical member mounted in a central aperture formed in the cone which is adapted to discharge the fuel towards the centre of the generator. The cone and hemisphere are controlled by balance weights and levers, by adjusting which the charge can be distributed uniformly in the interior of the generator, etc.—H. H.

Kiln. L. P. Ross, Standish, N.Y., Assignor to Northern Iron Co. U.S. Pat. 1,004,085, Sept. 26, 1911.

IN a rotary kiln, a scraping bar is provided, mounted loosely in the stationary lower end wall so as to bear against the inner surface of the kiln in a position somewhat higher than the lowest point.—A. T. L.

Char; Kiln for revivifying ——. R. S. Kent, Brooklyn, N.Y. U.S. Pat. 1,004,176, Sept. 26, 1911.

THE kiln comprises two sets of vertical retort tubes arranged at opposite sides of a fire-box. The side walls of the fire-box extend upwards and inwards, and form a narrow opening for the delivery of heating gases in the centre of the kiln, some distance from the nearest of the tubes. The outlet flues lead from the lower part of the kiln, so that the gases circulate first around the upper part of the tubes and then around the lower part.—A. T. L.

Furnace; Rotary ——. D. Baker, Philadelphia, Pa. U.S. Pat. 1,004,340, Sept. 26, 1911.

A ROASTING furnace comprises a long inclined rotating tube through which the ore passes slowly towards the lower end, and a short conical portion forming a continuation or widening of this tube at its lower end and rotating at a higher speed. The heating gases are introduced into the lower end of the conical portion. The fine ore is desulphurised in the slowly-rotating upper part of the furnace, and is heated more highly and fused into nodules as it passes rapidly through the lower part.—A.T.L.

Drying apparatus. E. A. Bronson, Newburgh, N.Y. U.S. Pat. 1,004,358, Sept. 26, 1911.

THE material to be dried passes along an inclined trough, heated by steam, and the trough is rocked about a longitudinal axis.—A. T. L.

Centrifugal separator for gases. J. Fetzer, Assignor to J. J. Gerlach, jun., Pittsburgh, Pa. U.S. Pat. 1,004,760, Oct. 3, 1911.

THE separator consists of a vessel in the form of a frustum of a cone which is caused to rotate axially upon hollow journals through which the gases enter and leave the vessel. Internally the vessel is divided into three transverse compartments which communicate with one another near the peripheral wall of the casing and are provided with baffles for communicating rotation to the gases. The mixed gases enter the compartment of smaller diameter, and the separated gases of different densities are removed separately from the middle and larger compartment respectively by passages formed in the hollow journal.—H. H.

Crystals; Method of producing ——. H. H. Dow, Assignor to The Dow Chemical Co., Midland, Mich. U.S. Pat. 1,004,858, Oct. 3, 1911.

A PROCESS for obtaining crystals from an impure solution consists in passing such solution in succession through a series of evaporating pans, and simultaneously transferring the crystals from pan to pan of the series in a direction opposite to that in which the solution flows. —H. H.

Crystallisation by evaporation, with automatic circulation of liquid; Apparatus for ——. Soc. d'Exploitation de Procédés Évaporatoires, Système Prache et Bouillon. Fr. Pat. 428,851, June 30, 1910.

THE apparatus comprises two circulating chambers of unequal height connected at the bottom with a crystallising chamber containing hollow baffle-plates through which steam is circulated. The liquid is caused to flow in one direction through the apparatus by steam admitted above the liquid in the lower circulating chamber, and in the opposite direction by gravity, the admission and exhaust valves for the steam being controlled by floats in the two chambers. The crystals collect in a conical vessel at the bottom of the crystallising chamber, and are removed periodically.—H. H.

Classification of ores and other solid bodies according to their density; Apparatus for the mechanical ——. R. E. Trottier. Fr. Pat. 429,117, July 6, 1910.

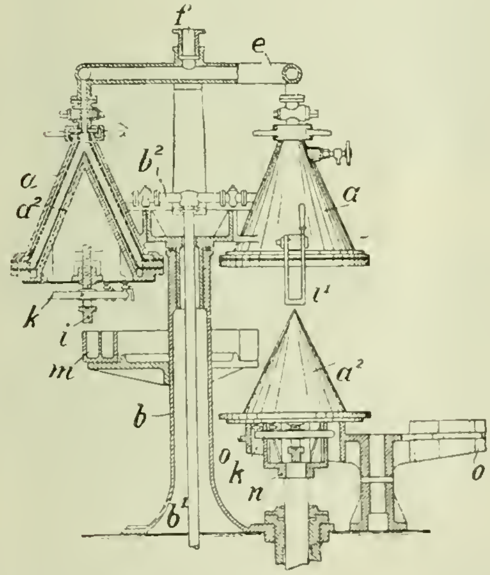
THE material to be classified is placed in a tray consisting of a number of perforated plates inclined at different angles, the whole being immersed in water contained in a large outer vessel. When the tray is agitated in a suitable manner, the water is caused to circulate and deposits the finer particles according to their density in pockets formed in the outer vessel, while the larger and heavier particles remain on the tray but are separated by reason of the varying inclinations of the plates.—H. H.

Filter presses; Drip-plates for ——. Gentrup und Petri. Fr. Pat. 429,240, May 3, 1911.

A drip-plate to collect the liquid leaking from the chambers of a filter-press is formed in two parts hinged one at each side of the press. The plates are attached to chains passing round a drum which can be rotated by a hand lever to bring the plates into one or other of two positions. In one position the plates overlap so as to form an inclined plate extending completely across the press for conducting liquid to a collecting trough at the side. In the other position the plates become steeply inclined to one another and serve as a funnel leading to the drainage trough below the press.—H. H.

Filter; Continuous ——. P. Dehne. Ger. Pat. 229,066, Feb. 20, 1908.

The filter consists of a number of filtering chambers, mounted so as to rotate around a central pillar, the connections being so arranged that a chamber can be cut out of the system, emptied, and again put into operation without stopping the working of the apparatus. In the apparatus shown (see Fig.), four filtering chambers, *a*, rotate around the central pillar, *b*. The liquid to be filtered is supplied under pressure to the pipe, *f*, and passes through the ring pipe, *e*, to the filtering chambers, each of which consists of two concentric perforated cones, *a*, a^2, covered with filtering material. The filtrate passes through the perforated walls into gutters and thence through cocks into the annular trough, *m*. The washing water is introduced through the pipe, b^1, and passes to the filtering chambers through branches, b^2. When it is desired to replace one of the filtering chambers, the latter is brought over the lifting device, *n*, and the latter is raised until the turn-table, o, is in contact with the inner cone of the chamber, which is then unfastened from the outer cone; the lifting device is then lowered, the turn-table is rotated so as to bring a new inner cone into position, the lifting device is raised, and the new inner cone is fixed in position.—A. S.



Filter-press; Continuous ——. P. Dehne. Ger. Pat. 237,921, Dec. 24, 1909. Addition to Ger Pat. 229,066, Feb. 20, 1908.

The rotating table, *o* (see preceding abstract), is made fork-shaped, the two arms enclosing the lifting device, *n*, when in position for the replacement of the inner cone of one of the filtering chambers by a fresh one.—A. S.

Homogenising liquids; Apparatus for ——. W. Fette. Ger. Pat. 237,737, Dec. 2, 1909.

The apparatus is of the type in which the liquid is rendered homogeneous by passing it between two blocks, one fixed and the other rotating, and the object of the invention is to render the wear of the surfaces uniform. For this purpose, the driving spindle is fixed eccentrically to the rotating block and is mounted in an eccentric guide, which is rotated at a speed different from that of the spindle. By means of this arrangement, the rotating-block moves over the surface of the fixed block in a series of curves, and the surfaces are worn evenly.—A. S.

Colloidal substances; Process for separating —— *from pseudo-solutions.* Richter und Richter, Frankfort on Maine, and L. von Orth, Charlottenburg, Germany. Eng. Pat. 23,466, Oct. 10, 1910. Under Int. Conv., Dec. 31, 1909.

See Fr. Pat. 421,276 of 1910; this J., 1911, 479.—T. F. B.

Drying machines having steam heated cylinders. T. F. Dexter, Providence, R.I., U.S.A. Eng. Pat. 3605, Feb. 13, 1911. Under Int. Conv., Feb. 19, 1910.

See Fr. Pat. 425,986 of 1911; this J., 1911, 950.—T. F. B.

Coal [*charcoal*] *of high activity; Process for manufacturing* ——. F. Richter, Frankfort on Maine, Germany. U.S. Pat. 1,001,222, Aug. 22, 1911.

See Fr. Pat. 428,540 of 1911; this J., 1911, 1183.—T. F. B.

Solids; Liquid gravity separation of ——. F. I. du Pont, Wilmington, Del. U.S. Pat. 1,004,815, Oct. 3, 1911.

See Fr. Pat. 419,752 of 1910; this J., 1911, 120.—T. F. B.

Evaporating apparatus. P. Kestner, Lille, France, Assignor to Kestner Evaporator Co., Philadelphia. U.S. Pat. 1,005,553, Oct. 10, 1911.

See Eng. Pat. 5020 of 1910; this J., 1910, 1190.—T. F. B.

Vegetable extracts; Process of preparing desiccated ——. P. Kestner, Lille, France. U.S. Pat. 1,005,554, Oct. 10, 1911.

See Fr. Pat. 409,053 of 1909; this J., 1910, 743.—T. F. B.

Raising or forcing liquids; Methods and apparatus for ——. H. A. Humphrey. Fr. Pat. 429,845, March 20, 1911 (under Int. Conv., March 31, 1910), and Addition, dated March 14, 1911, to Fr. Pat. 393,312, June 26, 1908. Under Int. Conv., March 22, 1910.

See Eng. Pats. 7824 and 7152 of 1910; this J., 1911, 524. —T. F. B.

Filtering liquids; Apparatus for ——. G. Alexander. Fr. Pat. 430,158, May 26, 1911.

See Eng. Pat. 12,355 of 1911; this J., 1911, 1100.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Chamber settings [*for gas manufacture*] *at Weimar; Results of working* ——. Engelking. J. Gasbeleucht., 1911, 54, 973—977.

The coking chambers are 4 m. long, 0·45—0·50 m. wide and 1·8 m. high at the centre, and three chambers are built together in one setting. The coking period is 4 or 5 times

as long as with retort settings, and the chamber settings are therefore less convenient in meeting varying demands for gas and require more care to ensure the production of gas of uniform quality. On the other hand the yield of gas and of ammonia is higher, the coke is more valuable, there is less naphthalene, the chambers require less labour, and the cost of repair and maintenance is considerably less. The following particulars are given as the result of 9 months' working.—*Gas.* The average yield of gas is 32·5 cb. m. at 15° C, and 760 mm. per 100 kilos. of coal, and the gas has a calorific value of 5050—5100 cals. per cb. m. (steam condensed), the chambers being run without the introduction of steam. *Coke.* The coke is very dense and hard, weighing 50—55 kilos. per 100 litres. The total yield of coke is 70 per cent. of the weight of the coal. The quantity used in the gas producers amounts to 18·3 per cent. of the coal carbonised, but this has been reduced to 15·5 per cent. in newer settings having larger regenerators. *Tar and ammonia.* There is less tar than with retort settings, and the tar is free from water. The amounts obtained are 3·68 per cent. of tar and 0·234 per cent. of ammonia, reckoned on the coal carbonised. *Graphite.* Only 2500 kilos. of graphite had been removed from the coking chambers after making 4·5 million cb. m. of gas, or one-sixth as much as with retort settings. *First cost.* The cost of installing the chamber ovens was about 25 per cent. greater than the cost of retort settings for the same output.
—A. T. L.

Coal gas; Function of tar in the condensation of ——. A. H. White and P. S. Tour. J. Gas Lighting, 1911, **116**, 117—118.

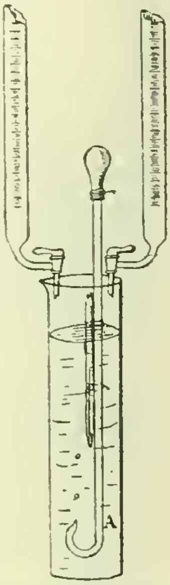
EXPERIMENTS were made in order to determine whether in ordinary works practice the tar and gas in the condensers are in equilibrium as regards the solution of benzene and naphthalene in the tar. Successive portions of purified gas were passed through a sample of the tar at different temperatures, and the calorific power and candle power were tested before and after this tar-scrubbing. The gas was found to be impoverished by the scrubbing, showing that the tar had been separated from the gas before equilibrium was reached. It was also found that the percentage of naphthalene in the crude tar increased in the course of the carbonisation of a charge in the retorts, whilst the percentages of light oil in the tar and of benzene in the purified gas decreased, and it should therefore be possible to enrich the poorer gas by scrubbing with the tar collected soon after charging, which is poor in naphthalene and rich in light oils. Although rapid cooling of the crude gas would increase the candle-power, owing to the retention of benzene in the gas, the present method of slow cooling is best for small plant as it renders the removal of tar-fog more simple.—A. T. L.

Selenium [in sulphuric acid]; Influence of —— in the refining of mineral oils. F. Schulz. Chem.-Zeit., 1911, **35**, 1129—1130.

THE author discusses the action of selenium present in sulphuric acid used for refining petroleum and its wax. Petroleum refined with an acid containing 0·5 per cent. of selenium has a decided yellow tint in comparison with that purified by treatment with pure acid. Selenium dioxide has a greater action than the element itself. The colouration is not removed by subsequent treatment of the petroleum with pure acid. The author considers that selenium acts as a direct oxidising agent and not merely as a catalyser. Nitric and nitrous anhydrides are found to have a similar but decidedly greater action than selenium dioxide.—A. SELD.

Petroleums [heavy crude petroleums, viscous lubricants, "black oils," etc.]; A convenient method for determining the density of heavy ——. J. McC. Sanders. Chem. Soc. Proc., 1911, **27**, 250.

THIS apparatus consists of a curved glass tube, A, of the form shown, provided with a small rubber bulb or a rubber tube with a pinchcock, according to the density of the oil to be examined. In addition, two graduated burettes of 100 c.c. capacity, a 100 c.c. cylinder, a thermometer, and a rubber-tipped glass rod. Two solutions of alcohol and water are required, one containing 0·5 per cent. of alcohol, the other 75 per cent., both by volume. The alcohol used should be pure, and the water free from air. A well-mixed sample of the oil is poured into the curved glass tube so as to nearly fill it; if the oil is very viscous, the small, rubber, pear-shaped cap is used to close the upper orifice of the tube, otherwise the tube and pinchcock are employed. The burettes are then filled each with one of the alcoholic mixtures, the level of the liquids being brought to the zero point on the burettes, and these are then supported one on each side of the glass cylinder. About 75 c.c. of the more dilute alcohol are then run into the cylinder from the burette, and the glass tube is immersed in the cylinder. By means of the pinchcock or rubber bulb, a single small drop of the oil is expelled from the lower orifice of the tube, when, if the density of the liquid is greater than that of the oil drop, the latter will immediately rise to the surface, and can be "fished out" by touching it with the rubber-tipped glass rod. A little of the stronger alcohol is then run in from the other burette, and another trial drop of the oil expelled; these operations are repeated until the densities of the mixture and the oil drops are identical. The volumes of the two alcohols used to form the mixture are read off from the burettes, and the density of the mixture is calculated from the amounts used.



Petroleum oil; Utilisation of waste lyes in the refining of ——. J. Hausman. Petroleum, 1911, **7**, 13—15.

PETROLEUM oil which has been refined with black recovered sulphuric acid requires treatment with an excess (about 40 per cent.) of soda lye in order to render it neutral to phenolphthalein. This is due to the presence of certain organic acids which yield soluble barium salts (see this J., 1911, 1149). A large saving of alkali (from 70 to 90 per cent. according to the conditions) may be effected, by using the residual lye from such treatment for the preliminary washing of a fresh portion of oil. A further advantage is that the lyes will then contain a greater amount of naphthenic acids, and will require less sulphuric acid for their neutralisation.—C. A. M.

Petroleum oil; Action of catalytic agents on ——. L. Ubbelohde and S. Woronin. Petroleum, 1911, **7**, 9—13.

ACCORDING to the theory of Engler and Routala unsaturated lubricating petroleum oils of high molecular weight undergo catalytic decomposition in nature, with the formation of liquid paraffins (and gases) and naphthenes, whilst the more unsaturated residues unite to form lubricating oils poorer in hydrogen and of higher molecular weight. In studying the effects of catalytic agents upon the decomposition, 100 grms. of coarsely powdered porous earthenware upon which nickel had been reduced in metallic form were impregnated with 10 to 12 grms. of the petroleum oil, and heated at regulated temperatures from 180° to 500° C. in a current of purified nitrogen or hydrogen. The gases were collected and analysed by the usual methods, whilst the distillates were compared with those obtained under parallel conditions, but without the presence of a catalytic agent. No lowering of the vapour pressure appeared to be caused by the catalytic action. The results are given in tabular form. Various proportions (according to the partial pressure, temperature, etc.) of hydrogen, methane, ethane and heavy hydrocarbons were produced under the influence of the catalytic agent, whilst the distillates were of quite

different character from those yielded by the oil alone. A certain proportion of carbon monoxide and dioxide was invariably produced, the oxygen in which was attributed to the esters detected by Krämer in crude petroleum oils.
—C. A. M.

Sulphur in petroleum; Determination of ——. D. Lohmann. Chem.-Zeit., 1911, 35, 1119—1120.

Engler's lamp method, which is the most convenient for illuminating oils, gives unreliable results in the case of certain Mexican oils, owing to the concentration of the sulphur in the lamp oil. Accurate results may invariably be obtained by the use of Mahler's calorimetric bomb for the combustion. From 1 to 1·5 grms. of the oil are introduced into the bomb, which is then filled with oxygen. The pressure required is 10 atmos. for benzine, 15 for kerosene, 18 for gas oil, 20 for fuel, lubricating and crude oils, and 25 for asphaltum, coke and coal. Ignition is produced by means of a current of 8 volts and 2 amp., and the gases formed in the combustion are conducted into a solution of 2 grms. of pure sodium carbonate in 25 c.c. of water. About 10 per cent. or less, of the total sulphur in the material will be found in this solution, which is subsequently used for the first rinsing of the bomb. The total solution and washings (about 250 to 300 c.c.) are evaporated on the water bath to 50 c.c., and filtered from the precipitated iron and aluminium hydroxides (derived from the ignition wire and the glazing of the bomb), and the filtrate acidified with 7·5 c.c. of hydrochloric acid, and heated for about an hour on the water bath to expel carbon dioxide, after which 10 c.c. of 10 per cent. barium chloride solution are added, the beaker left for an hour on the water bath, and then allowed to stand for 12 hours, and the liquid filtered while hot. The precipitate is treated with 3 drops of strong hydrochloric acid and 40 c.c. of water and again separated, washed, and ignited at a moderate temperature. Provided that at least 0·01 grm. of barium sulphate is left, the result will be accurate. When an oil contains less than 0·14 per cent. of sulphur several combustions should be made and the products united.—C. A. M.

PATENTS.

Fuel; Manufacture of composite solid ——. Comp. d'Agglomérés d'Anthracite pur, and A. Besson, Paris. Eng. Pat. 9471, April 18, 1911.

The fuel is composed of 905 parts of powdered anthracite, 60 parts of hard pitch ("*brai dur*"), 20 parts of petroleum coke, and 5 parts of sodium or potassium nitrate, with or without 10 parts of powdered wood charcoal. The charcoal and the nitrate are intimately mixed and then incorporated with the other ingredients in a mixer heated to 80° or 85° C. The product is finally heated to 125°—150° C. in order to remove the excess of volatile substances. The agglomerated fuel resembles anthracite. It contains only 6—7 per cent. of volatile substances and has a heating value of 8500 cal. per kilo.—A. T. L.

Coal briquettes; Manufacture of ——. H. J. Phillips, London, and A. Phillips, Tredegar. Eng. Pat. 14,841, June 26, 1911.

Bituminous or semi-bituminous coal is ground with water to form a stiff pulp, and this is compressed into briquettes without heating and under moderate pressure. The briquettes are dried by heating at 150°—220° F. and are finally subjected to high pressure whilst still hot. The briquettes may also be made with an agglomerant. The pitch or resin, or a mixture of both, is ground with water to a fine emulsion and this is poured on to the ground wet coal and mixed in, the briquetting process being carried out as before. The quantity of pitch used is from 1 to 3 per cent.—A. T. L.

Coked briquettes; Manufacture of ——. P. E. Simon. Fr. Pat. 428,900, April 25, 1911. Under Int. Conv., May 26, 1910.

The briquettes are carbonised in suitable retorts under reduced pressure in order to hasten the carbonisation, and the products given off during the heating are recovered.
—W. H. C.

Briquettes formed of coal, peat, coke, wood and other solid combustible materials mixed with liquid combustibles; Manufacture of ——. Naamlooze Benootschap Briquet Co. Fr. Pat. 429 781. May 17, 1911.

Mixtures of the materials mentioned in the title are submitted to a thorough mixing and grinding in suitable mixing machinery, so that a product is obtained in such a plastic condition that it can be formed into briquettes without the addition of an agglomerant.—W. H. C.

Coke ovens; Apparatus for quenching, screening, and loading coke from bye-product ——. J. Mackenzie, Middlesbrough. Eng. Pat. 24,086, Oct. 18, 1910.

The operations of quenching, screening and conveying the coke from the oven to the waggon are effected concurrently by means of a self-contained apparatus which is movable along the battery of ovens. The apparatus comprises a guide-frame which is brought opposite the oven and directs the coke on to the lower end of a conveyor. The guide-frame is provided with water nozzles for quenching the coke, and the conveyor is formed of interlocking bars carried by an endless chain, so that the coke is screened whilst being conveyed to the waggon.
—A. T. L.

Coke ovens or gas retorts; Quenching the coked product of ——. A. O. Jones, Whitley Bay. Eng. Pat. 28,662, Dec. 9, 1910.

The coke is discharged into a truck and taken as quickly as possible into a brickwork quenching chamber. This chamber is provided with end doors by which it may be tightly closed during quenching. Water spray pipes are arranged below the roof, and an outlet flue for steam and a drain pipe lead from the lowest point of the floor.
—A. T. L.

Vertical-retort gas apparatus. J. H. Taussig, Philadelphia, Pa. U.S. Pat. 999,349, Aug. 1, 1911.

The patent relates to means for opening and closing from the operating platform, the doors at the bottom of the retorts, without requiring the presence of an attendant beneath the retorts. Each door is connected by a pivot device with a horizontal lever by which it may be lowered to open the retort, or raised to close it and press the door against its seating. This lever is worked by a cable acting on a quadrant arm which forms a bell-crank with the horizontal lever. The quadrants are arranged outside the setting, and the cables are run to the operating platform and are worked by rods moving vertically which may be clamped in any desired position. These rods are raised by means of an overhead travelling hoist, through a spring connection which has a scale to indicate when the closing pressure is sufficient.—A. T. L.

Gas; Generation of —— from steam and combustible fluids or solids. F. and M. P. Roberts, Nottingham. Eng. Pat. 21,391, Sept. 14, 1910.

Water is mixed with one-half its weight of oil, or melted fat, and the mixture is led to a "flash generator" maintained at a temperature higher than 700° C. The resulting gas is cooled and led under pressure to a storage tank whence it passes as required through a reducing valve to a holder.—A. T. L.

Gas-producer apparatus. J. A. Herrick, New York. U.S. Pat. 1,004,024, Sept. 26, 1911.

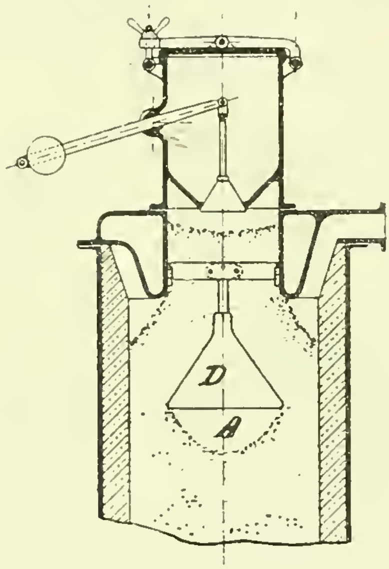
A pair of producers in communication at their upper ends and provided at their lower ends with tuyère-boxes and gas outlet orifices, is so operated that one producer works with an up-draught and the other with down-draught, the currents being reversed at intervals. This reversal is effected by means of inter-connected valves controlling the gas outlets and the supply of blast to the tuyère-boxes. For this purpose two valve-chambers are provided, one in connection with a pair of chambers leading to the two tuyère-boxes, and the other in connection with a pair of chambers leading from the two gas outlets.—A. T. L.

Compound gases; Synthetic manufacture of ——. H. Lane. Fr. Pat. 429,301, May 5, 1911.

In order to effect a steady combination of gases such, for example, as hydrogen and hydrocarbons in the presence of spongy nickel, the gaseous mixture is introduced into a series of jacketed catalyser tubes at various points in the length thereof. The temperature of the gas is thus prevented from rising to a point at which decomposition would set in. The tubes should be of small diameter, for example 5 cm., and the liquid for the bath in which the tubes are immersed should preferably boil at a temperature favourable to the desired reaction and be maintained at the boiling point.—H. H.

Gas-producer for low-grade fuels. U. Zanella. Fr. Pat. 429,637, May 12, 1911. Under Int. Conv., May 14, 1910.

A cone, D, is suspended within the generator as shown in the figure, in order to effect a better distribution of the fuel, and to leave a hollow space, A, in the body of the producer. In this way the oxidising and reducing zones of the producer are kept more distinct.—W. H. C.



Suction gas producers and the like; Sprinklers for scrubbers for ——. W. H. Moore, and Ambrose Shardlow and Co., Sheffield. Eng. Pat. 13,193. June 1, 1911.

The sprinkler is suspended by a short length of flexible pipe in order that it may remain horizontal. The water enters near the bottom of a hollow boss in the centre of the sprinkler and passes upwards through a helical channel so as to avoid splashing. The sprinkler itself comprises an umbrella-shaped plate with serrated edges, and grooves leading to the serrations. The water is distributed over the top of this plate from a central tray formed thereon, and having notched edges.—A. T. L.

Rectification and regeneration of the absorbing oils which have been used for the extraction of benzol from gases. H. Koppers. Fr. Pat. 429,671, May 12, 1911.

The oil, after being preheated by passing through a heat interchanger through which the oil freed from benzol also passes as it leaves the distilling column, is delivered by a pump into the upper part of the column. A portion of the gas from which the benzol has been extracted is withdrawn from the gas main after the washers, and after being heated is passed into the lower portion of the distilling column. The hot gas passes upwards, liberating and carrying with it the benzol contained in the oil. The mixture of gas and benzol vapour is passed through a condenser and then through a refrigerator, the benzol being deposited and collected. The gas which may still contain traces of benzol is returned to the main stream at a point in front of the washers so that any benzol is recovered. The oil freed from benzol running from the column is, after cooling, used over again. The recovery of the benzol is effected at as low a temperature as possible in order to avoid altering the absorbing oils which are easily oxidised and changed at high temperatures.
—W. H. C.

Wax; Refining crude mineral ——. Wachs- und Oel-Werke v. Boyen und Hoepfner Ges. m. b. H. and E. C. W. A. von Boyen, Barmstedt, Germany. Eng. Pat. 22,500. Sept. 28, 1910.

Montan wax, obtained by extracting lignite with organic solvents, is treated with 30 to 50 per cent. of concentrated nitric acid at 85° to 130° C. so as to oxidise the resin, and an equal amount of melted paraffin wax is then added in order to precipitate the insoluble resinous products. If a colourless product is desired, the mixture of montan wax and paraffin wax is treated with sulphuric acid and decolourising powder. If a yellow or slightly yellow wax is required, the addition of the paraffin wax may be omitted.—A. T. L.

Asphalt [*asphaltum*]; *Manufacture of* —— *from petroleum residuum or from crude petroleum.* C. B. Forward, Urbana, Ohio, U.S.A. Eng. Pat. 9646. April 20, 1911.

Petroleum residuum, having a density of 17°—22° B., is heated in a still to about 625° F. for 24 to 60 hours in order to drive off the volatilisable constituents, and is then heated in an open vessel at a lower temperature, for example at 525° F. for 5 to 24 hours until the product has the desired consistence.—A. T. L.

Hydrocarbon oils; Apparatus for treating —— [*with hydrogen*]. D. T. Day, Washington, D.C. U.S. Pat. 1,004,632, Oct. 3, 1911.

The apparatus comprises a horizontal cylindrical casing divided by transverse partitions into a central oil-chamber with vapour-chambers at either end. The two partitions are connected by vapour-tubes containing porous absorptive contact material. One of the vapour chambers is open at the top to the oil-chamber, and the other is fitted with a valved escape pipe by which the pressure may be controlled. Hot gases or vapours containing free hydrogen are admitted near the bottom of the oil-chamber and pass with the vapours through the tubes connecting the two vapour-chambers.—A. T. L.

Coke ovens; Process for charging ——. W. Hiby. Fr. Pat. 429,893, May 17, 1911. Under Int. Conv., Aug. 11, 1910.

See Eng. Pat. 18,922 of 1910; this J., 1911, 1004.—T. F. B.

Gasifying granular or powdered fuel; Process and generator for ——. A. von Kerpely. Fr. Pat. 430,248, May 27, 1911. Under Int. Conv., June 1, 1910.

See Ger. Pat. 235,488 of 1910; this J., 1911, 1105.—T. F. B.

Hydrocarbons; Process for purifying ——. Richter und Richter, Berlin. Eng. Pat. 23,467. Oct. 10, 1910. Under Int. Conv., May 12, 1910.

See Fr. Pat. 421,277 of 1910; this J., 1911, 409.—T. F. B.

Rotary pumping apparatus for ensuring a regular flow to automatic gas-analysis recorders. Eng. Pat. 468. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Coal; Distillation of ——, and a new method of analysis. H. Strache. Chem.-Zeit., 1911, 35, 1100—1101.

Ordinary laboratory distillation tests yield less gas and more tar than are obtained in gas retorts, because the conditions of heating are not the same. The practical conditions can be imitated more closely by heating 0·1—0·2 grm. of finely powdered coal in a small hard glass tube which is kept surrounded by the flame, the heating being always uniform but gentle at first and gradually increasing. The tube is weighed before and after the distillation, and the coke left in the tube may be afterwards burnt to ash, and the carbon and hydrogen determined if desired. An asbestos plug is used to retain the tar, and this may be weighed after drying in a vacuum desiccator. The gas evolved during distillation is collected in a special form of explosion pipette in order that its heating value may be directly determined. This pipette comprises an explosion bulb enclosed within an outer bulb containing air. At the end of the distillation, the coke is allowed to cool, the distillation tube is opened and air is drawn through to sweep all the gas into the pipette, and to fill the latter completely with gas and air. The mixture is exploded, and the increase of pressure in the air surrounding the pipette is proportional to the heating value of the gas. This increase of pressure is registered by a manometer. The calorimeter described is calibrated by means of pure hydrogen.—A. T. L.

Patents.

Coal; Recovery of by-products formed during the dry-distillation or gasification of ——. Coke Oven Construction Co. and J. Marr, Sheffield. Eng. Pat. 29,935, Dec. 23, 1910.

The gases are cooled to 15°—35° C. so that the whole of the tar and nearly all the moisture are condensed, and the gases pass directly from the tar extractors to saturators in which the ammonia is removed by sulphuric acid. The gas from the saturators is practically free from moisture and is taken direct to the point of consumption. To avoid the production of any effluent, the ammoniacal liquor, after separation from the tar, is evaporated to dryness, the vapours being passed through a saturator and thence to the stack. If the gas is not required to be free from moisture, it may be passed through the saturators together with the vapours from the ammoniacal liquor.—A. T. L.

Metal filaments for electric lamps; Manufacture of ——. W. C. Heraeus Ges. m. b. H., Hanau, and C. Trenzen, Cologne, Germany. Eng. Pat. 1544, Jan. 20, 1911.

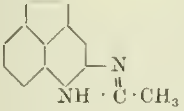
See Fr. Pat. 425,112 of 1911; this J., 1911, 883.—T. F. B.

Electric furnaces for treating metal filaments. Eng. Pat. 8996. *See* XI.

III.—TAR AND TAR PRODUCTS.

Acenaphthene. II. F. Sachs and G. Mosebach. Ber. 1911, 44, 2852—2862.

Acenaphthene has recently acquired technical interest through the preparation from it of certain valuable vat dyestuffs. Thus a further study of its substitution products seemed desirable. When a solution of acenaphthene in glacial acetic acid is treated with concentrated nitric acid, 5-nitroacenaphthene is produced which, on reduction with sodium hydrosulphite furnishes the 5-amino-derivative. This, on diazotisation and combination with β-naphthol gives an azo-compound, and when acetylated and nitrated yields 4-nitro-5-acetylaminoacenaphthene. The latter, on reduction with hydrosulphite, gives anhydroacetyl-4 : 5-diaminoacenaphthene



and on hydrolysis yields 4-nitro-5-aminoacenaphthene from which 4 : 5-diaminoacenaphthene is produced by reduction. Nitroacetylaminoacenaphthene, when heated with alcoholic sodium hydroxide gives 5-hydroxy-4-nitroacenaphthene, yellowish red needles, m. pt. 148° C., which is converted on reduction into 5-hydroxy-4-aminoacenaphthene, m. pt. 159° C. By reducing 5 : 6-dinitroacenaphthene with stannous chloride and hydrochloric acid the diamino-compound is obtained, the constitution of which was proved by the preparation of certain condensation products.—J. C. C.

Patents.

Chlor-aralkylsulphonic acids; Manufacture of —— and of intermediate products. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 29,720, Dec. 21, 1910.

See Ger. Pat. 234,913 of 1910; this J., 1911, 946. The chloro-aralkylsulphochlorides are converted into the corresponding chloro-aralkylsulphonic acids by treatment with hydrolysing agents under "mild" conditions, for instance by treatment with limited quantities of water in presence of alcohol.—T. F. B.

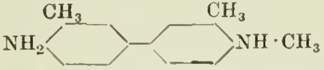
Indole; Process for preparing homologues and derivatives of ——. Ges. f. Teerverwertung m. b. H. Ger. Pat. 238,138, March 3, 1911.

Compounds of aromatic hydrazines with aldehydes or ketones, of the general formula, $Ar.NH.N:CH.R$ or $Ar.NH.N:CRR^1$, are heated with zinc chloride or similar condensing agent and an indifferent solvent, at a temperature not greatly exceeding that at which the reaction commences. The indole derivatives are isolated from the products by fractionation or by conversion into alkali-indoles (see Ger. Pat. 223,304; this J., 1910, 936). Solvent naphtha and other neutral tar oils are suitable solvents. In preparing alkylindoles the best temperature to use is from 140°—150° C.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Hydrazo compounds. VII. Methylhydrazotoluene, methyltolidine and ethylbenzidine. B. Rassow and A. Becker. J. prakt. Chem., 1911, 84, 329—352.

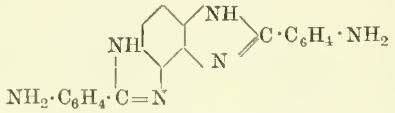
Methyltolidine,



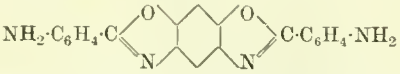
obtained by subjecting methylhydrazo-*o*-toluene (prepared by acting on hydrazo-*o*-toluene with methyl sulphate) to the "benzidine" transformation, is colourless and melts at 85° C. With nitrous acid it forms, first a diazonium salt and then, slowly, the nitroso-derivative of the latter. Both of these combine with β-naphthol to give azo-compounds and the nitroso-dyestuff loses its nitroso-group when heated with alcoholic hydrochloric acid, the product being identical with that obtained from the diazonium compound alone. Corresponding dyestuffs are also obtained from dimethylaniline and β-naphtholdisulphonic acid (R-salt), except that the nitroso-derivative of the latter was not prepared. The monoazo-dyestuffs obtained from diazotised methyl-*o*-tolidine and the above components can unite further with a diazo compound, giving rise to disazo dyestuffs: as examples dyestuffs were prepared from benzenediazonium chloride and methyl-*o*-tolidineazodimethylaniline, and from methyl-*o*-tolidineazo-β-naphtholdisulphonic acid and benzenediazonium chloride and diazotised sulphanilic acid respectively. Of the two latter the first dyes cotton a dark red violet which is not fast to light and the last produces blue shades. In these dyestuffs the diazo group combines at the ortho position with respect to the methylamino group. By treating hydrazobenzene with ethyl sulphate and magnesium oxide in benzene solution, a very small amount of monoethylbenzidine, m. pt. 73°—74° C. was obtained.—J. C. C.

Benziminazoles and benzoxazoles and their azo-dyestuff derivatives. O. Kym. Ber., 1911, 44, 2919—2932.

pp'-Diaminodi-α-phenylbenzdi-iminazole :—



is prepared by heating nitro-*p*-phenylenediamine with *p*-nitrobenzoyl chloride to form the corresponding dinitrobenzoyl derivative ; this is nitrated to 2 : 3-dinitro-*pp'*-dinitrodibenzoyl-*p*-phenylenediamine and this, on reduction, furnishes the above diamine. When tetrazotised and combined with components, azo dyestuffs are obtained. thus with aminonaphtholdisulphonic acid (H) the product dyes cotton dark violet, with β-naphtholdisulphonic acid the shade obtained is dull violet and with α-naphthol, rose. By a corresponding series of reactions, starting from 4 : 6-dinitroresorcinol, *pp'*-diaminodi-α-phenylbenzdioxazole



is prepared. This can also be tetrazotised and combined as above and gives, with H acid a dyestuff furnishing brownish violet shades on cotton, with β-naphtholdisulphonic acid bluish lilac shades and with α-naphthol brownish rose shades.—J. C. C.

PATENTS.

Indophenolic compounds and dyestuffs therefrom ; Manufacture of ——. R. B. Ransford, London. From L. Cassella und Co., Frankfort-on-the-Maine, Germany. Eng. Pat. 27,051, Nov. 21, 1910.

INDOPHENOLS are obtained by condensing carbazolecarboxylic acid or its esters with *p*-nitrosophenol or a homologue thereof in sulphuric acid. When these indophenols or their leuco-compounds are heated with alkali polysulphide, vat dyestuffs are produced. Example : 21·1 kilos. of carbazolecarboxylic acid are dissolved in about 10 times the weight of sulphuric acid, the solution being cooled, and 12·3 kilos. of *p*-nitrosophenol dissolved in 10 times its weight of sulphuric acid are added in the cold. After a short time the greenish blue solution is poured on ice and the blue precipitate may be transformed into the leuco compound by reducing agents. 50 kilos. of this indophenol or the corresponding amount of the leuco-compound are stirred into a mixture of 240 kilos. of sodium sulphide and 128 kilos. of sulphur which have been melted together and mixed with 50 litres of water. The solution is evaporated until the boiling point has reached 115° C. and is then boiled for 24 hours under a reflux condenser. On diluting, the dyestuff precipitates. It gives a yellow vat with alkaline hydrosulphite from which cotton is dyed in dark blue shades.—J. C. C.

Alizarin ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 2354, Jan. 30, 1911.

THE direct conversion of anthraquinone into alizarin can be effected by means of dilute alkalis (*i.e.*, solutions containing less than 50 per cent. of alkali) if the reaction is carried out in presence of anthraquinonesulphonic acids or of sulphites, with or without addition of oxidising agents. *Example:* A mixture of 100 parts of the sodium salt of anthraquinone-β-sulphonic acid, 50 parts of anthraquinone, 25 parts of sodium nitrate, and 1425 parts of 28 per cent. caustic soda solution, is heated in an autoclave for three to four days at 180°—200° C. ; the product is dissolved in water, treated with air, filtered, and the alizarin recovered from the filtrate in the usual manner. —T. F. B.

Black dyestuffs ; Manufacture of ——. Read Holliday and Sons, Ltd., J. Turner, and H. Dean, Huddersfield. Eng. Pat. 8474, April 5, 1911.

BLACK dyestuffs for cotton are produced by using chloro-*m*-phenylenediamine ($Cl : NH_2 : NH_2 = 1 : 2 : 4$) as end-component. For example, *p*-aminobenzeneazo-α-naphthylamine-6 (or 7)-sulphonic acid is diazotised and combined with an alkaline solution of aminonaphtholsulphonic acid G ; this intermediate product is diazotised and combined with chloro-*m*-phenylenediamine in alkaline solution.—J. C. C.

Monoazo colouring matter especially suitable for the preparation of pigment colours ; Manufacture of a ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort-on-the-Maine, Germany. Eng. Pat. 13,619, June 7, 1911.

THE dyestuff is prepared by combining diazotised *p*-nitro-*o*-toluidine ($CH_3 : NH_2 : NO_2 = 1 : 2 : 4$) with β-hydroxynaphthoic acid in the presence of sodium acetate and Turkey red oil. It is converted into a lake by heating it with aluminium hydroxide and water for half an hour at 75° C. and then for 15 minutes with barium chloride at the same temperature. It forms a bright bluish red powder.—J. C. C.

[Oxazine] dyestuffs ; Process for producing violet to red mordant ——. Manuf. de Mat. Col. ancien. L. Durand, Huguenin, et Cie. Fr. Pat. 429,302, May 5, 1911. Under Int. Conv., May 9, 1910.

SEE U.S. Pats. 1,002,825 and 1,003,257 of 1911 ; this J., 1911, 1204 and 1205. Alkylated amino-*m*-hydroxybenzoylpropionic acids may be used in place of the alkylated amino-*m*-hydroxybenzoylbenzoic acids. The products may subsequently be sulphonated.—T. F. B.

Monoazo dyestuffs for wool, fast to washing, and process for producing them. Act.-Ges. f. Anilinfabr. Fr. Pat. 430,146, May 26, 1911. Under Int. Conv., March 3, 1911.

SEE U.S. Pat. 1,003,293 of 1911 ; this J., 1911, 1205. Ethylbenzylanilinesulphonic acid may be replaced by sulphonic acids of other alkylaralkylanilines.—T. F. B.

Vat dyestuffs of the anthraquinone series ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,781, Dec. 10, 1910.

SEE Ger. Pat. 235,094 of 1910 ; this J., 1911, 885.—T. F. B.

Vat dyes. W. Bauer, Vohwinkel, A. Herre, and R. Mayer, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,005,140 and 1,005,141, Oct. 10, 1911.

SEE Addition of June 1, 1910, to Fr. Pat. 407,507 of 1909 ; this J., 1910, 1369.—T. F. B.

Triphenylmethane dyes. M. Weiler, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,004,609 and 1,004,610, Oct. 3, 1911.

SEE Addition of March 18, 1911, to Fr. Pat. 404,800 of 1909 ; this J., 1911, 1205.—T. F. B.

Orange wool [azo] dye. R. Kothe, Vohwinkel, O. Dressel, Elberfeld, and H. Hoerlein, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,005,233, Oct. 10, 1911.

SEE Eng. Pat. 17,015 of 1910 ; this J., 1911, 483.—T. F. B.

[*Azo*] *dyestuffs dyeing cotton directly; Process for producing* ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 429,823, April 29, 1911. Under Int. Conv., May 10, 1910.

See Eng. Pat. 12,433 of 1910; this J., 1911, 612.—T. F. B.

Azo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 429,824, May 1, 1911. Under Int. Conv., May 5, 1910.

See Eng. Pat. 11,172 of 1910; this J., 1911, 275.—T.F.B.

Azo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 430,030, May 22, 1911. Under Int. Conv., June 23, 1910.

See Eng. Pat. 19,545 of 1910; this J., 1911, 1108.—T.F.B.

Trisazo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 430,588, June 3, 1911. Under Int. Conv., June 23, 1910.

See Eng. Pat. 19,487 of 1910; this J., 1911, 885.—T.F.B.

Mordant dyestuffs of the oxazine series; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 429,965, May 19, 1911. Under Int. Conv., June 15, 1910.

See Eng. Pat. 20,096 of 1910; this J., 1911, 1109.—T. F. B.

Polyazo dyestuffs; Manufacture of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 2615, Feb. 1, 1911. Under Int. Conv., March 19, 1910.

See Ger. Pat. 232,790 of 1910; this J., 1911, 611.—T.F.B.

Vat [*indigo*] *dyestuffs; Manufacture of halogenised* ——. O. Imray, London. From Soc. of Chem. Industry in Basle, Basle. Eng. Pat. 8900, April 10, 1911.

See U.S. Pat. 997,766 of 1911; this J., 1911, 1006.—T.F.B.

Vat dyestuffs of the anthraquinone series containing sulphur; Manufacture of ——. F. Ullmann, Charlottenburg, Germany. Eng. Pat. 11,421, May 11, 1911. Under Int. Conv., June 30, 1910.

See Fr. Pat. 429,584 of 1911; this J., 1911, 1205.—T.F.B.

Nigrosines or indulines; Process for making deep black ——. L. Stange. Fr. Pat. 429,920, May 18, 1911. Under Int. Conv., May 25 and July 27, 1910.

See Ger. Pats. 233,600 and 234,468 of 1910; this J., 1910, 678 and 796.—T. F. B.

Monoazo dyestuff especially suitable for preparing lakes; Process for making a ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 430,583, June 3, 1911.

See Eng. Pat. 13,619 of 1911; preceding.—T. F. B.

Manufacture of colouring lakes [*from azo dyestuffs*]. Eng. Pat. 13,527. *See* XIII.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Anticipated shortage of mechanical pulp in Norway. Board of Trade J., Oct. 19, 1911. [T.R.]

H.M. Consul at Christiania reports that, according to the trade journal "Farmand" of 30th September, mechanical pulp stocks in Norway are exhausted owing to the restriction in production, the recent lock-out, and purchases by United States firms. Owing to shortage of water, the production of mechanical pulp in the coming winter is likely to be greatly curtailed in Norway, Sweden and Finland; and so far as can be judged there will not be a sufficient supply to keep all paper machines running till March, when the rivers will again be filled.

Flax fibre in U.S.A. Report to the National Paint, Oil and Varnish Association. Oil, Paint, and Drug Rep. Suppl., Oct. 9, 1911.

For several years flax fibre has been used in the manufacture of binder twine, but little has been done in the United States in utilising flax fibre for the finer grades of linen cloth. The Western Linen Company of Duluth, after many experiments with various types of machinery and chemical processes, are now producing from flax straw, coming direct from the threshing machine, a linen yarn which they are selling at 20 c. per pound in ton lots. One acre of land produces about one ton of flax straw, which yields about four hundred pounds of fibre.

Adsorption in solutions; Studies on ——. *I. Absorption of acids by wool.* G. v. Georgievics and A. Pollak. Monatsh. Chem., 1911, 32, 655—675. (Compare this J., 1888, 621.)

The absorption of acids by wool is shown to be an actual adsorption process. With the acids used, adsorption is found to proceed irregularly in the case of the weakest solutions, but with solutions containing 0·5 grm. of acid and upwards in 250 c.c. of water, the adsorption can be expressed by formulæ, and diagrams of curves are given in illustration. Ignoring the results obtained with the weakest solutions and taking molecular proportions of the acids, the order of adsorption was found to be as follows:—Nitric, hydrochloric, oxalic, sulphuric, formic, succinic, adipic and acetic, nitric acid being the most adsorbed and acetic acid the least. Mineral acids are, in general, adsorbed to a greater extent than fatty acids, but the reverse is the case when charcoal is the adsorbent. The authors' results agree with those obtained by Walker and Appleyard on the adsorption of acids by silk (this J., 1896, 650). No relation could be found between the adsorption of an acid and the degree of dissociation of its solution. The adsorption of acids by wool was found to be but little dependent on the temperature, usually a little less was adsorbed at the higher temperatures. The adsorption of an acid is decidedly affected by the presence of another and in varying ways. For example, the adsorption of sulphuric acid from very dilute solutions is slightly increased, but decidedly diminished from stronger solutions by the presence of hydrochloric acid, whilst the adsorption of hydrochloric acid from all concentrations is lessened by the presence of sulphuric acid. The adsorption of acid by wool from a solution of a mixture of acids is less than from an equivalent quantity of a single acid. This excludes the possibility of a simple salt formation between the fibre substance and the acid.—A. Sbld.

Cellulose solutions; The viscosity of ——. H. Ost. Z. angew. Chem., 1911, 24, 1892—1896.

The author seeks to introduce a new measure of the chemical condition of cellulose based on the fact that chemically modified cellulose gives under equal conditions solutions of lower viscosity than those of normal cellulose. In order to standardise such a method it was necessary first to establish a standard solvent, which itself exerts the minimum of chemical action on the cellulose to be tested. The most suitable of the known solvents is cuprammonium. It is difficult to prepare a cuprammonium of standard strength by the action of ammonia upon copper, but a solvent of sufficient power for the purpose is obtained in the following manner: 59 grms. of copper sulphate are dissolved in 3 litres of hot water and precipitated with just sufficient ammonia to leave the filtrate free from copper. The precipitate is collected, washed with hot water and drained. The thick paste is placed in a litre flask, and shaken with ice-cold ammonia of sp. gr. 0·900, the volume being made up with this to 1 litre. After 24 hours the reagent is filtered through asbestos and should contain approximately 13—14 grms. of copper and 200 grms. of ammonia per litre. The author has designed a special viscosimeter for these observations; it is after the fashion of a 25 c.c. pipette with a funnel above the bulb and an accurately made capillary stem below it, 2 mm. in bore for a length of 200 mm. The lower end of this stem is turned upwards terminating in a receiving bulb of 40 c.c. capacity. Marks are made at the top and bottom of the 25 c.c. pipette-bulb and the time is noted during which the liquid flows through the capillary whilst the level falls from the top mark to the bottom one. The results are expressed in terms of water as unity. For preparing the solution, 1 grm. dry weight of the cellulose (weighed air-dry) is placed in a stoppered flask with 50 c.c. of standard cuprammonium solution, shaken repeatedly at the ordinary temperature and diluted after 24 hours, or other specified period, with 50 c.c. of water for the viscosity test. The results showed that the viscosity varied according to the degree of chemical modification of the cellulose. The solutions of lightly bleached cotton cellulose showed viscosities of over 30, and mercerisation for a short period had no effect in lowering the viscosity, but the prolonged action of concentrated alkali, especially at a high temperature, gave products of low viscosity; the action of acids, also of heat alone, had a similar effect. Certain irregularities are liable to occur in carrying out observations on solutions of relatively high viscosity. Determinations made consecutively on the same solution showed very large decreases in viscosity with each determination; this peculiarity is not noticed in the case of solutions initially of low viscosity. The viscosity also decreases when the solutions are preserved in stoppered flasks. This is attributed to oxidation. On the other hand, when the 2 per cent. solutions are preserved at rest without dilution, the decrease in viscosity is not great, and if determinations are made with the solutions at this concentration, the above anomalies are less apparent. In some cases the viscosity rises owing to loss of ammonia.—J. F. B.

Paper pulp from eucalyptus. Paper Making, 1911, 30, 376.

Samples of pulp of excellent quality have been prepared from the eucalyptus (blue gum), which has been planted over large areas in Southern California. The pulp is strong, clean and slightly reddish, owing to the action of the alkali. Experiments with this wood as a raw material for paper pulp have been carried out at Washington and leave no doubt as to its suitability for the purpose. A sufficient growth of blue gum may be obtained in 4—6 years; the stump yields a further good growth three years after cutting.—J. F. B.

Paper; The rosin-sizing of ——. C. G. Schwalbe. Z. angew. Chem., 1911, 24, 1918—1919.

The sizing of paper is a most complicated problem on account of the multitude of factors which come into play. First, the composition of the rosin plays a part, owing to the presence of unsaponifiable matter and oxidation products which are insoluble in petroleum spirit. The unsaponifiable matter coarsens the emulsion produced by dissolving a size containing free rosin in water, whilst the constituents which are insoluble in petroleum have no sizing action and therefore are inimical to good results. Rosin emulsions are dissociated strongly when diluted with water, the purity of the water playing an important part. The presence of 1·25 grm. of sodium chloride per litre is sufficient to flocculate the free rosin emulsion. Sodium sulphate is even more powerful, flocculation being produced by 0·1 grm. per litre, whilst 0·6 grm. per litre of calcium sulphate is sufficient to precipitate 70 per cent. of the total rosin. Salts of the alkaline earths not only flocculate the free rosin but form resinates which have little or no sizing value. When aluminium sulphate is added to the pulp, it reacts with the size and with the fibre simultaneously; the fibre is able completely to decompose aluminium sulphate, the alumina being precipitated and the sulphuric acid neutralised by the basic matter of the fibre. The salts forming the hardness of industrial waters likewise interact with the alum. Whether the actual sizing constituent ultimately deposited in the paper is free rosin or aluminium resinate is still a matter of dispute; the weight of the evidence is in favour of the free rosin theory. The alumina, however, is an essential factor of permanent sizing. Paper sized with free rosin precipitated by an acid is not permanently sized. The author suggests that in such papers, the particles of rosin become oxidised by the action of light and air, being converted into the product insoluble in petroleum (see above). On the other hand the particles of rosin precipitated by alum are assumed to be coated with a film of aluminium hydroxide which protects them from oxidation.—J. F. B.

Patents.

Flax, hemp, rhea or ramie and other fibre-yielding plants; Treatment of —— for the obtainment of fibres therefrom. R. Blitz, Snaresbrook. Eng. Pat. 4869, Sept. 26, 1910.

The process consists in treating the stalks of plants, either in a broken, flattened or natural condition, by means of an alkaline bath and an acid bath. The alkaline bath contains fluorides of alkalis and either caustic alkalis or sulphides with or without alkaline carbonates. To this bath are also added vegetable or animal fats, olive oil or thick mineral oils. The stalks are digested in the bath at a temperature between 100° and 212° F., for 2—8 hours, according to the temperature. They are washed with water and then transferred to the acid bath containing sulphites, bisulphites or metabisulphites of alkalis, acidulated with a very small proportion of oxalic, citric or sulphuric acid.—J. F. B.

Wool and other fibre drying machines. A. Sowden, Shipley. Eng. Pat. 26,800, Nov. 18, 1910.

The wool fibre or other sliver, passing generally from a back-washing machine, is conducted through a chamber in which are situated hot pipes and fans for circulating the heated air inside the chamber. As the fibre enters the chamber, it is subjected to a beating or opening treatment by passing over a rocking frame or rocking bars operated by an eccentric, which knock or tap the fibre. The fibre is guided inside the chamber by perforated cylinders having internal fans and bars which hold the fibre at a slight distance from the surface of the cylinders.—J. F. B.

Flax fibres: Process for the preparation of ——. E. Bek, Schaffhausen, Switzerland. U.S. Pat. 1,004,136, Sept. 26, 1911.

The flax fibres are prepared by first separating the woody portions from the valuable fibre, scouring the latter in a lye composed of sodium sulphide and a volatile oil for about an hour and a half, removing the scoured fibres and storing them under cover until they have undergone a fermentation process and gliadin is separated from them, finally rinsing and drying the fibres.—J. F. B.

Cellulose-cuprammonium solutions suitable for spinning; Process for preparing ——. Rheinische Kunstseidefabrik. Ger. Pat. 237,816, March 23, 1910. Addition to Ger. Pat. 236,537, Aug. 1, 1908 (see Fr. Pat. 405,571 of 1909; this J., 1910, 417).

The free organic acids may be replaced by their alkali salts. Thus, the alkali salts of tartaric, citric, or oxalic acids may be added to the solvent or to the cellulose solutions.—T. F. B.

Artificial fibres, films, etc., from cellulose-cuprammonium solutions; Process for preparing ——. R. Hömberg. Ger. Pat. 237,717, Aug. 5, 1909.

The artificial products obtained from cellulose-cuprammonium solutions to which have been added aldehydes or compounds of ammonia with aldehydes (excepting the aldehydic sugars or their compounds), are said to be distinguished from those produced without the use of aldehydes, by their improved "feel," transparency, and strength, and also, though to a smaller extent, by their increased resistance to water.—T. F. B.

[Cellulose] solutions for use in spinning artificial fibres, etc.: Process for preparing stable ——. Glanzfäden A.-G. Ger. Pat. 237,716, June 26, 1908. Addition to Ger. Pat. 228,872, Feb. 20, 1908.

Stable solutions, suitable for use in making artificial fibres, etc., are obtained by the addition of polyhydric alcohols, such as mannitol or dulcitol, to cellulose-cuprammonium hydroxide solutions prepared in the usual manner.—T. F. B.

Artificial fibres; Process for preparing ——. J. C. Hartogs. Ger. Pat. 237,744, Aug. 19, 1910.

As the separate fibres emerge from the precipitating baths, they are introduced into an indifferent liquid with which the precipitating liquid is immiscible or only slightly miscible, in order to overcome the tendency of the fibres to adhere together. For example, viscose solutions are coagulated by means of dilute sulphuric or other acid, and the fibres are passed through a layer of an indifferent liquid which is provided above or below the acid solution.
—T. F. B.

Patterned papers; Manufacture of ——. L. Fiedler, Coswig, Germany. Eng. Pat. 7615, Mar. 27, 1911.

In a combined papermaking and printing machine for the manufacture of wall-papers and the like, the pattern is printed on the paper at a suitable place in the drying section of the machine, *i.e.*, whilst the paper is still damp, before it reaches the final drying cylinders. It is claimed that the presence of a certain amount of moisture in the paper allows the printing colour to penetrate and work into the surface of the paper, thereby producing sharply defined, intensely and permanently coloured patterns.
—J. F. B.

Cotton substitute from ramie; Method of producing a ——. P. Birkenstock, L'Arbresle, France. U.S. Pat. 1,004,974, Oct. 3, 1911.

See Fr. Pat. 421,166 of 1910; this J., 1911, 481.—T. F. B.

Acetyl-cellulose sheet. C. Mijnssen, Wilmersdorf, Germany. U.S. Pat. 1,005,454, Oct. 10, 1911.

See Fr. Pat. 411,298 of 1910; this J., 1910, 978.—T. F. B.

Cellulose solutions; Treatment of ——. Soc. Anon. pour la Fabr. de la Soie de Chardonnet. Fr. Pat. 430,445, Aug. 10, 1910.

See Eng. Pat. 1436 of 1911; this J., 1911, 888.—T. F. B.

Preparation of varnishes with a cellulose ester base. Fr. Pat. 429,788. *See* XIII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Dyeings on the fibre; Development of —— *by light-energy.* O. Baudisch. Chem.-Zeit., 1911, 35, 1141—1142.

The ammonium salt of α-nitrosonaphthylhydroxylamine is best prepared as follows: α-nitronaphthalene is reduced by ammonium sulphide to α-nitronaphthylhydroxylamine. The dried substance is dissolved in ether or benzene and dry ammonia gas is led through the solution at 0° C. To the solution, containing excess of ammonia, is added all at once an excess of the theoretical amount (1 mol.) of amyl nitrite, when the ammonium salt separates in almost white leaflets which are filtered off and washed with ether. For the production of colour on the fibre, the salt is dissolved in warm dilute ammonia, the solution filtered, and wetted silk or wool is placed in the solution for about 15 minutes. The fibre is then squeezed out and steamed gently, washed with cold water and dried in the dark. When exposed to the daylight, particularly direct sunlight, the fibres assume a bright red colour which is very fast. In the above steaming process, which produces a yellow colour on the fibre, if formaldehyde is present the colours produced are still brighter. The explanation of the process is that the ammonium salt is converted by steaming into α-nitrosonaphthalene which then, favoured by the reducing property of the fibre, changes to azoxynaphthalene to which the yellow colour is due. The change produced by light consists in the conversion of this into o-hydroxyazonaphthalene. Ammonium salts of other nitrosoarylhydroxylamines can be applied in the same way.—J. C. C.

Some compounds of titanium. [*Preparation of some titanium mordants.*] Stähler and Bachran. *See* X.

Patents.

Dyeing apparatus. W. R. Smith, Assignor to Buffalo Leather Co., Buffalo, N.Y. U.S. Pat. 1,004,486, Sept. 26, 1911.

The apparatus consists of an endless horizontal trough with means for circulating liquid through it, and a basket mounted on a vertical axis situated nearer one side of the trough than the opposite side, so that the basket is caused to rotate on its axis by the movement of the liquid in the trough. The trough illustrated has a substantially straight portion and an abruptly curved portion (in plan resembling the trough of a hollander beating engine) and a basket is situated in the curved portion of the trough at each end, so that the liquid moving round the trough is deflected against the outside of the basket so as to rotate it.—J. F. B.

Dyeings on unmordanted vegetable fibres; Process for producing fast ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 238,253, Oct. 6, 1910.

The leuco-compounds obtained by the reduction of α-β-naphthylene-*pseudo*-azimino-β-anthraquinonyl and its derivatives, are fixed on vegetable fibres, and the dyestuff is developed by oxidation. This property of dyeing unmordanted cotton is possessed by all compounds which have at least one *pseudo*-azimino group in the β-position in the anthraquinone molecule.—T. F. B.

Brown shades on fibrous material; Production of —— *and preparations to be used therein.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 2700, Feb. 2, 1911.

See Addition of Feb. 15, 1911, to Fr. Pat. 357,472 of 1905; this J., 1911, 952.—T. F. B.

Brown to olive shades on the fibre; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 430,526, May 15, 1911. Under Int. Conv., May 30, 1910.

See Eng. Pat. 412 of 1911; this J., 1911, 534.—T. F. B.

Indigo-vat; Preparation suitable for the ——. A. Schmidt, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,005,481, Oct. 10, 1911.

See Eng. Pat. 18,761 of 1910; this J., 1911, 1047.—T. F. B.

Printing fabrics; Process for ——. F. Krokert. Fr. Pat. 430,066, May 23, 1911.

See Eng. Pat. 9090 of 1910; this J., 1911, 617.—T. F. B.

[*Electrolytic*] *apparatus for producing bleaching solution.* Eng. Pat. 28,277. *See* VII.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Potassium acetate; Hydrates of ——*: their solubility and transition point.* R. Abe. Mem. Coll. Sci. and Eng., Imp. Univ., Kyoto, 1911, 3, 211—215.

The solubility of potassium acetate in water increases with rise of temperature, and there is a break in the curve at 41·3° C., corresponding to the transition from the hydrate, $2C_2H_3O_2K,3H_2O$, stable below this temperature, into the hydrate, $2C_2H_3O_2K.H_2O$ stable at higher temperatures. The values of the solubility (grms. of salt per 100 grms. of water) at different temperatures between 0° and 96° C., are as follow: 0·1° C., 216·7; 5°, 223·9; 10°, 233·6; 15°, 243·1; 20°, 255·6; 25°, 269·4; 30°, 283·8; 35°, 301·8; 40°, 323·3; 45°, 332·2; 50°, 337·3; 55°, 343·6; 60°, 350·0; 65°, 356·5; 70°, 364·8; 80°, 380·1; 90°, 396·3; and 96° C., 406·5.—A. S.

Cuprous oxide in aqueous ammonia solutions; Solubility of ——; and composition of the cuprous-ammonia complex. F. G. Donnan and J. S. Thomas. Chem. Soc. Proc., 1911, **27**, 213.

The solubility of crystalline cuprous oxide in solutions of ammonia of different concentrations has been determined at 25° C. It is found that for a certain range of ammonia concentrations the concentration of total copper is approximately proportional to the square root of the "free" ammonia. From this result the conclusion is drawn that in these solutions the cuprous-ammonia hydroxide present is mainly of the type $(Cu{\cdot}NH_3)OH$.

Chlorine; Action of —— on alkalis, and of carbon dioxide on bleaching powder. R. L. Taylor. Chem. Soc. Proc., 1911, **27**, 243.

In reply to Higgins' suggestion (this J., 1911, 485) that the increased bleaching efficiency of a solution of bleaching powder on the removal of free lime or the addition of chlorides (Taylor, this J., 1910, 693, 1302) is not due to the reversal of the action and consequent liberation of chlorine, but, in the first case, to the further action of the carbon dioxide of the air, and, in the second case, to the increased attraction of such solutions for the carbon dioxide of the air, the author pointed out that most of his experiments were performed either in absence of air or with air from which the carbon dioxide had been removed, and described further experiments performed in closed vessels, in which he obtained similar results. Higgins further stated that other neutral salts of sodium behaved in a similar manner to the chloride in stimulating the bleaching action of a solution of sodium hypochlorite. Further experiments by the author show that if a solution of sodium hypochlorite contains considerable excess of free alkali, its bleaching action is very slow, and it is not much stimulated by the addition of any sodium salts, but if there is not much free alkali present, the stimulating action of sodium chloride is much greater than that of other neutral sodium salts. Higgins represents the action by two equations, and the author by three, the second and third of the latter being merely a simplification of Higgins' second.

Lithium persulphate; Preparation of ——. C. N. Otin. Z. Elektrochem., 1911, **17**, 919.

Lithium persulphate does not crystallise when an attempt is made to prepare it by electrolysis of a concentrated solution of lithium sulphate in sulphuric acid. The author has obtained a specimen of 82 per cent. purity by electrolysis with the aid of sulphuric acid of sp. gr. 1·3. This acid served as anolyte, the anode being a platinum wire coiled round a porous cell containing dilute sulphuric acid (sp. gr. 1·175) and a cathode of sheet lead. The whole cell was cooled by a freezing mixture of ice and salt. Working with 50 c.c. of anolyte, an anode current density of 0·75 to 1·15 amp. per sq. cm., and an E.M.F. of 4 to 5·2 volts, the concentration of persulphuric acid at the anode could be brought to 580 grms. per litre. In the presence of 1 grm. of lithium sulphate, a concentration of 625 grms. per litre could be obtained. The anode solution was treated with barium carbonate, filtered, neutralised with lithium carbonate, and the resulting solution evaporated *in vacuo*. A rose-coloured residue of impure lithium persulphate was left.—W. H. P.

Hydrogen peroxide; Synthesis of high percentage —— by the silent electric discharge. F. Fischer and M. Wolf. Ber., 1911, **44**, 2956—2965.

The authors have passed the silent discharge through mixtures of hydrogen and oxygen, and investigated the amount of hydrogen peroxide produced. To avoid explosion it was necessary to work in one of the following ways: (1) *With electrolytic gas under reduced pressure.* At 3 cm. of mercury and the temperature of liquid air, only about 2·5 per cent. of the theoretical yield (calculated from the oxygen) of hydrogen peroxide was obtained. (2) *With non-explosive mixtures.* If a mixture is taken containing so much oxygen that it does not explode, the main product is ozone. With excess of hydrogen (about 97 per cent. by volume), however, good yields (calculated from the oxygen) could be obtained, using a Berthelot ozoniser. At 22° C. the yield was 6·4 per cent., at —20° C. about 34 per cent., at —80° C., 54 per cent., and at the temperature of liquid air, from 59—87·5 per cent. in different experiments. The yield of 87·5 per cent. must correspond to a solution of hydrogen peroxide in water containing at least 86·9 per cent. of peroxide by weight. (3) *With electrolytic gas diluted till non-explosive by the presence of an inert gas.* Using carbon dioxide as diluent at the lowest possible temperature, only 4 per cent. of the oxygen was converted into hydrogen peroxide.—W. H. P.

Hydrogen peroxide; Modified cobalt reaction for the detection of small quantities of ——. M. Leuchter. Chem.-Zeit., 1911, **35**, 1111.

The following manner of carrying out the cobalt test for hydrogen peroxide enables very small quantities of the latter to be detected. Two c.c. of a solution, consisting of a mixture of equal weights of a 1 per cent. solution of cobaltous chloride and of a solution containing 1·6 parts of borax, 20 parts of glycerol, and 100 parts of water, are placed in a test-tube and the solution to be tested is poured on its surface. If hydrogen peroxide be present, a brownish zone appears at the junction of the two liquids. A similar reaction is given by perborates, and also by persulphates on heating or on the addition of a few drops of sodium hydroxide solution.—W. P. S.

Graphite; Transformation of other forms of carbon into ——. W. C. Arsem. Met. and Chem. Eng., 1911, **9**, 536—537.

Regarding the specific gravity as the most characteristic feature of graphite, the author proposes that the use of the latter term be restricted to that allotropic form of carbon having the sp. gr. 2·25—2·26. An investigation was undertaken to determine (1) whether a pure form of carbon can be transformed into graphite by means of heat alone, or (2) whether it is possible (as held by Acheson) to effect the conversion by the addition, before heating, of a quantity of mineral matter insufficient to form carbides with the whole of the carbon. It was found that, at 3000° C., all the pure forms of carbon tested reached a limiting density which was not appreciably raised by the addition of small amounts of mineral matter, the end product being graphite in some cases and not in others. The impure carbons were found to behave in a similar manner, their properties after firing being characteristic for each variety and independent of the amount of ash present.—W. E. F. P.

Sulphur-tellurium; Metallographic and photochemical investigation of the system ——. M. Chikashigé. Mem. Coll. Sci. and Eng., Imp. Univ., Kyoto, 1911, **3**, 197—210.

A metallographic study of mixtures of sulphur and tellurium showed that these form no chemical compound, but two series of mixed crystals (solid solutions); the eutectic, which contains 7 per cent. of tellurium and melts at 109° C., is composed of these two solid solutions. Solid tellurium dissolves up to 2 per cent. of sulphur. The solubility of tellurium is different in the different modifications of sulphur. Fused γ-sulphur dissolves up to 20 per cent., fused β-sulphur up to 10 per cent., and solid β-sulphur up to 2 per cent. of tellurium. On strongly cooling the β-sulphur-tellurium mixed crystals, rich in sulphur, they undergo a rapid transformation, owing to the change of β- into α-sulphur, the latter of which dissolves only 0·5 per cent. of tellurium. The transformation also occurs on exposure to light in the case of mixed crystals containing from 0·5 to 2 per cent. of tellurium, the excess of tellurium above 0·5 per cent. (the limit of solubility in α-sulphur) separating in the form of mixed crystals rich in tellurium. Mixed crystals containing less than 0·5 per cent. of tellurium are practically unaffected by light. This is the case, for instance, with Japanese red sulphur, which, according to Divers and Shimidsu (Chem. News, 1893, 48, 284) contains 0·17 per cent. of tellurium. The author's results confirm the view that the precipitate produced by hydrogen sulphide in a solution of tellurous acid must be a mixture of sulphur and tellurium. Experiments showed that the weight of the precipitate is always about 1·4 per cent. less than that corresponding to the equation: $H_2TeO_3+2H_2S=3H_2O+Te+2S$.—A. S.

Radioactive emanation of the gases from steam jets (soffioni) containing boric acid; Concentration of the —— by means of charcoal at low temperatures. C. Porlezza and G. Norzi. Atti R. Accad. dei Lincei. Roma, 1911, [5], 20, I., 932—934. Chem. Zentr., 1911, 2, 1264—1265.

The gases from the soffioni (steam jets which issue from the ground in certain volcanic districts in Tuscany) are radioactive. A sample of these gases (9300 c.c.), without any preliminary treatment, when tested in a bell-electroscope of an electrostatic capacity of 14·5, showed an activity of 12,000 volts per hour. By removal of carbon dioxide and hydrogen sulphide from the gas, the radioactivity was increased to 200,000 volts per hour. Both the original gas and the gas freed from carbon dioxide and hydrogen sulphide were rendered inactive by passage through a tube containing charcoal, cooled by a mixture of carbon dioxide and ether (—77° C.). From the ordinary temperature down to —10° C., the charcoal had no effect on the radioactivity of the original gas; at —16° to —20° C., it reduced the radioactivity by one-half. On passing a large quantity of the gas (freed from carbon dioxide and hydrogen sulphide) 1 litre at a time, through the charcoal at —77° C., it was found that the seventeenth litre was still active (to about one-half the original degree) after leaving the charcoal. On subsequently heating 5 grms. of the charcoal, a gas was obtained having an activity of 6,800,000 volts per hour, or 34 times as great as that of the original gas.—A. S.

Influence of selenium [in sulphuric acid] in the refining of mineral oils. Schulz. *See* IIa.

Flame arising from nitrogen-burning arc. Strutt. *See* XI.

Sulphur and pyrites in Russia. Mining and Eng. World, Chicago. Oct. 14, 1911. [T.R.]

Sulphur deposits are found in the Caucasus and in the Trans-Caspian regions. They are unworked, because they are poor and because Russian producers of sulphuric acid now use pyrites. The deposits of pyrites in Russia are mostly to be found in the Ural districts, but also in Central and South Russia and in the Caucasus. The best of these deposits are far from the centres of chemical industry, so the cost of carriage causes Russian manufacturers to use foreign pyrites. The chemical industry is making some effort to develop in the east, and as it moves nearer, the exploitation of the Ural pyrites will become greater. The pyrites in Central and South Russia is associated with coal. This pyrites contains a considerable percentage of carbon, which makes it unsuitable for the production of sulphuric acid by the contact process. The content of sulphur is about 30 per cent. The pyrites produced in both districts is used only in a few local factories. In the Caucasus copper pyrites is produced, which is used in the chemical industries. By far the richest deposits of iron pyrites in Russia are to be found in the Ural district. The pyrites of these deposits is much in demand, but it splits in roasting, and gives off much dust. Much of the pyrites produced in the Kysshtim district is consumed in the local copper smelting works. Accurate details of the production of pyrites for the use of the chemical industry are available only for the year 1908. Then the production in the Urals totalled about 50,000 tons; in central Russia it was 2500; in the Caucasus about 5000, or a total of about 57,500 tons. On the other hand, the importation in that year of foreign pyrites amounted to 90,000 tons. This increased to 110,000 in the year 1910.

In St. Petersburg the pyrites coming overland, partly by water, cannot compete with foreign pyrites; and the only factory consuming it there is the Ochtensk powder factory, which is obliged by Imperial regulation to use Russian raw materials, and it requires for its furnaces the small, but dustless, Kysshtim pyrites. The districts in which the chemical industry in Russia uses Ural pyrites are limited to the Urals, the banks of the Kama, and the Volga, and the industrial areas of Moscow and Ivano-Voznessensk. The chemical industry in these districts is developing very rapidly. Last year, besides the existing works, a sulphuric acid factory was opened in the Upper Isset district, at Rudyanka, and also by the P. K. Oushkoff Co. at Kazan.

Sulphur production in the United States. U.S. Geol. Survey, 1910. [T.R.]

The United States produced 255,534 long tons of sulphur in 1910, valued at $4,605,112. This is an increase of 16,222 tons in quantity and $173,046 in value over the output for 1909. The imports of sulphur for 1910 were valued at $558,611, while the exports amounted to $552,941. Four States—Louisiana, Nevada, Utah, and Wyoming—produced practically all of the sulphur.

The production of pyrites in the United States in 1910 amounted to 238,154 long tons, valued at $958, 608. The imports of this mineral were largely in excess of the domestic production, being 803,551 long tons in 1910, valued at $2,748,647.

Insecticides, Paris green, etc.; Importation of —— into the United States. Board of Trade J., Oct. 19, 1911. [T.R.]

A recent circular of the U.S. Treasury Department notifies that Articles 1,017—1,022 and 1,028—1,030 of the Customs Regulations of 1908 are amended so as to apply to insecticides, Paris greens, lead arsenates, and fungicides in the same manner as they have hitherto been applicable to food and drug products. All invoices of insecticides, Paris greens, lead arsenates, and fungicides imported into the United States must be accompanied by a special declaration of the shipper made before a United States consular officer.

Patents.

Nitric acid; Recovery of —— from kieselguhr and other inert absorbent. F. M. Hale, Catford, Kent, and A. C. Scott, Cardiff. Eng. Pat. 24,379, Oct. 20, 1910.

Nitric acid is recovered from kieselguhr, infusorial earth, or the like, which has been saturated with it for purposes of transport, by treatment in a suitable nitric acid distilling apparatus.—O. R.

Nitric acid; Manufacture and concentration of ——. F. M. Hale, Catford, Kent, and A. C. Scott, Cardiff. Eng. Pat. 25,386, Nov. 1, 1910. (See also this J., 1911, 1057, and preceding abstract.)

In order to recover nitric acid from the infusorial earth or other inert absorbent with which it may be combined for purposes of transport, the impregnated material is fed into a heated retort in which a reduced pressure or vacuum can afterwards be created. Whilst being heated under the reduced pressure, the mass is subjected to a stirring process, by means of a rake, ploughshare or some equivalent means, to keep the whole material at a uniform temperature. —W. C. H.

Nitrogen pentoxide in monohydrate of nitric acid; Production of solutions of ——. Elektrochem. Werke Ges. m. b. H., Berlin. Eng. Pat. 15,432, July 3, 1911. Under Int. Conv., July 16, 1910.

Solutions of nitrogen pentoxide in nitric acid are produced by the electrolytic oxidation of "nitrogen dioxide" or nitrous acid dissolved in nitric acid. For example, if 17 kilos of "nitrogen dioxide" be dissolved in 80 kilos. of nitric acid (monohydrate) and the solution be oxidised electrolytically in the anode compartment of a cell taking 200 ampères (per sq. m.) at 7 volts, then the "nitrogen dioxide" is completely oxidised by an expenditure of 11,000 ampère-hours and an acid containing 20 per cent. of dissolved nitrogen pentoxide is obtained.—A. S.

Nitrous gases; Absorption of ——. H. Pauling, Gelsenkirchen, Germany. Eng. Pats. 14,121 and 14,122, June 14, 1911. Under Int. Conv., Nov. 17, 1910.

The nitrous gases, produced, for example, by the electric combustion of air, are made to give a large portion of their heat to steam boilers or the like, and at a temperature of about 400° C. enter an acid-proof tower, in which they come in contact with dilute sulphuric acid flowing in the opposite direction. In this tower the gases become strongly charged with moisture which is largely eliminated in a condensing plant, and in a drying tower, in which the gases come into intimate contact with sulphuric acid flowing in an opposite direction. The gases are then oxidised, and the residuary gases are entirely absorbed by highly concentrated sulphuric acid. This sulphuric acid, containing "nitrous sulphuric acid" (*Nitrosylschwefelsäure*), is passed to the drying tower, where it becomes diluted, and then to a small denitration plant in which it is concentrated, and can then be used again to absorb the residual nitrous gases. Under the second patent, the whole bulk of nitrous gases are subjected to oxidation and absorption, and the residual nitrous gases, according to whether they contain an excess of nitric oxide, or an excess of nitrogen peroxide, are mixed with a portion of the gases coming from the oxidation chamber, or with a corresponding amount of non-oxidised furnace gases, in the proportion of one of nitric oxide to one of nitrogen peroxide or *vice versa*, and are then subjected to absorption by alkaline absorbents, sulphuric acid or other agents which act similarly.—W. C. H.

Ammonia; Causing nitrogen to react to form ——. W. A. Phillips and J. G. Bulteel, London. Eng. Pat. 23,046, Oct. 5, 1910.

A cylindrical furnace-chamber is packed with refractory material (firebrick or magnesite) resting on a perforated false bottom. A circular block of refractory material rests on the packing, immediately below the cover of the chamber, so as to leave an annular space. Into this is blown tangentially a mixture of air and hydrocarbon gas, alkali in powder (preferably baryta as barium carbonate) being fed into the blast just before it enters the chamber. At the temperature of combustion cyanide is formed, and is carried off with the gases through the exit pipe at the bottom of the chamber. Here, before the temperature has fallen below that at which steam ceases to react on cyanides, steam is injected (if necessary, in such a way as to increase the draught), and the cyanide decomposed, with formation of ammonia, which is absorbed in the condensed water, and barium carbonate, which is separated by filtration and returned to the process.
—J. T. D.

Ammonia from nitrolime [calcium cyanamide]; Producing ——. J. H. Lidholm, Alby, Sweden. Eng. Pat. 18,207, Aug. 11, 1911. Under Int. Conv., Sept. 12, 1910.

The nitrolime or other nitrogen compound produced therefrom, is heated with a solution of alkali hydroxide or carbonate. The formation of ammonia is greatly accelerated by the alkali. The best method of working consists in lixiviating the nitrolime with water, treating the solution of calcium cyanamide with carbon dioxide (produced in a subsequent stage of the process), whereby calcium carbonate is precipitated, and then passing the resulting solution of cyanamide or dicyandiamide into a closed boiler containing a solution of alkali carbonate heated to 180° C. The carbon dioxide which is evolved together with the ammonia, is used for precipitating calcium carbonate in an earlier stage of the process.—A. S.

Ammonium sulphate; Manufacturing ——. E. Collett and M. Eckardt, Christiania, Norway. Eng. Pat. 29,386, Dec. 17, 1910. Under Int. Conv., Dec. 20, 1909.

The salts formed by the reaction of ammonia on a mixture of sulphuric and sulphurous acids are treated further with gases (formed, for example, by burning pyrites in such a way as to produce a high proportion of sulphuric anhydride) containing a mixture of sulphuric and sulphurous anhydrides, or with such gases together with air, so as to convert the ammonium sulphite into sulphate.
—J. T. D.

Limekiln. P. McLoon, Glencoe, Mo., Assignor to P. J. Dauernheim, St. Louis, Mo. U.S. Pat. 1,001,207, Aug. 22, 1911.

The kiln consists of a base section supporting a vertical cylindrical shell, inside which is a vertical chamber of rectangular cross-section, constructed of firebrick, the intervening space being filled with broken stone, gravel, or the like. A furnace, mounted on the base, extends across the lower part of this chamber, and the outer shell is provided with openings through which access is afforded to the fuel- and ash-doors in either end of the furnace. The furnace is water-jacketed and is provided with openings along its sides through which the heat acts directly on the limestone fed into the firebrick chamber. Pokeholes are provided at the level of, and above, the furnace, through which pokers can be inserted to agitate the limestone. In the base, below the furnace, there are discharge openings for the burnt lime.—A. S.

Bleaching solution; [Electrolytic] Apparatus for producing ——. J. T. Niblett and The Electrolytic Apparatus Syndicate, Ltd., London. Eng. Pat. 28,277, Dec. 5, 1910.

The chloride solution to be electrolysed is made to flow through one or more shallow trays of large area, each tray being provided with a number of electrodes arranged in two rows, with the positive electrodes in the upper and the negative electrodes in the lower row. The trays are so inclined as to present the electrodes broadside on to the stream of chloride solution, the level of which is slightly above the electrodes. Whilst flowing through the trays the solution becomes agitated, owing to the impediment afforded by the electrodes, and the gas given off at the electrodes during the passage of the current is consequently liberated and the heat dissipated. The supply of electrolyte is automatically regulated by means of a controlling valve, which is operated by an electro-magnet in circuit with the electrodes.—O. R.

Manganates; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,701, May 15, 1911.

Manganese oxides mixed with highly concentrated caustic alkali lye are heated in an autoclave to a high temperature (say 350°—400° C.) under increased pressure (say 2 atmospheres) till the mixture is thoroughly dehydrated. The resulting melt contains about 75 per cent. of manganate.—J. T. D.

Sapphire; Synthetic ——. A. V. L. Verneuil, Paris, Assignor to L. Heller and Son, New York. U.S. Pat. 1,004,505, Sept. 26, 1911.

A synthetic sapphire containing oxides of aluminium, iron and titanium, and having the same colour, transparency and hardness (about 9, diamond being 10) as the natural sapphire, but distinguishable from the latter by having beneath its surface and embedded in it, a number of bubble-like spots bounded by rounded walls, and also curved rift-like streaks or cracks. The body portion may also contain curved layers.—W. C. H.

Cyanamide; Method of making ——. F. S. Washburn, Nashville, Tenn., Assignor to American Cyanamide Co., Baltimore, Md. U.S. Pat. 1,004,509, Sept. 26, 1911.

Finely divided calcium carbide is made to rise and fall or move progressively through and become intimately mixed with an atmosphere of nitrogen ; the carbide and nitrogen are raised to the temperature necessary to start the reaction, and the temperature and pressure suitable for keeping up the reaction are automatically maintained. The speed at which the carbide moves is regulated to ensure that practically all of it reacts with the nitrogen. —W. C. H.

Tartrates from wine lees or marcs ; Extraction of ——. J. Auzies, N. Secheyron, and G. Subra. Fr. Pat. 429,068, April 24, 1911.

The lees are treated with sulphuric acid of 66° Bé., then exactly the amount of hot water required to dissolve the tartaric acid and potassium sulphate is added to the liquor, and on cooling the latter substance is allowed to crystallise out. The liquor is filtered, and the tartaric acid separated from it by cooling and crystallising, or, especially if a considerable amount of pectic substance is present, by dialysis ; in this case the liquids on either side of the porous partition are maintained at different temperatures, and subjected to the action of a high tension continuous electric current.—W. C. H.

Oxygen ; Process of generating ——. M. Mauran, Niagara Falls, and J. H. MacMahon, La Salle, N.Y. U.S. Pat. 1,001,873, Aug. 29, 1911.

The process relates to the production of oxygen by the action of a catalytic agent, such as a salt or oxide of cobalt upon a hypochlorite solution. In order to obtain the catalyst in such a form that it may be used repeatedly, it is mixed with a supporting medium such as moulded Portland cement or baked clay, or it may be pressed into the surface of the supporting medium, whilst the latter is still soft. The mixture containing the catalyst may be used as a lining for the reaction vessel, or it may be formed into slabs or balls which are suspended or fixed in the reaction chamber.—A. S.

Hydrogen from gaseous mixtures which contain it ; Process and apparatus for the separation of ——. Ges. für Linde's Eismaschinen A.-G. First Addition, dated March 31, 1911 (under Int. Conv., March 4, 1911) to Fr. Pat. 427,983, March 31, 1911 (this J., 1911, 1212).

The portion of the gaseous mixture which is not liquefied, and consists chiefly of hydrogen, is not allowed to expand, but is removed under a pressure equal to that to which the compressed gaseous mixture has been brought. The liquid air or liquid nitrogen, used for refrigeration is evaporated at a pressure below that of the atmosphere, in order to obtain a more complete separation of the secondary additional elements in the gaseous mixture. The liquid air or liquid nitrogen is thus used only for the ultimate refrigeration of the hydrogen which has already been freed from the main quantity of condensable gases. Also, the hydrogen, before it is brought to the expansion apparatus may be subjected to slight heating in a counter-current device, by means of the compressed gaseous mixture which has not yet been decompesed. —W. C. H.

Water ; Process and apparatus for the decomposition of ——. L. Bénier. Fr. Pat. 428,854, June 30, 1910.

Decomposition is effected by subjecting water vapour to the simultaneous action of heat, reduced pressure, and chemical affinity ; the last acts only by influence, and without causing actual chemical combination. The apparatus consists of two concentric cylinders, with an annular space between them, and is provided externally with a heating device. The water to be decomposed is contained in the outer cylinder, and the inner cylinder is connected with a suction and compressing pump. The inner wall of the outer cylinder is lined with aluminium or graphite, and the outer wall of the inner cylinder is covered with copper oxide. In this way the water vapour is subjected at the same time to the action of heat from the heating chamber, of reduced pressure produced by the suction pump, and to the affinity of aluminium or carbon for oxygen, and of copper oxide for hydrogen, and is dissociated by the combined action of the three agents. The temperature is maintained below that at which either the wall of the outer cylinder can combine with the oxygen, or the copper oxide can be decomposed by the hydrogen, so that these gases can be drawn off and compressed in a suitable receiver by the pump.—W. C. H.

Iodine from various mineral substances ; Extraction of ——, *and purification and refining of alkali salts.* J. H. Laureau. Fr. Pat. 429,195, May 1, 1911.

The claim is for the use of various substances, such as water from certain springs, from mines, from the manufacture of saltpetre and ammonium salts, the drainings from salt-marshes, and from the refining of sea-salt, the débris of fish and crustaceans, etc., for the production of iodine, magnesia, etc., by the usual methods.—W. C. H.

Ammonia ; Manufacture of —— *and catalytic agents for use therein.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 19,778, Aug. 28, 1910.

See Fr. Pat. 429,696 of 1911 ; this J., 1911, 1211.—T. F. B.

Nitrous gases ; Process for absorbing ——. Salpetersäure-Ind.-Ges. m. b. H. Fr. Pat. 430,113, May 24, 1911. Under Int. Conv., Nov. 17, 1910.

See Eng. Pat. 14,121 of 1911 ; preceding.—T. F. B.

Nitrous gases ; Process for completely absorbing highly diluted ——. Salpetersäure-Ind.-Ges. m. b. H. Fr. Pat. 430,112, May 24, 1911. Under Int. Conv., Nov. 27, 1910.

See Eng. Pat. 14,122 of 1911 ; preceding.—T. F. B.

Calcium perborate ; Manufacture of ——. Chem. Werke vorm. Dr. H. Byk, Charlottenburg, Germany. Eng. Pat. 1626, Jan. 21, 1911. Under Int. Conv., Jan. 22, 1910.

See U.S. Pat. 999,497 of 1911 ; this J., 1911, 1057.—T. F. B.

Hydrogen peroxide ; Vessels for producing and storing ——. A. Pietzsch and G. Adolph. Fr. Pat. 430,538, May 24, 1911. Under Int. Conv., June 3, 1910.

See Ger. Pat. 233,856 of 1910 ; this J., 1911, 747.—T. F. B.

Hydrogen ; Process and apparatus for separating —— *from mixtures of gases.* Ges. f. Linde's Eismaschinen, Hollriegelsgreuth, Germany. Eng. Pat. 7205, March 22, 1911. Under Int. Conv., May 6, 1910.

See Fr. Pat. 427,983 of 1911 ; this J., 1911, 1212.—T. F. B.

Oxygen and nitrogen from air ; Process for the separate extraction of —— *by means of alkali manganate or permanganate.* G. Kaszner. Fr. Pat. 430,092, May 24, 1911. Under Int. Conv., May 28, 1910.

See Ger. Pat. 233,383 of 1910 ; this J., 1911, 621.—T. F. B.

Oxygen and nitrogen from air, Process for the separate extraction of —— *by chemical means.* G. Kassner. Fr. Pat. 430,093, May 24, 1911. Under Int. Conv., May 28, 1910.

See Ger. Pat. 234,849 of 1910 ; this J., 1911, 895.—T. F. B.

VIII.—GLASS ; CERAMICS.

Artificial teeth made from porcelain ; Colouring ——. H. Eisenlohr. Sprechsaal, 1911, 44, 609—610.

American artificial teeth are coloured only in the surface enamel, but English and German practice favour homogeneous masses stained throughout. The composition given by the author is 20 per cent. of quartz to 80 per cent. of felspar previously fritted at cone 9 and finely ground. Bone ash, up to 5 per cent.. may be added to induce a natural appearance. The stain is prepared by firing colouring oxides with the above body to cones 10—11, finely grinding and mixing with the mass. Yellow stain is obtained from 90 per cent. of the frit and 10 per cent. of raw titania; red-brown, from 90 of frit to 10 of nickel monoxide; gray, from 98·3 of the frit to 1·7 of a stain made from 70 parts of spathic iron ore and 2 of cobalt oxide fired at 1000° C. for 12 hours. The final mixings for the coloured teeth are:—Ivory, 100 parts of frit, 2·5—5 of yellow stain; Deep yellow, 100 of frit, 10—20 of yellow stain; Ivory gray, 100 of frit, 2·5—10 of yellow stain, 2—10 of gray stain; Gray, 100 of frit, 6—26 of gray stain, 0—2·7 of brown, 0—9 of yellow; Brown, 100 of frit, 1—3 of brown stain, 10 of gray, and 0—20 of yellow stain.—H. H. S.

Chrome glazes; Red ——. A. Berge. Sprechsaal, 1911, **44**, 581—584.

WORKING on glazes of the general formula:

$$\left.\begin{matrix}(0{\cdot}05Cr_2O_3,0{\cdot}1\text{–}0{\cdot}2Al_2O_3)\\(0{\cdot}7\text{–}0{\cdot}1PbO,0{\cdot}1\text{–}0{\cdot}0K_2O,0{\cdot}05\text{–}0{\cdot}00CaO,0{\cdot}3\text{–}0{\cdot}0Na_2O)\end{matrix}\right\}0{\cdot}6\text{—}0{\cdot}7SiO_2$$

the author comes to the following conclusions. Chrome red can exist only in basic glazes and fluxes. Boric acid does not act as an acid (see also Singer, this J., 1910, 1309). The basicity should be as great as possible and produced chiefly by means of lead oxide. Firing should be short and be discontinued immediately the glaze has run to a smooth surface, when a rapid cooling should take place. —H. H. S.

Abrasive materials in the United States. U.S. Geol. Survey, 1910. [T.R.]

THE total estimated value of all the abrasive materials consumed in the United States for the five years 1906 to 910 is given in the following table:—

Year.	Natural abrasives.	Artificial abrasives.	Imports.	Total value.
	$	$	$	$
1906	1,473,393	777,081	909,964	3,160,438
1907	1,680,737	1,027,246	754,140	3,462,123
1908	1,074,039	626,340	476,073	2,176,452
1909	1,329,750	1,365,820	653,779	3,349,349
1910	1,406,805	1,604,030	1,223,827	4,234,662

Imports.—The year 1910 was marked by a notable increase in the importations particularly of emery, chiefly "crude ore and rock." Though the quantity of grain emery was less than that reported in 1909, its value nearly doubled. The imports of manufactures of emery were considerably smaller than for the preceding year.

Infusorial earth.—Heretofore infusorial earth has been largely used as an abrasive and in the manufacture of dynamite. Its porosity also renders it useful as a packing and fireproof building material. So far as known it is not used in the manufacture of dynamite in the United States, where, however, a new use of the material is reported in the manufacture of records for talking machines. For this purpose it is boiled with shellac, and the resulting product has the necessary hardness to give good results. In Europe, especially in Germany, infusorial earth has lately been used in preparing artificial fertilisers, especially in the absorption of liquid manures: in the manufacture of water glass, of various cements, of glazing for tiles, of artificial stone, of ultramarine and various pigments, of aniline and alizarin colours, of paper, sealing wax, fireworks, gutta-percha objects, Swedish matches, "solidified" bromine, scouring powders, papier-mache, and many other articles, and there is a large and steadily-growing demand for it.

Artificial abrasives.—In this class are included carborundum, alundum, and crushed steel. "Aloxite" and "samite" are trade names applied to forms of carborundum recently placed on the domestic market. These industries have grown vigorously, and their value in 1910 exceeded that of the natural abrasives by $197,225. The production of artificial abrasives in 1910 showed an increase of 2,559,000 lb. in quantity and of $238,210 in value, as compared with 1909. A new artificial abrasive, "corubin," has recently been put upon the market by the Goldschmidt Thermit Co., which states that the material is produced from the slag resulting from the reaction between aluminum and chromium oxides. It is practically pure alumina containing a trace of chromium oxide, which gives it a red colour. The total production of carborundum, crushed steel and alundum in the United States since 1906, inclusive, is given in the following table:—

Year.	Quantity.	Value.
		$
1906	11,774,200	777,081
1907	14,632,000	1,027,246
1908	8,698,000	626,340
1909	20,468,000	1,365,820
1910	23,027,000	1,604,030

PATENTS.

Tiles, pottery and analogous ware; Ovens for use in the manufacture of ——, *and for other purposes.* C. Dressler, London. Eng. Pats. 18,114, July 29, and 28,617, Dec. 8, 1910.

TUNNEL ovens are provided internally with one or more combustion chambers, arranged longitudinally, and structurally independent of the main heating chamber. The chambers are arranged on opposite sides of the passage way along which the trucks carrying the articles to be fired pass, so that air will be heated and caused to ascend at the opposite outer sides of the chambers to the top of the oven, then descend through the articles stacked on the trucks, and pass laterally from the trucks beneath the combustion chambers, to their outer sides, there to be re-heated and again circulated. Each unit of length of the combustion chambers is provided with expansion joints, and is placed on a thin layer of loose granular refractory material to allow of free expansion. The chambers comprise longitudinal walls, and internal blocks or bricks, arranged transversely, to cause the hot products of combustion to follow a zig-zag path. The combustion chambers may be composed wholly or partly of rows of pipes, or hollow brick walls. The products of combustion are drawn by means of some exhausting arrangement in one direction only to prevent their entering the main heating chamber of the oven through any cracks in the walls. The walls of the oven are covered with some heat non-conductor, composed of loose material held in position in separate superposed boxes. The ledges of the oven which carry the combustion-chambers above the bottom of the passageway for the trucks are formed with channels containing loose non-conducting material, and may also be provided with pipes for the passage of air, to prevent excess of heat reaching the lower part of the oven.—W. C. H.

Clay-cleansing apparatus. M. Bohn, Nagykikinda, Hungary. Eng. Pat. 29,176, Dec. 15, 1910.

CLAY is forced through a channel, the walls of which are formed of perforated plates or sieves, through which the clay is delivered; the larger impurities, such as stones, etc., are retained by the sieves and forced into a cylinder containing a worm, which discharges them at such a rate, that a kind of plug of coarse stones is continuously present in the cylinder. The cleanser preferably delivers the clay into a similar appliance situated immediately below it, from which the twice-cleansed material passes into the feeding apparatus of a brick-press.—O. R.

Vitreous compounds; Process of rendering —— *turbid.* L. Weiss, Munich, Germany. U.S. Pat. 1,001,789, Aug. 29, 1911.

THE process consists in causing steam or heated vapour to act on a fused mass containing a boron compound and a refractory oxide, and concurrently cooling the mass. The refractory oxide may be zirconia or the oxide of some quadrivalent element. The fused mass of a boron compound and a refractory oxide, which produces the turbidity when cooled as above, may be compounded separately, or the ingredients may be added to a vitreous mass, and whole fused and cooled under the action of heated vapour. The vitreous mass containing the finely disseminated particles of a double compound of boron and a refractory oxide is claimed as a new product that is not attacked by alkalis or acids, with the exception of hydrofluoric acid.—W. C. H.

Alumina and magnesia ; Composition of matter containing ——. T. B. Allen, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 1,001,497, Aug. 22, 1911.

See Fr. Pat. 429,610 of 1911 ; this J., 1911, 1213.—T. F. B.

IX.—BUILDING MATERIALS.

Lime ; Specifications for ——. Verein deutscher Kalkwerke E.V. Tonind.-Zeit., 1911, 35, 1405—1407.

Three grades of lime are distinguished, namely : (1), Fat or non-hydraulic lime, (2), feebly-hydraulic lime, and (3), strongly-hydraulic lime. Each of these grades is prepared by calcining limestone below its sintering temperature, and may be slaked dry, or sumped. Mortars made from feebly-hydraulic and from strongly-hydraulic lime should harden under water after keeping in air not more than 21 days and 7 days respectively. Quicklime, intended for the market, should be protected from damp, should leave no residue on a 20-mesh (per sq. cm.) sieve, and not more than 2 per cent. residue on a 120-mesh sieve. Slaked lime should not leave more than 10 per cent. residue on a 900-mesh sieve. The setting time of lime, *i.e.*, the time of incipient solidification of a paste composed of slaked lime and water, is determined as follows : a syrupy paste of lime and water is introduced into a shallow mould and is periodically pierced in a vertical direction by means of a thin iron rod ; the age of the lime-paste at the first period, when the withdrawal of the iron rod is unaccompanied by any flowing back of the paste, indicates the setting time of the lime. Constancy of volume is determined by enclosing a slab of lime-paste in a zinc vessel fitted with a felt lid, which is kept moistened to prevent the drying out of the slab. The latter is subsequently submerged in water at the ordinary temperature, and should show no signs of cracking or buckling after 10 days. For the determination of the tensile strength, mortars are prepared from 1 part by weight of lime and 3 parts by weight of standard sand ; these are formed into briquettes, which are kept at an average temperature of 15°—20° C. in an atmosphere of 85 per cent. humidity, before testing in the usual forms of apparatus. The minimum tensile strengths should be as follow : (a), for non-hydraulic limes, after 28 and 56 days in air, 2 and 3 kilos. per sq. cm. respectively ; (b), for feebly hydraulic limes, after 21 days in air and 7 days under water, 2 kilos. per sq. cm. ; after 21 days in air and 35 days under water, 3 kilos. per sq. cm. ; (c), for strongly hydraulic limes, after 7 days in air and 21 days under water, 5 kilos. per sq. cm. ; after 7 days in air and 49 days under water, 8 kilos. per sq. cm.—O. R.

Poles ; Preservative treatment of ——. W. H. Kempfer, U.S. Dept. of Agric., Forest Service, Bull. No. 84, June 12, 1911.

Owing to the comparatively high cost of the pressure method of treatment with creosote, the present investigations were directed to simpler and cheaper methods which could be employed locally. Special attention was given to the seasoning of the timber ; and investigations were conducted with the object of (1) testing the efficiency of various wood preservatives and of applications of varying amounts ; (2) developing a method for impregnating that portion of the pole (the butt) most subject to decay ; (3) designing inexpensive apparatus for local use in the application of the treatment. The woods used were chestnut, cedar (3 kinds), and pine (3 kinds) ; and six different commercial preservatives (of which analyses are given) were employed. The following conclusions were drawn :—The reduction in weight of poles by seasoning is commonly from 16 to 30 per cent. ; thorough seasoning is an essential preliminary to preservative treatment. Poles cut during the autumn and winter lose weight less rapidly, but more regularly, than those cut during the spring and summer ; the shrinkage during seasoning does not exceed 1 per cent. on the circumference ; too rapid seasoning may be detrimental to the timber by causing excessive "checking." The superficial application of a preservative to the butt of a pole (by means of a brush) is not as effective as actual impregnation of the wood, but may be expected to add two or three years to the life of the pole. Impregnation of many pole timbers may be successfully accomplished, in open tanks, by simple immersion first in the hot, and then in the cold, preservative ; the latter, by this process, may be applied to the butts only, a great saving of preservative being thus effected.
—W. E. F. P.

Patents.

Slate refuse ; Utilisation of —— *for the manufacture of artificial slates or tiles.* O. J. Owen, Blaenau Ffestiniog, Wales. Eng. Pat. 17,093, Oct. 25, 1910.

The slate waste is crushed and about one-third of it is ground to an impalpable powder. The whole is then mixed with a mineral cement and usually an alkali silicate, and the moist mixture moulded into shape under a pressure of about 10 cwt. per sq. in. The articles may be further treated with solutions of sodium silicate and calcium or magnesium chloride, afterwards washing thoroughly to prevent efflorescence.—B. M. V.

Concrete, cement and the like ; Manufacture of products of ——. H. S. Owen, New York. Eng. Pat. 8085, March 31, 1911. Under Int. Conv., April 1, 1910.

Moulds made of paraffin wax or similar material, are produced by dipping a mould-former covered with a layer of moisture, into melted paraffin wax, then withdrawing it, and detaching the film of wax in the form of a mould. The walls of the mould may be laminated by coating the mould-former with successive layers of wax, which shrink one upon another. Concrete, cement, or the like, after mixing with water, is introduced into the wax moulds, and when it has set, the wax mould is melted off by means of hot water.—W. C. H.

Wood ; Process of vulcanising ——. C. Howard, New York, Assignor to National Lumber Vulcanising Corporation, Delaware. U.S. Pat. 1,004,168, Sept. 26, 1911.

The wood is subjected to the action of a vacuum in which it is then gradually heated to a maximum temperature of less than 250° F. This is followed by a moist heating, during which the temperature is below 230° F., and the moist wood is finally subjected to a temperature of about 380° F.—W. E. F. P.

Plaster for casts ; Process for improving ——. Berliner Gipswerke L. Mundt vorm. H. Kühne. Ger. Pat. 237,802, July 1, 1910.

The addition of glue, borax, or alum to plaster prepared by the boiling process, in order to control its setting and hardening, is known, but casts produced from plaster treated in this way are frequently defective. According to the present patent, the glue, borax, or alum is added before the boiling process, whereby it is claimed the resulting plaster is harder and denser, and shows no tendency to give defective casts.—A. S.

Lumber ; Drying ——. A. D. Linn, Grand Rapids, Mich. U.S. Pat. 1,005,243, Oct. 10, 1911.

See Eng. Pat. 24,193 of 1909 ; this J., 1910, 1384.—T.F.B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron ore high in sulphur; Concentration and purification of —— by roasting in a rotary kiln. J. O. Handy and J. M. Knote. J. Ind. Eng. Chem., 1911, 3, 723—730.

THE ore with which the tests were made contained 4·01 per cent. of sulphur, and consisted of 32·6 per cent. of magnetite, 27·1 of siderite, 7·5 of pyrites, 13·2 of calcite, 10·8 of magnesite, 2·5 of manganous oxide, and 6·3 per cent. of silica. The results of tests with a rotary kiln, 70 feet long, similar to a cement kiln, show that roasting in such a kiln, fired with powdered coal, will efficiently desulphurise iron ore high in sulphur. The details of the trials are given in tables and curves. The results indicate that the kiln should be at least 125 feet long, so as to give a zone 30 ft. long at 1100°—1200° C., preceded by a zone 20 feet long at 900°—1100° C.—A. S.

Blast furnace; Direct and indirect reduction in the iron ——. M. Levin. Metallurgie, 1911, 8, 606—613.

THE author has investigated the conditions in the blast furnace under which the direct reduction: $FeO+C=Fe+CO$, the mixed indirect reduction: $2FeO+C=2Fe+CO_2$, and the pure indirect reduction: $FeO+C+O=Fe+CO_2$ take place by analysis of the gases. It is shown that if the proportion of carbon monoxide is greater than 53 per cent. of the nitrogen by volume, there is no pure indirect reduction, but only a direct and mixed reduction taking place, whilst if the proportion is less than 53 per cent. then there is only a pure indirect reduction possible. Thermal data are then calculated from the analyses, and it is concluded that the difference in heat units for direct, mixed, and pure indirect reduction is the same whatever metallic oxide yields the gaseous gram-atom of oxygen. The same is true for direct and indirect reduction and leads to the equation: $2CO=C+CO_2+38{\cdot}96$ cals.

—A. H. C.

Cast iron; Contraction of ——. E. Rosenberg. Stahl u. Eisen, 1911, **31**, 1408—1413.

IN an attempt to explain the superiority of gray iron over white iron for the production of castings, the author gives details of two sets of calculations on the volume relationships of the two kinds of iron in the liquid state, at 1000° C. (just after solidification), and at 0° C. Having regard to the various factors left out of consideration owing to lack of available data, the results obtained by the two methods of calculation agree satisfactorily and show that in the case of white iron there is a diminution of volume on solidification, whilst in gray iron there is an increase, and this increase is greater the more decided is the gray character of the iron (see Turner, this J., 1906, 538, and Hague and Turner, this J., 1910, 1160). The results of the calculations are summarised in the following table, the figures representing the specific gravity under the conditions given. The values for the gray and white irons were obtained from published data on the sp. gr. of solid and molten pig iron and on the coefficient of linear expansion, the latter being taken as 0·0000175 for the figures in col. I., and as 0·000033 for those in col. II. The figures in the last two columns of the table were obtained by calculations based on the relative densities of pure iron, iron carbide, and graphite, and the separation of graphite from the carbide during solidification.

	Gray iron.		White iron.		Pig iron containing:	
	I.	II.	I.	II.	3 per cent. of graphite and 1 per cent. of combined carbon.	1 per cent. of graphite and 2 per cent. of combined carbon.
Liquid ..	6·89	6·89	6·89	6·89	7·1	7·1
1000° C.	6·75	6·46	7·22	6·91	6·9	7·2
0° C.	7·1	7·1	7·6	7·6	7·2	7·4

—A. S.

Electric smelting of iron are at Trollhättan, Sweden. J. A. Leffler. (Report to the Swedish Association of Ironmasters, May 31, 1911.) Met. and Chem. Eng. 1911, **9**, 368—371, 459—463, and 505—509. (See also this J., 1911, 896—897.)

THE furnace, designed by Grönwall, Lindblad and Stalhane for the production of 23 tons of pig iron per 24 hours, comprises two main portions—the shaft and the crucible or hearth—connected by a sand seal. The total height of the structure is 13·7 m., the distance from the bottom of the hearth to the top of the furnace being 12·7 m. The shaft consists of a shell of steel plates, 10 mm thick around the stack and 12 mm. around the bosh, and is lined with firebrick to a thickness of 360 mm. in the bosh and 450 mm. in the stack; the top of the shaft supports a Tholander charging bell and cone. The crucible or hearth rests upon a concrete foundation and is enclosed in a sheet-iron casing 15 mm. thick; it has an arched firebrick roof, which is supported by the top of the casing, the latter being suitably reinforced for the purpose. Adjacent to the casing and foundation, the hearth is lined with firebrick and next with magnesite brick, the dish-shaped bottom consisting of a mixture of magnesite and pitch rammed in so as to extend for some distance up along the walls. Through the arched roof four converging electrodes project into the crucible, each at an angle of 65° to the horizontal; the electrodes are 2 m. long and 660 mm. square in section, each being composed of four carbons. At the openings in the roof the electrodes, which are adjustably mounted, are surrounded by cooling jackets of copper provided at the top with asbestos packing to prevent leakage of the gas circulating through the apparatus. This gas is drawn from the cool upper part of the furnace by means of a fan, and, after being freed from dust, is blown under the hot roof of the crucible, thus prolonging the life of the roof by preventing overheating and at the same time giving up its heat to, and assisting in the reduction of, the charge of ore, charcoal and limestone within the shaft. The volume of the furnace and gas-piping being constant, additional gas (proportional to the amount of ore reduced) is continuously produced, this excess being originally allowed to burn to waste in the air. The total capacity of the furnace, 38·00 cub. m., is apportioned as follows to the various parts of the structure: crucible 12·45 cub. m., neck 0·45, bosh 3·50, cylindrical portion of shaft, 11·80 and stack 9·80. The electric energy for the plant consists of a three-phase alternating current of 25 cycles and 10,000 volts tension. The two furnace transformers are each of 1100 kilowatts with a guaranteed overload capacity of up to 1375 kilowatts under one hour; they are coupled according to the Scott method, giving secondary two-phase currents. Regulation is possible between 50 volts and 90 volts in eight stages, and also, by different connections of the secondary coils, from 100 volts to 180 volts; the voltage can be regulated during operation. The low-tension conduits from the transformers consist of 6 copper bars (8 mm. by 200 mm.) for each electrode; and the current is conducted to each electrode through 48 cables, each of which has an area of 185 sq. mm. The average results obtained during 5 months working were as follow:—

Iron in ore		61·54 per cent.
Iron in charge		57·00 per cent.
Slag per ton of iron		327 kilos.
Charcoal per ton of iron		24·79 hectolitres.
Electric energy per ton of iron		2391 kilowatt-hours.
Iron per kilowatt-year		3·66 tons.
Electrode consumption per ton of iron	gross	10·28 kilos.
	net	5·27 kilos.

The pig iron produced over the whole period contained on the average 3·2 per cent. of carbon, 0·3 of silicon, 0·3 of manganese, 0·028 of sulphur and 0·015 of phosphorus, the average composition of the slag being 43 per cent. of silica, 5 of alumina, 3 of titanium dioxide, 2 of ferrous oxide, 2 of manganous oxide, 30 of lime, 15 of magnesia and 0·05 of calcium sulphide. The production of pig iron of uniform composition for any desired length of time being largely dependent upon the even circulation of the gas through the furnace, experiments are in progress for bringing the latter factor more under control. From the experience gained in working, the author considers that, with a furnace of this capacity, four electrodes is the minimum number, and is of opinion that by the employment of six electrodes with three-phase currents, the more uniform distribution of the heat obtained would result in greater efficiency.—W. E. F. P.

Electric iron smelting in Sweden. T. D. Robertson. Met. and Chem. Eng., 1911, **9**, 525—528.

The following additional particulars are given with regard to the plant at Trollhättan (see preceding abstract). The thermal efficiency of the furnace, after working for five months, was found to be 80 per cent.; the efficiency of the Swedish charcoal blast furnace is 82 per cent., that of the English blast furnace being 70 per cent. The excess of gas produced in the Trollhättan furnace amounts to 550 cb. m. per ton of pig iron; each cb. m. will develop from 2100 to 2500 Calories, the percentage of combustibles in the gas averaging 80 per cent. The conditions governing the grade of iron produced in the furnace are similar to those obtaining in the ordinary blast furnace except that the irregular influence of the air-blast is absent. The maximum output of the furnace is obtained when making white iron, the production of grey iron requiring a higher temperature and consequently a greater power consumption. In view of the existence of numerous deposits of iron sands and poor magnetites which, although easily concentrated, are too expensive to briquette for treatment in the ordinary blast furnace, the author emphasises the successful smelting of concentrates in the Trollhättan furnace as an important advance. Mention is also made of two important alterations which have recently been effected at Trollhättan. The first consists in the installation of cylindrical electrodes provided with screw joints, so that when an electrode becomes too short, a new one can be screwed on above it—thus obviating the loss due to stump ends. In addition the electrical contact can now be made at the point where the electrode enters the roof (instead of at the end as in the old arrangement), thus saving about 40 kilowatts and permitting of the furnace taking up 3000 h. p. instead of 2500 h. p. The second alteration relates to the gas-circulating arrangement in which the inefficient dust-collector has now been replaced by a water scrubber, the cleaned gas being blown into the furnace by means of a fan.—W. E. F. P.

Electric pig-iron (Trollhättan, Sweden); Behaviour and qualities of ——, in the open-hearth process. E. Odelberg. (Report to the Swedish Association of Ironmasters, May 31, 1911.) Met. and Chem. Eng., 1911, **9**, 509—510.

The characteristic feature of electric pig-iron being its freedom from oxides, a much lower silicon content than that desirable for ordinary blast-furnace grey iron is sufficient to effect the necessary reactions in the open-hearth process; as, moreover, the production of white iron is more economical than that of high-silicon grey iron in the electric furnace, the presence of an excess of silicon in electric pig-iron is a disadvantage. In the treatment of low-carbon electric pig-iron by the open-hearth process, charges consisting of 50 per cent. of the iron and 50 of scrap were used in the basic hearth, the proportions being respectively 64 and 36 in the acid hearth; excellent results were obtained, a hot and fluid steel being produced with a considerable saving of time over ordinary practice. It has been shown, by means of practical manufacturing tests, that in quality the new steel is equal to that produced from Swedish charcoal blast-furnace iron.—W. E. F. P.

Iron and steel; Progress in the electrometallurgy of ——. D. F. Campbell. Faraday Soc., Oct., 1911. [Advance proof.]

An account is given of the production of electro-iron and steel in Sweden, Germany, and America, indicating the direction in which progress has been made (see also this J., 1910, 1160).—A. H. C.

Cementation of iron by solid carbon. G. Charpy and S. Bonnerot. Comptes rend., 1911, **153**, 671—673.

Owing to the discordant results which have been observed (see this J., 1910, 214, 1013), the cementation of iron by solid carbon *in vacuo* was again investigated. Carefully purified graphite was compressed at 3000 atmos. between plates of extra soft Martin steel, as in the previous experiments. Gas was evolved, but by vigorous pumping the pressure could be reduced very much. It was found that no trace of cementation occurred on heating at 950° C. for 38 hours, when the pressure was about 0·1 mm. of mercury. Distinct cementation occurred in several hours when the pressure rose above 0·5 mm. of mercury. The authors conclude that at 950° C. no cementation of iron by solid carbon is produced in the absence of gases.—H. E. P.

Steel; The life history of cells and grains in ——. H. M. Howe. Int. J. Metallog., 1911, **2**, 13—25.

In steels with less than 0·90 per cent. of carbon there may occur (1) "grains" of ferrite, and (2) "cells" of pearlite, mixed with more or less ferrite in a finely divided state, bounded by walls or shells of ferrite. It is thus the author limits and defines the meaning of "grains" and "cells." (In steels with over 0·90 per cent. of carbon, cementite would replace ferrite in the above.) The size of both grains and cells increases with the temperature to which the steel has been heated, and with the length of exposure at that temperature. When a low-carbon steel is heated to about 700° C., the grains of ferrite rapidly increase in size, for, since the grains are in immediate contact with each other, growth does not entail translation or migration, but merely the rotating of adjoining particles about their own centres until they have the same crystalline arrangement. At 900° C. the ferrite passes into austenite, the change being accompanied by the shattering of the pre-existing coarse grains of the old ferrite. In a higher carbon steel the grains of ferrite are isolated by intervening masses of pearlite, and hence such a steel does not coarsen rapidly when heated to 700° C. As a steel containing enough carbon to yield a cell structure is heated through the critical range, the pearlite first passes into austenite, and as the temperature rises, the ferrite is absorbed by the austenite, a homogeneous mass of austenite resulting. If the temperature is maintained, the grains of austenite will increase in size in the same way that ferrite grains do when a low-carbon steel is kept at 700° C. As the steel cools through the critical range, ferrite is expelled. According to the rate of cooling this ferrite will more or less accumulate at the boundaries of the austenite grains. It will also segregate along the cleavages of the austenite or remain diffused through the latter. When the low limit of the critical range is reached, the austenite abruptly changes back into pearlite. It is thus seen that the size which the austenite grains attain determines the size of the cells in the cooled steel, and that whether the cell structure will be visible depends on the rate of cooling. The formation of the cell structure is most assisted by a moderately rapid cooling, as in air. A very rapid cooling affords no time for the massing of the ferrite, whilst a very slow cooling allows the ferrite massed at the cell boundaries to coalesce by surface tension, and also allows that which had remained in the austenite grains to assemble. Both these actions tend to obscure the cell structure. The parallel bars of ferrite in slowly cooled steels are the results of the massing of ferrite along the cleavages of the austenite grains. Steels high in manganese, such as steel rails, tend to show marked cellular structure owing to the retarding action which the manganese exerts both on the growth and the break-up of the cells.—T. St.

Molybdenum steel; Production of —— in the electric furnace. E. T. Dittus and R. G. Bowman. Met. and Chem. Eng., 1911, **9**, 531—534.

The authors give the results of laboratory experiments, mostly qualitative, on the direct production of molybdenum steel by the simultaneous reduction of iron ore (hæmatite) and molybdenite (molybdenum sulphide). The reduction of the iron ore was effected by means of coke, ferrosilicon being used as the desulphurising agent in the proportion required by the equation: $MoS_2+Si=Mo+SiS_2$. The electric furnace employed was adapted for use either on the Héroult or the Girod principle. From the results obtained, the authors conclude that molybdenum steel, low in sulphur, can be made in the electric furnace in the manner indicated, and that the molybdenite may be added in the form of low-grade concentrates. The Girod type of furnace appears to be superior to the Héroult, but the furnace should preferably be of the tilting type for facilitating the tapping of the metal, which is very refractory.—W. E. F. P.

Cast and Mannesmann tubing; Rusting of ——. H. Wölbling. Metallurgie, 1911, **8**, 613—617.

Cast iron and steel and Mannesmann tubes were enclosed in a moist oxygen atmosphere, and the absorption of the gas measured in order to determine any difference in the degree of rusting that took place. The tubes were previously sand-blasted and washed in water, alcohol, and ether. The results obtained varied, and only further work can determine whether this variation depends upon the character of the external surface of the tubes or upon any unfavourable conditions of the experiments.—A. H. C.

Iron; Electrolytic corrosion of —— *by direct current.* J. L. R. Hayden. J. Franklin Inst., 1911, **172**, 295—308.

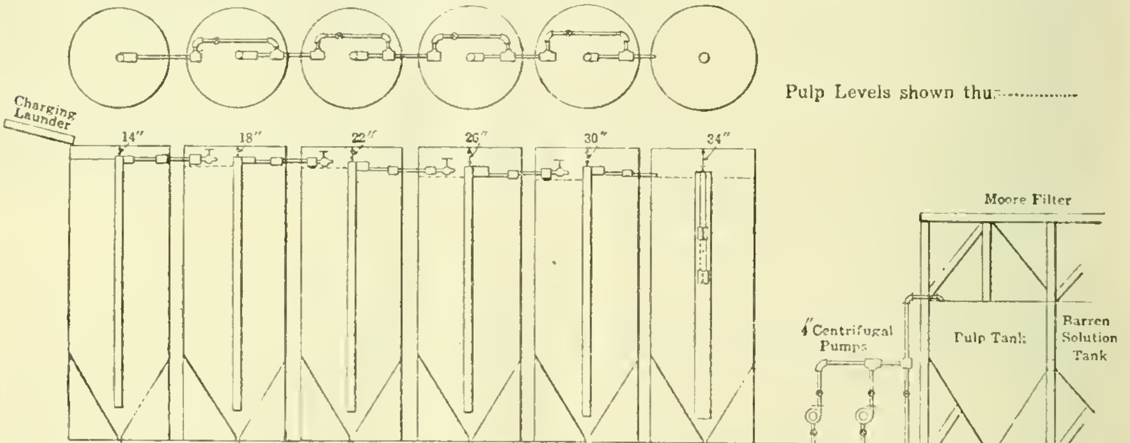
In view of the importance of the corrosion of iron rails, pipes, etc., by stray electric currents in the ground (see this J., 1906, 186; 1907, 695, 899; 1909, 1089), the author made a series of laboratory experiments on the effect of passing currents of different strengths between sheet iron electrodes in various weak saline solutions. It was found that according to the conditions, the iron was either "active" (low potential difference between electrodes; corrosion in accord with Faraday's law) or "passive" (high potential difference, no appreciable corrosion). High current density, alkaline reaction of electrolyte, and presence of nitrates and especially of bichromates tend to produce the passive condition, whilst the presence of sulphates and especially of chlorides tends to produce the active condition. When the iron is active, the products of corrosion appear to be ferrous compounds, whilst when the iron is in the passive condition, apparently ferric compounds are formed. A small proportion of chloride is sufficient to destroy the efficiency of passivifying agents: for example in 1 per cent. solutions of potassium bichromate and potassium nitrate, the presence of 0·04 and 0·02 per cent. respectively of ammonium chloride was sufficient to induce corrosion.
—A. S.

Cyaniding; Continuous —— *at Natividad.* H. Adams. Amer. Inst. Min. Eng., June, 1911. Eng. and Min. J., 1911, **92**, 696—698.

The ore treated contains 5 to 8 per cent. of sulphides (pyrites, galena, and blende) with a schistose gangue, the value being chiefly gold contained in the pyrites. Cyanide tests showed an extraction of 92 to 93 per cent. of the gold and Pachuca tanks 12 ft. by 35 ft. (100 tons capacity) were put into commission in January, 1910. With intermittent filling of the tanks, great difficulties were experienced owing to packing of the pulp and a continuous system was therefore adopted. The author considers that even when the ore does not pack, the continuous system possesses advantages. The system has been in operation since Sept., 1910, and no appreciable classification of the ore during treatment has been observed, nor has the flow from one tank to another caused difficulty, this being regulated satisfactorily at a cost of 62 cents (2s. 7d.) per day. There are six tanks in series (see Fig.), with a fall of 4 in. from tank to tank; a wooden box 7 in. wide, 10 in. long and 6 in. deep is attached to the side of each of the 15 in. central tubes with the tops of both flush. A 4 in. pipe passes from each box to the next tank through a valve; by-pass valves and pipes being also provided so that any tank may be cut out of series. The overflow from one tank to another is thus a fair sample of the whole contents of the tank, since mixing of the pulp takes place in the central tube; further the level of the inflow pipe is 2 in. below the tops of the air-lift tube but slightly above the pulp level, so that no part of the pulp entering the tank can pass out without having gravitated to the bottom and risen through the air tube. The regulation of the flow from tank to tank is effected by sliding covers on the overflow boxes. As the last tank of the series discharges to a Moore filter, where an intermittent feed is necessary, its air tube is fitted with two pairs of sliding doors to permit of agitation at different levels. The bottom discharge connections are retained on all the tanks, being used in conjunction with the by-passes for emptying when necessary.—B. M. V.

Losses in cyanide practice, [*avoidance by vacuum filtration.*] H. F. Julian. Mining Mag., 1911, **5**, 284—290.

If the pulp settles readily it may be thickened by decantation before passing to the filters, a consistence of one part of solids to one part of liquid being aimed at to avoid the need of agitation in the filter tanks. With some pulps, however, 3 parts of water to 1 of solids are needed. High-pressure filters will produce a thicker cake in a given time than vacuum filters when the pulp is crystalline, but with amorphous pulp the cake will be thin, soft, and varying greatly in porosity owing to segregation and thus incapable of being washed without great dilution of the filtrate. These faults can be avoided in a vacuum filter by employing a low suction at first, to give greater porosity, and by keeping the pulp agitated to prevent segregation. A cake from a pressure filter after exposure to air, will contain from 70 to 110 lb. of dry ore per cb. ft. according to the material, while a vacuum cake will contain 45 to 65 lb. per cb. ft., and 30 to 35 per cent. by weight of the cake is valuable liquor. Since



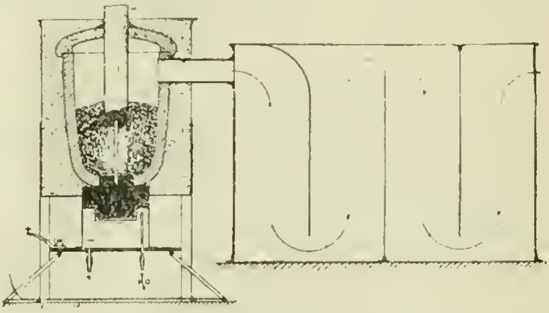
the rate of formation of the cake is inversely proportional to the time of filtration, at a certain stage (to be found by trial) it is economical to stop and proceed to wash. To avoid compacting the cake during transfer to the washing vats, suction should be taken off if this is possible without the cake dropping off the frame. Washing with cyanide solution is recommended in order to extract values which have remained undissolved or have been re-precipitated. The author strongly deprecates hurrying this stage as the value of metal removed far exceeds the cost of the process and it is desirable to use a minimum of solution with slow percolation to obtain a filtrate as rich as possible. Any scum (generally very rich) which has been formed in the lixiviating vats may conveniently be now transferred to the filter along with a little slime. If, as is usual, the washing solution is made from barren solution out of the zinc boxes, it must be thoroughly aerated and if clear should be made muddy by addition of slime to correct any local variations in the permeability of the cake, and just before use, it should be made slightly stronger in cyanide than the lixiviating solution. It is generally economical to save the cyanide in the cake by a water wash: here again haste is undesirable as the latter portion of the cyanide is held by adsorption and the vacuum should be decreased after a while to avoid unnecessary dilution of the filtrate. The author condemns washing by decantation on account of the large losses caused not only by imperfect removal of solution, but because on dilution, colloidal precipitates (*e.g.* silica) may come down and carry much gold and silver with them. —B. M. V.

Gold and silver; Determination of ——, in copper. E. F. Kern and A. A. Heimrod. Met. and Chem. Eng., 1911, 9, 496—499.

As the result of investigation into the methods ordinarily employed, the following processes are recommended as affording accurate and concordant results in the determination of gold and silver in alloys of these metals with copper. *Gold in copper-gold alloys:* 1 A.T. (29·166 grms.) of the alloy is placed in a covered beaker with 20 c.c. of distilled water, and 90—100 c.c. of strong nitric acid are added in small portions at a time. At the end of the reaction 40 c.c. of strong sulphuric acid are added and the liquid is evaporated just to dryness. The residue is taken up with 500 c.c. of water, a solution containing 10 grms. of crystallised ferrous sulphate being then added to destroy free nitric acid and precipitate any dissolved gold. 25 c.c. of a saturated solution of sodium chloride, and sufficient silver nitrate to produce a bead of convenient composition for parting are then added, the hot liquid being rapidly stirred to cause the precipitated silver chloride to coagulate and collect all the finely divided gold. After filtering and washing the precipitate free from copper salts, the beaker is thoroughly wiped out with a piece of filter paper which is afterwards added to the main precipitate. The latter is then placed on a litharge-glazed scorifier with 20 grms. of test lead, the filter paper is slowly burnt off, a further 20 grms. of test lead are added, with a pinch of borax glass, and the scorification is concluded in the usual manner. The resulting lead button is cupelled, and the bead parted with dilute nitric acid as usual. In the assay of prepared copper-gold alloys containing approximately 10, 36 and 96 oz. of gold per ton (of 2000 lb.), the results obtained showed very close agreement. *Silver in copper-silver alloys:* From 5 to 20 grms. are dissolved in strong nitric acid (3 c.c. per grm. of alloy) and the solution is evaporated until crystallisation of copper nitrate commences. 400 c.c. of cold distilled water are then added, followed by 25 c.c. of a solution of ammonium thiocyanate (containing 25 grms. per litre), the latter being added quickly and with constant stirring to coagulate the precipitate of silver thiocyanate. After separation by filtration the precipitate is washed free from copper salts, returned with the paper to the beaker in which the precipitation was made, and digested with 80 c.c. of strong nitric acid; the beaker is allowed to remain on a hot plate until all the paper is decomposed and the precipitate dissolved. The solution is then evaporated to a small volume to expel oxides of nitrogen; and, after cooling, 300—350 c.c. of distilled water are added, followed by 20 c.c. of a saturated solution of barium nitrate to precipitate the sulphuric acid present. 3 c.c. of ferric alum solution are then added and the solution is titrated at ordinary temperature with a solution of ammonium thiocyanate (3·2 grms. per litre) which has been previously standardised against pure electrolytic silver. In the assay of copper-silver alloys containing upwards of 100, 500 and 1300 oz. of silver per ton, the results obtained by this method were very concordant. It is important that all oxides of nitrogen be expelled after the initial treatment with nitric acid, and that the liquid be not too hot during the precipitation of the silver, since the presence of oxides of nitrogen may cause some of the silver thiocyanate to redissolve, while cuprous thiocyanate may be precipitated with the silver if the solution is too hot.—W. E. F. P.

Copper ores; Electric smelting of —— and of the intermediate products of the copper blast furnace. Part III. J. Schilowski. Metallurgie, 1911, 8, 617—625.

In continuation of experiments on electric smelting of copper ores (see this J., 1910, 356, 431, 1013), an ore containing 10·1 per cent. of copper, 9·25 of arsenic, 15·00 of sulphur, 27·1 of iron, 0·48 of manganese, 20·3 of silica and 9·45 of alumina was smelted in a specially designed electric furnace with sublimation chambers (see Fig.). The ore gave on melting a "roast" and a "speiss" which required separate smelting. In order to determine the most economical charge for the furnace it is necessary to consider the electric power required and the loss of copper in the slag. As regards the consumption of the carbon electrodes there is very little difference for different charges in the furnace. A third factor in economy is the proportion of roasted ore to speiss produced. These three factors determine the greatest economy conditions in a charge containing 60—70 per cent. of roasted ore, when (1) the power used is at a minimum value; (2) the slag contains five per cent. of the copper in the charge; (3) the roasted ore contains less than nine times the amount of copper of that in the speiss. If the charge varies from the above then the amount of power used rises. If more ore is taken the quantity of slag increases as well as the copper in the speiss; if more unroasted ore be taken, both these copper contents fall, but the amount of power used rises so rapidly that the increase in cost nullifies every other advantage.—A. H. C.



Copper-silver-gold; Ternary system of ——. E. Jänecke. Metallurgie, 1911, 8, 597—606.

The cooling curves of nine alloys of gold and silver, and sixty-three alloys of copper, silver, and gold were taken using an electric furnace lined with magnesite, in conjunction with a chronograph. Equilibrium diagrams are given for the ternary system copper-silver-gold. It was found that the equilibrium diagram of the silver-gold binary system differed from that of Rose and Roberts-Austen, there being no break in the curve at 50 atoms per cent. The ternary system showed the theoretical behaviour. Thermal and microscopical investigation proved the alloys to consist of homogeneous mixed crystals. The solid alloy containing 42·5 atoms per cent. of copper, 33·5 of silver, and 24·0 of gold was in equilibrium at 800° C. with the molten alloy containing 42·5 atoms per cent. of copper, 36·5 of silver, and 21·0 of gold. The paper is illustrated by eleven microphotographs, which are discussed and shown to be in accord with the thermal examination of the alloys.—A. H. C.

Copper sulphate and sulphuric acid; Conductivity of mixtures of ——. H. K. Richardson and F. D. Taylor. Met. and Chem. Eng., 1911, **9**, 536.

For the purpose of calculating the voltage drop due to electrolytic resistance in copper refining, the authors have measured the conductivity of mixtures of copper sulphate and sulphuric acid at 25° and 45° C. The values obtained (reciprocal ohms per cm.) are shown in the following table:—

Temperature.		25° C.				45° C.				
Grms. of H_2SO_4 per 100 c.c.	0	5	10	15	20	0	5	10	15	20
Grms. of $CuSO_4,5H_2O$ per 100 c.c. 0	—	0·208	0·410	0·565	0·683	—	0·246	0·492	0·683	0·839
5	0·953	0·204	0·388	0·531	0·646	0·0205	0·242	0·461	0·643	0·791
10	0·0221	0·195	0·350	0·500	0·600	0·0294	0·222	0·422	0·606	0·738
15	0·0343	0·189	0·338	0·458	0·558	0·0468	0·217	0·381	0·545	0·690
20	0·0423	0·182	0·319	0·433	—	0·0574	0·212	0·378	0·521	0·643

The conductivity of sulphuric acid solutions is increased by the addition of copper sulphate when the amount of acid is less than 3 grms. per 100 c.c., and decreased when the acid exceeds this amount; when the quantity of acid present is just 3 grms. per 100 c.c. the addition of a little copper sulphate has no effect upon the conductivity of the mixture. The temperature coefficient of mixtures of equal parts of copper sulphate and sulphuric acid appears to be that of the sulphuric acid alone.—W. E. F. P.

Manganese; Ferromagnetic compounds of —— *with phosphorus, arsenic, antimony and bismuth.* S. Hilpert and T. Dieckmann. Ber., 1911, 44, 2831—2835.

Manganese forms ferromagnetic compounds with the elements of the nitrogen group mentioned in the title. On heating, the magnetisability disappears within a short range of temperature, reappearing on cooling. The critical range of temperature varies with the compound and rises on passing from phosphorus to bismuth. The authors prepared the phosphide by heating pure manganese prepared from the electrolytic amalgam, with red phosphorus in a sealed tube to 600° C. After extracting the product with dilute hydrochloric acid, an insoluble residue was left. This may be obtained containing 36·1 per cent. of phosphorus (MnP), or higher percentages up to nearly that corresponding to MnP_2. The critical temperature (18°—26° C.) does not vary with the phosphorus content, but the magnetisability is smaller in the specimens containing higher percentages of phosphorus. The phosphides are black odourless substances, insoluble in hot hydrochloric acid, but soluble in dilute nitric acid. The arsenide (critical temp. 40°—45° C.) has been previously described (this J., 1911, 1216). The antimonide is obtained as a grey powder by dissolving the calculated quantity of antimony in a manganese amalgam, and distilling off the mercury. Its critical temperature is 320°—330° C. (See also Williams, this J., 1907, 927). The bismuthide, obtained in the same way, as a silver white regulus, has a critical temperature for magnetisability of 360°—380° C.—W. H. P.

Electric nickel smelting. W. L. Morrison. Met. and Chem. Eng., 1911, 9, 546—552.

The investigation relates to the development of a commercial process for the electric smelting of the nickel ore at Webster, New Caledonia. The ore, which consists mainly of hydrated silicates of magnesia and nickel with varying quantities of iron and chromium oxides, occurs in three varieties, viz., reddish-brown ore containing the greatest amount of iron and aluminium oxides, hard green ore containing about 1·9 per cent. of nickel oxide, and soft green ore containing about 8 per cent. of nickel oxide. The rich ore occurs in only comparatively small amounts, but large quantities of ore averaging 1·75 per cent. of nickel oxide are available. Most of the nickel being used in the steel industry, the experiments were directed to the production, in one operation, of a nickel silicide which could be sold directly to manufacturers of nickel steel. In a plant erected for smelting-trials on a commercial scale, the furnace employed was of the Héroult crucible type using direct current. It was lined with graphite and coke dust, contact between the bed and the cast-iron bottom-plate of the furnace being effected by means of iron rods 10 in. long and ½ in. in diameter. As the generators could only be operated at half load, only one Acheson graphite electrode, 8 in. square in section, was used for nearly all the trials, the single electrode taking as much as 5000 ampères at times. In one run during which 7 tons (2000 lb.) of the raw brown ore were treated in two charges, the ore contained 42·5 per cent. of moisture and water of hydration, the amount of dry ore treated being thus 8050 lb.; the weight of limestone used was 3600 lb., that of coke being 1940 lb. The net time of smelting was 45·75 hours, the power employed averaging 170 kilowatts. The nickel silicide obtained weighed 1242 lb. and contained 11·9 per cent. of nickel. The amounts of ore treated, and silicide obtained, per kilowatt-year were respectively 9000 lb. and 1380 lb. The efficiency of the furnace is estimated at from 60 to 70 per cent. as compared with a furnace utilising the heat of the waste gases for drying and pre-heating the ore. The output of the plant varied from 800 lb. to 1200 lb. of silicide per day, but could be raised to 2500 lb. per day by operating the generators at full load. The cost of operating the plant was 148·80 dollars (£31) per 24 hours, but the actual cost of smelting could not be reasonably deduced since by operating the generators at full load the cost of power would have been only 56·2 cents (2s. 4d.) per kilowatt-day as against the actual cost of 74 cents (3s. 1d.) per kilowatt-day.—W. E. F. P.

Electrolytic nickel; The peeling off [from the electrode] of ——. K. Engemann. Z. Elektrochem., 1911, **17**, 910—917.

The tendency of electrolytic nickel to detach itself from the electrode in thin layers is usually due to the presence of traces of iron. From acid solutions of pure nickel sulphate and chloride, quite firm deposits are obtained even at low temperatures and high current densities. In ammoniacal solutions, however, the stripping is still marked even in the absence of iron. When iron is present in the electrolyte it separates more rapidly than the nickel, so that the first layers contain more iron than the later ones. It is found that all conditions which are favourable to the stripping are those which cause the lack of uniformity in the ratio iron : nickel in successive layers of the cathode metal. Low acidity and low temperature of the electrolyte increase the tendency to strip, while a gradual rise in current density first tends to promote and then to retard stripping. The hardness of electrolytic nickel does not depend to any considerable extent on the use of the sulphate rather than the chloride, but the flexibility is greater when the sulphate is used. Increase of the acidity of the electrolyte, or the addition of a sodium salt causes an increase both in hardness and in flexibility, when the other conditions are the same. —W. H. P.

Nickel-zinc alloys. E. Vigouroux and A. Bourbon. Bull. Soc. Chim., 1911, **9**, 873—879.

In addition to the compound, $NiZn_3$, already known (see this J., 1908, 1065), two new compounds of nickel and zinc are shown to exist, viz., $NiZn_4$ and Ni_3Zn. The former has been isolated in the form of a crystalline, non-magnetic powder having the sp. gr. 7·71 and melting at about 850° C.—A. Seld.

Zinc; Effect of temperature upon ductility of ——. W. B. Haines. Proc. Royal Soc., 1911, **85**, A, 526—532.

Commercial zinc wires, containing a small proportion of lead, were fixed vertically in a bath of castor oil and stretched by a weight applied to the upper end by means of a pulley; a cathetometer being used to measure the extension of the wire. At each temperature the rate of extension was calculated from observations for several loads ranging up to the breaking stress. It was found that between 80° and 90° C. the metal becomes remarkably soft; as soft, in fact, as it is at 150° C. At a few degrees above 90° C. a hardening of the zinc sets in, which is so rapid that at 110° C. the behaviour is comparable with that at 30° C. There is, however, greater brittleness than at this lower temperature. From 110° onward there is a regular softening as the temperature rises, up to 200° and probably at least up to 250° C. This hardening in the region of 100° C. takes some time to develop. The effect of heating the wire to temperatures above 120° C., and then cooling, is to diminish greatly its tenacity and ductility, through the induction of a crystalline structure. It can be restored to its former condition by hammering. Experiments on bars of pure zinc failed to show these changes in the region of 100° C., the only peculiarity being the hardening in the region of 200° C.—R. C. P.

Tellurium and zinc; Alloys of ——. M. Kobayashi. Mem. Coll. Sci. and Eng., Imp. Univ., Kyoto, 1911, 3, 217—221.

A thermal and micrographic study showed that tellurium and zinc form the compound, TeZn, which consists of dark red to black crystals melting at 1238·5° C., and having the sp.gr. 5·54 at 13° C. This compound is miscible with tellurium in the molten condition, and the melting point falls with increasing quantities of tellurium, finally to the melting point of pure tellurium (443·5° C.). The compound appears to be nearly immiscible with zinc in the molten condition.—A. S.

Titanium; Some compounds of ——. [*Preparation of metallic titanium and some titanium mordants; and detection of gold with titanium trichloride*]. A. Stähler and F. Bachran. Ber., 1911, **44**, 2906—2915.

In continuing the work of Stähler and Georges (this J., 1909, 1125) the authors have improved the apparatus used in the preparation of titanium trichloride by the reduction of the tetrachloride with hydrogen. When the trichloride is heated in a porcelain tube to 660°—700° C., in a current of hydrogen, it decomposes, leaving a deep-black powder consisting of the dichloride, ($2TiCl_3 \rightleftarrows TiCl_4 + TiCl_2$), with small amounts of metallic titanium and included hydrogen. In order to see if metallic titanium could be obtained in quantity, the authors, having obtained the dichloride in this manner by keeping the temperature at 700° C. until no more tetrachloride was evolved, then raised the temperature to 1100° C. A further evolution of tetrachloride took place, and a dark-grey spongy mass remained. This proved to contain 78·9 per cent. of metallic titanium, $2TiCl_2 \rightleftarrows TiCl_4 + Ti$. In subsequent experiments the authors succeeded in raising the percentage to 94·4, but no higher, owing to the impossibility of entirely preventing the porcelain tube from being attacked. Attempts to reduce the tetrachloride by the action of hydrogen sulphide and metals and by the electrolysis of the solution in anhydrous hydrocyanic acid were all unsuccessful. With a view to the possible utilisation of the salts of trivalent titanium as mordants, various organic salts were prepared and examined. Double formates of titanium and sodium, potassium, and ammonium, were prepared by adding solutions of the alkali formates to solutions of the trichloride, with exclusion of air. On concentrating, a paste of olive-green microscopic needles separated. The potassium and ammonium salts respectively were found to have the formulæ:—$Ti(CHO_2)_3,3Ti(CHO_2)_2OH,2KCHO_2$; $Ti(CHO_2)_3,3Ti(CHO_2)_2OH,2NH_4CHO_2,H_2O$. These double formates dissolve in water to olive-green solutions which become hydrolysed at 50° C. When heated in absence of air, the dry salts decompose with evolution of formaldehyde:—$Ti_2O_3 + HCO_2H = 2TiO_2 + HCHO$. The dry salts are fairly stable in air, but the solutions very easily decompose with separation of titanic acid. Dilute solutions were proved to act suitably as mordants. Titanium trichloride may be used for the detection of gold. When a few drops of the aqueous solution are added to a very dilute solution of gold chloride, an intense violet colouration is formed. One part of gold in 30 million parts of water may be thus detected.—T. St.

Cerium; Metallic ——. A. Hirsch. Met. and Chem. Eng., 1911, **9**, 540—544.

The investigation, extending over three years, was undertaken with the object of utilising the rare-earth residues and by-products from the incandescent gas mantle industry in the preparation of metal for the production of alloys. After many experiments in the preparation and reduction of various salts, the metal was eventually prepared by the electrolysis of the fused, anhydrous chloride in an iron vessel. The latter consisted of a 3 in. iron pipe screwed tightly into a 5 in. iron flange to which a bottom plate was attached by bolts and nuts; at the end of a run the metal and electrolyte were removed by detaching the bottom plate. The electrolyte consisted of cerous chloride containing a small percentage of sodium chloride, and, to maintain the bath in a well-fused condition without permitting the temperature to reach the alloying-point of cerium and iron, small amounts of potassium fluoride and of a mixture of the latter with barium chloride were added from time to time. In this manner the electrolysis of about 1500 grms. of cerous chloride yielded 380 grms. of metal in 3 hours, the current employed averaging 200 ampères at not more than 15 volts; the ampère efficiency was 36·5 per cent. The metal produced contained about 98 per cent. of cerium, the impurities consisting mainly of iron, cerium oxide, and cerium carbide, of which the iron accounted for over 1 per cent. Purification was effected by means of mercury, solid amalgams being prepared by boiling the cerium with mercury in a long iron pipe provided with a tube condenser; the iron and other impurities floated and were skimmed off the surface of the mixture, and the mercury was finally separated from the purified amalgam by distillation at a high temperature in a magnesia receptacle contained in an exhausted quartz vessel. Metallic cerium of about 98 per cent. purity has the sp. gr. 6·92 at 25° C.; hardness (as determined by the scleroscope), 25·9 and 9·5 for rolled and freshly cut surfaces respectively; ultimate strength (as determined in an Olsen testing machine, with test-bars of 0·212 in. diameter). 12,900 lb. per sq. in.; and no elongation with a constant load at 350 lb.; specific heat, 0·0524 (20° to 100° C.); m. pt., 635° C. The metal is malleable and highly ductile; it has a fairly high latent heat of fusion and thermal conductivity. The pure metal is weakly, but definitely, paramagnetic. The specific electrical resistance of a sample containing 93·6 per cent. of cerium and 4·5 of iron was 71·6 microhms per cm. cube; the single potential of cerium in normal solution of its chloride measured against the normal calomel electrode was found to be —3·16 volts. With a hot junction at 100° C. and a cold one at 30° C., the thermo-electromotive force was 0·000250 volt; and with the hot junction at 200·5° C. and the cold junction at 30° C., 0·000502 volt; the current flowed at the hot junction from copper to cerium. The heat of oxidation of the metal is 1740 calories per grm. or 60,900 calories per grm.-equivalent (CeO_2 = 243,600). Cerium is very slightly attacked by cold water; a slow evolution of hydrogen occurs in boiling water and the metal is tarnished black. At room temperature, ethyl alcohol, amyl alcohol, chloroform, carbon tetrachloride, concentrated sulphuric acid, concentrated ammonia solution and concentrated sodium hydroxide have no action upon the metal; ethyl ether has a very slight action, as also have 3 per cent. and 30 per cent. solutions of hydrogen peroxide; dilute sulphuric, concentrated and dilute hydrochloric, and concentrated and dilute nitric acids have a moderately vigorous action; and the metal is also moderately attacked by solutions of ammonium chloride and potassium chloride. At boiling temperature, chloroform, carbon tetrachloride, concentrated sulphuric acid and concentrated ammonia solution have no action upon the metal; ethyl alcohol, amyl alcohol, ethyl ether and concentrated sodium hydroxide have a slight action; dilute nitric acid, ammonium chloride, potassium chloride and 3 per cent. hydrogen peroxide have a moderate action; with dilute sulphuric, concentrated and dilute hydrochloric, and concentrated nitric acids and 30 per cent. hydrogen peroxide the action is very vigorous and results in the evolution of gas. Cerium burns with luminescence when heated in air to 160° C. When sealed in a glass bottle and kept warm for some time, a highly pyrophoric black powder—probably a suboxide—forms upon the surface of the metal. Heated in chlorine to 210°—215° C., or in bromine vapour to 215°—220° C., the finely divided metal (filings) combines with the halogen with emission of light; no light is emitted, although partial combination is effected, when the metal is heated in iodine vapour to 300° C. By heating the metal to 345° C. in hydrogen, cerium hydride is produced, without luminescence. At 1000° C. cerium combines with nitrogen (also without luminescence) to form the nitride; and direct combination also ensues when the metal is heated in sulphur vapour.

Alloys of cerium. Alloys (or compounds), generally containing about 70 per cent. of cerium, were made with silver, gold, platinum, copper, tin, antimony, arsenic, carbon, silicon, sulphur, selenium, tellurium, lead, calcium, sodium, aluminium, zinc, cadmium, chromium, iron, manganese, nickel, tungsten, mercury and magnesium. Cerium silicide ($CeSi_2$) is formed by the reduction of cerium oxide with graphite and silicon. This compound is brittle and when added to cerium in such proportion as to form a mixture containing about 15 per cent. of silicon, a good pyrophoric alloy results. The whole series of magnesium-cerium alloys were prepared for the investigation of their optical properties; most of these alloys are brittle, those containing 75 to 85 per cent. of cerium being highly pyrophoric. The magnesium-cerium alloys form excellent agents for thermal reduction processes since —the combination of the two metals being endothermic— more heat is developed by the oxidation of the alloy than by that of the two metals in simple admixture.—W. E. F. P.

Cerium-tin alloys. R. Vogel. Z. anorg. Chem., 1911, **72**, 319—328.

THE author has investigated the cerium-tin alloys by the method of thermal analysis, combined with microscopic examination, and the equilibrium diagram of the system is given. The metals are miscible in all proportions, in the molten state, and form the compounds, Ce_2Sn, Ce_2Sn_3, and $CeSn_2$, which are highly exothermic and melt at 1400°, 1165°, and 1135° C. respectively. The alloys are attacked by water, with the evolution of gas, and those containing 0—50 per cent. of tin are rapidly oxidised on exposure to air; when containing less than 80 per cent. of tin, they are pyrophoric, emitting sparks on being scratched; the maximum pyrophoric effect is observed with the alloy containing 30 per cent. of tin (corresponding to the compound, Ce_2Sn), which also exhibits the maximum hardness. The cerium-lead alloys bear a general resemblance to those of cerium and tin.—F. SODN.

Metals; Transport of particles of certain ——, under the influence of heat. G. Reboul and E. Grégoire de Bollemont. Comptes rend., 1911, **153**, 628—630.

FROM copper, deposits similar to those produced on platinum (see this J., 1911, 429) were obtained when the latter was replaced by aluminium, nickel or porcelain; but no deposit was produced upon silver. The most abundant deposits were obtained in an atmosphere of oxygen, the quantity of copper transported being successively smaller in air, nitrogen and carbon dioxide. Only a small deposit was obtained by heating copper and platinum together in a vacuum; and when an atmosphere of hydrogen was employed, there was no deposit upon the platinum in the neighbourhood of the copper, but a deposit was produced exterior to that neighbourhood. In an experiment in which silver and gold were employed, a white deposit, corresponding to the contour of the silver, was produced upon the gold—a circumstance which is regarded as explaining why no deposit of copper was obtained upon the silver employed in a previous experiment. In explanation of the phenomena observed, the authors suggest that, under the influence of heat, occluded gases are expelled from the surface of the metal by the explosion of the microscopic pockets or cavities containing them; and that metallic particles are thus mechanically entrained and projected on to the surface of the receiving metal. The influence of the gaseous atmosphere is explained on the hypothesis of chemical combination, accompanied by explosion, between the gas of the atmosphere and that expelled from the metal.
—W. E. F. P.

Application of the Edison accumulator in electro-analysis. [Determination of silver and its separation from other metals.] Brunck. *See* XXIII.

PATENTS.

Iron by electrodeposition; Production of ——. S. O. Cowper-Coles, London. Eng. Pat. 28,226, Dec. 5, 1910.

ANODES of pig-iron or cast iron are employed, and the cathodes consist of electrolytic sheet iron, prepared as described in Eng. Pat. 28,897 of 1906 (this J., 1907, 699), suspended in a suitable electrolyte. Brushes or scrapers are fixed to, but insulated from, the cathodes, which are slowly rotated, in order to remove the crusts of graphite, carbon, or other impurities, which accumulate on the anode surfaces. Adjustable means are provided for advancing the brushes as the anodes dissolve away.—B. N.

Iron; Apparatus [mandrels] for the electrodeposition of ——. S. O. Cowper-Coles, London. Eng. Pat. 28,592, Dec. 8, 1910.

IN order to render easy the removal of the brittle deposit of iron from the mandrel, the latter has a hollow annular space which is heated by a steam coil, gas or other means. The material of the mandrel may have a coefficient of expansion different from that of iron.—B. M. V.

Iron and steel; Recarburising means for regenerating superheated or burnt ——. P. Türke and W. Hofheimer, Munich, Germany. Eng. Pat. 1703, Jan. 23, 1911.

THE metal is heated to redness and sprayed with a finely powdered mixture containing 50 per cent. of "terpene resin," 10 of copper sulphate, 20 of calcium phosphate, 10 of borax and 10 of sodium sulphate; or with a similar mixture in which the proportion of copper sulphate is much smaller than that of calcium phosphate and does not exceed that of sodium sulphate.—W. E. F. P.

Steel; An improved ——. P. R. Kuehnrich, Sheffield. Eng. Pat. 11,063, May 8, 1911.

FOR use in the manufacture of tools, etc., claim is made for a steel containing from 2 to 3·5 per cent. of carbon and from 13 to 17 of chromium; such steel, it is stated, may be easily softened (for machining purposes) and subsequently hardened.—W. E. F. P.

[Iron] Castings; Method of making locally-hardened ——. F. K. Vial, Assignor to Griffin Wheel Co., Chicago. U.S. Pat. 1,004,115, Sept. 26, 1911.

CLAIM is made for the use of chromium in counteracting the tendency to softness in the casting; and of silicon and chromium, respectively, in regulating the proportions of graphitic and combined carbon which the casting shall contain. The use of chromium is likewise claimed for regulating the degree of surface chill in the casting, the mould employed being provided with a metal chiller; and also for rendering the iron suitable for any desired size of casting, the proportion of chromium employed for the latter purpose increasing with the size of the casting required.—W. E. F. P.

Gun-barrel and analogous object. F. Hatlanek, Kladno, Austria-Hungary. U.S. Pat. 1,005,115, Oct. 3, 1911.

The gun-barrel, or other article subject to repeated heating during use, is composed of ordinary steel alloyed with from 4 to 5 per cent. of copper. W. E. F. P.

Ores or blast-furnace flue dust; Process for reducing ——. F. W. Yost, Chicago. Eng. Pat. 14,431, June 15, 1910. Under Int. Conv., Sept. 4, 1909.

The finely divided ore or dust is mixed with a suitable fuel, and the mixture, after being moistened with water, is charged evenly on to the perforated hearth of a furnace. Combustion being initiated by heating the upper surface of the charge, an oxidising blast is passed in from below until the combustion zone reaches the hearth; a reducing blast is then substituted for the oxidising blast and the reduction proceeds in an upward direction through the charge.—W. E. F. P.

Ores; Concentration of ——. H. H. Greenway, Clare, S. Australia. Eng. Pat. 21,856, Sept. 20, 1910. Under Int. Conv., Oct. 5, 1909.

The powdered ore is mixed with slightly acidified water containing in solution a minute quantity of an alcohol (such as methyl-, ethyl-, propyl-, butyl-, or amyl alcohol, or mixtures of these) to which latter from ½ to 2 per cent. of its weight of oleic acid (or an oil) has been previously added. The cold or heated mixture is agitated, either with or without simultaneous aeration, and the resulting froth or scum containing the concentrates is removed in any convenient manner.—W. E. F. P.

Ores; Concentration of ——. H. H. Greenway, Clare, S. Australia, and H. Lavers, Broken Hill, N.S.W. Eng. Pat. 21,857, Sept. 20, 1910. Under Int. Conv., Oct. 20, 1909.

The powdered ore is mixed with water—slightly acidified or not—containing a minute quantity of an essential oil, such as eucalyptus, the cold or heated mixture being agitated so as to form a froth or scum (containing the concentrates) which is removed in any convenient manner. —W. E. F. P.

Concentration of ores [*by flotation*]. H. H. Greenway, Clare, S. Australia, and H. Lavers, Broken Hill, N.S.W. Eng. Pat. 22,973, Oct. 4, 1910. Under Int. Conv., Dec. 1, 1909.

The ore is mixed with water usually containing a small percentage of an acid such as sulphuric acid, and either (a) a minute quantity of a mineral, animal or vegetable oil or a fatty acid and one or more essential oils; or (b) a minute quantity of one or more alcohols together with a mixture such as (a); or (c) a minute quantity of an essential oil and one or more alcohols. The mixture is agitated, and the scum or froth produced, which carries the values, is separated by known methods. The action may sometimes be improved by heating the mixture. —B. M. V.

Ores; Apparatus for the separation of ——. Comp. d'Entreprises de Lavage de Minerais, Paris. Eng. Pat. 8155, Mar. 31, 1911. Under Int. Conv., Apr. 8, 1910.

The apparatus comprises a battery of primary classifiers (connected in series and working without the injection of pure water) and one of secondary classifiers (also connected in series, but working with an injection of pure water), the members of the first battery being connected in parallel with those of the second.—W. E. F. P.

Aluminium; Treatment of ——, *to render it capable of resisting external influences.* F. Pucillo, Gênes, Italy. Eng. Pat. 22,684, Sept. 30, 1910.

The metal is treated with the following solutions in the order given: (1) Caustic soda, followed by acidified water and pure water; (2) chlorides of iron, zinc, tin and ammonium in succession; (3) ammoniacal cupric chloride containing sodium or calcium tartrate; (4) alcoholic zinc acetate followed by an aqueous solution of an alkali carbonate; (5) water acidified with sulphuric or nitric acid. The latter is succeeded by washing, cleaning and heating the metal to a temperature above 200° C., when the surface—it is claimed—is suitable for receiving any metallic deposit (by electro-deposition or otherwise), or for receiving a coating of varnish. To render the metal "completely incapable of being attacked by external influences," the above procedure is followed by treatment with a hot liquid consisting of an oxidised mixture of crude mineral oil, drying oils and resins, after which the metal is dried at a high temperature and finally washed with a hot solution of caustic soda.—W. E. F. P.

Clad metals [*Iron coated with copper*]; [*Electrical*] *Process of and apparatus for making* ——. J. F. Monnot, Assignor to Duplex Metals Co., New York. U.S. Pat. 1,004,673, Oct. 3, 1911.

A metal, such as iron, is provided with a cohering, dense, impervious coating of another metal, such as copper, by making the iron a cathode in a bath of fused electrolyte containing a dissolved ductile high-melting-point metal, such as copper, the bath being maintained at a temperature above the normal melting point of the dissolved metal. A current is passed until the iron becomes covered with a layer of the copper in a fluid state.—B. N.

Metal articles; Method of making compound ——, *and forming compound bodies of different metals.* H. W. Fisher, Pittsburgh, Pa., Assignor to Standard Underground Cable Co. U.S. Pats. 1,005,628 and 1,005,629, Oct. 10, 1911.

(1) A metal is electroplated at its melting point on to the inside of a metallic tube (or other metallic surface), the tube (or other article) is then submerged in a flux which is subsequently displaced by molten metal; from a blank made in such a manner, a compound wire may be drawn. (2) A metal, *e.g.*, iron, is electroplated with a second metal, *e.g.*, copper at the melting point of the second metal, and a further coating of the second metal or of a third metal is then deposited electrolytically at the atmospheric temperature.—B. M. V.

Zinc ores and the like; Rotatory metallurgical furnace for roasting ——. P. Schmieder, Lipine, Germany. U.S. Pat. 1,004,916, Oct. 3, 1911.

An inclined rotatory cylinder, having distributing channels disposed lengthwise in its walls, is provided with feeding-nozzles which communicate with the distributing channels and with the interior of the cylinder. The nozzles extend in a direction opposite to that of rotation, so that the material within the cylinder is prevented from entering them; and means are provided for the supply of air to those channels in which feeding-nozzles are covered by the material.—W. E. F. P.

Rotatory sintering furnace. H. C. Wolle, Johnstown, Pa. U.S. Pat. 1,005,396, Oct. 10, 1911.

A narrow metallic cooler is inserted at the sintering zone, in the lining of a rotary furnace, to prevent accumulation of sintered material. The connection between the circulating pipes for the cooling medium and the external supply and discharge pipes is on the axial line of the furnace. —B. M. V.

Steel; Apparatus for the manufacture of ——. G. J. Stock, Darlington. U.S. Pat. 1,004,929, Oct. 3, 1911.

See Eng. Pat. 11,869 of 1910; this J., 1911, 1019.—T. F. B

Foundry sand; Method for treating or renovating ——. A. Poulson, Farnworth, Widnes. Eng. Pat. 22,660, Sept. 30, 1910.

See Fr. Pat. 429,355 of 1911; this J., 1911, 1220.—T. F. B.

Copper matte; Method of bessemerising ——. E. A. C. Smith, Baltimore, U.S.A. Eng. Pat. 22,792, Oct. 1, 1910. Under Int. Conv., Oct. 1, 1909.

See U.S. Pat. 943,280 of 1909; this J., 1910, 162.—T. F. B.

Steam [from molten slag]; Generating ——. W. L. Johnson, Assignor to Bell Bros., Ltd., Middlesbrough. U.S. Pat. 1,005,711, Oct. 10, 1911.

See Eng. Pat. 7518 of 1911; this J., 1911, 1020.—T. F. B.

Ores; Process for treating complex —— *in the converter.* Soc. Commerciale des Mines, Minerais, et Métaux. Fr. Pat. 430,159, Aug. 3, 1910.

See U.S. Pat. 1,003,051 of 1911; this J., 1911, 1219.—T.F.B.

Zinc; Electrolytic process for separating —— *from zinc sulphate solutions.* K. Namekawa, J. Miyazawa, K. Miyabara, and S. Emura. Fr. Pat. 430,167, March 16, 1911. Under Int. Conv., March 19, 1910.

See U.S. Pat. 998,379 of 1911; this J., 1911, 1020.—T.F.B.

Zinc ores and other sulphide ores; Process for the complete roasting of ——. M. Liebig. Fr. Pat. 430,236, May 27, 1911. Under Int. Conv., June 10, 1910.

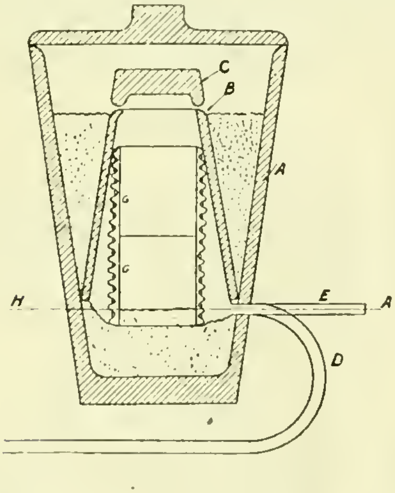
See Ger. Pat. 237,034 of 1910; this J., 1911, 1122.—T.F.B.

Classification of ores and other solid bodies according to their density. Fr. Pat. 429,117. *See* I.

XI.—ELECTRO-CHEMISTRY.

Laboratory furnace; Electric ——, *with resistor of ductile tungsten or molybdenum.* R. Winne and C. Dantsizen. Met. and Chem. Eng., 1911, 9, 537—538.

Two types of furnace are described, the first being a crucible furnace which is shown in vertical section in the accompanying figure. The heating wire of ductile tungsten or molybdenum is wound on an alundum cylinder, G, having a helical groove on its outer surface. A and B are Battersea crucibles, the latter being inverted and having the bottom cut off; C is the crucible bottom, used as a cover. The bottom of A and the space between A and B are filled with powdered silica. A current of hydrogen is passed into the furnace through the pipe, D, and current is supplied to the winding through two large copper connectors, E. The winding consists of 260 cm. of molybdenum wire of 1·27 mm. square section; and the temperature of the furnace can safely be raised to 1700° C., at which a current of 25 volts and 45 ampères is required. The second type consists of a tube furnace comprising an alundum or porcelain tube, wound with tungsten or molybdenum ribbon and enclosed in a tight metal casing filled with powdered silica. A hydrogen atmosphere is maintained within the casing to prevent oxidation of the winding.—W. E. F. P.



Nitrogen-burning arc; Flame arising from the ——. R. J. Strutt. Proc. Royal Soc., 1911, 85A, 533—536.

Recent investigations have thrown considerable light on the processes occurring in the nitrogen-burning arc, not in agreement with conclusions reached by other workers. (See Howles, this J., 1907, 290). In pure gases there is no flame, though the form of the arc from a Ruhmkorff coil supplied with alternating current in the primary circuit varies in form with the gas employed. With air, however, there is an arc with a slight rise in the middle, accompanied by a greenish-yellow envelope which rises to a considerable height above the arc, and terminates in a sharp point, like a candle-flame. On reduction of pressure, this flame expands, until it fills the bulb containing the air. It also remains visible for a moment after the arc has been switched off. This greenish-yellow flame is in no way distinct from the "after-glow" observed in vacuum tubes containing air. The latter can, by suitable experimental analysis, be proved to be due to the further oxidation of oxides of nitrogen by ozone. Accordingly it is concluded that the flame arising from the arc is due to the same cause. The arc produces ozone and oxides of nitrogen. These substances, independently produced, unite chemically in the region above and beyond it.—R. C. P.

Preparation of lithium persulphate. Otin. *See* VII.

Synthesis of high-percentage hydrogen peroxide by the silent electric discharge. Fischer and Wolf. *See* VII.

Conductivity of mixtures of copper sulphate and sulphuric acid. Richardson and Taylor. *See* X.

Rapid electroanalysis with agitation [of the electrolyte] by bubbles of gas. Fischer and others. *See* XXIII.

Rapid electroanalysis under reduced pressure. Fischer and others. *See* XXIII.

Patents.

Furnaces; Electric —— *for treating metal filaments and a method of manufacturing same.* G. Lüdecke, and The Imperial Lamp Works (Brimsdown), Ltd., Brimsdown, Middlesex. Eng. Pat. 8996, April 11, 1911.

A cylinder of carbon, or like refractory material of lower electrical conductivity than tungsten, is exhausted, and a chloride or oxy-chloride of tungsten or molybdenum, or mixtures of these, is vapourised within the cylinder, in the presence of hydrogen or other reducing agent if necessary. Tungsten or molybdenum is deposited as a lining on the inner wall of the cylinder, by heating the carbon outwardly to incandescence. The cylinder, thus lined with metal, is used in the heating zone of an electric furnace, for the treatment of raw filaments for the purpose of decarbonising and sintering the metal. The cylinder is held between cast iron, or the like, rings, which are connected with the electrodes of an electric circuit, so that the carbon cylinder forms a part of the heating resistance. —B. N.

Furnaces; Method of charging electric ——. A. L. Robinson, Assignor to International Acheson Graphite Co., Niagara Falls, N.Y. U.S. Pat. 1,004,469, Sept. 26, 1911.

In electric furnaces used for graphitisation, an intermediate layer is disposed between the charge to be treated, such as a body of carbon, and a refractory embedding material. The intermediate layer, which differs from the charge and embedding material, may consist of bituminous matter and a refractory filler, which becomes caked or solidified under the conditions existing in the furnace.—B. N.

Carbon; [Electrical] Method of heating —— and electric-resistance furnace. W. A. Smith, Assignor to International Acheson Graphite Co., Niagara Falls, N.Y. U.S. Pats. 1,004,923 and 1,004,924, Oct. 3, 1911.

(1). An electric current is passed through a body of carbon or carbonaceous material, in order to obtain a commercially uniform product by expelling the volatile constituents. The body of material, which is supported by fixed refractory walls, serves as a heating resister between terminals which are embedded substantially axially within the material, the latter being advanced in the direction of the axis of the furnace, and substantially parallel to the lines of the flow of current. (2). The furnace comprises a vertical shaft, a terminal or electrode near the upper end of the shaft, and a second electrode located axially about the middle of the furnace, and supported in such a way as to permit the free passage of the charge. A discharge orifice is arranged near the bottom of the furnace, and a rotary arrangement acting in conjunction with the orifice causes a regulated downward movement of the charge. A combustion chamber surrounds the interior wall of the furnace adjacent to the heating zone, whilst a cooling arrangement is provided for the charge below the said zone.—B. N.

Electrolysing apparatus. J. H. Fischer, E. G. Luening, and A. W. Collins, Milwaukee, Wis. U.S. Pat. 1,004,249, Sept. 26, 1911.

The apparatus comprises a number of metallic cases, open at the bottom, each of which is divided by a metallic diaphragm into two cells, insulated from one another in the electrolyte. Each cell is provided with an upper outer nipple, and an upper gas-outlet tube. In each case, one cell is provided with an anode and the other cell with a cathode, the electrodes being insulated from the diaphragm and the case. Conductor posts extend from the electrodes through the nipples, the posts being provided with insulating material in gas-tight connection with insulating material within the nipples.—B. N.

Gases; Electrical purification of —— and apparatus therefor. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 142, Jan. 3, 1911.

See Fr. Pat. 425,593 of 1911; this J., 1911, 906.—T. F. B.

Furnaces; Electric ——. J. H. Reid, Newark, U.S.A. Eng. Pat. 1609, Jan. 21, 1911.

See Fr. Pat. 425,720 of 1911; this J., 1911, 962.—T. F. B.

Resistance-furnace. W. D. Coolidge, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,004,557, Oct. 3, 1911.

See Eng. Pat. 1470 of 1908; this J., 1909, 248.—T. F. B.

Furnace; Rotating electric —— principally for making aluminium nitride. O. Serpek. Fr. Pat. 430,553, Aug. 11, 1910.

See Eng. Pat. 29,299 of 1910; this J., 1911, 905.—T. F. B.

Anodes for use in the electrolytic treatment of alkaline salt solutions. A. T. K. Estelle, Stockholm. Eng. Pat. 5734, March 7, 1911. Under Int. Conv., March 9, 1910.

See Fr. Pat. 427,127 of 1911; this J., 1911, 1070.—T. F. B.

Electrodes for secondary batteries or storage cells; Manufacture of ——. V. de Karavodine, Billancourt, France, Assignor to S. B. Apostoloff, London. U.S. Pat. 1,004,793, Oct. 3, 1911.

See Eng. Pat. 66 of 1910; this J., 1911, 371.—T. F. B.

Depolarising agents for electric cells. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 429,921, May 18, 1911. Under Int. Conv., Oct. 10, 1910.

See Eng. Pat. 11,906 of 1911; this J., 1911, 1123.—T. F. B.

[Electrolytic] apparatus for producing bleaching solution. Eng. Pat. 28,277. *See* VII.

XII.—FATS; OILS; WAXES.

Oil palms in the Lake Tanganyika district. E. Zimmermann. Tropenpflanzer, 1911, **15**, 549—559

The chief forests of palm trees near Lake Tanganyika are in German territory. Until recently there were at least 700,000 trees in the vicinity of Usumbura, and not less than 200,000 in the valleys and on the coast between Usumbura and Udjidji. The forest of Ikungu, a few miles from Usumbura, still contains, on a moderate estimation, from 75,000 to 90,000 large trees; whilst to the south on the river Kanigi there still remain from 75,000 to 100,000 trees. A single tree produces, on the average, 75 kilos. of fruit, from which the natives extract 7½ litres of pure oil for sale and 2½ litres of less pure oil for their own use. By means of European plant from 10 to 12 litres, or in many cases up to 15 litres, of oil would be obtained. From 14 to 18 kilos. of kernels are also annually produced by each tree. The varieties of palm producing the best oil are known locally as *kibuyi* and *ihole*, the fruit of the latter yielding 50 to 80 per cent. more oil than that of the former. There is also a third variety, *itunguru*, which yields a more fluid oil than the others. It is used locally as a lamp oil. The annual output of oil in Usumbura and its vicinity is estimated at not more than 200,000 litres, corresponding to 20,000 to 30,000 trees. This lack of development of the industry is attributed partly to the fact that the natives have always regarded the production of oil as a matter of secondary importance, and partly to sleeping sickness being particularly rife in many of the forests.—C. A. M.

Para rubber-seed oil; Composition of ——. S. S. Pickles and W. P. Hayworth. Analyst, 1911, **36**, 491—492. (See also this J., 1905, 1117; 1907, 769; 1910, 35; 1911, 755.)

A specimen of Para rubber-seed oil extracted from the kernels of undecorticated seeds (yield 48·8 per cent.), dried to a hard varnish in about 12 days on exposure to the air. It had the following characters:—Sp. gr. at 15°/15° C., 0·9239; acid value, 29·9; saponification value, 185·6; iodine value, 133·3; titer test, 33° C.; Hehner value, 96·4; Reichert-Meissl value, 0·5. The fatty acids consisted of 14 per cent. of saturated acids (stearic acid and an acid or mixture of acids melting at 56·5° C.) and 86 per cent. of unsaturated acids (oleic acid, 32·6; linolic acid, 50·9; and linolenic acid, 2·5 per cent.). The tetrahydroxystearic acid obtained by oxidation of the unsaturated acids melted at 159°—160° C.—A. S.

Fat from the seeds of Lophira alata (Banks); Composition of the ——. S. S. Pickles and W. P. Hayworth. Analyst, 1911, **36**, 493—494. (See also this J., 1907, 1265; 1908, 1161.)

The fat was extracted from seeds from Sierra Leone by cold percolation with light petroleum; yield 40—43 per cent. It had the sp. gr. at 40°/40° C., 0·9016—0·9044; acid value, 25·9—48·0; saponification value, 180·7—194·6; iodine value, 69·8—72·5; Reichert-Meissl value, 0·8—0·9; titer test, 47°—49° C. The mixed fatty acids consisted of 50 per cent. of saturated acids (arachidic acid, palmitic acid, and probably a smaller quantity of an acid of lower melting point) and 50 per cent. of unsaturated acids composed of about equal parts of oleic acid and linolic acid (m. pt. of tetrahydroxystearic acid, 160° C.).
—A. S.

Fatty acids; Determination of free —— in presence of alkali- and alkaline-earth soaps. D. Holde and J. Marcusson. Z. angew. Chem., 1911, 24, 1945—1948.

For the determination of free fatty acids in mixtures containing mineral oil and alkali- and alkaline-earth soaps, the following process is recommended:—10 grms. of the fatty compound are dissolved as completely as possible in 50 c.c. of a mixture of 9 vols. of petroleum spirit and 1 vol. of absolute alcohol, and the solution, if necessary, is filtered whilst still hot, using for washing a little of the petroleum spirit—alcohol mixture. The clear solution is shaken with 30 c.c. of 50 per cent. (by vol.) alcohol, the lower layer is separated, and the free fatty acids titrated with a standard alkali solution using phenolphthalein as indicator. If difficulty is experienced in dissolving the fatty compound, 100 c.c. of a mixture of 8 vols. of petroleum spirit and 2 vols. of absolute alcohol may be used, adding in extreme cases a further 10 c.c. of alcohol. If benzene is used instead of petroleum spirit in the solvent mixture, the fatty compound dissolves more rapidly but the results obtained are too high.—J. A.

Rosin; Determination of —— in fats. W. Fahrion. Chem. Rev. Fett-Ind., 1911, 18, 239—242.

The determination of rosin in fats by the Twitchell method (this J., 1891, 804) is subject to errors which the author states may be, in large measure, avoided by the following modifications. The rosin and the free fatty acids existing in the fat are extracted by dissolving 5 grms. of the fat in a mixture of 50 c.c. of petroleum spirit and 20 c.c. of 90 per cent. alcohol, adding $N/1$ alkali in presence of phenolphthalein until a red colour is obtained, and diluting with water until the alcohol is of 60 per cent. strength. The soap solution is treated with 1 c.c. of $N/1$ alkali and the alcohol evaporated on a water bath. The mixed rosin and fatty acids are obtained by acidifying and shaking out with ether in the usual way. Esterification is carried out by treating the mixed acids with 20 c.c. of absolute alcohol and shaking the solution vigorously with 20 c.c. of petroleum spirit and 1 c.c. of concentrated hydrochloric acid. Should a separation occur, absolute alcohol is added until a homogeneous liquid is obtained. Esterification becomes complete by allowing the solution to stand overnight, when phenolphthalein and $N/1$ alkali are added until a red colour is just obtained. The solution is diluted with water till the alcohol is of 60 per cent. strength and from the alcoholic solution of rosin soap the rosin acids are obtained as in the original method. —J. A.

Candelilla wax. J. McConnell Sanders. Chem. Soc. Proc., 1911, 27, 250.

A sample of Candelilla wax, prepared in the month of January (1911), from plants collected in Coahuila, had the appearance of a greenish-white mass with a granular fracture. It contained a considerable proportion of water, and when freed from this, was dark brown, and gave the following values: Melting point, 67·5° C.; density, 0·9850; acid value, 14·39; saponification value, 46·76; iodine value (Hübl) 16·60 per cent.; unsaponifiable matter, 77·00 per cent.; hydrocarbons, 48·60 per cent. The wax contained hentriacontane and myricyl alcohol. (See also this J., 1910, 288, 705, 1021, 1396.)

Wax; Saponification of —— in sterilising apparatus. A. Wichmann. Pharm. Zentralh., 1911, 52, 363—367.

The wax is saponified under pressure.—J. O. B.

Glycerin prices and production in the United States. Oil, Paint, and Drug Rep., Oct. 16, 1911. [T.R.]

The imports of glycerin into the United States are mainly the crude article, which pays 1 c. per lb. tariff duty, while 3 c. is imposed on the refined. In the fiscal year 1910 the imports aggregated 41,181,526 pounds, appraised at $3,663,763. The amount imported in 1909 was 36,248,421 lb. and, in 1908, 32,481,068 lb. The imports from France have been averaging about 16,000,000 lb. yearly, while imports from England have about doubled in the past five years, reaching almost 12,000,000 lb. in 1910. It is probable that some of the shipments of glycerin from Spain to the United States come *viâ* other European countries, and are credited thereto in Spanish export statistics. American imports of glycerin from Spain appear as 563,072 lb. in 1910, against 939,034 lb. in 1909, and 1,101,803 lb. in 1908. The American production of glycerin is greater than the importation. In the census of 1905 the output of glycerin in the soap industry was 27,660,661 lb., valued at $2,958,115. Combined with the glycerin produced in chemical and allied products, the total production in 1905 was 46,972,658 lb., having a value of $5,355,320. The amount of glycerin used in the manufacture of explosives in 1905 in the United States was 24,561,527 lb., worth $3,129,665.

Patents.

Oil from oleaginous material; Apparatus for extracting ——. J. E. Mills, Chapel Hill, N.C., Assignor to H. B. Battle, Montgomery, Ala. U.S. Pat. 1,005,733, Oct. 10, 1911.

The extraction apparatus consists of a column, the solvent being fed in at the top and the oil and solvent drawn off at the bottom. At a point near the bottom, the material to be extracted is fed into the column and a shaft, with paddle wheels, keeps it and the solvent in agitation. The material, after extraction, floats to the top and is removed by a conveyor. The solvent used is specifically heavier than the material to be extracted.—G. W. McD.

Metallic catalysers; Process of making ——. E. C. Kayser, Assignor to The Procter and Gamble Co., Cincinnati, Ohio. U.S. Pat. 1,004,034, Sept. 26, 1911.

An inert absorptive and relatively bulky material, such as kieselguhr, is impregnated with a solution of a reducible nickel salt containing oxygen, and then dried, finely divided and reduced in hydrogen. Or the nickel may be precipitated in an insoluble form and soluble salts removed by washing, prior to the drying and reduction of the powder. —C. A. M.

Fatty acids or their glycerides; Method for saturating —— with hydrogen. E. C. Kayser, Assignor to The Procter and Gamble Co., Cincinnati, Ohio. U.S. Pat. 1,004,035, Sept. 26, 1911.

The fatty acids or their esters are brought into intimate contact (in the form of a spray or otherwise) with an atmosphere of hydrogen (which may be under pressure) in the presence of a catalytic agent in the state of a powder (see preceding abstract).—C. A. M.

Oils, fats, and similar substances; Treatment of ——. The Techno-Chemical Laboratories, Ltd. Fr. Pat. 430,337, May 30, 1911.

See Eng. Pat. 7726 of 1910; this J., 1911, 1022.—T. F. B.

Soap; Manufacture of ——. A. S. Grant, Scharbeck, Belgium. Eng. Pat. 22,213, Sept. 24, 1910.

See Fr. Pat. 417,547 of 1910; this J., 1911, 37.—T. F. B

Medicinal [mercurial] soaps; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 24,981, Oct. 27, 1910.

See Addition of Jan. 7, 1911, to Fr. Pat. 402,740 of 1909; this J., 1911, 907.—T. F. B.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Patents.

White lead; Manufacture of ——. G. V. Barton, Liverpool. Eng. Pats. 21,662, Sept. 17, 1910, and 6662, March 16, 1911.

Pure, non-fused, sublimed lead oxide, made in accordance with Eng. Pat. 13,458 of 1908 (this J., 1909, 992) is mixed with water in, for example, a vessel provided with an arrangement for agitating the mixture. A little acetic acid or lead acetate, (generally not exceeding in amount 1 per cent. of the weight of lead oxide) is added, and carbon dioxide, preferably pure, is passed into the vessel under pressure (say 10 atmospheres). The amount of carbon dioxide used is, preferably, that required to give a product containing about 30 per cent. of lead hydroxide and 70 per cent. of lead carbonate.—E. W. L.

Colouring matter lakes [from azo dyestuffs]; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 13,527, June 6, 1911.

The dyestuffs obtained by combining diazotised *p*-aminobenzophenone with either 2-naphthol-6-mono- or 2-naphthol-3.6-disulphonic acid are converted into lakes by the usual methods. The lakes are brilliant orange and bluish-red, respectively, and are fast to light and water. —T. F. B.

Paints; Method of making ——. A. S. Ramage, Assignor to The Chemical Development Co., Buffalo, N.Y. U.S. Pat. 1,004,078, Sept. 26, 1911.

A suitable paint carrier is incorporated with a pigment and an insoluble metallic soap which has been previously melted; or the metallic soap may be precipitated in the presence of the pigment, and the resulting mixture dried, melted, and incorporated with the carrier.—C. A. M.

Plastic phenolic condensation product. J. W. Aylsworth. Fr. Pat. 429,292, May 5, 1911.

The employment of halogen derivatives of phenol or its homologues, and in particular of poly-halogen derivatives such as pentachlorophenol, as solvents or plasticising agents of the masses produced by the condensation of phenol is attended with certain advantages. Amongst these is the fact that the reaction is more complete, and the final product, therefore, harder and more amenable to working (pressing, stamping, etc.). For the production of non-inflammable masses suitable for forming into sheets for roofings and other constructional purposes, a suitable halogen derivative of an organic radicle is employed together with some fibrous filling matter. The following example is given of the production of calendered sheet:—100 parts of phenol resin and 10—60 parts of tetrachloronaphthalene are melted together in an appropriate mixer and kept at 93°—110° C., while 7—12 parts of hexamethylenetetramine (or other similar hardening agent) and 2—10 parts of a pigment are added. The mass is then rapidly cooled, before the reaction sets in, and reduced to powder. The powder is mixed with 50—200 parts of asbestos fibre or of a mineral filler, and 10—50 parts of cow-hair. The mass is worked in suitable heated mixers and is then calendered into sheet. The sheets are finally heated at 125°—130° C. to complete the reaction. A similar mass suitable for moulded work is also described.—E. W. L.

Varnishes; Preparation of —— *with a cellulose ester base.* Leduc, Heitz et Cie. Fr. Pat. 429,788, May 17, 1911.

One part of a 33 per cent. solution of cellulose acetate in acetone is diluted with 1 part of benzene and 1 part of ethyl alcohol (90°); or, better, 1 part of a 25 per cent. solution of cellulose acetate in acetone, containing 2·5 per cent. of β-naphthol and 2·5 per cent. of hexachloroethane, is diluted, for example, with 2 parts of a mixture composed of 70 per cent. of benzene and 30 per cent. of ethyl alcohol (90°). No heat is applied in the preparation of these solutions. Such solutions may be employed for insulating the windings of coils; they do not dissolve the coating of cellulose acetate on which they may be applied. They may also be employed for impregnating very thin and other papers, tissues, etc. for the purpose of forming a dielectric layer, or of rendering them impermeable to gases and liquids; for preserving eggs; for impregnating linen, etc. In order to produce a transparent glossy surface, the first layer of acetone-benzene-alcohol varnish is covered with a solution of cellulose esters in tetrachloroethane. Organic colouring matters may be incorporated as desired.—E. W. L.

Oxide and sulphate of lead; Treatment of impure products containing —— *by means of salts of alkaline earths.* H. K. Hof and B. M. Rinck. Wansleben am See, Germany. Eng. Pat. 22,615, Sept. 29, 1910.

See Ger. Pat. 227,389 of 1909; this J., 1910, 1379.—T. F. B.

White lead and the like; Buckles for use in the manufacture of ——. H. P. Cavarly, Richmond Hill, N.Y., U.S.A. Eng. Pat. 16,155, July 12, 1911.

See U.S. Pat. 999,205 of 1911; this J., 1911, 1072.—T. F. B.

Monoazo colouring matter especially suitable for the preparation of pigment colours. Eng. Pat. 13,619. *See* IV.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; [Effect of] vulcanisation [on the mechanical properties] of ——. P. Breuil. Caoutchouc et Guttapercha, 1911, 8, 5298—5306.

The research deals with the effect upon the mechanical properties of rubber of the following factors:—Time of vulcanisation, temperature of vulcanisation, nature of the rubber, and the temperature at which the tests are carried out. The mixings employed were (1) 100 of fine Para and 10 of sulphur; (2) 100 of Congo and 10 of sulphur; (3) 200 of Para, 100 of Congo and 30 of sulphur; (4) 100 of Para, 200 of Congo and 30 of sulphur. The temperatures employed for vulcanisation were 135° C. and 145° C., and the times 30 minutes, 1, 1½, 2, 2½ and 4 hours. Tests were carried out at —10° C., —12° C. and +19° C. The loads required to produce the following elongations of the 25 mm. test-pieces were noted: 40, 80, 120, and 160 mm. The permanent elongation on reducing the load to zero was measured, and the breaking-strain, and elongation at and after break determined. It was thought that by studying the mechanical properties of the samples at low temperatures, some insight into the correctness or otherwise of the vulcanisation might be obtained, on the grounds that an object of vulcanisation is to minimise the hardening effect of low temperatures upon the rubber. The results appear to warrant in a general way the conclusion that if comparable results of the mechanical tests are obtained at low and at ordinary temperatures, the sample is correctly vulcanised; if not, under-vulcanisation may be suspected. The detailed results of the tests are displayed in tables, but the following points may be specially mentioned. Although as the degree of sulphuration increases, the recovery of the sample on removal of the load becomes more and more perfect, reaching zero in some instances, yet hysteresis is always exhibited; the area of the hysteresis diagram diminishes as the degree of vulcanisation increases. Permanent deformation is least in the case of Para, greatest in the case of Congo rubber. The deformation of the samples cured at 135° C. is greater than that of samples cured at 145° C. In the case of Para the ratio is about 2 to 1; in the case of Congo 3 or 4 to 1. In the case of samples cured at 135° C. the load necessary to produce a given elongation increases with the time of vulcanisation. When vulcanisation is carried out at 145° C., however, a maximum occurs at about 2½ hours. Confirming the results obtained by Bontaric the author finds that the time required for vulcanisation at 145° C. is about 60 per cent. less than that at 135° C. (to obtain equivalent mechanical properties). It was found that samples which were vulcanised for 30 minutes were more easily extended than the unvulcanised samples. This is probably due to the fact that depolymerisation and vulcanisation proceed side by side on heating, the former outstepping the latter in the early stages of the cure (see Axelrod, this J., 1910, 34). Mixtures of rubbers show in some instances better mechanical properties than those of either constituent alone.

It is also shown that "elasticity," as measured by the rebound of a steel ball is diminished on vulcanisation progressively with the temperature and time of vulcanisation.—E. W. L.

Vulcanisation: Apparently reversible nature of ——. P. Bary and L. Weydert. Comptes rend., 1911, **153**. 676—679.

A SAMPLE of vulcanised rubber was extracted for 7 hours with acetone. After heating for 8 hours at 145° C. in carbon dioxide, the extracted rubber was again extracted with acetone for 7 hours, when a certain amount of sulphur was found in the extract. The extracted rubber was treated in the same way twice more, when a further extract of sulphur was obtained. Another sample of vulcanised rubber was dissolved in xylene: the xylene was then removed by distillation in steam. The combined sulphur in the residual rubber was less than the combined sulphur in the original sample. It was not found possible to apply the law of mass action to such results. The authors conclude that the reaction of vulcanisation is reversible, and that in the normal state rubber is polymerised. Vulcanisation occurs by rupture of the chains of rubber molecules, and is thus dependent on depolymerisation.—H. E. P.

Indiarubber; Determination of total sulphur in ——. C. E. Waters and J. B. Tuttle. J. Ind. Eng. Chem., 1911, **3**. 734—737.

A COMPARISON of Henriques' method (this J., 1899, 950) and various proposed modifications of it (see Wagner, this J., 1907, 538; Huebener, this J., 1909, 1312) for the determination of total sulphur in rubber, showed that nitric acid alone does not completely oxidise the sulphur to sulphuric acid in the time ordinarily taken for a determination, and hence gives low results. Huebener's method (*loc. cit.*) is inapplicable when the rubber contains mineral fillers (especially barium carbonate and litharge) capable of yielding insoluble sulphates. The method of precipitating and treating barium sulphate suggested by van't Kruys (this J., 1910, 902) gives high results. For the determination of total sulphur in rubber, Henriques' method, modified by using nitric acid saturated with bromine for the oxidation, is recommended. (See also this J., 1909, 431, 843.)—A. S.

Composition of Para rubber seed oil. Pickles and Hayworth. *See* XII.

Rubber latex; Coagulants for ——. Chem. Trade J. Oct. 28, 1911. [T.R.]

OF the rubber coagulants at present employed in Ceylon, "Purub" and "Martinol" find the most extensive use. The former is a patented article (German Patent No. 189,235), and consists simply of hydrofluoric acid of prescribed concentration (see this J., 1908, 1029). The latter is a wood distillate containing acetic acid, methyl alcohol, and phenolic bodies, and it also is patented. It is said that rubber coagulated with martinol and tested some months later in Calcutta showed a much better nerve than the freshly coagulated material, which, moreover, withstands the Indian climate better than rubber coagulated with acetic acid alone (see this J., 1910, 1464). Another proprietary article—"Pracol"—is said to be nothing but alum, whilst "Compound" is a mixture of acetic and cresylic acids. This latter substance is used mainly in Mexico. Pahl's patent, which claims the use of carbon dioxide as coagulant (see this J., 1911, 225), may prove of importance.

PATENTS.

Rubber latex; Method of and means for coagulating and otherwise treating ——. J. S. Da Costa, Belem, Brazil, and R. Bridge, Castleton, Lancs. Eng. Pat. 19,730, Aug. 24, 1910.

RUBBER latex, contained in a suitable tank or vessel, is coagulated by means of smoke formed by burning green vegetable matter, creosote, or the like: the smoke is sifted free from soot and other solid matter, and is passed over the surface of the latex, or injected into it by means of steam or heated air. As soon as coagulation begins, the coagulum is removed by means of a screw-conveyor or similar device and passed between pressing rollers, to remove surplus moisture and latex, the expressed water and latex being conducted back into the coagulating tank. The coagulum in sheet form may be dried by means of hot air, or in a vacuum apparatus, and subsequently subjected to further rolling and sheeting treatment, or moulded into blocks by means of hydraulic presses.—O. R.

Rubber; Process of and means for smoking and drying sheet —— *after coagulation.* J. S. Da Costa, Belem, Brazil, and R. Bridge, Castleton, Lancs. Eng. Pat. 21,634, Sept. 17, 1910.

THE rubber in small or non-continuous sheets, or in block form, is placed in trays or on hanging devices in a vacuum chamber. Smoke from a suitable furnace is freed from carbon and other solid matter by passing it through a baffling device, and is then admitted to the vacuum chamber for the required period, at the end of which it is exhausted from the chamber. The admission and exhaustion of smoke may be repeated as many times as may be found desirable, and the rubber may be dried by alternately or successively admitting or creating heat within the vacuum chamber by a steam coil or equivalent means.—E. W. L.

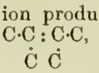
Indiarubber; Cleansing crude ——. L. Norzagaray, London. Eng. Pat. 22,201, Sept. 24, 1910.

IN apparatus for cleansing, extracting or mixing crude rubber, a new arrangement of parts is claimed. The crude rubber is placed in a vertical tube, down which it is forced into a conical vessel, grooved or corrugated inside. A ribbed cylinder rotates in this vessel and forces the rubber upwards under an increasing pressure. At the top of the vessel the rubber is cut between blades. The conical vessel is kept filled with hot or cold water or other liquid. The apparatus can also be used for the coagulation of latex.—H. E. P.

India rubber; Compound for use as a substitute for —— *and manufacture thereof.* F. Tolkien, East Barnet. Eng. Pat. 1723, Jan. 23, 1911. Addition to Eng. Pat. 23,755, Oct. 28, 1907 (this J., 1908, 695).

THE compound consists of a mixture of solutions of calcium, zinc and barium chlorides, a solution of calcium nitrate, with or without pure glycerin, a solution of formalin, and farina. The solutions, with or without the glycerin, are mixed in a cool state, the farina is stirred in till thoroughly incorporated, and the mass is moulded to shape. Tyres may be filled with the product. The strength of solution used is an important factor. Examples of suitable mixtures are given.—H. E. P.

Dihalogen derivatives of paraffinoid hydrocarbons and rubber-like products resulting from them. W. H. Perkin, F. E. Matthews, and E. H. Strange. Fr. Pat. 429,225, May 2, 1911.

SUBSTANCES analogous to rubber are obtained by the polymerisation of hydrocarbons containing two conjugate double linkages. Such hydrocarbons may be prepared from paraffinoid or ethenoid hydrocarbons, or from the monohydroxy derivatives of the former, through the di-halogen substituted paraffins. Starting with a paraffin containing at least four carbon atoms in a straight chain, the di-halogen substitution product is prepared by the direct action of chlorine or bromine or of both halogens simultaneously. From a monohydroxy paraffin of similar skeletal structure the di-halogen paraffin is obtained, for example, by first replacing the hydroxyl group by halogen through the action of a halogen acid, and then treating the product with twice or nearly twice the amount of halogen which it is still necessary to introduce into the molecule. From the olefines of similar structure the di-halogen paraffins are obtained by halogenating the halogen-acid addition products, and from olefines containing the group,  $\begin{matrix}C\cdot C:C\cdot C,\\ \dot{C}\ \ \dot{C}\end{matrix}$ the di-halogen paraffin is prepared by direct addition of halogen (chlorine or bromine or both). From the di-halogen paraffins, obtained by one or other of the above processes, hydrocarbons containing two conjugate double linkages are prepared by the elimination of two molecular proportions of halogen acid, and these products are treated in such a way as to induce polymerisation. The rubber-like product is separated by distilling off the unpolymerised portions, or by precipitation. As an example of the process, starting with a paraffin, the following is given:—114 parts of normal octane, preferably diluted with an equal volume of inert solvent such as carbon tetrachloride, are treated with 142 parts of chlorine. The carbon tetrachloride is distilled off and the residue treated with alcoholic potash. The hydrocarbons thus obtained are left for about ten weeks in contact with metallic sodium, when a portion is found to be polymerised. The unpolymerised fractions are removed by distillation. Examples of the other processes are given.—E. W. L.

Chewing-gum [from low-grade rubber]; Manufacture of ——. J. D. Darling, Philadelphia. Assignor to Keystone Trading Co. U.S. Pat. 1,005,001, Oct. 3, 1911.

See Eng. Pat. 186 of 1909; this J., 1909, 1051.—T. F. B.

Rubber; Treatment of vulcanised ——. W. W. Wildman and J. Christy. Fr. Pat. 430,532, May 22, 1911.

See U.S. Pat. 993,485 of 1911; this J., 1911, 817.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Gallotannic acid; The acid character of ——. R. Paniker and E. Stiasny. Chem. Soc. Proc. 1911, 27, 213.

The authors have applied Bredig and Fraenkel's method to the determination of the hydrion concentration of gallotannic acid. This method is based on the dissociation of diazoacetic ester by the catalytic action of hydrions, the concentration of which determines the speed of the development of nitrogen. Different samples of gallotannic acid, prepared by different—and partly new—methods of purification, were used, and their acid character was found distinctly greater than could be explained by the presence of phenolic groups only, thus leading to the conclusion that free carboxylic groups are present. This confirms the views of Schiff and Nierenstein, but does not agree with those of Böttinger (Ber., 1884, 17, 1503; also Etti, this J., 1884, 181), Walden (this J., 1898, 181), and Dekker (this J., 1906, 821). The authors are of the opinion that even the purest gallotannic acid obtainable is no single substance, but a mixture of at least two components of allied character.

Tannins; Analysis of ——. L. E. Levi and A. C. Orthmann. J. Amer. Leather Chem. Assoc., 1911, 6, 466—476.

The authors prepared a number of complex chromium compounds and studied their behaviour with tannic acid. The compound, $Cr_2(SO_4)(C_2H_3O_2)_2CrO_4$, was found to give with tannic acid a precipitate, the amount of which was constant for the same amount of tannin. It was prepared by dissolving freshly-precipitated chromium hydroxide by heating with sulphuric acid, adding barium acetate to the boiling solution, boiling for five minutes, allowing to stand over night, and then filtering. Chromic anhydride (CrO_3) was added to the filtrate and the solution again boiled and allowed to cool. The reagent so prepared was found to precipitate all the tannins and tannic acid, but not non-tannins. With a solution containing 0·1 grm. of tannin the amount of chromium hydroxide (calculated as Cr_2O_3) precipitated was found to be, from a large number of tests, 0·0663729 grm., and this calculated to the hypothetical monoglucoside, $C_{20}H_{20}O_{14}$, gave a factor of 0·0441571 grm. of Cr_2O_3 which is the factor used in the determinations. A table showing the agreement with determinations by the hide powder method is given. The experiments are being continued with a view to determining the non-tannins.—J. R. B.

Cellulose extract. [Tanning extract from waste sulphite-cellulose lyes.] W. Eitner. Gerber, 1911, 247—229, 241—243, 255—256.

Although no tannin is contained in the pine or fir wood used in the manufacture of cellulose, it has been thought that the dissolved encrusting substances had a tanning effect. Mitscherlich was the first to bring forward the suggestion, and Ziegler patented the process combined with a previous chrome tannage, but in this the cellulose liquor did little more than colour the leather which was already tanned and mordanted by the chromium salt. For the purification and rendering fit for tanning of the liquor, König suggested the addition of zinc dust which changes the sulphurous acid in part to thio-acids which, by their reducing action, destroy the dark colouring matter. Although the incrusting substance is not changed into tannin by this treatment, the product known as "*Fichtenholz*" had a use in manufacture, not so much in actual tanning as in leather dressing as a filling and weighting material. The material had however a kind of very weak tanning action which was caused by a small quantity of zinc sulphate formed during the purifying process. The presence of zinc sulphate affords a laboratory method for the detection of "*Fichtenholz*" when added to other extracts. An extract has lately appeared in commerce under the name of "*Excelsior Fichtenholz extract*," which does not appear in any way different from that made in a Hungarian cellulose works by König's process.

Comparative analyses are as follows:—

	Hungarian extract.	German extract.	Excelsior extract.
	per cent.	per cent.	per cent.
Substances removed by hide powder	22·8	22·6	25·8
Substances not removed by hide powder	27·5	28·2	28·0
Water	49·6	49·0	46·2

The "Excelsior" extract contains 7·5 per cent. of ash as compared with 5·32 per cent. in the Hungarian extract. The extract is stated to give a clear liquor and a light coloured leather but the same is true of the German and Hungarian "*Fichtenholz*" extract and the extract, although producing a light-coloured leather itself, cannot improve the colour produced on leather by dark tanning materials. Owing to the high percentage of matter not absorbed by hide which is convertible into sugars and acids, "Excelsior" extract should possess a strong swelling action and should, for the same reason, have acid- and weight-giving properties; the statement that these substances are converted into active tanning material is incorrect. The author has succeeded in dissolving the difficultly soluble portion of a quebracho extract in a liquor from a cellulose works in Silesia. The active agent in dissolving this material appears to be, for the most part, the free sulphurous acid in the cellulose lye, as lyes which had been purified or neutralized with sodium carbonate had only a slight solvent action. Of the "*Fichtenholz*" extracts at present on the market, the solvent action on impure quebracho extracts is, at best, only equal to that of chestnut or oakwood extract, and any statement that they produce complete solubility without residue is an exaggeration. After showing that the claims made on behalf of "Excelsior" extract as being superior to other extracts of the same kind are false, the author shows to what extent "*Fichtenholz*" extract may be of value in the tanning industry. Hides were placed in cellulose extract of 25° Barkometer without any drawing of the grain being produced. The strength of the liquor was lowered by the goods, and after making up to the original strength again, the same effect was noticed several times until the strength remained constant at 55° Bkr., by which time no more of the dissolved substances were removed by the hides. The goods were yellow brown in colour, but dried out stiff and horny, were rendered swollen and transparent by treatment with acids and completely transformed to glue on boiling, thus showing that the tanning effect was nil. A piece of the hide thus treated and washed showed a percentage of 31·2 per cent. of dry matter as compared with 30·6 per cent. in the original hide. The difference of 0·5 per cent. is due to the colouring matter which is the only constituent of the liquor absorbed by the hide. Parallel experiments were carried out by immersing hides in liquors made from (1) pure German "*Fichtenholz*"; (2) a mixture of "*Fichtenholz*" and quebracho extract; and (3) pure quebracho extract. Tanning was complete in the mixed liquor in six weeks, finishing in a liquor of 65° Bkr., while with the pure quebracho liquors, finishing at 35° Bkr., the period was longer by two weeks. The dry yield of (1) was 38 per cent., (2) 69 per cent., and (3) 65 per cent. of leather without washing. The goods were then laid in water for two days and again dried. The yield of (1) which was practically raw hide was 32·3 per cent., of (2) 58·5 per cent., and of (3) 59·3 per cent., which shows that even when mixed with quebracho extract, "*Fichtenholz*" has no tanning action; it is washed out by water, and could therefore only be of use in unwashed sole-leather. The practical advantage in the use of "*Fichtenholz*" extract is the saving of about 25 per cent. in the time of the tanning process, probably caused by its effect on the rate of diffusion. As a weighting material the extract is taken up better by the leather than many other materials; an addition in weight of up to 33·6 per cent. is obtained, but the leather is made hard and brittle. Although the refined extract is light in colour, it makes leather dark when introduced in large quantities and bleaching is difficult, as the colour is liable to be uneven and much of the extract again washed out. Cellulose extract has lately been mixed with chestnut-wood and oak-wood imitations, and sold as the latter at a cheaper price than the genuine extracts.—D. J. L.

Leather and fur which will resist treatment with boiling water; The production of ——. J. Schneider and V. Šimáček. Collegium, 1911, 368—369.

The resistance offered to boiling water by raw skin after treatment with solutions of various inorganic salts and organic substances was determined. This was ascertained by determining the amount of precipitate produced on adding a solution of tannin and salt to the water in which the sample had been boiled. When the resistance to boiling is small, the formation of glue is seen by the gelatinisation of the aqueous extract. For exact determinations of resistance to water, the material was heated for an hour with water on the water-bath; in other cases it was simply treated with boiling water. When the pelt was shaken with solutions of metallic salts and digested with water, the following results were obtained. (1) The pelt was completely transformed into gelatin with salts of beryllium, calcium, zinc, titanium, vanadium, antimony, bismuth, manganese, iron and cobalt. (2) The pelt became tender and transparent, and the solution gelatinised with salts of copper, rubidium, nickel and osmium. (3) The pelt became tough and the solution gelatinised with salts of magnesium, strontium, cadmium, barium, aluminium, zirconium, tin, lead, molybdenum, tungsten, selenium, and ruthenium. (4) The pelt became tough and the solution did not gelatinise, but gave a precipitate with tannin with salts of mercury, thallium, cerium, and thorium. (5) The extract gave no precipitate with tannin, with salts of calcium, vanadium, chromium, uranium, and platinum. Some organic substances tried, gave results similar to the metallic salts in the following classes. (2) β-naphthol; (3) benzaldehyde, thymol and α-naphthol; (4) chloral hydrate; (5) formaldehyde, acetone, quinol (hydroquinone), and phoroglucinol. The action of the metallic salts is much influenced by their dissociation and acidity or alkalinity. If the hide is swollen the action is more marked. In experiments on hastening the action of acetone in rendering the pelt resistant to boiling by the addition of acids, it was found that butyric acid (1 grm. of 50 per cent. acid to 100 grms. of acetone) had the greatest effect, lactic acid much less and acetic, formic, hydrochloric, and sulphuric acids no action at all. Further experiments will show to what extent the above substances will be of use in tanning, either alone or in combination with other materials. With organic substances, the time taken must be considered, since acetone has been found to require at least fourteen days to produce leather.

—D. J. L.

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Note: (*a*) signifies abstract.

Stripped myrobalans. Oil, Paint, and Drug Rep., Oct. 16, 1911. [T.R.]

It has been recently proposed in Calcutta to strip the husk from the stone of myrobalans and ship the former for tanning purposes instead of shipping the myrobalans intact. Analyses at the Indian Museum showed the superior tanning value of the husks and the worthlessness of the stone. Last year India exported 73,355 tons of these nuts. Had only the valuable husks been shipped there would have been a saving of half the freight.

Patents.

Tanning, especially quebracho, extract liquors; Method of clarifying ——. A. Redlich, Vienna. Eng. Pat. 16,527, July 18, 1911.

The hot tanning extract liquors, especially quebracho liquors, as they come from the diffusion apparatus, or at a concentration of up to 12 Bé., are boiled for two or three hours (without any addition of alkali) at ordinary or slightly increased pressure (up to 3 atmospheres), air being excluded. They are then allowed to cool while being stirred, without the addition of acid. A flocculent deposit is formed, leaving the liquid clear, and the latter can then be evaporated in the usual manner. The slime can be treated as described in Eng. Pat. 4358 of 1908 (this J., 1908, 696).—E. W. L.

Plastic or elastic masses [from gelatin]; Process of preparing ——. J. Stockhausen. Fr. Pat. 428,468, April 4, 1911.

Gelatin, or other animal or vegetable colloid, is dissolved in glycerin, and the solution obtained is incorporated with one or more of a large number of specified admixtures, of which the most important are camphor dissolved in acetone, tars or resins, and flowers of sulphur. The product is hardened by means of 4 per cent. formaldehyde, or with tannin, and may subsequently be vulcanised.—O. R.

Gelatin; Process for preparing ——. C. von Girsewald. Fr. Pat. 430,016, May 22, 1911.

See Eng. Pat. 12,566 of 1911; this J., 1911, 1224.—T. F. B.

XVI.—SOILS; FERTILISERS.

Drainage water of a soil; Composition of the ——, *with and without vegetation.* L. Lyon and J. A. Bizzell. J. Ind. Eng. Chem., 1911, 3, 742—743.

Tanks, slightly over 4 ft. square and 4 ft. deep, with a capacity of 3½ tons of soil, and arranged so that the drainage water could be collected, were filled with clay loam soil in 1909, and in 1910 four were sown with maize and two with oats, whilst three were used for control purposes. The tanks received the natural rainfall but no other water. The results of the investigation are shown in the following tables:—

I. *Average flow of drainage water in litres per tank.*

Tank Nos.	Crop.	May 23 to June 1.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May 23, 1910, to May 1, 1911.	Oct. 1, 1910, to May 1, 1911.
2, 4, 8	None	48·8	25·9	1·1	0·1	45·2	31·0	90·3	73·1	199·6	14·0	156·0	76·6	761·7	640·6
3, 5, 7, 9 .	Maize	44·6	24·3	0·8	0·0	0·6	0·1	0·0	4·8	176·9	9·0	172·6	84·5	518·2	447·9
6, 10	Oats	50·1	24·0	0·2	0·2	0·0	0·0	6·0	52·7	149·3	6·0	172·3	105·4	566·2	491·7

II. *Substances removed in drainage water, in lb. per acre, May 23 to Oct. 1, 1910.*

Tank Nos.	Crop.	Total solids.	Nitrates (NO_3)	Nitrate-nitrogen.	Bicarbonates (HCO_3).	Silica (SiO_2).	Phosphates (PO_4).	Calcium (Ca).	Magnesium (Mg).	Potassium (K).	Sodium (Na).
2, 4, 8	None	405	48·3	10·9	249	5·9	trace.	66·3	10·8	1·4	19·5
3, 5, 7, 9	Maize	151	12·2	2·8	111	3·0	trace	27·6	6·8	0·4	6·2
6, 10	Oats	175	18·4	4·1	99	4·0	trace	31·8	7·8	0·4	5·8

III. *Substances removed in drainage water, in lb. per acre. Oct.* 1, 1910 *to May* 1, 1911.

Tank Nos.	Crop.	Total solids.	Nitrates (NO_3).	Nitrate-nitrogen.	Bicarbonates (HCO_3).	Silica (SiO_2).	Calcium (Ca).	Magnesium (Mg).	Potassium (K.)	Sodium (Na).
2, 4, 8	None	2179·6	481·5	108·7	890·7	22·6	340·4	65·2	9·6	92·1
3, 5, 7, 9	Maize	649·7	35·2	8·0	446·9	11·8	130·4	23·4	5·3	53·0
6, 10	Oats	728·0	37·3	8·4	517·0	12·1	141·6	23·9	9·2	46·1

—A. S.

Denitrification ; Formation of oxides of nitrogen in ——. I. Detection, determination, and occurrence of nitrous oxide in fermentation gases. S. Suzuki. Zentr. Bakter. u. Parasitenk., 1911, II. Abt., **31**, 27—49. Chem. Zentr., 1911, **2**. 1267—1268.

The method used by the author for the detection of nitrous oxide in gaseous mixtures depends upon the fact that by means of electric sparks nitrous oxide is decomposed into nitrogen and oxygen, which then re-unite to form nitric oxide and subsequently nitrogen peroxide. The gas is collected in an explosion pipette filled with mercury and after passage of the sparks is treated with a solution of potassium iodide and starch ; in presence of nitrous fumes the well-known blue colour appears immediately or after some time. As little as 1 per cent. of nitrous oxide in a gaseous mixture can be detected by this method. For the determination of nitrous oxide in gaseous mixtures, the author prefers combustion of the gas (previously freed from carbon dioxide by potassium hydroxide solution and from oxygen by alkaline pyrogallol solution) with carbon monoxide in a Drehschmidt platinum capillary. After combustion, the carbon dioxide is absorbed, and the amount of nitrous oxide is calculated from the diminution in volume. The original gaseous mixture should be collected over mercury (not over saturated calcium chloride solution), and if it contain more than 10 per cent. (by vol.) of nitrous oxide, it should be diluted with nitrogen.

Some data as to the occurrence of nitrous oxide in the gases produced by pure cultures of denitrifying soil bacteria are tabulated in the original.—A. S.

Nitrogen ; Assimilation of —— by rice. W. P. Kelley. Hawaii Agric. Expt. Stat., Bull. No. 24, June 16, 1911, pp. 20.

The experiments were made to contrast the value of ammonium sulphate and sodium nitrate as nitrogenous fertilisers for rice. In field trials ammonium sulphate produced considerable increases in the yields of straw and grain, and when applied before planting it gave greater yields than when it was applied at intervals during growth. Sodium nitrate was without effect, however applied. In pot experiments sodium nitrate was only of value when applied near the "heading" period of the rice. Soya-bean cake produced considerable increase, but ammonium sulphate was the most effective. In paddy soils denitrification takes place, resulting in the formation of nitrites. Ammonia is developed during the time of irrigation and the nitrates originally present become reduced to a very small quantity. The greatest quantities of recoverable ammonia occur where ammonium sulphate is applied ; measurable increases in the amount of ammonia in the soil are found after one and two month's growth of the rice. Experiments in flasks show that formation of ammonia takes place to a considerable extent in submerged rice soil. Sand cultures show that when nitrates are the only source of combined nitrogen, unhealthy and stunted growth follows. In practice the use of ammonium salts and not nitrates is recommended for rice culture. The failure of rice to assimilate nitrates properly may be due to a lack of nitrate-reducing enzymes. Possibly rice, having grown for centuries under conditions that largely exclude the formation of nitrates, has in a measure lost the power of reducing nitrates.—E. F. A.

Calcium requirements of plants and various proportions of calcium to magnesium in nutrient solutions. I. Konowalow. Landw. Versuchs., 1911, **74**, 343. Biedermann's Zentr., 1911, **40**, 665—667.

A number of sand, water and soil cultures of barley, oats and millet were made, in which, whilst the other nutrients were kept constant, the amount of calcium was varied between wide limits. The development of the plant was found to depend directly on the amount of calcium, an increase up to a certain limit causing an increase of the crop. In almost every case the maximum crop both of dry matter and of the individual parts was obtained with a solution containing 0·2 per cent. of calcium. Barley and millet developed best when calcium was present as tribasic calcium phosphate, ammonium nitrate being the source of nitrogen. Under otherwise parallel conditions, calcium carbonate was equally effective when added as marble or as pure precipitated carbonate. The crop was not lessened by so extreme a proportion of lime to magnesia as 53 : 1. A complete lack of magnesia prevented development : thus, barley plants grown in water culture without magnesium gave 0·84 grm. of dry matter, without calcium they gave 0·34 grm., whilst in normal nutrient solution the crop was 18·13 grms. It is considered that the favourable action of calcium cannot be attributed to its neutralising any deleterious action of magnesium.
—E. F. A.

Formaldehyde and substances yielding it ; Nutrition of green plants with ——. T. Bokorny. Biochem. Zeits., 1911, **36**, 83—97.

Formaldehyde in solution acts as a poison to plants but it is found possible to grow *Spirogyra* under conditions such that very minute quantities of formaldehyde as gas may be constantly passed through the culture solution. Starch is proved to be formed directly from the formaldehyde. It is also shown that *Spirogyra* forms starch on prolonged exposure to a very dilute solution of formaldehyde. Control plants without formaldehyde remain entirely free from starch. The chlorophyll apparatus of plants is also able to elaborate starch from methylal but only when exposed to the light ; in the dark no starch is formed. Sodium formaldehyde sulphite is also of value for starch formation in the light. Methyl alcohol is shown to have a stimulating effect on germinating beans ; with peas it causes shortening of the stem and root, but a more extensive lateral root system and thickening and branching of the stem.—E. F. A.

Patents.

[Fertiliser] Humus ; Inoculated —— and process of making same. C. Ellis, Montclair, N.J., Assignor to Ellis-Foster Co. U.S. Pat. 1,002,248, Sept. 5, 1911.

Peat containing a high percentage of nitrogen is dried and mixed with from 2—8 per cent. of "borax waste" (chiefly calcium sulphate and carbonate containing borax) and is then sterilised by heating. Basic slag (3—5 per cent.) is added and the mass is moistened with a solution of nitrogen-assimilating bacteria and exposed to air or passed through a heated chamber to convert the nitrogen present in the peat into nitrogen compounds available for plant life.—G. W. McD.

Product [Fungicide] for the protection of plants. Ver. Chem. Fabr. Landau. Kreidl, Heller und Co. Fr. Pat. 429,583, May 10, 1911. Under Int. Conv., June 8, 1910.

The salts of the rare earths, particularly of cerium and yttrium, possess fungicidal properties, and can be used for the protection of plants in a similar manner to copper sulphate. They possess the advantage over the latter of being innocuous to man and animals. Preference is given to the sulphates of cerium and yttrium which are obtained as by-products in the manufacture of thorium salts. In using them for spraying, etc., a one or two per cent. solution is rendered alkaline by means of lime and this is applied in the usual manner to the plants.—E. W. L.

Arsenate of lead in an aqueous paste, with or without the addition of soap or of Sapindus (saponin) for the destruction of insects and parasites on vines ; Process for the preparation of ——. C. Dubois. Fr. Pat. 429,600, May 10, 1911.

A solution of sodium arsenate is added to a solution of a lead salt, preferably the nitrate, till no further precipitation takes place ; the liquid is then tested, and if acid in reaction, sodium carbonate is added to complete the precipitation of all the lead arsenate. The precipitate is collected, washed, and treated in a filter-press, until a paste, containing about 45 per cent. of water is obtained. The salt contained in the paste is the compound, $PbHAsO_4$, and can be easily brought into and retained in suspension in water, especially when mixed with soap, or with saponin from *Sapindus utilis*.—W. C. H.

Nitrogen from certain residual liquors; Process for the recovery of —— by precipitation of the soluble nitrogenous matter. H. L. A. M. Watrigant, Lille, France. Eng. Pat. 7394, March 24, 1911. Under Int. Conv., March 26, 1910.

See Fr. Pat. 424,980 of 1910; this J., 1911, 978.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Beet sugar factory; Undetermined losses in the ——. H. Pellet. Sucr. Belge, 1911, 39, 478—486.

Continuing his investigations on this subject (cf. this J., 1911, 822), the author now claims to be able to show that in the case of beet factory products the values obtained by the double polarisation (Clerget) method do not represent the actual content of sucrose. It is pointed out that the differences between the sucrose values by the direct and double polarisation methods may vary from 0·2 to 0·4 per cent., according to the season and country, being greater in the case of thick juices (syrups), than in that of thin juices, but not proportionately so. These differences have been attributed to "plus sugar" substances in the beet, and it has been thought that the error due to their presence could be obviated by the use of the double polarisation method, in place of the direct polarisation, formerly generally employed. Now, however, it is known that this is not so, and that the optically-active substances present in the beet may be lævo-rotatory or dextro-rotatory according to conditions. If in determining the sucrose content of the beet, the direct aqueous method, in which an excess of basic lead acetate is added, be employed, the rotatory power of the optically-active bodies, *e.g.*, glutamine, glutamic acid, asparagine, aspartic acid, is changed; but it is impossible to say previously whether this change will be in the direction of increasing or of decreasing the polarisation. The reason for this is that glutamine and glutamic acid are dextro-rotatory in a basic lead acetate solution, whereas asparagine and aspartic acid are lævo-rotatory under the same conditions, and the relative proportions of these substances is not constant. In general, it will be found, the direct polarisation is decreased by basic lead acetate, and when this is so, the presence of an excess of glutamine over asparagine substances is indicated. In the presence, however, of the hydrochloric acid used to effect inversion, all the optically-active substances exhibit dextro-rotation, and the lævo-rotation of invert sugar, if present, is diminished, so that finally the double polarisation method gives too low a result. It has been further observed that equal amounts of basic lead acetate, made in the manner given in the French Codex, and of that prepared according to Courtonne, do not produce the same rotation in the case of glutamine, glutamic acid, asparagine, aspartic acid, under similar conditions of concentration, the Courtonne solution giving less change of rotation. Summarising his conclusions, the author states that results have now been obtained showing that: (1) the double polarisation (Clerget) method, as ordinarily carried out, gives values less than the actual sucrose present; (2) the difference will be the greater the more glutamine and asparagine substances, especially the former, are present; and (3) although it is possible to obtain a result by the double polarisation (Clerget) method that is appreciably less than the direct polarisation, it by no means follows that this value should be accepted as representing the sucrose alone, present in the particular product examined.—J. P. O.

Dextrose; Decomposition of —— by dilute sulphuric acid. H. Ost and T. Brodtkorb. Chem.-Zeit., 1911, 35, 1125—1126.

The authors confirm the results obtained by Ost and Wilkening (this J., 1910, 688) on the hydrolysis of cellulose, the conversion into fermentable dextrose being practically quantitative when a solution of cellulose in concentrated sulphuric acid is diluted until it contains 1—2 per cent. of acid and is not heated beyond 110°—120°C. Tables are now given showing the results obtained on heating solutions of dextrose, acidified with sulphuric acid, to 120°—145° C., the destruction of dextrose being very rapid at the higher temperature. 5 and 0·5 per cent. solutions of dextrose were found to give practically the same results. The decomposition products consisted of humic substances, formic and lævulinic acids. Neutral solutions of dextrose also suffer decomposition on heating to 120°—145° C., but to a very much smaller extent than the acidified solutions.—A. Sbld.

Invert sugar; Behaviour of —— in alkaline solution in presence of hydrogen peroxide. A. Jolles. Biochem. Zeits., 1911, 36, 389—393.

In continuation of earlier work (see this J., 1910, 1401) the author has observed the fall in rotatory power of invert sugar in $N/10$, $6N/10$ and $4N/5$ alkaline solutions in presence of hydrogen peroxide. When the solutions contain about 5 per cent. of the latter substance, their alkalinity rapidly diminishes (at 37° C.), especially at first, owing to the conversion of the sugars into acids by the peroxide, a process which under these conditions occurs to a much greater extent than the transformation of the sugars by the hydroxyl ions in the sense of the reaction of Lobry de Bruyn. It was observed that after the optical rotation of the solutions had fallen to zero, it increased in some cases to a small positive maximum and again diminished to zero. This is easily explained by the more rapid decomposition of lævulose as compared with dextrose.—J. H. L.

Honey; Detection of invert sugar in ——. E. Feder. Z. Unters. Nahr. Genussm., 1911, 22, 412—413.

Five grms. of the honey are mixed in a porcelain basin with 2·5 c.c. of a freshly-prepared aniline hydrochloride solution (100 c.c. of aniline plus 30 c.c. of 25 per cent. hydrochloric acid) and the mixture is stirred until it becomes homogeneous. Should invert sugar be present in the sample, a cherry-red colouration develops almost immediately; the tint changes after about 15 minutes and becomes orange-red in about 30 minutes. Pure honey yields a yellow or yellowish-brown colouration. The intensity of the colouration depends on the quantity of hydroxymethylfurfural present in the invert sugar and the test is stated to be more trustworthy than that described by Hartmann (this J., 1911, 565).—W. P. S.

Hexose-phosphoric acid esters. Von Lebedeff. *See* XVIII.

Patents.

Organic colouring matters [caramel] from carbohydrates and similar substances; Preparation of ——. Gillman and Spencer (1902), Ltd. Fr. Pat. 430,546, May 31, 1911. Under Int. Conv., May 31, 1910.

See Eng. Pat. 13,225 of 1910; this J., 1911, 1226.—T. F. B.

Kiln for revivifying char. U.S. Pat. 1,004,176. *See* I.

XVIII.—FERMENTATION INDUSTRIES.

Nitrogen fixation by yeasts and other fungi. C. B. Lipman. J. Biol. Chem., 1911, 10, 169—182.

Several investigators have stated that the capacity for fixing atmospheric nitrogen is possessed by the moulds *Penicillium glaucum* and *Aspergillus niger*. The author's work confirms these statements and shows that similar powers, in greater or less degree, are possessed by *Botrytis cinerea*, a parasitic fungus, and by some true yeasts (*S. apiculatus*, *cerevisiae* and *ellipsoideus*), non-sporulating yeasts and mycoderma yeasts. Pure cultures of the eighteen organisms studied were grown in solutions of dextrose, maltose, lactose, sucrose and mannitol containing small quantities of the necessary salts. After one month the increase in nitrogen was determined. The greatest increase observed (2·94 mgrms. of nitrogen per grm. of mannitol) was in the case of a non-sporulating yeast (Torula) in a solution of mannitol in distilled water. The organisms studied showed great individual differences, and alteration in the nature of the medium affected them differently. In most cases tap-water, as a basis for the culture medium, appeared to be more favourable to fixation of nitrogen than distilled water. Mannitol and lactose are more favourable than dextrose. sucrose and maltose when dissolved in distilled water, but in tap-water dextrose is the best. Maltose is the most unsatisfactory of the sugars studied, as regards its influence on nitrogen-fixing power.—J. H. L.

Zymase ; Production of —— from fresh brewery yeast by plasmolysis. P. Rinckleben. Chem.-Zeit., 1911, **35**, 1149—1150.

The success of Lebedeff in preparing solutions of zymase by simple maceration of dried yeast (see this J., 1911, 1081) has led the author to attempt the extraction of the enzyme from fresh yeast. 400 grms. of fresh bottom-fermentation brewery yeast, containing 77 per cent. of moisture, were digested with 25 grms. of glycerol for 15—40 hours at temperatures between 23° and 30° C. Slight auto-fermentation usually occurred, the mass liquefying more or less. The yeast cells afterwards showed signs of plasmolysis ; they had contracted in size, and the protoplasm had shrunk away from the cell-walls and become granular. The filtered juice, treated with sucrose and a trace of toluene, was in most cases devoid of fermentative activity but in some cases positive results were obtained. The activity of the juice appears to depend on the duration and temperature of the digestion, on the concentration of the glycerol, and probably on the physiological state of the yeast employed. The best temperature for the digestion is 25° C. ; at 30° C. no active extracts were obtained, owing to the rapid destruction of the zymase by the proteolytic enzymes during plasmolysis. The co-enzymes appear to be decomposed more rapidly than the zymase itself, for in some cases the filtered extract showed fermentative activity only after addition of boiled yeast juice. The author has also obtained active extracts by employing for the plasmolysis, in place of glycerol, a mixture of sodium phosphate and the residue from the evaporation of boiled yeast juice. It is probable that the co-enzymes present in the latter protect the zymase against proteolytic enzymes during plasmolysis.—J. H. L.

Hexose-phosphoric acid esters. II. A. v. Lebedeff. Biochem. Zeits., 1911, **36**. 248—260.

The author gives a historical resumé of the discoveries concerning the rôle of phosphoric acid in alcoholic fermentation. He has established by analysis that the molecule of the *p*-bromophenylhydrazone of the hexose-phosphoric acid ester contains two phosphoric acid residues, whereas the molecule of the osazone contains only one. This confirms the recent work of Harden and Young (see this J., 1910, 711 ; 1911, 705) whose formula for the phosphoric acid ester, viz., $C_6H_{10}O_4(PO_4H_2)_2$, the author also accepts. He rejects, however, the equations suggested by Harden and Young to represent the course of fermentation (this J., 1910, 711). These equations do not explain the fermentation of dihydroxyacetone, in the course of which a hexose-phosphoric acid ester is produced identical with that formed during the fermentation of sucrose (see this J., 1911, 973). The identity of the ester in the two cases indicates that it is probably an acrose biphosphate ; possibly also one of the phosphoric acid residues is combined with a carbon atom adjacent to the carbonyl group. —J. H. L.

Alcoholic fermentation ; An intermediate product of ——. H. Euler and A. Fodor. Biochem. Zeits., 1911, **36**, 401—410.

This investigation was undertaken in order to decide between the opposing views of Iwanoff (who stated that a triose phosphoric ester is formed during alcoholic fermentation) and Harden and Young (see this J., 1910, 711). Most of the authors' results confirm the conclusions of Harden and Young. The preparation of the potassium salt of a phosphoric acid ester from sugar solutions, treated with phosphates and dried yeast, is described fully. Analysis of the salt and molecular weight determinations indicated the formula, $C_3H_7O_3PO_4KH$. The ester was hydrolysed by heating with dilute sulphuric acid. The solution so obtained did not appear to contain a hexose ; it was almost optically inactive and produced no definite osazone with phenylhydrazine. On the other hand, it contained all the decomposition products of dihydroxyacetone, although not the triose itself. The unhydrolysed ester produced, on warming with phenylhydrazine, a compound identical with the phenylhydrazine salt of the hexosazone phosphoric ester studied by Lebedeff and by Harden and Young (this J., 1911, 705). The authors conclude that although a hexose diphosphoric acid ester is undoubtedly formed during fermentation by means of pressed yeast juice, the experimental evidence indicates that a triose monophosphoric acid ester may also be formed.—J. H. L.

Wort and beer ; Determination of protein in ——. W. Wüst. Z. ges. Brauw., 1911, **34**. 497—499.

Experiments are described relating to different methods of evaporating samples of beer or wort preparatory to the Kjeldahl operation. Exact results are obtained when the evaporation is carried out on a water-bath or at 120° C. If the sample is concentrated to one-third of its volume over a flame, the percentage of protein found is somewhat low (*e.g.*, 0·5033 instead of 0·5094 per cent.). All three methods of heating give exact results if the sample is first treated with 4—5 c.c. of strong sulphuric acid, but the use of a direct flame necessitates constant attention on account of frothing. The practice of fermenting samples of wort before evaporation, by adding traces of yeast, has recently been condemned by Fürnrohr (see this J., 1911, 825).—J. H. L.

Beer ; Influence of changes in the acid-content on the stability of ——. F. Scönfeld and W. Hirt. Woch. Brau., 1911, **28**, 467—472, 489—491.

The authors treated samples of four different beers with progressively increasing quantities of acid and alkali (lactic acid and potassium hydroxide), and observed the period elapsing before the appearance of cloudiness or deposit, and also the nature of the deposited or suspended matter. The results with all four beers were, in the main, similar. Small additions of acid (less than 0·2 per cent.) were found to act favourably by delaying the formation of haze, whilst larger amounts had the reverse effect. Addition of alkali, even in small amounts, resulted in a more rapid and copious formation of cloudiness. The haze produced in beers treated with acid was pulverulent in appearance, and, under the microscope, was found to consist chiefly of non-living matter—resin-globules and albumin with a few yeasts, sarcinæ and bacteria (rods). Minute additions of acid to the original beers produced a distinct effect in checking the development of bacteria, whilst larger concentrations were required to affect the yeast-cells present. No living organisms were found in beers treated with 0·6 per cent. of acid. The partial or complete neutralisation of the original acidity of the beers by addition of alkali led to a marked increase in the multiplication of micro-organisms, especially of bacteria, and the cloudiness produced, which was gelatinous and flocculent in appearance, was found to consist chiefly of living matter. If the beer is actually rendered alkaline, yeasts are soon eliminated, and in some such cases the authors obtained almost pure cultures of sarcinæ. Sterilised beers treated with alkali might be used, like Bettges' solution, for the detection of sarcinæ and their cultivation. The authors draw the practical conclusion, that if an attempt is made to increase the acidity of beers in the natural way in order to render them more stable, the acidity to aim at should not be limited to that found to give the best results in these laboratory-experiments (in which the acid was added artificially to finished beers). The greater the acidity of the liquor during fermentation and storage in cask, the more completely will precipitable matter be removed during these processes, and the less will there be to separate subsequently from the filtered beer.—J. H. L.

Cider vinegar [; Detection of adulteration of ——]. F. E. Mott. J. Ind. Eng. Chem., 1911, 3, 747—750.

From a study of pure cider vinegars and of the published analytical data on such vinegars, the author shows that there is a relation between the content of lævulose and of dextrose therein. If the amounts of lævulose and dextrose (percentage of total solids) be plotted on squared paper as abscissæ and ordinates respectively, then a line drawn from the zero point through the point corresponding to 15 per cent. of dextrose and 25 per cent. of lævulose will represent the maximum values for dextrose in relation to the corresponding values for lævulose in pure cider vinegar, and a higher value for dextrose indicates adulteration with a foreign dextro-rotatory substance. In determining the lævulose and dextrose, a method must be used in which the error due to the presence of aldehydes in the vinegar is eliminated. The author uses an adaptation of Browne's method (this J., 1906, 446). The total solids from 10 c.c. of the vinegar are dissolved in 25 c.c. of water, the solution made up to 100 c.c., and the reducing sugars determined by Munson and Walker's method (this J., 1906, 656). Then 50 c.c. of the vinegar are treated with 5 c.c. of basic lead acetate solution and two teaspoonfuls of animal charcoal, filtered, and the filtrate polarised in a 200 mm. tube at 20° C. From the polarisation (*p*) expressed in Ventzke degrees and the percentage of reducing sugars (R) in the total solids, expressed as dextrose, the percentages of lævulose (L) and of dextrose (D) are calculated by means of the formulæ:—

$$P = \frac{p \times 26{\cdot}048}{\text{total solids}}; \quad L = \frac{0{\cdot}793R - P}{2{\cdot}08}; \; D = R - 0{\cdot}915L.$$

—A. S.

Patents.

Malt; Process for preparing colour —— in the state of meal. H. Durst. Fr. Pat. 429,547, May 9, 1911. Under Int. Conv., May 11, 1910.

Green malt is dried at 25°—40° C. until it has acquired the hardness requisite for grinding; it is then ground, and the meal is bolted in order to remove husks and embryos. The product thus obtained may be kept for a long time, if desired, in silos. Prior to torrefaction, the meal is moistened by exposing it in a layer of about 1 cm. deep, to moist air. During torrefaction, the meal is kept in motion by any suitable means, and the torrefaction is effected more rapidly and uniformly than that of malt in the form of whole corns. Owing to the absence of husks and embryos, the torrefied meal is free from any bitter or empyreumatic flavour.—L. E.

Fermentation vessel for effecting the complete fermentation, etc., of wort or beer. P. Devresse et Cie. Fr. Pat. 429,044, Jan. 24, 1911. Under Int. Conv., March 8, 1910.

The apparatus comprises a closed cylindrical vessel lined with tinned, silvered or gilt copper. The vessel is fitted with a jacket or with a coil, for heating or cooling, and with a manometer, safety valve, etc., and serves for boiling, cooling, and fermenting the wort, and for carbonating and pasteurising beer. The wort is introduced through a cock at the bottom of the vessel, and boiled with hops (the latter being contained in bags) under a diminished pressure of ½ an atmosphere. After being cooled to 10° C., the wort is pitched with yeast and undergoes fermentation and automatic carbonation simultaneously; during fermentation, cooling is effected with water, and after fermentation, with air under reduced pressure. To pasteurise beer in bulk, the vessel is filled completely with the beer, the latter then being heated under a pressure of two atmospheres for say 2 hours; the temperature of the beer should be 42° C. or more, and to attain this temperature without exceeding a pressure of two atmospheres, a control-cock is provided for the exit of beer from the vessel. A second method of pasteurising beer in bulk consists in filling the vessel to four-fifths of its capacity with beer, introducing carbon dioxide under a pressure of 2 atmospheres, and then heating to 42° C. or higher temperature for, say, 2 hours. To pasteurise bottled beer, the bottles are heated in the vessel, a pressure of two atmospheres being maintained in the latter; owing to the external pressure there is no danger of the bottles bursting.—L. E.

Distilling apparatus, especially for distilling worts, and the products obtainable with such apparatus. I. Bauer. Fr. Pat. 428,995. April 27, 1911.

The apparatus includes two heaters, each fitted with an exit-pipe at the top and an inlet-pipe at the bottom. A cock is provided which, in one position, makes communication between the exit-pipe of one heater and the inlet-pipe of the other, between the exit-pipe of the latter heater and an outlet-pipe which serves both heaters in turn, and between the inlet-pipe of the former heater and a steam-pipe. On turning the cock through 90°, all communications are closed, and on turning the cock through another 90°, communications are made again but in the reverse sense. Each heater is fitted at the bottom with a discharge-cock for spent wash, and a pipe affords communication between the upper part of each heater and a wort-recipient beneath the heaters. When it is required to introduce a fresh charge into one of the heaters, the charge in the other heater being half-spent, the cock first mentioned is turned to cut off all communications, and steam is then admitted through a cock at the top of the wort-recipient, whereby wort is pumped from this recipient into the heater. The cock first mentioned is then turned so that steam passes into the heater containing the half-spent charge, entrains the last portion of alcohol, etc., and then passes to the heater containing the fresh charge. The vapour from this heater passes to a vessel which communicates, by a tubulure fitted with a baffling cap, with a dephlegmator. The latter is provided with an overflow and with a cover cooled by a current of water, a horizontal plate below the cover serving to insure more intimate contact between the vapour and the cover. The vapour from the dephlegmator passes to a refrigerating column in which it descends through a series of chambers of lenticular shape. These chambers consist of two parts, placed one on the other, with a plate between, and one of the chambers communicates by a pipe with the dephlegmator, whereby part of the distillate is returned to the latter.—L. E.

Wines of the saké type from rice, and other like wines from cereals; Manufacture of ——. R. B. Ransford, London. From Soc. Franç. des Distilleries de l'Indo-Chine, Paris. Eng. Pat. 20,521, Sept. 2, 1910.

See Fr. Pat. 415,074 of 1909; this J., 1910, 1267.—T. F. B.

Extraction of tartrates from wine lees or marcs. Fr. Pat. 429,008. *See* VII.

XIXa.—FOODS.

Benzoic acid [in condiments, etc.]; Determination of ——. O. Folin and F. F. Flanders. J. Amer. Chem. Soc., 1911, 33, 1622—1626.

In order to determine the amount of benzoic acid in catchups, etc., 25 grms. of the preparation are weighed into a 50 c.c. beaker, and 2 c.c. of concentrated nitric acid added. About 0·3 grm. of sodium nitrite is added in small portions, with stirring. The mass is transferred to a 500 c.c. stoppered funnel, using 200 c.c. of a saturated solution of ammonium sulphate, and is extracted five times with chloroform, using 50, 35, 25, 25, and 25 c.c. respectively. Care must be taken that the liquid is not shaken violently during the extraction. The chloroform extract is shaken with 200 c.c. of a saturated solution of pure sodium chloride containing 3 c.c. of 10 per cent. hydrochloric acid to the litre. The chloroform is drawn off and shaken with another 200 c.c. of the acidified sodium chloride solution. It is finally drawn off and titrated with standard sodium ethoxide solution using phenolphthaleïn as indicator. The alkali solution is prepared by dissolving 2·3 grms. of clean sodium in a

litre of absolute alcohol. It is standardised against benzoic acid dissolved in 165 c.c. of chloroform, care being taken that the latter contains no free hydrochloric acid.
—F. SHDN.

Foodstuffs; Handling, transportation, and storage of perishable ——. *III. Select methods of analysis.* J. S. Hepburn. J. Franklin Inst., 1911, **172**, 369—398.

A DESCRIPTION of the methods of analysis used in the researches, of which the results have been previously published (see this J., 1911, 826, 1083). The methods given include those for the general analysis of flesh; the determination of the nitrogenous constituents, including creatine and creatinine: the determination of the fat, and the examination of the latter, including the determination of phosphorus and nitrogen and detection of aldehydes, oxygen, and lipase in the crude fat; and the analysis of milk and eggs. A bibliography is appended to the paper.—A. S.

Benzoic acid, benzoates, and food preservatives in Germany. Oil, Paint, and Drug Rep., Oct. 16, 1911. [T.R.]

THE report made by the health officials of Germany on the use of benzoate of soda in foods has been transmitted to the Agricultural Department by the officials of the State Department. That the German authorities had taken this stand was known, but the details of the report are new. The report concludes as follows: The Royal Scientific Deputation for Medical Affairs is of the opinion that the use of benzoic acid and benzoates should not be permitted for the preservation of foodstuffs. For even if in small amounts it may be harmless, still there is the danger that by its addition to foods and drinks such amounts will be introduced that may possibly result in harm to the organism. Benzoic acid may be formed within the body out of foodstuffs to which no benzoate has been added. A further consideration, which should be directed against the use of chemical preservatives in general, is that by their use proper care and cleanliness on the part of manufacturers and salesmen with foods that may undergo decomposition may be neglected. This seems especially to be the case with margarin, for the preserving of which benzoic acid is used at present in large quantities. Commerical margarin at present contains much water, whereby its keeping qualities are lessened, while good margarin may be kept for months without preservatives. The poorly prepared and high water-containing margarin becomes a better nutrient ground for moulds and bacteria and for these reasons a preservative is required. Similar considerations arise in reference to protein-containing foods. The experiments of the Imperial Health Department have shown that a slight putrefactive odour of sausage meat, which may be weakened by aeration but not removed, will disappear after a time when benzoic acid or sodium benzoate is mixed with it. By this means an appearance of freshness can be given to foodstuffs that already have started decomposing.

Assimilation of nitrogen by rice. Kelley. *See* XVI.

PATENTS.

Granular or pulverulent material [flour]; Apparatus for treating —— *with liquids.* F. H. Loring, London. Eng. Pat. 18,330 of 1911; date of Appl., Sept. 15, 1910.

THE apparatus is intended primarily for moistening flour. The flour is fed from a hopper by a vertical worm on to a sieve in the upper part of a closed chamber, and is caused to pass through the sieve by rotating scraper arms which preferably carry brushes. Water is sprayed into the chamber beneath the sieve through atomising nozzles directed downwards. The moist flour is removed from the bottom of the chamber by rotating worms. The sieve is preferably made with a circular mesh to prevent clogging.
—A. T. L.

Flour, starch, dextrins, etc.; Process of bleaching and preserving ——. Banque du Radium. Fr. Pat. 428,969, July 4, 1910.

THE flour, etc., is placed on a travelling band and passed beneath a quartz plate fitted in a chamber containing an arc lamp, a Geissler tube, a mercury vapour lamp, or other source of ultra-violet or similar rays.—W. P. S.

Coffee berries free from caffeine; Process of obtaining ——. L. Klein. Fifth Addition, dated April 5, 1911, to Fr. Pat. 409,700, Nov. 11, 1909 (this J., 1910, 779, 837, 1130, 1404).

THE drum in which the berries are treated as described in the original specification and in the additions to the same (*loc. cit.*) is mounted in a chamber which may be closed hermetically; this chamber is provided with a sliding door and the opening of the drum is controlled by means of levers which work on the shaft of the drum.
—W. P. S.

Chocolate; Manufacture of a cooked, digestible —— *containing all the nutritive constituents of cocoa and capable of being used with water or milk without further cooking.* L. M. Dardenne. First Addition, dated April 20, 1911, to Fr. Pat. 426,491, May 4, 1910 (this J., 1911, 976).

THE cooked chocolate, obtained as described in the original specification (*loc. cit.*) is spread in thin layers on metallic plates and maintained at a temperature of from 30° to 32° C., until it has attained the desired consistence. The pieces are then broken into small fragments which are dried at 28° C., and pressed into tablets or the like.
—W. P. S.

Milk; Process for the preservation of ——. M. Labouré, Paris. Eng. Pat. 24,275, Oct. 19, 1910.

SEE Fr. Pat. 420,582 of 1909: this J., 1911, 381.—T. F. B.

Milk; Process for treating [sterilising] ——. T. G. Mollinger, Assignor to S. B. Monroe, Kalamazoo, Mich. U.S. Pat. 1,005,275, Oct. 10, 1911.

SEE Eng. Pat. 24,162 of 1910; this J., 1911, 1083.—T. F. B.

Malt coffee; Manufacture of ——. O. Gaebel, Breslau, Germany. Eng. Pat. 5863, March 8, 1911.

SEE U.S. Pat. 995,956 of 1911; this J., 1911, 976.—T. F. B.

Alimentary products consisting essentially of soja grains [soya beans]; Non-fermented and sugared ——. Yu Ying Li, Valées, France. Eng. Pat. 11,789 of 1911, date of appl., Dec. 31, 1910.

SEE Fr. Pat. 424,125 of 1910; this J., 1911, 827.—T. F. B.

Albuminous substances from soya beans; Process for preparing ——. A. Sauer. Fr. Pat. 430,185, April 13, 1911. Under Int. Conv., April 18, 1910.

SEE Eng. Pat. 9478 of 1911; this J., 1911, 764.—T. F. B.

Cocoa; Process of purifying ——. L. Greiser, Berlin. U.S. Pat. 1,004,870, Oct. 3, 1911.

SEE Eng. Pat. 23,765 of 1909; this J., 1910, 588.—T. F. B.

Meat powder. J. G. Grotkass, Bremen, and K. Schirm, Leipzig-Plagwitz, Germany. U.S. Pat. 1,005,539, Oct. 10, 1911.

SEE Fr. Pat. 409,675 of 1909; this J., 1910, 779.—T. F. B.

XIXB—WATER PURIFICATION; SANITATION.

Water; Sterilisation of —— *by ultra-violet rays.* Grimm and Weldert. Mitt. K. Prüf.-Anst. f. Wasserversorg. u. Abwasserbeseit., 1911, [14], 85—112. Chem. Zentr., 1911, 1, 1454.

THE experiments were made with a mercury vapour lamp of 1200 candle power enclosed in a double-walled quartz vessel, through which the water was passed. Clear water containing less than 100 bacteria per c.c. could be sterilised when passed through the apparatus at a velocity of

0·55 cb. m. per hour, but with water very rich in bacteria, sterilisation was effected only when the velocity did not exceed 0·45 cb. m. per hour. Turbidity, and the yellow colouration due to colloids, such as is observed in peaty waters, destroy the efficiency of the treatment for practical purposes. The cost of the treatment is very high compared with that of existing processes. (See also this J., 1911, 1027, 1228.)—A. S.

Carbon in sewage and sewage purification; Study of ——. H. W. Clark and G. O. Adams. J. Ind. Eng. Chem., 1911, **3**, 738—742.

During the past 10 years data have been collected at the Lawrence Experimental Station (Massachusetts State Board of Health) as to the part played by carbon compounds (other than carbonates) in sewage and sewage purification. Determinations of the carbon content and loss on ignition of evaporation residues, showed that in the case of residues from sewage, carbon formed, on the average, 23 per cent. of the total residue and 50 per cent. of the loss on ignition, the corresponding figures for residues from other products being: surface waters, 7·5 and 26; sewage effluents from filters of coarse material, 10 and 36; wool scourings, 17 and 54; and paper mill waste, 23 and 61 per cent. respectively. The ratio of carbon to organic nitrogen in the different products was as follows: sewage, more than 11½; surface waters, 16—20; sewage effluents, 6½—7½; wool scourings, 21; paper mill waste, 14½. In a number of sewage sludges, nearly one-half of the organic matter consisted of fatty substances, and the carbon content of the sludge was about 55 per cent. of the loss on ignition. In sediments from trickling or contact filters, the carbon content was 50 per cent. of the loss on ignition. Septic tank sludge contains 56—61 per cent. of carbon, and the carbon content of the fatty substances therein is about 25 per cent. of the total carbon. In the case of sands from sewage filters, a considerable portion of the loss on ignition may be due to chemically combined water. In some specimens examined, the carbon content was 7—12 times as high as the organic nitrogen, and on the average was about 35 per cent. of the loss on ignition. Experiments were made to determine the maximum oxygen consumed by boiling with permanganate till no further reduction of the latter took place (8 hours usually sufficed) and the results were compared with the oxygen consumed in two minutes, and with the amount of oxygen theoretically necessary to oxidise the carbon content of the sewage, etc. In unfiltered sewage the two-minutes "oxygen consumed" was 10—19 per cent. and the maximum "oxygen consumed" 34—54 per cent. of the theoretical value, whilst in filtered sewage, the corresponding figures were 13—28 and 51—86 per cent. respectively, and in effluents and waters the percentages were still higher. The clogging of sewage filters is due chiefly to non-nitrogenous carbon compounds (cellulose, fats, etc.). In the matter retained by the filters, the amount of carbon is about seven times as high as that of organic nitrogen. About 75 per cent. of the carbonaceous matter stored in the filter is contained in the first foot in depth. A study of nitrification in sewage has indicated that if the carbon content of the sewage is 10 times that of the nitrogen, nitrification will not take place. If the nitrogen content be increased, nitrification begins, but may again be checked by increasing the carbon content.—A.S.

Bibliography of tannery waste treatment. Esten. *See* XV.

Patents.

Water; Treatment of ——. C. Neff and A. Brandes, Hanover, Germany. Eng. Pat. 22,522, Sept. 28, 1910.

The apparatus described in a previous patent (this J., 1907, 1129) where water trickles over sheets of aluminium, exposed to light, is used under conditions where light is excluded.—G. W. McD.

Water for industrial uses; Process and apparatus for the purification of —— [*removal of calcium salts, etc.*]. A. Metz. Fr. Pat. 428,919, April 25, 1911.

The water is passed in the form of a thin layer over the surface of inclined bright metallic or other reflecting surfaces, and during its passage is submitted to the direct action of natural or artificial light. The calcium salts and other matters deposited on the bright surfaces are removed by means of travelling rotating brushes, and the treated water is passed through a settling tank before being used for boilers, etc.—W. P. S.

Water and liquids in general; Apparatus for the mechanical treatment of ——. L. Linden. Fr. Pat. 428,903, April 25, 1911.

A settling tank, with inclined sides and a number of sumps or wells at its lower part, is provided with an inner false-side fitted at a slightly increasing angle to the side and extending to just above the upper walls of the wells. The water to be treated flows from a channel downwards through the space between the side and the false-side, under the lower edge of the latter, and thence rises through horizontal sieves situated on the other side of the false-side. A number of vertical baffle-plates are provided in the space between the false-side and the side of the tank, others being placed at the upper parts of the wells. When the water has filled the second compartment of the tank, it flows into horizontal channels through narrow slits in the covers of the latter, passes downwards through filtering material in the channels, and is run off from the lower parts of these into a main channel.—W. P. S.

Geraniol as a disinfectant; Employment of ——. A. Lumière. Fr. Pat. 429,308, July 12, 1910.

Geraniol, in a pure state or mixed with other substances, is employed as a disinfectant.—W. P. S.

Water; Process for clarifying —— *and for purifying it from germs.* R. Gans, Pankow, Germany. Eng. Pat. 28,353, Dec. 6, 1910. Under Int. Conv., Jan. 6, 1910.

See Fr. Pat. 423,388 of 1910; this J., 1911, 645.—T. F. B.

Sterilisation of liquids; Apparatus for the ——. V. Henri, A. Helbronner, and M. von Recklinghausen, Paris. Eng. Pat. 6178, March 11, 1911. Under Int. Conv., March 12, 1910.

See Fr. Pat. 424,369 of 1910; this J., 1911, 978.—T. F. B.

Sterilisation of water and other liquids. V. Henri, A. Helbronner, and M. von Recklinghausen. Fr. Pat. 430,256, May 27, 1911. Under Int. Conv., May 27, 1910.

See Eng. Pat. 12,949 of 1910; this J., 1911, 764.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Codeine in opium; Determination of ——. A. E. Andrews. Analyst, 1911, **36**, 489—490.

The methods of Van der Wielen (Pharm. Zeit., 1903, **48**, 267), and Caspari (this J., 1904, 1164) were found to be unsatisfactory, the latter owing to the fact that when morphine is precipitated from an aqueous solution containing codeine, it carries the latter down with it. The following method, provided the details be adhered to, has been found to give good results. 12 grms. of dry opium are exhausted with successive small quantities of cold water, and the volume of the filtered aqueous solution is adjusted to 100 c.c. To this, 20 c.c. of a 20 per cent. solution of lead acetate are added, and after standing overnight, the liquid is filtered quickly through a paper placed in a Buchner funnel. From 100 c.c. of the filtrate (=10 grms. of opium), the lead is removed by means of hydrogen sulphide; the precipitate is washed, and the washings are concentrated before adding to the main filtrate, from which the hydrogen sulphide has been expelled by a current of air. The solution (not more than 130 c.c.) is shaken well with 20 c.c. of a 20 per cent. solution of sodium salicylate, and the resinous precipitate produced is separated by filtering through a small fluted paper. A few crystals of thebaine salicylate are added to the solution and the liquid stirred to facilitate the separation of any thebaine as salicylate. After standing overnight the liquid is filtered through the same filter, and the above treatment repeated until no further separation occurs. The filter is then washed, and the filtrate concentrated to 10—15 c.c., and whilst still warm, transferred to a separator, the rinsings being placed in a second separator. The solution is shaken at least three times in succession with ether, which is then used for extracting the liquid in the second separator, and the aqueous solutions are next united and treated with 10 c.c. of a 20 per cent. solution of caustic soda, and extracted at least four times in succession with a slightly larger volume of ether. The ether extracts are washed separately with 20—30 c.c. of water, then united, dried with anhydrous sodium sulphate, and distilled until only a few c.c. are left, when the codeine crystallises out. The alkaloid is dried in an exhausted desiccator, weighed, dissolved in excess of $N/10$ acid, and the solution titrated back with $N/10$ caustic soda, using litmus or methyl orange as indicator. —A. S.

Morphine; Determination of —— by extraction with phenyl-ethyl alcohol. A. D. Thorburn. J. Ind. Eng. Chem., 1911, **3**, 754—756.

Phenylethyl alcohol is only slightly soluble in water and dissolves a little more than one-twentieth of its weight of crystallised morphine. It forms a persistent emulsion with water, but this can be avoided by adding ethyl alcohol to the aqueous layer and diluting the phenylethyl alcohol with benzene. For the determination of morphine, 10—15 c.c. of a solution of the alkaloid (liberated from its salts by addition of ammonia) in 30 per cent. alcohol, are extracted with a mixture of 3 c.c. of phenylethyl alcohol and 1 c.c. of benzene, and the extraction is repeated with successive quantities of 2 c.c. of the solvent mixture until the aqueous alcoholic solution no longer gives a reaction with Mayer's reagent (13·546 grms. of mercuric chloride and 49·8 grms. of potassium iodide dissolved in water to 1 litre) or with iodine (two extractions usually suffice). The solution of the alkaloid in the mixture of phenylethyl alcohol and benzene is heated on the water-bath for 1 hour, and transferred to a separator, the containing vessel being washed with ether, of which 20 c.c. are used. The alkaloid is then removed by extracting successively with 10 c.c. of $N/10$ sulphuric acid and three portions of 3 c.c. of water, and the acid solution is titrated with $N/10$ potassium hydroxide, using hæmatoxylin as indicator.—A. S.

Apomorphine hydrochloride; Test for β-chloromorphide in commercial ——. A. Schneider. Pharm. Zentralh., 1911, **52**, 537—538.

The following is recommended to supplement the tests which have been published for the detection of impurity, now identified as β-chloromorphide, in commercial apomorphine hydrochloride. About 0·1 grm. of the salt, dissolved in 10 c.c. of water, is treated with 20 c.c. of ether and 5 c.c. of sodium bicarbonate solution saturated in the cold. The mixture is shaken until the precipitate is dissolved by the ether. The aqueous portion is then run off, and the ether solution washed three times with 20, 20 and 20 c.c. of water. The ether solution is then evaporated, and the residue is dissolved in 5 c.c. of a 1 : 200 solution of siver nitrate in strong nitric acid : the acid mixture is heated for 10 minutes on the boiling water bath, when a clear brown liquid should be obtained showing not more than barely perceptible clots of silver chloride. Another impurity sometimes present, the polymerised amorphous salt, is readily detected by microscopical examination.—J. O. B.

Hydrastinine and cotarnine; Synthesis of ——. H. Decker. Chem.-Zeit., 1911, **35**, 1076—1077.

The condensation of piperonal with hippuric acid yields piperonylpyruvic acid, which passes into a homopiperonoylpiperonylalanine by the action of ammonia. This is converted into a substituted dihydroisoquinoline derivative, which is methylated and then reduced. From the product, piperonal, is split off, with the formation of hydrastinine. Formylhomopiperonylamine can be made to yield a norhydrastine by condensation, which when methylated passes into hydrastinine. Myristicin can be converted into formylmyristicylamine, from which cotarnine can be prepared. (See this J., 1910, 897.) —F. Shdn.

Alkaloids; Double salts of antimony pentachloride with the hydrochlorides of certain ——. T. S. Thomsen. J. prakt. Chem., 1911, **84**, 410—422.

Double salts of the hydrochlorides of quinine, quinidine cinchonine, cinchonidine, morphine, codeine, strychnine, cocaine, caffeine and nicotine with antimony pentachloride are described. 10 grms. of the alkaloid are dissolved in 200—300 c.c. of 90 per cent. alcohol, 30—40 c.c. of 40 per cent. hydrochloric acid are added and then the calculated amount of antimony pentachloride previously dissolved in 40 per cent. hydrochloric acid (1 grm. in 4 c.c. of solution). The crystals are collected, washed with alcoholic hydrochloric acid and then with alcohol and dried in the air.—T. C. C.

Alkaloids; Sublimation of minute quantities of —— in a vacuum. Eder. Apoth.-Zeit., 1911, **26**, 832.

By means of a specially constructed apparatus (see author's Inaugural Dissertation, Eidg. tech. Hochschule, Zürich.) many alkaloids can be sublimed and the appearance of the sublimate can be examined under the microscope. Cocaine sublimes between 75° and 90° C., atropine between 93° and 110° C., narcotine between 146° and 156° C. Caffeine, theobromine, cantharidine, solanine and cinchonine give a crystalline sublimate. Other alkaloids give a film at first, which becomes crystalline as the sublimation proceeds. To this group belong hyoscyamine, narcotine, quinine, quinidine, cinchonidine, codeine, yohimbine, pilocarpine hydrochloride, thebaine, morphine, and strychnine. Cocaine, brucine, papaverine, piperine, atropine, physostigmine, hydrastine, scopolamine hydrobromide, and aconitine give a film which does not become crystalline during the sublimation. Narceine, colchicine, veratrine, and emetine do not form a crystalline sublimate at all.—F. Shdn.

Alkaloids; Behaviour of —— towards quinone and chloral hydrate. E. Schaer. Apoth.-Zeit., 1911, **26**, 831.

A solution of quinone in pure sulphuric acid gives colour-reactions with certain alkaloids. Morphine, codeine and narceine give a deep orange-red colour which is fairly permanent; brucine produces a chocolate-red colouration. Strychnine gives a reddish colouration after some time, similar to that produced with hydrogen peroxide (see this J., 1910, 1078). Digitalin, santonin and acetanilide also give characteristic reactions. The sulphuric acid used should be of about 95 per cent. strength. An 80 per cent. solution of chloral hydrate can be used to dissolve the quinone in place of the sulphuric acid. The reagent must be applied to the free base however, not to the alkaloidal salt. A brownish-yellow colouration changing rapidly to a dirty cherry-red is produced by the following alkaloids :—brucine, morphine, codeine, strychnine, veratrine, coniine, cocaine, atropine, and quinine. The same colour is produced much more slowly by narcotine and narceine. A 30 per cent. solution of chloral hydrate can be used to detect alkaloids in small fragments of plants, drugs, etc. The material is macerated with the solution for 1—2 hours, the liquid filtered off, and treated with the reagent dissolved in a fresh portion of the chloral hydrate solution. Drugs containing starch or gummy matter are extracted with a 70—80 per cent. solution of chloral hydrate in alcohol, the extract evaporated on the water-bath and the residue taken up with the aqueous solution of chloral hydrate.—F. Shdn.

Chrysophanic acid, Frangula-emodin and certain oxonium compounds of anthracene derivatives. O. Fischer and H. Gross. J. prakt. Chem., 1911, **84**, 369—382.

Frangula-emodin can be converted into a trihydroxyanthraquinonecarboxylic acid, which the authors call emodic acid, and therefore the parent substance contain three hydroxyl groups in the nucleus. It thus differs from aloe-emodin in that the latter contains two hydroxyl groups in the nucleus and one in the methyl group.—J. C. C.

Essential oils; Constituents of ——. The essential oil of Xanthoxylum aubertia Cordemoy and Xanthoxylum alatum Roxb. F. W. Semmler and E. Schossberger. Ber., 1911, 44, 2885—2890.

The essential oil of *Xanthoxylum aubertia* (*Evodia aubertia* Cordem.) occurs to the extent of about 3·7 per cent. in the fruit. After removing the oil, further distillation produces a crystalline solid, m.pt. 83° C. The oil itself has the following characters: sp. gr. 0·8653, α_D = —23° 35′ and n_D=1·48131. On fractionation about 2—3 per cent. of an aliphatic terpene was obtained. This boiled at 70°—80° C. at 16 mm., and had the sp. gr. 0·8248 at 20° C., n_D=1·49775, and α_D= +30°. It showed a marked tendency to polymerise. About 80—90 per cent. of the oil boiled between 115° and 130° C. at 16 mm., and the remainder solidified on cooling. By treating the large fraction with an ice-cold permanganate solution, a sesquiterpene, *evodene*, was left unattacked. This boils at 119°—123° C. at 9 mm., has the sp. gr. 0·8781 at 20° C., n_D= 1·49900, and α_D=—58°. It amounts to about 20—30 per cent. of the original oil. The same fraction was also found to contain methyleugenol. The dimethyl ether of phloracetophenone, $C_{10}H_{12}O_4$, m.pt. 85° C. was found in the residue left after distilling the oil. The oil of *Xanthoxylum alatum* had the sp. gr. 0·8632 at 20° C., n_D=1·4795, α_D=—23°. About 80 per cent. of the oil distilled between 50° and 60° C. at 9 mm. This fraction consisted of a sesquiterpene with the sp. gr. 0·840 at 20° C., n_D= 1·47457, and α_D= —26°. It formed a monohydrochloride boiling at 83°—87° C. at 10 mm., which, on reduction, gave a hydrocarbon boiling at 52°—58° C. at 9 mm., and with the sp. gr. 0·8275 at 20° C., n_D=1·4582, and α_D=—17°. When ozonised, the hydrocarbon yielded a ketone, the semicarbazone melting at 123° C. It appears possible that this hydrocarbon, styled *xanthoxylene*, is *l*-sabinene. The oil also contains cuminic aldehyde, and an aldehyde yielding a semicarbazone, m.pt. 221° C. In addition the oil yields the dimethyl ether of phloracetophenone.—F. Shdn.

Chenopodium; Chemical investigation of the oil of ——. E. K. Nelson. U.S. Dept. Agric. Bureau of Chem., Circular No. 73, June 24, 1911.

The oil examined was distilled from *Chenopodium ambrosioides*, var. *Anthelmintica*. Three samples distilled by steam had the sp. gr. 0·955—0·970 at 25°/25° C., n_D=1·4726—1·4723 at 25° C., and α_D=—5·4° to —8·8° at 25° C. Two of the samples were soluble in three parts of 70 per cent. alcohol, the third dissolved in 7 parts. The oil consists of about 15 per cent. of cymene and about 70 per cent. of ascaridol (Schimmel's Report, April, 1908). This unstable substance has the composition $C_{10}H_{16}O_2$, and boils at 96°—97° C. at 8 mm. The sp. gr. is 0·9985 at 20°/20° C., n_D at 20° C.=1·4769; α_D at 20° C.=+0·7°. When reduced with ferrous sulphate at a temperature below 35° C., a glycol, $C_{10}H_{18}O_3$, is formed, which boils at 271°—272° C., melts at 62·5°—64·0° C., has the sp. gr. 1·0981 at 20°/20° C., and n_D=1·4796 at 20° C. The monobenzoate melts at 136°—137° C., and the dibenzoate at 116·5°—117·5° C. When ascaridol is heated in cymene to 150° C., molecular rearrangement takes place with the formation of the anhydride of the above glycol. Upon oxidation with permanganate, a dibasic acid, ascaridic acid, $C_{10}H_{16}O_5$, is formed, m.pt. 116·5°—117° C. A small amount of another acid, $C_{10}H_{16}O_6$, m.pt. 186°—187° C. is formed during the oxidation with permanganate. Ascaridol is probably a peroxide related to oxythymoquinone.—F. Shdn.

Myrica Gale, L.; Composition of the essential oil of ——. S. S. Pickles. Chem. Soc. Proc., 1911, 27, 220.

The oil of *Myrica Gale*, L. (bog myrtle, sweet gale, etc.) required for this investigation, was distilled from specimens of the plant collected in Argyllshire. Two separate consignments of the raw material contained different proportions of leaves and twigs, and the oils obtained in the two cases consequently varied somewhat in character. The oil obtained from a sample consisting mostly of leaves, was pale yellow. It had a pleasant, herb-like odour, and possessed the following chemical and physical characters:

Yield of oil on air-dried material, 0·203 per cent.; sp. gr. at 15°/15° C., 0·912; α_D = −11°26′; acid value=4·0; ester value = 19·2; saponification value of acetylated oil = 56·4. The constituents of the oil were found to include the following substances: (1) a crystalline paraffin hydrocarbon m.p. 63—64° C., having probably the composition $C_{29}H_{60}$ (0·75 per cent.); (2) free palmitic acid (2·5 per cent.); (3) terpenes, including dipentene; (4) cineole; (5) esters of fatty acids; (6) a mixture of alcohols of high boiling points; and (7) a sesquiterpene. The cineole and terpenes together constitute approximately 50 per cent. of the oil.

Oil of Pinus longifolia; Constituents of the ——. H. H. Robinson. Chem. Soc. Proc., 1911, 27, 247.

By fractional distillation, the oil of *Pinus longifolia* was found to be divisible into two portions; one portion, amounting to about one-third of the whole, was of a much lower boiling point than the other, and was found to be *l*-pinene. The remaining two-thirds was mainly composed of an oil boiling at 173° C., having sp. gr. at 15°/15° C., 0·867 and α_D about +13°. From this, by treatment with dry hydrogen chloride, sylvestrene bihydrochloride was obtained, from which sylvestrene was regenerated. From the mother liquors left after removing as far as possible the sylvestrene bihydrochloride, dipentene was obtained. It is thought very possible that the sylvestrene is not present as such in the original oil, but that a terpene is there contained, which unites with hydrogen chloride to form sylvestrene dihydrochloride, just as pinene yields a hydrochloride from which camphene is obtained when the hydrogen chloride is removed.

Camphor; Determination of ——. H. C. Fuller. J. Ind. Eng. Chem., 1911, 3, 791—792.

The determination of camphor by means of hydroxylamine (see Nelson, this J., 1911, 1086) can be applied directly to spirits of camphor.—A. S.

Hydroaromatic compounds; Hydrogenation of ——. V. Skworzow. J. prakt. Chem., 1911, 84, 422—424.

l-Menthone is quantitatively reduced to a mixture of solid (α_D=+37·87) and liquid (α_D=+16) menthols by dissolving it in 10 times its quantity of methyl or ethyl alcohol and treating the solution with more than twice the theoretical quantity of sodium in an autoclave. The mixture becomes heated during the reaction to 70°—80° C., and the maximum pressure is 30—40 atmospheres. A minute amount of copper, dissolved from the apparatus, appears to act as a catalyst, as the results in glass were not so good. Similarly pulegone yields a mixture of solid and liquid *l*-menthols boiling at 212° C.—J. C. C.

Violet perfume; Artificial ——. Chem. and Drug., 1911, 79, 34.

Of recent years there has been a growing tendency to recognise the value of the higher aldehydes of the acetic series in synthetic perfumery, and several of the best known artificial orange and rose perfumes contain traces of these aldehydes. Nonyl aldehyde finds employment in the manufacture of perfumes of the following type: Cyclamen, muguet, lilac, and artificial rose; octyl aldehyde in jasmine, jonquil, hyacinth, and narcissus. Quite recently, however, the leading French perfumers have turned their attention to duodecyl aldehyde, and its use appears necessary if the finest artificial violet perfumes are to result. According to the most recent reports from French perfumers, the addition of from 5 to 10 per cent. of this aldehyde to any of the bodies of the ionone type produces a bouquet infinitely superior to that of simple ionone.

Ether making plant; Destruction of —— by stray electric currents. I. L. C. Eckelt. Chem.-Zeit., 1911, **35**, 1131.

The destruction of some ether plants, after only 36 hours working, was found to be owing to the electrolysis of the lead and iron heating- and condensing-tubes, caused by leakages of current from a defective electrical installation. A fatal explosion in the manufacture of collodion from guncotton is attributed to a spark caused by a similar leakage of current.—A. Sbld.

Benzoic acid; Determination of ——. E. Remy. Apoth.-Zeit., 1911, **26**, 835—836.

Benzoic acid may be determined by an iodometric method. The acid (0·05 to 0·5 grm.) is dissolved in 30 c.c. of 50 per cent. alcohol. Aqueous solutions of potassium iodide and potassium iodate are prepared, and equal volumes of each (5—10 c.c.) added to the benzoic acid solution. The iodine set free is titrated with thiosulphate. One molecule of benzoic acid is equivalent to one atom of iodine.—F. Shdn.

Hydrocyanic acid and benzaldehyde; Investigation of solutions of ——, and cherry-laurel water. P. H. Wirth. Pharm. Weekblad, 1911, **48**, 1049—1059, 1065—1078. Chem. Zentr., 1911, **2**, 1131—1132.

The dissociation of benzaldehydecyanhydrin in aqueous solution is a reversible reaction:

$$C_6H_5{\cdot}CH(OH){\cdot}CN \rightleftarrows C_6H_5{\cdot}CHO + HCN,$$

and the same condition of equilibrium is obtained whether starting from the cyanhydrin or from its components. The degree of dissociation increases with the dilution of the solution, and at constant concentration increases with rising temperature. Hydroxyl ions increase and hydrogen ions diminish the velocity of dissociation; in presence of alkali, the degree of dissociation also is increased. With tolerably high concentrations of alkali, equilibrium is attained practically instantaneously. With high concentrations of acid, on the other hand, the velocity of dissociation is diminished so greatly that the reaction practically ceases.

In the preparation of bitter almond water or cherry laurel water by distillation, the distillate contains at first benzaldehyde and hydrocyanic acid, and the final condition of equilibrium is attained the more slowly or quickly according to whether the solution is more or less strongly acid.—A. S.

Formaldehyde; Note on the assay of ——. E. Elvove. Amer. J. Pharm., 1911, **83**, 455—471.

The amount of formaldehyde in strong commercial solutions of about 37 per cent. strength can be determined by means of a solution of potassium cyanide instead of hydrogen peroxide. Half a c.c. of the sample is weighed into a stoppered conical flask of about 150 c.c. capacity, and 100 c.c. of a standard solution of potassium cyanide (approximately $N/10$) are added. The whole is well mixed and added to a mixture of 40 c.c. of $N/10$ silver nitrate and 10 c.c. of 10 per cent. nitric acid in a 200 c.c. measuring flask. The smaller flask is washed into the measuring flask, which is then filled up. After shaking, 100 c.c. are filtered off and the excess of silver titrated by means of $N/10$ thiocyanate solution. The volume of thiocyanate solution used is doubled and subtracted from 40, giving the equivalent of uncombined potassium cyanide in c.c. of $N/10$ silver nitrate. This is subtracted from the corresponding equivalent of the total potassium cyanide added, and the difference multiplied by 0·003, gives the weight of formaldehyde in the sample.—F. Shdn.

Paper pulp from eucalyptus. See V.

Patents.

Alkaloidal extracts; Process for preparing ——. F. W. Frank. Ger. Pat. 237,756, May 15, 1910.

Crude alkaloidal drugs, ground or unground, are saturated with water or steam and then treated with a solvent which is definitely, though slightly soluble in water; paraldehyde may be used as the solvent. In this process, a saturated aqueous solution of the solvent is formed around the particles under treatment, and in this the sugar and similar water-soluble matters are less soluble, and the alkaloid is generally more soluble than in water. —T. F. B.

Monoguaiacolphosphoric acid; Process for preparing the mono- and disodium salts of ——. Chem. Fabr. Gedeon Richter. Ger. Pat. 237,781, Sept. 26, 1909.

The crude product of the action of phosphorus oxychloride on guaiacol is decomposed by means of water, and the resulting solution of guaiacolphosphoric acid and hydrochloric acid is treated with a quantity of sodium carbonate sufficient only to form, in addition to sodium chloride, the acid sodium salt of guaiacolphosphoric acid which, being practically insoluble in the sodium chloride solution, separates in a crystalline form; it can now be purified by crystallisation from methyl alcohol, and then converted into the disodium salt by treatment with the calculated quantity of sodium carbonate.—T. F. B.

Carboxyalkylsalicylosalicylic acids; Process for preparing ——. A. Einhorn. Ger. Pat. 238,105, Dec. 25, 1908.

Salts of salicylic acid are treated, in the cold, with chlorocarbonic acid alkyl esters, with or without addition of water or organic solvents (excepting anhydrous alcohols and pyridine or analogous tertiary bases), and the mixture is allowed to stand for a long time at the ordinary temperature. The products of the reaction contain the desired carboxyalkylsalicylosalicylic acids,

$$\text{AlkylO}{\cdot}CO{\cdot}O{\cdot}C_6H_4{\cdot}CO{\cdot}O{\cdot}C_6H_4{\cdot}COOH.$$

—T. F. B.

Mono- or dichlorohydrins; Process for preparing ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 238,341, March 18, 1908.

Mono- or dichlor-hydrins are readily obtained by treating glycerin with dry hydrochloric acid gas, in presence of esters of inorganic or organic acids.—T. F. B.

Sulphocyanic [thiocyanic] acid compounds [with proteins]; Production of ——. J. Nerking, Düsseldorf, Germany. Eng. Pat. 13,934, June 12, 1911.

A finely powdered thiocyanate is ground up with powdered albumin (animal or vegetable), gelatin, or casein; a solvent such as water or alcohol, may be added, or either or both of the components may be used in the form of solutions. Proteins insoluble in water may be dissolved in alkaline solutions. When solutions are used, the reaction products may be separated by evaporating *in vacuo* or by precipitation with alcohol. The products obtained are gum-like or rubber-like substances containing thiocyanic acid. They are insoluble or sparingly soluble in water and alcohol; the soluble part is coagulated by boiling or by addition of strong acids; the insoluble part only swells with water. The products are non-poisonous and hence are suitable for medicinal use.—A. S.

Nitrophenylnitromethanes, their homologues and derivatives; Manufacture of ——. Soc. Chim. des Usines du Rhône, ancien Gilliard, P. Monnet et Cartier, Paris. Eng. Pat. 17,985, Aug. 8, 1911. Under Int. Conv., April 27, 1911. Addition to Eng. Pat. 6077 of 1911, dated March 12, 1910.

In carrying out the process described in the main patent (see Fr. Pat. 426,635 of 1911; this J., 1911, 981), it is advantageous to use the nitric acid in the form of vapour; in this form even the strongest acid acts on nitrotoluenes without substantial nitration occurring in the nucleus, whilst with acids of lower concentrations (*e.g.*, 70 per cent.) the necessary temperature may be maintained without external heating. *Example:* 1000 kilos. of 100 per cent. nitric acid are passed, in the form of vapour, through

2000 kilos. of o-nitrotoluene heated to 140° C., the temperature being maintained at 130°—140° C.; 400 to 500 kilos. of o-nitrophenylnitromethane are obtained.—T. F. B.

Bacterial products. W. Schultz, Charlottenburg, Germany. U.S. Pats. 1,005,076 and 1,005,077, Oct. 3, 1911.

See Ger. Pats. 223,561 and 224,396; this J., 1910, 977 and 1037.—T. F. B.

Acid albuminate; Method of producing ——. E. Nussbaum, Vienna. U.S. Pat. 1,005,456, Oct. 10, 1911.

See Fr. Pat. 379,689 of 1907; this J., 1907, 1251.—T.F.B.

Di-iodo fatty acids of high molecular weight; Production of alkyl esters of ——. Soc. pour l'Ind. Chimique à Bâle. Fr. Pat. 430,404, Aug. 8, 1910.

See Eng. Pat. 19,350 of 1910; this J., 1911, 239.—T. F. B.

Use of geraniol as a disinfectant. Fr. Pat. 429.308. *See* XIXb.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Photographic sensitive surfaces. O. Fulton, London. Eng. Pat. 22,426, Sept. 27, 1910.

Photographic emulsions, which may be applied to any surface, are prepared in paste or paint form with the addition of kaolin or a preparation of kaolin. The kaolin is preferably mixed with the component which does not contain the soluble silver salt (*viz.*, the solution containing alkali halide and gelatin), which is then mixed with the silver solution; the whole may be reduced to a dry condition, to be subsequently converted into a paste by the addition of water.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Gases caused by blasting in mines; Report on investigations into the composition of ——. (Corrigenda et addenda). E. A. Mann, Chief Inspector of Explosives in Western Australia. (See this J., 1911, 447.)

Some of the figures given for the nitrogen content of collodion cotton in the original report have been found to be incorrect, and the amended results show that in seven collodion cottons examined, the nitrogen content varied from 11·27 to 12·16 per cent. This correction necessitates alterations in the calculations for oxygen balance in the various explosives. In twenty samples of various brands of gelignite, gelatin dynamite and blasting gelatin, three were found to be theoretically underoxidised, the greatest deficiency being 1·47 per cent. of oxygen. In those which were theoretically overoxidised, the highest excess of oxygen was 6·13 per cent. When the paper wrappers were taken into account in the calculations, eleven of the explosives were found to be underoxidised, the greatest deficiency being 3·63 per cent. Determinations of the velocity of detonation were made, the lowest figure obtained being 1708 metres per second for one of the gelignites and 4100 metres per second for one of the blasting gelatins. The view is advanced that in gelatimised nitroglycerin explosives containing collodion cotton, sensitiveness to detonation is due to free nitroglycerin distributed throughout the mass of the explosive, in intimate contact with the main mass of colloidal mixture of collodion cotton and nitroglycerin. It is considered possible that this nitroglycerin is very slowly absorbed into the mass of the colloid, and there exerts its power of solution upon particles of collodion cotton not completely dissolved, and that when this absorption takes place the explosive becomes less plastic and less sensitive. The general experience in Western Australia is that an explosive which, on landing from Europe, is soft and plastic will, after a lengthy storage in the magazine, become stiff and more rigid to touch, whilst the common experience is that such explosives explode only under excessive stimulus, and are very apt to leave unexploded portions in the bottoms of the bore-holes in mines. These facts, in the author's opinion, would indicate that an explosive which, brought direct from the factory, contains a certain proportion of free nitroglycerin and is therefore quick and sensitive, becomes inert on storage. When an increase in inertness takes place it is further often accompanied by fall of heat test and it is suggested as an explanation of this that an extended solution of collodion cotton due to the further absorption of nitroglycerin liberates small quantities of acids from the fibres of the collodion cotton which have not been extracted by washing in the factory. The heat tests immediately after manufacture are higher than those obtained when the explosive is landed in Australia, and although the voyage through the tropics has been advanced as a possible explanation of this, no physical change has been given as a possible key to the series of phenomena observed.
—G. W. McD.

Early matches; Characteristics and chemical composition of some ——. E. G. Clayton. Chem. Soc. Proc., 1911 27, 229.

Methyl chloride and air; Inflammability of mixtures of ——. Saposchnikoff. *See* I.

Patents.

Explosives. C. F. G. Van Pittius, Amsterdam, Holland. Eng. Pat. 25,274, Oct. 31, 1910.

Di- or tri-nitroglycerin (10 parts) is dissolved in liquid trinitrotoluene (50 parts). Solid trinitrotoluene (38 parts is then added and thoroughly incorporated. Acetylcellulose and collodion cotton (2 parts) are added and incorporated at the ordinary temperature. The resulting jelly (40 parts) is mixed with either ammonium or potassium perchlorate (60 parts), or the jelly (30 parts) is mixed with ammonium nitrate (35 parts) and ammonium perchlorate (35 parts).—G. W. McD.

Blasting charges or cartridges, and the like; Fume destroying composition for use with ——. S. W. Young, Palo Alto, California. Eng. Pat. 11,495, May 12, 1911.

Ammonium carbonate (2 parts) is mixed with one part of either bleaching powder, manganese dioxide, potassium chlorate, potassium permanganate, or potassium bichromate. This mixture is loaded into the bore-hole with the cartridge.—G. W. McD.

Erosion in guns; Method of minimising —— and preventing flare-back. H. Maxim, Hopatcong, N.J. U.S. Pat. 1,005,052, Oct. 3, 1911.

The explosive is burnt in the gun in the presence of a non-explosive material in the form of indurated uniform grains, containing oxalic acid, which absorb heat as the combustion of the explosive proceeds and produce non-combustible gases which prevent flare-back.—G. W. McD.

Explosive. J. G. Nathurst, Kingston, N.Y. U.S. Pat. 1,005,739, Oct. 10, 1911.

To a mixture of nitroglycerin, nitrocellulose and a metallic oxidising agent (94 parts) is added nitrated dextrin containing 12·75 parts of nitrogen (6 parts).—G. W. McD.

Guncotton; Process for increasing the solubility of —— in its various solvents. T. Chandelon. Fr. Pat. 429,750 May 16, 1911. Under Int. Conv., May 17, 1910.

The process consists in subjecting guncotton to the combined action of heat and pressure in presence of "an acid." The guncotton, on being removed from the nitrating bath, is freed from the excess of acid, and is then agitated with so much water that the concentration of the acid solution

reaches from 1·5 to 3 per cent. If necessary more acid may be added to bring this about. After some time the mass is drained and introduced into an autoclave where it is heated at a temperature varying from 103° C. to 140° C. (according to the degree of solubility it is required to produce), and at the corresponding pressures, viz., 1·1 to 3·5 atmospheres for from half-an-hour to 3 hours. The product is washed quite free from acid in hot or cold water, and the after-manipulation follows in the usual way.
—E. W. L.

Explosions; Composition for destroying gases and smoke resulting from ——. Globe Chemical Works. Fr. Pat. 429,922, May 18, 1911.

See Eng. Pat. 11,495 of 1911; preceding.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Potassium; its qualitative detection as the cobaltinitrite. L. T. Bowser. J. Amer. Chem. Soc., 1911, **33**, 1566—1569.

Potassium may be detected in dilute solutions by means of the following test: 5 c.c. of the solution are placed in a tall beaker of 50 or 100 c.c. capacity, which is put on a mirror. Another beaker of the same size containing 5 c.c. of pure water, is also put on the mirror. To each are added 2·5 c.c. of sodium cobaltinitrite reagent (this J., 1910, 1218) and 5 c.c. of 95 per cent. alcohol. Each beaker is then viewed so that the image of the observer becomes visible. If the test solution shows a dimmer image than the blank, potassium is present in quantity amounting to two or more parts per million. Ammonium salts must be absent, but other metallic salts do not interfere with this test. The solution must be neutral or acid with acetic acid.—F. Shdn.

Barium, strontium, calcium and lead; Qualitative detection of ——. P. E. Browning and P. L. Blumenthal. Amer. J. Sci., 1911, **32**, 246—248.

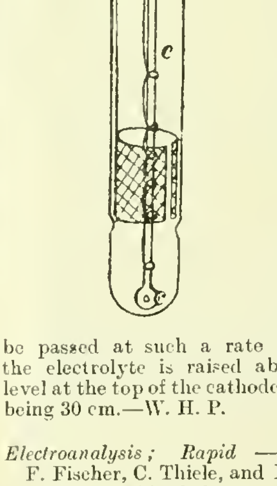
Elements which form insoluble sulphates, more especially barium and strontium, may be detected before group precipitation in the ordinary course of qualitative analysis. The following method is suggested:—About 10 c.c. of a solution which may contain mercury in the mercurous condition, silver, lead, barium, strontium and calcium, besides other elements, is treated with hydrochloric acid in faint excess and the precipitated chlorides are filtered off. To the filtrate are added about 5 grms. of ammonium acetate and a 10 per cent. solution of ammonium sulphate until precipitation is complete. After gentle warming, the alkaline-earth sulphates are filtered off and washed with a saturated solution of ammonium acetate until the washings give no test for lead by hydrogen sulphide. To the precipitated sulphates on the paper a small amount of pure sugar carbon is added, the paper is rolled up, and the mass heated to full redness for a few minutes with exclusion of air. The fused mass is treated with about 5 c.c. of 50 per cent. acetic acid and warmed, when, if the alkaline-earth elements are present, an odour of hydrogen sulphide will generally be evident. The extract is thrown on a filter and the residue washed with about 5 c.c. of water. The filtrate containing acid and water is tested for barium with a few drops of potassium chromate solution. The barium chromate is removed by filtration, and the filtrate boiled with sodium carbonate to precipitate strontium and calcium as the carbonates. If the precipitate of the carbonates be very small, it may be dissolved in hydrochloric acid and tested spectroscopically. If, however, it be not too minute in quantity, it should be dissolved in nitric acid after careful washing, and the strontium and calcium separated by "dehydration with amyl alcohol."—R. C. P.

Calcium; Determination of —— in presence of magnesium and phosphates. F. H. McCrudden. J. Biol. Chem., 1911, **10**, 187—199.

The method already given (see this J., 1910, 170) may be modified in the following respects without loss of accuracy. The original solution should be brought to a volume of 75—150 c.c. Ten drops of concentrated hydrochloric acid (sp. gr. 1·20) may be used instead of 10 c.c. of $N/2$ acid. If the solution be shaken for ten minutes after addition of the oxalic acid, boiling may be omitted, and a similar shaking, after the addition of the ammonium oxalate and sodium acetate, may be substituted for standing the liquid over night. The precipitate of calcium oxalate is collected on a small ash-free filter paper and washed free from chlorides with a 0·5 per cent. solution of ammonium oxalate. It may then be determined gravimetrically as already described, or volumetrically as follows: The filter is filled three times, to the extent of about 2/3, with cold distilled water, each washing being allowed to drain through completely before adding the next. The paper is then punctured and the precipitate washed through into a flask; the liquid is made up to about 50 c.c., and after addition of 10 c.c. of concentrated sulphuric acid, is titrated with standard permanganate solution. When analysing the ash of fæces the calcium oxalate precipitate is obtained in a more granular condition if 15 c.c. of sodium acetate solution, instead of 8 c.c., are added to the liquid. The determination of magnesium in the filtrate from the calcium oxalate may be carried out as already described (*loc. cit.*), or the filtrate may, after addition of nitric acid, be evaporated to dryness, and the residue heated over a free flame until the ammonium salts are decomposed and fusion occurs. After cooling, the residue is taken up with dilute hydrochloric acid and the magnesium precipitated as usual. Another method of destroying the organic matter is to add 3—5 c.c. of concentrated sulphuric acid to the filtrate, and evaporate in a small Kjeldahl flask until the water is removed, the acid being subsequently neutralised with ammonium carbonate and the magnesium precipitated.—J. H. L.

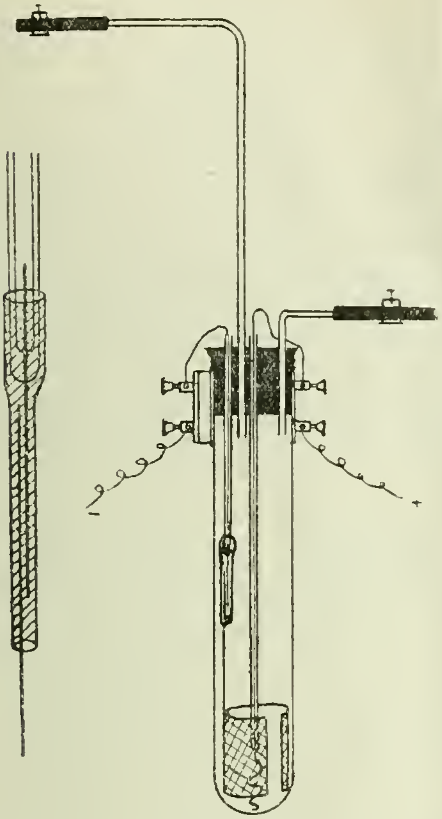
Electroanalysis; Rapid —— with agitation [of the electrolyte] by bubbles of gas. F. Fischer, C. Thiele, and E. Stecher. Z. Elektrochem., 1911, **17**, 905—906.

The authors have devised the apparatus illustrated in the figure, in which electroanalysis can be rapidly carried out if the electrolyte is agitated by a stream of gas bubbles passed rapidly through it from a high-pressure cylinder. The gas must usually be hydrogen when the deposit is metallic, although carbon dioxide may be used for acid electrolytes. Air may only be used when the deposit is a peroxide. The two left hand terminals are insulated from the metal collar, *a*, but are connected with each other, forming a connection with the cathode which is of platinum gauze. The anode of platinum wire runs from the upper right hand terminal and is coiled round the tube, *c*, which serves to introduce the gas. The funnel at the mouth prevents loss by spraying, and if the electrolyte is kept at the usual temperature of 60° C., the condensed water will wash back the spray into the solution. The gas should be passed at such a rate that the upper surface of the electrolyte is raised about 5 cm. from its original level at the top of the cathode, the total length of the vessel being 30 cm.—W. H. P.



Electroanalysis; Rapid —— under reduced pressure. F. Fischer, C. Thiele, and E. Stecher. Z. Elektrochem., 1911, **17**, 906—908.

The apparatus described in the preceding abstract can be so modified that the gases and water vapour given off during the electrolysis may be used to agitate the electrolyte. To accomplish this the size of the escaping bubbles is increased by working under reduced pressure as shown



in the figure. The left hand tube is connected with an ordinary water pump, while the right hand one is closed by a screw clip. The cathode connection is made as shown in the large scale diagram. The wire conveying the current is sealed into the bottom of the glass tube, and over it is slipped a piece of rubber tubing of very small bore; the stem of the gauze cathode is then pushed up inside the rubber tubing. When the electrolysis is concluded, the pump tube is pushed to the bottom of the vessel, and the right hand tube is connected with a wash bottle of distilled water. On opening the screw clip the electrolyte is removed and the deposit washed without interruption of the current. —W. H. P.

Magnesium; Determination of —— as oxide. O. Kallauner. Chem.-Zeit., 1911, **35**, 1165—1166.

The determination of magnesium by ignition of the chloride to oxide is subject to error in that decomposition is never quite complete. Results, sufficiently accurate for technical purposes, may be obtained, however, by prolonged heating at a fairly high temperature (500°—550° C. does not suffice), or by repeated evaporation of the magnesium chloride solution with mercuric oxide, followed by ignition first at a moderate temperature and then more strongly.—L. E.

Iron: Quantitative separation of —— from manganese. J. A. Sanchez. Bull. Soc. Chim., 1911, **9**, 880—881.

Pyridine is added to a slightly acid solution of the ferric and manganous salts until no further precipitation takes place, the mixture is then boiled for 10 min. and filtered. The precipitated ferric hydroxide is washed with a hot saturated aqueous solution of pyridine and then with boiling water. Precipitation of the iron is complete, whilst all the manganese remains in solution. With relatively large quantities of manganese, however, it is advisable to dissolve the precipitate in hydrochloric acid and re-precipitate. Metals precipitated by hydrogen sulphide from acid solutions should preferably be first removed. If zinc be present the ferric hydroxide must be dissolved and re-precipitated with ammonium chloride and ammonia.—A. Sbld.

Edison accumulator; Application of the —— in electroanalysis. [*Determination of silver and its separation from other metals.*] O. Brunck. Z. angew. Chem., 1911, **24**, 1993—1997.

The simple method of Foerster (this J., 1906, 1007) for the quantitative electro-deposition of copper from copper sulphate solutions, depends on the use of a single lead accumulator, the voltage of which (2·05), though sufficiently high to decompose the copper sulphate, is too low for most other sulphates and does not lead to a pulverulent deposit of the metal. If a single Edison accumulator be used, with a maximum voltage of about 1·37, copper (which requires 1·49) cannot be deposited, but the nobler metals, silver, mercury, the platinum metals, etc., may easily be separated from sulphuric acid solutions. The process is specially suitable for the estimation of silver, and its separation from copper, lead, arsenic, and antimony. No resistance or ammeter will usually be necessary, since after the removal of the silver the current will cease. The quantity of water required to wash the deposit is much less than in ordinary electroanalysis, since the washing need not be carried out when the current is passing. The electrolyte is best kept at about 80° C., and at this temperature it is easy to deposit a reasonable quantity of silver in a few hours. The only inconvenience of the method is caused by the low solubility of silver sulphate. In the presence of dilute sulphuric acid, however, the solubility is sufficient to prevent the volume of the electrolyte from becoming too unwieldy. The use of dilute solutions is necessary also, because with too great a conductivity there results a high cathode current density which causes a loose deposit. If the current density is more than 0·2 amp. per sq. dm., it is necessary in the early stages of the electrolysis to introduce a little resistance to reduce its value. If an Edison accumulator is not available, a dry cell of convenient E.M.F. may be used.—W. H. P.

Determining carbon and nitrogen in organic compounds. E. P. Frankland. Chem. Soc. Proc., 1911, **27**, 207.

The Frankland-Armstrong vacuum combustion process (J. Chem. Soc., 1868, **21**, 77) can be adapted for the estimation of carbon and nitrogen in organic compounds. The gases (carbon dioxide and nitrogen) evolved during the combustion of a known weight of substance, generally 0·1 grm. or less, are collected, and measured over mercury in a graduated vessel; the carbon dioxide is then absorbed with aqueous potassium hydroxide, and the residual nitrogen transferred to a narrower graduated tube and measured over water. The process can be carried out in less time than is required by the ordinary carbon-hydrogen combustion method, and the figures obtained both for nitrogen and carbon in a variety of organic compounds are in good agreement with theory. The presence of bromine in the molecule, even up to 80 per cent., has not been found to affect the accuracy of the results, hence this method appears to be of especial advantage in connection with organic substances containing both nitrogen and halogen.

Determination of sulphur in petroleum. Lohmann. *See* IIa.

Distillation of coal and a new method of analysis. Strache. *See* IIb.

Cobalt reaction for the detection of small quantities of hydrogen peroxide. Leuchter. *See* VII.

Specifications for lime. *See* IX.

Determination of gold and silver in copper. Kern and Heimrod. *See* X.

Some compounds of titanium. [*Detection of gold with titanium trichloride*]. Stähler and Bachran. *See* X.

Determination of free fatty acids in presence of alkali- and alkaline-earth soaps. Holde and Marcusson. *See* XII.

Determination of rosin in fats. Fahrion. *See* XII.

Saponification of wax in sterilising apparatus. Wichmann. *See* XII.

Determination of total sulphur in indiarubber. Waters and Tuttle. *See* XIV.

Analysis of tannins. Levi and Orthmann. *See* XV.

Detection, determination, and occurrence of nitrous oxide in fermentation gases. Formation of oxides of nitrogen in denitrification. Suzuki. *See* XVI.

Detection of invert sugar in honey. Feder. *See* XVII.

Determination of protein in wort and beer. Wüst. *See* XVIII.

[*Detection of adulteration of*] *cider vinegar.* Mott. *See* XVIII.

Handling, transportation, and storage of perishable foodstuffs. III. Select methods of analysis. Hepburn. *See* XIXa.

Determination of benzoic acid [*in condiments, etc.*]. Folin and Flanders. *See* XIXa.

Determination of codeine in opium. Andrews. *See* XX.

Determination of morphine by extraction with phenylethyl alcohol. Thorburn. *See* XX.

Test for β-chloromorphide in apomorphine hydrochloride. Schneider. *See* XX.

Behaviour of alkaloids towards quinone and chloral hydrate. Schaer. *See* XX.

Determination of camphor. Fuller. *See* XX.

Determination of benzoic acid. Remy. *See* XX.

Assay of formaldehyde. Elvove. *See* XX.

Patent.

Automatic gas-analysis recorders and the like instruments; Rotary pumping apparatus for ensuring a regular or steady flow to ——. D. H. Simpson. Leeds. Eng. Pat. 468, Jan. 7, 1911.

The flow of gas to the apparatus is controlled by a pumping drum driven at a regular speed, the drum being enclosed by a casing to the upper part of which the gas-discharge pipe of the recorder is connected. The arrangement resembles that of a wet gas-meter; but whereas in the latter the rate of rotation of the chambered drum is determined by the incoming gas, in the former a regular supply of gas is ensured by rotating the drum at a fixed rate.—W. E. F. P.

XXIV.—MISCELLANEOUS ABSTRACTS.

Condensation of vapours. F. Becker. Z. physik. Chem., 1911, **78**, 39—70.

The author has investigated the effect of cooling saturated vapours by adiabatic expansion, under such conditions that the solid substance is the stable phase on condensation. In the case of benzophenone and o-nitrophenol, which readily form supercooled liquids, the primary product on condensation is the liquid, while in the case of camphor, borneol, and isoborneol (which are not readily supercooled), the first product of condensation is the crystalline solid. The experiments were carried out in a dustless atmosphere and in each case the minimum rarefaction necessary to produce any condensation at all was noted, together with the relation between the rarefaction required and the temperature. When the substance condensed to a liquid, it was found that the necessary rarefaction decreased with rising temperature, while the effect was reversed for those substances which condensed to form a solid. From this it is deduced that a supersaturated vapour condenses to a liquid more easily when it is more dense, and to a crystalline solid less easily when it is more dense. From the rarefaction required for condensation it is possible to calculate the degree of supercooling of the vapour, and if the vapour pressure of the substance is known, its partial pressure may also be calculated. From these may be drawn a curve similar to a vapour pressure curve which will show the extent of supercooling possible with a given pressure of the vapour, and the amount by which the saturation pressure may be exceeded at a given temperature, before condensation takes place. Iodine forms a peculiar special case in the author's experiments. When the adiabatic expansion is considerable, crystals are formed on cooling, but when it is only slight, the vapour is momentarily decolourised, and there is an intermediate stage caused by the formation of invisible particles which cannot be identified as solid or liquid. The degree of supercooling necessary to condense a vapour under given conditions is the same whether the condensation takes place in the interior of the gaseous phase or on a smooth glass surface. In the condensation of water vapour in contact with supercooled water at temperatures down to —4° C., the author has never observed the separation of solid particles, even when rarefaction has been carried to 400 mm.—W. H. P.

Trade Report.

German chemical industry. Chem. Tr. J., Oct. 21, 1911.

To the Verein zur Wahrung der Interessen der Chemischen Industrie Deutschlands, assembled in annual meeting at Stuttgart last month, Dr. Horney presented a report on the present position of German chemical industry. The exports of chemical products were valued last year at 690 million marks, against 612 million marks in the preceding year, and the internal consumption also showed a marked increase. In spite of this, profits do not show any great increase. A study of the profit-and-loss accounts of 179 companies with an aggregate share capital of 665 million marks, 158 millions debentures, etc., and 213 millions reserves, shows an average profit of 9·51 per cent. on the capital involved, against 9·35 per cent. in the preceding year. This increase is very unevenly divided, and less than a third of the companies share in it. The artificial silk industry, mineral colour industry, and match industry had a less profitable year than the preceding one, and no fewer than 41 companies were unable to show any profit at all. But since trade was above normal in 1909, Dr. Horney sets out the relation of profits to capital involved for twelve years, taking that of 1899 as standard, and calling it 100. There was a big drop in

1900 to 91·2, and a continuous fall to 87·8 in 1902, followed by a steady recovery, culminating in 1907 with 114·3, after which came the slump of 1908 (97), since when there has been a gradual recovery to 103·3.

Books Received.

Abhandlungen über Dialyse (Kolloide). Drei Abhandlungen von Th. Graham. Herausgegeben von E. Jordis. Verlag von Wilhelm Engelmann. Leipzig. 1911. Price M. 3.

Small volume, containing 179 pages of subject matter with six illustrations. Three articles by Graham, taken from the Philosophical Transactions for 1861, the Journal of the Chemical Society for 1864, and the Philosoph. Trans. for 1866 respectively, and dealing with the following subjects :—I. Use of the diffusion of liquids in analysis. II. The properties of silicic acid and other analogous colloid substances. III. On the absorption and dialytical separation of gases by means of colloid diaphragms. A short biography of Graham with a list of his researches, etc., follows, and from page 147—179 is a series of notes, remarks and references.

Collective Index of the Journal of the Institute of Brewing, Including the Transactions of the Laboratory Club, 1887—1890; Institute of Brewing, 1890—1894; North of England Institute of Technical Brewing, 1891—1894; Yorkshire Institute of Brewing, 1893—1894; and the Midland Counties Institute of Brewing, 1894; together with the Journal of the Federated Institutes of Brewing, 1895—1903 (Vols. I. to IX); and the Journal of the Institute of Brewing, 1894—1910 (Vols. X. to XVI.—Vols. I. to VII. New Series), 1887—1910. Compiled by William H. Bird. Harrison and Sons. 45, Pall Mall, London. 1911. Price 10s. 6d.

8vo. volume, containing 550 pages of subject matter, made up of Part I., containing 130 pages, devoted to an alphabetical index of names; Part II., containing pages 131—542, Index of subjects; Part III., 543—545, Index of general matter, and Part IV. (pages 546 to 550), List of journals from which abstracts have been taken. It forms "an exhaustive book of reference to scientific work carried out in connection with the Fermentation Industries in all parts of the world."

Kompendium der Färberei-Chemie auf wissenschaftlicher und praktischer Grundlage. Für Studierende und Industrielle. Von Prof. Antonio Sansone. Uebersetzung des Verfassers aus dem Italienischen, unter Mitwirkung von Fachmännern revidiert, ergänzt und erweitert. A. Hartleben's Verlag. Wien und Leipzig. 1912. Price M. 14.

Large 8vo volume, containing 326 pages of subject matter, with 53 illustrations, followed by an alphabetical index of subjects, and 14 sheets of dyed specimens. The text is subdivided as follows :—I. Introduction, more or less historical. II. Textile fibres. III. Materials and Chemical products employed. IV. Dyestuffs. V. Preparation of textile fibres and materials. VI. Use of the dyestuffs. VII. Testing of the condition of preparation of the goods before dyeing. VIII. Theories of dyeing and colouring. IX. The Mechanical Appliances, Machinery and Apparatus. X. General explanation of the tables of dyed samples, etc. XI. International atomic weights and tables.

Subject List of Works on Chemical Technology (including Oils, Fats, Soaps, Candles, and Perfumery; Paints, Varnishes, Gums, Resins, Indiarubber; Paper and Leather Industries) in the Library of the Patent Office. [Patent Office Library. Subject Lists. New Series, YN—ZB.] Published at the Patent Office, 25, Southampton Buildings, London, W.C. Price 6d.

Fifty-Fourth Report of the Commissioners of His Majesty's Inland Revenue, being for the year ended 31st March, 1911. [Cd. 5,833.] Wyman and Sons, Fetter Lane, E.C. Price 1s. 6d.

Second Report of the Commissioners of His Majesty's Customs and Excise (for the year ended 31st March, 1911), being the 55th Report relating to the Customs and the 54th Report relating to the Excise. [Cd. 5,827.] Wyman and Sons, Fetter Lane, E.C. Price 9½d.

East India (Trade). Review of the Trade of India in 1910–11. [Cd. 5909.] Wyman and Sons, Fetter Lane, E.C. Price 1s. 1d.

This is the annual report on the foreign trade of British India for the year ended 31st March, 1911, which has been already issued as an Indian Government publication (see this J., 1911, 1141), and has now been republished in this country.

*New Books.

Adressbuch des Deutschen Reiches f. Handel, Gewerbe u. Industrie. Hrsg. v. Carl Schulte. IV. Bd. Prov. Brandenburg, Stadtkreis Berlin, Grossherzogtümer Mecklenburg-Schwerin u. Mecklenburg-Strelitz, die Provv. Pommern, Posen, Schlesien, Ost- u. Westpreussen. Ausg. 1911. (XXXV, 1613 S.) Lex. 8°. Elberfeld, C. Schulte. 1911. Cloth M. 10.

Billiter, Dr. J. : Die elektrochemischen Verfahren der chemischen Gross-Industrie. Ihre Prinzipien u. ihre Ausführg. II. Bd. Elektrolysen m. unlösl. Anoden ohne Metallabscheidg. Mit 228 Fig. u. 53 Tab. im Text u. e. Anh. : Neuerungen der letzten Zeit auf dem Gesamtgebiete der techn. Elektrolyse wässr. Lösgn. (IX, 537 S. m. 9 Fig.) gr. 8° Halle, W. Knapp. 1911. M. 28.50.

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Helferich, B.: Synthese einiger neuen Glucoside. Berlin. 1911. 46 S. 8°.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding lists can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

Patent Specifications may be purchased at the Sale Branch of the Patent Office, Quality Court, Chancery Lane, London, W.C., fifteen days after the date on which acceptance of the complete specification is advertised. The price is 8d. each.

I.—GENERAL PLANT; MACHINERY.

Applications.

22,930. Lilienfeld. Separation of gaseous mixtures.* Oct. 17.

22,955. Candy and Candy. Filters. Oct. 18.

22,989. Lloyd. Retorts. Oct. 18.

23,099. Kean. *See under* X.

23,237. Roberts. Means for taking samples of powdered substances or liquids. Oct. 21.

23,267. Davey. Evarporators for making distilled water. Oct. 21.

23,431. Johnson. Furnaces, etc. Oct. 24.

23,561. Osborne. Desiccation of fluid substances. [U.S. Appl., Oct. 26, 1910.]* Oct. 25.

23,704. Mower and Hessling. Drying apparatus. Oct. 26.

23,813. Kirkham, Hulett, and Chandler, Ltd., and others. Apparatus for effecting intimate contact between liquids and gases. [Addition to No. 18,129 of 1908.] Oct. 27.

23,864. Fowler and Medley. Apparatus for treating gases and vapours with liquids. Oct. 28.

23,887. Fertilizers, Ltd. Tank for filtering sludge and carrying off the solids therefrom. Oct. 28.

Complete Specifications Accepted.

24,508 (1910). Hiltruper Terrazzo u. Cementwaarenwerke. *See under* IX.

28,004 (1910). Green and others. *See under* VII.

28,982 (1910). Bernhardt. Regenerative furnaces. Nov. 1.

459 (1911). Gilbert. Regulation of the air supply to rotary kilns. Nov. 1.

1123 (1911). Mueller. Arrangement of filling for cooling towers, etc. Nov. 1.

3364 (1911). Schwerin. Simultaneous separation and draining of vegetable, animal, or mineral substances. Oct. 25.

16,314 (1911). Haddan (Tucker's Crate and Barrel Co.). Barrels. Oct. 25.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

22,746. Holmes and Co., Ltd., and Howell. Process and apparatus for distilling bituminous materials. Oct. 16.

22,916. Hodder and Conover. Manufacture of coal and other briquettes. Oct. 17.

22,989. Lloyd. *See under* I.

23,017. Davicion. *See under* VII.

23,216. Cutler. Coke-producing apparatus. Oct. 20.

23,446. Laing. Apparatus for the destructive distillation of mineral oils, etc.* Oct. 24.

23,447. Fearon. Purifying or desulphurising hydrocarbon gases. Oct. 24.

23,448. Fearon. Retort for distilling shale, wood, etc. Oct. 24.

23,468. Wallbaum. Manufacture and use of emulsion products from asphalt, pitch, paraffin, montan wax, Japan wax, etc. Oct. 24.

23,562. Fabry. Horizontal or inclined regenerative coke ovens.* Oct. 25.

23,641. Wynne. Purification of paraffin or petroleum oils. Oct. 26.

23,696. Davidson. Purification of illuminating and coke-oven gas. Oct. 26.

23,879. Stuart-Walker. Gas generators or producers. Oct. 28.

Complete Specifications Accepted.

24,667 (1910). Richter und Richter. *See under* III.

24,684 (1910). Fleischer. Gas producers. Oct. 25.

25,254 (1910). Ross. Incandescent gas mantles. Nov. 1.

7640 (1911). Zschocke. Filters for separating suspended impurities from gas. Nov. 1.

8280 (1911). Pyzel. Sweating pans for sweating out from crude paraffin, etc., substances which melt at different temperatures. Nov. 1.

11,904 (1911). Muller. Manufacture of incandescent mantles. Oct. 25.

14,767 (1911). Kunze. Gas generators. Nov. 1.

III.—TAR AND TAR PRODUCTS.

Application.

23,468. Wallbaum. *See under* II.

Complete Specification Accepted.

24,667 (1910). Richter und Richter. Purification of liquid hydrocarbons and alcoholic liquids, and manufacture of carbon therefor. Oct. 25.

IV.—COLOURING MATTERS AND DYES.

Applications.

23,110. Imray (Meister, Lucius, und Brüning). Manufacture of vat dyestuffs of the anthraquinone series.* Oct. 19.

23,791. Newton (Bayer und Co.). Manufacture of a colouring matter suitable for the production of lakes. Oct. 27.

23,924. Newton (Bayer und Co.). Manufacture of leucoquinizarine. Oct. 28.

Complete Specifications Accepted.

24,652 (1910). Ransford (Cassella und Co.). Manufacture of 3.6-diaminoacridine and its derivatives. Oct. 25.

25,183 (1910). Ullmann. Manufacture of anthraquinone derivatives containing nitrogen. Nov. 1.

894 (1911). Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds and colouring matters of the anthracene series. Nov. 1.

2797 (1911). Newton (Bayer und Co.). Manufacture of tetratrisazo dyestuffs. Nov. 1.

13,304 (1911). Act.-Ges. f. Anilinfabr. Manufacture of monoazo dyestuffs for wool. Oct. 25.

15,809 (1911). Act.-Ges. f. Anilinfabr. Manufacture of vat dyestuffs of the anthraquinone series. Oct. 25.

22,067 (1911). Soc. pour l'Ind. Chimique à Bâle. Manufacture of vat dyestuffs. Nov. 1.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

22,962. Toone and Toone. Process for finishing paper, cardboard, pasteboard, etc. Oct. 18.

22,998. Von Hodenberg. Manufacture or treatment of pulp sheets or boards. Oct. 18.

23,024. Firmin and Jarrett. Treatment of sulphite or other pulp for card-making, etc. Oct. 18.

23,036. Schleu. Nitrocellulose solvent and method of obtaining nitrocellulose solutions.* Oct. 18.

23,632. Meister, Lucius, und Brüning. Manufacture of partly translucent paper. [Ger. Appl., Oct. 26, 1910.]* Oct. 25.

23,857. Boucherie. Preservation of textile fabrics and yarn, and rendering them impermeable and fireproof. [Fr. Appl., Nov. 24, 1910.]* Oct. 27.

Complete Specifications Accepted.

25,393 (1910). Stocks. Manufacture of pulp for paper-making and like purposes. Nov. 1.

1539 (1911). Meister, Lucius, und Brüning. Manufacture of effect papers. Oct. 25.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

22,915. Heilmann und Co., and Battegay. Production in printing and dyeing fabrics, of colours usually produced from β-naphthol. [Ger. Appl., Oct. 17, 1910.]* Oct 17.

23,166. Haas and Gebauer. Rollers for calenders, dyeing and mercerising machines, etc.* Oct. 20.

23,324. Ashton. Recovery of materials used as resists in printing on textile fabrics. Oct. 23.

23,857. Boucherie. *See under* V.

Complete Specifications Accepted.

24,841 (1910). Shaw and McGregor. Apparatus for use in bleaching and dye works. Oct. 25.

833 (1911). Melling. Apparatus for washing or other treatment of cloth in rope form. Nov. 1.

4595 (1911). Johnson (Badische Anilin und Soda Fabrik). Dyeing yarn with indanthrene colouring matters. Nov. 1.

6258 (1911). Meister, Lucius, und Brüning. Dyeing with certain vat dyestuffs. Oct. 25.

10,673 (1911). Ratignier and Pervilhac. Printing patterns on fabrics or tissues. Nov. 1.

16,557 (1911). Johnson and Newton. Rendering fabrics and the like non-inflammable. Oct. 25.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

22,736. Garroway. Production of sodium alum crystals. Oct. 16.

22,737. Garroway. Plant for concentrating sulphuric acid. Oct. 16.

23,017. Davicion. Recovery as sulphate of the ammonia in distillation gases.* Oct. 18.

23,190. Wolff. Manufacture of formates of chromium and aluminium.* Oct. 20.

23,226. Young. Manufacture of alkali cyanides. Oct. 21.

23,391. Justice (Henkel und Co.). Manufacture of readily soluble alkali silicates in powder form.* Oct. 23.

23,544. Serpek. Manufacture of aluminium nitride.* Oct. 25.

23,798. Fouquet, Pamart, and Cadiot. Manufacture of oxygen and hydrogen by dissociation of steam. Oct. 27.

23,869. Humphries. Apparatus for producing oxides of sulphur and sulphuric acid from sulphur. Oct. 28.

Complete Specifications Accepted.

24,501 (1910). Friedrich und Co., and Hirsch. Manufacture of sulphurous acid salts. Oct. 25.

28,004 (1910). Green, and Huncoat Plastic Brick and Terra Cotta Co. Gay Lussac, Glover, and like towers. Nov. 1.

9260 (1911). Ges. f. Linde's Eismaschinen. Separation of hydrogen from mixtures of gases. Oct. 25.

12,308 (1911). Kassner. Process for obtaining oxides of nitrogen. Nov. 1.

12,314 (1911). Sinding-Larsen. Binding and utilising atmospheric nitrogen. Nov. 1.

14,502 (1911). Thompson (Chem. Fabr. Gedeon Richter). Preparation of stable and solid hydrogen peroxide compounds. Oct. 25.

14,588 (1911). Guignard and Watrigant. Recovery of the hydrocyanic acid contained in certain gases. Nov. 1.

VIII.—GLASS; CERAMICS.

Applications.

22,830. Soc. Anon. des Faïenceries de Creil et Montereau, and Faugeron. Baking or firing porcelain and similar products. [Fr. Appl., Oct. 24, 1910.]* Oct. 16.

23,730. Hidoux and Bernheim. Process of welding ceramic material to metals and metallic substance [Fr. Appl., Nov. 4, 1910.]* Oct. 26.

Complete Specification Accepted.

6441 (1911). Royer. Furnaces or ovens for melting glass, metals, etc. Nov. 1.

IX.—BUILDING MATERIALS.

Applications.

22,793. Krojanker. Manufacture of oil capable of resisting low temperatures, especially for impregnating wood, etc. [Ger. Appl., Nov. 9, 1910.]* Oct. 16.

22,925. Katz. Method of making rigid bodies of gypsum cement, concrete, etc.* Oct. 17.

23,139. Monseur. Preservative for wood and other organic materials. [Bel. Appl., Nov. 5, 1910.]* Oct. 19.

Complete Specifications Accepted.

24,508 (1910). Hiltruper Terrazzo und Cementwaarenwerke. Lining shafts with concrete. Nov. 1.

25,142 (1910). Lowry. Manufacture of cement or plaster. Nov. 1.

26,574 (1910). Nicol. Apparatus for testing and recording the setting of cement, etc. Oct. 25.

27,807 (1910). Pennington. Cements. Nov. 1.

8468 (1911). Koenman. Preservation of wood. Nov. 1.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

22,755. Bingham. Production of ferro-silicon. Oct. 16.

22,778. Soc. Anon. Ital. G. A. Armstrong & Co. Case-hardening articles of iron, steel, and steel alloys. [Ital. Appl., Oct. 17, 1910.]* Oct. 16.

22,943. Thierry. Treatment of sulphide ores of zinc, etc.* Oct. 17.

22,982. Clark. Effecting the adherence of copper and its alloys to iron and steel articles.* Oct. 18.

22,030. Vautin. Recovery of metals from slags. Oct. 18.

22,038. Gayley. Sintering fine ore material. [U.S. Appl., June 8, 1911.]* Oct. 18.

22,099. Kean. Apparatus for filtering, drying, or liquid treatment of pulps, slimes, etc., in metallurgical operations. Oct. 19.

23,117. Hoveler. Smelting metals, particularly the production of tin from ores. [Ger. Appl., Oct. 19, 1910.]* Oct. 19.

23,178. Bingham. Production of ferro-manganese-silicon and ferro-silicon. Oct. 20.

23,279. Cappel. Extraction of metals from ores, speiss, metallic residues, etc.* Oct. 21.

23,367. Von Olszewski. Tin-oxidising furnaces. Oct. 23.

23,526. Wilmot. Manufacture of steel.* Oct. 24.

23,716. Penner. Coating iron with other metals. [Ger. Appl., Oct. 26, 1910.]* Oct. 26.

23,861. Herrmann and Otto. Direct production of iron and steel.* Oct. 27.

Complete Specifications Accepted.

24,009 (1910). Dedolph. Smelting process. Oct. 25.

25,030 (1910). Schwabacher. Treatment of calcareous ores. Oct. 25.

1131 (1911). Buddeus. Process and apparatus for roasting fine ores. Oct. 25.

6441 (1911). Royer. *See under* VIII.

XI.—ELECTRO-CHEMISTRY.

Applications.

22,759. Knowles. Electrolytic apparatus. Oct. 16.

23,025. Dental Manufacturing Co., Ltd., and Tugman. Negative electrodes for electrolysis, cataphoresis, and osmosis. Oct. 18.

Complete Specifications Accepted.

5165 (1911). British Thomson-Houston Co. (General Electric Co.). Insulating material. Oct. 25.

8998 (1911). Lake (Florence). Electric furnaces. Nov. 1.

XII.—FATS; OILS; WAXES.

Applications.

23,026. Brown. Manufacture of soap. [Addition to No. 29,598 of 1910.] Oct. 18.

23,468. Wallbaum. *See under* II.

Complete Specifications Accepted.

24,111 (1910). Evans. Oil-extracting machinery. Oct. 25.

24,608 (1910). Nobel's Explosives Co., Rintoul, and Innes. Production of polymerised glycerine. Oct. 25.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Application.

22,802. Rappold. Manufacture of paint for protecting iron, wood, etc., from sea-growths.* Oct. 16.

Complete Specification Accepted.

11,726 (1911). Legg. Production of chrome pigments. Oct. 25.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

23,210. Butler. Indiarubber substitute. Oct. 20.

23,630. Stockhausen. Production of a substitute for rubber. [Addition to No. 9264 of 1911. Ger. Appl., Dec. 22, 1910.]* Oct. 25.

23,723. Johnson (Badische Anilin und Soda Fabrik). Manufacture of caoutchouc. Oct. 26.

Complete Specifications Accepted.

23,727 (1910). Beaver and Claremont. Ageing rubber sheet. Oct. 25.

24,790 (1910). Matthews and Strange. Manufacture of synthetic caoutchouc. Nov. 1.

26,093 (1910). Turns. Manufacture of indiarubber substitute, etc. Nov. 1.

20 (1911). Clarkson. Treatment of latex from rubber and analogous trees. Oct. 25.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

22,806 and 22,807. O'Brien. Machines for treating hides, skins, and leather.* Oct. 16.

Complete Specification Accepted.

29,075 (1910). Cox. Manufacture of horn and like substance. Nov. 1.

XVI.—SOILS; FERTILISERS.

Complete Specification Accepted.

19,043 (1911). Dunham. Treatment of phosphorites or phosphate rock to render them suitable for fertilising purposes. Oct. 25.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

23,613. Patz and others. Manufacture of malt extract.* Oct. 25.

23,839. Baker. Manufacture of stout. Oct. 27.

Complete Specifications Accepted.

24,667 (1910). Richter und Richter. *See under* III.

5339 (1911). Martin, Bartholomew, and Schaaf. Treating and purifying liquids containing albumin in the process of brewing. Oct. 25.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

22,792. Hickling and Tomlinson. Extraction of gases from sewage to remove the offensive odours. Oct. 16.

23,267. Davey. *See under* I.

23,595. Monhaupt. Manufacture of edible products from bassia seeds.* Oct. 25.

Complete Specifications Accepted.

24,793 (1910). Klein. Treatment of coffee beans. Nov. 1.

25,091 (1910). Tildesley, Ritchie, and Watkins. Process for improving flour. Nov. 1.

3065 (1911). Machell and Garvie. Apparatus for separating suspended solids, grease, etc., from waste liquids. Nov. 1.

16,431 (1911). Petzholdt. Manufacture of cocoa. Nov. 1.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

22,794. Newton (Bayer und Co.). Manufacture of β-imidazolylethylamine. Oct. 16.

22,795. Bayer und Co. Process for producing pinacone. [Ger. Appl., Oct. 20, 1910.]* Oct. 16.

23,022. Meister, Lucius, und Brüning. Manufacture of therapeutic preparations of tubercle bacilli. [Ger. Appl., Oct. 19, 1910.]* Oct. 18.

23,197. Newton (Bayer und Co.). Manufacture of pyrazolone derivatives of the benzene series containing free hydroxyl groups. Oct. 20.

23,528. Keller and Taaffe. Extraction of nicotine. Oct. 24.

23,721. Oelenheinz and van der Meulen. Process of fermenting the green juice of the tobacco plant. Oct. 26.

23,736. Wellcome, Pyman, and Remfry. Manufacture of hydrohydrastinine. Oct. 26.

Complete Specifications Accepted.

24,608 (1910). Nobel's Explosives Co., and others. *See under* XII.

26,676 (1910). Newton (Bayer und Co.). Manufacture of derivatives of *m*-oxyhydrocinnamic acid. Nov. 1.

28,583 (1910). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of organic mercury compounds. Nov. 1.

10,494 (1911). Stebbins. Medical compounds. Nov. 1.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

23,645. May. Production of cinematograph films, photographic plates, etc., in natural colours. Oct. 26.

XXII.—EXPLOSIVES; MATCHES.

Applications.

23,036. Schleu. *See under* V.

23,493. Meyer. Manufacture of detonating compounds. [Addition to No. 21,337 of 1911.]* Oct. 24.

23,835. Brock. Pyrotechnic compositions. Oct. 27.

XXIII.—ANALYTICAL PROCESSES.

Application.

22,909. Barry. Ascertaining and indicating the presence of gases other than those ordinarily contained in the atmosphere. Oct. 17.

Complete Specifications Accepted.

24,036 (1910). Baillet. Registering automatic apparatus for analysing furnace gases. Oct. 25.

11,696 (1911). Oldham. Apparatus for the observation of gas-caps and testing miners' safety lamps. Oct. 25.

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Official Notice.

ANNUAL GENERAL MEETING, 1912.

In accordance with the provisions of By-law 64, notice is hereby given that the Annual General Meeting will be held in the Rumford Hall of the Chemists' Club, 50, East 41st Street, New York City, at 10 a.m. on Tuesday, September 3rd, 1912. A programme of the proceedings will be issued later.

Under Regulation 5, all elections to the Committees and all elections of officers of local sections, with the exception of those to fill up unforeseen vacancies, must take place so that they can be reported to the Council in time to be considered at the meeting held under By-law 24 not less than two months prior to the Annual General Meeting.

Charles G. Cresswell,
Secretary.

Liverpool Section.

Meeting held at Liverpool University on Wednesday, October 25th, 1911.

MR. ARTHUR CAREY IN THE CHAIR.

HURTER MEMORIAL LECTURE.

SOME VIEWS ON THE PRESENT CONDITION AND PROSPECTS OF THE INORGANIC CHEMICAL INDUSTRY IN ITS TECHNICAL AND ECONOMIC ASPECTS.

BY MAX HASENCLEVER.

When I received your Committee's invitation to deliver the Hurter Memorial lecture this year, I did not hesitate to accept it, as I consider it a special favour to be granted the privilege of paying honour to the memory of so famous a member of our profession as Dr. Ferdinand Hurter, who amongst all those who ever devoted themselves to applied chemistry, lives in our memory as one of the best. Endowed with a remarkable theoretical knowledge combined with practical foresight and experience, at the same time distinguished by a modest nature and great personal worth, he gained the greatest esteem everywhere. To his productive life we may well apply a German poet's saying :—

" Was vergangen kehrt nicht wieder,
aber ging es leuchtend nieder,
leuchtet's lange noch zurück."

In the history of applied chemistry his name will shine forth also to future generations, and his valuable work will always occupy a prominent position.

The object of my address will be to give you a general view of the present state of that branch of chemical industry to which Dr. Ferdinand Hurter devoted the greater part of his life.

Although the development of the alkali industry has not of late been so successful as during Hurter's lifetime, the number of patents granted and the papers published in our periodicals on improvements and new inventions bear witness to the keen work that is continually being done in inorganic chemical industry. If I desired to enumerate every feature of the numerous productions in this line I could but repeat the contents of the exhaustive and interesting reports published by Dr. Reusch in the "Chemiker Zeitung," by Helbing in the "Chemische Industrie," or by Dr. Keler in the "Zeitschrift für angewandte Chemie." I wish, however, to confine myself to such matters as, in my opinion, are of particular importance to the practical man.

From this point of view I shall have to deal in the first instance with sulphuric acid, the basis of the whole chemical industry.

As regards the roasting of pyrites, the mechanical furnace will no doubt be preferred to the hand furnace when new plant is erected.

Recently the Wedge furnace, developed and thoroughly tried during long years of practice in the United States, has been successfully introduced in Europe. In Germany this furnace is already working satisfactorily in five of the best known chemical works, and another 15 of the furnaces are in course of construction. The work done by the largest type of it, is six or seven times as large as that of the well-known Herreshoff furnace, and amounts to about 20 tons of pyrites in 24 hours. The main feature of the Wedge furnace is that it permits of repairs being made without interruption of its working. There seems to be no particular economy in cost of construction or in working expenses. Its design, however, is much more compact and simpler than that of seven Herreshoff furnaces.

For the chlorination roasting of burnt ore the mechanical furnace of Ramen Beskow of Helsingborg is being widely adopted. By utilising the sulphur contained in the burnt pyrites for heating, it secures a considerable saving of fuel.

There is very slow progress in mechanical furnaces for roasting zinc-blende. Many zinc works in Germany have spent large sums of money on experimental furnaces of their own construction. I do not see, however, why Matthiessen and Hegeler's furnace, which has stood the test for many years in the United States, has not been more rapidly adopted in Europe, for it is always more expedient and cheaper to buy existing experience than to gather it at one's own expense. The main difficulty in introducing mechanical furnaces for zinc-blende in Germany seems to be the fact that most of the zinc works are obliged to buy their ore without being able, in every instance, to select the quality according to their requirements. The result is that generally part of the ores received contain more or less lead, and sinter when roasted. They deposit on the hearth of the furnace and stick to the rods and moving parts, causing stoppages which make economical working very difficult.

Improvements in the roasting of lead ores, which are now being utilised for the manufacture of sulphuric acid, also deserve notice. The lead ores treated in Europe carry 11 to 15 per cent. of sulphur, the greater part of which is contained as lead sulphide. By the old roasting methods, the burner gases contained 0·8 to 1·0 per cent. of sulphur dioxide. The convertor-gases of the well-known Huntington-Heberlein process, by which air is blown through a layer of lead ore one metre thick, yield up to 15 per cent. of sulphur dioxide during the stage of their most active development, while at the beginning and the end of the roasting, gases very poor in sulphur dioxide are produced. The result is that a fairly continuous gas-current can only be obtained by working a large number of convertors charged at different times, the production of sulphurous acid being in a different stage in each of the convertors.

Manufacture of sulphuric acid in connection with the Huntington-Heberlein process was first introduced at the Muldenhütte in Freiberg, Winkler's contact process being used. The same roasting method is in operation at the Royal Friedrichshütte near Tarnowitz in Silesia, the roaster gases being treated by the chamber process.

As compared with the Huntington-Heberlein convertors, the working of which is intermittent, the Dwight-Lloyd furnace, improved by Schlippenbach, works continuously. By this apparatus the air is not blown through the material from underneath, but sucked down across it from the top to the bottom. The advantage of this furnace consists in delivering a regular gas-current of 4 to 6 per cent. of sulphur dioxide by separating continuously the rich from the poor gases and, in all probability, about 90 per cent. of the sulphur, contained as sulphide in the lead ore, can be utilised for the manufacture of sulphuric acid, that is to say, 4 tons of lead ore will yield one ton of sulphuric acid of 60° B. (142° Tw.). A large plant for the manufacture of sulphuric acid by the contact process combined with furnaces of this design is in course of erection at Stolberg and will be started in a few months. There will certainly be difficulties to overcome at the beginning, as the gases contain 5 to 6 per cent. by vol. of carbon dioxide and much dust.

If all the lead ores smelted in Germany were to be treated in this way, they would yield about 40,000 tons of sulphuric acid of 60° B. a year. In England the production would only be about 6,000 tons, in Belgium 18,000 tons, in France 12,000 tons, in Spain 75,000 tons.

It has no doubt been easily possible everywhere to improve the yield of the lead chamber space by increasing the production. It seems, however, to be advisable not to go too far in this respect and to be satisfied with a production of 5 to 6 kilos. of sulphuric acid of 60° B. per cubic metre of chamber space in 24 hours, or, expressed in the English units, about 11 c. ft. per lb. of sulphur burnt per 24 hours, as some works have had the unpleasant experience that with increased production, the cost of chamber repairs rose enormously. As regards large yields in as little space as possible, the tower processes of Opl of Hruschau and of Griesheim-Elektron certainly deserve notice. Opl's process, with its 8 towers in series, works in a similar way to the chamber process: towers 1 and 8—the first and the last—act together, that is to say, the nitrous vitriol flowing from tower 8 is run down tower 1, where it is denitrated. In the same way tower 2 works with tower 7, 3 with 6, and 4 with 5, the acids being raised on to the towers by the direct action of compressed burner gases, an operation which is protected by patents. The Griesheim process differs from Opl's process inasmuch as, instead of nitrous vitriol, nitric acid is used, which has to be completely regenerated after the formation of sulphuric acid. Neither tower process, particularly the Griesheim one, has yet reached such a stage of development as to allow a definite opinion to be formed upon it. This will, however, soon be the case, as plants designed from the results of the experience gained with more or less provisional arrangements, are in course of construction. The tower process will no doubt have the advantage over the chamber process of saving space, and the cost of its construction will also be lower than that of chambers. It remains to be seen, however, whether the saving effected by smaller capital charges will not be counterbalanced by increased working expenses and repairs. Its working certainly requires careful supervision, as the consumption of nitric acid easily becomes very heavy. In addition, the acid, through being continuously in contact with the packing material of the towers, will probably become more impure, even if the burner gases are subjected to a preliminary purification.

I believe that it will be very difficult to effect further savings in the manufacture of sulphuric acid by the chamber process. On the other hand, the cost of sulphuric acid is, in my opinion, often underestimated by engineering firms who devote themselves to the construction of sulphuric acid plant. On the basis of figures at my disposal, I have made up the following cost sheet :—

Cost of sulphuric acid plant.

(2 Units of 5000 cubic metres (176,500 c. ft.) chamber space.)
Annual production 20,000 tons of sulphuric acid 60° B.
(5½ kilos. acid 60° B. per cubic metre in 24 hours.)
(11 c. ft. per lb. sulphur per 24 hours.)

Buildings and plant for crushing, conveying, roasting and storing pyrites	M.344,000
Buildings, chambers, including boilers, engines and concentrators (736 tons of lead at 300 marks per ton)	M.624,000
Accessory plant : (Nitric acid, water supply, railway sidings, electric light, bath and meal rooms for workmen, works railway, drains, etc.)	M.89,000
	M.1,057,000
Depreciation, 8 per cent.—in round figures	M.85,000

Manufacturing costs of 100 kilos. of sulphuric acid 60° B.

Roasting of pyrites ($\frac{1}{10}$ ton sulphuric acid at 142° Tw.).			
Available sulphur in pyrites		M.1.00	
Crushing and roasting		M.0.25	
Depreciation		M.0.14	
			M.1.39
Manufacture of sulphuric acid :			
Working of chambers including repairs		M.0.46	
Concentration		M.0.15	
Depreciation : Chambers	M.0.25		
Accessory plant	M.0.05		
		M.0.30	
			M.0.91
			M.2.30
Average carriage expenses in Rhineland			M.0.30
Tank wagons			M.0.10
Cost, delivered free, consumers' works			M.2.70
4 per cent. interest on capital invested			M.0.20
			M.2.90

In the manufacturing costs of sulphuric acid, the prices of the raw material play the most important part, and the amount of the first item in my cost sheet, "Available sulphur in pyrites M.1 per 100 kilos." will probably have to be modified (1), if the works are in a position to burn pyrites from their own mines instead of having to buy it at the market price ; (2) if pyrites containing copper is treated and the yield of copper credited to the sulphuric acid account : or (3) if sulphide of iron from gas works can be had at a low price, or (4th and finally), if it is possible to buy the burner gases from zinc works on favourable terms. All these possibilities, however, are exceptions and not often found.

It is a mistake, still occasionally made, to believe it to be cheaper to make sulphuric acid from zinc blende than from pyrites, on the assumption that the sulphur contained in the blende has not to be paid for. Even old hands who ventured on roasting zinc blende have been greatly disappointed. With the high wages and prices of fuel ruling to-day, the charges for roasting zinc blende by hand amount to at least M. 1,50 per 100 kilos. of sulphuric acid of 60° B. It must besides be remembered that losses of zinc and inefficient roasting may materially increase the costs. The zinc works making sulphuric acid do not debit the total roasting expenses to the sulphuric acid account, but only that part of the charges which exceeds those incurred by the former method of roasting in the reverberatory furnace, without any production of sulphuric acid. The balance of the charges is debited to the zinc-account. Owing to this way of reckoning, which, in reality, is not correct, because the zinc-works are no longer permitted by law to roast their ores without making sulphuric acid, these works are frequently willing to sell their acid at low prices.

Altogether the charges for roasting blende are higher than those for pyrites, crushing, roasting, and depreciation taken together. The latter, which amount to M. 1.39 in my calculation, are the same both with the tower and the chamber process ; it therefore remains to be ascertained what the clear manufacturing costs of sulphuric acid, including amortisation, will amount to by the tower process.

I still have to mention that with the plant considered in my calculation only about 10 per cent. of the total acid is concentrated in the Glover, the remainder having to be evaporated in special concentrating apparatus. A saving in the concentrating charges will be effected if a greater quantity of Glover acid can be sold.

For depreciation of the plant, I have taken a rate of 8 per cent., which leads to about scrap value in 10 years. Interest at a rate of 4 per cent., which, I think, should also be taken into consideration, increases the cost by another M. 0,20 per 100 kilos. of sulphuric acid of 60°. Finally I must point out that the value of the land has not been taken into account, and that construction and working expenses will be materially increased by railway sidings, laboratory, offices, etc., in case an entirely new factory has to be built instead of additional plant in works already existing.

The purification of the burner gases from arsenic and dust is to-day easy and only a question of additional cost in plant. There is nothing new to say regarding the contact processes, only it is interesting to note that very well-known factories working the contact process, have also adopted to a large extent Gaillard towers for concentrating chamber acid.

The consumption of sulphuric acid is constantly increasing with the steady development of the superphosphate industry. In 1910 the production of superphosphate was :—In England, 1,000,000 tons ; in Germany, 1,400,000 tons ; in France, 1,600,000 tons. The same quantity of sulphuric acid of 60° B. is necessary per ton for these productions. During the last few years the acid consumption has experienced an enormous increase owing to the increasing number of coke ovens which manufacture by-products. On the other hand, the selling prices of sulphuric acid have been very unfavourable, considering the high prices of pyrites, fuel, and wages.

Manufacturers of sulphuric acid in the industrial district of Rhineland and Westphalia experience great difficulty in dealing with a syndicate of the ammonia makers from coke ovens, who, in view of their large consumption of sulphuric acid which amounts to 300,000 tons, threaten to start their own manufacture of acid and try by every means to depress the prices. Against these proceedings a combination of sulphuric acid makers is powerless.

There is at present a great scarcity of sulphuric acid in this district, and because at the low prices ruling, no one feels inclined to invest further capital in sulphuric acid plant. It is all very well for the coke ovens to make enormous profits on the by-products, but they should not grudge other industries the smallest profit. Then there would certainly be enough acid at their disposal. It is particularly striking that the acid works are obliged to buy their coal and coke at high prices prescribed by the syndicates established by the same mines, who consume their sulphuric acid. By these remarks I intended to show the disadvantages of being dependent on syndicates or large consumers. As far as I know, the situation in England in this respect in much better than with us.

It is interesting to note that by clever advertising, the selling price of nitrogen in sulphate of ammonia has now reached the market value of the nitrogen in Chile saltpetre.

New troubles for all the makers of sulphuric acid may be caused by the processes of Burkheiser and Walther Feld, which consist in fixing nitrogen by utilising the sulphur contained in coal. In the Burkheiser process the gases leaving the coke-ovens, and containing sulphuretted hydrogen, cyanogen, and ammonia, pass through a purifier packed with a specially prepared bog-iron ore which absorbs the sulphuretted hydrogen. The ammonia in the gases is absorbed by liquor in a scrubber behind the purifier, so that when the gas leaves the ammonia scrubber it is free of both sulphur and ammonia, and is therefore ready for use. When the purifier is saturated with sulphuretted hydrogen, the gas current is turned off and put on to a second purifier from which it travels by the same path as from purifier 1. By passing a regulated current of air through the first purifier, the sulphide of iron is oxidised. The sulphurous acid produced is brought in a suitable way into reaction with the liquors containing ammonia, and forms ammonium sulphite and eventually sulphate. The sulphite is said to be converted into sulphate through oxidation by atmospheric air during a storage of several months. The process has lately been materially improved by making the absorption of the sulphuretted hydrogen continuous in one apparatus, while the roasting of the iron sulphide takes place in a plant separated altogether from the absorption. In the interests of the owners of this process I can give no further details.

In plant erected by Walther Feld, iron salts have been used as intermediate absorbers for binding the sulphur. Feld has, however, simplified his process, and he took out new patents about six months ago. He now binds the sulphur and ammonia only by salts, which are already contained in the gas liquor. To start the process he leads sulphurous acid into concentrated gas liquor, making a solution of ammonium tetrathionate, which is capable of absorbing sulphuretted hydrogen and ammonia at the same time, forming ammonium thiosulphate and sulphur, according approximately to the following equation :—

$$(1)\ (NH_4)_2S_4O_6+2NH_3+H_2S=2(NH_4)_2S_2O_3+S.$$

By leading sulphurous acid into this solution, ammonium tetrathionate is again formed according to the equation :—

$$(2)\ 2(NH_4)_2S_2O_3+3SO_2+S=2(NH_4)_2S_4O_6,$$

which may again absorb sulphuretted hydrogen and ammonia. As soon as, after repeated circulations, the solution has reached a sufficient degree of concentration, part of it is drawn off and heated to boiling point in a suitable vat by steam coils. This causes the ammonium tetrathionate to be converted into ammonium sulphate, which remains in solution, molecular sulphur is precipitated, and sulphurous acid escapes. The sulphur dioxide (compare equation 2) is brought back into the process. The last stage of the process can be expressed by the equation :—

$$(3)\ (NH_4)_2S_4O_6=(NH_4)_2SO_4+2S+SO_2.$$

The combination of ammonia and sulphur, according to equation 1, takes place in a special absorbing apparatus invented by Feld, while the regeneration, as in equation 2, and the final stage, as in equation 3, take place in wooden vats. The sulphur precipitated in the final operation (compare equation 3) is filtered when the vat is emptied, dried in a centrifugal machine, burnt in a sulphur oven and used in the process as sulphur dioxide (compare equation 2). Both processes are no doubt of great interest.

Burkheiser's process is working in connection with coke ovens at Flemalle Grande, near Liège in Belgium. Feld's process is working at the gas works in Königsberg. The latter process is thus in excellent hands, who will make out of it all that is possible. Burkheiser, particularly, claims that his process gives at the same time an increased yield of ammonia by converting hydrocyanic acid into ammonia. Which of these processes has the greater value can be decided only after careful investigation on the working scale. It is certain that the coke oven gases carry sufficient sulphur to fix the ammonia they contain, and that the reactions in both processes are practicable. The adoption of one of these processes will therefore no doubt be seriously considered when new coke ovens or gas works have to be erected.

Whether existing plants will be replaced by one of the new processes, seems, at least for the present, to be doubtful, as it must be remembered (1), that the new processes are more complicated than the old ones and require more attention ; (2), that the plant will be more expensive ; (3), that it is not as easy to obtain an ammonium salt of as good a quality ; and (4), that a royalty will have to be paid on the profits realised. But at any rate the manufacturer of sulphuric acid will not be able to check the natural course of events.

For the manufacture of nitric acid, Uebel's system with three boilers, which allow a continuous working, is being adopted in many cases. It secures material savings in space and fuel. The apparatus treats 1800 kilos. of nitrate of soda in 24 hours.

As regards the soda industry, it is of great importance that up to now serious disturbances have been avoided through erection of new ammonia-soda works. Should this not be possible in the long run, a dissolution of the syndicates will certainly be the consequence, which will mean a great collapse for all makers of soda, no matter by what process they are working. The electrolytic process has become popular rather quickly. There are to-day a great many processes which apparently differ very little in their efficiency. They are, of course, in the first place, competitors to the Leblanc process. We often read that the old Leblanc process has almost entirely been replaced by electrolysis. It is, however, not sufficiently known that manufacturers of Leblanc-soda have also been progressive and improved their process up to quite recently. Instead of the old, we may call it to-day the new Leblanc process. Such modern Leblanc processes with well selected and suitably developed accessory processes, as they are working to a large extent in England, have nowhere disappeared, and they will not be replaced by any of the other soda processes known to-day as long as the demand for bleaching powder and caustic soda is maintained.

In my opinion it would have been more economical to produce by the Leblanc process all the electrolytic products derived from the chlorides of sodium and potassium, as far as they are based on fuel.

A large firm of electrical manufacturers is trying, through advertisements, to induce consumers of chlorine to start their own manufacture of this product, with the object of supplying the necessary apparatus. They publish estimates of the costs of production which, in my opinion, do not speak in favour of the electrolytic methods. These proceedings, however, must naturally affect the selling prices of caustic soda and bleaching powder.

Still, I admit that electrolytic works have obtained indirectly valuable advantages over the conservative Leblanc-soda maker. Once familiar with electrolysis, it was easy for them to take up new manufactures in the same line. I may mention the manufacture of metallic sodium and magnesium, calcium, calcium carbide, chlorate of potash, the electrolytic production of chrome salts, and finally the utilization of the hydrogen obtained as a by-product in decomposing chloride salts. The hydrogen is used either for balloons, or, mixed with oxygen, for the autogenous cutting and welding process, and to a small extent also for the manufacture of artificial gems.

The latter manufacture, which is perhaps not yet generally known, consists in converting chemically pure amorphous alumina by the heat of the oxy-hydrogen flame into crystallised alumina. By the addition of chromium oxides the ruby is made; by the addition of titanic acid or ferric oxide the sapphire. The chemical and physical properties, hardness, refraction, specific gravity, etc., of these synthetic gems are identical with those of the natural stones. Strange to say, the prices of the latter have not been influenced so far. The public values jewels only if a very high price has been paid for them. Possibly the synthetic gems have also been sold from the commencement too cheaply.

The jeweller, of course, opposes the introduction of synthetic stones, and maintains that he is able to distinguish them from the natural stones, but this I seriously doubt.

A direct advantage of the electrolytic method over the Leblanc process worth mentioning, is, that the chlorine is obtained as concentrated gas, which may be used for the manufacture of organic chlorine compounds, whereas the chlorine produced by the Deacon process, being dilute, cannot be used for the same purpose without special treatment. On the other hand, the Leblanc process has the option of selling hydrochloric acid.

With reference to the fixation of atmospheric nitrogen, all parties interested will, no doubt, have noticed by recent reports, that the well known large German companies have to a great extent retired from the enterprises in Norway, which, in a few months, will start on a large scale the exploitation of the Birkeland-Eyde-Schönherr process, the said companies remaining interested with only a small capital. This circumstance does not speak in favour of the prospects regarding the oxidation of atmospheric nitrogen, which process Prof. Dr. Bernthsen demonstrated by experiment at the last International Congress of Applied Chemistry.

The same German concerns expect, perhaps more from the Haber process which they own. The yield by the Haber ammonia synthesis is said to amount to 9 per cent. The necessary pressure of 200 atm. together with the high temperature of 500° C. may, however, still cause difficulties in working the process on a large scale.

The use of calcium cyanamide as a direct fertilizer makes slow but steady progress; in some works, at least, it has been possible to restrict its conversion into ammonium sulphate, and to sell more cyanamide instead.

A very interesting method of fixing atmospheric nitrogen is the Serpek process connected with the manufacture of aluminium; in this process, bauxite is heated with coal to a temperature of about 1700° to 1800° C.; 15 to 18 per cent. of nitrogen is absorbed in the form of aluminium nitride. On treating this nitrogen-containing bauxite with caustic soda in the usual way by the Bayer process, ammonia escapes from the autoclaves and materially reduces the manufacturing costs of alumina and aluminium. The merit of having recognised the value of the Serpek process to the aluminium industry, and of having developed it, is due to M. Badin, General Director of the Compagnie A. R. Pechiney et Cie., of Salindres, France.

In concluding my lecture I wish to refer to the difficult position of purely inorganic chemical works in Germany as compared with the well known large colour works, which, with their huge and excellent scientific and commercial organisation, as well as their splendid financial position, represent enormous powers. The German colour works long ago ceased to purchase the inorganic products they required. At present they work their own mines, make all inorganic and intermediate products themselves, not only for their own requirements, but also for sale, and control every branch of chemical industry. The great advance of these large concerns makes it very difficult for the inorganic works to take up new manufactures to compensate for the continued falling off in the profits on heavy chemicals. I hope that drawbacks of this kind will not be so seriously felt in England if organic chemical industry should develop extensively, as, no doubt, was the intention of the Patents' Act of 1907, and I conclude with the hope that English chemical industry may continue to be successful and may meet with increasing prosperity.

Nottingham Section.

Meeting held at University College, Nottingham, on Wednesday, October 25th, 1911.

MR. S. R. TROTMAN IN THE CHAIR.

DAMAGES AND DISCOLOURATIONS CAUSED IN FINISHING LACE GOODS.

BY S. R. TROTMAN, M.A., F.I.C.

ABSTRACT.

There are few problems in connection with the lace trade which are more difficult to solve than those concerned with the cause of many of the damages and discolourations exhibited by finished goods.

During its life history from raw material to dressed lace the cotton passes through frequently four distinct sets of processes. Each of these is liable to cause damage, which may be either immediately apparent or whose appearance may be deferred to any of the subsequent stages. It is not therefore possible to consider damages caused by any one process entirely apart from those liable to be due to the preceding ones, as sometimes a fault developed during one process is entirely due to carrying out the preceding one in an incomplete or faulty manner. Thus mechanical strains may weaken cotton to just that extent which, while enabling it to stand the stress of the present process, may make it unable to withstand succeeding tensions. Common forms of mechanical damage include those caused by unevenness in the bowls of a washing or similar machine, careless singeing or the presence of destructive loading materials during the singeing process, the presence of grit, shot holes and other similar forms of steam damage, strains caused by faulty plaiting or circulating in the keir, or partial mercerisation under the uncontrolled action of caustic lye. In nearly all these cases the appearance of the damage may be deferred to a later stage in the processes.

Passing to damages of purely chemical origin, we have again many which require two stages of the operations for their complete development. Thus incomplete removal of the reagents used in one process will sometimes cause interaction with those used in the next. Thus albuminoids not removed by the soda boil cause waste of chlorine and sometimes tendering at a later stage, due to the decomposition of the chlorine compounds. Undetected metallic oxides, such as are often associated with black lead stains, act as catalytic agents in the presence of chlorine and favour local over-bleaching. Even this may not be immediately apparent, since tendering due to oxycellulose frequently requires some time to develop. Oxycellulose, as we know, may be produced in at least two of the stages of the bleaching operations.

Damage due to acid, or chemicals capable of liberating acid, is again only apparent when the goods are dried off or calendered. The presence of lime and magnesia soaps only makes itself noticeable after the goods are finished and stored. Impurities left in the cotton by an incomplete lye boil generally require some time to work their way to the surface, as also does mineral oil, which may have been dissipated through the fabric without having been actually removed.

Illustrations such as these might be further multiplied, but sufficient has been said to show that, in many cases, the whole life history of the piece of damaged material must be considered in order to arrive at a satisfactory opinion as to the origin and nature of the damage.

The faults which may be due to the "finishing" alone are fairly numerous, and it is not easy to make an exhaustive list. The following are among the common causes met with.

Loss of colour or tendering due to the use of faulty starch or glue.—Starch is very commonly bleached with sulphurous acid and sometimes it is not properly washed afterwards. Thus the finished product contains both sulphurous and sulphuric acid. The quantity may not be large, but even a very small percentage may cause considerable trouble, the cotton being sometimes actually tendered. It generally acts, however, in other ways. Ultramarine, which is sometimes used as a blueing material, is very sensitive to acids. Under the influence of acid it loses its colour and liberates sulphuretted hydrogen. Now blue is frequently added to make a second class colour simulate a first class. Hence when mixed with a starch containing acid the second class colour or sometimes actually a bad colour results. Thin starches are the worst with regard to acid. Not only are they generally made by an acid process but they frequently contain, in addition to dextrin, considerable quantities of dextrose. This after drying or calendering in presence of an acid, frequently gives rise to caramel and consequently a bad colour. The following is an example of such a starch which I proved by actual experiment to have these properties :—Water, 10·40 per cent. ; dextrin, 20·25 per cent. ; dextrose, 6·95 per cent. ; starch, 62·40 per cent. ; acid, 0·35 per cent. Sour or mouldy starches are sometimes a cause of trouble. These are nearly all associated with a high water and nitrogen content. Glue or gelatins chiefly act indirectly. When the peptone or hydrolysed nitrogen content is high they are hygroscopic and contain plenty of nitrogenous food material. Hence they are very liable to mould.

Damage due to bacterial growth.—Unscoured cotton is very liable to be attacked by bacteria if an undue amount of moisture is present. This sometimes actually causes tenderness which makes the fibre break down under the tensions to which it is subjected during manufacture or finishing. In the bleaching yard also there is always a possibility of bacterial infection when goods are left lying in heaps in a damp warm atmosphere, and this is particularly the case when they are not completely bottomed in the lye boiling. But it is chiefly in the finished state that this trouble occurs, since as already mentioned the dressing materials frequently favour the growth of bacteria. This source of damage is really more common than is generally supposed. I have already drawn the attention of this Section to these points and shown a culture of a remarkable red mould which had caused a pink discolouration.

Blueing materials.—The blueing materials in more or less general use are smalt, ultramarine, Prussian blue, and aniline dyes. Of these, smalt is quite resistant to acids and alkalis ; ultramarine is destroyed by acids, Prussian blue by alkalis, while aniline dyes may be sensitive to either. Many bad whites are due to double reaction between the blue and traces of acids or alkalis left in the goods or unknowingly introduced with the dressing materials. I have already referred to acid starches, and I have on more than one occasion seen cases of interaction of an acid starch with a blueing agent.

Softeners.—These bodies, consisting as they do commonly of a soap basis, are always liable to give rise to discolourations unless carefully selected. Some proprietary softeners too are distinctly acid and have the power of attacking metals such as iron and copper or tin, all of which may if dissolved give rise to discolourations. I have recently examined a softening mixture which contained no less than 0·65 per cent. of tin. The mixture was strongly acid in reaction and had caused the development of a brownish discolouration on some lace goods. This I proved to be due to sulphide caused either by exposure to air or by liberation of sulphuretted hydrogen from the ultramarine used for the blueing. Soluble oils too, if of the sulphonated type, are occasionally sufficiently acid to give rise to similar trouble or even cause tendering.

Metallic discolourations.—These are chiefly iron, lead, tin and copper. Tin has already been mentioned. Iron discolourations are produced in all stages of the finishing processes. Lead is chiefly derived from lead-lined keirs or pipes, but also occasionally from such materials as tartaric acid which are sometimes used. When introduced in this way lead even in minute traces gradually becomes converted into sulphide with the production of a brownish colour.

Aniline stains.—These are produced by storing goods in the neighbourhood of pieces freshly dyed with aniline black and are of a rose pink colour. The discolouration usually shows chiefly on the exposed folds. The sample exhibited shows a typical case. It must be remarked, however, that it is not safe to conclude that all such pink stains are due to aniline, since in addition to the mould previously mentioned, pink torula certainly, and *bacillus prodigiosus* possibly, can grow on dressings with the production of a similar colour.

Scottish Section.

Meeting held at Glasgow on Tuesday, October 24th, 1911.

PROFESSOR THOMAS GRAY IN THE CHAIR.

EFFECT OF THE BLEACHING PROCESS ON THE WEIGHT AND STRENGTH OF TEXTILES.

BY S. H. HIGGINS, M.SC.

It has been shown that the bleaching process, if properly carried out, has little or no deleterious effect on the strength of the cotton fibre. Thus O'Neill showed that in some cases the strength of individual warp threads increased as much as 15 per cent. after bleaching, while in other cases there was a decrease to only 60 per cent. of the original strength. In the present author's experience, this alteration in strength entirely depends on the cleanliness of the grey cloth or yarn. If the yarns are well sized and contain much foreign matter then the bleaching process causes a decrease in strength, because the removal of this matter clinging to the fibres causes the structure of the yarn to be disturbed ; but if the yarn is a clean one there is no such diminution in strength. Similar remarks apply to loss in weight during bleaching, a pure yarn showing little change and an impure yarn a much greater loss in weight.

Any increase in tensile strength produced in the bleaching process the author finds always takes place during the boiling operation (*vide* Hübner and Pope, this J., 1903, 22, 70). It is evident that during this operation there is a more effective binding of the fibres and thus a consolidation of the threads. The author conducted a series of tests on the loss in strength and weight of linen fabrics during the bleaching process and obtained the following results :—

Loss in weight of linen during bleaching.

	Weight. grms.	Loss per cent.
Example 1. Brown linen	92·1	—
After steeping	88·7	3·8
,, lime boiling	77·15	16·2
,, lye boiling	70·93	22·9
,, chemicing	69·53	24·5
Fully bleached	67·52	26·7

	Per cent.
Example 2. Loss on lime boil	9·6
,, 3. ,, ,, lye boils	15·9
,, 4. ,, ,, ,, ,,	15·15
,, 5. ,, ,, chemic and sour	1·44

The results show that the decrease in weight takes place principally in the preliminary boiling, before the bleaching proper: in the example given it is seen that the boiling accounts for 86 per cent. of the total drop in weight during the whole process. The chemicing process does not appreciably affect the weight and the many subsequent treatments through which the linen goes before being fully bleached, are also seen to have little effect on the weight of the goods. As the decrease in weight due to the boiling operations is unavoidable and must exist where goods are cleansed and properly bleached, it follows that in the particular system of bleaching used for the example given there is the least possible reduction in weight. The figures also serve to show that the so-called "half-bleaches" owe their weight entirely to the original impurities of the cloth, these not being removed by proper boiling. The following ash determinations fully bear out this contention:—

	Ash. per cent.
Brown linen	1·28
After lime boil	0·18
,, lye boils	0·084
,, chemicing	0·08
. . . . .	
Fully bleached	0·074
Half bleached linen	0·37

The ash determinations also support the conclusions drawn from the previous weight determinations, viz., that most of the foreign matter is removed during the boiling operations. The term "foreign matter" is here and in other cases applied to the non-cellulose portion of the linen yarn. In another instance an ash content of 0·045 per cent. was obtained for fully bleached linen.

Loss in tensile strength of linen during bleaching.—The pieces of linen used in the previous weight determinations were now divided into warp and weft threads and the warp threads were broken in a Schopper testing machine. Thirty such tests were made in each case to give the following average results (Example 1). Owing to the irregular nature of all linen yarns a large number of tests have to be made before a true average is arrived at.

	Tensile strength. grms.
Example 1. Brown yarn	1270
After lime boil	960
,, lye boils	1070
,, chemic	930
. . . . .	
Fully bleached	910
Decrease in strength	28·3 per cent.

	grms.
Example 2. Brown yarn	950
After lime and lye boils	730
,, chemic	720
. . . . .	
Fully bleached	710
Decrease in strength	25·3 per cent.

	Warp.	Weft.
Example 3. Brown yarn	1050	800
After lime and lye boils	890	860
,, chemic	860	810
. . . . .		
Fully bleached	780	740

It is noticed that the lye boiling often causes an increase in tensile strength, although the removal of a large amount of foreign matter from the fibre militates against such an effect. The weft, it is noticed, is more affected in this way than the warp. This is due to the fact that it is usually softer than the warp and more liable to untwist so that the boiling has more opportunity of increasing the cohesion and consolidation. In the brown state the yarns were generally found to untwist easily under tension and thus soon break.

It is thus seen that linen is quite different from cotton as regards its alteration in weight and strength during the bleaching process. In the case of linen the yarns contain so much foreign matter that during the boiling operations there may be a decrease of 30 per cent. in the weight, whereas for cotton the decrease is usually about 5 per cent. (*vide* Trotman and Pentecost, this J., 1910, 4). There is naturally a decrease in strength owing to the removal of this large portion of the substance of the fibre, but the figures show that if the process be properly conducted as in the case under consideration, the decrease in strength and weight is almost entirely due to the boiling and is therefore unavoidable. Efficient bleaching therefore removes the non-cellulose material from the neighbourhood of the pure fibre without appreciably impairing the tensile strength of the pure fibre itself.

BLEACHING FAULTS: THE TENDERING OF LINEN FABRICS DUE TO METALLIC OXIDES.

BY S. H. HIGGINS, M.SC.

In a paper read recently before this Society (this J., 1911, 30, 188), the author called attention to a case of tendering in linen fabrics and explained the cause of the trouble as being due to the presence of copper oxide on the fibres while immersed in the bleaching cisterns. In this way linen bleachers were supplied with an explanation, hitherto unknown to them, and were thus enabled to determine that the fault mentioned belonged to the manufacture of the cloth. Briggs (this J., 1911, 30, 397) supported the contention that this fault was entirely due to the manufacturer and that the bleacher was powerless either to foresee or to remedy it. He agreed with the characteristics of the damage which were described, but attributed the tendering to the presence of metallic copper and not of copper oxide. At the outset it must be confessed that it is a very difficult matter to determine whether any particular damage has been caused by metallic copper or by copper oxide. These faults are seldom apparent until the later stages of the finishing process, and only careful inspection then reveals them. To find them during the bleaching process is very difficult: the author has repeatedly tried to do so and has with this intention specially marked places containing dark coloured yarn, but he found that either this dark colour disappeared in the bleaching process or displayed no tendering and no copper compounds at the place marked. Even when isolated at the finishing stage the chemical examination of these single yarns is difficult, because the bleaching process usually takes away that part of the yarn and the adhering particles which one is in search of. A number of further experiments bearing on this matter were performed and are here described.

On isolating one of these dark yarns which had become tender during the bleaching process and adding an acidified solution of potassium ferrocyanide to the black matter, a reddish coloration was produced showing that the copper was present as copper oxide and not as metallic copper. This reaction was shown on the piece of linen exhibited to the Manchester Section of this Society during the reading of the author's previous paper, but was not fully described in the printed paper. Briggs, however, states that the example of this damage which he had examined required exposure to gaseous chlorine before a coloration with the ferrocyanide solution could be obtained, and therefore this pointed to the presence of metallic copper. He refers to the work of White (this J., 1903, 132—134) as supporting his contention that metallic copper is the active substance in this tendering action.

Soubeiran (Annales de Chimie et de Physique, 48, 1831) stated that copper plunged into bleaching powder solution became coated with a blue layer of oxychloride of copper and at the same time small bubbles of oxygen were evolved, the action being a slow one. White confirmed this observation and found that in a particular experiment 60 c.c. of oxygen were given off during the first 12 hours, 70 c.c. during the second period of 12 hours, and 55 c.c. in a third similar period. Considering these figures it appears remarkable that the copper after becoming coated with oxychloride (no agitation took place during the experiment), gave off as much oxygen as during the first period of 12 hours, and, as the constitution of the oxychloride is given as $2CuO, CuCl_2, 4H_2O$, the author compared the actions of copper oxide and of metallic copper on bleaching powder solution.

Action of copper oxide on bleaching powder solution.—Copper sulphate was precipitated by sodium hydroxide solution and the copper hydroxide well washed. A quantity of the precipitate was suspended in 50 c.c. of water and 50 c.c. of bleaching powder solution of sp. gr. 1·08 were added. The whole was well mixed and introduced into a 50 c.c. burette standing over a basin containing the mixture. A brisk effervescence took place and soon the burette was filled with oxygen.

Action of metallic copper on bleaching powder solution.—Finely divided copper which had been precipitated from copper sulphate solution by adding granulated zinc was now introduced into an inverted burette containing bleaching powder solution of sp. gr. 1·04 and standing over a basin containing that solution. It was noticed that the metallic copper had a faint green colour when introduced into the solution and that no immediate evolution of oxygen took place. In a short time the greenish colour gave place to a deep reddish blackness which made the tube almost opaque. This was afterwards shown to be due to the formation of copper oxide. After this change of colour oxygen began to be evolved but the evolution was not brisk.

Comparison of the rates of evolution of oxygen from bleaching powder solution caused by metallic copper and by copper oxide.—Equal volumes of copper sulphate solution were precipitated by sodium hydroxide and by metallic zinc to give samples of cupric hydroxide and of metallic copper. These were well washed and introduced into burettes containing bleaching powder solution as in the previous experiments. The sluggish action of the metallic copper was again noticed, but the copper oxide acted much more quickly, giving a brisk evolution of oxygen. The metallic copper caused 40 c.c. of oxygen to be given off in 12 hours, whereas 90 c.c. of the gas were evolved in 2 hours in the burette containing the copper oxide. In this experiment the states of division of the copper and the copper oxide were not the same, but yet one is led to the conclusion that in this evolution of oxygen from bleaching powder solution copper oxide is the active catalytic agent and that metallic copper only acts in so far as it is capable of being oxidised by the bleaching powder solution to copper oxide. The author thinks this conclusion also applies to the action of the metals—iron cobalt and nickel—on bleaching powder solution ; these are the only metals which cause bleaching powder solution to give off oxygen and all are oxidised during the action.

The action of the oxides of copper and of iron on bleaching powder solution in the presence of linen.—Three samples of boiled linen each weighing 11 grms. were taken and two of them were immersed in caustic soda solution. They were then wrung well and placed one into a solution of ferric chloride and the other into a solution of copper sulphate. After remaining in these solutions for 30 minutes both were well washed. These pieces of linen, as well as the untreated sample, were now placed separately into equal volumes of bleaching powder solution and allowed to stand for 2 hours, after which they were well washed ; it was then found that the untreated linen was quite strong, that containing the iron oxide much weaker, and that containing the copper hydroxide quite rotten. This experiment serves to show that copper oxide on the linen fibre causes tendering in the bleaching cistern and also that iron rust has a similar effect although not in the same degree. Dobbin and White (this J., 1903, 131—132) showed that ferric hydroxide caused bleaching powder solution to give off oxygen, but on applying bleaching powder solution to iron stains on linen cloth could not find any tendering of the linen. It is well-known, however, that iron stains do cause tender parts during the bleaching process, and the experiment described above proves that this is the case when the iron oxide is intimately incorporated with the fibre. It was also noticed that on using very strong bleaching powder solution for steeping the copper and iron mordanted linen, the solution became warm ; such an evolution of heat, produced locally, would also tend to cause tendering at the parts of the linen to which the copper oxide and iron rust might be attached.

Action of copper soaps on linen in the bleaching cistern.—The author in the previous paper (*loc. cit.*) stated that copper was dissolved out from the machinery bearings by vegetable oils of high acid value and splashing on to the cloth this oil, thus containing copper soaps, caused the tendering described. Some of the green matter often found about machinery bearings was rubbed into a piece of linen cloth and at the same time copper soap obtained by precipitating copper sulphate with soap solution was similarly rubbed into a piece of linen. These pieces of linen were then placed in bleaching powder solution for 2 hours. It was then found that the part of the linen in contact with the copper compounds was quite rotten, whereas the rest of the piece was very strong. This experiment finally proves that the explanation previously given by the author was a right one. The effects of compounds of copper and iron on textiles during bleaching have now been studied, but there is yet the zinc which is contained in the brasses of the machinery to be considered.

Effect of metallic zinc and of zinc oxide on bleaching powder solution.—Zinc dust was introduced into a burette containing bleaching powder solution of sp. gr. 1·04 as in the other experiments. Only a few bubbles of gas, which proved to be hydrogen, were evolved. The zinc was oxidised to zinc oxide which was found to have no action on bleaching powder solution. Thus, zinc hydroxide prepared by precipitating zinc sulphate by sodium hydroxide solution had no action on bleaching powder solution. On adding zinc sulphate to bleaching powder solution the precipitation of calcium sulphate and of zinc hydroxide is brought about, the latter compound being produced by the interaction of the zinc sulphate and the free lime of the bleaching powder solution. For this reason the supernatant liquid is neutral and therefore of active bleaching properties. From these experiments it is evident that the zinc contained in brass plays no part in the example of tendering which has been described. Moreover, any zinc or iron attached to the linen is probably acted upon and partially removed by the acid treatment to which linen goods are submitted before coming in contact with the bleaching powder solution. Although the foregoing experiments further support the explanation which the author previously offered, yet Briggs' communication has served to call attention to another means of introducing copper into the fabric, namely, by neglected lubrication. If the lubrication of the machinery be not properly attended to then the grinding might cause the production of finely divided brass which would be introduced into any oil subsequently applied to the bearing. This oil coming in contact with the linen would cause the trouble described and, moreover, copper might be introduced into the fabric in this way, no matter what kind of oil was used for the lubrication. That metallic copper does sometimes cause tendering is supported by the example given by Ermen during the discussion on the previous paper, and also by a case in the present author's experience where some cotton yarn was made quite rotten on treating with bleaching powder solution in a copper Obermaier machine. Referring to other black yarns in bleached linen cloth, Briggs mentions those produced owing to the use of graphite lubricants, the graphite being introduced into the yarn by contamination ; an example of similar contamination was previously given by the present author. These faults are troublesome and require hand washing to remove them, but no tendering is caused. Recovered oil might also lead to similar discolorations. Further it has been shown that cylinder oils after much use are sometimes found to contain fatty acids produced by the polymerisation of the hydrocarbons contained in the oil and if such oils, after recovery, be used for lubricating textile machinery, there is the possibility of the same trouble arising as has been previously attributed to vegetable lubricants of high acid value. In conclusion it must again be stated that the fault here described is very troublesome to linen bleachers. The trouble occurs at all times with heavy linens and at particular times the number of such faults is very great. Moreover, although this fault has been particularly discussed as being caused by the spinning process, it must be remembered that splashes of oil containing copper or copper compounds sometimes occur during the weaving process and cause damage during the bleaching operations, so that the above description should emphasise the necessity of attention to the lubrication of spinning and weaving machinery if this damage is to be prevented.

Discussion.

Dr. L. Dobbin said that the bleaching powder solution used by Mr. Higgins was much stronger than that used in ordinary bleaching practice. In the investigation he had carried out with Dr. White, to which reference had been made in the course of the paper, they had tried to produce holes from iron stains, and having got satisfactory stains, submitted them to the bleaching process. They could not, however, get anything approaching to real tendering of the linen by treatment such as might occur in practice. As Mr. Higgins was probably aware, the first instance of this copper effect seemed to have originated in the West of Scotland. It was observed in the forties of last century by Walter Crum, who drew the attention of Mitscherlich to it. Pinholes in linen had been found to be due almost invariably to minute fragments of solid hypochlorite which had not been removed from the solution employed in bleaching. Occasionally the holes had been found to originate from particles of iron.

Mr. HIGGINS, in reply, said that the solutions were used strong in order to accentuate their effect. If strong solutions produced tendering only at the places in contact with the metallic oxides, it was inferred that weaker solutions had a similar effect although not in the same degree. So that when using the solutions of ordinary bleaching practice the deterioration in the strength of the linen at the parts touching the oxides might be so small as to escape detection. This actually occured in practice as it was found that an iron spot might not indicate immediate tendering, but rubbing or laundering sometimes brought out the defect. He had found these tender places particularly in goods which had been rebleached. As regards the copper effect described, he was aware of the observation of Walter Crum and also of a paper by W. Thomson on the tendering as applied to cotton fabrics and not to linen goods: in his previous paper the author stated that his intention was to call attention to this fault in linen cloth, to acquaint the linen manufacturer with the cause of the trouble and to point out that the bleacher could not prevent such damage being produced.

Journal and Patent Literature.

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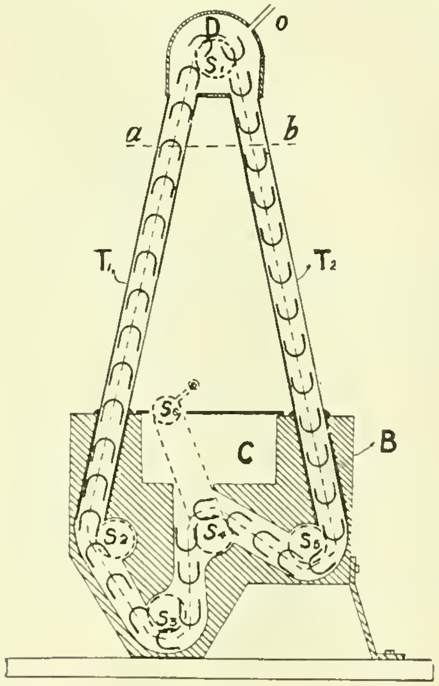
German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Air-pump; A new type of mercury ——. S. R. Williams. Amer. J. Science, 1911, 32, 13—16.

THE author describes a simple mercury pump, constructed on the principle of the chain and bucket water-dump, which will exhaust directly against atmospheric pressure up to X-ray vacua. A vertical section of the pump is shown in the figure. An endless chain, fitted with buckets, runs over the sprocket-wheels, s_1, s_2, s_3, s_4, and s_5, in the casing composed of the two tubes, T_1 and T_2, of boiler tubing, and the chamber, D, of cast iron, galvanised over on the outside to insure that it is airtight. Mercury is poured into the chamber, C, in the cast-iron base, D, until it is nearly full, and the vessel to be exhausted is attached at o. Then, by gearing attached to the drive wheel, s_6, the buckets in the tube, T_2, are caused to rise; on passing over s_1, they discharge the mercury they contain, and become inverted, carrying down air, which when the buckets return to their original position on passing under s_3, rises through the mercury in C and escapes. As the exhaustion proceeds, the mercury gradually rises in T_1 and T_2 until it stands at barometric height (*a*—*b*). The rate of exhaustion is limited only by the rate of diffusion of the gas though the tube, o, from the vessel under exhaustion. It is added that "not only the buckets, but also the chamber D, and the tubes, might very well be enamelled inside, which would give the same surface as glass, with the strength of iron or steel."—A. S.



PATENTS.

Rotary drying machines; Means for compensating unequal tensions or strains caused by heat expansion or contraction in ——. R., W. G., and F. R. Simon, Nottingham. Eng. Pat. 23,180, Oct. 6, 1910.

To eliminate unequal tensions the steam heating tubes are attached rigidly to a header, this header being free to move backwards and forwards within certain limits in a rigid casing to which it is attached by a number of springs.—B. G. McL.

Drying apparatus. G. Merlini. Fr. Pat. 430,263, May 29, 1911. Under Int. Conv., June 1, 1910.

THE apparatus comprises a closed chamber fitted with a steam or water heating-coil, and connected with an exhauster for withdrawing the vapours. The apparatus is intended for drying solid substances, particularly cereals, or for concentrating liquid or semi-liquid materials. When used for drying grain, there may be a screw conveyor for feeding the grain towards the outlet, and the grain may be circulated continually through a closed channel from the outlet to the inlet.—A. T. L.

Beating, mixing or whisking machines. T. Morton, Wishaw, N.B. Eng. Pat. 23,712, Oct. 13, 1910.

The bearing frames cast in one piece, usually employed for supporting the cylindrical mixing vessels, frequently become distorted when being attached to the vessels, with consequent locking of the bearings. In the present invention these frames are made in three parts, viz., a rigid bracket containing the bearing bushes, and two flexible bands which embrace the vessel at either end.
—B. G. McL.

Furnace-gases ; Process for cleaning ——. R. Böcking and Comp. Erben-Stumm-Halberg und R. Böcking G. m. b. H., Halbergerhütte, Germany. Eng. Pat. 29,933, Dec. 23, 1910. Under Int. Conv., May 30, 1910.

The gases are cooled to the dew point and then heated slightly before filtration, the most satisfactory results being obtained by passing the gases to the filter at about 20° C. above the dew point. The preliminary cooling takes place by upward passage through a wide vertical cylinder; in order artificially to raise the dew point, the gases may be caused to impinge on a layer of water in the bottom of this cylinder. The reheating is effected in a tubular heater by means of steam, hot air or otherwise, the gases thereafter passing upwards through the filtering medium placed in a vessel provided with a hopper bottom for removal of the solid matter. A by-pass is also provided for taking a portion of the gas direct to the heater.—B. G. McL.

Liquids containing finely divided matter in suspension ; Apparatus for treating ——. W. McD. Mackey, Leeds. Eng. Pat. 1327, Jan. 18, 1911.

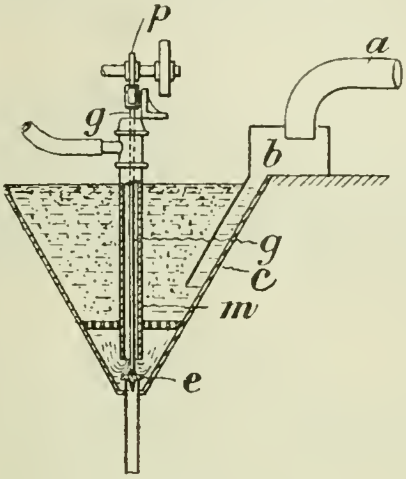
The claims relate to improvements in the apparatus described in the Eng. Pat. 11,410 of 1905 (this J., 1906, 231). A sloping partition is provided near the lower end of the inclined vessel, and forms with the sides of the latter a chamber into which the muddy liquid is introduced. The provision of this mud chamber causes the incoming liquid always to meet a sufficiency of deposited solid matter to ensure rapid settling. When the chamber becomes full, the excess of deposited solids flows over the partition into the adjacent space and is removed by a chain pump or other suitable means.—W. H. C.

Materials in suspension ; Separation of ——. B. Schwerin, Fr. Pat. 429,310, Jan. 30, 1911. Under Int. Conv., Jan. 31 and Feb. 19, 1910.

The materials in suspension are separated by decantation, electric osmose, etc., electrolytes of an acid nature being added to the bath when it contains substances, such as corundum, which travel towards the cathode under the influence of the electric current, whilst electrolytes of a basic character are added when the bath contains substances, such as clay, powdered carbon, etc., which travel towards the anode. Substances which in themselves are not electro-active may be made so by the absorption of colloidal substances, which are distinctly electropositive or electronegative.—B. N.

Separating the lighter from the heavier particles in mixtures of the same ; Apparatus for —— particularly applicable to the separation of fine coal from sand and other substances. J. Simon, Saarbrücken, Germany. Eng. Pat. 5179, March 1, 1911.

The materials to be separated are fed by the pipe, *a*, into the feed hopper, *b*, from which they pass into the conical separating vessel, *c*. The latter is provided with an outlet valve, *e*, attached to the rod, *g*, and operated intermittently by the cams, *p*. The rod, *g*, passes through a central water supply pipe, *m*. The water strikes against the upper surface of the valve, *e*, and is deflected in an upward direction, carrying with it the fine particles of coal in suspension. These overflow with the water over the upper edge of the vessel, *c*, into a suitable de-waterer (not shown). The heavier impurities sink to the bottom of the vessel, *c*, and are flushed out each time the valve is opened.—W. H. C.



Drum grinding mills ; Rotating drum apparatus for ——. J. Pfeiffer, Kaiserslautern, Germany. Eng. Pat. 9249, April 13, 1911.

In drum grinding mills in which the grinding is performed by the hammering action of freely falling bodies, the following improvements are claimed :—1. The material is fed into the centre of the drum, the ground material being caused to travel rapidly towards the ends, where it leaves the drum by annular openings, the size of which are capable of adjustment. 2. The drum is supported on two sets of rollers, one of which frictionally transmits the power required for driving, either directly to the drum or to a driving ring of larger diameter attached thereto. To put the drum out of action, it is elevated from the driving rollers by a third roller and allowed to swing backwards on its axis as far as the weight of material inside will permit, in which position it is retained, this procedure facilitating restarting. 3. The packings of felt or like material usually employed to prevent dust leakage are replaced by vanes arranged so as to cause a current of air to be drawn into the drum casing when the drum is in action. The application of this dust-preventing device to other forms of apparatus such as mixing and drying drums is also claimed.—B. G. McL

Packing material. Mitsui and Co., Ltd., and A. C. Chapman, London. Eng. Pat. 10,235, April 27, 1911.

A packing material poisonous to mould growths and not poisonous to human beings, and at the same time odourless, is made by soaking paper, paper pulp, cotton wool or a like material in a solution, made by dissolving 1½ oz. of boric acid and 6 drachms of copper sulphate in 4 pints of water and 2½ oz. of salicylic acid in 4 pints of methylated spirits and mixing equal quantities of the solutions, and drying at a gentle heat. The copper sulphate may be omitted if desired.—B. G. McL.

Cooling towers ; Filling for ——. O. H. Mueller, Camberwell. Eng. Pat. 15,291, June 30, 1911.

The filling, which is intended for liquid-cooling towers where the cooling is effected by an upward current of air, consists of cells of hexagonal or other convenient form, with each side common to two cells. These cells are formed into units, the junctions between the units on the same layer taking place half-way along the lateral walls. Projections and corresponding recesses on the tops and bottoms of the units prevent lateral movement, the tower when filled containing hexagonal passages direct from top to bottom.—B. G. McL.

Condensation apparatus having a large surface. J. J. A. Crolbois. Fr. Pat. 429,946, July 30, 1910.

The apparatus consists of a number of narrow concentric annular chambers, alternate chambers being connected with a dome-shaped space above, into which the vapour to be condensed is delivered. The other chambers are connected with a supply of condensing water which circulates through them. The vapours are condensed and discharged from the lower portions of the annular chambers.—W. H. C.

Evaporator. J. Parker, Philadelphia, Pa. U.S. Pat. 1,005,571, Oct. 10, 1911.

The evaporator has a vapour and liquid separator (see U.S. Pat. 989,996, this J., 1911, 604) at the lower end of the heating tubes; the separating chamber surrounds the tube casing and is divided into three superimposed sections, the vapour being removed from the uppermost section at a level above that of the lower ends of the tubes; the entrained liquor is arrested in the middle section and passes through apertures to the lower section, where it mixes with and whence it is removed with the concentrated liquor.—B. G. McL.

Evaporating apparatus. G. W. Childs, Ridgway, Pa. U.S. Pat. 1,005,600, Oct. 10, 1911.

In a multiple-effect evaporator in which the various units are symmetrically disposed around a central condenser, means are provided by which the evaporating chamber of one unit may be connected alternately with the heating chamber of the next unit or with the condenser. Liquid-level regulators and connecting pipes maintain the level of the liquid in the pans at the desired height and permit of its transference to any of the other units.—B. G. McL.

Evaporator. F. M. de Beers, Chicago, Ill. U.S. Pat. 1,006,363, Oct. 17, 1911.

The evaporator is provided with a steam-chest having sides which flare outwardly from the bottom to the top, the heating tubes being substantially parallel with the walls, so as to direct the liquid towards the walls of the evaporator. The steam-chest is provided with a jacket spaced apart from the walls and a tapering deflector to direct the steam towards the walls of the evaporator.
—W. H. C.

Ammonia cylinders; Means for packing ——. J. D. Campbell, Detroit, Mich. U.S. Pat. 1,005,596. Oct. 10, 1911.

The packing of the piston-rod in an ammonia compression cylinder is effected by providing in the stuffing-box an outer and an inner ring; by means of an oil-pump and valve gearing external to the cylinder, a pressure is maintained in the space between the outer and inner rings which is slightly in excess of the pressure in the intake pipe.—B. G. McL.

Filtering under pressure through porous [*collodion*] *membranes; Apparatus for ——.* J. Malfitano. Second Addition, dated May 4, 1911, to Fr. Pat. 401,926, April 9, 1909. (See this J., 1910, 1289.)

The collodion membrane is formed upon a network or basis of thick threads or filaments of the same material. The threads are formed by squirting the collodion through an orifice and then drying the filament. The thread may be wound spirally on a glass cylinder or deposited in a network pattern on a glass plate. A flexible border is then formed by means of liquid collodion with the addition of oil or resin, and after drying this border, the membrane is formed as in the principal patent.—A. T. L.

Separation of powdered or granular solid bodies suspended in liquids; Apparatus working under vacuum or pressure for the continuous ——. C. C. Leclaire and A. and G. Héricourt. Fr. Pat. 429,819, April 24, 1911. Under Int. Conv., April 27, 1910.

The liquid is fed on to the upper surface of one end of an endless band of filtering material which passes over and forms the cover of a tank within which a vacuum is maintained. The tank is so mounted that it can receive periodical blows or shakings. The liquid passes through into the tank and the solids are transported by the band across the tank to the opposite side, whence they are removed by a scraper. The band then passes beneath the tank and is washed by jets of water before returning to receive a fresh charge of material. Variations of the apparatus are described: the band may be arranged round a perforated drum which rotates partially immersed in a tank containing the liquid. A vacuum is maintained within the drum, the liquid which enters is withdrawn by pipes and the solid deposit is removed by a scraper. In another form the drum is enclosed in an outer casing, partly filled with the liquid, and a plus pressure is maintained within the drum so that the liquid is forced through.
—W. H. C.

Filter-press; Continuous ——. C. C. Leclaire and A. and G. Héricourt. Fr. Pat. 429,820, April 24, 1911. Under Int. Conv., April 30, 1910.

The solid matter is removed from the filtering surfaces of the plates by scrapers which rotate within each chamber of the press. These scrapers detach the deposited solids and deliver them into a longitudinal channel beneath the plates. A screw conveyor working in this channel continuously discharges the solid matter. In order to keep the filtering surfaces free, the press receives periodical blows or shocks.—W. H. C.

Filter-press and washer; Continuous ——. M. A. Wischnjakoff. Fr. Pat. 430,290, May 29, 1911.

The filter-press comprises a double cylindrical casing, of which the inner wall forms, or supports, the filtering medium. A rotating screw device is arranged in the compartment into which the liquid is introduced, which may be either the inner compartment or the outer annular chamber. This screw removes the solid matter from the filtering surface continuously and delivers it in a compressed state through a conical mouthpiece and loaded valve at the end of the press. When the solid matter is to be washed, in order to recover the whole of the filtrate, as in sugar refining, the press delivers it to the lower end of a vertical cylindrical casing forming the washer. This is constructed similarly to the press, but the rotating shaft carries radial arms at its lower end for breaking up the filter-cake and mixing it with water. The material is carried up through the washer and the filtrate is collected in two or more fractions taken from different heights.
—A. T. L.

Volatile solvents in the treatment of materials for the separation of fatty or other matters; Process for the complete recovery of —— and enabling the material to be obtained free from moisture. L. E. Donard. Fr. Pat. 429,827, May 5, 1911.

After the material has been extracted by the solvent, a current of vaporised solvent is passed through the mass so as to raise its temperature to that of the boiling point of the solvent. The apparatus is then connected with a vacuum pump which removes the vaporised solvent.
—W. H. C.

Volatile liquids; Process and apparatus for the recovery of ——. S. C. Early, A. G. Christiansen and The Farringdon Works and H. Pontifex and Sons, Ltd. Fr. Pat. 429,934, May 19, 1911. Under Int. Conv., Feb. 13, 1911.

The air or gas mixed with the vapour of the volatile liquid is passed upwards through a column fitted with perforated trays, provided with overflow openings alternately at the centre and at the periphery. Cold water delivered by a pump is sprayed over the uppermost tray and flows downwards, condensing the vapour of the volatile liquid. The condensed liquid and the water flow from the bottom of the column through a sealed pipe into a separator. The separated liquid floats on the water and flows into a reservoir, and the water after being cooled by cold brine circulated through a coil contained in the separator is returned to the pump and used again. —W. H. C.

Distillation, evaporation, and concentration of liquids; Apparatus for ——. P. E. Ballias. Fr. Pat. 430,383, June 1, 1911.

The apparatus comprises a cylindrical vessel having a double vertical wall at the lower part for heating by steam under pressure. The interior tubular heating device, which is immersed in the liquid, consists of an upper and lower set of concentric horizontal rings, corresponding members being joined by series of vertical tubes. The upper rings are connected by pipes within the chamber with a single steam supply pipe. The lower rings are slightly inclined and each has a drain tube at its lowest point running to a single outlet. The arrangement is such that the connections for the heating tubes do not pass through the double-walled part of the casing.—A. T. L.

Chemical reactions between solids and gases or mixtures of gases; Process for the promotion of —— and arrangement of furnaces for this purpose. J. R. C. Rudolphs and A. G. Thisell. Fr. Pat. 430,388, June 1, 1911.

The materials to be treated are finely powdered and placed in fireclay recipients which are placed in the compartments of a furnace and heated by gas. The gas or mixture of gases which is to act on the material is introduced by suitable movable pipes in such a manner that it does not come into contact with the products of combustion until it has passed through and acted on the material under treatment; it then mixes with the waste fire gases and serves to give a preliminary heating to the pots, next in order in the furnace. The furnace is arranged like a circular kiln, some pots being heated, some being acted on by the gas and others being cooled preliminary to being withdrawn.—W. H. C.

Vessels composed of pure oxides of iron resistant to chemical influences. W. Günther. Ger. Pat. 237,736, June 18, 1909.

The claim is for the use of vessels prepared from pure oxides of iron by casting.—A. S.

Crystals from a saturated saline solution; Process for the production of ——. P. Piccard. Ger. Pat. 238,739, June 11, 1910.

The solution is circulated continuously in a closed evaporator divided into two compartments and provided with a vertical heating device. At intervals the direction of flow of the solution is reversed, whereby any crystalline deposits formed locally on the walls of the evaporator are continuously removed.—A. S.

Hydrocarbons and alcoholic liquids; Process for purifying liquid —— by carbon and for the manufacture of carbon suitable for the purpose. Richter und Richter, Berlin. Eng. Pat. 24,667, Oct. 24, 1910. Under Int. Conv., March 4, 1910.

See Fr. Pat. 421,760 of 1910; this J., 1911, 409.—T. F. B.

Nickel lined articles, such, for example, as vessels and apparatus for use in chemical manufactures and the like; Manufacture of ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 25,959, Nov 8, 1910.

See Fr. Pat. 422,985 of 1910; this J., 1911, 605.—T. F. B.

Porous articles of refractory material; Manufacture of ——. G. B. Schwerin, Frankfort on Maine, Germany. Eng. Pat. 2626, Feb. 1, 1911.

See Fr. Pat. 426,072 of 1911; this J., 1911, 942.—T. F. B.

Separation and draining of vegetable, animal, or mineral substances; Process for the simultaneous ——. B. Schwerin, Frankfort on Maine, Germany. Eng. Pat. 3364, Feb. 9, 1911. Under Int. Conv., Feb. 12, 1910.

See Ger. Pat. 233,281 of 1910; this J., 1911, 605.—T. F. B.

Purification of liquids or the separation of solids or foreign matters contained in liquid or fluid substances from same; Impts. in and apparatus for the ——. J. E. Hatton and J. P. Sala, Havana, Cuba. Eng. Pat. 5901, March 9, 1911. Under Int. Conv., March 11, 1910.

See Fr. Pat. 427,090 of 1911; this J., 1911, 1101.—T. F. B.

Evaporating saline solutions; Apparatus for ——. P. Piccard. Fr. Pat. 429,951, May 19, 1911. Under Int. Conv., June 10, 1910.

See Ger. Pat. 238,739 of 1910; preceding.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Bituminous coal industry of America. B. F. Bush, American Mining Congress at Chicago, Oct., 1911. [T.R.]

Questions were submitted to all the country's principal operators, and, together with the averages of the respective answers, are as follows:

1. Capital invested in business. For each ton of coal sold $1.41 is invested in land, machinery, and equipment.

2. Average total cost of production, labour cost (mine workmen only), administration, and average selling price at mine. Total cost in 1910 averaged $1.07, including 95 cts. for labour and supplies. Administration cost 12 cts. per ton, including office and sales expenses, insurance, taxes, legal advice, etc., but not including depreciation, interest nor profit. Average selling price at mine, $1.11.

3. Estimate of increased cost necessary to meet demand for conservation. Two to 15 cts. in different fields, averaging perhaps 5 cts.

4. Depreciation of values per 100 tons daily capacity. About 4 cts. per ton covers the average depreciation of coal reserves and plant.

5. At what price must coal sell? The increased prices necessary for a fair return on the money invested range from 5 to 25 cts., averaging 12 cts.

Over-production, over-capacity, and ruinous competition were discussed at length. Two possible remedies were suggested. First, district sales agencies to control prices and output, under subjection to an Interstate Coal Commission. Government assistance in encouraging foreign markets.

Coking; Contribution to the chemistry of ——. W. Hempel and F. Lierg. Z. angew. Chem., 1911, 24, 2044—2046.

The authors show that coke contains silicides, which accounts for its hardness, and they also suggest that the presence of finely divided silica has much to do with the formation of coke: the silica being reduced, with formation of carborundum and ferrosilicon. Although it is possible to analyse a mixture of graphite and carborundum by burning off the graphite at 900°—1000° C., at which temperature the carborundum is not attacked, the authors have not succeeded in obtaining carborundum from coke in this manner.

Complete analyses of coke however, are quoted which show that part of the silicon in coke is combined with iron or carbon. Determining nitrogen by burning the coke in a current of oxygen and then analysing the mixture of oxygen, carbon dioxide, and nitrogen formed, always yielded higher results than Kjeldahl's method, in some cases double the amount of nitrogen being found. From the analysis of cokes it is seen that the inorganic constituents play an important part in its formation. It should therefore be possible, by adding suitable ingredients, to produce a good coke from any coal, even from one which in the ordinary way is "non-caking." A long series of experiments proved that this is really the case. For example: a mixture of 120 grms. of non-caking coal, 18 grms. of powdery coke obtained from the same, 4·8 grms. of clay, and 8 grms. of pitch dissolved in 18 grms. of tar, gave a coke with a crushing strength of 235 kilos. per 0·6 sq. cm. This coke had less than 10 per cent. of ash. Best quality cokes, tested for comparison, had a crushing strength of 86—109 kilos. per 0·6 sq. cm.—R. W. N.

Lamp black: Production and uses. B. B. Butler, Min. and Eng. World, Oct. 28, 1911. [T.R.]

At Cabot's lamp black plant at Grantsville, W. Va., the open-ring method of manufacture is used, though the waste is greater in the use of this method than any other (this J., 1894, 128). The "rings" in which the black is produced are 60 ft. in circumference, and near the top of the ring is a flat, smooth iron plate entirely covering the ring. The black is made by impinging the burning natural gas jet upon the surface of the plate, which is kept constantly revolving. Against the plate is arranged an automatic scraper which removes the black produced. By means of screw conveyors the black is conveyed from the scraper to a large bin, where it is ground, sifted, and bolted, and all foreign matter eliminated. The better part is elevated to a packer bin, while the waste is carried off. From the packing bin it is run into bags, containing 12½ lb. each and into barrels containing 100 lb. of black. The capacity of this plant is nearly 8000 lb. daily. Each ring contains 1265 burners, or tips. In all 142,945 tips are employed, consuming 9,143,560 cu. ft. of natural gas daily. At least one-fourth of the gas burned, and probably one-third, is wasted, in the form of lamp-black carried through the vents in the "rings" by the heat. A dense cloud of black smoke arises from the plant and hovers over it.

Sulphur in lighting gas; Determination of ——. J. Niermeyer. J. Gasbeleucht., 1911, **54**, 1078—1079.

Total sulphur is determined by passing the products of combustion of the gas through standard iodine solution, containing starch indicator, until decolourisation occurs, as described by Somerville (J. Gas Lighting, 1910, **112**, 28—29, this J., 1910, 1192), but special attention is called to the following points. In order to prevent loss of iodine by volatilisation from the standard solution, an excess of potassium iodide is added, preferably 10 c.c. of 10 per cent. potassium iodide solution for 10 c.c. of $N/100$ iodine solution. The products of combustion are cooled before reaching the iodine solution. The amount of sulphur dioxide in the products of combustion corresponds to 92—94 per cent. of the total sulphur in the gas, since it has been shown that 6—8 per cent. of the sulphur always burns to sulphur trioxide.—A. T. L.

Methane; A simple method for the determination of —— in producer gas and enriched water gas. S. H. Worrell. Met. and Chem. Eng., 1911, **11**, 576.

The measuring burette used is calibrated over its entire length, is water-jacketed and provided with a three-way tap, to one limb of which a pipette containing potassium hydroxide solution is permanently attached, whilst another limb is attached to the various absorption vessels in succession. The absorption of the various constituents is effected in the following order: carbon dioxide by potassium hydroxide; "illuminants" by bromine solution followed by potassium hydroxide; oxygen by phosphorus; carbon monoxide by cuprous chloride in acid solution, using a double pipette and agitating the liquid in contact with the gas, followed by potassium hydroxide to remove acid vapours. Hydrogen and any carbon monoxide which has escaped absorption are oxidised by several passages over palladium oxide heated to between 90° and 100° C.; the contraction and the subsequent contraction in contact with potassium hydroxide give the hydrogen and the carbon dioxide produced from the carbon monoxide respectively, which latter is added to that already found. In the gas consisting of methane and nitrogen which now remains, the methane is determined by combustion with heated copper oxide; for this purpose a narrow piece of combustion tubing packed with fine copper oxide from which the actual dust has been removed is used; the oxide is kept in position by plugs of asbestos, the ends of the tube being packed with glass wool to diminish the air space; the total air space in the tube need not exceed one c.c. and is determined by measuring the water required to fill it, a subsequent correction being made. If all the hydrogen had been removed in the last operation, there should be no direct contraction, the methane being represented by the contraction produced by the absorption of carbon dioxide in the potassium hydroxide pipette.—B. G. McL.

Paraffin hydrocarbons with air; The lower limit of inflammation of mixtures of the ——. M. J. Burgess and R. V. Wheeler. Chem. Soc. Proc., 1911, **27**, 262. (See also this J., 1911, 1199.)

The conditions under which self-propagation of flame can take place in mixtures of inflammable gases and air were discussed, and the authors find that the smallest quantity of pure methane that will enable self-propagation of flame to take place when a source of heat is introduced into a mixture of it with air, is 5·6 per cent. by volume of the mixture. That is to say, the "lower-limit mixture" contains 5·6 per cent. of methane. It was shown, too, that for the paraffin hydrocarbons, the lower limit of inflammation varies inversely as the calorific value of the gas. Thus, if L=the proportion of the paraffin hydrocarbon necessary to form a lower-limit mixture, and C=its calorific value, $L=k\,(1/C)$, where k is a constant.

Using methane as the standard to obtain the value of k, the observed and calculated values of L are as follows:—

Gas.	L observed.	L calculated.
Methane	5·60 standard	5·60
Ethane	3·10	3·15
Propane	2·17	2·19
n-Butane	1·65	1·68
n-Pentane	1·37	1·36
*iso*Pentane	1·32	1·36

Acetylene; Copper-compounds of ——. W. Manchot. Oesterr. Chem.-Zeit., 1911, **14**, 264—265.

Solutions, constant in their content of cuprous chloride, but varying in their content of hydrochloric acid, were found to absorb greater quantities of acetylene as the content of hydrochloric acid diminished, up to a maximum, after which further diminution of the hydrochloric acid lessened the amount of absorbed acetylene. The compound, $C_2H_2,CuCl$, is formed in this case. If the copper concentration be increased, the compound, $C_2H_2,2CuCl$, is produced; not, however, by direct addition of copper, but by dissociation of the first compound—$2(C_2H_2,CuCl)=C_2H_2,2CuCl+C_2H_2$. Similar results were obtained with phenylacetylene and other substituted acetylenes, but not with diacetylenes such as $C_6H_5C\vdots C{\cdot}C\vdots CC_6H_5$, which form no addition-compounds with copper salts. The power of forming addition compounds depends on the nature of the substituting radicles.—J. T. D.

Paraffin wax; Influence of variations in the sample upon the solidification point of ——. F. Breth. Petroleum, 1911, **7**, 106—107.

Paraffin wax which consists of fractions of different solidification points will show different results in samples taken from different parts of the moulded block. The portion near the middle of the block shows the highest solidification point, whilst portions taken from exterior parts may give results differing, according to the author's experiments with different kinds of wax, by as much as 0·7° C. It is therefore essential that in commercial valuations samples should be taken from different parts of a block.—C. A. M.

Sewage clarification plant at Elbing, Germany, with special reference to the production of gas from the sludge. Schweizer. *See* XIXb.

Distillation of dried sewage sludge for the production of lighting gas. Bayer and Fabre. *See* XIXb.

Carbon monoxide detector. Nowicki. *See* XXIII.

Patents.

Coal, peat and the like; Apparatus for extracting water from ——. C. Burnett, Durham. Eng. Pat. 23.215, Oct. 7, 1910.

The material is fed through a hopper into a horizontal, cylindrical chamber, having perforated walls for the escape of water, in which it is compressed by a reciprocating piston; the feeding and compressing means are operated independently, the pressure of the piston being applied when the material is stationary. By means of a ram or similar device, the partly dried material is further compressed at a point near to the delivery end of the chamber, this pressure being exerted during the return movement of the feeding means.—W. E. F. P.

Coal washing and the like. W. McD. Mackey, Leeds. Eng. Pat. 763, Jan. 11, 1911.

For the purpose of causing the fine dirt to coagulate and settle, lime or baryta is added to the wash water, the proportion employed being from 4 oz. to 1 lb. of lime, or from 12 oz. to 3 lb. of baryta, per 1000 gallons of wash water.—W. E. F. P.

Coke ovens or retorts; Horizontal ——. Ofenbau-Ges. m. b. H., Munich, Germany. Eng. Pat. 6617, Mar. 16, 1911. Under Int. Conv., Apr. 27, 1910.

The oven is of the kind in which the heating gases pass through the flues continuously in one direction. The heating flues are arranged vertically in the walls between adjacent coking chambers, and the waste gases pass from these flues into a sole flue beneath each chamber. A gas supply conduit is arranged beneath every alternate sole flue, and air conduits beneath the intermediate sole flues, so that the air and gas are preheated by the gases in the sole flues. The gas passes from each supply conduit to the two adjacent sets of heating flues by branch conduits provided with valves. Each gas-supply conduit may be divided by transverse vertical walls into two or more separate conduits, and each of these may be divided by horizontal walls into two or more superimposed intercommunicating passages.—A. T. L.

Coking furnace. S. Lelièvre. Fr. Pat. 430,127, May 26, 1911.

The furnace is adapted for coking peat, sawdust, and similar materials which require heating in the interior of the mass. The coking chamber is traversed by a series of horizontal tubes through which the heating gases take a circuitous course from a combustion chamber beneath to a "recuperator" above the coking chamber, and additional air for combustion is admitted at the ends of successive sets of the tubes. The gases evolved during the coking process are taken by down-flues to the combustion chamber and serve for heating the furnace. The "recuperator" serves for drying and heating the next charge of peat, etc. The heating gases from the flues in the coking chamber pass through a similar set of tubes in the "recuperator." The dried charge is admitted to the coking chamber by withdrawing the horizontal plates which separate the two chambers. Heating flues are also provided in the outer walls of both chambers.—A. T. L.

Gas producers. T. W. S. Hutchins, Stockton-on-Tees. Eng. Pat. 23,549, Oct. 11, 1910.

In producers of the type in which the generating chamber comprises two compartments operated alternately, claim is made for the application of known types of reversing valves, operated by a water motor, for simultaneously alternating both the air supplied and the gas taken off, the valves having a rectilinear, reciprocating action or a rocking movement.—W. E. F. P.

Water gas; Manufacture of carburetted ——. L. D. Carroll, London. Eng. Pat. 28,763, Dec. 10, 1910.

An oil heater is arranged in the gas-conduit between the fixing chamber and the washer seal, as described in Eng. Pat. 6324 of 1893 (this J., 1893, 746), and in order that the heating of the oil may not be interrupted during the air blow, a small quantity of air is admitted to the lower part of the gas conduit during this period, so as to burn the carbonaceous deposit which has been formed on the oil-heater during the gas-making period, thereby heating the oil and keeping the gas conduit clear of deposited carbon. The air for this purpose is taken from a branch of the air-blast main, the supply being controlled by a valve connected with the stack valve, and the quantity of air being regulated independently by a stop-cock.—A. T. L.

Gas-producer apparatus. J. A. Herrick, New York. U.S. Pat. 1,005,210, Oct. 10, 1911.

The producer is of the kind in which the blast is introduced into both the upper and lower portions, the gas being drawn off at the middle of the height of the fuel column through a central up-take. According to the invention, the body of the producer has fixed upper and lower parts, and a rotating intermediate part. The cover-plate rotates, and carries with it a fuel hopper and a water-cooled inclined poker, both eccentric to the axis of the producer. During the rotation of the cover-plate, the fuel hopper and the poker are rotated about their own axes.—A. T. L.

Gas-producers in which the ash is fused. Soc. des Gazogènes Marconnet. Fr. Pat. 430,254, May 27, 1911.

To prevent the formation of masses of clinker in the fuel bed, the blast inlet and the gas outlet are arranged so as to localise the zone of combustion in the neighbourhood of the hearth, and so that the hot gases do not traverse the whole of the fuel bed, and further, mechanical stirrers or pokers are provided. In one arrangement the blast is admitted by a central tuyère extending downwards from the top-plate and delivering the blast near the hearth. The gas outlets are at the periphery of the producer at the level of the hearth. The tuyère may carry stirring arms and may be rotated. When using a highly bituminous fuel, a small gas outlet is provided at the top of the producer, and part of the gas is thus allowed to pass up through the fuel column so as to drive off the volatile constituents and moisture. In modifications, the gas outlets may be slightly higher or lower than the blast inlet, or the blast inlet and gas outlet may be interchanged.—A. T. L.

By-products from gas manufacture, and purification of gas. K. Burkheiser. Third Addition, dated May 12, 1911, to Fr. Pat. 394.926, Oct. 5, 1908. (See this J., 1909, 359; 1911, 13.)

To increase the yield of ammonium sulphite and sulphate, the liquor is treated with lime and a current of hot air or steam is passed to expel the dissolved ammonia, cyanogen and hydrogen sulphide. These gases are mixed with the crude gas in the coolers. It is found that the cyanogen is retained in the purifiers and is converted into ammonia during the revivifying process.—A. T. L.

Crude petroleum from moisture, bases and sand; Method of and means for separating ——. R. G. Jones, Los Angeles, Cal. U.S. Pat. 1,005,977, Oct. 17, 1911.

The apparatus consists of an upright cylinder with a conical bottom, divided into a number of annular compartments by vertical cylindrical partitions which do not extend below the cylindrical portion. The crude oil enters the upper part of the centre compartment and is heated by steam. This compartment is covered and provided with an escape pipe for any vapour given off. The conical lower part of the vessel is filled with water and the heated oil flows alternately up and down the succeeding annular compartments to the outermost, from the top of which it is discharged. During this flow the impurities settle out and collect in the water in the conical bottom, from the apex of which they are discharged.—W. H. C.

Retorts or ovens for carbonising coal and the like; Manufacture of ——. J. G. Aarts, Dongen, Holland. Eng Pat. 23,550, Oct. 11, 1910.

See Fr. Pat. 421,316 of 1910; this J., 1911, 409.—T. F. B.

Gas producers. E. Fleischer, Dresden, Germany. Eng. Pat. 24,684, Oct. 24, 1910.

See Fr. Pat. 422,699 of 1910; this J., 1911, 529.—T. F. B.

Apparatus for separating the lighter from the heavier particles in mixtures of the same, particularly applicable to the separation of fine coal from sand. Eng. Pat. 5179. *See* I.

Apparatus for concentrating acid [from petroleum sludge.] U.S. Pat. 1,005,425. *See* VII.

Apparatus for indicating the presence of poisonous or inflammable gases in air. Fr. Pat. 429,862. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Wood; Waste —— and its utilisation [for turpentine and wood pulp]. G. B. Frankforter. J. Ind. and Eng. Chem., 1911, 3, 4—10.

The author has attempted to estimate the amount of waste wood produced by the lumber industry of the United States. The proportion of wood utilised in the form of lumber, lath and shingles barely reaches 40 per cent. of the weight of the trees felled, even with the most modern appliances. From the statistics for the year 1907, it is computed that the wastage in that year amounted to over 150 million tons. This large amount of waste is generally disposed of by destructor furnaces specially erected for the purpose. Investigations on the Norway pine and Douglas fir, showed that the specific gravity of the wood varied very widely even in the same tree. The oleoresin in the Norway pine was found to be fairly evenly distributed, but in the Douglas fir some portions of a tree might contain as much as 50 per cent., whilst other portions of the same tree showed only 3 per cent. The following results were obtained by extraction with organic solvents: lean wood, 4—6 per cent.; resinous wood, 43—46 per cent.; average wood, 14—16 per cent. These figures were obtained from stumps; analyses of the trunks generally gave much lower results. The oleoresin from both species showed: resin 78 per cent., terpenes 22 per cent. Probably one-fifth of the pine and fir wastes is sufficiently rich in oleoresin to make its recovery profitable even by the old process of destructive distillation. Experiments have shown that the yield and quality of the products in the case of coniferous wood depend greatly on the manner of heating the retort. The best results are obtained with a retort in the form of a long inclined cordate tube arranged so that the heat may extend gradually from the bottom to the top, the wood being fed in continuously at the cooler end. An advantage is gained by making openings near the upper end of the retort through which much of the oleoresin may flow out without undergoing distillation. The following results were obtained with three common species of pine and fir: charcoal 22—24, gaseous products 24—26, tar and terpenes 14, pyroligneous acid and water 37—38 per cent. of the wood taken. Most of the distillers fail to find a market for the tar, and burn it; they also throw away the pyroligneous acid. By heating the wood with superheated steam, it is possible to obtain the whole of the terpenes present, but the resin still remains in the wood. The author has been experimenting with an extraction process with very promising results. The plant consists of a battery of extraction vessels and a steam-heated boiler for the solvent, either light petroleum or coke-oven benzene. The waste wood is treated in these vessels with the vapours of the solvent, which condense, and extract the oleoresin, returning with it to the still. After extraction, the residual solvent is removed by forcing air and steam through the wood. The extracted waste is finally treated *in situ* with an alkaline lye for its conversion into pulp. Sawdust, stumps, roots and branches of resinous woods are all capable of treatment by this process, the yield of pulp ranging from 16 to 43 per cent. according to the quality of the material.—J. F. B.

Turpentine from Douglas fir. Oil, Paint and Drug Reporter, Oct. 16, 1911, 53.

In the Douglas fir belt, west of the Cascades in Washington and Oregon, much of the resinous wood waste from the lumbers mills is distilled to recover products. The wood is cut up into pieces not more than 6 inches long by 2 inches cross section and is charged into the retorts. It is first steam-distilled for from six to eight hours, at the end of which time the temperature will have risen to about 325° F. and practically all the turpentine will have passed over. The steam is then stopped and fire distillation commenced; the gas is scrubbed and then either allowed to escape or it is burned under the retorts. One cord of selected Douglas fir waste yields 150 gallons of pyroligneous acid, 12 gallons of tar oils, 20 gallons of tar, from 4 to 12 gallons of turpentine, 800 pounds of charcoal and from 200 to 400 pounds of pitch. Attempts have been made to distil the wood of the stumps left in the ground after the timber has been felled, and from one cord of stumpwood, 8 gallons of turpentine, 20 gallons of tar oils, 35 gallons of tar and 42 bushels of charcoal were obtained. It is however considered that at present prices the distillation of stump wood could not be profitable.—W. H. C.

Patents.

Peat, wood and similar substances; Continuous furnace for carbonising ——. A. Wengler. Fr. Pat. 430,257, May 27, 1911.

The retort is divided into two compartments by a vertical partition, and during the operation these are used in turn for coking, one being available for discharging and recharging. The heat is maintained by the combustion of part of the fuel or of the gases generated, the products being drawn off rapidly by means of ejectors. The ejectors are supplied with steam which is generated from the condensed products of distillation in a boiler arranged in a chamber in which the coke is cooled, and the steam is superheated in a coil passing around the wall of the retort. The lower end of each compartment of the retort is closed by a door, by means of which the coke can be discharged into a chamber beneath and allowed to cool. In starting, a fire is built in this chamber and the combustion products taken partly direct to the coking chamber and partly to the feeding hopper which is arranged above the coking chamber.—A. T. L.

Mantles for incandescence gas lighting; Manufacture of ——. W. Bruno. Fr. Pat. 430,417, June 2, 1911. Under Int. Conv., June 4, 1910.

The fabric is impregnated in the usual manner with a solution of thorium and cerium salts and is then dipped for a few minutes in a solution of sodium peroxide.—A. T. L.

Electrodes for arc lamps; Use of metallic tungsten and uranium for ——. Banque du Radium. First Addition, dated Aug. 9, 1910, to Fr. Pat. 418,280, July 15, 1910 (this J., 1911, 77).

Ultra-violet rays are produced from an arc struck between tungsten or uranium electrodes mounted in a quartz envelope containing inert gases. The lamp may be immersed in water or other liquid without the use of a second protective envelope.—A. T. L.

Metallic filaments for electric incandescence lamps; Manufacture of ——. H. Bresler. Fr. Pat. 429,850, April 6, 1911.

Filaments made, not by drawing the metal, but by squirting a plastic mass containing an agglomerant, are decarbonised and rendered conducting by heating them in gross in an electric furnace in an inert atmosphere. For this purpose large numbers of the filaments are hung on the arms of a star-shaped support.—A. T. L.

Pyrophoric metal alloy. U.S. Pat. 1,006,849. *See* X.

III.—TAR AND TAR PRODUCTS.

Diazoamino-compounds; New method of preparation of ——, *and a new reaction for nitrous acid.* W. Vaubel. Chem.-Zeit., 1911, **35**, 1238.

By treating the hydrochloride or nitrate of an amine such as aniline or *p*-toluidine with half a molecular proportion of sodium nitrite in aqueous or alcoholic solution, or by mixing the solid materials, the corresponding diazoamino-compound is produced. The reaction may be used for the estimation of nitrites in potable waters by adding aniline hydrochloride to the sample. A yellow coloration or even precipitation is produced and by this means the presence of 0·00035 per cent. of nitrite may be detected, but at this dilution several hours are required for the development of the colour.—J. C. C.

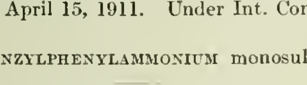
Patents.

Tar resulting from the treatment of such carbonaceous materials as coal for the production of fuel; Recovery of by-products from the ——. W. G. Moore, Birmingham. Eng. Pat. 23,376, Oct. 10, 1910.

The tar, produced when coal or other carbonaceous material is distilled under reduced pressure at 850°—1000° C. (see Eng. Pat. 18,148 of 1910; this J., 1911, 410), is distilled in such a manner that about 40 to 45 per cent. by weight of the tar is condensed; this condensate may be fractionated or the vapours may be collected in fractions. It is stated that certain of the constituents separate in the condensate, forming definite layers, which may be separated mechanically. The small fraction collected near the end of the distillation consists of a light brown, sticky substance, whilst the residue is of a bituminous nature. —T. F. B.

Dimethylbenzylphenylammonium monosulphonic acid; Manufacture of a ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 9360, April 15, 1911. Under Int. Conv., Nov. 21, 1910.

Dimethylbenzylphenylammonium monosulphonic acid,



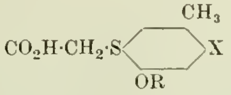
a compound of value in textile printing, is obtained by treating a salt of methylbenzylanilinemonosulphonic acid (containing the sulphonic group in the benzyl group) with a methyl halogenide, dimethyl sulphate, or a methyl ester of a sulphonic acid (compare Ger. Pats. 234,915 and 234,916 of 1910; this J., 1911, 982).—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Patents.

Vat dyestuffs; Manufacture of violet blue ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst on the Maine, Germany. Eng. Pat. 24,569, Oct. 22, 1910.

Violet blue vat dyestuffs are prepared by treating with chlorosulphonic acid the thioglycollic acid of the constitution,



where R = an alkyl group and X = a halogen, such as chlorine or bromine. Example: One part of an acid of the above constitution, in which $R{=}CH_3$ and X=Cl, is added at 15° C. to 5 parts of chlorosulphonic acid and the mixture is stirred until the formation of the dyestuff is completed. The mass is then poured on ice, the dyestuff collected and purified by treating it with boiling sodium hydroxide solution. With hydrosulphite it gives a yellow vat from which cotton and wool are dyed in violet blue shades.—J. C. C.

Vat dyestuffs; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 430,002, May 20, 1911. Under Int. Conv., June 9, 1910.

When isatin chloride or its substitution products is condensed with 6(or 5)-amino-3-oxy-1-thionaphthene or with 4(or 5)-acetaminophenyl-2-thioglycol-1-carboxylic acid, and the products halogenated, dyestuffs are obtained which dye from the vat fast shades different from those obtained from α-isatin-anilide (see Addition to Fr. Pat. 390,484; this J., 1910, 687). For example, 20 grms. of the condensation product from isatin chloride and 6-amino-oxythionaphthene are heated for two hours at 180°—190° C. with 200 grms. of nitrobenzene and 20 c.c. of bromine; after cooling the dye is filtered and purified by treatment with alcohol; it gives a brown vat with alkali hydrosulphite in which cotton and wool are dyed red-brown shades. The dyestuff obtained in a similar manner from dibromo-isatin chloride and 6-amino-oxythionaphthene dyes dark brown shades.—T. F. B.

Indigoid vat dyestuffs containing chlorine; Production of ——. F. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 8203, April 1, 1911.

The dyestuffs are obtained by condensing α-keto-derivatives of isatin or of its homologues or of their halogen substituted products (in which the oxygen of the keto-group is replaced by substituents such as halogen, sulphur, the amino- or alkyloxy-group) with α-naphthol or α-anthrol or with substituted derivatives containing a free ortho- and para-position with regard to the hydroxyl group and by treating the condensation products with sulphuryl chloride. This patent is concerned only with those dyestuffs containing not more than one atom of chlorine in the naphthol or anthrol nucleus. Example 1: 273 parts of the finely powdered dyestuff prepared from isatinanilide and α-naphthol are suspended in 300 parts of glacial acetic acid and 165 parts of sulphuryl chloride are added. The mixture is stirred for 4 hours at the ordinary temperature, then for 2 hours during which the temperature is raised to 70° C., and finally for 2 hours at this temperature. After cooling, the dyestuff is collected, washed and dried. It gives with hydrosulphite a yellow vat from which textile fibres are dyed in pure violet shades. The dyestuff is identical with that produced from isatinanilide and 4-chloro-α-naphthol. Example 2: The dyestuff prepared from dibromoisatin chloride and α-naphthol is treated similarly. The product dyes cotton in deep reddish blue shades.—J. C. C.

Dyestuffs of the anthracene series; Process for producing new ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated May 18, 1911 (under Int. Conv., July 11, 1910), to Fr. Pat. 404,345, June 23, 1909 (this J., 1910, 146).

DYESTUFFS such as those described in the chief patent can be obtained by treating 1 : 5-dibenzoyldiaminoanthraquinone or its derivatives with oxidising agents, except sulphuric acid.—J. C. C.

Anthraquinone derivatives; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 238,981, July 27, 1910.

ACYLATED *o*-diamino-anthraquinones or their derivatives are heated alone or with addition of diluents, water, or dehydrating agents: similar products are obtained if *o*-diamino-anthraquinones are treated with acylating agents until ring-formation is effected. The products may be used as dyestuffs or for the preparation of dyestuffs.
—T. F. B.

Azo dyestuffs; Process for producing basic ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 430,470, April 13, 1911. Under Int. Conv., April 20, 1910.

BASIC dyestuffs which dye artificial silk brown shades fast to water, are obtained by combining the diazo compounds of amines or of acidyldiamines with triaminodiphenyl, tetrazotising the resulting products or hexazotising the saponified compounds, and combining with two or three molecules of amines, diamines, naphthylenediamines, aminonaphthols or their alkyl derivatives, or mixtures of these products.—T. F. B.

Trisazo dyestuffs; Process for producing brown tertiary ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 430,527, May 15, 1911. Under Int. Conv., May 21, 1910.

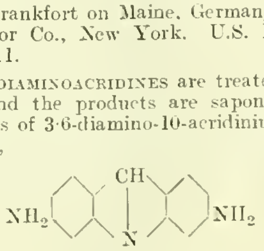
THE diazo compounds of aminosulphonic acids or aminocarboxylic acids are combined with two molecules of the same or with one molecule of two different amines of the benzene series in which the *p*-position is free (*e.g.*, aniline, *o*- or *m*-toluidine, *p*-xylidine, etc.): or the diazosulphonic or carboxylic acids are combined in any order with one mol. of one of the above amines and with one mol. of α-naphthylamine or of 1·6- or 1·7-naphthylaminesulphonic acid. The resulting amino-disazo compounds are diazotised and combined with nitrophenylenediamine, nitrotoluylenediamine, or dihydroxyquinoline.—T. F. B.

Triphenylmethane dyestuffs: Process for preparing chrome ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 238,487, July 5, 1910.

BENZALDEHYDE derivatives, such as the o-halogen, *o*-sulpho, and *p*-alkylamino compounds, are condensed with one mol. of salicylic or cresotinic acid and with one mol. of a *m*-substituted salicylic acid or other hydroxycarboxylic acid of the benzene or naphthalene series with which condensation in the position *para* to the hydroxyl group is impossible; the leuco-compounds thus produced are oxidised to triphenylmethane dyestuffs.—T. F. B.

3.4-*Diamino-acridinium and its salts.* P. Ehrlich and L. Benda, Frankfort on Maine, Germany, Assignors to Cassella Color Co., New York. U.S. Pat. 1,005,176, Oct. 10, 1911.

3.6-BISACIDYLDIAMINOACRIDINES are treated with alkylating agents and the products are saponified: by this means the salts of 3·6-diamino-10-acridinium compounds, of the formula,



are formed (R means an alkyl radical and X a negative substituent). They are orange to red crystalline powders, soluble in water with a slight green fluorescence, and in methyl and ethyl alcohols with an intense green fluorescence; they dye cotton treated with tannin yellow shades fast to soda and soaping. 3.6-Diamino-10-methylacridinium chloride, a brownish red substance, is especially claimed.—T. F. B.

Monoazo dyestuffs of the pyrazolone series; Production of yellow ——. Soc. pour l'Ind. Chim. à Bale. First Addition, dated July 26, 1910, to Fr. Pat. 388,279, Mar. 18, 1908 (this J., 1908, 893).

DYESTUFFS similar to those described in the chief patent are obtained by combining the diazo derivatives there mentioned with a sulphoaryl-5-pyrazolone-3-carboxylic acid containing alkyl, oxyalkyl, sulpho or halogen groups in the ortho position to the nitrogen of the pyrazolone.
—J. C. C.

Black dyestuffs; Manufacture of ——. Read Holliday and Sons, Ltd. Fr. Pats. 430,289, May 29, 1911, and 430,321, May 30, 1911.

(1). BLACK azo dyestuffs are obtained by the use of chloro-*m*-phenylenediamine as end component. *Example*: *p*-Chloroaniline is diazotised and combined with aminonaphtholdisulphonic acid H in acid solution, the mixture is rendered alkaline, a solution of tetrazotised benzidine added and, subsequently, a solution of 1-chloro-2 : 4-phenylenediamine. The resulting dyestuff produces deep greenish black shades on cotton. (2). Tetrazotised benzidine is combined with aminonaphtholdisulphonic acid H, in acid solution, the mixture is rendered alkaline and diazotised *p*-chloroaniline is added. The intermediate product thus obtained is then combined with 1-chloro-2 : 4-phenylenediamine. The dyestuff gives deep black shades on cotton.—J. C. C.

Vat dyestuffs of the anthracene series; Process for producing ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 430,439, June 2, 1911.

FAST vat dyestuffs are obtained by heating with anhydrous aluminium chloride a number of anthraquinone derivatives, other than α- and β-aminoanthraquinones. Such derivatives are chloro-anthraquinones, thiocyanoanthraquinones, anthraquinone-sulphonic acids, and even anthraquinone itself and its homologues. *Example:* 100 parts of anthraquinone are intimately mixed with 75 parts of anhydrous aluminium chloride, and the mixture is heated for one hour at 250° C.; the reaction is complete when the molten mass becomes solid. The black powder obtained can be washed with hydrochloric acid or used at once; its alkali hydrosulphite vats dye cotton brown shades. The dyes from 2-chloro-anthraquinone and thiocyano-2-anthraquinone dye bronze-brown shades, whilst those from naphthanthraquinone and 1-chloro-anthraquinone dye grey shades.—T. F. B.

Azo dyestuffs; Process for preparing red to brown chrome ——. Farbwerk Mühlheim vorm. A. Leonhardt und Co. Ger. Pat. 238,596, June 28, 1910.

FAST chrome dyestuffs are produced by combining the diazo compounds of chloro, nitro, or chloronitro derivatives of o-aminophenol with 1.3.6- or 1.3.4-aminonaphtholsulphonic acid. The dye from diazotised *p*-nitro-o-aminophenol and the 1.3.6-acid dyes wool from acid baths yellow shades, which become yellowish-red on chroming, whilst if the 1.3.4-acid is used in place of the 1.3.6-acid, a dye is obtained which dyes wool yellow shades which are converted by chroming into deep blackish-brown.
—T. F. B.

3.6-*Diaminoacridine and its derivatives; Manufacture of* ——. R. B. Ransford, London. From L. Cassella und Co., Frankfort-on-Maine, Germany. Eng. Pat. 24,652, Oct. 24, 1910.

SEE Ger. Pat. 230,412 of 1910; this J., 1911, 352, and U.S. Pat. 1,005,176 of 1911; preceding.—T. F. B.

Azimino-ortho-toluidines; Manufacture of alkylated and aralkylated derivatives of —— and of monoazo dyestuffs therefrom. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 25,461, Nov. 2, 1910.

See Fr. Pat. 424,070 of 1910; this J., 1911, 738.—T. F. B.

Azo dyestuffs; Manufacture of basic ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 26,249, Nov. 11, 1910.

See Fr. Pat. 430,470 of 1911; preceding.—T. F. B.

Azo dye; Diazotisable green ——. A. Blank and M. Latten, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,006,051, Oct. 17, 1911.

See Eng. Pat. 30,284 of 1910; this J., 1911, 1006.—T. F. B.

Monoazo dyestuffs for wool; Manufacture of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 13,304, June 2, 1911. Under Int. Conv., March 3, 1911.

See Fr. Pat. 430,146 of 1911; this J., 1911, 1246.—T. F. B.

Vat dyestuffs of the anthraquinone series; Process for the manufacture of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 15,809, July 7, 1911. Under Int. Conv., Aug. 11, 1910. Addition to Eng. Pat. 404 of 1911, dated May 12, 1910.

See Fr. Pat. 428,819 of 1911; this J., 1911, 1205.—T. F. B.

Azo dye. H. Freimann, Stockum, Assignor to C. Jäger G. m. b. H., Dusseldorf-Derendorf, Germany. U.S. Pat. 1,006,929, Oct. 24, 1911.

See Fr. Pat. 412,138 of 1910; this J., 1910, 1003.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cellulose and dilute solutions of salts. B. Rassow. Z. angew. Chem., 1911, 24, 1127.

Cotton cellulose is capable of absorbing and fixing small quantities of copper from dilute solutions of copper salts, approximately the equivalent quantity of free acid remaining in the solution; the absorbed copper cannot be removed by washing. Unbleached cotton absorbs more copper than bleached cotton. If the cotton be thoroughly purified, chiefly by means of caustic soda solution and hot water, its capacity of absorbing copper is reduced to a minimum, the very slight absorptive power still retained being probably due to oxycellulose. Cellulose hydrate and hydrocellulose do not absorb copper from solutions of its salts. It is suggested that the "copper sulphate" value determined as indicated above, would prove a valuable adjunct to Schwalbe's "copper value" for distinguishing different kinds of celluloses. No adsorption of copper salts (sulphate and acetate) as such from dilute aqueous solutions by cotton could be detected. Analogous results to those obtained with copper sulphate solutions are yielded by solutions of nickel sulphate, aluminium sulphate, and potassium chloride with carefully bleached and purified cotton. Artificial silks (Pauly and viscose silks) fix a larger quantity of metal than cotton does. The absorption of the metal is independent of the concentration of the solution, the temperature, and the time of contact. Silver nitrate is reduced by the different kinds of cellulose, and hence the amount of silver fixed increases with the concentration of the solution. Basic dyestuffs behave in a similar manner to the metallic salts; a small but distinctly recognisable quantity is fixed in such a form that it cannot be removed by washing.—A. S.

"Cellit" varnish; The reputed acidity of ——. H. Frederking. Mitt. königl. Materialprüfungsamt, 1911, 29, 360.

Schluttig has raised objection to the use of "cellit" varnish for the preservation of old documents, recommended by Martens (this J., 1911, 414), on account of its supposed acid reaction. It is true that this varnish and its diluting medium, when tested directly with litmus, show a slight reddening reaction, but the reaction with litmus is not a valid test for free acid. The solvent medium of "cellit" varnish is a mixture of ethylacetate and acetoacetate; these solvents were shaken with water and the aqueous extracts were concentrated; both were slightly acid to litmus, but had no action on Congo paper, and were free from chlorides and sulphates. The slight acidity was therefore due to traces of harmless organic acids. The "cellit" solids were likewise tested for the presence of sulphuric acid, possibly present in combined form as aceto-sulphuric ester (of cellulose). The sulphuric acid of such mixed esters is very resistant to alkaline hydrolysis but is readily split off by the action of boiling water. The author found that a sample of commercial cellulose acetate, when boiled with water, gave sufficient free sulphuric acid to react with Congo paper. But on the other hand, when "cellit" was subjected to the same treatment, not a trace of mineral acid could be detected in the extract. Even when completely decomposed by boiling nitric acid, "cellit" yields only traces of sulphates, which may be attributed to the ash-constituents of the cellulose employed. Eichengrün, the inventor of "cellit," also states that the cellulose ester, now being produced under that name by an improved process, can contain at most only traces of sulphuric acid, these being firmly bound by the mineral residue of the cotton. No fear need be entertained as to the possible injury of documents preserved with this varnish.—J. F. B.

Waste wood and its utilisation [for turpentine and wood pulp]. Frankforter. *See* IIb.

Patents.

Treating textile plants and vegetable matters for obtaining vegetable fibres and paper pulp, applicable also for degreasing wool and other animal fibres; Process of ——. J. F. P. McInerny, Swansea. From L. Peufaillit, Tunis, N. Africa. Eng. Pat. 22,869, Oct. 3, 1910.

The material to be treated is introduced into an autoclave containing water to which crude petroleum has been added in quantity equal to at least 5 per cent. of the weight of the substance under treatment. After thoroughly immersing the material in this liquor the autoclave is hermetically sealed and heated to 120°—180° C. for 2—6 hours according to the nature of the fibrous substance. Any other hydrocarbon may be used instead of petroleum. —P. F. C.

Textile fibre and pulp; Process of converting fibrous plants into ——. F. F. Strong, St. Petersburg, Fla. U.S. Pat. 1,005,354, Oct. 10, 1911.

The raw fibrous material is first crushed, then mixed with a salt solution and the whole is submitted to cathode electrolytic action. The bubbles of hydrogen which are liberated among the cell masses assist in the disintegration of the material, and the sodium hydroxide which is formed acts as a cleansing agent. The scoured fibrous material finally undergoes an electrolytic bleaching process. All these operations are carried out continuously.—P. F. C.

Wool and other fibrous substances or the like; Machines for washing ——. W. R. Kay, Bingley, Yorks. Eng. Pat. 28,192, Dec. 5, 1910.

Deflector or depressing plates, in the form of inverted V-shaped troughs with their outer ends open, are arranged to enter and leave the liquid vertically and also to move horizontally through the liquid. The plates have prongs arranged on one or other, or on both of the lower edges.

The troughs may be arranged at right angles, or parallel, to the direction of movement, or may be inclined towards, or parallel to, each other and inclined to the direction of movement.—B. N.

Wool; Scouring or cleaning ——. W. J. Croston, Lawrence, Mass., Assignor to W. H. Dwelly, Brookline, Mass. U.S. Pat. 1,006,726, Oct. 24, 1911.

"Wool clips" are freed from materials with which they are marked by subjecting the marked wool to the action of a solvent containing "benzine," carbon bisulphide and alcohol. The wool is then subjected to mechanical pressure to disintegrate the marking materials, and afterwards agitated to separate mechanically the marking materials from the wool.—B. N.

Threads, filaments, strips or films of cellulose; Manufacture of ——. S. Courtauld and Co., and S. S. Napper, Coventry. Eng. Pat. 406, Jan. 6, 1911.

To an ordinary acid coagulating bath, such as is used in the preparation of artificial viscose silk, it is found advantageous to add a small quantity of a zinc salt, preferably the sulphate. The amount of the salt should be less than 3 per cent. of the weight of the bath. A typical coagulating liquor prepared according to this invention contains 8·5 parts of sulphuric acid, 9 parts of glucose, 4 parts of ammonium sulphate, 12 parts of sodium sulphate, 1 part of zinc sulphate and 65·5 parts of water.—P. F. C.

Cellulose; Process for the preparation of highly concentrated solutions of ——. Comp. franç. des Applications de la Cellulose. Fr. Pat. 429,841, July 27, 1910.

Homogeneous solutions containing up to 15 per cent. of cellulose are prepared by making an intimate mixture of cellulose and cupric hydroxide and dissolving this mixture in ammonia. For instance: 30 kilos. of cotton waste, purified and lightly bleached, are reduced in a hollander breaking engine to a uniform pulp, which is finally diluted to a volume of about 3000 litres. In a separate vessel, 60 kilos. of copper sulphate are dissolved in 300—400 litres of water and the cold solution is poured gradually into 40 litres of caustic soda lye of 38° Bé. diluted with 3—4 times their volume of water. Rise of temperature is to be avoided, and the dehydration of the cupric hydroxide may be further prevented by adding a little sugar to the soda lye. The paste of cupric hydroxide is mixed by mechanical means with the cellulose pulp, and absorption rapidly takes place. The water is drained off and the pulp is pressed or centrifuged. The product is reduced to small granules in a mixing machine and sprayed with 100 litres of ammonia solution of 28° Bé., representing a weight of ammonia gas equal to that of the cellulose. The whole is stirred for about 20 minutes, left to steep for 24 hours, treated with about 0·5 litre of soda lye diluted with an equal volume of water per kilo. of cellulose, which has the effect of liquefying the mass, and then mixed until a homogeneous solution results.—J. F. B.

Celluloid-substitutes; Non-inflammable ——. L. L. T. Labbé. Fr. Pat. 430,035, May 22, 1911.

Non-inflammable substitutes for celluloid are manufactured by incorporating materials such as gelatin or casein with substances which will increase their tenacity and reduce their hygroscopic properties, *e.g.*, shellac or gelatinous silica. For instance, a solution of gelatin in water to which are subsequently added acetic acid, alum, glycerin and glucose, is mixed with a solution of shellac in alcohol, ammonia or borax, and the mixture is evaporated. Alternatively the two solutions above may be mixed with a solution of casein in borax and evaporated. After casting into moulds, the articles may be treated with formaldehyde. According to another process, a solution of silicic acid, prepared by adding an excess of hydrochloric acid to a solution of a silicate is mixed with a solution of gelatin or casein, then neutralised and mixed with gelatinous silica and glycerin.—J. F. B.

Films of celluloid or other materials; Apparatus for manufacture of ——. Soc. Ind. de Photographie. Fr. Pat. 430,086, Aug. 1, 1910.

The apparatus consists of a closed cylinder, the surface of which is divided up by a helical partition, the pitch of which determines the width of the film produced. The helix is made of channel-iron and a trough containing the solution of celluloid, gelatin, or the like, is engaged in these channels so that it slides on horizontal guides along the length of the cylinder as the helix revolves. The surface of the cylinder is coated with glass, polished metal or enamel and the solution is deposited in the space between the convolutions of the helix. For drying the film, the cylinder is provided with a hollow shaft with a partition inside. Hot air is delivered into one end of the shaft and is distributed by fixed arms near the walls of the cylinder. This air escapes through holes in the hollow shaft on the other side of the partition. The whole cylinder is enclosed in a casing through which hot air is circulated for the recovery of the solvent.—J. F. B.

Cellulose xanthate; Preparation of ——. A. J. Burette. Fr. Pat. 430,221, May 22, 1911. Under Int. Conv., June 17, 1910.

Instead of combining the alkali-cellulose with an excess of carbon bisulphide, as is customary in practice, it is treated with a limited quantity of the reagent, that is, from 15 to 20 per cent. of the weight of the cellulose. The cellulose, steeped in soda lye, is pressed uniformly so that the weight of the moist alkali-cellulose only amounts to 2·5 times the weight of the original cellulose. The material is then reduced to flakes and spread in thin layers on perforated trays. The trays are stacked in a chamber, a vacuum is produced and the prescribed quantity of carbon bisulphide is admitted in the form of vapour. By thus limiting the proportions of reagents and water, the cellulose xanthate does not cake together during the reaction and, when dissolved, it gives a viscose which does not require to be "ripened" before use.—J. F. B.

Esparto; Manufacture of pulp or half-stuff from —— *by bacteriological, electrolytic and electro-chemical methods.* F. E. M. Dubrot. Fr. Pat. 430,230, Aug. 4, 1910.

The esparto grass is first treated with a ferment extracted from the gastric juices of herbivorous animals in presence of sea-water which attacks the pectic constituents. The material is then subjected to the action of an electric current of low tension, in presence of a solution of caustic soda of 3°—7° Bé., so that the chlorides of the sea water remaining in the grass are decomposed. The grass is pressed, reduced to a pulp in a breaking engine and subjected to the bleaching action of a hypochlorite produced by the circulation of sea water alternately through an electrolyser and the pulp in the breaking engine.—J. F. B.

Separation of suspended solid matter [fibrous material] from a liquid under pressure in a closed vessel; Process and apparatus for ——. A. Müntzing. Fr. Pat. 430,589, June 3, 1911. Under Int. Conv., June 9, 1910.

The apparatus is intended more particularly for separating fibrous matter, for example, in preparing wood-pulp by digesting the wood with water under pressure. The liquid is pumped into the larger end of a conical tube and passes through the perforated walls into an outer casing. The solid matter is removed continuously towards the smaller end by a rotating screw conveyor. The intermediate part of the conical tube is not perforated and the conveyor fits it closely, so that the hydrostatic pressure is not transmitted beyond this part of the tube.—A. T. L.

Vegetable fibres of kapok and other plants; Process of treating brittle ——. E. G. Stark, Altchemnitz, Germany. U.S. Pat. 1,006,142, Oct. 17, 1911.

See Eng. Pats. 28,701 of 1909 and 3757 of 1910; this J., 1911, 81.—T. F. B.

Cellulose products; Manufacture of ——. Comp. Franç. des Applications de la Cellulose, Paris. Eng. Pat. 27,878, Nov. 30, 1910. Under Int. Conv., Jan. 21, 1910.

See Fr. Pat. 422,565 of 1910; this J., 1911, 532.—T. F. B.

Cellulose solutions; Process for the preparation of ——. Comp. Franç. des Applications de la Cellulose, Paris. Eng. Pat. 28,779, Dec. 10, 1910. Under Int. Conv., July 27, 1910.

See Fr. Pat. 429,841 of 1910; preceding.—T. F. B.

Cellulose; Manufacture of dyed acidyl derivatives of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 1556, Jan. 20, 1911.

See U.S. Pat. 994,738 of 1911; this J., 1911, 888.—T. F. B.

Effect papers; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 1539, Jan. 20, 1911. Under Int. Conv., Feb. 25, 1910.

See Fr. Pat. 424,328 of 1910; this J., 1911, 740.—T. F. B.

Soda-pulp mills; Process of treating waste liquors from ——. E. L. Rinman, Gottenborg, Sweden. U.S. Pat. 1,005,882, Oct. 17, 1911.

See Fr. Pat. 401,856 of 1909; this J., 1909, 1163.—T. F. B.

Packing material. Eng. Pat. 10,235. *See* I.

Treatment of seaweeds for the extraction of mineral and organic chemical substances. Addition to Fr. Pat. 352,069. *See* VII.

Manufacturing industrial alcohol, glucose, and cellulose from vine shoots. Fr. Pat. 429,825. *See* VIII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Dyeing process with substantive dyestuffs; Contribution to the knowledge of the ——. W. G. Schaposchnikoff. Z. physik. Chem., 1911, 78, 209—227.

Weighed samples of ordinary and mercerised cotton and artificial silk were thoroughly cleansed with inert solvents and then dyed under standard conditions of concentration, temperature and time in aqueous solutions of different commercial substantive dyestuffs, viz.: Cotton Orange G, Oxamine Pure Blue XX, Dianil Garnet B, Benzo Pure Blue 4B, and Diamine Pure Blue. No additions of Glauber's salt or sodium chloride were made to the dye-bath. The dyestuffs (which were purified by dialysis before use) were chosen on account of their high sulphur content, so that the quantity fixed on the fibre could be subsequently obtained from a sulphur determination of the dyed material. From a series of such experiments the author draws the following conclusions, limiting them strictly to his experimental conditions:—(*a*) The course of the dyeing process may be expressed by one of the two equations: (1) $C_f = \beta C_b^{\frac{1}{a}}$, where C_f is the final concentration of the dyestuff on the fibre, C_b is the concentration of the dyestuff remaining in the dye-bath after the process is completed, and a and β are constants; (2) $C_f^a + AC_f — A{,}10k = 0$, where $10k$ is the weight of dyestuff which is put into the dye-bath for each gram of material to be dyed, and A is a constant. (*b*) The dyeing of cellulose with substantive dyestuffs obeys the laws expressed in (*a*), whether the cellulose is in the form of ordinary cotton, mercerised cotton or artificial silk. (*c*) When dyed under the same experimental conditions, the proportion of dyestuff fixed on the mercerised fibre is 10 per cent. greater than the proportion fixed on ordinary cotton. This difference may be made the basis of a method of determining the degree of mercerisation. (*d*) The amounts of different dyestuffs fixed on cellulose when dyed under comparable circumstances vary approximately with the molecular weights of the dyestuffs.
—P. F. C.

Crepon effects on cotton fabrics; Production of black ——. E. Justin-Mueller. Sealed note No. 1249, May 9, 1901. Bull. Soc. Ind. Mulhouse, 1911, 81, 203—205.

When a concentrated solution of sodium hydroxide is printed on to a cotton fabric which has been previously dyed with a black dyestuff fast to caustic alkalis, the crepon effect thus produced appears deeper in shade than the unprinted parts of the material. To remedy this defect, the author tops the dyed fabric before printing, with a black dyestuff which is destroyed by a concentrated solution of sodium hydroxide. Basic dyestuffs are specially suitable for this purpose. On applying the alkaline printing colour to the topped fabric, the gain in intensity of colour on the printed parts due to mercerisation is counterbalanced by the loss in depth due to the discharge of the topped dyestuff, and a uniformly dyed fabric, is obtained —P. F. C.

Wax reserve style on silk; Suppression of toluene or benzene in the production of the ——. J. Dépierre. Sealed note No. 1259, June 1, 1901. Bull. Soc. Ind. Mulhouse, 1911, 81, 205—206.

The fabric is printed with a wax reserve, then dyed in the cold and is finally passed through a tank containing carbon tetrachloride in order to remove the wax. The carbon tetrachloride can be prevented from volatilising by covering its surface with a layer of water.—P. F. C.

Printing with sulphur dyestuffs; New method of ——. C. Favre. Sealed note, No. 1715, March 9, 1907. Bull. Soc. Ind. Mulhouse, 1911, 81, 207—209.

A printing colour which does not contain caustic alkali and has no injurious action on the engraving of the copper printing rollers, is obtained by adding formaldehyde to a cold aqueous solution containing a sulphur dyestuff, sodium sulphide, glucose, potassium carbonate and a suitable thickening agent, and then allowing the mixture to stand for ten hours. The addition of hydrosulphite to such a printing colour, though not essential, is beneficial. Two minutes' steaming in the Mather-Platt is sufficient to fix the dyestuff on the fibre, producing prints equal in fastness to those obtained by the caustic soda process. M. Battegay in a report on this note confirms the author's results but, on the question of priority, draws attention to Ger. Pats. 164,506 and 168,598 of 1904 and 198,691 of 1906 granted to Cassella und Co. (this J., 1906, 217 and 1214).—P. F. C.

Cellulose and dilute solutions of salts. Rassow. *See* V.

Chromi- and ferri-acetates. Weinland. *See* VII.

Patents.

Wool unshrinkable; Process for rendering —— whilst retaining its structure and suppleness and rendering it easy to bleach. G. Lumpp. Fr. Pat. 430,279, May 29, 1911.

The wool is immersed for 15—30 minutes in a bath of hypochlorites which has been neutralised with organic acids, or with phosphoric or boric acids, and simultaneously treated with aldehydes, principally formaldehyde.—B. N.

Bleaching and dye works; Apparatus [winch] for use in ——. J. Shaw, Stockport, and M. M. McGregor, Invercraig. Eng. Pat. 24,841, Oct. 26, 1910.

The winch comprises a closed hexagonal drum having projecting lugs fixed to the end pieces at each corner. These lugs carry *lignum vitae* blocks which act as bearings for rollers extending from end to end of the drum and so mounted that they can revolve freely without touching it. —P. F. C.

Dyeing indigo and other vat colours. A. Ashworth, Bury. Eng. Pat. 24,434, Oct. 21, 1910.

The cover of an enclosed rectangular iron tank is provided at each end with a vertical slot which extends the whole width of the cover and projects above it like a bottle neck. Through these openings the fabric to be dyed enters and leaves the tank, which is kept full to at least half way up the slots with a solution of the leuco compound of the vat dyestuff. Immediately underneath the entry opening and entirely immersed in the liquor is arranged a pair of squeezing rollers for expelling the air which the fabric contains. The cloth next passes under and over a series of guide rollers, then leaves the tank and without breaking its vertical travel is passed between a pair of horizontal squeezing rollers so that the expressed liquor can run back into the vat. After passing through an aerating chamber the cloth is after-treated in the ordinary way.—P. F. C.

Dyeing fabrics; Process of ——. A. Rutler, Assignor to Susquehanna Silk Mills, Sunbury, Pa. U.S. Pat. 1,005,888, Oct. 17, 1911.

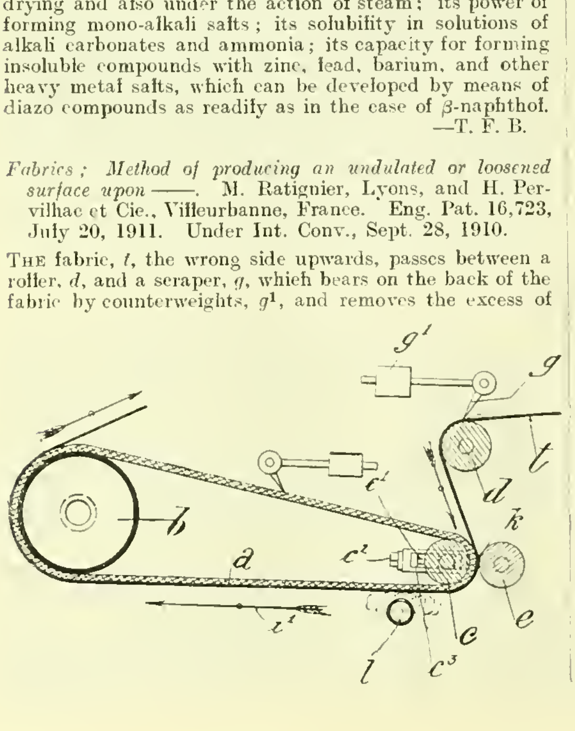
The fabric is passed under tension, in the form of a "web" or "span" of material in the shape of an arc, over a bath of dye without coming into actual contact with the liquid in the bath. The dye is showered upon the material in excess of that which it can absorb, and the excess is allowed to flow freely from the web into the bath to be used again after mixing.—B. N.

Printing and dyeing on fabrics the colours usually produced by means of β-naphthol; Process for producing by ——. Heilmann und Co., and M. Battegay. Ger Pat. 238,841, Oct. 18, 1910.

2.1-Naphtholcarboxylic acid is used in place of β-naphthol, either alone or in conjunction with other phenols, in the single- or double-bath process. The colour lakes produced on the fibre are identical with those obtained from β-naphthol, since Nietzki and Guitermann have shown that the carboxyl group of 2.1-naphtholcarboxylic acid is eliminated when treated with diazo compounds. The advantages of the naphtholcarboxylic acid over β-naphthol are, the stability and non-volatility of the alkali salts on drying and also under the action of steam; its power of forming mono-alkali salts; its solubility in solutions of alkali carbonates and ammonia; its capacity for forming insoluble compounds with zinc, lead, barium, and other heavy metal salts, which can be developed by means of diazo compounds as readily as in the case of β-naphthol. —T. F. B.

Fabrics; Method of producing an undulated or loosened surface upon ——. M. Ratignier, Lyons, and H. Pervilhac et Cie., Villeurbanne, France. Eng. Pat. 16,723, July 20, 1911. Under Int. Conv., Sept. 28, 1910.

The fabric, t, the wrong side upwards, passes between a roller, d, and a scraper, g, which bears on the back of the fabric by counterweights, g^1, and removes the excess of an adhesive substance which is spread on the back of the fabric in a thin layer. The fabric then passes between the rubber table, a, and a pressure roller, e, the roller, c, being provided with tensioning means, such as bearing blocks, c^1, adjustable by nuts, c^2, in guides, c^3. At the point where the fabric passes over the table at c, it is stretched more considerably on its outer surface, but when the fabric resumes its direction in a straight line, the contraction of the rubber causes the fabric attached to it to shrink. The material is fixed in this form by vapour supplied through the pipe, l, and is afterwards cooled by the roller, b, through which cold water or air is passed. The shrinkage, after expansion, distends the threads of the warp, giving an undulated or loosened surface to the right side of the fabric, thus producing a "fluffy" appearance.—B. N.



Fabrics or the like non-inflammable; Means for rendering ——. F. Johnson and M. Newton, Nottingham. Eng. Pat. 16,557, July 18, 1911.

A mixture of approximately equal parts of borax, powdered alum and common salt is dissolved in water and the fabric is treated with the solution and dried. —P. F. C.

Fabrics impermeable to gases; Process for rendering ——. N. Hornstein. First Addition, dated Oct. 10, 1910, to Fr. Pat. 429,166, July 9, 1910 (this J., 1911, 1208).

The fabric is treated with agar-agar dissolved in water and formaldehyde as in the principal patent, and then covered with a solution of collodion in oil of turpentine, alcohol and ether, or the fabric may be treated with steam charged with formaldehyde.—B. N.

Dyes on the fibre; Manufacture of compounds suitable for the production of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 1441, Jan. 19, 1911.

See Fr. Pat. 426,201 of 1911; this J., 1911, 948.—T. F. B.

Dyeing with certain vat dyestuffs. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 6258, March 13, 1911. Under Int. Conv., March 15, 1910. Addition to Eng. Pat. 3241 of 1911, dated Feb. 28, 1910.

See Addition of Jan. 31, 1911, to Fr. Pat. 425,486 of 1911; this J., 1911, 952.—T. F. B.

Dyeing; Process of ——. M. Kahn and A. Ossenbeck, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,006,097, Oct. 17, 1911.

See Eng. Pat. 12,140 of 1910; this J., 1911, 280.—T. F. B.

Liquid-dyeing apparatus. H. Eicken, Grevenbroich Germany. U.S. Pat. 1,006,471, Oct. 24, 1911.

See Eng. Pat. 11,182 of 1910: this J., 1911, 280.—T. F. B.

Manufacture of a dimethylbenzylphenylammonium monosulphonic acid. Eng. Pat. 9360. *See* III.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Salt deposits of Ontario. Board of Trade J., Nov. 2, 1911.

The following particulars regarding the salt deposits of Ontario are taken from the annual report of the Provincial Bureau of Mines for 1910:—The area in Ontario in which salt is known to occur lies entirely in the south-western peninsula bordering Lake Huron, the St. Clair River, Lake St. Clair, and the Detroit River. Such exploratory boring as has been done indicates that there are a number of separate relatively small basins. The beds range from mere seams to formations 200 feet or more in thickness. The supply of salt in Ontario is practically inexhaustible. The bulk of the salt manufactured is used in Ontario. The quantity of salt produced in 1910 was 84,071 tons, valued at $414,978, as compared with 77,490 tons, valued at $389,573, in 1909.

Calcium chloride, calcium hydroxide, and water at 25° C. ; The system ——. F. A. H. Schreinemakers and T. Figee. Chem. Weekblad, 1911, 8, 683—688. Chem. Zentr., 1911, 2, 1513.

Examination of mixtures of calcium chloride, calcium hydroxide, and water at 25° C., showed that besides calcium hydroxide and calcium chloride ($CaCl_2,6H_2O$), two oxychlorides ($CaO,CaCl_2,2H_2O$ and $4CaO,CaCl_2,14H_2O$) are obtained as solid phases, both of which are decomposed by pure water.—A. S.

Double oxalates of sodium and nickel, and sodium and cobalt ; The stability of the ——. J. W. Dodgson. Chem. Soc. Proc. 1911, 27, 260—262.

On boiling nickel oxalate, $NiC_2O_4,2H_2O$, with an approximately 2*N*-solution of sodium carbonate, a green solution is obtained ; when this is filtered from the residue, and allowed to remain for about twenty-four hours, green crystals separate, which consist of the double oxalate of sodium and nickel, with but a small amount of impurity. The green solution cannot be crystallised by evaporation aided by heat. Three specimens of the crystalline compound were prepared, one (*a*) by boiling 20 grms. of nickel oxalate with 100 c.c. of a 2*N*-solution of sodium carbonate, another (*b*) by boiling 15 grms. of nickel oxalate with 100 c.c. of a 4*N*-solution of sodium carbonate, and a third (*c*) by boiling sodium oxalate and nickel oxalate in molecular proportions with water. A green solution was obtained in each case ; it was filtered, and allowed to remain for a few days, when the crystals separated, and were washed several times with cold water and dried in the air. Analysis indicated in each case the formula : $Na_2C_2O_4,NiC_2O_4,8H_2O$. The reaction which takes place is obviously a balanced reaction, and may be represented by the equation :

$$Na_2CO_3+2NiC_2O_4 \rightleftarrows Na_2C_2O_4,NiC_2O_4+NiCO_3,$$

the actual conditions of equilibrium depending on the relative masses of the sodium carbonate and nickel oxalate reacting.

The double oxalate of cobalt and sodium is easily prepared by boiling together cobalt oxalate and sodium oxalate with water. The pink solution deposits crystals on keeping, which on analysis gave numbers indicating the formula : $Na_2C_2O_4,CoC_2O_4,8H_2O$. It is therefore obvious that neither nickel oxalate nor cobalt oxalate can be completely converted into carbonate by the action of a sodium carbonate solution, and that in each case a soluble double oxalate is formed, which is stable in the presence of excess of sodium oxalate.

[*Silicates*] *Decomposition with lime.* H. Seger and E. Cramer. Tonind-Zeit., 1911, 35, 1514.

In the determination of alkalis by the Lawrence Smith method (sintering with ammonium chloride and calcium carbonate) in silicates which are not decomposed by acids, decomposition is said to be complete if the silicate be very finely ground, otherwise a very high temperature is necessary for the sintering process. In order to determine at what temperature complete decomposition is obtained with lime, when clay or other silicates, bauxite, and pure alumina are used, the following mixtures were made, the components being ground together in equivalent quantities. 1. 200 grms. of pure marble dust and 258 grms. of Zettlitz kaolin $=2CaO,Al_2O_3,2SiO_2,2H_2O$. 2. 100 grms. of pure marble dust and 140·16 grms. of bauxite $=CaO,Al_2O_3$. 3. 100 grms. of pure marble dust and 102 grms. of alumina $=CaO,Al_2O_3$. Small briquettes were made of these mixtures and burnt, and also 5 grms. of each, in the form of powder, were heated in a platinum crucible. With the first mixture, signs of initial fusion appeared at the temperature of Seger cone 8, but subsequent treatment of the sintered masses with hydrochloric acid of sp. gr. 1·1 only yielded a clear solution with a mass which had been heated to about cone 20. In the case of the second mixture a temperature of cone 26 was necessary to obtain the same result, though initial fusion appeared at cone 16. The third mixture began to show signs of fusion at cone 20, but even after heating to cone 33 the mass yielded a residue insoluble in hydrochloric acid. The sintered material was finely ground, mixed with water and made into pats. All three masses set after 9, 7 and 5 hours respectively, but did not possess any great strength ; the third mass possessed the most, and the first mass the least strength of the three. The authors conclude that it is not practicable to use 1 equivalent of calcium oxide to 1 equivalent of alumina, or 2 equivalents of calcium oxide to 1 equivalent of clay substance, because the temperature necessary for decomposition is then so high.
—W. C. H.

Chromi- and ferri-acetates. R. Weinland. Chem.-Zeit., 1911, 35, 1096—1097.

Chromium is capable of forming a large number of acetates, mostly basic, in which only part of the acetic acid is in ionic combination. Three series of acetates have been obtained, one of green and two of violet compounds. The green compounds are most easily prepared and three of them have been isolated, viz., $Cr_3(C_2H_3O_2)_7(OH)_2$ with 1, 4, or $6H_2O$; $Cr_3(C_2H_3O_2)_8(OH),4H_2O$; and $Cr_3(C_2H_3O_2)_9,3H_2O$. In these salts the cation is the complex group, $Cr_3(C_2H_3O_2)_6$, the remaining acetic acid residues being replaceable by other acids. The chloride, $Cr_3(C_2H_3O_2)_6(OH)_2Cl,8H_2O$, platinichloride, $Cr_3(C_2H_3O_2)_6,\frac{1}{2}PtCl_6(OH)_2,5H_2O$, and bichromate acetate, $Cr_3(C_2H_3O_2)_6(C_2H_3O_2)(Cr_2O_7),2H_2O$, have been prepared. The base, $Cr_3(C_2H_3O_2)_6(OH)_3$, of this series of salts, can only be obtained in aqueous solution. It is formed when chromium hydroxide or chromium salts of volatile acids (*e.g.*, the chloride or nitrate) are heated with excess of acetic acid. The chromate of the base is produced by the action of glacial acetic acid on chromic acid. Acetates of one of the violet series of compounds are obtained by repeated evaporation of solutions of the green acetates. Three violet acetates have been thus prepared, viz., $Cr_6(C_2H_3O_2)_{12}(OH)_6,24H_2O$; $Cr_6(C_2H_3O_2)_{13}(OH)_5,24H_2O$; and $Cr_6(C_2H_3O_2)_{16}(OH)_2$ with 3 or $6H_2O$. From the acetates of this series, the chloride, $Cr_6(C_2H_3O_2)_{12}(OH)_5Cl,10H_2O$, and bromide, $Cr_5(C_2H_3O_2)_{11}(OH)_5Br_2,14H_2O$, have been prepared, and it is concluded that the cation contains five acetic acid residues, the composition of the base being $Cr_3(C_2H_3O_2)_5(OH)_4$. The bromide would thus have the formula :

$$\left.\begin{array}{l}Cr_3(C_2H_3O_2)_5(C_2H_3O_2)(OH)_2Br\\ \quad Cr_3(C_2H_3O_2)_6(OH)_3Br\end{array}\right\}+14H_2O.$$

A mixed acetate of the violet and green series had the composition, $Cr_6(C_2H_3O_2)_{13}(OH)_5,10H_2O$. The second violet series of acetates is obtained from the green acetates in a similar manner to the first violet series, but with a more prolonged treatment. Three acetates have been prepared, viz., $Cr_6(C_2H_3O_2)_9(OH)_9,xH_2O$; $Cr_6(C_2H_3O_2)_{10}(OH)_8,24H_2O$; and $Cr_6(C_2H_3O_2)_{14}(OH)_4,xH_2O$. In this series the cation is probably $Cr_2(C_2H_3O_2)_3$. In all three series of salts, the chromium is precipitated by ammonia only on boiling. The cation of the green series is capable of combining with 3 mols. of pyridine or of ammonia, without separation of acetic acid. The salts of the violet series are also capable of combining with pyridine.

All of the crystalline ferri-acetates which have been yet prepared are derivatives of the hexa-acetotriferribase, $Fe_3(C_2H_3O_2)_6(OH)_3$ (see this J., 1910, 486), corresponding to the green chromium salts. The cation, $Fe_3(C_2H_3O_2)_6$, of this base, is also present in the chloroacetate compounds formed in solutions of ferric chloride in glacial acetic acid. By the action of pyridine on the ferri-acetates, compounds containing 4 and possibly also 2 atoms of iron in the ferri-acetate group are produced.
—A. S.

Nitrogen ; Industrial production of pure ——. G. Claude. Comptes rend., 1911, 153, 764—766.

For the production of ammonia from calcium cyanamide, nitrogen of a high degree of purity (99·6 to 99·75 per cent.)

is demanded. The author's apparatus (see this J., 1911, 745, and 1905, 969) should in theory furnish pure nitrogen, but in practice it has yielded only nitrogen of 97—98 per cent. By recent improvements in the apparatus, however, it has been found possible to produce a gas of 99·6 per cent., and the liquefaction of this in quantity has been rendered easier by using as a cooling bath not liquid oxygen, but the liquid (of lower temperature) which circulates at the base of the rectifying column. By introducing the liquid so obtained into the upper end of the rectifying column, a regular yield of nitrogen of a purity of 99·9, never less than 99·8 per cent. is obtained, whilst oxygen of 80 per cent. is furnished at the lower end. An installation of 125 H.P., yielding 400 cub. m. of liquid nitrogen hourly, is already at work, and four others are in course of construction or erection.—J. T. D.

Copper compounds of acetylene. Manchot. *See* IIa.

Preparing diazoamino-compounds, and a reaction for nitrous acid. Vaubel. *See* III.

Patents.

Concentrating acid [from petroleum sludge]; Apparatus for ——. E. B. Gray, Beaumont, Tex., Assignor to P. R. and J. L. Gray, Elizabeth, N.J. U.S. Pat. 1,005,425, Oct. 10, 1911.

The apparatus for concentrating weak acid derived from petroleum sludge comprises a series of inter-communicating open pans in which the acid is progressively heated, followed by a series of stills, also inter-communicating, each provided with a water-jacketed hood and condenser. The stills and pans are all placed at the same level on the furnace, the liquid from the last pan discharging into the first still. A pipe conducts the uncondensed gases to the water supply.—B. G. McL.

Sulphuric acid and "oleum" [fuming sulphuric acid]; Process of obtaining monohydrate ——. A. G. Duron. Fr. Pat. 430,145, May 26, 1911.

Dilute sulphuric acid is concentrated and is then enriched by the addition of sulphuric anhydride, this being produced by the dissociation of a portion of the concentrated acid. The dissociation is effected by means of heated air, the waste heat of which is then utilised for the concentration of the dilute acid in a "concentrator" and a "regenerator," the air passing finally through a condenser to deprive it of the last traces of acid. Dilute acid is supplied to the regenerator and, passing downwards, undergoes preliminary concentration by contact with the heated gas, and part of this acid is then used, in the lowest stage of a "separator" tower, for the absorption of water from dissociated acid vapours, the upper part of the tower being fed with 96—98 per cent. acid from the concentrator, for the absorption of the sulphuric anhydride from the same vapours. The concentrator receives most of the acid from the regenerator (situated above it) and is so arranged that the heated air passes rapidly in a thin layer over the surface of the acid, without giving rise to agitation of the liquid.—F. Sodn.

Nitric acid; Process for the concentration of dilute ——. O. Dieffenbach and C. Uebel. Ger. Pat. 238,370, July 3, 1909.

The dilute nitric acid is distilled in contact with pyro- or meta-phosphoric or arsenic acids, or their acid salts, which retain the water and allow concentrated nitric acid to be obtained. After the distillation, the ortho-acid left in the retort may be heated to a higher temperature to convert it into the pyro- or meta-acid for use again. —A. S.

Hydrochloric acid gas: Process for the production of dry ——. Saccharin-Fabrik A.-G. vorm. Fahlberg, List und Co. Ger. Pat. 238,570, Jan. 13, 1911. Addition to Ger. Pat. 186,398, Oct. 13, 1906.

In working the process described in the main patent (see Fr. Pat. 384,727 of 1907; this J., 1908, 502), in which the reaction between sodium chloride and sulphuric acid is effected in a medium of fused sodium bisulphate, irregularities are apt to occur owing to the presence of bubbles of gas in the fused bisulphate as it is run off. In order to avoid these, it is proposed to effect the reaction above a layer of fused bisulphate. The uppermost layer then contains sodium bisulphate and sulphuric acid, and as the reaction proceeds, becomes denser and gradually sinks. The fused bisulphate is slowly and continuously withdrawn from the bottom.—A. S.

Ammonia-concentrator. W. H. Wright, St. Paul, Minn. U.S. Pat. 1,005,761, Oct. 10, 1911.

The ammoniacal vapours are first cooled by passing laterally through a condenser provided with a battery of vertical cooling tubes; thence the vapours pass downwards through a counter-current condenser; in this condenser the lower side of each layer of tubes conveying the cooling medium is formed as a series of arches so that the uncondensed vapour in passing from one arch to another is caused to bubble through the already condensed liquor and so become absorbed. The condensed liquor is prevented from being bodily forced along by vertical projections extending from the top of each layer of cooling tubes upwards into the arches on the bottom of the cooling tubes in the next layer above.—B. G. McL.

Alkali chlorides; Apparatus for the electrolysis of —— with mercury cathode. R. Frank. Fr. Pat. 429,869, May 2, 1911.

The cell, A, is provided with a horizontal base covered with mercury as the cathode, the metal being circulated and forming a closed hydrostatic circuit. The cell is divided by a middle partition, B, and partitions, C, C^1, C^2, C^3, into four compartments, I and II, in which the electrolysis of the chloride occurs, and III and IV in which the amalgam formed is decomposed by the water to form alkali hydroxide. Four trenches, F, F^1, F^2, F^3, in the base are filled with mercury, and the partitions, C, C^1, C^2, C^3, dip respectively into the mercury in these without reaching to the bottom of the cell. The contents of the various cells are thus separated, but the mercury may pass from one compartment to another under the partitions. The mercury is circulated by rotating drums, E and E^1, provided with ribs or grooves, H. The partition, B, may be omitted, and three compartments only employed, the outer compartments being then connected by a tube of communication placed below or at the side of the cell. Two cells may be connected in series, the two outside compartments being similarly connected by tubes of communication, so that the mercury may be circulated from one to the other.—B. N.

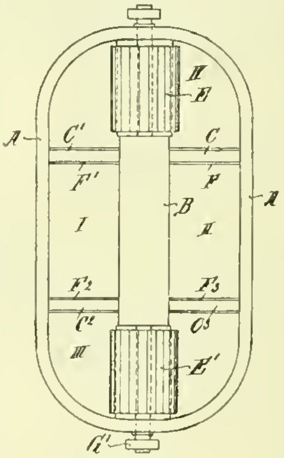


Fig. 1.

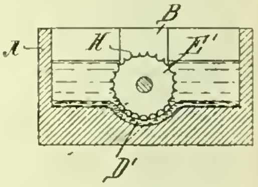


Fig. 2.

Salt-making, and means for removing incrustations of calcium sulphate from brine-heating surfaces. H. Frasch, New York, Assignor to The United Salt Co., Cleveland, Ohio. U.S. Pats. 1,006,195, 1,006,196, and 1,006,197, Oct. 17, 1911.

(1) Salt, made in the form largely of coarse skeleton grains, is exposed to incrusting brine "in progressive motion," preferably in showers, the salt being disposed on a receiver, through which the brine can pass. (2) Drops of saturated brine are exposed to an "evaporation-promoting atmosphere," under such conditions, as to size of drops and difference of vapour tension between the brine and the atmospheric moisture, that evaporation proceeds more rapidly than the crystallisation of the salt, the brine in consequence becoming supersaturated; it is then allowed to precipitate salt, first whilst sufficiently quiet to permit the fine grains of salt to settle, and secondly whilst in sufficient motion to ensure such grains being carried along with the current. (3) Surfaces which have been incrusted with calcium sulphate by the previous conductive heating of brine are treated with steam, and this is made to condense by cooling the walls on the opposite side by means of brine (preferably saturated boiling brine) of lower temperature; the condensed water then dissolves and carries away the calcium sulphate, and the brine is simultaneously evaporated, steam and brine being applied alternately to each side of the walls. Apparatus is described which is divided into chambers by heat-conducting walls, one chamber being provided with pipes for supplying steam and brine and means for withdrawing the condensed water and the water-vapour and salt respectively, while the other chamber is similarly provided or is so arranged that any desired cooling medium may be employed.—F. Sodn.

Crystals of inorganic salts; Process for the production of large pure ——. H. Osten. Ger. Pat. 238,548, Oct. 12, 1909.

The saline solution is treated with hydrogen sulphide or a soluble sulphide, or a mixture of the two, in such quantity that after precipitation and separation of any impurities precipitable by these reagents, an excess of the latter is left. It is stated that crystals of such salts as potassium bromide and iodide and ammonium bromide, when formed in solutions containing hydrogen sulphide or a soluble sulphide are of better shape and appearance and of greater purity than when produced in the ordinary way.—A. S.

Drying agent [calcium or magnesium chloride and sodium chloride]; Process for the manufacture of a ——. Allgem. Ges. für Chem. Ind. m. b. H., Berlin. Eng. Pat. 13,990, June 12, 1911. Under Int. Conv., June 22, 1910.

The drying material, which is intended particularly for drying gases, is prepared by fusing together one part by weight of calcium chloride or magnesium chloride, or a mixture of the two, with at least three parts of sodium chloride; it is claimed that the pieces of disintegrated material will substantially retain their shape during the drying of the gas and can be revivified by means of hot dry air.—B. G. McL.

Seaweeds; Treatment of —— for the extraction of mineral and organic chemical substances. Mme. Laureau née J. H. Laureau. Fourth Addition, dated May 2, 1911, to Fr. Pat. 352,069, March 6, 1905. (See this J., 1905, 892, 1172; 1906, 19, 315.)

The substances specified in the First Addition may be added as solids or solutions (acid, alkaline, or neutral), and, in the manufacture of fucose, any fat or oil may be introduced, hot or cold, into the extracts which have been treated, with or without soap, the product being of use for rendering building materials, sacking, cord, etc., impermeable. The portion of the seaweed remaining after treatment is claimed as a marketable product, suitable for use in the manufacture of paper pulp, etc.—F. Sodn.

Nitrogen compounds [calcium cyanamide]; Process of manufacture of ——. K. Schick and Aktienges. für Stickstoffdünger. Fr. Pat. 430,060, May 23, 1911. Under Int. Conv., Nov. 8, 1910.

Halogen salts (which need not be absolutely dry) are added, little by little, to molten calcium carbide, as it leaves the furnace in which it is produced, and the solidified material, whilst still red hot, is treated with nitrogen. —F. Sodn.

Nitrogen compounds [nitrides] from nitrogen, charcoal and metallic oxides; Production of ——. Soc. Gén. des Nitrures. Ger. Pat. 238,340, May 22, 1910.

The process is intended especially for the manufacture of aluminium nitride (see Eng. Pat. 12,601 of 1910; this J., 1911, 361). The hollow resistance may have projections on its inner side; the resistance material may be a mixture of the nitride and charcoal, and the furnace lining may be composed of the sintered nitride.—A. S.

Hydrogen peroxide solutions; Process for rendering concentrated —— stable by means of alcohol. Oesterreich. Verein f. Chem. u. Metall. Produktion. Ger. Pat. 238,339, Sept. 13, 1910.

Highly concentrated hydrogen peroxide solutions are rendered stable by addition of alcohol in amount sufficient to give products containing at least ten per cent. of alcohol. The amount added should be increased from twice to four times if the hydrogen peroxide contains considerable amounts of impurities which favour its decomposition. It is stated that the resulting solutions are quite stable at ordinary temperatures, and can be boiled without material alteration.—T. F. B.

Hydrogen; Process and apparatus for the preparation of —— by a wet method. G. F. Jaubert. Fr. Pat. 430,302 Aug. 6, 1910.

A strong solution of a caustic alkali, or a solution of sodium or potassium sulphate containing such, is made to act upon a compound or alloy of silicon (preferably ferrosilicon, manganosilicon, or silicospiegel) in such a way, that the heat produced in preparing the alkali solution is utilised in effecting the reaction, no external heat being required. The reaction takes place in a generating vessel, fitted with a stirring device and surmounted by a feeding hopper containing the powdered alloy; this vessel communicates both with an arrangement for washing and cooling the gas and with another vessel, also provided with a stirrer, in which the solution of caustic alkali is prepared (*e.g.*, by dissolving 1 part by weight of sodium hydroxide in 1½—2 parts of water). The water which has served to cool the gas in the condenser passes either to the generator or to the dissolving vessel. A strong solution of alkali being used, an acid silicate is obtained as by-product, and a saving of alkali is therefore effected; moreover, non-caustic residues, suitable for use in dyeing and bleaching, are obtained.—F. Sodn.

Ammonia; Production of ——. F. Haber, Karlsruhe, and R. le Rossignol, Berlin, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,006,206, Oct. 17, 1910.

See Fr. Pat. 417,940 of 1910; this J., 1911, 26.—T. F. B.

Lime-kilns. N. Mathot, Brussels. Eng. Pat. 23,333. Oct. 8, 1910.

See Fr. Pat. 422,683 of 1910; this J., 1911, 687.—T. F. B.

Sulphurous acid salts; Manufacture of ——. Dr. Friedrich und Co., Glösa, Saxony, and F. Hirsch, Vienna. Eng. Pat. 24,501, Oct. 21, 1910. Under Int. Conv., Nov. 29, 1909.

See Fr. Pat. 421,610 of 1910; this J., 1911, 542.—T. F. B.

Alkali metals ; Process for effecting the peroxidation of the ——. Soc. Anon. des Usines de Rioupéroux, Rioupéroux, France. Eng. Pat. 15,189, June 29, 1911. Under Int. Conv., July 12, 1910.

See Fr. Pat. 429,306 of 1910 ; this J., 1911, 1212.—T. F. B.

Salts of heavy metals ; Electrolytic manufacture of difficultly soluble ——. C. Luckow, Cologne, Germany. U.S. Pat. 1,006,389, Oct. 17, 1911.

See Eng. Pat. 408 of 1910 ; this J., 1910, 756.—T. F. B.

Aldehyde-sulphoxylates ; Process of producing ——. F. Riethof, Teplitz-Thurn, Assignor to Blumberg und Rindskopf, Zuckmantel, Austria-Hungary. U.S. Pat. 1,006,793, Oct. 24, 1911.

See Eng. Pat. 8339 of 1910 ; this J., 1910, 1204.—T. F. B.

Borates containing active oxygen ; Process of making ——. F. L. Schmidt, Charlottenburg, Germany, Assignor to The Roessler and Hasslacher Chem. Co., New York. U.S. Pat. 1,006,798, Oct. 24, 1911.

See Eng. Pat. 19,775 of 1909 ; this J., 1910, 424.—T. F. B.

Nitrogen compounds from carbides ; Method of producing ——. A. R. Frank, Halensee, Germany, Assignor to Soc. Gen. per la Cianamide, Rome. U.S. Pat. 1,006,927, Oct. 24, 1911.

See Eng. Pat. 5314 of 1907 ; this J, 1908, 749.—T. F. B.

Hydrogen ; Process and apparatus for separating —— from mixtures of gases. Ges. f. Linde's Eismaschinen A.-G. Hollriegelsgreuth, Germany. Eng. Pat. 9260, April 13, 1911. Under Int. Conv., March 4, 1911. Addition to Eng. Pat. 7205 of 1911, dated May 6, 1910.

See Addition of March 31, 1911, to Fr. Pat. 427,983 of 1911 ; this J., 1911, 1253.—T. F. B.

Oxygen and nitrogen from the atmosphere ; Process for obtaining and separating ——. G. Kassner, Münster, Germany. Eng. Pat. 12,307, May 22, 1911. Under Int. Conv., May 28, 1910.

See Ger. Pat. 233,383 of 1910 ; this J., 1911, 621.—T. F. B.

By-products from gas manufacture and purification of gas. Addition to Fr. Pat. 394,926. *See* IIa.

Electrolytic recovery of waste liquor. U.S. Pat. 1,006,836. *See* XI.

VIII.—GLASS ; CERAMICS.

Glazes ; Coefficient of expansion of ——. J. Wolf. Sprechsaal, 1911, **44**, 627—628.

Using the method of Lavoisier and Laplace for the measurement of the coefficient of expansion, the author finds a close agreement between the results and the theoretical figures calculated from the composition of the glaze by Mayer and Havas (this J., 1911, 543). The results were as follows :—

Glaze composition.						Coefficient of expansion, $a \times 10^7$		
K_2O	Na_2O	CaO	PbO	SiO_2	B_2O_3	Found	Calc.	Per cent. diff.
0·35	0·35	0·30	—	4·00	—	245·9	247·9	−0·84
0·50	—	—	0·5	3·00	—	290·0	298·8	−3·00
0·36	—	0·14	0·5	3·00	—	286·2	281·8	+1·60
0·40	0·10	—	0·5	2·90	0·2	278·8	288·5	−3·36
0·60	—	0·25	0·15	4·00	0·07	241·7	240·9	+0·33

And similarly with a dozen other glazes containing cryolite, fluorspar, tin oxide, and various stains.—H. H. S.

[Silicates.] Decomposition with lime. Seger and Cramer. *See* VII.

Permeability of porcelain and copper ferro-cyanide membranes. Bartelt. *See* XXIV.

IX.—BUILDING MATERIALS.

Portland cement ; Constitution of ——. E. Wetzel. Mitt. königl. Materialprüfungsamt, 1911, **29**, 355—359.

Raw cement material from a cement works was burnt at various temperatures. The cooling curve was observed for each burning and the changes in minute structure brought about by increase in temperature were observed microscopically. The material was mixed with water, moulded into a cake, dried and burnt without a crucible, the cake resting on a sheet of platinum foil ; burnings were effected at temperatures between 1300° and 1600° C., in an electric furnace, generally for half an hour. The duration of the "halting-point" in the cooling curves affords a measure of the degree of fusion, and the lowering of the "halting-point" indicates the accumulation in the fused mixture of new compounds which lower its melting point. Indications of fusion of a portion of the material were already apparent at a temperature of 1320° C. ; with increased temperature of burning, the degree of fusion increases, and starting from a burning-temperature of 1400° C. the "halting-point" falls 25°—30° C., indicating chemical combination. The sample burnt at 1600° C., showing the highest degree of fusion, was subjected to microscopic analysis. Large crystals (alite crystals) were observed embedded in the ground-mass, each crystal being surrounded by a white zone ; the ground-mass in places had the appearance of a eutectic mixture. Besides these constituents, white roundish grains were found irregularly dispersed and accumulated in patches ; these probably corresponded with the coarser grains of calcium oxide originally present in the mixture. These grains were not observed in mixtures poor in lime. (See also this J., 1911, 425.)—J. F. B.

Le Chatelier test [for cement] ; Rejection of the ——. O. Strebel. Tonind-Zeit., 1911, **35**, 1508—1509.

In connection with the Le Chatelier test for the volume-constancy of cement the results of experiments, carried out exactly according to the English rules for applying the test, are recorded. Six cements, procured in the open market, and suspected of lacking volume-constancy were tested at 10 testing places. The analyses and standard tests of the cements were also made. The results showed great discrepancies ; not only did the measurements of the expansion at any particular stage of the test, say after 24 hours' exposure to the air, vary very widely, but also one and the same cement was returned by some of the observers as unsatisfactory, and by others as constant in volume. In view of these results the author feels justified in describing the Le Chatelier test as unreliable, in spite of some recent official support it has received. He concludes that it is proved that the results of the test may indicate a cement to be constant in volume, which shows considerable instability in cold water, and since a cement of abnormal composition would be withdrawn from the open market, reliance on the results of the test would lead to great dangers in practice.—W. C. H.

Cement ; Retrogression in the tensile strength of ——. J. M. O'Hara. Proc. Amer. Soc. Civil Eng., 1911, **37**, 1059—1064.

The standard specifications for Portland cement adopted by the American Society for Testing Materials require that briquettes of neat cement should show no retrogression of tensile strength between 7 and 28 days. According to the author, the initial setting and tensile strength of cements are due to calcium aluminates, and the true strength and hardening to calcium silicates. In recent years it has been the custom in America to produce cements with a higher calcium silicate factor and to grind them more finely in order that the permanent strength might be attained more rapidly. With such cements there is usually no retrogression after 28 days, but there is frequently retrogression between 7 and 20 days. It is not customary to test at intermediate periods between 7 and 28 days and hence the cements are passed as conforming with the specifications. The author considers that a cement should not be rejected on account of retrogression of tensile strength at the 28-day period, for in the case of an otherwise sound cement, this is probably due only to delay in attaining the true permanent strength.—A. S.

Floors of wet cellars; Mixtures of cement and hydraulic materials for ——. Schäcke. Allgem. Zeits. f. Bierbrauerei u. Malzfabrik., 1911, 39, 499—500.

Cement is not suitable for floors of cellars which are exposed to the saline or acid liquors of beer and yeast residues. Asphalt, also, and similar mastics fail to withstand their action. The author finds that a mixture of cement, trass and sand is suitable, but recommends a cheaper material composed of 1 part of cement, 2 of sand, and 2 of leucitophyr, a phonolite which comes into commerce as artificial potash manure at the price of M. 2 per 75 kilos. It contains 17·5 per cent. of alkalis as compared to 10·5 per cent. in trass.—H. H. S.

[*Silicates.*] *Decomposition with lime.* Seger and Cramer. *See* VII.

Patents.

Timber; Electric process for drying ——. Alcock and Co. Proprietary, Ltd., Melbourne, Australia. Eng. Pat. 25,175, Oct. 29, 1910. Under Int. Conv., Nov. 5, 1909.

In the treatment of logs, liquid electrodes or sheet metal terminals are employed as contacts between the ends of the timber and the current wires. The liquid electrode consists of a conducting liquid contained in a receptacle of which the end of the log forms the base or one side according as the log is treated in the vertical or horizontal position. In the treatment of planks in stacks, the necessary air-spaces are formed by means of lead electrodes placed at regular intervals between, and at the sides of, the planks. The treatment may be conducted *in vacuo* or in an enclosed chamber from which the moist air is withdrawn at intervals and replaced by dry air; and a preservative may also be employed in conjunction with the process.—W. E. F. P.

Wood; Process of preserving ——. K. L. F. Friedemann, Stockholm, Sweden. U.S. Pats. (1) 1,006,076 and (2) 1,006,077, Oct. 17, 1911.

The preservatives employed are (*a*) an aqueous solution of "calcium cresate" (or combinations of phenols with alkaline-earths) and (*b*) an oil such as creosote. In (1) the wood is first impregnated with the water-solution and then with the oil, the latter being allowed to permeate the whole of the wood, or only the outer layers, as required. In (2) the impregnation is effected in one operation, an emulsion of the aqueous solution and the oil being employed.—W. E. F. P.

Mortar or plaster; Manufacture of dry ——. E. Cramer, Assignor to Terrasit-Industrie G. m. b. H., Berlin, Germany. U.S. Pat. 1,006,725, Oct. 24, 1911.

The mortar comprises a mixture of inert material, a mortar-forming material for binding purposes, and magnesium oxide, which does not form part of the mortar-forming material. Sufficient magnesium oxide is present to absorb the natural moisture of the mixed substances, and for further absorption of moisture, thus preventing the deterioration of the mortar during storage and transportation.—B. N.

Portland cement; Process for the manufacture of a —— *from blast-furnace slag.* J. Elsner. Fr. Pat. 430,126, May 26, 1911.

The granulated or powdered slag is thoroughly incorporated, by fine-grinding, with appropriate salts such as alkali chlorides and salts of aluminium and magnesium, and the mixture is subjected—with or without the addition of lime—to a temperature of about 1000° C. The salts may be added to the slag in the form of an aqueous solution, a current of air being then passed over the charge during the drying and subsequent heating.
—W. E. F. P.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

The Malm chlorination process. A. G. Brownlee. Amer. Mining Congress, Chicago, Oct., 1911. [T.R.]

The process consists in the dry chlorination in a tube mill of the ores which are previously crushed to about 10-mesh. The ore is fed continuously at one end; the dry chlorine at the discharge end is kept in contact with the ore long enough to recover 40 per cent. to 70 per cent. of the metal contents. The discharge is then subjected to pyritic roasting; the iron and manganese chlorides are oxidized, the chlorine converting the remaining metal sulphides into chlorides, which are later extracted from solution.

Proposed U.S. experimental ore testing station. Eng. and Mining World, Nov. 4, 1911. [T.R.]

The American Mining Congress has sent a memorial to the U.S. Congress asking for the establishment, under the direction of the Bureau of Mines, of a metallurgical experimental ore-testing station where methods for extracting metals from low-grade ores can be devised and tested.

Pig-iron and cast-iron; Determination of phosphorus in —— *without separating silicon.* E. R. E. Müller. Chem.-Zeit., 1911, 35, 1201—1202.

Four grms. of the sample are dissolved in 60 c.c. of nitric acid of sp. gr. 1·2, with gentle heating. The solution is made up to 100 c.c., mixed and filtered. In dissolving, care must be taken to exclude even traces of hydrochloric acid, otherwise gelatinous silica may separate. Also, the solution should not be evaporated to a volume of less than 30 c.c. Of the clear filtrate, 25 c.c., representing one grm., are pipetted off for the phosphorus estimation. (Portions of the remainder may be taken for the estimation of manganese and for the determination of combined carbon by the colour method.) To complete the oxidation of the phosphorus, 2 c.c. of potassium permanganate solution (40 grms. per litre) are added, and the solution boiled for 2 minutes. Following this, the solution is cooled by immersing in running water for 10 minutes. The excess of permanganate is destroyed by the addition of a little sodium peroxide. To complete the solution of manganese peroxide a second addition of sodium peroxide is generally necessary, and the action may be assisted by the addition of 1 c.c. of concentrated nitric acid. No more than 1 c.c. of nitric acid should be added, otherwise the phosphorus results will be too low. After the manganese peroxide has all gone into solution, the excess of hydrogen peroxide is destroyed by heating, and the phosphorus is then precipitated at a temperature of about 40° C. with ammonium molybdate solution. The time occupied in bringing the estimation to this stage is 45 minutes. The phosphomolybdate precipitate is collected on a weighed paper, and dried for $\frac{1}{4}$—$\frac{1}{2}$ hour, until the point of the filter paper has become dark blue-green. Results obtained by this method are given which are in close agreement with those obtained by the long method involving the filtration of silica—Ledebur's instructions being followed in the latter method.—T. St.

Metals; Aerial oxidation (rusting) of ——. W. R. Dunstan and J. R. Hill. Chem. Soc. Trans., 1911, **99**, 1835—1853.

Further experiments have been made on the rusting of iron in connection with the view previously expressed (this J., 1907, 414) that the presence of dissolved oxygen and iron are the only necessary conditions for rusting. Tilden's results (this J., 1908, 941) confirm the view that the presence of carbonic acid (or another acid) is not essential to rusting. The electrolytic theory, according to which pure iron, by virtue of its electrolytic solution pressure dissolves in pure water, the dissolved iron being subsequently oxidised in contact with oxygen or air, is disproved by the experiments of Lambert and Thomson (this J., 1910, 1456) who showed that pure iron does not rust in pure water containing dissolved oxygen, and by an experiment made by the author. This experiment was so carried out that of two Jena glass flasks connected by a long piece of glass tubing, one flask and the connecting tube were completely filled with boiled distilled water, whilst the other flask contained boiled distilled water surmounted by an atmosphere of oxygen free from carbon dioxide; in the flask filled with water there were some pieces of bright highly purified iron. If the iron dissolves in pure water, as required by the electrolytic theory, it should gradually diffuse, and on meeting oxygen diffusing from the second flask, should be oxidised, and rust should be produced in the connecting tube. This, however, did not happen, but after a long time, a greenish coating (a mixture of ferrous and ferric hydroxides) appeared on the surface of the iron. Other arguments are also adduced against the electrolytic theory. Experiments on the action on iron of those substances which inhibit rusting showed that all of them render the iron passive. The passivity was ascertained by tests with nitric acid of sp. gr. 1·2 and with a 0·5 per cent. solution of copper sulphate, and by noting the time which elapsed before rusting began in distilled water. Rusting is inhibited and the iron rendered passive by 0·01 to 1 per cent. solutions of chromic acid, 1 per cent. solutions of potassium bichromate, chromate, bromate, iodate, hydroxide, and ferrocyanide, 1 per cent. solution of sodium arsenate, 0·5 per cent. solution of potassium permanganate, 1 per cent. solution of hydrogen peroxide, 1 per cent. solution of barium hydroxide, 1 per cent. and 0·13 per cent. solutions of sodium carbonate, 0·14 per cent. solution of potassium carbonate, 1 per cent. solution of borax, ammonia solution of sp. gr. 0·880, and 4 per cent. solution of potassium chlorate. Rusting proceeds and the iron is not rendered passive in 1 per cent. solutions of potassium chlorate and iodide and sodium chloride and sulphate, and 2 per cent. solution of potassium nitrate. The passivity persists after removal of the iron from the solution, and is not destroyed by careful washing with distilled water. It is destroyed by dilute acids, including carbonic acid, as well as by many salts. Very dilute alkali solutions rust iron readily and do not render iron passive. Experiments with zinc, copper, aluminium, and magnesium showed that, with some exceptions, the same solutions render these metals passive just as they render iron passive; this is especially the case with solutions of chromates. It would appear therefore that the mechanism of the rusting of iron does not differ essentially from that of the rusting of other metals. In support of this view, it has been found that by means of potassium ferricyanide and ferric chloride (see Keiser and McMaster, this J., 1908, 141), traces of hydrogen peroxide can be detected during the rusting of iron just as in the rusting of other metals. The hydrogen peroxide is however probably due to a secondary reaction and is not an intermediate product of the main reaction, for all of the metals used, rust readily in solutions of potassium iodide, in which the existence of hydrogen peroxide is impossible. The authors conclude that the aerial oxidation of metals is due to the direct action of oxygen dissolved in water. Experiments which have been recently recorded as showing that the presence of carbonic acid is necessary for the rusting of iron (see Moody, this J., 1909, 245; Friend, this J., 1910, 882) may be explained by the fact that carbonic acid will destroy the passivity of iron induced by solutions of chromic acid or alkali, etc.—A. S.

Iron and certain other metals; Passivity of ——. W. R. Dunstan and J. R. Hill. Chem. Soc. Trans., 1911, **99**, 1853—1866. (See also preceding abstract.)

The passive state is not confined to iron, nickel, and cobalt; zinc, copper, and magnesium (and probably lead) are also rendered passive by dilute solutions of potassium chromate and bichromate. Iron is rendered passive by chromic acid and alkali solutions even when air is completely excluded. Iron which has been rendered passive by chromic acid and then washed with distilled water, remains passive for more than 1 hour when immersed in distilled water, but rusting then gradually takes place, owing to destruction of the passivity by the carbonic acid of the air. If carbon dioxide be excluded, the passive iron remains bright in distilled water for several months, although active iron under the same conditions rusts readily. The passivity of iron is destroyed locally by scratching the surface. It is also destroyed by violent shaking, by dilute acids and by certain salts, especially haloid salts. The action of haloid salts is due to acid ions liberated by a slight electrolysis, for in presence of phenolphthalein, a pink colour (indicating free alkali) rapidly develops on certain areas of the surface of the iron. The electrolysis is induced by a difference of potential set up by unequal action of air on the surface of the iron; in absence of air, passive iron is not rendered active by haloid salts. The passivity of iron is destroyed by heating in a vacuum at above 400° C. and in hydrogen at 240°—250° C., but not at lower temperatures. The latter temperature (240°—250° C.) is also that at which magnetic oxide of iron begins to be reduced by hydrogen. The facts described are all in agreement with the view that the passivity of iron is due to an oxide film. The passivity of zinc (and probably magnesium and lead) and copper is also to be attributed to a protective film, which, in the case of copper, makes the metal appear of a slightly redder colour. The film on copper is non-metallic, for it interferes with amalgamation by mercury. The passivity of copper is destroyed by various reagents which dissolve oxides of copper; it is probably due to a film of cuprous oxide. The passivity of zinc, magnesium and lead is probably also due to oxide films on the metals.—A. S.

Blast-furnace gases; Utilisation of ——. W. Dixon. West of Scotland Iron and Steel Inst. Times Eng. Suppl., Oct. 25, 1911.

The advantage of blast-furnace gas for power production (see this J., 1911, 546, 627) is pointed out. Of the total power (1,033,509 b. h. p.) now produced in large gas engines by means of blast-furnace gases, Germany contributes 46·5 per cent.; America, 32·5; France, 5·4; Belgium, 4·6; Austria-Hungary, 2·4; Great Britain, 2·4; and other countries, 6·2 per cent.—A. S.

Vanadium; Colourimetric method for ——, *in iron and steel.* C. R. McCabe. Chem. News, 1911, **104**, 194—196 and 202—203.

The process depends upon the brown colouration produced by the addition of hydrogen peroxide to an acid solution of vanadic acid. Since the colour is masked by iron, deepened by strong acids, and partly bleached by excess of hydrogen peroxide, and is only produced by vanadium which is fully oxidised (V_2O_5), it is essential that the colours for comparison be obtained under precisely similar conditions. As practised by the author, the method is applicable to nearly all steels and irons, and permits of the estimation of vanadium, tungsten, nickel and chromium in the same sample. The time required for a determination varies from 45 min. to 2 hours, according to the nature of the material. The following solutions are required:—(1) *Hydrogen peroxide:* 100 c.c. of the ordinary 2·6 per cent. solution are diluted to 500 c.c. 5 c.c. are used in each determination. (2) *Hydrofluoric acid:* The pure acid is diluted to a convenient strength, the amount employed in each determination being equivalent to 0·5 c.c. of the strong acid. (3) *Ferric chloride in hydrochloric acid:* 500 grms. of the crystallised salt ($Fe_2Cl_6.6H_2O$) are dissolved in 300 c.c. of hydrochloric acid (1 : 1) and diluted to 500 c.c. 5 c.c. of this solution contain 1·5 c.c. of strong hydrochloric acid and about 0·1 grm. of iron. (4) *Standard neutral vanadic acid:* About 0·2 grm. of pure vanadium pentoxide is mixed with 36 c.c. of water and 4 c.c. of strong hydrochloric acid and warmed. When dissolved, 4 c.c. of ammonia solution (sp. gr. 0·96) are added and the solution is diluted so that 1 c.c. contains 0·0002 grm. of vanadium. [*Note.*—It is essential that the minimum quantity of well-diluted hydrochloric acid be employed in dissolving the pentoxide.] Pure vanadium pentoxide is best prepared from high-grade vanadate of iron containing about 60 per cent. of vanadium pentoxide, 38 of ferric oxide and 2 of silica. 5 grms. are heated with 100 c.c. of strong hydrochloric acid, 20 c.c. of water and 1 of hydrofluoric acid are added and the mixture is filtered. The filtrate is extracted three times in succession with 50 c.c. of ether to remove the iron, and, after filtration, the separated acid solution is heated, or air is blown through it, to remove the residual ether. It is then diluted to about 250 c.c. and heated to boiling, when about 10 grms. of potassium chlorate are added, followed by sufficient potassium carbonate (from 25 to 30 grms.) to nearly neutralise the solution. When the proper degree of acidity is reached, a copious precipitate of hydrated vanadium pentoxide is produced and the liquid is then diluted and boiled. The precipitate is filtered off, washed, and dried at 100° C.

Determination of vanadium in steel. In the absence of chromium, the determination is conducted as follows:—2 grms. are dissolved in 40 c.c. of hydrochloric acid, 5 c.c. of nitric acid (sp. gr. 1·2) are added, the solution is concentrated to about 10 c.c. and poured into a separating funnel; the beaker is rinsed out with hydrochloric acid (1 : 1) the combined volume being thus made up to 20 c.c. 50 c.c. of ether (free from alcohol) are then added and the mixture is well shaken and allowed to settle to separate the bulk of the iron. When separated, 1·5 c.c. of the ether solution is added to the acid liquid, this amount of iron (about 0·1 grm.) being sufficient to occlude the vanadium in the subsequent ammonia-precipitation without interfering with the separation of nickel (if present). The acid solution is diluted to about 225 c.c. and boiled; ammonia solution is then cautiously added, with brisk stirring, the amount used being 10 c.c. in excess of that required to precipitate the iron. The boiling is continued for 30 seconds; the iron precipitate contains all the vanadium and is practically free from manganese. It is collected on an 11 cm. paper and washed with hot water. In the absence of nickel a single precipitation is sufficient, but two are necessary if nickel be present. The filter paper containing the precipitate is opened in a dish, and warmed with 3 c.c. of hydrochloric acid (1 : 1) and about 7 c.c. of water to dissolve the precipitate, care being taken to avoid maceration of the filter paper; the solution is clear if the occlusion of manganese has been avoided. The solution is poured into the tube in which the comparison is to be made (Camp's manganese tubes are recommended) and the dish and paper are washed with cold water, and the washings added—thus making the volume up to about 40 c.c. 0·5 c.c. of strong hydrofluoric acid is added to decolourise the iron salt, and to the colourless solution 5 c.c. of the dilute hydrogen peroxide are added, the brown colouration appearing on mixing. Into the second tube, 5 c.c. of the acid ferric chloride solution and a measured quantity of the standard vanadium solution are placed and diluted to 40 c.c.; the requisite amounts of hydrofluoric acid and hydrogen peroxide are added in succession, and the colourations are then compared. When chromium is present, the separated acid solution containing 1·5 c.c. of the ether extract is evaporated to about 1 c.c., 50 c.c. of strong nitric acid are added and the solution boiled until it assumes a clear green colour. To the boiling solution sufficient potassium chlorate (2 or 3 grms.) is added to precipitate the manganese and oxidise the chromium; after boiling for a few moments the liquid is diluted to about 225 c.c. with boiling water and precipitated with ammonia solution of which the amount used is 10 c.c. in excess of that required to precipitate the iron. The precipitate contains manganese from which it is separated by a second precipitation with ammonia in the same manner, the remainder of the process being then conducted as already described. When tungsten is present, the filtrate from the determination of this metal is used for the determination of vanadium. Since the evaporation to dryness in the tungsten determination, reduces some of the vanadium, the latter is re-oxidised by nitric acid before the separation of the iron by ether. The use of sulphuric acid in the tungsten determination must be avoided. The presence of titanium (in those quantities apt to occur in iron and steel) does not interfere with the vanadium estimation, since the yellow colour produced by the addition of hydrogen peroxide to solutions of this metal is destroyed by hydrofluoric acid. The vanadium colour, however, is slightly modified by the presence of titanium and the comparison is best made in artificial light. The capacity of ferric hydroxide to occlude vanadium is such that the precipitate produced by 0·1 grm. of iron will retain practically the whole of the vanadium from 2 grms. of a steel containing less than 0·2 per cent. of this metal; and, as a safe working rule, only as much of the sample as will contain 6 mgrms. of vanadium as a maximum should be taken for the determination. The method frequently gives higher results than those obtained by older methods, but gives accurate results when checked against the U.S. Bureau of Standards vanadium steel containing 0·15 per cent. of vanadium and against artificial mixtures of vanadium solutions with solutions prepared from carbon-steels and alloy steels.—W. E. F. P.

Nickel; Occurrence and determination of —— in ferro-vanadium. H. Schilling. Chem.-Zeit., 1911, 35, 1190.

Samples of ferrovanadium of different origin were found to contain nickel, two for example containing 2·85 and 0·91 per cent. respectively, whilst three others were free from nickel. Brunck's rapid method of determination (this J., 1907, 643) gave accurate results:—One grm. of the finely pulverised material is dissolved as far as possible in 30 c.c. of hydrochloric acid (sp. gr. 1·12), the solution oxidised by means of nitric acid (sp. gr. 1·4) (added drop by drop) and evaporated, and the residue heated to destroy nitrates. After cooling, it is re-dissolved in hydrochloric acid (sp. gr. 1·12), and the solution filtered from the silica, which is washed with hot dilute hydrochloric acid. The filtrate is treated with 20 c.c. of tartaric acid solution (1 : 5), made faintly alkaline with ammonia, and the nickel precipitated with dimethylglyoxime solution.—C. A. M.

Nickel [in German silver]: Note on the determination of ——. F. Ibbotson. Chem. News, 1911, 104, 224. (See also this J., 1911, 549.)

In the determination of nickel by precipitating with dimethylglyoxime in an ammoniacal solution (see this J., 1907, 643, 1217), instead of weighing the precipitate after washing with hot water and drying at 100° C., it is better to wash with water containing ammonium nitrate (thus preventing any tendency of the precipitate to pass through the paper) and then to ignite to nickel oxide. This may be done without loss if care be taken first to char the paper without allowing it to take fire. The nickel in German silver may be estimated by means of dimethylglyoxime without first separating the copper. 0·5 grm. of German silver is dissolved in 10 c.c. of nitric acid (sp. gr. 1·20), diluted to 400 c.c., 2 or 3 decigrms. of tartaric acid added and then excess of ammonia. After heating the solution to 50° C., excess of the dimethylglyoxime reagent is added, and the solution is allowed to stand in a warm place for a few minutes. The precipitate is filtered on paper pulp and washed with hot water containing ammonium nitrate until the washings are colourless. As the precipitate at this stage always contains copper, it must be dissolved in a little dilute nitric acid and reprecipitated. The precipitate whilst still wet is enclosed in two filter papers, transferred to a crucible and heated cautiously until the papers are thoroughly charred. The temperature is then slowly raised and the ignition completed at a bright red heat.
—T. St.

Cyanide solutions; Electrolytic oxygen in ——. T. H. Aldrich, jun. Min. and Eng. World, Oct. 21, 1911, 791—792.

THE author found cyanide solutions which had been subjected to the action of an electric current more effective in dissolving gold and silver from ores than those aerated in the ordinary manner, this being specially noticeable in the treatment of ores containing considerable quantities of sulphides. Either direct or alternating current may be used (a high current density being necessary in the former case to prevent deposition of precious metals on the electrodes) and the solution may be electrolysed before, or during, contact with the ore. In the arrangement finally adopted, alternating current was used, the lead electrodes employed being situated in the sump containing the barren solution. With the ores treated, it was found that not only was a greater extraction of precious metal obtained, but the consumption of cyanide was considerably decreased, as compared with ordinary agitation processes; and the use of the current was found to be less expensive than the air-agitation of, or the addition of oxidising agents to, the solution.—W. E. F. P.

Gold-bearing cyanide solutions; Assay of —— by electrolysis. C. Crichton. J. Chem., Met., and Min. Soc., S. Africa, 1911, **12**, 90—92.

THE apparatus consists of four sets of eight cells, the cells and sets being connected in parallel. The current is obtained from three 2-volt accumulator cells in series, and varies in strength from 0·04 to 0·1 ampère according to the strength of the cyanide solutions used. The anodes consist of $\frac{5}{16}$ inch lamp carbons, held in position in the centre of each beaker by means of clamps fitted to a horizontal copper bar which runs parallel to and 6 inches above the line of beakers. The cathodes consist of cylinders of assay lead foil which fit just inside the beakers; the lower edges are notched. The cathodes are connected by means of insulated flexible wires with a copper rod which runs along the front side of the row of beakers. The terminals are made by almost severing narrow strips of the cathodes and folding the strips over the ends of the flexible wires. Complete deposition of the gold from 10 or 20 assay ton portions is effected in four hours. The carbons are then raised clear of the beakers, the current switched off, the lead cathodes disconnected and removed to a hot plate to dry. When dry, these are folded into a small compass and cupelled with a little silver, and the buttons parted and weighed.—T. St.

Gold and silver; Precipitation of —— in cyaniding. H. A. Megraw. Min. and Eng. World, Oct. 7, 1911, 685—687.

IN the zinc method of precipitation, the metal is employed in the form of shavings or powder (zinc fume). Pure zinc is not a good precipitant, and although commercial zinc generally contains sufficient lead to effect a satisfactory precipitation, lead acetate is frequently added to the zinc shavings for this purpose. A selective action occurs in the different compartments of the zinc-boxes, a large proportion of the incoming values of gold and silver being precipitated in the head compartments, whilst other metals are precipitated lower down in the box. In this way copper is frequently plated out on the zinc shavings in the lower compartments, mercury is almost entirely deposited in the first compartments, and arsenic and antimony are distributed throughout the whole box; when large quantities of gold are present in silver ores, a separation of these metals from the solvent may take place in the zinc-boxes, the silver tending to be deposited in the earlier, and the gold in the later, compartments. The use of powdered zinc, proposed by Sulman, was at first unsuccessful because the metal was not removed from the solution immediately on the completion of precipitation; this critical requirement was first realised by Merrill, and successful precipitation is now effected by mixing the zinc dust with the solution at the suction of the solution pump, whence the liquid is passed through a filter-press before delivery to the storage tank. The zinc-dust process possesses obvious advantages, and being probably the most economical of all precipitation methods, is likely to be universally employed.—W. E. F. P.

Colloidal gold. A. Gutbier. Z. Chem. Ind. Kolloide, 1911, **9**, 175—189.

WHEN a 1 : 1000 solution of gold chloride, neutralised with sodium carbonate, is reduced with a dilute aqueous solution of hydrazine hydrate, a blue gold hydrosol is formed at the ordinary temperature, whilst at higher temperatures, metallic gold is precipitated (see this J., 1902, 1250). With unneutralised solutions of gold chloride of 1 : 2000 or lower concentration, also, hydrazine hydrate produces a blue gold hydrosol at the ordinary temperature, but if the gold chloride solution be heated to boiling before adding the hydrazine hydrate, a red hydrosol, with a more or less decided violet tinge, is produced.—A. S.

Tin; Determination of ——. R. J. Morgan. Min. and Eng. World, Oct. 14, 1911, 757.

THE author recommends the use of finely powdered pure metallic antimony for reducing solutions of stannic chloride preparatory to titration with iodine. A table of nine experiments is given showing more accurate results by this method than when reduction is effected by iron nails or nickel foil.

Amount of tin taken.	Amount of tin found using as reducer:		
	Antimony.	Iron.	Nickel.
grm.	grm.	grm.	grm.
0·00114	0·00114	0.00104	0·00109
0·05700	0·05746	0·05610	0·05590
0·11400	0·11466	0·11024	0·11128

—B. M. V.

Tin and antimony; Alloys of ——. N. Konstaninoff and W. Smirnoff. J. Russ. Phys.-Chem. Soc., 1911, **43**, 1201—1220.

THE results of a thermal study of tin-antimony alloys and of measurements of the conductivity and its temperature-coefficient, show that after the establishment of equilibrium, the alloys consist of: (1) solid solutions of tin in antimony, with a limiting concentration 10 atoms per cent. of antimony; (2) the definite compound, SnSb, capable of dissolving up to 56 per cent. of antimony; (3) the definite compound, Sn_3Sb_2, capable of dissolving up to 44 per cent. of antimony; and (4) solid solutions of antimony in tin with a limiting concentration of 10 atoms per cent. of tin.—T. H. P.

Aluminium-cobalt, also molybdenum and tungsten alloys; Mechanical and chemical properties of ——. H. Schirmeister. Metallurgie, 1911, **8**, 650—655.

SIX alloys of aluminium and cobalt were prepared containing from 0 to 20 per cent. of cobalt, and a curve representing their tensile strengths is given. The strongest alloy was one having a coarsely crystalline fracture and containing 12·6 per cent. of cobalt; its tensile strength was 5·84 kilos. per sq. mm. as compared with 6·32 kilos. for pure aluminium. Alloys containing up to 10 per cent. of tungsten and 6·32 of molybdenum in addition were then made and the curves of their tensile strengths is given. The addition of tungsten raised the tensile strength and produced a finely crystalline fracture, an alloy containing 11·58 per cent. of cobalt, 0·94 of tungsten, and 0·13 of silicon having a tensile strength of 12·3 kilos. per sq. mm. as compared with 4·6 kilos. for pure aluminium cast under the same conditions. The hardness of the alloys was proportional to their cobalt content; they were excellent to machine, polished well, and were very resistant to atmospheric influences. Their specific gravity was from 2·8 to 2·9. The addition of molybdenum exerted the same influence as tungsten without any further advantages. The best method for the preparation of the alloys was either to add the oxide to melted aluminium or better by the use of the "thermite" reaction, and it is not recommended to alloy the individual metals.—A. H. C.

The alkali metals and rhodium, and iridium; Electrical properties of the ——. Broniewski and Hackspill. Comptes rend., 1911, **153**, 814—816.

The alkali metals were purified by distilling *in vacuo*, and experiments were carried out between 0° C. and —78° C., and —183° C. The values for the thermo-electric power in microvolts $\frac{(dE)}{(dt)}$, compared with lead, were as follows:—Cæsium $+ 0{\cdot}66 - 0{\cdot}0010t$, rubidium $-8{\cdot}26 - 0{\cdot}0302t$, potassium $- 11{\cdot}33 - 0{\cdot}0376t$, sodium $-4{\cdot}16 - 0{\cdot}0144t$. On comparing rubidium and cæsium with copper it was found that there was a sharp break in the curve at the melting point of cæsium. The thermo-electric values for rhodium and iridium, compared with lead, at temperatures between 100° C. and —78° C., were $+2{\cdot}17 + 0{\cdot}0014t$ and $+2{\cdot}44 - 0{\cdot}0014t$ respectively.—G. W. McD.

Solid solutions of metals; Formation of —— by diffusion in the solid state. G. Bruni and D. Meneghini. Atti R. Accad. dei Lincei, Roma, 1911, [5], 20, I., 927—931. Chem. Zentr., 1911, 2, 1425.

Experiments similar to those with nickel and copper described previously (this J., 1911, 1064) have also been made with gold and copper and gold and silver. Here also solid solutions of the metals were produced. In the case of a copper wire coated alternately with 33 thin layers of nickel and copper, the maximum electrical resistance was attained after 2 hours, but the microscopic structure of the layers was very irregular.—A. S.

Patents.

Steels; Process for rendering very hard —— machinable. Soc. Anon. Établissements de Dion-Bouton. Fr. Pat. 430,362, May 31, 1911.

The steel is heated to a temperature well above its transformation point and allowed to cool very slowly so as temporarily to destroy the martensitic structure to which the hardness is due. After machining, the original structure is restored by annealing followed by rapid cooling.
—W. E. F. P.

Zinc; Separation and recovery of —— from ores and other metalliferous substances. G. G. M. Hardingham, London. From T. Huntington, Pertusola, Italy. Eng. Pats. 20,896, Sept. 8, 1910, and 8035, March 30, 1911.

The powdered material, mixed with fuel, is charged into a closed converter provided with a water- or air-cooled grate. The charge is ignited at the top and a current of hot air is forced through the mass in a downward direction, the conditions being such that zinc vapour is produced and subsequently condensed by its passage through the openings in the cooled grate. Limestone, iron ore, silica or other materials are added to the charge in such proportions as to effect sintering, but not fusion, at a temperature somewhat above that necessary for the reduction and volatilisation of the zinc.—W. E. F. P.

Zinc ores and compounds; Metallurgy of ——. A. L. J. Queneau, Overbrook, Pa., Assignor to Queneau Electric Zinc Furnace Co., Philadelphia, Pa. U.S. Pat. 1,006,876, Oct. 24, 1911.

The ore is introduced into a rotary furnace with no more than the requisite amount of reducing agent, and is reduced in the presence of a highly liquid slag, whilst the contents of the reducing chamber are tumbled about. The temperature of the charge is maintained at the reducing point by passing an electric current through a fluid resistor within the reducing chamber.—T. St.

Zinc; Metallurgy of ——. A. L. J. Queneau, Philadelphia, Pa., Assignor to Queneau Electric Zinc Furnace Co., Philadelphia, Pa. U.S. Pat. 1,006,877, Oct. 24, 1911.

Zinc ores and compounds are reduced in an electrically heated rotary furnace, with the interior of which a condenser communicates by means of a flaring opening, the vapours, as they enter the condenser, being thereby quickly expanded. The reducing chamber is provided with a lining expansible longitudinally, the end plates being held in yielding relationship thereto. Intermediate between the lining and the end plates are interposed refractory conductors, consisting of annular courses of refractory conducting blocks composed of a mixture of refractory material and carbonaceous material. The refractory conductors extend partially into the furnace interior. The furnace is heated by passing an electric current through a fluid resistor situated within the reducing chamber, the furnace portion of the circuit being completed through the refractory conductors and the conducting end plates.
—T. St.

Furnaces; Annealing, hardening, case-hardening and retort ——. J. Zeugin, Pratteln, Switzerland. Eng. Pat. 23,272, Oct. 7, 1910.

The admission of primary air to the furnace is regulated by coarse and fine adjustments. The former consists of a damper in the chimney and is adjusted once for all when the furnace is first tested; the latter, situated on the slag door, comprises a number of air-holes which are regulated by means of an adjustable plate. The secondary air employed with the flue-gases in the combustion chamber is preheated by an arrangement of tortuous flues and air-passages in the structure.—W. E. F. P.

Metallic coverings; Process for removing ——. L. Kochs, Düsseldorf, Germany. Eng. Pat. 24,227, Oct. 19, 1910.

Metal scraps are heated in a revolving container provided with disintegrating teeth. The container is situated inside, and communicates through openings with, a heating chamber. This in its turn is enclosed by a fire-chamber which is in communication with a furnace. Compressed air (if desirable, ozonised air) is continuously supplied to the heating chamber, which is, except for the air ports, hermetically sealed. Under the combined action of the heat, air, and continuous vibration and knocking, the metallic covering is separated from the material, and recovered in the form of oxides and ashes, and also in metallic form.—T. St.

Calcareous ores; Treatment of ——. H. Schwabacher, London. Eng. Pat. 25,030, Oct. 27, 1910.

Metallic sulphide ores containing calcareous matter are ground and treated with sulphurous acid, whereby soluble calcium sulphite is formed. The insoluble metallic sulphides are allowed to settle, dried, and roasted. The sulphur dioxide thus formed serves for the treatment of the next charge of ore. The calcium sulphite solution may also be made to yield sulphurous acid by heating, or if water is scarce, air may be blown through the solution in order to form insoluble calcium sulphate, which may then be separated.—T. St.

Aluminium; Process for soldering ——. J. S. Rae, Aberdeen. Eng. Pat. 27,730, Nov. 29, 1910.

The cleaned surfaces are first tinned with an alloy composed of 2 parts by weight of tin and 1 of zinc, and then soldered with ordinary solder containing 2 parts by weight of tin and 1 of lead.—W. E. F. P.

Lead and lead-alloys; Process of refining ——. L. E. Wemple, Assignor to Hoyt Metal Co., St. Louis, Mo. U.S. Pat. 1,006,323, Oct. 17, 1911.

The molten lead is intimately mixed with a fused alkali hydroxide and then withdrawn, adhering alkali being afterwards removed from the metal by means of a neutralising agent. In the treatment of lead-alloys containing antimony and tin, a reducing agent is mixed with the alkali hydroxide in order that these elements may not be removed from the alloy.—W. E. F. P.

[Copper-nickel] Ores; Process of treating ——. F. R. and A. H. Carpenter, Denver, Colo., Assignors to K. Thomas, New York. U.S. Pat. 1,006,355, Oct. 17, 1911.

The sulphide nickel-copper-iron ore or matte is first subjected to a dead roast and then (in admixture with raw sulphides and common salt) to a chloridising roast, whereby the copper is converted into chloride which is subsequently leached out with water. The leached residue, consisting of nickel and iron oxides with practically no copper, is smelted for the production of ferro-nickel or nickel steel.—W. E. F. P.

Copper or copper alloys; Method and apparatus for the treatment of scraps of ——. L. Jourdan and A. Gaillard. First Addition, dated May 3, 1911, to Fr. Pat. 415,760, May 6, 1910 (this J., 1910, 1316).

Claim is made for the recovery of the hydrogen liberated during the electrolysis; for the direct production, in the electrolysing vessel, of copper sulphate (and other soluble copper salts) in the crystalline state; and for the application of the process to the production of precipitated electrolytic copper from ores, either directly, by placing the ore in the anode-vessels, or indirectly, by employing as the electrolyte solutions obtained by the wet treatment of copper ores.—W. E. F. P.

Alloy; Pyrophoric metal ——. G. F. Hofmann, Munich, Germany. U.S. Pat. 1,006,849, Oct. 24, 1911.

The alloy consists mainly of manganese and antimony, with a small addition of metallic cerium.—T. St.

Hydrometallurgical solutions; Process for precipitating —— *by means of an improved precipitant.* C. W. Merrill, Berkeley, Cal. U.S. Pats. 1,006,865 and 1,006,866, Oct. 24, 1911.

The precipitant is added to the solution as the latter issues from a receiver, or as it passes through a duct. The precipitant and solution then travel together to a pressure filter where solid and liquid are separated. While the solution and precipitant are being conveyed to the filter, the precipitant is subjected to mechanical treatment in order to remove any deterrent coating from the surface of its particles.—T. St.

Cerium and similar metals, and their alloys; Preparation of ——. A. Kratky and W. Brückner. Fr. Pat. 430,116, May 24, 1911. Under Int. Conv., April 1 and 18, 1911.

In an electrolytic process for obtaining, in a molten state, metals which are usually deposited in powdery form by direct electrolysis, the dehydrated salt (or salts) of the metal (or metals) is gradually added to a bath composed of fused salts of metals more electropositive than those to be extracted; the bath may consist, for example, of a mixture of calcium chloride, barium chloride and calcium fluoride. The crude metal or alloy obtained is re-melted under a protective covering (of similar composition to that of the bath) which acts also as the heating medium and the electrolytic bath.—W. E. F. P.

Iron; Process of extracting —— *from its ores.* S. G. Martin, Chicago. Eng. Pat. 24,052, Oct. 18, 1910.

See U.S. Pat. 975,625 of 1910; this J., 1910, 1458.—T.F.B.

Metals; Apparatus for the extraction of —— *from their ores.* G. Mitchell, Los Angeles, Cal., U.S.A. Eng. Pat. 23,260, Oct. 7, 1910.

See Fr. Pat. 421,524 of 1910; this J., 1911, 431.—T. F. B.

Ore roasting furnaces. T. Edwards, Ballarat, Victoria. Eng. Pat. 23,565, Oct. 11, 1910.

See Fr. Pat. 422,958 of 1910; this J., 1911, 903.—T. F. B.

Ores; Process and apparatus for roasting fine ——. W. Buddeus, Wiesbaden, Germany. Eng. Pat. 1131, Jan. 16, 1911.

See Fr. Pat. 425,109 of 1911; this J., 1911, 904.—T. F. B.

Ores or concentrates; Desulphurising ——. U. Wedge, Ardmore, Pa., U.S.A. Eng. Pat. 1535, Jan. 20, 1911. Under Int. Conv., Jan. 20, 1910.

See U.S. Pat. 976,525 of 1910; this J., 1910, 1459.—T.F.B.

Smelting process [for zinc and lead ores]. E. Dedolph, Kaslo, B.C., Canada. Eng. Pat. 24,009, Oct. 17, 1910. Under Int. Conv., Nov. 4, 1909.

See U.S. Pat. 959,924 of 1910; this J., 1910, 826.—T.F.B.

Zinc and/or copper from complex ores or the like; Obtaining ——. J. R. Williams and H. W. and B. Bradley, Sheffield. U.S. Pat. 1,006,330, Oct. 17, 1911.

See Eng. Pat. 26,711 of 1908; this J., 1910, 160.—T. F. B.

Portland cement from blast furnace slag. Fr. Pat. 430,126. *See* IX.

Electrolytic recovery of waste liquor. U.S. Pat. 1,006,836. *See* XI.

XI.—ELECTRO-CHEMISTRY.

Assay of gold-bearing cyanide solutions by electrolysis. Crichton. *See* X.

Patents.

Insulating material. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y. Eng. Pat. 5165, March 1, 1911.

A phenolic aldehyde condensation product and a fat pitch (stearine pitch, wool fat (or wool oleine-) pitch, etc.) are dissolved in a common solvent, such as amyl acetate, and cambric or other fibrous material is impregnated with the composition, the solvent being then allowed to evaporate. The material, manufactured in this way, has a positive temperature resistance coefficient.—B. N.

Battery; Electric ——. W. Morrison, Chicago, Ill. U.S. Pat. 1,006,494, Oct. 24, 1911.

The electric battery, of the bromine gravity type, comprises a containing cell of conducting material, and a negative element at or near the bottom, which is made in the form of a number of pockets or recesses. A granular porous substance, such as carbon, fills the pockets, and bromine in the free state is contained within the porous material. A suitable electrolyte is employed, and a positive element fixed above the negative one.—B. N.

Electrode; Binoxide of hydrogen [hydrogen peroxide] ——. W. Morrison, Des Moines, Iowa, Assignor to Vesta Accumulator Co., Chicago, Ill. U.S. Pat. 1,006,774, Oct. 24, 1911.

Suitable active material is mixed with a solution of ammonium sulphate, for binding purposes, and with hydrogen peroxide, and the paste thus formed is applied to a support or grid for making negative electrodes or positive pole plates. The paste is dried, and the electrode dipped into a dilute solution of hydrogen peroxide, again allowed to dry, and finally dipped into a solution of dilute sulphuric acid and hydrogen peroxide.—B. N.

Electrolytic recovery of waste liquor; Process and apparatus for ——. F. F. Farnham, McKeesport, Pa., Assignor to National Tube Co., Pittsburgh, Pa. U.S. Pat. 1,006,836, Oct. 24, 1911.

Solutions, such as iron sulphate, are electrolysed by an electric current passing from an anode, through a diaphragm attached to the anode, to a cathode. Iron is deposited at the cathode, and the solution at the anode is subjected to chemical actions forming sulphuric acid. This liquid passes through the diaphragm and perforations in the anode into an anode chamber, thus separating the portion of the solution which has been acted upon from the main bulk of the liquid.—B. N.

[Electric] Tungsten-furnace. A. Appelberg, Schenectady N.Y., Assignor to General Electric Co., N.Y. U.S. Pat. 1,006,620, Oct. 24, 1911.

The electric furnace comprises a chamber with a closed cover, with tubular "tungsten heaters" supported from the cover. Means are provided for connecting the heaters in series, and an arrangement actuated by springs holds the connecting means in contact with the heaters. An atmosphere of an inert gas, such as hydrogen, is maintained within the chamber. Openings are provided in the bottom and cover of the chamber, through which the material to be heated may be introduced in proximity to the tungsten, during the time that the latter is at the normal working temperature.—B. N.

Furnace ; Electric ——. M. M. Kohn. Fr. Pat. 429,802, Feb. 6, 1911.

The furnace comprises an external envelope, lined with non-conducting material, within which is the heating chamber containing several heating elements, the latter being removable separately and independently of the outer envelope. The heating elements are each formed of an appropriate number of blocks, which may be wedged together, so as to form a section of the required length. An envelope surrounding the crucible, muffle or other body, is formed from several sections assembled together, and by using angle blocks, with intermediate spacing blocks, an envelope of any suitable transverse section may be obtained. Each of the heating elements or blocks is provided with a heating body, such as carbon or a metallic wire, lodged in pairs in grooves, dovetail in form, to protect the body against accidental displacement and with a covering to avoid oxidation from the atmosphere. Suitable communication is made between the heating chamber and the grooves containing the heating bodies. Each element contains several passages, which do not communicate with the heating chamber, and through which an auxiliary resistance passes, forming part of the heating body. Means are provided for putting the auxiliary resistance in and out of the circuit, for the purpose of regulating and controlling the current. Each heating body may also be provided with extensions in the form of internal heating resistance spirals, placed in grooves similarly to the heating bodies, and arranged so that the latter and the helices may be coupled in series, in parallel, or in suitable combinations, with or without the helices in the circuit. This is accomplished by connecting the various heating bodies, and helices, with a commutator, the latter being arranged on the envelope of the apparatus, in order to avoid external connections other than the wires which bring the current to the furnace. —B. N.

Electric flames ; Production of —— in form of discs for effecting gaseous reactions. Elektrochem. Werke G. m. b. H. and F. Rothe. Fr. Pat. 429,910, May 18, 1911. Under Int. Conv., July 8, 1910.

The furnace comprises a cylindrical chamber, short in comparison to its diameter, and the electrodes are disposed at equal distances in a plane cutting the cylinder transversely in the middle. The gas is introduced through tangential tubes, arranged one on each side of one of the electrodes, and leaves through exit tubes arranged at the axis of the cylinder. The gas thus takes a spiral movement from the periphery to the centre of the cylinder, and the flaming arcs are spread into a disc-like flame parallel to the spiral.—B. N.

Galvanic batteries. W. Morrison, Des Moines, Iowa, U.S.A. Eng. Pat. 25,315, Oct. 31, 1910. Under Int. Conv., Nov. 22, 1909.

See U.S. Pat. 975,885 of 1910 ; this J., 1910, 1461.—T.F.B.

Electric conductors [*Insulation of aluminium wires, etc.*]. Ges. f. Elektrotechnische Ind. m. b. H., Berlin. Eng. Pat. 5569, March 6, 1911. Under Int. Conv., June 28, 1910.

See Fr. Pat. 425,532 of 1911 ; this J., 1911, 905.—T. F. B.

Manufacture of pulp or half-stuff from esparto by bacteriological, electrolytic, and electro-chemical methods. Fr. Pat. 430,230. *See* V.

Apparatus for the electrolysis of alkali chlorides with mercury cathode. Fr. Pat. 429,869. *See* VII.

Electric process for drying timber. Eng. Pat. 25,175. *See* IX.

XII.—FATS ; OILS ; WAXES.

Oil-seed [*Sioer, Skaphium lanceatum, Miq.*] ; *A new* ——. K. Gorter. Arch. Pharm., 1911, **249**, 481—482.

The seeds of a wild plant growing in Palembang (Sumatra), known to the natives as "Sioer," and which has been identified as *Skaphium lanceatum* Miq. (*Xanthophyllum lanceatum* J.J.S.), yielded 39·17 per cent. of fat when extracted with ether. The fat thus obtained, is coloured green by chlorophyll. It is solid at 15° C., completely melted at 48° C., and has the following characters : acid value, 12·2 ; saponification value, 198·5 ; Reichert-Meissl value, 0 ; iodine value (Hübl), 36·6 ; m.pt. of free fatty acids, 54° C. ; solidifying point of free fatty acids, 51·5° C. ; mean molecular weight of free fatty acids, 268. The oil shows great similarity to Tengkawang oil (Borneo tallow). The pressed seeds contain a poisonous saponin.—F. Shdn.

Oil ; Fluorescence test of purity of ——. P. H. Walker and E. W. Boughton. Oil, Paint and Drug Reporter, Oct. 16, 1911.

Tests made in the laboratory of the U.S. Dept. of Agriculture with Outerbridge's method of detecting mineral and rosin oils in fatty oils (this J., 1911, 964) have shown that the uviol lamp is inferior as a source of light to the inclosed arc-light. Although in this way fluorescence is greatly magnified, its presence is not a proof that an oil has been adulterated with rosin or mineral oil. Thus out of 16 samples of pure linseed oil only half were free from fluorescence whilst 5 of the remainder showed pronounced fluorescence. In the case of other fatty oils also, the fluorescence was as marked as in the case of many pure mineral oils. Samples of linseed and olive oils which were free from fluorescence became strongly fluorescent after being heated to 300° C. On the other hand, certain samples of turpentine oil showed no fluorescence even after the addition of mineral oil, whilst others of undoubted purity were strongly fluorescent.—C. A. M.

Castor-seed lipase. Y. W. Jalander. Biochem.-Zeits., 1911, 36, 435—476.

The author has studied microscopically mixtures of lipase, fat (or oil), and water (or dilute acetic acid) and finds that a kind of "reversed emulsion" is produced, consisting of the fat or oil as continuous phase in which are dispersed colloidal particles of the lipase swollen by water. If a mixture of fat and lipase be shaken with a relatively large volume of $N/10$ acetic acid, an emulsion of the ordinary type is produced at first, but the dispersed fat globules are filled with innumerable minute particles of the lipase swollen by absorption of water. This emulsion is not stable, and after a comparatively short time, the fat globules coalesce, the water is absorbed by the lipase, and the stable "reversed emulsion" is produced. The presence of neutral fat appears to be essential for the production of the "reversed emulsion." When shaken with water or with dilute acetic acid, or with a mixture of $N/100$ acetic acid and oleic acid, the particles of lipase do not become swollen. In his experiments the author used either the so-called cytoplasma suspended in cottonseed oil, or dried castor-seed lipase freed from oil by extraction with petroleum spirit (see Nicloux, this J., 1904, 614 ; 1906, 485 ; also Fr. Pat. 335,902 and addition thereto, this J., 1904, 327, 942). The activity of different specimens of the purified lipase did not differ widely. Details of numerous experiments under different conditions are tabulated. A stable emulsion was best prepared by mixing 1 grm. of triolein with 0·005 grm. of the lipase, adding 0·6 c.c. of $N/100$ acetic acid, and then slowly rotating the mixture ; an emulsion was produced after

1½ mins., which on vigorous shaking became creamy. In an emulsion prepared in this way the hydrolysis of the fat will proceed to the equilibrium condition even on standing, but the velocity of hydrolysis is increased by agitation, best by a continuous slow rotation (25—40 turns per minute). For purified castor-seed lipase the best results are obtained in a medium containing acetic acid between $N/500$ and $N/10$ concentration ; a greater concentration of acid than $N/10$ acts unfavourably. For powdered castor seeds freed from fat, the best results are obtained at a concentration of acetic acid of $N/10$. A preliminary treatment of the lipase with water or acetic acid weakens but does not destroy the activity of the enzyme (compare Nicloux, this J., 1904, 687 ; 1906, 485). Fat-free castor seed powder which has been subjected to a preliminary treatment with $N/10$ acetic acid shows maximum lipolytic activity in presence of water alone without addition of acetic acid (compare Tanaka, this J., 1910, 1259). According to Nicloux the lipase maintains its activity unaltered during the hydrolysis, but the author has never been able to separate a product possessing lipolytic activity after hydrolysis has ceased, and states that the activity of the enzyme decreases considerably even in 48 hours. Dry purified lipase shows no considerable loss of activity in six months, but loses its activity rapidly in presence of neutral fats with water or acetic acid absent. The maximum hydrolysis attained by the author was 96·22 per cent. in 5 days, using 40 parts of lipase to 1000 of triolein. For periods of over 60 mins. and within fairly wide limits of concentration of enzyme, Schütz's formula : $\frac{x}{\sqrt{e}}$ = a constant, holds approximately (x = saponification value, e = quantity of enzyme) ; and with a constant concentration of enzyme, the formula $\frac{x}{t^m}$ = a constant, also holds (t = time, m = a constant varying according to conditions between 0·57 and 0·7). (See also this J., 1902, 1541 ; 1904, 550, 1152 ; 1905, 977, 1242 ; 1906, 994, 1106, 1157 ; 1907, 263 ; 1909, 149 ; 1910, 287.)—A. S.

Oil-water emulsions ; Stability of ——. E. Hatschek. Z. Chem. Ind. Kolloide, 1911, 9, 159—164.

The author prepared emulsions of castor oil (sp. gr. 0·97), oleic acid (sp. gr. 0·8), nitrobenzene (sp. gr. 1·2) and two kinds of petroleum (sp. gr. 0·71 and 0·91 respectively) in water, and of castor oil in a mixture of alcohol and water of the same density, and studied their behaviour on addition of electrolytes (hydrochloric acid and sodium sulphate). The emulsions were prepared by introducing from a pipette a solution of the oil in alcohol or acetone into a large excess of water kept in vigorous agitation (see Hatschek, this J., 1910, 125, 1065) ; in each case the emulsion contained 1 part of oil in 5000. Emulsions of this kind show a great similarity to suspensoids, especially colloidal metal solutions, with regard to size and electrical charge of the dispersed phase, and the author shows mathematically that the repulsion between the particles due to their electrical charge far outweighs the tendency to coalesce and to rise or fall under the influence of gravity, and hence the emulsions are very stable. On addition of an electrolyte, the first effect is the destruction or neutralisation of the electrical charge on the particles. The particles remain in vigorous Brownian motion at first, but this gradually lessens and finally ceases owing to fusion of smaller particles to form larger ones, and with increase of size of the particles, the rise or fall due to gravity, which comes into play immediately the electrical charge is neutralised, proceeds with increasing velocity. In this separation due to gravity, the difference between the specific gravity of the dispersed phase and that of the continuous phase is an important factor ; for example, comparing emulsions of castor oil (sp. gr. 0·97) and of light petroleum (sp. gr. 0·7) in water, for the same rate of clarification, the particles in the former would need to be 3·16 times larger in radius than in the latter, or in other words, 31·6 times as many of the smaller particles would have to coalesce in the castor oil emulsion as in the petroleum emulsion, for the same rate of clarification. The results obtained experimentally confirmed the theoretical deductions, and it was found that the coalescence of the dispersed particles, after the neutralisation of their electrical charge, proceeds comparatively slowly ; for instance in emulsions of light petroleum, 24 hours after addition of hydrochloric acid, a notable quantity of dispersed particles of the original size (0·4—0·8 μ) was still present. It is pointed out that the considerations brought forward may explain the behaviour of stable colloidal solutions. If there is no sensible difference between the specific gravity of the dispersed phase and of the continuous phase, then after addition of an electrolyte only an alteration of the degree of dispersion, but no precipitation, can take place, and if there is no considerable difference of refractive index between the two phases, or the dispersed particles are not coloured, no change in appearance, perceptible macroscopically, will be produced.—A. S.

Palmitic acid-sodium palmitate ; The system ——. F. G. Donnan and A. S. White. Chem. Soc. Trans., 1911, **99**, 1668—1679.

Krafft (this J., 1894, 1027 ; 1896, 206, 601) has expressed the opinion that the formation of acid salts of fatty acids plays no unimportant part in the manufacture of soaps. The authors have examined mixtures of palmitic acid and sodium palmitate containing up to about 38 per cent. of the latter, the mixtures being maintained at various temperatures between 60° and 82° C. until equilibrium was attained, when the composition of the liquid and solid phases was determined. The results give no indication of the formation of definite compounds, the solid phases consisting of three series of solid solutions. It is probable that the phases which can separate from aqueous soap solutions, or are present in the colloidal state in such solutions, may be solid solutions of acid and soap or phases of variable composition, containing the three components, fatty acid, sodium oxide, water.—A. S.

Determination of saponin and saccharin in oil emulsions. Carlinfanti and Marzocchi. *See* XXIII.

Patents.

Oils ; Manufacture of solid fatty substances from ——. H. Schlinck und Co., A.-G., Hamburg, Germany. Eng. Pat. 8147, March 31, 1911. Under Int. Conv., Jan. 30, 1911.

Oil in liquid condition at the lowest possible temperature and in the thinnest film is passed by centrifugal force, in presence of hydrogen, through openings in the wall of an enclosed drum, in which openings a support having a rough or porous surface covered with precipitated palladium is arranged ; the catalyst may also be fastened on the walls of the drum. The oil is led back one or more times into the drum by means of a pump, according to the degree to which it is desired to harden it, or a number of such centrifugal drums may be arranged and operated in series. The process is to be applied particularly to the manufacture of edible fats.—J. A.

Process for the complete recovery of volatile solvents in the treatment of materials for the separation of fatty or other matters. Fr. Pat. 429,827. *See* I.

Manufacture of rubber substitute. U.S. Pat. 1,006,274. *See* XIV.

Rubber substitute from soya bean oil. Fr. Pat. 430,183. *See* XIV.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Waste wood and its utilisation. Frankforter. *See* IIb.

Turpentine from Douglas fir. *See* IIb.

Reputed acidity of "cellit" varnish. Frederking. *See* V.

Patents.

Chrome pigments ; Production of ——. B. Legg. Fr. Pat. 429,895, May 17, 1911.

A solution of lead nitrate is treated with sulphuric acid, and the precipitated lead sulphate is treated with soluble chromates. Or, the lead sulphate may be washed and treated with sodium or potassium hydroxide before replacing the combined sulphuric acid by chromic acid. —C. A. M.

Varnishes and driers ; Apparatus for the manufacture of ——. M. Régent, C. Bygodt, and N. Leclercq. Fr. Pat. 429,948, July 29, 1910.

The materials are heated electrically in a vat provided with a movable cover, an agitator, means for condensing volatile products, and an automatic device for extinguishing accidental conflagration.—C. A. M.

Water-colours ; Process for preparing ——. Günther Wagner. Ger. Pat. 238,453, Sept. 2, 1910.

In order to prepare water colours which, at great dilutions, furnish even coatings when dry, it is proposed to add to the usual binding agent a mixture of carbon tetrachloride with a sulphonated mineral oil or with Turkey-red oil, which will give a stable emulsion.—T. F. B.

Chrome pigments : Production of ——. B. Legg, Stonebridge Park. Eng. Pat. 11,726, May 15, 1911.

See Fr. Pat. 429,885 of 1911 ; preceding.—T. F. B.

Lac ; Treatment of ——. W. A. Freymuth, London. U.S. Pat. 1,005,953, Oct. 17, 1911.

See Fr. Pat. 409,794 of 1909 ; this J., 1910, 770.—T. F. B.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Patents.

Rubber sheet ; [Artificially] ageing ——. C. J. Beaver, Hale, Cheshire, and E. A. Claremont, Manchester. Eng. Pat. 23,727, Oct. 13, 1910.

Pure sheet rubber, in the form of strip, thread, etc., is "aged" artificially, and thus endowed with greater strength and elasticity, by exposing it to radiation between the red and the ultra-violet, and screening it from all other. As a source of such rays a mercury vapour lamp is named ; the radiation from this source is filtered through a bluish-green glass. A machine is described consisting of a closed hollow cylinder, provided with a door through which the rubber can be introduced into its interior, and with internal ribs which assist in exposing fresh surfaces of rubber as the cylinder revolves. The lamp is arranged in the hollow axle of the cylinder, and means are provided for the insertion of the necessary radiation screens around the lamp.—E. W. L.

Latex from rubber and analogous trees ; Treatment [coagulation] of ——. W. Clarkson, Lesmahagow, N.B. Eng. Pat. 20, Jan. 2, 1911.

Rubber or analogous latex is coagulated and rendered antiseptic by mixing it with a solution containing alcohol, water and aldehyde, preferably while the increased temperature due to heat of solution is still evident. It is claimed that by this process "the caoutchouc globules are cleansed, coagulated, cured or preserved, and rendered ready for 'sheeting' or 'blocking.'" An odoriferous substance, such as musk, may be added with the coagulating mixture, in order to disguise the unpleasant odour given off during coagulation.—E. W. L.

Vulcanised rubber ; Process for regeneration [devulcanisation] of ——. H. P. C. G. Debauge. Second Addition, dated May 17, 1911, to Fr. Pat. 413,809, March 18, 1910 (this J., 1910, 1322, 1465).

The rapidity of the process of devulcanisation in presence of hydrocarbons or other solvents is increased by the addition of such accelerators as zinc oxide, litharge, zinc sulphide, etc., and the desulphurisation is rendered more complete in the presence of higher oxides such as lead dioxide, manganese dioxide, ferric oxide, etc., or of oxides (such as cuprous oxide) which are capable of forming oxysulphides (CuS,CuO). The higher oxides act by removing free sulphur as it is liberated from combination, being themselves reduced to lower oxides with simultaneous formation of sulphates :—*e.g.*, $3PbO_2+S=PbSO_4+2PbO$; $3Mn_3O_4+S=MnSO_4+8MnO$.—E. W. L.

Rubber, gutta-percha and balata ; Manufacture of a foam of ——*vulcanised at high temperatures.* F. Pfleumer. Fr. Pat. 430,473, April 19, 1911. Under Int. Conv., Aug. 6, 1910.

The process consists in vulcanising the rubber, etc. in an atmosphere of gas, *e.g.*, nitrogen, at a high pressure, thus causing a quantity of the gas to be absorbed by the rubber, etc., and subsequently, after vulcanisation, releasing the external pressure, when the rubber mass will be blown out into a spongy mass by the pressure of the absorbed gas. For example, 10 parts by weight of raw rubber are made into a dough with 2½ parts by weight of petroleum benzine or benzol, from ⅕ to 1 part of precipitated sulphur or an equivalent amount of "golden sulphide" being added. The dough is shaped into a form similar to, but occupying less space than, that of the finished article to be produced. The space occupied by the raw dough will bear to that of the final mass the proportion of about 13 : 100 if the vulcanisation be carried out under a gas pressure of about 100 atmospheres. The absorptive power of the rubber mass may be increased considerably by mixing with it porous substances in the form of powder, such as fossil meal, etc. The shaped mass is vulcanised in an autoclave under the necessary pressure of gas (*e.g.*, nitrogen), the heating being effected from the outside. Rubber which has already been vulcanised with not more than 10 per cent. of sulphur may be treated in a similar manner. Where the spongy mass is to be used under an external pressure, as in the case of filling for bicycle and motor tyres, the external gas pressure must not be released, after vulcanisation, below the working pressure (2 to 3 atmospheres in the case of bicycle, and 4½ to 8 in the case of motor tyres), until the mass is cold.—E. W. L.

Rubber substitute ; Manufacture of ——. N. Reif, Hanover, Germany. U.S. Pat. 1,006,274, Oct. 17, 1911.

Sulphur monochloride is mixed with oil under high pressure in a suitable mixing apparatus, and the mixture is forced out in tubular form with a rotary motion. During the reaction, the mixture is brought into contact with a finely divided neutralising substance to reduce it to a flake-like condition.—J. A.

Rubber substitute from soya-bean oil ; Process for preparing a ——. F. Gössel and A. Sauer. Fr. Pat. 430,183, April 11, 1911. Under Int. Conv., April 12, 1910.

A rubber substitute is prepared from soya-bean oil by one or other of the following processes :—(1) by treatment of the oil with nitric acid of sp. gr. 1·14 to 1·40, as already described in this J., 1911, 38 ; (2) by heating 40 parts of soya-bean oil with 7—12 parts of sulphur at 150°—190° C. ; (3) by mixing 40 parts of soya-bean oil, with 8—14 parts of sulphur chloride, preferably diluted with benzene, heat being applied to start the reaction, and the mixture cooled to moderate it when necessary ; (4) by heating the oil for some time to a temperature above its boiling point, or by partially polymerising the oil in this way, and subsequently heating it with sulphur ; (5) for use in the manufacture of linoleum, by blowing heated air through it, the usual additions being made.—E. W. L.

Gutta-percha; Manufacture of plastic masses resembling ——. E. van den Kerkhoff. Fr. Pat. 429,879, May 23, 1911.

PLASTIC masses resembling gutta-percha may be obtained by mixing nitrocellulose or celluloid with oils or fats which have already undergone a preliminary heating with certain organic compounds containing negative substituents. For example, to 30 kilos. of a fatty oil are added 6 kilos. of *p*-nitrotoluene, previously moistened with a little alcohol (or other neutral volatile solvent), and the mixture is heated in a closed vessel for 10 hours at 80° to 100° C. The dark brown product is transferred to a dough-mill and 50 kilos. of nitrocellulose, thoroughly impregnated with alcohol (or other neutral volatile solvent), and 14 kilos. of a solvent which acts vigorously upon nitrocellulose, are added. The resulting pasty mass is worked between moderately hot rollers until it is nearly free from alcohol, and is quite homogeneous. After machining to the desired shape, or blocking and cutting into thin sheet, it is allowed to dry for some days at a moderate temperature. —E. W. L.

Rubber or rubber-like substances, and resin from materials containing them; Process for separating ——. Soc. Internat. "Asia-caoutchouc." Fr. Pat. 430,511, May 10, 1911.

SEE U.S. Pat. 978,696 of 1910; this J., 1911, 99. E. W. L.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Tanning extracts; The use of chrome leather in the valuation of ——. G. Grasser. Collegium, 1911, 390—392.

FOR the determination of the colour of leather which would be produced by various extracts, the author makes use of chrome-tanned calf skin in the following manner: 25 grms. of fluid or 8 grms. of solid extract are dissolved in 100 c.c. of water at 70° C., and after cooling, placed in a 150—180 c.c. flask in a shaking apparatus with a piece of chromed calf skin, 8 cm. by 10 cm. in size and of about 10 grms. weight. After shaking for an hour and allowing to stand three hours, the skin is well washed in water, and after removing superfluous water with a cloth, is dried in the air in a dark place. The original green colour does not influence the colour produced with the extracts at the strengths used. The amount of extract used in a test of its colouring properties should be calculated from its percentage of tannin and not, as hitherto, equal weights of extracts taken regardless of their strength. A source of error in the official method of tannin analysis is pointed out. The non-tannin solution, as obtained in the analysis of a fresh extract is almost colourless, except in the case of mangrove. If a liquor from the tan-pits is analysed, however, the non-tannin solution is deeply coloured owing to the increase of non-tannins caused by the removal of the tannin by the goods. The hide powder used in the analysis therefore removes more non-tannins than occurs in practice and therefore more tannin is shown in the material by analysis than is available to be taken up by the goods in practice. —D. J. L.

Tanning of gelatin and hide. M. L. Meunier and A. Seyewetz. Collegium, 1911, 373—379.

THE authors have made further experiments on the tanning of gelatin and hide by bromine and hypobromites (this J., 1911, 1077), and have also studied the effect of chlorine and hypochlorites, and of iodine and hypoiodites. The tanning effect was measured by the extent to which the gelatin was rendered insoluble in boiling water. Gaseous chlorine decomposed the gelatin without rendering it insoluble. Chlorine water produced violent swelling alone, but at a low temperature and in presence of salt, the swelling was reduced and the gelatin rendered insoluble. With sodium hypochlorite solution, the gelatin became completely insoluble, but at temperatures higher than 12° C., excessive swelling took place. Bleaching powder acted in the same way as sodium hypochlorite, but rise of temperature was more harmful. The action of bromine and hypobromites was much more regular than that of chlorine and hypochlorites. Bromine water rapidly rendered gelatin insoluble without decomposing it, but swelling took place, owing to the formation of hydrobromic acid, unless salt was added. The best results were obtained with 10 grms. of gelatin, 400 c.c. of water, 100 c.c. of saturated bromine water, and 100 grms. of sodium chloride. With sodium hypobromite the gelatin was rendered insoluble without swelling. The proportions recommended are :—10 grms. of gelatin, 400 c.c. of water, 100 c.c. of saturated bromine water (or 3 grms. of bromine), and 1·5 grms. of caustic soda. Iodine did not produce complete insolubility either in the form of vapour or in solution. The action of hypochlorites, hypobromites and hypoiodites on actual skin was analogous to their action on gelatin. The action of the halogens does not give such an intensive tannage as quinone, and the product is less resistant to boiling water and has more the appearance of pelt. It is easy to make use of bromine for practical tannage provided that salt is added to reduce the swelling. It is suggested that the method might prove useful as a preliminary tannage for all kinds of skins, and for the preservation of skins in the form of pelt. The skins are quite imputrescible after the treatment. From the practical point of view, bromine is too expensive and therefore chlorine compounds are recommended. Good results have been obtained with bleaching powder. For 100 kilos. of skins, a solution of 3 kilos. of bleaching powder and 3 kilos. of salt in 300 litres of water is used. The treatment lasts one day for sheep skins, and the subsequent treatment is as for pickled skins.—J. R. B.

Gelatin jelly; Determination of the melting point of a ——. C. W. Gamble. J. Municipal School of Technol., Manchester, 1911, 4, 115—119.

THE author has been able to obtain satisfactory results in the determination of the melting or liquefying point of gelatin jellies by a capillary-tube method. The capillary tube is half filled with a warm gelatin solution of the desired concentration, containing a small quantity of thymol as an antiseptic, and is then kept under a bell-jar until complete setting of the jelly has taken place; a vessel of water is also placed under the bell-jar in order to prevent drying of the surface of the jelly. The capillary tube is then attached to a thermometer in the usual manner and heated in a water-bath—a large beaker in which is mounted a test-tube for receiving the capillary tube, both test-tube and beaker being provided with stirrers. The temperature at which the concave meniscus at the surface of the jelly disappears is taken as the melting point: six successive determinations are made with each sample, the first result being rejected, and the mean of the remaining five taken as the true value. Jellies of high concentrations give less concordant results than those of lower concentrations. A concentration of 5 grms. per 100 c.c. is recommended for the class of gelatin usually employed for photographic purposes.—A. S.

PATENTS.

Bone, skin and analogous material; Process for extracting fat from ——. C. von Girsewald. Fr. Pat. 430,015, May 22, 1911. (See also this J., 1911, 1271.)

IN extracting the fat from materials intended for the preparation of gelatin, the vapour of the petroleum spirit or other volatile solvent finally remaining in the pores of the substance is condensed by means of the introduction of vapour of the same solvent up to a pressure sufficient to effect the condensation. This effects more complete extraction of the fat, and prevents re-admission of air.—C. A. M.

Glue from chrome-tanned leather waste; Process for the manufacture of ——. C. Sadlon. Ger. Pat. 237,752, June 2, 1909.

THE leather is treated for several days at the ordinary temperature with a sufficient quantity of caustic alkali solution to convert it into a structureless, dough-like mass. This is neutralised with acid, and after washing with water, can be converted into glue by gentle warming, without the usual boiling process.—A. S.

Tannin extracts ; Process for decolorising ——. J. Paessler, Freiberg, and H. Arnoldi, Weinheim, Germany. U.S. Pat. 1,006,977, Oct. 24, 1911.

See Eng. Pat. 19,804 of 1909 ; this J., 1909, 1321.—T. F. B.

Unliming hides and the like ; Process and product for use in ——. G. Eberle, Stuttgart, Germany. U.S. Pat. 1,006,539, Oct. 24, 1911.

See Eng. Pat. 21,202 of 1909 ; this J., 1910, 226.—T. F. B.

XVI.—SOILS ; FERTILISERS.

Soils ; Effect of soluble salts on the absorption of phosphates by ——. H. E. Patten. J. of Phys. Chem., 1911, **15**, 639—658.

Experiments were made to test the effect of a second solute on the solubility of phosphate. Quartz and two soils, one open and sandy, the other a clay, were used, and water or an aqueous solution was allowed to percolate through a known weight of the quartz or soil mixed with a quantity of calcium monophosphate equivalent to 350 lb. of superphosphate per acre. More phosphate was extracted when weak solutions of common salts such as potassium chloride, sulphate, nitrate or carbonate were passed through the soil than was obtained by the use of distilled water alone. The effect is not one of solubility alone, as excess of water was always used ; it is due to a disturbance and rearrangement of the equilibrium which exists between the soluble matter retained by the soil and the soil solution. After disturbance by the added salts, the equilibrium tends to readjust itself, giving a steady value for the concentration of the leachings. The absolute values of phosphates in the percolates do not represent those obtainable under field conditions, where many other factors have to be taken into account.—E. F. A.

Cereals ; Action of carbon bisulphide on the germinating power of ——. P. Fantechi. Staz. sperim. agrar. ital., 1911, **44**, 515—516. Chem. Zentr., 1911, **2**, 1476.

Under ordinary conditions carbon bisulphide vapour has no action on the germinating power, and the vapour from 10 c.c. is sufficient for the disinfection of 1 hectolitre of seeds. If the seeds be immersed in liquid carbon bisulphide for 2 minutes and then exposed to the air, about 10 per cent. of the seeds are rendered incapable of germinating. By immersion for 1 minute, followed by exposure for 24 hours to carbon bisulphide vapour, or by exposure to the vapour at 30° C., half of the seeds lose their germinating power. The germinating power is entirely destroyed by exposure of the seeds to carbon bisulphide vapour at 40° C.—A. S.

Sulphur preparation which can be easily wetted. Vermorel and E. Dantony. Comptes rend., 1911, **153**, 194.

The authors have shown previously that sulphur mixed with 1 per cent. of soap is easily wetted by water. It is not, however, wetted by saline solutions or by certain acid copper preparations used as fungicides. A preparation which can be wetted by water and by acid, basic, or neutral solutions is obtained by mixing 100 kilos. of sulphur with a solution of 200 c.c. of oleic acid (commercial oleine) in 2 litres of denatured alcohol, and then evaporating off the alcohol.—A. S.

Digitalis purpurea : The presence of manganese in ——. J. Burmann. Bull. Soc. Chim., 1911, **9—10**, 957—959.

It has been found that manganese is an invariable constituent of the purple digitalis and that other varieties do not contain this element. It is possible therefore to distinguish the purple variety by determining the percentage of manganese in the ash of the leaves. One specimen gave 5·8 per cent. of ash which contained 9·02 per cent. of manganese and 0·8 per cent. of iron. It would appear also that the presence of manganese in the soil is essential for the cultivation of this variety.—J. A.

Patents.

Phosphorites or phosphate rock ; Treatment of —— *to render the same suitable for fertilising purposes.* H. V. Dunham, New York. Eng. Pat. 19,043, Aug. 24, 1911.

The rock is ground to pass through a 80—100-mesh sieve and mixed with about 15 per cent. of sulphuric acid (50° Bé.) and 30 per cent. of water. The mixture is heated, usually to a white heat, in a calcining furnace, and afterwards finely ground again. The product contains most of its phosphorus in the "citrate-soluble" form.—J. H. L.

Fungicides, insecticides, etc. W. A. Voss, London. Eng. Pat. 23,477, Oct. 10, 1910.

Seeds, such as hemp or canary seed, are immersed in a 40 per cent. solution of formaldehyde and heated to a temperature of 80° to 100° C. for a few hours. After being mixed with an inert powder, to facilitate distribution and prevent sticking, the seeds are spread over the surface of the soil to be treated and dug or ploughed in.—J. A.

XVII.—SUGARS ; STARCHES ; GUMS.

Beet ; Optically-active substances of the —— *destroyed by lime on heating.* F. Herles. Z. Zuckerind. Böhmen, 1911, **36**, 72—79.

Although the author's observation that beet juices on being heated with lime undergo a diminution in polarisation has been confirmed by a number of investigators, there are some who do not agree that the difference is due to the presence in the juices of optically-active substances which are decomposed by the lime. Weisberg, for example, considers that the diminution of polarisation is simply due to the precipitation of lead saccharate by the basic lead acetate formed by the action of the lime on the normal lead acetate added for defecation. It is now contended that this is impossible under the author's experimental conditions, since the amounts of lime and normal lead acetate are so chosen that while some basic lead acetate is formed, there is always present an excess of the normal salt, the formation of lead saccharate thus being precluded. Using the author's method, Pellet has been unable to find evidence of the presence of the optically-active substances decomposable by lime ; but the author has found that these substances are either absent, or present only in very small amount, in the French and Belgian beets used by Pellet. During the past campaign a number of beets have been examined by the method previously described (this J., 1908, 1168 ; and following Abstract), and from these determinations the conclusion is drawn that there is no doubt as to the existence of optically-active substances decomposable by lime, but that their amount depends upon various conditions, as the nature of the soil, the methods of cultivation, the manure, or the seed employed, being at times as high as 0·57 per cent. on the root.—J. P. O.

Beet ; Simplified method for the determination of the optically-active substances, decomposable by lime on heating, that are present in the ——. F. Herles. Z. Zuckerind. Böhmen, 1911, **36**, 79—81.

In order to make the method described previously (this J., 1908, 1168) applicable for rapid routine work in the factory, it has now been modified, so that the several reagents used, instead of being weighed, are measured. To prepare the milk of lime, 100 grms. of calcium oxide are carefully slaked, triturated with water, and, after cooling, made up to a litre; while the normal lead acetate solution is made by dissolving 350 grms. of the salt in water, and likewise completing the volume to a litre. In carrying out the actual determination, two polarisations are made, one before, and the other after heating with lime, the same amount of lime and lead salt being present in each case. For the first polarisation, the double normal sugar weight of diffusion or saturation juice is taken in a 100 c.c. flask, 40 c.c. of the 35 per cent. normal lead acetate solution and 10 c.c. of the well mixed milk of lime added, the the froth removed with ether, the volume made up with water, and the contents of the flask shaken until all the lime has passed into solution, then filtered, and polarised. In making the second reading, the double normal sugar weight and 10 c.c. of the milk of lime, are well mixed together, boiled for 3 minutes over the naked flame, or kept for 10 minutes in a boiling water-bath, cooled, 40 c.c. of the 35 per cent. lead solution added, the liquid made up to 100 c.c. with water, well mixed, filtered, and polarised. It is preferable to use the 400 mm. tube, while the decrease in polarisation observed as the result of the action of the lime is most conveniently expressed as a percentage on the root.—J. P. O.

Beetroot campaign; Abnormal work during the present ——. F. P. Pillhardt. Deutsche Zuckerind., 1911, 36, 812.

DURING the early part of the present campaign, it was found that the sugars made in certain German factories were not of the usual quality, being characterised by a grey colour and a very low alkalinity. Diffusion had been conducted without difficulty, but the juice obtained was of low purity. Both defecation and carbonatation had been carried out readily, and the scums were homogeneous and easily sweetened off. It was, however, remarkable that whilst filtering the scums of the first saturation, a strong smell of ammonia was observed. Another unusual occurrence was the inconstant alkalinity of the thick-juice, which was generally very low, and sometimes even disappeared altogether, giving place to a slight acidity, although the alkalinity of the thin-juice entering the evaporators had been kept the same throughout. On determining the calcium salts present in the thick-juice, by titration with alcoholic soap solution, the figure found was very high, amounting on an average to 0·195 per cent. (calcium oxide), whereas in ordinary work only 0·06 per cent. is found. Boiling to grain was irregular, and crystallisation was difficult, so that a low yield of first product resulted. As the cause of such abnormal conditions, it is suggested that either unripe or unsound roots, which therefore contained comparatively large amounts of amino-acids and acid amides, had been sliced. Owing to the presence of these bodies, a large amount of ammonia had been formed by the action of the alkali during defecation; and this, on volatilisation in the effects, had largely caused the unusual fall of alkalinity after evaporation. Moreover, a portion of the alkalinity had been neutralised by the acids formed by the decomposition of the acid amides, and this to a less extent had also contributed to the low alkalinity of the thick-juice.—J. P. O.

Aluminium bisulphite; Use of —— in the beet sugar factory as decolourising and de-incrustating agent. O. Durieux. Sucr. Belge, 1911, 35, 535—536.

IT is stated that aluminium bisulphite has been used during the past three campaigns at the Givry factory, Belgium, with very satisfactory results. The second carbonatation juice, saturated almost to neutrality to phenolphthalein, and passed through the presses, is treated in the supply tanks, from which the evaporators are fed, with the aluminium compound at the rate of 300 c.c. to every 10 hectolitres. Hydrolysis takes place immediately, the sulphur dioxide given off acting on the organic non-sugars as a decolourising agent: whilst calcium aluminate is formed with the slight excess of lime. In the evaporators, the constant movement of the small amount of calcium aluminate throughout the boiling mass has been found to have the effect of preventing the deposition of mineral salts on the heating tubes, so that the efficiency of the apparatus is considerably increased, as compared with ordinary working. In this way, it is possible to proceed through the entire campaign without cleaning the tubes; and, moreover, the evaporation is easier, on account of the greater fluidity of the juices. On passing the syrups drawn from the third vessel of the effect through the thick-juice presses, further purification takes place, owing to the absorption of the organic non-sugars by the precipitate that is retained. Thus, it is claimed, the syrup is freed from the greater part of its impurities, so that boiling is satisfactory, and crystallisation in the mixers proceeds readily, a larger proportion of crystals being obtained.—J. P. O.

Influence of acids on the inversion of sucrose by sucrase. Stoward. *See* XVIII.

Determination of sucrose and detection of dextrin in certain foods. Vollant. *See* XIXA.

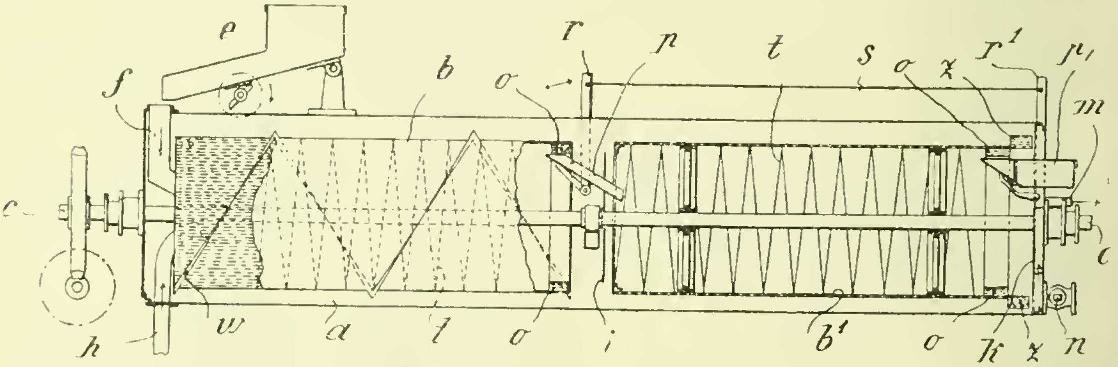
PATENTS.

Beetroots; Producing juice from ——. H. Bosse, Hecklingen, Germany. U.S. Pat. 1,005,931, Oct. 17, 1911.

THE roots are disintegrated and caused to fall through steam. The juice is then extracted in a diffusion battery, and the residual slices are pressed in presence of steam, the press liquor being returned to the battery.—L. E.

Diffusion juice [Sugar]; Process and apparatus for the continuous dry defecation of ——. K. Krause. Fr. Pat. 429,601, May 10, 1911.

THE apparatus includes a trough, *a*, containing one or more cylindrical sieves, *b*, *b′*, mounted on a rotatable shaft, *c*. Quicklime is introduced, in small quantities and in proportion to the amount of juice, by the channel, *e*, and through the inlet, *f*, whilst the juice, previously heated to about 80° C., is introduced in measured quantity



through the pipe, *h*, which may be situated, as shown, at the same end of the trough as the inlet, *f*, or at the other end. Openings in the lower parts of the partitions, *i* and *k*, serve for the passage of the treated juice. The outlet, *m*, serves for the exit of the treated juice from the trough and the latter may be completely emptied by the tap, *n*. Channels, *p* and *p'*, each consisting of two parts, one fixed and the other hinged, are also provided ; the fixed parts pass through openings in the upper parts of the partitions, *i* and *k*, whilst the hinged parts which project into the sieves and are worked by levers, *r* and *r'*, are adjusted so as to carry away residual lime from the collecting pockets, *o*, each time that a fresh charge of lime is introduced. The levers are connected by the rod, *s*, and can thus be worked simultaneously. The sieves are fitted internally with spiral grooves, *t* ; projecting plates (not shown) situated between the grooves, serve to distribute the lime over the interior surface of the sieves. The sieves are fitted externally with helices, *w*, whereby sand, etc., which passes through the sieves, is carried towards the end from which the juice is discharged ; the end of the last sieve is fitted with blades, *z*, for conveying the sand, etc., to the channel for the discharge of residual lime. —L. E.

[*Sugar*] *Diffusion process.* S. von Grabski. Ger. Pat. 238,670, March 9, 1909.

Each diffuser is provided with a pump by means of which the juice can be circulated over a heating device in the diffuser ; forced from one diffuser to another ; and circulated through a heater whilst a diffuser is being filled. The diffusers are connected together in the fashion of a multiple-effect evaporator, and by production of a partial vacuum, a certain amount of evaporation is effected in the diffusers. In this way not only is the work of the evaporators lightened, but less lime is required in the defecation process.—A. S.

Sugar and other soluble substances ; Apparatus for continuously dissolving ——. M. G. Hummelinck, Vlaardingen, Holland. Eng. Pat. 9295, April 13, 1911.

The solid and solvent are together fed into one end of a horizontal cylinder containing a revolving stirring mechanism which throws the mixture against the walls of the cylinder and keeps it travelling round the walls in a thin layer by centrifugal action. The shaft on which the stirring arrangement is fixed carries also two discs extending almost to the walls, so that the cylinder is divided into three compartments, the dissolving mixture passing from one to the next through the narrow annular space between the disc and the walls. The solution is ejected tangentially near the end of the third compartment. Into the middle compartment steam or gas, for heating or saturating the liquid, may be introduced through an inlet in the wall of the cylinder. The bubbles of steam or gas cannot escape from the middle compartment unless the pressure becomes excessive, when the excess passes into the third compartment and escapes by a special vent. Within the first compartment a perforated cylinder, rotating with the stirring machinery, acts as a screen in keeping back from the walls of the vessel large particles of solid.—J. H. L.

[*Sugar*] *Defecating and evaporating apparatus.* F. P. Watrous, Long Beach, Miss. U.S. Pat. 1,006,321, Oct. 17, 1911.

The apparatus comprises a tank divided into a central boiling compartment and side settling compartments by partitions which are of less height than the wall of the tank. One of the settling compartments is closed against the boiling compartment but is in communication with the other settling compartment, the last being in communication with the boiling compartment at the end remote from its communication with the first-named settling compartment. Means are provided for imparting the maximum degree of heat, longitudinally and centrally, to the boiling compartment, *e.g.*, with coils connected to the steam supply, and for imparting a less degree of heat to the settling compartments, *e.g.*, with coils supplied with exhaust steam.—L. E.

Sugar ; Process of manufacturing white or brown —— and molasses. F. T. M. Everard and F. Severus. Fr. Pat. 430,430, June 2, 1911.

All the mother-syrup of higher concentration than 55 per cent. from the centrifugal apparatus is mixed with the syrup from the evaporating apparatus, the mixture being treated with sulphurous acid and 100 grms. of hydrosulphite per 1000 litres. The mixture is subsequently boiled, whereby the sulphur dioxide is removed, and freed from solid matter by any suitable means : it is then boiled in an evaporating vessel into which has been previously introduced a stratum ("pied de cuite") consisting of a mixture of second jet sugar with syrup and purified mother-syrup. The massecuite thus obtained is centrifuged, and, on admitting steam, white or brown sugar is produced. The mother-syrup of higher concentration than 55 per cent. is worked up as previously described. The mother-syrup of lower concentration is sulphitated in a special apparatus, treated with hydrosulphite, and heated to 60°—70° C. It is then boiled in an evaporating vessel into which has been previously introduced a stratum consisting of a mixture of syrup and mother-syrup of high purity. The massecuite thus obtained is mixed and cooled in malaxeurs, and centrifuged, second jet sugar and molasses being thus produced.—L. E.

Plants ; Apparatus for continuously lixiviating ——. C. Steffen, Vienna. U.S. Pat. 1,006,311, Oct. 17, 1911.

See Fr. Pat. 356,636 of 1905 ; this J., 1905, 1316.—T.F.B.

Potatoes ; Process of treating ——. C. Steffen, Vienna. U.S. Pat. 1,006,312, Oct. 17, 1911.

See Fr. Pat. 368,002 of 1906 ; this J., 1906, 1230.—T. F. B.

Continuous filter-press and washer. Fr. Pat. 430,290. *See* I.

Manufacturing industrial alcohol, glucose, and cellulose from vine shoots. Fr. Pat. 429,825. *See* XVIII.

XVIII.—FERMENTATION INDUSTRIES.

Malt ; Determination of the enzymic power of ——. E. Moufang and A. Scheer. Woch. Brau., 1911, **28** 525—529.

There is at present no means of expressing the degree of modification of a malt numerically, so that malts of different types may be compared. The authors suggest as a measure of modification, a new value—the "enzymic power" of malt. The quantity of enzymes present in well modified malt is more than sufficient to produce satisfactory saccharification and proteolysis during mashing, and the yield of extract obtained is not much diminished if, before mashing, a portion of the grist is boiled with water to destroy its enzymes. The greater the proportion of the total enzymes of a malt which may be so destroyed without appreciably affecting the yield of extract, the higher is the enzymic power of the malt. Unlike the diastatic power, which concerns only saccharifying enzymes, the enzymic power represents the total enzymic activities of the malt. The authors have investigated eight malts of widely different types, by conducting with each a series of parallel mashes in which varying proportions (from 0 to 90 per cent.) of the grist were first boiled with water to destroy the enzymes. In each case the period of saccharification, the appearance of the filtered worts, the yield of extract and the attenuation after fermentation, were observed, and in some cases the acidity of the wort and the nature of the proteins present were investigated. Taking as a measure of the enzymic power the diminution in the yield of extract resulting from the destruction of 90 per cent. of the total enzymes, the values so obtained were found to represent fairly well the degree of modification. The diminutions in extract observed were 0·35, 0·48 (over-modified malts), 1·05, 1·51, 1·52 (well modified), 1·61 and 4·75 (insufficiently modified), and in the case of the remaining malt, modification was so deficient, that a destruction of only 35 per cent. of the enzymes produced a fall of 3·94 in the percentage extract. Investigations such as those described, in the author's opinion, furnish most valuable hints as to the best manner of working individual malts, especially when the decoction method or the spring method of mashing is employed.—J. H. L.

[Malt] extract returns, with some remarks on the specific rotatory power of wheat starch conversions and brewery worts. A. R. Ling. J. Inst. Brew., 1911, **17**, 570—586.

In many large English breweries the extraction of the malt during mashing is very incomplete, the spent grains often containing 5—14 per cent. of starch calculated on the dry grains. It has long been known that higher extracts can be obtained by fine grinding of the malt, but as this is attended by great dangers, such as "set" mashes and extraction of undesirable husk-constituents, many brewers have come to regard the attainment of high extracts as incompatible with the satisfactory production of sound beers. This is a mistaken view. "Set" mashes may be avoided, when very finely ground malt is employed, by the use of the Meura process in which the mash is filtered in a specially designed filter-press, but the author considers that better results are obtained by the use of modern roll-mills, such as those of Seck, Boby or Green, for grinding the malt. In these mills the farinaceous portions of the grain are thoroughly crushed, whilst the husks remain as far as possible intact and thus form a satisfactory filtering bed in the mash-tun. The author proceeds to discuss the value of the specific rotatory power of worts as an indication of the kind of product they will yield. Inasmuch as the rotatory power is calculated on the total solids of the wort, and not on the starch conversion products only, it may be influenced by other wort constituents and is therefore of uncertain significance. In order to determine the specific rotatory power of starch conversion products alone, the experiments described below were carried out. Most of the investigations hitherto published, relating to the saccharification of starch by malt diastase have been conducted with potato starch paste, the conditions differing, therefore, from those which obtain in the practical mashing process, where the conversion of the starch is effected below the temperature of gelatinisation. In order to approach the practical conditions as closely as possible, the author employed suspensions of wheat starch. Mixtures of 50 grms. of starch with 950 c.c. of water and 50 c.c. of malt extract were maintained at given temperatures (130°, 140° and 150° F.) and kept continuously agitated. Portions of 100 c.c. were withdrawn after successive intervals of one hour, and determinations made of the percentage of starch dissolved, the cupric-reducing power of the solution, and its optical rotatory power. The results were not so uniform as those obtained with starch paste, owing doubtless to differences in the susceptibility of the individual granules to the solvent action of the diastase. The following table shows the results obtained after 2 hours, using extracts of three different malts of diastatic powers (D.P.) 123°, 23° and 31° Lintner.

D.P.	Temp.	$[\alpha]_D$	R
123°	130° F.	152	73
23	130°	155	80
31	130°	153	—
123	140°	150	82
23	140°	156	75
31	140°	153	79
123	150°	156	78
23	150°	167	65
31	150°	158	69 (1½ hr.)

R is the cupric-reducing power, calculated as maltose, on 100 parts of starch hydrolytic products, deduced from the specific gravity of the solution by the solution-factor 4, and corrected for the malt extract employed. The values of $[\alpha]_D$ are also calculated on hydrolytic products reckoned in the same way. It is noteworthy that the malt of diastatic power 123° gave, at 130° F., products of lower reducing power than did the malt of 23°. So far as starch conversion is concerned the Lintner value seems of very doubtful utility as a guide when taken alone.—J. H. L.

Sucrose; Influence exerted by certain acids on the inversion of —— by sucrase. F. Steward. Bio-chem. J., 1911, **6**, 131—140.

The work of various investigators has shown that, in general, small quantities of acids increase the activity of sucrase (cp. O'Sullivan and Tompson, this J., 1890, 1049; Sörensen, this J., 1909, 950), and the author has made further experiments on this subject. The sucrase used was prepared by the method of Duclaux. Cultures of *Aspergillus niger* were grown on Raulin's solution for 4—5 days at 30° C. The mature mycelium was freed from the culture liquid, its under surface being thoroughly washed with distilled water; it was then left, with only its under surface in contact with distilled water, to undergo plasmolysis for 48—50 hours at 30° C., in absence of light. An almost colourless solution of the enzyme was thus obtained. It was found that within certain limits of concentration, each of the acids examined promotes the hydrolysis of sucrose by sucrase; the amount of acid necessary appears to depend on the nature of the acid and the proportion of enzyme. The action of the enzyme is accelerated by sulphuric, hydrochloric and nitric acids at concentrations of $N/1000$—$N/5000$, and by phosphoric acid at concentrations of $M/200$—$M/4000$; in the case of acetic acid, the range of favourable concentrations is much higher, this acid promoting the action of sucrase even at a concentration of $N/5$. The retarding influence exhibited by these acids at higher concentrations varies in a similar sense. The action of sucrase is almost completely arrested by sulphuric, hydrochloric, and nitric acids at concentrations of $N/50$, and by phosphoric acid at a concentration of $M/10$, whilst it is only considerably retarded by acetic acid at so high a concentration as $N/1$. In view of the work of Sörensen (*loc. cit.*) it seems probable that the influence of the acids on the action of sucrase depends, not on the acidity of the reaction medium, but on the concentration of the hydrogen ions present at each stage of the experiment. In respect of its behaviour in presence of acids, sucrase differs greatly from laccase, since, as Bertrand has shown (this J., 1907, 983), the oxidising action of the latter enzyme is completely arrested by very small quantities of the acids.—L. E.

Alcoholic fermentation; Mechanism of ——. A. v. Lebedeff. Ber., 1911, **44**, 2932—2942.

This paper summarises recent work on the problem of the mechanism of fermentation by active yeast juice, especially the work of the author (see this J., 1910, 1264; 1911, 973), Iwanoff, and Harden and Young (this J., 1909, 1322; 1910, 711; 1911, 705) on the sugar phosphoric esters. Experiments are described relating to the fermentation of dihydroxyacetone (see this J., 1911, 973). In solutions containing less than 5 per cent., this triose is fermented as well as sucrose, but somewhat less rapidly owing to its injurious action on the zymase. Addition of large quantities of phosphates appreciably retards the velocity of fermentation of dihydroxyacetone and also of sucrose. In concentrations of over 5 per cent. the triose ferments only about half as well as sucrose. Details of the isolation of hexose phosphoric ester from the fermentation of dihydroxyacetone are given. The ester is formed rapidly during the early stages of fermentation in presence of phosphates, and the evolution of gas is brisk; but when a large quantity of ester has been formed, fermentation becomes somewhat slower. A large concentration of ester appears to have a retarding influence on the rate of fermentation.—J. H. L.

Mixtures of cement and hydraulic materials for floors of wet cellars. Schäcke. *See* IX.

Specific gravity of absolute alcohol at 25° C. Kailan. *See* XX.

Patents.

Brewing ; Process of treating and purifying liquids containing albumin, in ——. S. G. Martin, Chicago, Ill., W. O. Bartholomew, St. Louis, Mo., and E. Schaaf, St. Mary's, Mo., U.S.A. Eng. Pat. 5339, March 3, 1911. Under Int. Conv., March 3, 1910.

Wort, either before or after the primary fermentation (but preferably after, in the chip cask), is treated for 2—8 minutes with ozone-free air containing about 2 per cent. of oxides of nitrogen (preferably nitrogen peroxide) produced by the flaming electric arc. This treatment assists in the removal of undesirable wort proteins and improves the brilliance, aroma, taste, stability and foam-holding power of beer.—J. H. L.

Fermented malt beverages ; Manufacture of ——. R. Wahl, Chicago. U.S. Pat. 1,006,154, Oct. 17, 1911.

Beer is freed from objectionable albuminoids by treating it with a solution of the "lactic-acid-extracted soluble substances of malt." This solution, which, owing to the action of the lactic acid, contains dissolved and peptonised albuminoids and practically no objectionable protein matter, also contains peptase whereby the albuminoids of the beer are digested.—L. E.

Alcohol, glucose, and pure cellulose from vine shoots ; Process of manufacturing industrial ——. P. Variot. Fr. Pat. 429,825, May 3, 1911.

The vine shoots, which contain 21·16 per cent. of amylaceous matter and 31·7 per cent. of cellulose, are ground and then boiled with dilute sulphuric acid, whereby the amylaceous matter is converted, first into dextrin, and then into glucose. The acid solution of glucose is decanted and expressed from the residue, neutralised with lime, fermented, and distilled, 140 litres of 90 per cent. alcohol being thus obtained from 1000 kilos. of shoots. The residue, which consists of the cellulose, is ground, and macerated with cold, concentrated sulphuric acid, whereby it is converted into amyloid. On adding water and heating to boiling, the amyloid is converted into glucose ; the acid solution is neutralised with lime, decanted, fermented, and distilled, a further quantity of about 150 litres of alcohol per 1000 kilos. of shoots being thus obtained. If desired, the cellulose residue may be used for paper-making.—L. E.

Alcoholic liquids and beverages ; Process of purification of alcohols, phlegms, wines, rums, tafias and other ——. M. J. D. de la Baume. Fr. Pat. 429,998, May 20, 1911.

The liquid is first "neutralised" by addition of sodium sulphate and then treated with sodium or barium thiosulphate and with sodium or potassium tartrate ; the whole process is effected in one vessel or even in the heater of the rectifying apparatus. The treated liquid is then rectified in the usual way.—L. E.

Fermentation processes. A. Lebbe. Fr. Pat. 430,110, May 24, 1911.

The wort is subjected to electrolysis, *e.g.*, by a 20-volt current of 1 ampère for 24 hours, it having been found that fermentation is assisted and may be regulated by such electric action. To replace metal electrodes, which would dissolve in the liquid, carbon electrodes are used, one of them being suspended from a wooden plate floating on the wort, whilst the other is attached to the bottom of the vat and projects upwards therefrom.—L. E.

Brewery-wastes and the like ; Trough-dryer for drying ——. F. E. Otto, Assignor to Phönix-Werk G. m. b. H., Meerane, Germany. U.S. Pat. 1,006,266, Oct. 17, 1911.

The apparatus includes a covered trough with a lateral air-inlet, a rotary drying-drum mounted in the trough, and an external heating arrangement on the outside of the trough opposite the collecting zone of the material to be dried in the trough. A comparment encompasses the lower part of the trough and the heating arrangement, and is so adapted as to admit air to the latter and to conduct it in its heated state to the air-inlet of the trough ; or the air may be admitted simultaneously to the drying-drum and to the heating arrangement. The drying-drum consists of a fore-drying division composed of a few wide-spaced tubes of large diameter, a finish-drying division, communicating with the fore-drying division, and composed of many narrow-spaced tubes of small diameter, an admission-chamber admitting the hot air to the fore-drying division and carrying one tubular journal of the drum, and a collecting-chamber carrying the other tubular journal of the drum. An angular, stationary outlet-pipe, sustained by a ball-bearing within the collecting chamber, reaches with one of its legs below the lowermost tube of the finish-drying division, whilst its other leg is connected with a condensing-pot. Shovels mounted on carriers connected with both divisions of the drying drum, and means for making the carriers self-sustaining, are also provided. —L. E.

Malt and like kilns. C. Brüne, Radeberg, Germany. Eng. Pat. 3338, Feb. 9, 1911.

See U.S.Pat. 1,001,347 of 1911 ; this J., 1911, 1100.—T.F.B.

XIXa.—FOODS.

Sucrose ; Determination of —— and the detection of dextrin in certain foods. A. F. Vollant. Ann. Falsif., 1911, **4**, 504—509.

The method described by Lemeland (this J., 1910, 1220) was found by the author to be quite trustworthy ; it may be applied to the determination of sucrose in raw sugars, syrups, confectionery, honey, and sweetened dry milk, and may also be employed for the detection of dextrin in foodstuffs. In the latter case, other substances, such as proteins and gums, are removed by means of suitable reagents, the sucrose present is inverted, and, together with other sugars, is destroyed by treatment with manganese dioxide and alkaline hydrogen peroxide ; any optical activity then exhibited by the solution is due solely to the presence of dextrin. For the determination of sucrose in dry milk, it is recommended that 5 grms. of the sample be extracted with three successive quantities of 25 c.c. of 0·1 per cent. acetic acid, the insoluble portion being separated each time by centrifugal action, and the united aqueous extracts are treated with 3 c.c. of a 25 per cent. solution of sodium metaphosphate and 3 c.c. of hydrochloric acid. The mixture is diluted to a volume of 100 c.c., filtered, and the sucrose determined in the filtrate after treatment with manganese dioxide and hydrogen peroxide. It is pointed out that the solution, after treatment, should be neutralised with acetic acid and not with nitric acid as described in the original paper (*loc. cit.*), and that the solution, after clarification with lead acetate, should be acidified with acetic acid and made up to a definite volume before being examined in the polarimeter.—W. P. S.

Preserved milk industry in New Zealand. Ch. of Com. J., Nov., 1911. [T.R.]

The production of condensed and powdered milk is assuming importance in New Zealand, and during 1910, 235,590 lb. of preserved milk were exported to other countries, of which the United Kingdom took 185,812 lb., the remaining shipments going chiefly to Australia and to the South Sea Islands. The powdered milk is sterilized and contains no cane or beet sugar ; also the casein, in the process of drying the milk, is divided into fine particles, as it is in human milk. Powdered milk as produced in New Zealand contains about 26 per cent. butter fat, 22·9 per cent. proteids, 42·3 per cent. milk sugar, and 5·6 per cent. mineral salts. It consists of a flaky powder of cream colour. Very complete sterilization is obtained during the desiccating process. The milk is dried within two hours of its being drawn from the cow, the cans into which the milk is received having previously been washed in lime water, then in cold water, and finally sterilized with steam. Tuberculosis is guarded against by veterinary inspection of the cows, and also by the sterilization of the cans, which insures the destruction of all bacilli. One kind of powdered milk is made entirely from skimmed milk, and is used in biscuit factories and in the manufacture of milk chocolates, for which purpose it is exported to England. The powder milk is a desiccated milk to which cream and lactose have been added. It has recently acquired a reputation in connection with South Polar exploration. The New Zealand method of evaporating milk into powdered form has lately been introduced into Australia. It is anticipated that the development of this industry may add considerable value to skimmed milk, which is now fed chiefly to pigs.

Casein manufacture in Australia. Ch. of Comm. J., Nov., 1911. [T.R.]

It is reported that a factory will be established at Lismore in New South Wales, for the manufacture of casein. While the factory proper will be at Lismore, precipitating stations will be established wherever a supply of from 2000 to 3000 gallons of skimmed milk can be obtained. At these stations the casein will be separated from the whey, and the product forwarded to the head factory for final treatment. The price to be paid to farmers will, it is estimated, be an increase of something like 100 per cent. on the value of the skimmed milk as pig feed.

Patents.

Tea; Process of drying —— after fermentation. G. C. Douglas, Dundee. From J. N. F. Greig, Assam, India. Eng. Pat. 23,706, Oct. 13, 1910.

The fermented leaf is subjected to a blast of air at the ordinary temperature until all the moisture necessary to stewing is removed, and is then passed through a rotating, slightly inclined cylinder which is heated to 200° F., or more, so that the leaf attains this temperature during its passage through the cylinder. A vertical cylinder may also be employed; in this case the leaf is fed in through a grid at the top of the cylinder, the lower end being closed. The leaf is discharged by opening this end of the cylinder, the upper end being closed meanwhile. The temperature of the cylinder must be maintained at considerably above 200° F. in order that the leaf may be heated to this temperature as it falls through the cylinder. The final drying of the leaf is effected by passing it once more through the cylinder, or by the use of any suitable apparatus.—W. P. S.

Baking powder. R. Dietrich, Hameln, Germany. Eng. Pat. 12,668, May 25, 1911. Under Int. Conv., Dec. 14, 1910.

The baking powder consists of a mixture of mono-ammonium phosphate, $NH_4H_2PO_4$, 18 parts, di-ammonium phosphate, $(NH_4)_2HPO_4$, 17 parts, sodium bicarbonate, 30 parts, and flour, 35 parts. The di-ammonium phosphate liberates carbon dioxide from the bicarbonate only when the dough is heated, and the mono-ammonium phosphate is added for the purpose of causing a preliminary liberation of the gas while the dough is cold.—W. P. S.

Sterilising milk and milk products; Process for ——. E. Wiener, Vienna. U.S. Pat. 1,006,992, Oct. 24, 1911.

See Eng. Pat. 19,621 of 1910; this J., 1911, 149.—T. F. B.

Manufacture of solid fatty substances from oils. Eng. Pat. 8147. *See* XII.

XIXB.—WATER PURIFICATION; SANITATION.

Galvanised iron pipes; Use of —— in water-supply. J. Drost. Apoth.-Zeit., 1911, **26**, 899—900.

At a country house galvanised cast iron pipes brought the water from a well in the farm-yard to the house pump, and also from the well to the yard pump. Notice was drawn to the water by the fact that horses refused to drink it after it had been standing a long time in the pipes; it had first to be pumped for some time. Three samples were taken: one directly from the well, another from the house pipe after the water had been standing in it unused for 12 hours, and another from the yard pump after standing unused for the same time. The greatest difference in the analyses was in the reduction of nitrate to nitrite in the pipe samples and in the great increase of the metallic impurity. The well water contained 0·16 mgrm. of iron per litre and no zinc; in the tap water the iron amounted to 2 mgrms. per litre and zinc oxide, 9 mgrms. per litre; in the yard water the iron was 20 mgrms. per litre and the zinc oxide 3·5 mgrms. per litre. The author made some experiments upon the solubility of zinc in drinking water and found that it depended rather on the quality of the galvanised iron than on the composition of the water. Action depends not only on microscopic portions of the iron being left uncoated but also on the purity of the zinc used.—J. H. J.

Water; Sterilisation of —— by ultra-violet rays. Rolle. Woch. Brau., 1911, **28**, 533—534. (See also this J., 1911, 1276.)

Although malt liquors cannot well be sterilised by means of the mercury lamp, owing to their opacity to ultra-violet rays (see Courmont, this J., 1911, 1027), clear water can be completely sterilised almost instantaneously. Rogier has devised an apparatus for this purpose, which can be fitted to a water tap. It consists of a cylindrical mercury lamp, 30 cm. long, enclosed in quartz, and fixed in the axis of an aluminium tube 10 cm. wide, constricted near one end so that the water, in passing through, is brought very close to the lamp. The apparatus requires a current of 6 ampères at 30 volts, and produces, per hour, 1000—1500 litres (200—300 galls.) of absolutely sterile water which can be used for drinking with perfect safety. The plant installed at Marseilles for sterilising the drinking water by ultra-violet rays, requires an expenditure of 12,000 kilowatt-hours per 100,000 cb. metres (220,000,000 galls.) at a cost of 0·24d. per cb. metre (1·1d. per 1000 galls.). A large waterworks with its own electric plant could, however, reduce this cost to 0·45d. per 1000 galls., which is cheaper than sterilisation by means of ozone (cp. Erlwein, this J., 1911, 1228) and the apparatus required is much simpler and less costly.—J. H. L.

Sewage clarification plant at Elbing, Germany, with special reference to the production of gas from the sludge. W. Schweizer. J. Gasbeleucht., 1911, **54**, 231—234.

The sewage is practically free from trades waste and the quantity to be dealt with is 2500—2900 cb. m. per day. After passing a sand collector, where sand and heavy mineral matter are deposited and coarse suspended impurities are retained by a screen, the sewage is transferred by an electrically driven centrifugal pump to mixing pits where it is treated by the Rothe-Degener precipitation process (compare Ger. Pat. 212,740 of 1908; this J., 1909, 1060), from 1 to 2 kilos. of ground lignite and 200—500 grms. of alumina per cb. metre being added to it. The lignite absorbs the dissolved organic substances and is caused to settle rapidly by the alumina. From the mixing pits, the sewage is passed to the clarification tower in which the sludge settles; the clear liquid overflows at the top, and the sludge is withdrawn from the conical lower part of the tower and forced by a centrifugal pump first to reservoirs and thence to filter-presses, in which the water-content is reduced from 95—98 per cent. to 60—70 per cent. The press-cakes from the filter-presses are dried in the air for 2—4 weeks until the water-content is reduced to 40—45 per cent., and is then used as fuel in gas-producers. The gas is passed through a dust-chamber, washer, and scrubber, and thence to the gas-engine. It contains carbon monoxide and dioxide, oxygen, hydrogen, ammonia, hydrogen sulphide, and nitrogen, but no methane; the lower limit of inflammability is at 37 per cent. of gas to 63 per cent. of air. During the "blowing" of the producer and on shutting-off the gas-engine, malodorous gases are evolved and these proved a great source of trouble, which has, however, now been overcome by the installation of a centrifugal pump, by which, when required, the gases are mixed with sufficient air to produce a non-explosive mixture and then forced through a column of incandescent coke. For a daily quantity of 3000 cb. m. of sewage, the total annual cost of materials and labour for the clarification and gas-production processes is given as M. 56,620 (about £2800), without allowing for the value of the gas produced.—A. S.

Sewage sludge ; Distillation of dried —— for the production of lighting gas. A. Bayer and L. Fabre. J. Gasbeleucht., 1911, **54**, 1113—1114.

Experiments carried out at Brünn have shown that sewage sludge after drying till it contains 25 per cent. of dry substance is superior to horse dung in its content of nitrogen and of phosphoric acid, but as the quantity is too great to be disposed of locally as a manure, it has been used, after complete drying for the production of lighting gas. The sludge with a water content of 96—97 per cent. is first distributed by means of a vacuum (200 mm. of mercury) over a filtering surface, and the cake is subsequently loosened by means of compressed air. In 1 hour, with a filtering surface of 1 sq. m., 33·3 kilos. of sludge containing 22·5 per cent. of dry substance are obtained. This is next completely dried and distilled in ordinary gas retorts. The dried sludge contains, on the average, 31·04 per cent. of carbon, 3·95 of hydrogen, 2·87 of nitrogen, 20·73 of oxygen, 41·41 of ash, 1·63 of phosphoric acid (P_2O_5), and 0·42 per cent. of potash, and has a calorific power of 2908 cals. On distillation at 600°—700° C., 55 kilos. of the dried sludge yield in 2½ hours a quantity of gas equivalent to 23·8 cb. m. per 100 kilos. The gas contains 2·2 per cent. of carbon dioxide, 4·8—7·3 of heavy hydrocarbons, 18·1—23·2 of methane, 14·4—17·5 of carbon monoxide, 41·7—44·2 of hydrogen, 0·8 of oxygen, and 7·9—12·0 per cent. of nitrogen ; it has a calorific power of 4122—4759 cals. The hydrocarbons present in the gas, apart from methane, consist chiefly of ethylene and probably also of acetylene. The yield of ammonia is 0·957 kilo. per 100 kilos. of dried sludge and that of coke is 52·63 per cent. The coke has a calorific power of 2300 cals. and is used as fuel for the final drying of the sludge, an addition of 2 kilos. of coal waste to the coke being necessary per 100 kilos. of partially dried sludge. —A. S.

Sulphur preparation which can be easily wetted. Vermorel and Dantony. *See* XVI.

Carbon monoxide detector. Nowicki. *See* XXIII.

Patents.

Liquids ; Apparatus for sterilising —— by ultra-violet rays. V. Henri, A. Helbronner, and M. von Recklinghausen, Paris. Eng. Pat. 23,077, Oct. 5, 1910.

The lamp employed is enclosed in a metal frame provided with quartz windows and the chamber thus formed around the lamp is supplied with air or other gas at a pressure slightly exceeding that outside the chamber when the latter is immersed in the liquid to be treated. The air, or other gas, is dried before being admitted to the chamber, and the object of the invention is to prevent leakage of liquid into the lamp chamber.—W. P. S.

Liquids ; Apparatus for treating —— with ultra-violet rays. V. Henri, A. Helbronner, and M. von Recklinghausen, Paris. Eng. Pat. 4895, Feb. 27, 1911.

In apparatus where a mercury vapour lamp surrounded by a quartz chamber is immersed in the liquid to be treated, a device, consisting of a ball-float or the like, is provided so that, by means of suitable connections, the operation of the lamp is prevented until the liquid rises to such a level in the tank in which the sterilising process takes place that the lamp is immersed completely in the liquid. The ball-float may be fitted in a small chamber on the pipe supplying the liquid to the tank containing the lamp. —W. P. S.

Filter. J. Laurie, Blantyre, N.B. From R. Laurie, Lagos, S. Nigeria. Eng. Pat. 29,325, Dec. 17, 1910.

The patent concerns the construction of "candles" of diatomaceous earth and of like material such as are used for filtering water. Filtration takes place by gravity outwards through a cup-shaped filtering vessel which is constructed with an internal reinforcement of wire gauze or mesh sufficient to support the vessel when full of liquid. The filtered liquid collects in an outer vessel of glazed clay, porcelain or other suitable substance. In order to obtain a greater filtering surface, the filtering vessel may contain a raised part in the bottom, in which case its lower part is further supported by a perforated outer cap screwed to it. The level of the liquid may be kept constant in the "candle" by means of a siphon from a reservoir.—B. G. McL.

Filters and filtering apparatus. Soc. Anon. du Filtre Chamberland Système Pasteur, Paris. Eng. Pat. 16,270, July 14, 1911. Under Int. Conv., July 29, 1910.

In order to prevent the clogging of the pores of the porcelain or other filter candles and mantles used for filtration, it is proposed to immerse them before use in a solution of collodion. In this way a thin film of collodion is obtained over the mantle and this forms an excellent filtering surface which lasts for a long time and prevents the passage of bacteria and colloids. In order to prevent the film of collodion from becoming brittle, the mantles after coating are dipped into glycerin or other hygroscopic substance. If desired the solution of collodion may be mixed with glucose, gelatin, tannin, or other substances capable of being dissolved out of the dried film by water, alcohol, etc.—W. H. C.

Water ; Method of and means for extracting micro-organisms and solids from ——. G. W. Durbrow, Los Angeles, Cal. U.S. Pat. 1,006,070, Oct. 17, 1911.

The water is passed through a filter consisting of compressed material, such as cotton, wool, asbestos, etc., which has been sterilised and treated with "a sticky substance which will not dissolve or melt in water at a temperature of 100° F."—W. P. S.

Gases ; Method of and apparatus for destroying noxious and other ——. C. T. A. H. Eckhardt and C. W. Meisser, Hamburg, Germany. Eng. Pat. 14,920, June 26, 1911.

The gases are passed through two or more furnaces adjacent to one another and arranged at different heights ; the gases enter the first furnace below the grate, pass through the fire, and then enter the second furnace below the grate, and so on.—W. P. S.

Disinfectants ; Process for preparing ——. Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Ger. Pat. 238,389, Feb. 3, 1911.

Boric acid and the bases of methyl violet, auramine, or vesuvine are dissolved in alcohol or phenol, or in a mixture of the two, with or without addition of water. The colour base and the boric acid may be dissolved in separate portions of phenol or alcohol and subsequently mixed, and soaps or soap solutions may be added to the resulting solutions. The boric acid salts of the colour bases have not hitherto been utilised for disinfecting purposes, owing to their slight solubility ; by this process they are rendered much more readily soluble in water.—T. F. B.

Liquids, especially water ; Apparatus for the mechanical treatment of ——. L. Linden, Brussels. Eng. Pat. 9258, April 13, 1911.

See Fr. Pat. 428,903 of 1911 ; this J., 1911, 1277.—T. F. B.

Use of metallic tungsten and uranium for electrodes for arc lamps. Addition to Fr. Pat. 418,280. *See* IIb.

Apparatus for indicating the presence of poisonous or inflammable gases in air. Fr. Pat. 429,862. *See* XXIII.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Ipecacuanha ; The alkaloids of ——. O. Keller. Arch. Pharm., 1911, **249**, 512—524.

After giving a brief summary of previous work on the alkaloids of ipecacuanha, the method used to extract and separate the bases is described. The drug was first extracted with ether, then treated with ammonia and again extracted with ether. The extract was concentrated and then diluted with ether. On adding alcohol saturated with hydrogen chloride, emetine hydrochloride was precipitated in an almost pure form. The drug was afterwards repeatedly extracted with the ether recovered from the first extract. After concentration and standing, the extract deposited crystals of cephaeline. Subsequent extraction of the drug with chloroform gave a small quantity of psychotrine. After applying a number of qualitative tests to emetine, the halogen acid salts were analysed, confirming tho formula of Paul and Cownley, $C_{30}H_{44}N_2O_4$. The base is not bi-tertiary, but is secondary-tertiary. It contains apparently two methoxyl groups and a hydroxyl group. It can be readily distinguished from cephaeline by colour reactions.—F Shdn.

Corydalis alkaloids. Alkaloids of the bulbocapnine group. J. Gadamer. Arch. Pharm., 1911, **249**, 498—502. (See this J., 1911, 646.)

The bulbocapnine group of the corydalis alkaloids can, with advantage, be separated into the corytuberine group and the glaucine group. The first comprises bulbocapnine, corydine, and corytuberine ; the second group includes dicentrine (*Dicentra pusilla*) and glaucine. All these substances are closely related to apolaudanosine, and are derivatives of phenanthrene. In the corytuberine group the hydroxyl groups or the corresponding methoxy-groups are in the 3.4-position, whilst in the glaucine group they are in the 2.3-position. The bases of the corytuberine group each contain a free phenolic group, whilst the alkaloids of the second series contain no such free groups. The bearing of this on the formation of the alkaloids in the plant is discussed.—F. Shdn.

Corydalis alkaloids. The corytuberine sub-group. J. Gadamer. Arch. Pharm., 1911, **249**, 503—510.

The alkaloids belonging to the corytuberine sub-group have the following constitution : bulbocapnine, $C_{17}H_{13}N(OCH_3)(O_2CH_2)(OH)$; corytuberine, $C_{17}H_{13}N(OCH_3)_2(OH)_2$; corydine, $C_{17}H_{13}N(OCH_3)_3(OH)$. Structural formulæ of these three alkaloids are given and the supporting evidence is fully discussed. (See this J., 1905, 634.)—F. Shdn.

Casimiroa edulis ; Constituents of the seeds of ——. F. B. Power and T. Callan. Chem. Soc. Proc., 1911, **27**, 257—258.

The material employed for this investigation consisted of the fresh seeds of *Casimiroa edulis*, La Llave and Lejarza (Nat. Ord. *Rutaceae*), which were obtained directly from Mexico. The kernels of the seed, representing about four-fifths of the weight of the entire material, gave abundant reactions for an alkaloid, and were found to contain an enzyme which slowly hydrolysed amygdalin.

An alcoholic extract of the kernels, when distilled in a current of steam, yielded a small amount of a pale yellow essential oil, which possessed an aromatic odour, and the following constants : sp. gr. at 20° C. = 0·9574 ; $a_D = -2° 25'$ in a 25 mm. tube. From the portion of the extract which was soluble in water there were isolated : (1) a new alkaloid, *casimiroine*, $C_{24}H_{20}O_8N_2$ (m. p. 196°—197° C.), which on heating with alkalis undergoes hydrolysis, with the elimination of carbon dioxide, yielding a new base, *casimiroitine*, $C_{23}H_{22}O_7N_2$ (m.p. 171° C.) ; (2) a new alkaloid, *casimiroedine*, $C_{17}H_{24}O_5N_2$ (m. p. 222°—223° C.) ; (3) benzoic acid, with apparently a trace of salicylic acid. The aqueous liquid contained, furthermore, a quantity of sugar, which yielded *d*-phenylglucosazone (m. p. 205°—207° C.). The portion of the extract which was insoluble in water consisted of a soft, oily resin, from which the following compounds were isolated : (1) sitosterol, $C_{27}H_{46}O$; (2) ipuranol, $C_{23}H_{38}O_2(OH)_2$; (3) a mixture of fatty acids ; (4) a new lactone, *casimirolid*, $C_{24}H_{28}O_8$ (m. p. 229°—230° C.), which yields a new hydroxy-acid, designated as *casimiroic acid*, $C_{23}H_{28}O_4(OH)\cdot CO_2H$ (m. p. 207° C.), of which the *silver* salt, *methyl* ester, and *acetyl* derivative were prepared ; (5) a yellow, phenolic *substance*, $C_{13}H_{12}O_6$ (m. p. 215°—218° C.).

The hypnotic or toxic properties attributed to *Casimiroa* seed could not be confirmed by physiological tests.

Essential oil of Santolina chamaecyparissus, L. [lavender cotton]. L. Francesconi and Scarafia. Gaz. chim. ital., 1911, **41**, II., 185—203.

Lavender cotton, a perennial plant used as a vermifuge, yields an essential oil on distillation with water. The yield and characters of the oil vary considerably according to the stage of growth of the plant. The best yield (1·15 per cent.) is obtained from plants collected in July, just before flowering. The crude oil contains small quantities of solid paraffin ; after filtering it has the sp. gr. 0·8654 at 25° C., and $[a]_D = -11·74°$. It has a yellow to orange colour, and a penetrating irritant odour ; after distillation with steam it is less coloured and has lost its unpleasant odour, but retains a camphoraceous odour. The oil contains neither phenols nor alcohols in the free condition, and only small quantities of esters (of a phenol and of an alicyclic alcohol) ; it contains a terpene, one or more oxyterpenes, and ketonic compounds.—A. S.

Production of attar of roses in Bulgaria. Board of Trade J., Nov. 9, 1911. [T.R.]

The yield of attar of roses from the Valley of the Roses, where some 7000 acres are under cultivation, amounted in 1910 to 5550 lb., valued at £148,000, an average of £26 15s. per lb. as against 11,000 lb., valued at £184,000, an average of £16 15s. per lb., in 1909. The 1911 crop has suffered from frost, and the price of the petals has risen from ¾d. to 2d. per lb. A rise may consequently be expected in the price of the essence. Owing to the deficiency in the last crops, and to the great demand, adulteration has reached such a pitch that the local authorities, who declare themselves unable to stem the smuggling into the district of the oil of geranium, sold in the market at 10s. per lb., propose to withdraw the prohibition against its introduction, so that the mixture may become a recognised article of trade.

Menthones ; Condensation of —— *with organo-magnesium compounds. Synthesis of homologues of menthol.* M. Murat. J. Pharm. Chim., 1911, **4**, 294—299.

By the condensation of natural *l*-menthone or synthetic, optically-inactive menthone (see Brunel, this J., 1905, 455) with phenylmagnesium bromide and cyclohexylmagnesium bromide respectively, the corresponding tertiary alcohols are produced, but these are very unstable. On dehydration by the usual methods, the alcohols yield the corresponding ethylenic hydrocarbons. The synthetic menthone was prepared from thymol. The latter was converted into thymomenthol by hydrogenation in presence of nickel (see Brunel, this J., 1905, 248) ; and the thymomenthol was converted into thymomenthone by means of finely-divided copper at about 300° C.—A. S.

Novaspirine (disalicylic ester of methylene-citric acid) ; Characters and tests for ——. K. Schuster. Pharm. Zeit., 1911, **56**, 642.

Novaspirine should melt at 150°—152° C. When either alone, or in solution with sodium carbonate, it is heated with a trace of resorcinol, formaldehyde is evolved, and in the latter case, the liquid becomes red. If one drop of solution of ferric chloride be added to the yellow solution obtained by dissolving a trace of novaspirine in one drop of potassium hydroxide solution and diluting with water, then on filtering the mixture the filtrate will be violet. If 0·5 grm. of novaspirine be hydrolysed by means of 12 to 15 c.c. of $N/1$ potassium hydroxide solution, and the resulting liquid acidified with hydrochloric acid, and shaken out with ether, to remove the salicylic acid, the aqueous portion, after warming to drive off the dissolved ether, and decolourising with animal charcoal, will give a crystalline precipitate of calcium citrate, when rendered alkaline with ammonia, filtered, and treated with alcohol and calcium chloride. The ether solution, on evaporation should leave a residue of salicylic acid. On shaking 1 grm. of novaspirine with water and filtering, the filtrate should give no reaction with silver nitrate, with barium chloride, nor with hydrogen sulphide. Novaspirine should leave no residue on incineration. An alcoholic solution of 0·1 grm. should give no violet colour with 1 drop of ferric chloride solution (absence of free salicylic acid). One grm. of novaspirine dissolved in alcohol should require for neutralisation not less than 45 c.c. of $N/10$ sodium hydroxide solution, the titration being rapidly performed, and the liquid kept cold by means of ice.—J. O. B.

Iodthion (di-iodohydroxypropane) ; Characters and tests for ——. K. Schuster. Pharm. Zeit., 1911, **56**, 642.

Iodthion should have a sp. gr. of 2·4 to 2·5. It should be soluble, to a clear solution, 2 : 1, in olive oil. If 3 c.c. of iodthion be shaken with 15 c.c. of water and filtered, the filtrate should be neutral. If 5 c.c. of this be acidified with dilute sulphuric acid, then treated with a little potassium nitrite solution and shaken with chloroform, the latter should show not more than a faint violet colour. A few drops when heated and incinerated should give off iodine and leave no residue. When 0·52 grm. is hydrolysed with a solution of 2 grms. of potassium hydroxide in 12 c.c. of water and 30 c.c. of alcohol, and the cold saponification liquid, acidified with dilute sulphuric acid, is treated with a little potassium nitrite solution and shaken with chloroform, the chloroform being separated, and the aqueous liquid repeatedly treated as before with potassium nitrite and chloroform, until the latter is no longer coloured violet, the united chloroform extract, after washing, should require not less than 15·75 c.c. of $N/10$ thiosulphate solution when titrated in the usual manner for the determination of iodine.—J. O. B.

Alcohol ; Specific gravity of absolute —— at 25° C. A. Kailan. Ber., 1911, **44**, 2881—2884.

According to careful determinations by the author, ethyl alcohol, dehydrated by means of metallic calcium, has a specific gravity of 0·78513 at 25° C./4° C. Winkler in 1905 obtained the value 0·78509 for alcohol similarly dehydrated, whilst Mendelejeff's value for alcohol dried by means of lime is 0·78522.—J. H. L.

Presence of manganese in Digitalis purpurea. Burmann. *See* XVI.

Determination of saponin and saccharin in oil emulsions. Carlinfanti and Marzocchi. *See* XXIII.

Patents.

Medicament and process of producing the same. A. D. Barr, Batesville, Ark. U.S. Pat. 1,005,137, Oct. 10, 1911.

By mixing a mononitrophenol with quinine in presence of water at 100° C., compounds are obtained which are almost insoluble in water or dilute acids, and which may be used as internal antiseptics. One claim covers a compound "containing substantially 73·114 — per cent. of quinine and substantially 26·886+ per cent. of mononitrophenol."—T. F. B.

1-p-Dimethylaminophenyl-2.3.4-trimethyl-5-pyrazolone ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 238,256, May 5, 1910.

1-*p*-Dimethylaminophenyl-2.3.4-trimethyl-5-pyrazolone, which is of use in medicine, is obtained by the methylation of 1-*p*-aminophenyl-3.4-dimethyl-5-pyrazolone, 1-*p*-aminophenyl-3·4-dimethyl-5-halogenpyrazole, 1-*p*-aminophenyl-3.4-dimethyl-5-alkyloxypyrazole, and 1-*p*-aminophenyl-2.3.4-trimethyl-5-pyrazolone or the alkyl or acid derivatives of the pyrazole compounds named. The product is less toxic than 1-*p*-dimethylamino-2.3-dimethyl-5-pyrazolone but is equally active in its therapeutic properties.—T. F. B.

1-Phenyl-2.3-dimethyl-4-isovalerylamino-5-pyrazolone and 1-phenyl-2.3-dimethyl-4.α-bromo-isovalerylamino-5-pyrazolone ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 238,373, May 5, 1910.

The above-named compounds are obtained by treating with methylating agents one of the following :—1-Phenyl-3-methyl-4-isovalerylamino-5-pyrazolone, 1-phenyl-3-methyl-4-isovalerylamino-5-isovaleryloxypyrazole, 1-phenyl-3-methyl-4-isovalerylamino-5-ethoxypyrazole, 1-phenyl-3-methyl-4-isovalerylamino-5-chloropyrazole, or the analogous α-bromo-isovalerylamino compounds. —T. F. B.

Infectious diseases ; Process for preparing agents for the prevention and cure of ——. Chem. Fabr. auf Actien vorm. E. Schering. Ger. Pat. 238,388, Dec. 25, 1910.

Suitable kinds of virus or bacteria, with the exception of tubercle bacilli, are shaken with soap solutions, without application of heat. The emulsions prepared in this way are injected into animals, from the blood of which the serum is extracted in the usual manner.—T. F. B.

Cinnamic esters ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,247, Dec 5, 1910.

See Ger. Pat. 235,357 of 1910 ; this J., 1911, 1088.—T.F.B.

Isoprene ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 1704, Jan. 23, 1911.

See Fr. Pat. 425,885 of 1911 ; this J., 1911, 968.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Determination of the melting point of a gelatin jelly. Gamble. *See* XV.

Patent.

Manufacture of films of celluloid, etc. Fr. Pat. 430,086. *See* V.

XXII.—EXPLOSIVES ; MATCHES.

Nitroglycerin ; Influence of the ratio of mixed acid to glycerin on yield and economy in the manufacture of ——. F. Hofwimmer. Chem.-Zeit., 1911, **35**, 1229—1230.

Schlegel's laboratory apparatus was used, 110 grms. of glycerin being taken in each case. The acid employed in all the experiments had the following composition :—Sulphuric acid, 52·5 per cent. ; nitric acid, 46·5 ; and water, 1 per cent. Eleven experiments were carried out. In the first experiment the amount of nitric acid present was that quantity theoretically required for complete conversion of the glycerin into nitroglycerin, whilst in the others an excess ranging from 5 to 50 per cent. in excess of theoretical requirements was used. In each instance the quantity of nitroglycerin was determined as obtained under the following conditions :—(1) Separation for 30 minutes. (2) "After-separation" for 3 days. (3) Extraction by chloroform. In addition, the amount of glycerol mononitrate remaining in the waste acids and not separable under any of the above conditions was also ascertained.

This figure was obtained by the determination of the nitrogen content of the waste acid by the nitrometer, and in the second place by the nitrogen content after evaporating the same sample of acid on the water bath. The difference between the nitrogen determinations, in the two instances, was considered to be nitric acid, the glycerin mononitrate remaining behind, under these conditions, with the sulphuric acid, and appearing in the final nitrometer determinations. The author found that no "after separation" of nitroglycerin took place until the experiment was reached in which nitric acid was present to the extent of 20 per cent. in excess of that required theoretically for nitration. The following table gives the results obtained :—

Percentage excess of nitric acid beyond theoretical requirements.	Percentage of nitrogen in nitroglycerin.			Yield.		
	First separation.	"After separation."	Extraction by chloroform.	Total.	After separation.	Loss in waste acids.
0	18·34	—	17·35	187·0	—	2·76
5	18·41	—	18·25	201·3	—	2·75
10	18·38	—	18·25	210·4	—	2·71
15	18·43	—	18·30	220·3	—	2·76
20	18·40	18·47	18·30	224·5	2·75	2·11
25	18·40	18·46	18·32	226·8	4·5	1·62
30	18·44	18·45	18·47	227·9	5·0	1·23
35	18·38	18·48	18·48	225·8	5·5	1·25
40	18·39	18·40	18·46	225·1	6·4	1·10
45	18·42	18·45	18·45	217·2	6·5	1·10
50	18·45	18·46	18·45	209·8	7·6	0·90

The higher the percentage of nitric acid in waste acid the greater is the loss by its solution in nitroglycerin. From the current prices of materials and the cost of denitrating and "after-separating," the author considers that the most economical conditions were obtained when there was an excess of from 15 to 20 per cent. of nitric acid in the mixed acids. The maximum yield, however, was obtained when there was 30 per cent. of nitric acid present in excess. The yield is influenced by two opposing conditions :—(1) The incomplete reaction according to the law of mass action ; (2) The solubility of the nitroglycerin in the waste acid.—G. W. McD.

Explosives ; Method of detonating ——. Taffanel and Dautriche. Comptes rend., 1911, **153**, 823—825.

IN considering the question of detonating a line of cartridges in a borehole, the authors divide the methods employed into three groups. Direct detonation consists in having the final cartridge, near the mouth of the borehole, carrying the detonator at its upper end. In inverse detonation, the final cartridge has the detonator at its lower end, next to the second in the line of cartridges, the wires being bent back and carried along the cartridge. In mixed detonation, the detonator is placed in the middle of the line of cartridges, of which one part is directly, and the other part inversely detonated. Experiments were made with explosives having ammonium nitrate as their base, and primed in the three different methods described above. Two cartridges were placed in line in the open, on a lead strip. The distances were then determined at which, under these conditions, the detonation was transmitted and the second cartridge exploded, or failed to explode, when the primed cartridge was detonated. The following table gives the results obtained :—

	Direct detonation. Second cartridge :		Inverse detonation. Second cartridge :	
	Exploded at cm.	Did not explode at cm.	Exploded at cm.	Did not explode at cm.
Grisoutine (30 per cent. nitroglycerin)	30	40	10	20
Grisoulite-roche (8·5 per cent. of dinitronaphthalene)	5	8	—	1
Grisoulite-couche (5 per cent. of potassium nitrate, and 5 per cent. of trinitronaphthalene)	5	8	1	2
Carbite d'Ablon, containing 26 per cent. of nitroglycerin, 33 per cent. potassium nitrate, and 41 per cent. of flour or woodmeal	12	16	1	2

When the detonator was placed in the middle of the cartridge, these differences (due to the method of detonation) disappeared. Experiments were also made to determine the velocity of the shock from each end of a primed cartridge, and showed that the intensity was very considerably greater at the end of the cartridge opposite to the detonator, and the authors point to this fact as the explanation of the differences obtained in the experiments quoted.—G. W. McD.

Initial detonation. L. Wöhler. Z. angew. Chem., 1911, **44**, 2089—2098. (See also this J., 1911, 925.)

THE methods of determining the velocity of and sensitiveness to, detonation are described. The author deals with the properties of the fulminates and hydrazoates as detonating agents. 0·25 grm. of mercury fulminate or 0·15 grm. of silver fulminate will not with certainty detonate trinitrotoluene, while 0·02 grm. of silver hydrazoate is ample for this purpose. The advantages of lead hydrazoate are described. It is less sensitive to shock and heat than fulminate, and less is required for detonating purposes. The sodium salt is easily prepared, but is hardly to be considered as an explosive. From this the lead salt is prepared by simple double decomposition. —G. W. McD.

Fulminate compositions ; Analysis of ——. Utescher. Z. ges. Schiess- und Sprengstoffwes., 1911, **6**, 402—403.

SHOULD nitro-compounds be present, they are removed by a suitable solvent. If gunpowder is present the sulphur is extracted with carbon bisulphide, and after dissolving the rest of the composition in dilute sulphuric acid, and precipitating the antimony and mercury as sulphides, the potassium chlorate in the filtrate is, by the addition of ferrous sulphate, reduced to chloride and determined as silver chloride. The potassium nitrate is taken by difference. When dealing with the ordinary detonator composition, 1 grm. is dissolved by heating with 100 c.c. of water containing 1 per cent. of sulphuric acid. Hydrogen sulphide is passed through the hot solution to precipitate the mercury and antimony as sulphides. The potassium chlorate is determined as potassium sulphate on evaporating the filtrate to dryness in a platinum dish. The glass is separated from the precipitate on the filter by dissolving the mixed sulphides in 5 c.c. of hydrochloric acid (sp. gr. 1·19) and 2 c.c. of 50 per cent. tartaric acid. The mercury in the acid filtrate is determined electrolytically in a Frary apparatus on passing a current of 3 volts and 1·5 ampères for 2 hours, using a roughened platinum anode and a carbon cathode. To determine the antimony the liquid, after being freed from mercury, is rendered alkaline and a current of 3 volts and 1 ampère is passed for 2 hours at a temperature of 80°—90° C. The separation may also be carried out gravimetrically by treating the mixed sulphides with hot ammonium sulphide to dissolve the antimony sulphide.—G. W. McD.

Explosion of detonator composition ; Circumstances attending an —— *which occurred on the 8th June, 1911, at the Works of the Cotton Powder Co., Ltd., at Uplees Marshes, near Faversham, in the County of Kent.* Major Cooper-Key, H.M. Chief Inspector of Explosives. [Cd. 5931.]

THE explosion took place in a building licensed for drying fulminate composition which, in this instance consisted of mercury fulminate (86 parts), potassium chlorate (9·5) and guncotton dust (4·5 parts). There were 21 lb. of explosive in kegs and 78 lb. spread out on rubber cloths on the benches. No artificial heat was provided, the explosive being merely spread out in a thin layer on rubber cloths until air-dried. The only workman present in the building at the time was killed. Major Cooper-Key considers that the workman was, at the moment of the explosion, spreading out the composition as thinly as possible on the rubber cloth, using his fingers as a comb. Guncotton is a dielectric and it was resting on a rubber cloth, which is also a dielectric and insulator. The workman was wearing rubber shoes, the weather was extremely hot, and the composition probably drier than usual. All these conditions were extremely favourable to the generation of a statical charge of electricity, which might in due course result in a spark, and it is to this cause that the explosion is attributed. Direct experiments made by Messrs. Dupré show that the composition in use at the time was not more sensitive to friction than that more ordinarily used, *i.e.*, mercury fulminate (80 parts), and potassium chlorate (20 parts). They further showed that the mere rubbing of rubber sheet with the fingers was sufficient to produce audible sparks, and this was practically a reproduction of the conditions obtaining at the time of the accident. Guncotton fluff was found to be easily ignited by a spark from an induction coil, and a mixture of guncotton and fulminate was much more easily fired. No appreciable difference was found between air-dried guncotton and samples specially dried in a water oven. It is suggested that the workmen in such buildings should be "earthed" by means of copper rivets in the rubber over-shoes, that some other material should be substituted for the rubber sheet used on the benches; that the habit of spreading the composition with the fingers should be prohibited unless it is quite wet throughout; and that the exclusion of guncotton dust as one of the ingredients of the composition would probably tend to minimise the risk of explosion.—G. W. McD.

Explosion; Circumstances attending an —— which occurred on July 26th, 1911, at the factory belonging to Messrs. Curtis's & Harvey, Ltd., situated at Cliffe, in the County of Kent. Major A. Cooper-Key, H.M. Chief Inspector of Explosives. [Cd. 5928.]

The washing house and filtering house containing some 2000 lb. of nitroglycerin exploded, and also a bogie containing about 800 lb. of cordite paste, standing some yards outside the mound. On the site of the washing house was a crater 50 ft. in diameter, and 9 ft. deep, and where the paste bogie stood, a crater 40 ft. in diameter, and 7 ft. deep. Three persons lost their lives by the explosion. The damage done to the other buildings in the factory was exceedingly severe and widespread owing to the exposed and unprotected position of the exploded bogie, and to the flatness of the ground on which the factory is built. The buildings near the scene of the explosion suffered severely, and mounded cartridge huts at a distance of 350 yards, had their roof beams split and their walls shifted. It is, in Major Cooper-Key's opinion, almost inconceivable that in view of the state of affairs in the washing house and filtering house, that the explosion could have originated there. There was no evidence to show whether this building or the bogie exploded first. One man was on the upper platform running nitroglycerin from the washing tank to the filtering tank by means of a rubber tube. The balance of the evidence was in favour of the view that the other workman was running nitroglycerin from the filter tank into the rubber bags containing guncotton intended for Mark 1 cordite. Major Cooper-Key considers that provided work was going on as usual (and there was considerable evidence that this was the case), that it was almost impossible to assume that the washing house exploded first, and that it is far more probable that the bogie, which had just left the porch of the building, was the originating cause. There was clear evidence that it was moving at the time, and after considering all the probabilities, the surmise is arrived at that, owing to a torn rubber bag, some of the Cordite Mark 1 paste fell upon the tram lines and was exploded by the bogie runner treading on it. The following recommendations are made, some for immediate, and others for gradual adoption:—(1) All "Runners" should be provided with hobnails and repairing plates of copper or aluminium, and no iron or steel nails should be allowed in their boot-soles. (2) If a bogie runs off the rails the occurrence should at once be reported to a foreman, and the bogie should not be replaced except under his supervision. (3) Points should be so arranged, by means of a counter-weight or spring, as always to be in gear with one line or the other. (4) All bogies should be carefully examined for spilt explosive at least once a week. (5) Experiments should be put in hand with a view to determine whether it would not be possible to substitute some other material in the place of iron or steel for bogie wheels, or at any rate, for the tyres of these wheels. Compressed paper or fibre would seem to be suitable if not too costly. (6) If it is found impracticable to use any such material for a flanged wheel running on rails, it is a question whether rails should not be done away with and rubber-tyred hand trucks running on asphalt or concrete paths substituted. Major Cooper-Key draws attention, however, to the danger of replacing one evil by another, and points out that considerable care and experiment would be necessary before introducing a radical alteration of this kind. Messrs. Curtis's & Harvey have, in consequence of this accident, introduced several alterations with a view to reduce the risk of accident during the conveyance of explosive, more especially of explosive such as cordite paste or thin jelly, by bogie. The floor of the bogie is now covered with linoleum carried up to a raised bead or edging all the way round. Under this floor or platform is a feathered edge to prevent any possibility of liquid nitroglycerin falling on the rails, and stringent regulations have been made to ensure a regular system of examination and washing. The bogies are 9 feet long over all, with a wheel-base of only 1 ft. 11 in., and this is of course open to objection owing to the liability to tip, but this defect is probably less likely to cause accident than would a long wheel-base in conjunction with the steep curves unavoidable in a factory of this kind with numerous buildings situated at distances of about 50 yards or so from one another. The Company have also devised a method of construction for the platforms outside the specially dangerous buildings which should undoubtedly make for safety. Outside the door of each such building the concrete is slightly dished and rendered with neat cement in such a way as to retain any liquid spilt on it, and so as permanently to remain covered with water to a depth of about an inch. On each side, beyond the edging or bead for retaining the water, a gully is formed to catch overflow and convey it to a labyrinth of the usual kind employed for trapping nitroglycerin.—G. W. McD.

Prohibition of importation of chemicals for the production of explosives in Turkey. Board of Trade J., Nov. 2, 1911.

A notification has been issued by the Turkish Customs, from which it appears that the prohibition of the importation into Turkey of chemicals for making explosives (see this J., 1911, 1232), is to be enforced from the 1st January next. The prohibition will apply to the following articles: Potassium chlorate, sodium chlorate, potassium nitrate, sodium nitrate, picrates, nitroglycerin, guncotton; but these articles, if destined for industrial or agricultural uses, will be delivered to the consignees, with the authorisation of the "*Grand Maitrise d'Artillerie*," in quantities which will be fixed, prior to importation, for each importer, by the Ministers of Public Works and Agriculture, respectively. The importation of pastilles of chlorate of potash and other similar preparations, in the form of specialities which cannot be employed in the manufacture of explosives, will continue to be permitted.

Patent.

Propulsive explosives; Manufacture and handling of ——. Birmingham Metal and Munitions Co., Ltd., and J. H. Barker, Birmingham. Eng. Pat. 2834, Feb. 3, 1911.

During the manufacture and handling of propulsive explosives, the strands are liable to break and the usual practice is to joint the broken strands by overlapping the ends and softening them with solvent. This produces a lapped joint of larger diameter than the main cord and introduces difficulties in loading. The present invention consists in jointing strands of explosive in cord, tubular or other form, in such a way that the section of the explosive or its ballistic power per unit length is not substantially changed. The ends of the strands to be united are preferably scarfed, *i.e.*, cut so that the ends do not lie at a right angle to the axis of the tube. A supporting piece of material of sufficient rigidity, such as horse-hair, catgut or the like, is inserted into the lumen of one of the tubes. It is preferable to use as a supporting means a piece of the same explosive of sufficiently small dimensions. Over the protruding part of the supporting piece of material is slipped the end of the other strand before adhesion is brought about by softening with the solvent.—G. W. McD.

XXIII.—ANALYTICAL PROCESSES.

Extraction; Apparatus for —— at high temperatures. B. Zhuravleff. J. Russ. Phys.-Chem. Soc., 1911, **43**, 1189—1190.

On an annular expansion on the outside and near the top of a Soxhlet extractor rests a narrow glass bell, mouth downwards. Steam is supplied to a perforated annular tube placed beneath the mouth of the bell, into which the steam rises and thus heats the extracting liquid. If the latter requires a higher temperature than is thus attained, the steam may be superheated, whilst if a lower temperature is desired, a portion of the steam is diverted by means of a three-way cock in the steam-delivery tube. In order that the condensed steam may not find its way into the flask containing the extracting liquid, round the lower tube of the extractor is fitted a slightly conical, rubber disc, which carries the water off to one side.—T. H. P.

Bismuth: Use of haematein in qualitative analysis and in the volumetric determination of ——. E. Vassallo. Gaz. chim. ital., 1911, **41**, II., 204—212.

The author uses a test-paper prepared with an alcoholic extract of logwood. 50 grms. of logwood are treated with 100 grms. of alcohol for 3 hours, and the solution is filtered. Strips of filter-paper are soaked in the solution and then dried in an atmosphere quite free from ammonia. Salts of a large number of metals give colour reactions with the test-paper in neutral solutions, but in acid solutions colours are produced only by bismuth, arsenic, antimony, and tin, and molybdic acid; the colours produced by arsenic, antimony, and tin are not stable in presence of much acid. and no colour reactions are given by arsenic and antimony when present as arsenates and antimonates respectively. The best method of carrying out the test is to drop the solution under examination on to the test-paper. and then immerse the latter in a glass dish filled with acidulated water. Bismuth, arsenic. antimony, and tin give a violet, and molybdic acid, a blue colour. For the detection of bismuth, tin, and molybdenum in an alloy or mineral. the substance is treated with nitric acid and a few crystals of sodium sulphate (to prevent any formation of bismuth arsenate) and evaporated until nitrous fumes are no longer evolved, but not to dryness. The mixture is diluted with water and the oxides of antimony and tin are filtered off. The filtrate is divided into two parts. One part is treated with sodium chloride (to prevent precipitation of bismuth phosphate) and then with a few drops of ammonia solution and excess of sodium phosphate and heated for a short time at 40° C. Any ammonium phosphomolybdate precipitated is filtered off, and the solution is tested for bismuth with the hæmatein paper. In the other portion of the solution, molybdic acid may be detected by means of hæmatein paper after precipitating the bismuth by alkali. The mixture of oxides of antimony and tin is washed with water acidified with nitric acid, then the antimony oxide is dissolved by means of boiling tartaric acid solution, and the residual tin oxide is dissolved in alkali, and the solution tested with hæmatein paper. The use of hæmatein paper is also recommended in the volumetric determination of bismuth, titration being effected with sodium phosphate (Ehrenfeld, Z. anal. Chem., **46**, 710), and the end point ascertained by testing for bismuth with hæmatein paper.—A. S.

Zinc, manganese, cobalt, nickel, copper and cadmium; Precipitation of —— from ammoniacal solution by sodium carbonate and trimethylphenylammonium carbonate. E. Schirm. Chem.-Zeit., 1911, **35**, 1177, and 1193—1194.

The metals mentioned in the title are precipitated more or less completely as hydroxides when their ammoniacal solutions are boiled till the excess of ammonia is removed. The incompleteness of the reaction is due to the interaction of the metallic hydroxide with the ammonium salt left in solution; complete precipitation ensues when the ammonium salt is decomposed by boiling with sodium carbonate. The method is especially useful in the determination of sulphates in presence of salts of the metals mentioned, especially zinc, on account of the tendency of the barium sulphate precipitate to contain traces of the metals when the precipitation is carried out directly on the original solution. In carrying out the method dilute sodium carbonate is added to the solution until complete precipitation ensues, (in the case of zinc, this precipitate consists of basic carbonate with basic sulphate); ammonium carbonate is then added till the precipitate is completely dissolved, the solution is boiled until ammonia is completely removed, and the precipitate is then filtered off and washed: all the sulphate is found in the filtrate but the precipitate retains an appreciable amount of sodium carbonate and re-precipitation by one of the known methods is necessary. In order to avoid this re-precipitation, the author replaces the sodium carbonate by trimethylphenylammonium carbonate, the traces of this salt carried down with the precipitate being removed in the subsequent ignition to oxide. The salt is best prepared by the action of rather less than the theoretical quantity of freshly precipitated silver carbonate on trimethylphenylammonium iodide. It contains a small quantity of the iodide and owing to the slight decomposition of the latter a green colour is imparted to the solution, which serves as an indicator, ammonium carbonate solution being added until the colour changes to pink. The precipitate is entirely free from sulphates only when sufficient ammonium carbonate solution is added during the boiling to prevent precipitation for the first minute; the complete removal of ammonium carbonate requires 1 to 1½ hours. In precipitating the barium sulphate, barium chloride should be added drop by drop, otherwise the precipitate is liable to contain barium chloride.
—B. G. McL.

Carbon monoxide detector. R. Nowicki. Oesterr. Zeits. Berg- und Hüttenw., 1911, **59**, 587—588.

The apparatus comprises a glass vessel through which the air to be treated is forced by a rubber bulb, a strip of paper moistened with palladium chloride solution being suspended in the vessel. When the vessel has been filled with the air under test, the cocks are closed and the time is observed at which the test paper begins to darken and is completely blackened. The apparatus very quickly (in 1 min. or less) indicates the presence of quantities of carbon monoxide exceeding 0·1 per cent., and will detect (after about 11 minutes) the presence of as little as 0·01 per cent.—A. T. L.

Saponin and saccharin in oil emulsions; Determination of ——. E. Carlinfanti and P. Marzocchi. Boll. Chim. Farm., 1911, **50**, 609—615. Chem. Zentr., 1911, **2**, 1488—1489.

One hundred grms. of the emulsion are diluted with an equal volume of water, and 400 c.c. of 95—96 per cent. alcohol added gradually with agitation, the mixture being then shaken frequently during 2 hours and allowed to stand for 24 hours. The supernatant clear liquid is filtered through linen and the residual oil is extracted with 60—65 per cent. alcohol and the extract also filtered. The aqueous alcoholic solution is neutralised with sodium carbonate and concentrated to 100 c.c. on the water-bath. Aromatic substances are then removed by extraction with ether, and the ether extract after shaking with water acidified with phosphoric acid, is evaporated, and the saccharin converted into alkali salicylate. The residue left after extraction with ether is treated with 20 grms. of ammonium sulphate, and the saponin removed by several successive extractions with 9 c.c. of phenol. The phenol solution is shaken with a mixture of 100 c.c. of ether, 30 c.c. of water, and 5 c.c. of alcohol, and after 24 hours the aqueous solution is separated, evaporated on the water-bath, and the residual saponin extracted with acetone, dried, and weighed.—A. S.

Determination of sulphur in lighting gas. Niermeyer. *See* IIa.

Determination of methane in producer gas and enriched water gas. Worrell. *See* IIa.

Preparing diazo-amino-compounds, and a reaction for nitrous acid. Vaubel. *See* III.

[*Silicates.*] *Decomposition with lime.* Seger and Cramer. *See* VII.

Rejection of the Le Chatelier test [*for cement*]. Strebel. *See* IX.

Determination of phosphorus in pig-iron and cast iron, without separating silicon. Müller. *See* X.

Colorimetric method for vanadium in iron and steel. M'Cabe. *See* X.

Determination of nickel in ferrovanadium. Schilling. *See* X.

Assay of gold-bearing cyanide solutions by electrolysis. Crichton. *See* X.

Determination of nickel [*in German silver*]. Ibbotson. *See* X.

Determination of tin in an ore. Morgan. *See* X.

Fluorescence test of purity of oils. Walker and Boughton. *See* XII.

Use of chrome leather in the valuation of tanning extracts. Grasser. *See* XV.

Determination of the melting point of a gelatin jelly. Gamble. *See* XV.

Determination of the optically-active substances, decomposable by lime, that are present in the beet. Herles. *See* XVII.

Determination of the enzymic power of malt. Moufang and Scheer. *See* XVIII.

Determination of sucrose and detection of dextrin in certain foods. Vollant. *See* XIXa.

Characters and tests for novaspirine (*disalicylic ester of methylenecitric acid*). Schuster. *See* XX.

Characters and tests for iodthion (*di-iodohydroxypropane*). Schuster. *See* XX.

Analysis of fulminate compositions. Utescher. *See* XXII.

Patents.

Poisonous or inflammable gases; Apparatus for indicating the presence of — in the air. A. Guasco and G. Mégret. Fr. Pat. 429,862, April 28, 1911.

The apparatus comprises two thermometers arranged side by side, the bulbs being separated by a partition. One bulb is embedded in a quantity of a "catalytic metal or alloy" such as platinum black, the other being uncovered; and the presence of deleterious gases is indicated by a difference in the readings of the two instruments. The embodiment of this principle in apparatus for automatically signalling the presence of dangerous quantities of deleterious gases in air is also claimed.—W. E. F. P.

Furnace gases; Registering automatic apparatus for analysing ——. A. L. E. Baillet, Lille, France. Eng. Pat. 24,036, Oct. 17, 1910. Under Int. Conv., Oct. 15, 1909.

See Fr. Pat. 408,038 of 1909; this J., 1910, 652.—T. F. B.

Gases, steam, or other vapours; Apparatus for testing ——, *and recording the solid and liquid admixtures therein.* E. K. H. Borchers, Friedenau, Germany. Eng. Pat. 659, Jan. 10, 1911. Under Int. Conv., Jan. 13, 1910.

See Ger. Pat. 225,625 of 1910; this J., 1910, 1477.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Membranes; Permeability of porcelain and copper ferrocyanide ——. F. E. Bartell. J. of Phys. Chem., 1911, **15**, 659—674.

Methods are described of determining the permeability for water of membranes of porcelain and copper ferrocyanide. During the passage of water there is a decrease in the permeability of porcelain due to mechanical clogging of the pores, but by employing a system of averaging results, constant permeability values were obtained. The amount of water passing was directly proportional to the pressure, which was caused to vary from 53 mm. to 5885 mm. of mercury; in other words Poiseuille's laws for the passage of liquids through capillary tubes applies to porcelain membranes. The influence of temperature over the range from 22·8° to 70° C. on the permeability was also found to follow Poiseuille's laws; in fact measurement of the change of permeability at different temperatures is a measure of the change of the viscosity of the liquid. Similar results were obtained with copper ferrocyanide membranes where the interstices are much smaller, probably within the region of molecular dimensions. The final conclusion is that reached by Bigelow (this J., 1908, 93), that the same laws express the passage of liquids through molecular interstices as through capillary tubes.—E. F. A.

Books Received.

Year Book of the Indian Guild of Science and Technology, 1911. M. A. Ramni Paniker, The University, Leeds.

This yearbook contains an account of the Guild and its rules, and an official report of the second Annual Proceedings, as well as a selection of papers, of which the following are of chemical interest :—"Sewage Disposal in India," by G. J. Fowler; "Oleaginous Seeds in India," by J. Lewkowitsch; "Tanning Materials," by H. R. Procter; "Mineral Colours in the Dyeing of Textile Fibres," by J. P. Sewastava; "Soap Making," by W. R. Ormandy and J. W. Spensley; "Colour Photography," by Adenath Sen; "Some Indian Oils and Fats," by A. Kesava Menon (see this J., 1910, 1428); and "Cold Storage of Food: Ice Production," by H. Menzies.

Theorie und Praxis der Massanalyse. Von Alexander Classen. Unter Mitwirkung von H. Cloeren. Akademische Verlagsgesellschaft m. b. H. Leipzig. 1912. Price M. 30; bound M. 32.

8vo volume, containing 749 pages of subject matter with 46 illustrations, and an alphabetical index of names and subjects. The last 22 pages of the work are filled entirely with tables. the preceding portion of the subject matter being classified as follows :—I. Introduction. II. The Indicators. III. Measuring vessels. IV. The volumetric system. V. Saturation analyses. VI. Acidimetric determinations. VII. Oxidation and reduction analyses. VIII. Iodometric analyses. IX. Precipitation analyses. X. Determination of potassium cyanide in presence of potassium ferrocyanide; of antimony with potassium bromate; of antimony in hard lead. Direct determination of iron in presence of titanium.

Chemisch-technische Untersuchungsmethoden. Unter Mitwirkung von E. Adam, P. Aulich, F. Barnstein, O. Böttcher.† A. Bujard, C. Councler.† K. Dieterich, K. Dümmler, A. Ebertz, C. v. Eckenbrecher, A. Eibner, F. Fischer, F. Frank, H. Freudenberg, E. Gildemeister, R. Gnehm, O. Guttmann.† E. Haselhoff, W. Herzberg, D. Holde, W. Klapproth, H. Köhler, Ph. Kreiling, K. B. Lehmann, J. Lewkowitsch, C. J. Lintner, E. O. v. Lippmann, E. Marckwald, J. Messner, J. Pässler, O. Pfeiffer, O. Pufahl, O. Schluttig, K. Scheeh, G. Schüle, L. Tietjens, K. Windisch, L. W. Winkler. Herausgegeben von Dr. Georg Lunge und Dr. Ernst Berl. Vierter Band. Sechste, vollständig umgearb. und verm. Auflage. Julius Springer's Verlag. Berlin, 1911. Price M. 24; bound, M. 26.50.

8vo volume, containing 1036 pages of subject matter, with 56 illustrations and four tables, also indexes of subjects and names. In an appendix following, there are thirty-five tables. The subject matter is sub-divided and classified as follows :—Raw Materials, methods of production, and intermediate products in the sugar manufacture (E. von Lippmann). I. Sugar beet. II. Beet juices, dilute juices, and products of the beet-juice operations. III. Syrups, thick juices. IV. Massecuites. V. Sugar. VI. Molasses, mother syrups, etc. VII. Products from molasses. VIII. Materials used. IX. Products of the cane sugar industry. Starch, Dextrin (C. v. Eckenbrecher). Alcohol and Spirits (A. Ebertz). I. Water examination. II. Raw materials and their examination. III. Malt preparation. IV. Mashes and their examination. V. and VI. Yeasts. VII. Examination of Vinasses and weak spirits. VIII. Alcoholometry. IX. Examination of crude spirits and rectified spirits as to purity. X. Denaturing agents. XI. Testing fusel oils. XII. Examination of sugars. Brandies and Liqueurs (G. Schüle). Vinegar (Schüle). Wine Examination (K. Windisch). Beer (C. J. Lintner). Vegetable tannins and their Examination (C. Councler). (a) Non-gravimetric methods of tannin determination. (b) Newest process according to the Conference of the International Assoc. of Chemists of the Leather Industry. Leather (J. Paessler). Paper (W. Herzberg). Inks (O. Schluttig). Tartaric acid industry (W. Klapproth). Citric acid industry (Klapproth). Inorganic colours (A. Eibner). Organic dyestuffs (R. Gnehm). Natural organic dyestuffs. Testing Textile fibres (R. Gnehm). I. Reagents and processes. II. Chemical methods. III. Microscopic examination of textile fibres. IV. Cotton-silk (mercerised cotton) and artificial silk. Examination of Dressing and Finishing Agents R. Gnehm).

Tables of Physical and Chemical Constants and some Mathematical Functions. By G. W. C. Kaye, D.Sc., and T. H. Laby. Longmans, Green and Co., 39, Paternoster Row, London, also New York, Bombay and Calcutta. 1911. Price 4s. 6d.

8vo volume, containing 147 pages of subject matter, and an alphabetical index. The subject matter consists of a collection of tables relating to :—I. General Physics, Astronomy, etc. II. Heat. III. Sound. IV. Light. V. Electricity. VI. Magnetism. VII. Radioactivity and Gaseous ionisation. VIII. Chemistry. IX. Mathematical tables.

The Journal of the Municipal School of Technology, Manchester. Volume 4. 1911. Published by the Education Committee.

A record of investigations undertaken by members of the teaching staff and students of the school. The following papers are of special chemical interest :—"Condition of indigo white in aqueous solutions," E. Knecht (this J., 1910, 208, 872). "Gravimetric methods for determining nickel in nickel steel," E. L. Rhead (this J, 1910, 430). "Testing of rubber for electrical work," A. Schwartz (this J., 1910, 223). "Apparatus for the study of gas-caps on the flame of an ordinary safety-lamp," G. H. Winstanley. "Properties of certain collagenous bodies and their behaviour towards light when associated with alkali bichromates," C. W. Gamble (this J., 1910, 65). "Determination of the melting-point of a gelatin jelly," C. W. Gamble (see page 1324). "Recent experiences with the sulphide toning of bromide of silver prints," W. F. A. Ermen and C. W. Gamble (this J., 1911, 657). "Crystallised caustic soda," F. S. Sinnatt. "Valuation of commercial hydrosulphites," F. S. Sinnatt (this J., 1910, 421). "Use of methylene blue as an indicator in iodometric titrations," F. S. Sinnatt (this J., 1910, 979). "Electrical theory of dyeing," W. W. Haldane Gee and W. Harrison. "Researches on bleaching powder," R. L. Taylor (this J., 1910, 1302). "Iron buff, Prussian blue, and manganese bronze," E. Knecht (this J., 1910, 1451). "Effect of twist upon the strength of single cotton yarns," J. Winterbottom. "Some physical properties of rubber," A. Schwartz and P. Kemp. Afterwards follow "Notices and Abstracts."

A Text Book of Inorganic Chemistry. By G. Senter, Ph.D., Lecturer on Chemistry at St. Mary's Hospital, etc. Methuen and Co., Ltd., 36, Essex Street, London, W.C. 1911. Price 6s. 6d.

8vo volume, containing 567 pages of subject matter, illustrated with 90 engravings. An index of subjects concludes the work. The text is clasisfied thus :—I. Illustrations of chemical change. II. Chemical attraction. III. The chemical elements, etc. IV. General properties of liquids. V. Chemical combination and the atomic theory. VI. Determination of atomic weights, etc. VII. Ozone and hydrogen peroxide. Thermochemistry. VIII. Chemical equilibrium. Thermal dissociation. IX. Osmotic pressure and molecular weight in solution. X. Nitrogen, the atmosphere, and the elements of the Helium group. XI. Oxides and Oxyacids of nitrogen. XII. Electrolysis and electrolytic dissociation. XIII. Combustion and flame. XIV. General properties of the metals and their compounds. XV. Metals of the alkalis; copper group; alkaline earths; zinc group; aluminium group; tin group; arsenic group; chromium group; manganese group; iron group; platinum group. XVI. Radioactivity.

The Lea Conservancy Board. Petrol and other Dangerous Goods. Bye-Laws. New bye-laws for regulating the conveyance, loading, and unloading of petrol, and other dangerous goods upon the River Lea. These came into operation on November 8th, 1911, No. 56 of the River Lea General Bye-Laws having been repealed. Waterlow and Sons, Limited, London Wall, London. 1911.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

Patent Specifications may be purchased at the Sale Branch of the Patent Office, Quality Court, Chancery Lane, London, W.C., fifteen days after the date on which acceptance of the complete specification is advertised. The price is 8d. each.

I.—GENERAL PLANT; MACHINERY.

Applications.

24,010. Martin. *See under* II.

24,257. Knight. Filtering diaphragm or film. Nov. 1.

24,400. Bedford and Bedford. *See under* XIX.

24,488. Lennox, Fairweather, and Brewtnall. Apparatus for cleaning and washing smoke. Nov. 3.

24,544. Amme, Giesecke, und Konegen A.-G. Straining or sieving apparatus for separating solid constituents from liquids. [Ger. Appl., Nov. 4, 1910.]* Nov. 4.

24,773. Cloud. Vacuum producing apparatus. Nov. 7.

24,783. Sperry. Centrifugal separators.* Nov. 7.

24,803. Gee, and Hydraulic Separating and Grading Co., Ltd. Separation by the action of centrifugal force. Nov. 7.

24,819. Franke. Pressing materials containing liquid. Nov. 7.

24,852. Kinmond. Heating drying cylinders. Nov. 8.

24,936. Coplans. *See under* XIX.

25,010. Kettle. *See under* II.

25,075. Marr. *See under* II.

Complete Specifications Accepted.

24,905 (1910). Richter und Richter. *See under* XIX.

25,682 (1910). Averine. Filters. Nov. 8.

30,083 (1910). Sinclair. *See under* VII.

1832 (1911). Liese. Utilisation of the heat of waste industrial water and other liquid. Nov. 15.

11,898 (1911). Brück. Magnetic separation of materials. Nov. 15.

15,371 (1911). Trottier. Apparatus for classifying solid materials. Nov. 15.

II.—FUEL; GAS; MINERAL OILS AND WAXES; DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

24,010. Martin. Reservoirs for petrol, alcohol, and other inflammable or explosive products. Oct. 30.

24,015. Flechtner. Purification of combustion gases.* Oct. 30.

24,024. Milbourne and others. *See under* VII.

24,169. Nickles. Gas generators. [U.S. Appl., Feb. 6, 1911.]* Oct. 31.

24,201. Steinhart and Twite. *See under* VII.

24,461. Ragot and Pierre-Hervotte. Gas producers.* Nov. 3.

24,654. Drägerwerk H. und B. Dräger. Apparatus for testing gas. [Ger. Appl., Nov. 5, 1910.]* Nov. 6.

24,748. Rigby and Testrup. Removal of water from peat. Nov. 7.

24,806. Still. Coke ovens.* Nov. 7.

24,864. De Fazi. Production of motor spirit. Nov. 8.

24,905. Lake (Schroeter). Manufacture of liquefiable hydrocarbon gases. Nov. 8.

25,010. Kettle. Vaporisation, dissociation, and decomposition of oil and other volatile substances. Nov. 10.

25,075. Marr. Purification of gases. Nov. 10.

25,177. De Fazi. Production of motor spirit. Nov. 11.

25,178. De Fazi. Removal of sulphur from mineral oils. Nov. 11.

Complete Specifications Accepted.

18,176 and 24,035 (1910). Wilton. Treatment of gases obtained by distilling or carbonising coal, etc. Nov. 8.

26,164 (1910). Suski. Production of binding material for the manufacture of fuel briquettes. Nov. 18.

26,512 (1910). Shedlock. Manufacture of artificial fuel. Nov. 15.

27,545 (1910). Knowles. *See under* XXIII.

29,196 (1910). Brassert and Witting. Method and apparatus for cleaning gas. Nov. 8.

17,723 (1911). British Thomson-Houston Co. (General Electric Co.). Arc lamp electrodes. Nov. 8.

22,357 (1911). Püning. *See under* VII.

III.—TAR AND TAR PRODUCTS.

Application.

25,166. Hoffmann-La Roche und Co. Separation of meta- and para-cresol. [Ger. Appl., March 2, 1911.]* Nov. 11.

Complete Specification Accepted.

26,336 (1910). Newton (Bayer und Co.). Manufacture of anthracene compounds. Nov. 8.

IV.—COLOURING MATTERS AND DYES.

Applications.

24,642. Newton (Bayer und Co.). Manufacture of alizarine. [Addition to No. 2354 of 1911.] Nov. 6.

25,162. Meister, Lucius, und Brüning. Manufacture of substantive dyestuffs fast to acids. [Ger. Appl., Nov. 22, 1910.]* Nov. 11.

Complete Specifications Accepted.

18,310 (1910). Newton (Bayer und Co.). Manufacture of a substantive azo dyestuff. Nov. 8.

26,577 (1910). Levinstein, and Levinstein, Ltd. Intermediate products for the manufacture of azo dyestuffs. Nov. 8.

28,872 (1910). Meister, Lucius, und Brüning. Manufacture of trisulphonic acids of the safranine series. Nov. 8.

30,106 (1910). Newton (Bayer und Co.). Manufacture of mordant dyestuffs of the triarylmethane series. Nov. 8.

3508 (1911). Ellis (Chem. Works formerly Sandoz). Manufacture of bromnaphthalene-1-diazo-2-oxide-4-sulphonic acid and of ortho-oxyazo colouring matter therefrom. Nov. 15.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

23,995. Wohl. Process of regaining the volatile solvents for cellulose esters. [Ger. Appl., Nov. 12, 1910.]* Oct. 30.

24,045. Brandenberger. Process for coagulating viscose. [Fr. Appl., Jan. 16, 1911.]* Oct. 30.

24,675. Shaw. Cleansing preparation for wool-scouring, etc. [Australian Appl., Nov. 7. 1910.]* Nov. 6.

24,802. Foster and Taylor. Manufacture of hand-made paper. Nov. 7.

24,815. Weston. Manufacturing paper.* Nov. 7.

25,136. Clark, and Hart Accumulator Co., Ltd. *See under* IX.

Complete Specifications Accepted.

18,606 (1910). Hart. *See under* XXII.

8638 (1911). Dorner. Utilisation of maize straw. Nov. 8.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

23,973. Roy. Manufacture of waterproofed fabrics.* Oct. 30.

24,270. Burder. Waterproofing mixture for fabrics. Nov. 1.

24,473. Ransford (Cassella und Co.). Dyeing vegetable fibres with halogenated dyestuffs. Nov. 3.

24,925. Simpson. Washing, bleaching, and dyeing of fibres or fabrics and apparatus therefor. Nov. 8.

Complete Specifications Accepted.

18,607 (1910). Hart. Waterproofing fabrics, yarns, etc. Nov. 15.

27,405 (1910). Johnson (Badische Anilin und Soda Fabrik). Production of discharge effects on fibre. Nov. 8.

29,381 (1910). Bradford Dyers' Assoc., Whitaker, and Graham. Treatment of textile fabrics with liquids. Nov. 15.

572 (1911). Boult (Eddystone Manufacturing Co.). Fabric-printing machines. Nov. 8.

9432 (1911). Newton (Bayer und Co.). Production of blue shades on wool. Nov. 15.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

24,024. Milbourne, Wright, and Walker, Ltd. Apparatus for producing ammonium sulphate and for purifying gas. Oct. 30.

24,035. Kaiser. Process for fixing nitrogen by autoxidation. [Ger. Appl., Dec. 24, 1910.]* Oct. 30.

24,164. L'Air Liquide. Luminescent tubes for rare gases. [Fr. Appl., Nov. 28, 1910.]* Oct. 31.

24,201. Steinhart and Twite. Manufacture of ammonia and hydrocyanic acid from producer gas in the electric furnace. Nov. 1.

24,238. Carl. Electrolysis of aqueous solutions of metallic salts. [Ger. Appl., Nov. 3, 1910.]* Nov. 1.

24,259. British Thomson-Houston Co. (General Electric Co.). Purification of asbestos. Nov. 1.

24,275. Burbery. Chemical product and its production.* Nov. 1.

24,562. Marino. Reduction of soluble salts for the purpose of subsequently electrolytically depositing the metals.* Nov. 4.

24,657. Badische Anilin und Soda Fabrik. Manufacture of ammonia. [Ger. Appl., Nov. 29, 1910.]* Nov. 6.

24,703. Hyde and Materne. Purification and collection of carbonic acid given off in treatment of dolomite, limestone, etc., in kilns, ovens, or the like. Nov. 7.

25,085. Ashcroft. *See under* X.

25,141. Serpek. Manufacture of nitrogen compounds of silicon and aluminium.* Nov. 11.

25,167. Chem. Fabr. Grünau, Landshoff und Meyer, and Brand. Preparation of anhydrous borax (borax glass). [Ger. Appl., March 2, 1911.]* Nov. 11.

Complete Specifications Accepted.

25,100 (1910). Swan and Kendall. *See under* X.

30,083 (1910). Sinclair. Ammonia and other gas compressors. Nov. 8.

7404 (1911). Carey, and United Alkali Co. Manufacture of soda from black-ash and recovery of sulphur from black-ash waste. Nov. 15.

11,103 (1911). Boult (Flugger). Manufacture of zinc oxide and zinc sulphide. Nov. 8.

16,426 (1911). Elektrochem. Werke. Electrolytic production of ammonium nitrate from hydrated nitric acid. Nov. 8.

19,032 (1911). Meister, Lucius, und Brüning. Manufacture of nitric acid. Nov. 8.

22,357 (1911). Püning. Direct extraction of ammonia as sulphate free from tar, from distillation gases. Nov. 15.

VIII.—GLASS; CERAMICS.

Applications.

23,972. Speirs. Substitute for fireclay and process of producing same. Oct. 30.

24,482. Kent, Lacell, and Silica Synd., Ltd. Articles made of silica glass and requiring leading-in wires combined therewith. Nov. 3.

Complete Specifications Accepted.

11,163 (1911). Podmore and Baily. Filtration of ceramic slip. Nov. 8.

14,033 (1911). Marino. Superficial metallisation of silicious articles. Nov. 15.

IX.—BUILDING MATERIALS.

Applications.

24,775. Poulsen. Manufacture of Portland cement. [Appl. in Denmark, Nov. 21, 1910.]* Nov. 7.

25,136. Clark, and Hart Accumulator Co., Ltd. Sulphur impregnation or vulcanising of hygroscopic substances such as wood, paper, etc. Nov. 11.

Complete Specification Accepted.

935 (1911). Craig and Ralston. Cement. Nov. 8.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

24,019. Chiradc and Canac. Direct aluminium nickeling.* Oct. 30.

24,163. Raman. Apparatus or precipitating metals from solutions.* Oct. 31.

24,170. Ashcroft. Treatment of sulphide ores. Oct. 31.

24,215. Stobie. Manufacture of electric steels. Nov. 1.

24,217. Tomkins (Kemp). Reduction of tin and similar ores or oxides. Nov. 1.

24,298. Pickering. Copper alloy and its manufacture. Nov. 1.

24,562. Marino. *See under* VII.

24,611. Vautin. Treatment of zinc. Nov. 6.

24,635. Soc. Anon. Ital. Gio Ansaldo Armstrong & Co. Cementation furnaces. [Ital. Appl., Nov. 23, 1910.]* Nov. 6.

24,742. Heskett. Furnaces of the Bessemer type, particularly for producing low-carbon steel. Nov. 7.

24,743. Owen and Fletcher. Electrodeposition of metals and alloys. Nov. 7.

24,760. Pearson. Electrical precipitation of precious metals from solutions. Nov. 7.

24,797. Blandy, and Metals Extraction Corporation, Ltd. Extraction of tin from its ores. Nov. 7.

25,085. Ashcroft. Treatment of sulphide ores and production of ammonia or ammonium salts or other nitrogenous compounds. Nov. 10.

25,142. Harris. Mechanical ore-roasting and like furnaces.* Nov. 11.

Complete Specifications Accepted.

18,679 (1910). Simpson and Oviatt. Furnaces for the direct production of iron or steel from iron ores. Nov. 15.

20,115 (1910). Berglof. Reduction of metals from their ores. Nov. 8.

22,569 (1910) and 8498 (1911). Mackie and Forwood. Manufacture of steel. Nov. 8.

22,581 (1910). Gräf and Peschel. Process of case-hardening metals. Nov. 8.

25,100 (1910). Swan and Kendall. Apparatus for manufacture of sodium and potassium. Nov. 8.

26,142 (1910). Costar, Bates, and British Insulated and Helsby Cables, Ltd. "Enamelling" wire. Nov. 15.

29,839 (1910). Pescatore. Production of zinc and other metals. Nov. 15.

11,205 (1911). Boczogo, Hollaki, and Duffek. Hardening iron and steel articles. Nov. 15.

XI.—ELECTRO-CHEMISTRY.

Applications.

24,238. Carl. *See under* VII.

24,258. British Thomson-Houston Co. (General Electric Co.). Insulating compounds. Nov. 1.

25,179. Wehrlin. Treatment of anode residues. [Ger. Appl., Jan. 11, 1911.]* Nov. 11.

Complete Specifications Accepted.

27,264 (1910). Knowles. Apparatus for purifying electrolytic gases. Nov. 15.

13,335 (1911). Elektrochem. Werke. Production of disc-like flaming arcs for carrying out gas reactions. Nov. 8.

16,426 (1911). Elektrochem. Werke. *See under* VII.

XII.—FATS; OILS; WAXES.

Applications.

24,304. Anyon. Soap. Nov. 2.

24,675. Shaw. *See under* V.

24,961. Enequist. Oils and pigments.* Nov. 9.

Complete Specification Accepted.

30,282 (1910). Crosfield and Sons, Ltd., and Markel. Conversion of unsaturated acids or their glycerides into saturated compounds. Nov. 8.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Application.

24,961. Enequist. *See under* XII.

Complete Specification Accepted.

14,768 (1911). Kohler. Method of making betulin suitable for the production of coating compositions. Nov. 15.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

24,101. Bradley. Artificial terpene or synthetic rubber. Oct. 31.

24,233. Higgins and Marcussen. Utilisation of old or waste rubber or rubber composition. Nov. 1.

24,549. Newton (Bayer und Co.). *See under* XX.

25,032. Norzagaray. Machine or apparatus for treating rubber milk or latex. Nov. 10.

Complete Specifications Accepted.

12,477 (1911). Wildman and Christy. Desulphurising and devulcanising rubber. Nov. 15.

17,124 and 17,125 (1911). Hiestrich Nachf. Extraction of indiarubber. Nov. 15

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

24,437. Connolly. Treatment of leather. Nov. 3

24,691 and 24,692. Heide (Perkins Glue Co.). Glue and method of making the same.* Nov. 6.

Complete Specifications Accepted.

5676 and 12,393 (1911). Trotman. Dechroming of chrome tanned leather, chrome shavings, etc., and detanning of tanned leather for the preparation of glue, etc. Nov. 15.

8070 (1911). Wilson. Means for facilitating the tanning of hides and skins. Nov. 15.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

24,010. Martin. *See under* II.

25,151. Schmidt. Manufacture of products with a vegetable base for use in preparing beverages, etc.* Nov. 11.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

24,050. Wilson. Manufacture of margarine, etc., and production of a synthetic milk. Oct. 30.

24,400. Bedford and Bedford. Filter cloths for the filtration of sewage. Nov. 3.

24,622. Horst. Production of an agent for removing germination and odour from air, liquids, and solids.* Nov. 6.

24,662. Revis, Bolton, and Bacon. Production of a soluble casein compound. Nov. 6.

24,722. Hargreaves. Preparation and preservation of food. Nov. 7.

24,936. Coplans. Apparatus for purifying water or other liquids by separating solid matter therefrom. Nov. 9.

Complete Specifications Accepted.

20,520 (1910). Ransford (Soc. Franç. des Distilleries de l'Indo-Chine). Treatment of leguminous matter and of soya in particular to make condiments and sauces. Nov. 8.

24,905 (1910). Richter und Richter. Manufacture of filter carbon. Nov. 8.

14,912 (1911). Banque du Radium. Apparatus for sterilising liquids by ultra-violet rays. Nov. 15.

18,984 (1911). Pearson and Pearson. Water softening and filtering apparatus under pressure. Nov. 15.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

24,101. Bradley. *See under* XIV.

24,549. Newton (Bayer und Co.). Production of isoprene. Nov. 4.

Complete Specification Accepted.

3594 (1911). Newton (Bayer und Co.). Manufacture of pharmaceutical products. Nov. 8.

XXII.—EXPLOSIVES; MATCHES.

Applications.

24,763. Bedier, Israel, and Cole. Explosives. [U.S. Appl., Nov. 7, 1910.]* Nov. 7.

24,960. Fairweather (Deuts. Sprengstoff A.-G.). Increasing the density of explosive nitro bodies.* Nov. 9.

Complete Specification Accepted.

18,606 (1910). Hart. Manufacture of nitrated cellulose. Nov. 15.

XXIII.—ANALYTICAL PROCESSES.

Application.

24,654. Drägerwerk H. und B. Dräger. *See under* II.

Complete Specification Accepted.

27,545 (1910). Knowles. Gas analysing apparatus. Nov. 15.

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DR. G. J. FOWLER IN THE CHAIR.

THE SEPARATION OF SOLIDS FROM LIQUIDS WITH SPECIAL REFERENCE TO SEWAGE PURIFICATION.

BY GILBERT J. FOWLER, D.SC., F.I.C.

The subject of sewage disposal is mainly a question of the separation of solids from liquids. Considered in this general way there may be suggestive hints having their application under quite other circumstances. Even to those whose special work is in the same direction as my own, some of the information which I have had the good fortune to gather during a recent visit to the Continent may come with a certain amount of novelty.

Modern sewage purification methods.—At the outset it may be well if I briefly describe the operations carried on at a modern sewage works.

The following statement shows the composition of ordinary domestic sewage: (i.) *Matters in solution* (mainly derived from urine), nitrogenous substances, *e.g.*, urea and kindred compounds, mineral salts, chiefly sodium chloride, together with phosphates. (ii.) *Matters in suspension, emulsion or colloidal solution:* Nitrogenous substances of complex character, containing sulphur (mainly derived from fæces), cellulose (disintegrated paper, etc.), soap and fat. (iii.) *Sedimentary matter:* Silt, sand, clay, etc. The process of purification of this liquid, it will be seen, must be largely one of removal of solid matter. The floating matters are removed in screens, the heavy detritus in catch pits, and the finest suspended solids either arrested in filter beds or in tanks subsequent to them. There has been much discussion as to the relative importance of the mechanical and bacterial agencies at work in the purification of sewage; the truth, as is frequently the case, lies between the extremes on either side. Bacteria and lower forms of life materially assist the process by altering the character of the suspended matter as well as by gasifying it and rendering it soluble. The changes in the strictly soluble matters are mainly if not entirely due to bacterial agencies. The final products of the purification of sewage are the following, viz.:—(i.) *Gases:* Methane, hydrogen, nitrogen, carbon dioxide. (ii.) *Soluble salts:* Nitrates, phosphates, sulphates, chlorides. (iii.) Insoluble residual matters conveniently termed "*humus.*"

In a series of diagrams and views were shown by typical examples the methods in common use for carrying out the various processes involved.

We may now consider these various operations in detail.

Screening.—More attention has been given to this problem on the Continent than in this country chiefly because the rivers there are, as a rule, larger in proportion to the towns than they are here, and in many cases a thorough screening is adequate to prevent nuisance in the river. Many of the devices used are costly and complicated, so that I shall only mention one which I have seen twice, and which was working as satisfactorily after five or six years as when it was put in, and that is the screen at the sewage works at Frankfurt am Main devised by Herr Uhlfelder, City Engineer of Frankfurt. This consists of five grids fixed on a central axis, like spokes on a wheel, which are rotated against the stream of the sewage in a semi-circular sump. Thus the floating matters are brought up to the surface. A squeegee arrangement followed by a brush drops on to each screen in turn, and is pushed along the bars of the screens, and constantly brings the accumulated material to the end of the screen and drops it on to a catch-plate. This is turned over by the movement of the screen on to a band conveyor which takes it away to a wagon. This seems to me an almost ideal automatic screen; it possesses the following advantages:—It has no bearings under water; it cannot become blocked and so cause the sewage to be backed up in the sewer and flow irregularly through the tanks; and the material is not forced through the tines. I believe that Mr. Garfield has a somewhat similar scheme at the Bradford Sewage Works.

The operation of screening is frequently necessary in the purification of manufacturer's effluents and may result in the recovery of valuable material, besides protecting the sewers from blockage and danger. In the West Riding of Yorkshire a large number of wool-dyeing works are provided with a so-called flock catcher, a simple arrangement which is shown in Fig. 1.* It is really astonishing what large quantities of fibrous material are swept from these screens, from effluent which at first sight seems almost free from suspended matter. The recovered flock can be used again or can be sold for fuel or for manure, whereas if not removed it has been known to cause serious blockage in the sewers. It is possible that a similar device might find application in paper mills, or for the recovery of waste yeast in breweries; this waste yeast if allowed to pass uncontrolled into the sewers may cause serious nuisance and, in the case of small sewage works, trouble with the filters. There is scope for considerable research in the discovery of a profitable use for waste yeast, which I am informed it often hardly pays to recover.

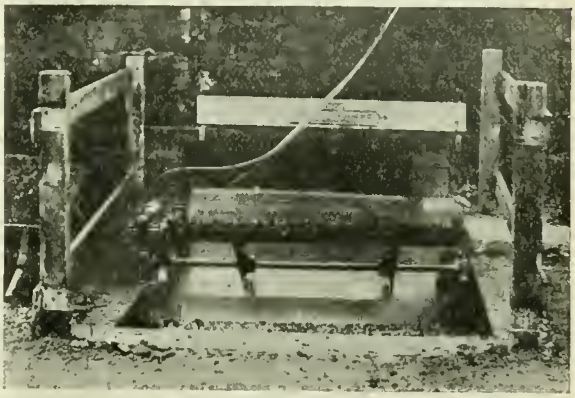

FIG. 1.

Catch pits† should be designed to collect only heavy detritus, not sludge. They are often made too large. It has been shown by Robinson that a velocity of 0·5 ft. per second will not move fine clay, and 0·7 ft. will just move coarse sand. Hence it may be stated that detritus may be removed from sewage at any velocity less than the former figure. To remove true suspended solids a velocity of 0·1 ft. per second or less is required. True detritus rapidly becomes sweet on exposure to air and may, if of a sandy nature, often find useful application.

Floating grease.—Grease, either in the separated condition or as soap, is probably the most valuable constituent of sewage, if it can be profitably recovered. There is no great difficulty in separating the floating particles of grease; much can be retained by ordinary scum boards, and a man with a sieve is an efficient fat-catcher. Various special devices have been brought forward for collecting floating grease, *e.g.*, the Kremer apparatus, and the Eric Merten apparatus. A modification of the Kremer apparatus is at work successfully at the Withington Works of the Manchester Corporation dealing with the surface water only of the sewage channel. I have only seen the Merten apparatus at work as a model, but I believe it is very successful in works producing greasy effluents, *e.g.*, tripe works, bacon factories, etc. There is certainly a considerable waste of oil and grease from many manufactories. In one case, where the attention of the Company was directed to the oil they were turning into the sewers, they established means to recover it, and the process is yielding a handsome profit. Much has been done in the recovery of grease from wool-scouring waste, but the process is by no means perfect. There is not such a chance of profit in the treatment of kier liquors in cotton bleaching, as the amount of oil present is much less, but very considerable purification of these liquors can be obtained at no very great expense, if they are cracked with acid in suitable apparatus.

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* By permission of Mr. J. P. Wakeford, City Surveyor, Wakefield.

† "Sewage Disposal," Kinnicutt, Winslow and Pratt, p. 74.

Finally mention may be made of laundries; a separate treatment of these effluents greatly assists the purification of the sewage from isolated institutions. With a satisfactory method of recovering the fatty acids precipitated by the lime treatment generally used, purification of these effluents would be more general.

Tank treatment.—A right design of tanks must depend on the correct appreciation of the principles attending the settlement of solid particles in a liquid medium. Broadly speaking, of course, the two forces acting on a particle are the translational velocity of the liquid and the acceleration due to gravity. If the problem is considered theoretically, from the point of view of varying spheres of equal radius, it is not very difficult; but in sewage, of course, we have to deal with particles of different shapes and specific gravities, and with all the complications due to the colloidal nature of much of the suspended matter. Consequently the problem is best solved by actual practical experiments. An instructive series of these was carried out some years ago for rectangular tanks by Herr Steuernagel, City Engineer of Cologne. Similar experiments have been carried out by others and go to show that there is an economic limit beyond which increase in the size of tanks has no proportional effect.

In the *conical* tank the forces on the particle are somewhat differently disposed and while at certain velocities good results can be obtained a sudden increase in velocity due, *e.g.*, to storm water is apt to produce a very bad effluent. On the other hand, these tanks have the advantage that the sludge can be readily removed without emptying the tank. A recent form of conical tank shown in Fig. 2* enables the sludge to be withdrawn at a much greater density.

The principle of the conical tank is made use of in *clarifying towers*, such as the many forms of water softening plant which are in use.

The only application of clarifying towers at present in use for sewage treatment is, I believe, in connection with what is known as the Kohle-Brei or carbon-mud method in Germany. They are, however, very useful for removing solid matter from trade waste where ground space is limited, and have been successfully applied by a Manchester firm to separate the sulphate of lime from the waste liquor of ammonia recovery plants.

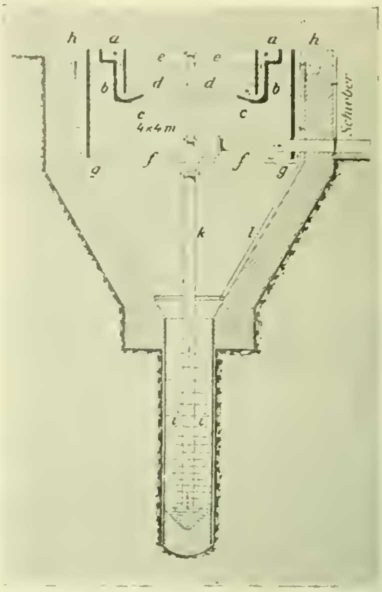

FIG. 2.

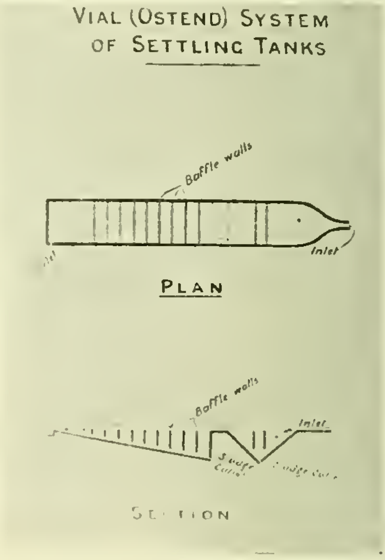

FIG. 3.

In the tanks so far described, the design is directed to cause a movement of the body of liquid as a whole, so that all currents may be eliminated and the number of forces acting on the particles reduced. Such a design assumes sufficient tank capacity to enable gravitational forces completely to operate. It is well known that if a turbid liquid is allowed to settle in a cylinder or beaker, for example, the surface layer of liquid is very quickly clarified and if this layer was equally and continuously removed at the same time that fresh turbid liquid was introduced into the beaker, a rapid clarification would be obtained. This principle is made use of in the Vial tank a diagram of which is shown in Fig. 3.* Here the liquid, together with a suitable precipitant, enters in a thin layer at one end; the particles quickly sink below the immediate surface and are dropped into the spaces of still water between the baffle walls. It was interesting when inspecting the tanks at Ostend to note how particles of cigar ash would fall through the upper stratum of liquid and suddenly be arrested in the still water beneath. An important result is that the liquid remains in contact with the sludge only a very short time.

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* By permission of Dr. K. Thumm.

* By permission of Dr. Maclean Wilson.

A somewhat similar principle is made use of in the so-called separator, invented by Mr. Commin. This is virtually a very extended cill, taking the liquid over in an extremely thin film so that again only the top clarified layer passes off. It would appear that such a device might have useful application in rapidly removing suspended solids from storm water, while for the rapid clarification of other liquids than sewage the same principle might be usefully applied.

At the Glasgow Corporation Sewage Works at Dalmarnock particularly good clarification is obtained by a system of sliding weirs taking off the top surface layer steadily down the tank.

Precipitation by chemicals.—Ordinary sedimentation must leave considerable quantities of lighter suspended matters still in the liquid. To assist in the settlement of these the use of various chemicals was early resorted to, but few of the numerous patented articles are still in use. Lime and salts of aluminium and iron, with the addition in a few cases of carbon in some form, alone remain.

The action of precipitants depends largely on two factors, the electrical charge of the precipitant and its absorptive power. Thus Hardy states that a suspension or colloid will be flocculated only by a solution or another suspension whose ions or particles are of opposing electrical sign. The actual specific gravity and physical characteristics, *i.e.*, degree of flocculence of a precipitant will also affect the results.

The absorptive power of a precipitant would seem to be something different from its precipitating power. Thus charcoal, and to a certain extent also hydrated oxides such as those of aluminium and iron, will withdraw actual crystalloids from solution, especially certain colouring matters. It was interesting at the Kingston Sewage Works, where alum, blood, and clay are used as precipitants, to notice the remarkable limpidity and freedom from colour of the effluent.

I have been engaged for some time in a careful study of the effect of precipitants upon sewage on behalf of a well-known firm, particularly in reference to the comparative efficiency of iron and aluminium salts, and the best conditions for their economic use. In view of the rather unexpected encouragement given to the use of chemicals by the findings of the Royal Commission, these experiments are of some general interest.

Although a great deal of attention has been given to this subject in the past, much still remains to be done. Thus the effect of precipitants on the separate constituents of sewage has not been very thoroughly gone into, and somewhat to our surprise we found that aluminium and iron salts have very little effect on anything but the fæcal emulsion. Lime precipitates the soap, but a decoction of vegetables, such as constitutes a large part of kitchen waste, was practically unaffected by any treatment.

There seems little doubt that in the absence of lime, alumina is a better precipitant than ferric hydroxide; and even in presence of an alkali a ton of ferric sulphate added per million gives a much greater bulk than an equal weight of alumino-ferric *i.e.* when precipitated in clear water. When used in conjunction with lime in soapy or greasy liquids this effect may be masked by the large precipitate due to lime.

I noticed a good many years ago at Davyhulme that ferric hydroxide precipitate was very light, but in view of the results published in the early Massachusetts Report by Allen Hazen, I have always concluded that ferric salts apart from lime were the best precipitant, if they could be readily prepared. Recent experience does not confirm this view, and in those cases where it is inconvenient to use lime (and this applies to a large number of small works) and the alkalinity of the sewage is relied on for precipitation, alumina undoubtedly gives a sharper and better precipitation than equivalent proportions of iron. It is only fair to say that the sewage experimented upon by Hazen was very dilute and that he paid no particular attention to the quantity of sludge produced, confining himself mainly to analysis of the effluent, and he guards himself by saying that his results may not apply to all sewages.

The question of the use of chemicals is mainly an economic one, whether it is better to spend money in keeping suspended matters away from the filters, and so reduce the area of these and their upkeep, or whether the cost of chemicals and the disposal of the resulting sludge outweighs the filter cost. The question is one which must, like so many others, be decided in accordance with local circumstances, among which facilities for sludge disposal must always be a governing factor. The following table of results, representing the mean of five laboratory experiments, indicates that clear tank effluents are obtained at considerable cost in chemicals and sludge.

Amount of precipitant used per million gallons.	Vol. of suspended matter in effluent c.c. per litre.	Vol. of sludge. c.c. per litre.
Nil	0·79	5·5
4 cwt.	1·00	7·4
8 ,,	0·66	11·9
12 ,,	0·36	17·6
16 ,,	0·23	21·3

Although, perhaps, too much stress must not be laid upon these, as they are after all only the results of a few tests, yet it is evident that to obtain any clear advantage over sedimentation alone, a mere perfunctory addition of chemicals will not as a rule suffice. It is quite easy, if a test is made under a strong light, to note the point where sharp flocculation begins and clear liquid is shown between the particles. When operating with an average sewage we have found this point to be somewhere about 10 to 12 cwt. per million gallons and this is confirmed by large scale practice. The limit may sometimes be lower, while there is a further upper limit beyond which little or no increase of purity follows the addition of chemicals.

Tank treatment assisted by biological action.—Considerations such as these were among the causes which led to the introduction of so-called bacterial or biological processes. The oldest of these and best known is the so-called septic tank, which is really the old-fashioned cesspool more or less scientifically designed. It is well known that many old cesspools were in use for years without becoming full. Hopes were at first entertained that in the septic tank similar conditions would prevail and that the sludge problem would so be solved. These hopes were doomed to disappointment, but a quite unreasonable reaction set in, in which the undoubted possibilities of the septic tank were forgotten. The history of recent developments of the so-called septic tank, or, as I prefer to call it, the anærobic treatment of sewage, forms an exceedingly interesting chapter in the scientific development of a process. One important factor which has been lost sight of in connection with the work of a septic tank is temperature.

Many of the most important organisms which are at work under anærobic conditions have their optimum temperature considerably above what is common in this country. The cellulose fermenting organisms, for instance, have an optimum temperature of about 90° F. It is easy, therefore, to understand why the septic tank experiments carried out in the vicinity of St. Petersburg were pronounced a failure, while in tanks at Matunga near Bombay the gas evolved is sufficient to drive a gas engine which pumps the sewage, and to leave sufficient remaining for heating and lighting purposes.

Another frequent subject of discussion in connection with septic tanks has been the necessity or otherwise for anærobic treatment prior to treatment on bacteria beds. This discussion has been confused through the fact that a town sewage in this country seldom arrives at the sewage works in a really fresh condition. Thus, most of the urea present has already been converted into ammonium carbonate. In latrine installations in the East this is by no means the case, and there, consequently, preliminary anærobic treatment possesses undoubted advantages.

The real difficulty with the septic tank in this country has been the production of nuisance both from the effluent and from the sludge, and also the fact that in spite of various devices, it has been hard to avoid considerable quantities of suspended matter passing away from the tank on to filter beds, owing to the disturbance of the sludge in the bottom of the tank through the evolution of gas. I believe that the Massachusetts State Board of Health were the first to try to obviate this difficulty by removing the sludge into a separate compartment and allowing it there to ferment. Their trials do not seem to have been altogether successful for some reason, and better success was obtained by Dr. Travis in his so-called hydrolytic tank. This tank is designed so that a comparatively small proportion only of the sewage comes into contact with the sludge. It was designed in this way under tho impression, held by most people at the time, that a renewal of the liquid over the sludge was necessary for efficient septic action. Unfortunately this small proportion of liquid passing over the sludge stratum permitted the effluent to be overcharged at times with suspended matter and also failed to eliminate nuisance. Dr. Travis sought to remedy the difficulty arising from the suspended matter by the provision of numerous baffle plates or so-called colloiders which serve as attractive surfaces for suspended particles. While no doubt some retention is possible by this means, experiments which we have made at Davyhulme would seem to show that the benefit is not great, unless the surfaces are so extended as to become almost impracticable. There is also the possible trouble of fungoid growths developing and in their turn causing pollution of the effluent.

All these difficulties are in large measure overcome in the latest development of the septic tank idea, known as the Emscher or Imhoff tank. This has now received a prolonged trial by the Emscher Genossenschaft, an important German Rivers Board controlling the valley of the Emscher in the neighbourhood of Essen. Dr. Imhoff, the inventor of the tank, is their chief engineer. The tank (Fig. 4)* is divided into an upper settling space and a lower sludge chamber. The settling space affords about two hours settlement for the sewage, the suspended matter drops through the slits into the sludge space from which it cannot reascend into the settling space. The tanks are of considerable depth, but this has the advantage that no great surface area is taken up. They are mostly built circular for engineering reasons. The design and appearance of various forms of tank can be seen in Figs. 5 and 6.*

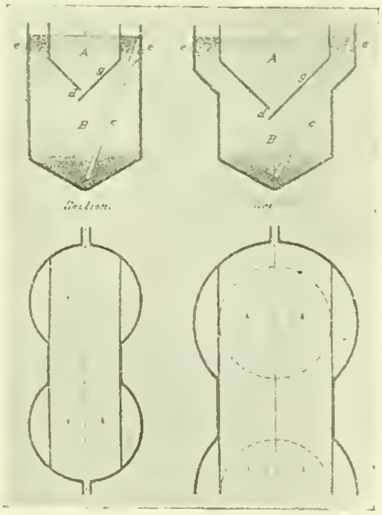

FIG. 4.

The successful working of an Emscher tank depends on scientific attention to detail. Some time of course elapses before fermentation takes place in the sludge compartment. It has already been stated that the cause of nuisance in the old septic tank is the development of noxious products in the effluent, and the nuisance which arises on removing the sludge is also due to the polluted effluent with which it is mixed. The working of the Emscher tank is directed to obtain an always fresh effluent from the settlement chamber, together with a sludge, the liquid and the solid portion of which shall be thoroughly "ausgefault" or, as Dr. Hering of New York translates it, "thoroughly rotted out," so that neither liquid nor solid has any further power of creating nuisance. The great point in the management of the Emscher tank lies in the right method and control of sludge removal. In the early stages of tank working there is, of course, not much sludge in the sludge chamber, and the liquid above it will readily become polluted; the gases of fermentation escape at the side often carrying with them masses of sludge which is still sticky and colloidal. Sometimes indeed this action causes what is known as "spitting," and portions of sludge are forced through into the settling chamber. This is believed by Dr. Thumm to be largely due to the unpurified water in the sludge chamber which readily foams, in the manner of a bad effluent, and he suggests the addition of salt to prevent this effect. Salt has the further advantage that the specific gravity of the liquid in the sludge chamber is higher than in the settling chamber and there is less chance of currents being set up. In course of time, say in six or nine months, the fermentation in the sludge chamber becomes complete, and inasmuch as no fresh water has entered the chamber, but only small quantities have left it as the suspended matter descended, the water is no longer putrefactive. At this point the tank is said to be "angearbeitet"—worked up, and a portion of sludge can be safely withdrawn.

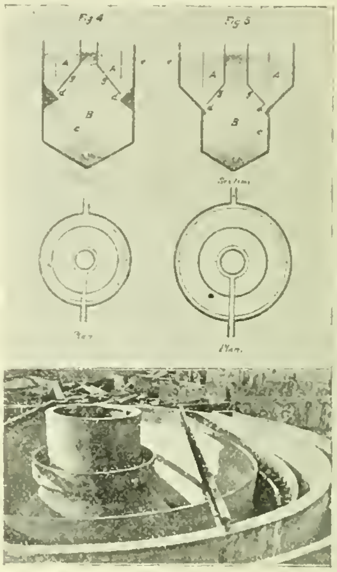

FIG. 5.

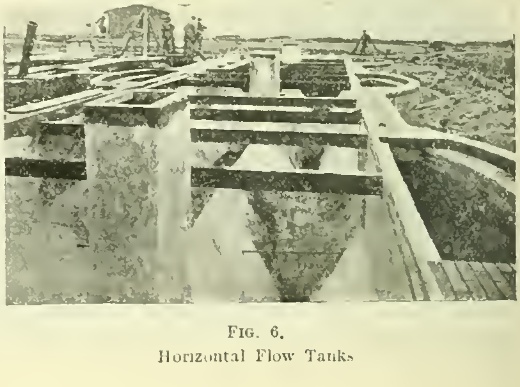

FIG. 6.
Horizontal Flow Tanks

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* By permission of Dr. Hering and Mr. C. Saville.

The sludge withdrawn from an Emscher tank flows readily, although containing, it is stated, only 75 per cent. of water. A snap sample which I took from a tank at Essen, still in the early stages of work, only contained 81 per cent. The apparent fluidity of the sludge is due to the fact that it is saturated with gas, and here again an important point in technique arises. When the sludge is run on to the sludge drying bed it rises like dough and water separates. If the drying bed is not well made, and the water does not readily drain off, the gases which cause the sludge to rise escape, and the solid matters then fall to the bottom and the water rises to the top, and draining then becomes very difficult.

As distinct from other sludge lagooning processes, the water draining from the sludge in the Emscher tank is, as has been stated, non-putrefactive, in fact nitrification often takes place in the sludge drying bed.

Well "rotted out" sludge is readily recognised by the readiness with which a small sample spread on any surface seems to "crack" and drain out the water.

That very considerable destruction of organic matter goes on is evident from the analyses of samples of dried sludge taken at Essen and Bochum. The Essen sludge, as has been stated, was from tanks not fully matured. At Bochum they had been at work some years and the difference is evident, the more so that Essen sewage contains iron salts calculated to increase the percentage of mineral matter :—

	Essen.	Bochum.
	per cent.	per cent.
Loss on ignition	38·00	22·14
Mineral matter	62·00	77·86
Total nitrogen	1·64	1·26
Phosphate (P_2O_5)	3·66	1·17
Greasy matter (carbon tetrachloride extract)	3·10	1·00

Thus a very real advance has here been made in the solution of the ever present sludge problem. A population about equal to that draining to the Withington Works of the Manchester Corporation can dispose inoffensively of its sludge on an area of less than half an acre. At present something like 50 acres of land are requisite for the permanent inoffensive disposal of the sludge at these works.

Even the manurial value of this rotted out sludge is not entirely lost; nitrogen, phosphoric acid and humus material are still present, and in conjunction with a little added lime have a useful effect in lightening heavy soils.

Before leaving the subject of the removal of solids from sewage with the help of anærobic bacteria I would repeat a suggestion I have made before, that in many works there must be a considerable amount of fermentable cellulose waste matter, paper etc., which might, one would think, furnish a useful source of power gas if submitted under scientific conditions to anærobic treatment.

Tank treatment under aerobic conditions.—The difficulties already referred to in connection with the septic tank led Mr. Dibdin to experiment on purely aerobic methods of sludge digestion, as under such conditions nuisance can seldom arise.

The slate bed is a development of the coarse primary contact bed first used at Sutton where the sewage after screening was led directly in to a bed formed of large pieces of clinker. Purification resulted but the difficulty was the somewhat rapid clogging of the bed. In the slate bed a series of pockets or chambers is obtained by building up roughly cut pieces of slate with distance pieces. The slate bed is used as a contact bed, *i.e.*, it is filled with the crude sewage, which is allowed to stand for an hour or two, when the solids deposit on the slates, and are exposed to air during the subsequent period of rest. It is important naturally that the period of contact should not be too prolonged, or anaerobic action will set in. As it is, the air trapped in the bed, or dissolved in the sewage as it falls through the slates, is sufficient to maintain ærobic conditions during the period of contact. When a slate bed is matured the surface of the slates is covered with a liver like mass of deposit, which can be stripped off, and smells somewhat like an exposed river bank. It is full of various forms of life, especially worms—just such forms of life indeed as would thrive in a river bed under such conditions. With continued use solids begin to discharge themselves along with the effluent from the bed, and they are now in a granular condition and can be readily intercepted by suitable means. They dry on the surface of a sludge drying bed to an inoffensive brown residue. Larger quantities of such humus, as it is conveniently termed, can be flushed out from time to time by a strong stream of water directed into flushing holes left at convenient distances in the slates.

It will be seen that both the anaerobic tank and the slate bed or aerobic tank are devices for inoffensively removing the larger organic suspended matters in the sewage. Neither of them can produce an effluent as free from the finer colloidal matters as is obtainable by chemical precipitation, and so in the design of filters to follow these processes, this fine suspended matter has to receive consideration. Inasmuch as it thus leaves the finer solids still to be dealt with, attempts have been made to dispense with tank treatment altogether and finish the whole process on one suitably constructed filter bed. Again it becomes a question of economy. Dibdin's coarse contact bed at Sutton fulfilled its purpose so far as it was intended at the expense of periodically taking out and washing the material. If this possibility is faced there is no reason why sewage should not be purified directly and completely on a properly constructed percolating filter. This is the idea of the Ducat filter, on which crude sewage is distributed on a carefully graded filter the finer medium being at the top. There is a Ducat filter on these lines at Market Drayton in Shropshire, enclosed in a wooden building, where fairly concentrated sewage has been treated for some years, to my knowledge, without the slightest nuisance, but some renewal of the top layers of material will probably eventually be necessary.

The elimination and purification of the finer colloidal substances as well as of the matters in true solution necessitates, or at any rate is greatly facilitated by, some form of absorptive action. It is thus that chemical precipitants act in removing the finer colloidal substances, and by the use of such materials as ground coal and charcoal it is possible even to produce an entirely non-putrefactive effluent. In fact I believe this has been done under some circumstances by the A B C process. No such action of course can take place in the Emscher tank and only to a limited extent in the slate bed. It is probable that the first stage of the purifying process which takes place in a well matured sewage filter, whether a contact bed or a percolator, is an absorptive action due to the humus-like material which clothes the particles of filtering medium. It has been shown recently by Müntz, one of the earliest investigators on nitrification, that peat under certain circumstances when mixed with carbonate of lime is an excellent nitrifying medium, and experimental trials have been made by Calmette with a filter bed constructed of bricks so as to give pockets as in a slate bed, and in the pockets pieces of peat and lime stone were placed. These field trials, however, did not bear out the promise of the laboratory experiments. The filter was used as a percolating filter and apparently the liquid passed through too rapidly. Possibly if it had been used on the contact principle like a slate bed, better results might have followed. At any rate we have here a useful hint towards possible future developments.

The trouble with percolating filters, apart from mechanical difficulties, is the greater liability to produce nuisance from smells and from flies than is the case with a contact bed, and also, what would seem to be the fact that there is an actual increase of suspended solids owing to growths in the lower portions of the filter. I was struck at a recent visit to the Kingston sewage works by the amount of solid matter discharged from the percolating filters there, although they were dealing with perhaps the most brilliantly clarified effluent produced in this country.

On the other hand, of course, the suspended matter which comes away from percolating filters will generally settle readily and can be removed by so-called humus tanks similar in form to that made use of successfully by Mr. Watson in Birmingham.

The suspended matter in contact beds, though apparently less in amount, is not so readily separated and there is opportunity for further research in this direction. There are possibilities, for example, in electrical treatment, although such experiments as have been tried, both in the electrical treatment of sewage, and the electrical clarification of oil emulsions, resolve themselves into a question of chemical precipitation by the hydrated iron oxide formed by the oxidation of the iron plates used.

A somewhat remarkable invention has been discussed recently, viz., the use of aluminium plates to prevent the formation of scale in boilers. It would appear that the aluminium exercises some influence which retains the particles of precipitated lime salts in such a condition that they do not set together to form scale. The actual loss of aluminium in the process is stated to be infinitesimal and so it seems to be in some way an ionising effect. Experiments in this direction to facilitate the clarification of turbid effluents would be interesting.

I cannot forbear to mention also a most illuminating suggestion once made to me by Dr. Maclean Wilson that it might be possible to discover some kind of clotting enzyme, which should do the work which now apparently takes place on the surfaces of the medium in the filter bed. If this could be done there is a possibility of enormous saving in costly works. Having regard to the progress which has already been made in the development of sewage disposal methods, progress which I have tried to show has been due to increasing knowledge of the scientific facts, it is reasonable to expect that equally great and perhaps more striking developments will take place in the future. For this end to be attained the united labours of many workers are required, and not only, as I said at the outset, may the sewage specialist be able to afford hints to the technical chemist working in other fields, but the latter may very well be able to supply a missing link which may turn failure into success.

New York Section.

Meeting held at 50, *East* 41*st Street, on Friday, October* 20*th,* 1911.

MR. M. C. WHITAKER IN THE CHAIR.

THE ANTISEPTIC EFFECT OF CREOSOTE OIL AND OTHER OILS USED FOR PRESERVING TIMBER.

BY JOHN MORRIS WEISS.

The preservation of timber and the selection of materials to be used for this purpose are matters of constantly increasing importance. The decay of timber is due to various organisms which are classed under the comprehensive group of fungi. This decay is only possible if favourable conditions for fungus growth and development exist.

It is true that fungi will not thrive if moisture and air are absolutely excluded, but it is a question whether any process or material which only depends upon waterproofing for its efficiency will give satisfactory practical results. It seems to the writer that a substance used for the purpose of preventing the growth of a fungus should have antiseptic value. Antiseptic efficiency combined with waterproofing makes a double safeguard.

The earliest exhaustive consideration of this question is in a paper by Sir Samuel Boulton on the antiseptic treatment of timber, and in the discussion of this paper (Proc. Inst. Civil Eng., **78**, S. 1883—4, Part 4). The antiseptic value of various constituents of creosote and also certain metallic salts was discussed, but no definite experiments were presented as far as wood-destroying fungi themselves are concerned.

Later Malenkovic ("Die Holzkonservierung in Hochbau" Wien, 1907) and Netzsch ("Die Bedeutung der Fluorverbindungen für die Holzkonservierung" Inaug. Dissert., München, 1909) have shown comparative antiseptic tests on the wood-destroying fungi proper, as well as on the common moulds. They worked mainly with metallic salts, zinc chloride, mercuric chloride, and the fluorides. Malenkovic compares zinc chloride, copper sulphate, phenolate of soda, sodium β-naphthol, etc., while Netzsch devotes his attention mainly to fluorides, although he also considers zinc chloride and copper sulphate. Recently, R. Nowotmy (Zeit. An. Chem. 24, May 19, 1911) has called attention to the value of laboratory research in connection with wood preservation. He feels that results cannot always be duplicated in practice, but that laboratory indications are a sign-post which enables us to avoid expensive mistakes, and that in the development of mycological investigation lies the advance of the science of wood preservation.

Recently the writer published an article entitled "The Action of Oils and Tars in Preventing Mould Growth" (this J., 30, Feb. 28, 1911). Several questions were opened up which it is the purpose of the experiments presented here to answer. The work was carried out along the same lines, but the scope was considerably extended. Pure cultures were used instead of mixed organisms, and a larger number of oils, both natural and prepared, were submitted to examination.

The first thing accomplished was an examination of several samples of rotten wood, in order to procure organisms suitable for the experiment. Those selected had, of necessity, the capability of propagating on laboratory media—at the same time unless they also had the capability of growing and developing on a moistened sterile wood block, they were rejected as unsuitable. The wood used for the blocks was poplar. Three organisms were selected for the tests, as representing three classes of which any may play a part in wood decay. They were :—1. *Bacillus subtilis.* 2. *Saccharomyces glutinis.* 3. *A* species of *Penicillium* corresponding closely to *Penicillium* No. 28, as described in Bulletin 118, Bureau of Animal Industry, U.S. Dept. of Agriculture. The second organism, a yeast in nature, developed slowly on sterile wood, but after a few months showed its characteristic red colour on the surface, and a microscopic examination of a thin section of the surface wood showed evidences of destructive action. The same was noticed with the bacillus, but neither seems to have a high degree of virility. The important feature seems to be that they make sound wood more susceptible to the attacks of higher fungi by a preliminary comparatively slight decomposition. The third organism grows very quickly on wood, and after two months the wood shows distinct signs of decay microscopically.

A number of materials were investigated, which may be divided into three classes : 1. Oils prepared in the laboratory ; 2. Pure substances occurring in these oils ; 3. Commercial creosoting oils. They were as follows :—

Class I.

1. Creosote oil with bases, acids and solid hydrocarbons removed.
3. No. 1 with 20 per cent. tar acids added.
4. No. 1 with 20 per cent. pure naphthalene added.
5. No. 1 with 5 per cent. filtered tar added.
6. No. 1 with 10 per cent. filtered tar added.
7. No. 1 with 20 per cent. filtered tar added.
8. No. 7 fractionated below 235° C. 33⅓ per cent.
9. No. 1 fractionated : 235°—272° C. 33⅓ per cent.
10. Residue of No. 9 : 33⅓ per cent.
11. Water gas tar distillate No. 22 plus 20 per cent. tar acids.
12. Water gas tar distillate No. 22 plus 5 per cent. tar acids.

Class II.

13. Pure phenol.
14. Pure cresol.
15. Pure naphthalene.
16. Pure anthracene.
17. Pure quinoline.
18. Pure paraffin.

Class III.

19. Straight run coal tar creosote.
20. Maintenance of Way Specification coal tar creosote.
21. Water gas tar distillate No. 1.
22. Water gas tar distillate No. 2.
23. Semi-asphaltic petroleum.*

The technique of the experiment was as follows: The medium used in the tests was composed of 0·5 per cent. Liebig's extract of meat, 1·0 per cent. peptone, 0·5 per cent. of sodium chloride, 0·03 per cent. each of maltose, lactose and glucose, 0·02 per cent. of calcium nitrate, and 1·2 per cent. of shredded agar agar. The medium was adjusted so as to be just neutral to litmus. This was found to be favourable to the development of all of the organisms used. Amounts of liquefied medium and material investigated were weighed into a sterilized separating funnel and thoroughly mixed at about 60° C. Then the mixture was poured into sterile petri-dishes, 10 c.c. of mixture being the charge for a dish. After coagulation the dishes were inoculated with pure broth cultures of the three organisms. The inoculation was performed by placing one loopful (loop 1 mm. diameter.) of the broth culture in the centre of the layer of medium in the dish. For the bacillus, 24-hour broth cultures at 37° C. were used,—for the yeast and fungus, 7-day broth cultures at room temperatures. The petri-dishes with the bacillus were incubated at 37½° C. for one week, and then observed. The dishes with the other two organisms were left for four weeks at room temperatures which varied between 18° and 22° C. At the end of these periods the conditions of the dishes were noted. It had been previously found that the times as above given were ample to show whether development would or would not take place. In a rough way I distinguished strong growth, retarded growth, slight growth, traces of growth, and no growth. In the case of the bacillus, presence or absence of spores was noted; in the case of the yeast, presence or absence of pigment.

All results were taken in duplicate, and in a very few cases where check results were not obtained, four or more observations were made until the results were concordant. The non-concordant results were in every case due to a contamination of the dish or of the culture, as in handling so many tests some contamination is unavoidable. The contaminated tests amounted to only about 1 per cent. of the total number undertaken.

Each series of tests started on any one day was accompanied by a control test on a dish with no antiseptic added, and if a satisfactory development did not take place in the medium free from antiseptic, that particular set of dishes was discarded and fresh tests made.

No oil or substance was carried over 10 per cent. in mixtures, as it was felt that if this amount of a substance did not prevent growth, it could not really be considered as having marked antiseptic properties. In general, the mixtures were carried upward to 1·00 per cent. by increments of 0·05 per cent., from 1·00 to 2·00 per cent. by increments of 0·10 per cent., from 2·00 to 5·00 per cent. by increments of 0·50 per cent., and from 5·00 to 10·00 per cent. by increments of 1·00 per cent.

Six tables accompany this paper. Table 1 shows the ordinary tests of the oils used in this investigation. Tables 2, 3, and 3a, 4 and 4a show the effect of the substances used in the tests on fungus, yeast, and bacterial growths, respectively.

First, to consider creosote oil of itself and in relation to its constituents. The neutral liquid hydrocarbons are in themselves strong antiseptics. The bases themselves are very effective, as shown in the tests on quinoline (No. 17). Pyridine was tried but was too volatile to give trustworthy results.

The tar acids are very strong antiseptics, and the antiseptic properties rise with the boiling point, as seen in the tests on phenol and cresol. The acids normally in creosote are still higher antiseptics. This is indicated by the fact that straight creosote, with but 15 per cent. acids, is stronger than the neutral oils with 20 per cent. of acids, mainly cresols, added.

The solid hydrocarbons, naphthalene and anthracene, show very little antiseptic value. The knowledge that oils high in naphthalene have been almost universally used for the treatment of marine timbers, and have given highly satisfactory results, would indicate that naphthalene possesses valuable properties as a preventive of the ravages of the teredo, etc., which properties are somewhat at variance with its low value in preventing fungus growth. This phase of the subject is worthy of further investigation.

Some creosotes are used with a filtered tar added, and the effect of this is seen in tests 5, 6 and 7. A moderate amount of tar increases the value of the neutral oils, owing to the tar acids thus added.

The neutral liquid oils of varying boiling point show wide differences. The medium heavy oils from 235—270° C. are slightly better than the lower boiling fraction. The fraction above 270° is very much poorer.

It seems to the writer that the following is probable: In neutral aromatic hydrocarbons the antiseptic value

Table I.

Tests of oils used.

No.		Per cent. Acids.	Per cent. Bases.	Per cent. Naphthalene.	Sp. gr. at 15·5C°.	Creosoter's Distillation.					
						170	200	210	235	270	315
1	Neutral liquid creosote	0	0	0	1·037	0	1·8	5·2	30·6	63·4	87·2
3	No. 1 plus 20 per cent. tar acids ...	20·0	0	0	1·037	0	8·3	20·7	47·5	71·9	89·0
4	do. plus 20 per cent. naphthalene..	0	0	8·9	1·036	0	2·1	7·1	46·6	72·6	89·2
5	do. plus 5 per cent. tar.........	0.6	0	0	1·045	0·3	2·9	5·0	33·0	61·6	85·8
6	do. plus 10 per cent. tar..........	1.0	0	0	1·052	0·1	2·0	5·4	27·6	59·0	81·9
7	do. plus 20 per cent. tar	1·8	0	0	1·067	0·7	3·2	7·1	27·2	56·8	75·1
8	do. fractionated to 235° C.	0	0	0	0·990	1·1	27·1	43·5	77·4	94·7	98·9
9	do. fractioned: 235° to 272° C.......	0	0	0	1·033	0	0·1	0·9	27·5	83·2	97·6
10	do. do.: above 272° C.	0	0	0	1·094	0	0	0	0·3	8·4	67·0
11	No. 22 and 20 per cent. tar acids ...	20·0	0	0	1·050	0	2·5	10·3	26·4	39·6	57·3
12	No. 22 and 5 per cent. tar acids	5·0	0	0	1·052	0	1·0	2·1	10·7	31·0	52·6
19	Straight run coal tar creosote........	15·0	3·0	27·4	1·049	0·2	6·4	22·3	60·3	76·5	86·2
20	M. W. coal tar creosote	9·0	3·0	22·6	1·063	0	0	1·2	33·2	60·5	78·0
21	Water gas tar distillate	0	0	0	1·024	0	1·1	2·7	18·9	50·2	81·4
22	Water gas tar distillate	0	0	0	1·053	0	0	0	5·3	24·3	49·0
23	Semi-asphaltic petroleum	0	0	0	0·973	0	0	0	0	0	0

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* Offered under trade name as a wood preservative.

TABLE II.

Effect of antiseptics on Penicillium (four weeks).

4—strong growth. 3—retarded growth. 2—slight growth. 1—trace of growth. 0—no growth.

Per cent.	1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
0·05	4	3	4	4	4	4	4	3	4	4	4	3	0	4	4	3	4	2	3	4	4	4
0·10	4	2	4	4	4	4	4	3	4	3	4	3	0	4	4	0	4	0	0	4	4	4
0·15	3	0	4	3	3	4	3	2	4	3	4	0	0	4	4	0	4	0	0	4	4	4
0·20	3	0	4	3	3	3	3	1	4	1	4	0	0	4	4	0	4	0	0	4	4	4
0·25	3	0	3	3	1	3	2	0	4	0	4	0	0	4	4	0	4	0	0	4	4	4
0·30	3	—	3	3	0	3	1	0	4	0	3	—	—	4	4	—	4	—	—	4	4	4
0·35	3	—	3	2	0	3	0	0	4	0	3	—	—	4	4	—	4	—	—	3	4	4
0·40	3	—	3	2	0	3	0	0	4	0	3	—	—	4	4	—	4	—	—	3	4	4
0·45	3	—	3	0	0	2	0	—	4	—	3	—	—	4	4	—	4	—	—	3	4	4
0·50	3	—	3	0	0	2	0	—	4	—	3	—	—	4	4	—	4	—	—	3	4	4
0·55	2	—	3	—	—	1	—	—	4	—	2	—	—	4	4	—	4	—	—	3	4	4
0·60	2	—	3	—	—	0	—	—	4	—	2	—	—	4	4	—	4	—	—	3	4	4
0·65	2	—	3	—	—	0	—	—	3	—	2	—	—	4	4	—	4	—	—	3	4	4
0·70	2	—	3	—	—	0	—	—	3	—	1	—	—	4	4	—	4	—	—	3	4	4
0·75	1	—	2	—	—	0	—	—	3	—	1	—	—	4	4	—	4	—	—	3	4	4
0·80	1	—	2	—	—	0	—	—	3	—	0	—	—	4	4	—	4	—	—	3	4	4
0·85	0	—	1	—	—	—	—	—	3	—	0	—	—	4	4	—	4	—	—	3	4	4
0·90	0	—	1	—	—	—	—	—	3	—	0	—	—	4	4	—	4	—	—	3	4	4
0·95	0	—	0	—	—	—	—	—	3	—	0	—	—	4	4	—	4	—	—	3	4	4
1·00	0	—	0	—	—	—	—	—	3	—	0	—	—	4	4	—	4	—	—	3	4	4
1·25	—	—	—	—	—	—	—	—	3	—	—	—	—	4	4	—	4	—	—	3	4	4
1·50	—	—	—	—	—	—	—	—	2	—	—	—	—	4	4	—	4	—	—	2	4	4
1·75	—	—	—	—	—	—	—	—	2	—	—	—	—	4	4	—	4	—	—	2	4	4
2·00	—	—	—	—	—	—	—	—	2	—	—	—	—	4	4	—	4	—	—	1	4	4
2·25	—	—	—	—	—	—	—	—	2	—	—	—	—	4	4	—	4	—	—	0	4	4
2·50	—	—	—	—	—	—	—	—	1	—	—	—	—	4	4	—	4	—	—	0	4	4
2·75	—	—	—	—	—	—	—	—	1	—	—	—	—	4	3	—	4	—	—	—	4	4
3·00	—	—	—	—	—	—	—	—	1	—	—	—	—	4	3	—	4	—	—	—	4	4
3·50	—	—	—	—	—	—	—	—	1	—	—	—	—	4	3	—	4	—	—	—	4	4
4·00	—	—	—	—	—	—	—	—	1	—	—	—	—	4	3	—	4	—	—	—	4	4
4·50	—	—	—	—	—	—	—	—	0	—	—	—	—	4	3	—	4	—	—	—	4	4
5·00	—	—	—	—	—	—	—	—	0	—	—	—	—	4	3	—	4	—	—	—	4	4
5·50	—	—	—	—	—	—	—	—	0	—	—	—	—	3	3	—	4	—	—	—	4	4
6·00	—	—	—	—	—	—	—	—	0	—	—	—	—	3	3	—	4	—	—	—	4	4
6·50	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	4	4
7·00	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	4	4
7·50	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	4	4
8·00	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
8·50	—	—	—	—	—	—	—	—	—	—	—	—	—	2	3	—	4	—	—	—	3	4
9·00	—	—	—	—	—	—	—	—	—	—	—	—	—	2	3	—	4	—	—	—	3	4
10·00	—	—	—	—	—	—	—	—	—	—	—	—	—	0	3	—	4	—	—	—	3	4

TABLE III.

Effect of antiseptics on Bacillus Subtilis (one week).

4—Strong growth. 3—Retarded growth. 2—Slight growth. 1—trace of growth. 0—No growth.

Per cent.	1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
0 05	4	3	4	4	3	4	4	4	4	4	4	4	3	4	4	4	4	1	3	4	4	4
0·10	3	1	3	3	3	3	4	3	4	4	4	3	0	4	4	3	4	0	0	4	4	4
0·15	2	0	3	2	0	3	3	2	4	3	4	0	0	4	4	2	4	0	0	4	4	4
0·20	1	0	2	0	0	0	3	0	3	1	4	0	0	4	4	0	4	0	0	4	4	4
0·25	0	0	0	0	0	0	3	0	3	0	3	0	0	4	4	0	4	0	0	4	4	4
0·30	0	0	0	0	0	0	2	0	3	0	3	0	0	4	4	0	4	0	0	3	4	4
0·35	0	0	0	—	—	0	0	0	3	0	3	—	—	4	4	—	4	—	—	3	4	4
0·40	0	—	0	—	—	0	0	0	3	0	3	—	—	4	4	—	4	—	—	2	4	4
0·45	—	—	—	—	—	—	0	—	2	—	3	—	—	4	4	—	4	—	—	2	4	4
0·50	—	—	—	—	—	—	0	—	2	—	2	—	—	4	4	—	4	—	—	2	4	4
0·55	—	—	—	—	—	—	—	—	2	—	2	—	—	3	4	—	4	—	—	1	4	4
0·60	—	—	—	—	—	—	—	—	1	—	2	—	—	3	4	—	4	—	—	0	4	4
0·65	—	—	—	—	—	—	—	—	1	—	1	—	—	3	4	—	4	—	—	0	4	4
0·70	—	—	—	—	—	—	—	—	0	—	0	—	—	3	4	—	4	—	—	0	4	4
0·75	—	—	—	—	—	—	—	—	0	—	0	—	—	3	4	—	4	—	—	0	4	4
0·80	—	—	—	—	—	—	—	—	0	—	0	—	—	3	4	—	4	—	—	—	4	4
0·85	—	—	—	—	—	—	—	—	0	—	0	—	—	3	4	—	4	—	—	—	4	4
0.90	—	—	—	—	—	—	—	—	0	—	0	—	—	3	4	—	4	—	—	—	4	4
0·95	—	—	—	—	—	—	—	—	0	—	0	—	—	3	4	—	4	—	—	—	4	4
1·00	—	—	—	—	—	—	—	—	0	—	0	—	—	3	4	—	4	—	—	—	4	4
1·25	—	—	—	—	—	—	—	—	—	—	—	—	—	3	4	—	4	—	—	—	4	4
1·50	—	—	—	—	—	—	—	—	—	—	—	—	—	3	4	—	4	—	—	—	4	4
1·75	—	—	—	—	—	—	—	—	—	—	—	—	—	3	4	—	4	—	—	—	4	4
2·00	—	—	—	—	—	—	—	—	—	—	—	—	—	3	4	—	4	—	—	—	4	4
2·25	—	—	—	—	—	—	—	—	—	—	—	—	—	3	4	—	4	—	—	—	4	4
2·50	—	—	—	—	—	—	—	—	—	—	—	—	—	3	4	—	4	—	—	—	4	4
2·75	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
3·00	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
3·50	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
4·00	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
4·50	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
5·00	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
5·50	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
6·00	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
6·50	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
7·00	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
7·50	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
8·00	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
8·50	—	—	—	—	—	—	—	—	—	—	—	—	—	2	3	—	4	—	—	—	3	4
9·00	—	—	—	—	—	—	—	—	—	—	—	—	—	2	3	—	4	—	—	—	3	4
10·00	—	—	—	—	—	—	—	—	—	—	—	—	—	1	3	—	4	—	—	—	3	4

increases with the increase of molecular weight by alkyl substitution. By increase of the number of rings in union with each other, the antiseptic value is lowered. Below 270° C., the hydrocarbons are more of the substituted benzene and naphthalene types—above 270° the anthracene substitution products predominate, hence the difference in effect.

Before considering the commercial oils tested, it is well to note that paraffin has practically no antiseptic properties at all.

The coal tar creosotes are very much stronger antiseptics than water gas tar distillates or petroleum residues. The straight creosote is a shade better than Maintenance of Way Specification creosote, owing to its greater tar acid content, and also to its greater content of the oils of best boiling point. Taking tests 1, 20, and 21, it can be seen that water gas tar distillate has only about one-third the efficiency of neutral coal tar oils of the same boiling point, and only one-sixteenth the efficiency of a corresponding straight run creosote. A higher boiling water gas tar distillate, such as No. 22, has practically no antiseptic value whatsoever.

The addition of tar acids to these water gas tar distillates, as seen in tests Nos. 11 and 12, materially improves them, but not up to coal tar creosote. Test No. 23, on heavy petroleum residue, shows that this substance cannot be classed as an antiseptic.

To summarize :—

1. The neutral oils of creosote are strong antiseptics.

Table IIIa.

Effect of antiseptics on Bacillus Subtilis spores (one week).

4—Strong growth. 3—Retarded growth. 2—Slight growth. 1—Trace of growth. 0—No growth.

Per cent.	1	3	4	5	6	7	8	9	10	11	12	13	14	15*	16*	17	18*	19	20	21	22*	23*
0·05	4	2	4	4	4	4	4	4	4	4	4	2	3	4	4	4	4	0	4	4	4	4
0 10	3	0	3	3	3	3	4	2	4	3	4	0	0	4	4	2	4	0	0	4	4	4
0·15	1	0	2	0	0	2	4	0	3	2	4	0	0	4	4	0	4	—	0	4	4	4
0·20	0	—	0	0	0	0	3	0	1	0	3	—	—	4	4	0	4	—	—	3	4	4
0·25	0	—	0	—	—	0	2	—	1	—	3	—	—	4	4	—	4	—	—	3	4	4
0·30	0	—	0	—	—	—	0	—	0	—	1	—	—	4	4	—	4	—	—	2	4	4
0·35	—	—	—	—	—	—	—	—	—	—	0	—	—	4	4	—	4	—	—	1	4	4
0·40	—	—	—	—	—	—	—	—	—	—	0	—	—	4	4	—	4	—	—	0	4	4

* In the case of pure naphthalene, the growth of the spores was "strong" with 0·05 to 2·5 per cent., "retarded" with 2·5 to 7·0 per cent., and none with over 7 per cent. With pure anthracene, pure paraffin, water-gas tar distillate No. 2, and semi-asphaltic petroleum, a strong growth was observed even up to 10 per cent.

Table IV.

Effect of antiseptics on Saccharomyces Glutinis (four weeks).

4—Strong growth. 3—Retarded growth. 2—Slight growth. 1—Trace of growth. 0—No growth.

Per cent.	1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
0·05	4	3	4	4	4	4	4	3	4	4	4	3	0	4	4	3	4	1	3	4	4	4
0·10	4	0	3	3	3	3	2	1	3	3	4	0	0	4	4	0	4	0	0	4	4	4
0·15	3	0	3	3	3	3	1	0	3	1	4	0	0	4	4	0	4	0	0	4	4	4
0·20	0	0	0	2	2	2	0	0	2	0	4	0	0	4	4	0	4	0	0	4	4	4
0·25	0	0	0	0	0	1	0	0	1	0	4	0	0	4	4	0	4	0	0	4	4	4
0·30	0	0	0	0	0	0	0	0	1	0	3	—	—	4	4	—	4	—	—	4	4	4
0·35	0	—	0	—	—	0	0	0	0	0	2	—	—	4	4	—	4	—	—	4	4	4
0·40	0	—	0	—	—	0	0	0	0	0	1	—	—	4	4	—	4	—	—	4	4	4
0·45	—	—	—	—	—	—	—	—	0	—	0	—	—	4	4	—	4	—	—	3	4	4
0·50	—	—	—	—	—	—	—	—	0	—	0	—	—	4	4	—	4	—	—	3	4	4
0·55	—	—	—	—	—	—	—	—	—	—	0	—	—	4	4	—	4	—	—	1	4	4
0·60	—	—	—	—	—	—	—	—	—	—	0	—	—	4	4	—	4	—	—	0	4	4
0·65	—	—	—	—	—	—	—	—	—	—	0	—	—	4	4	—	4	—	—	0	4	4
0·70	—	—	—	—	—	—	—	—	—	—	0	—	—	4	4	—	4	—	—	0	4	4
0·75	—	—	—	—	—	—	—	—	—	—	0	—	—	4	4	—	4	—	—	0	4	4
0·80	—	—	—	—	—	—	—	—	—	—	—	—	—	4	4	—	4	—	—	0	4	4
0·85	—	—	—	—	—	—	—	—	—	—	—	—	—	4	4	—	4	—	—	—	4	4
0·90	—	—	—	—	—	—	—	—	—	—	—	—	—	4	4	—	4	—	—	—	4	4
0·95	—	—	—	—	—	—	—	—	—	—	—	—	—	4	4	—	4	—	—	—	4	4
1·00	—	—	—	—	—	—	—	—	—	—	—	—	—	4	4	—	4	—	—	—	4	4
1·25	—	—	—	—	—	—	—	—	—	—	—	—	—	4	4	—	4	—	—	—	3	4
1·50	—	—	—	—	—	—	—	—	—	—	—	—	—	4	4	—	4	—	—	—	3	4
1·75	—	—	—	—	—	—	—	—	—	—	—	—	—	4	4	—	4	—	—	—	3	4
2·00	—	—	—	—	—	—	—	—	—	—	—	—	—	4	4	—	4	—	—	—	3	4
2·25	—	—	—	—	—	—	—	—	—	—	—	—	—	4	4	—	4	—	—	—	3	4
2·50	—	—	—	—	—	—	—	—	—	—	—	—	—	4	4	—	4	—	—	—	3	4
2·75	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
3·00	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
3·50	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
4·00	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
4·50	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
5·00	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
5·50	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
6·00	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
6·50	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
7·00	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
7·50	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
8·00	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	4	—	—	—	3	4
8·50	—	—	—	—	—	—	—	—	—	—	—	—	—	2	3	—	4	—	—	—	3	4
9·00	—	—	—	—	—	—	—	—	—	—	—	—	—	2	3	—	4	—	—	—	3	4
10·00	—	—	—	—	—	—	—	—	—	—	—	—	—	0	3	—	4	—	—	—	3	4

2. The middle portion of these neutral oils from 235—270° is the strongest, the higher boiling oils are considerably weaker, the lower oils slightly so.
3. High boiling bases of coal tar are strong antiseptics.
4. The coal tar acids are very strong antiseptics, their efficiency rising with the boiling point.
5. The solid hydrocarbons, naphthalene and anthracene, have low antiseptic value.
6. The addition of filtered tar in moderate amounts to creosote does not materially reduce its antiseptic value.
7. Paraffin has no antiseptic qualities.
8. Water gas tar distillates have lower antiseptic value, and in this respect are decidedly inferior to the neutral coal tar oils.
9. Coal tar creosote is in the highest degree superior as an antiseptic preservative to the water gas tar distillates and petroleum residues, used for the same purpose.

mixtures of coal-tar creosote with water-gas tar oil and with petroleum oil, in order to find out to what extent it would be necessary to add coal-tar creosote oil to these oils to impart to them decided antiseptic properties.

Dr. L. H. **Baekeland** said that one point of view had not been touched, namely, in what degree the presence of free phenol or free cresol had a weakening influence on wood-fibre. In some of his experiments, he had been confronted with such a weakening action, which was specially pronounced in wood containing much lignin. It was known that lignin dissolved in phenol or cresol. Pure cellulose stood this action much better. He was not sure that the relatively small amounts of phenols or cresols in creosote oil would have much effect.

Mr. **Howard F. Weiss** asked by what method the oils mentioned were distilled. He thought the statement concerning the use of naphthalene in the preservative treatment of piling was liable to give an erroneous impression. The author stated that oils high in naphthalene had been almost universally used for the treatment of marine timbers and had given highly satisfactory results, and that indicated that naphthalene possessed valuable properties as a preventative of the ravages of the teredo, which properties were somewhat at variance with its low value in preventing fungoid growth. The inference drawn in regard to the efficiency of naphthalene in protecting piling could not very well hold true, because, generally speaking, what was commonly called a high naphthalene oil did not refer to pure naphthalene but to a group of oils which belonged to naphthalene series. Therefore, there would be a marked difference in the toxicity of pure naphthalene and what was commonly called "naphthalene oils" and that results secured on the one could not with accuracy be applied to the other.

Table IVa.

Effect of antiseptics on Saccharomyces pigment (four weeks).

4—Strong growth. 3—Retarded growth. 2—Slight growth. 1—Trace of growth. 0—No growth.

Per cent.	1	3	4	5	6	7	8	9	10	11	12	13	14	15*	16*	17	18*	19	20	21	22*	23*
0·05	0	2	0	0	0	2	0	1	0	1	2	2	0	4	4	0	4	0	0	2	4	4
0·10	0	0	0	0	0	2	0	0	0	1	1	0	0	4	4	0	4	0	0	2	4	4
0·15	—	—	—	—	—	2	—	—	—	0	1	—	—	4	4	—	4	—	—	2	4	4
0·20	—	—	—	—	—	2	—	—	—	—	0	—	—	4	4	—	4	—	—	2	4	4
0·25	—	—	—	—	—	0	—	—	—	—	—	—	—	4	4	—	4	—	—	0	4	4

* A strong growth of the pigment was observed in presence of from 0·05 to 8·0 per cent. of pure naphthalene, and a slight growth with 8·5 per cent. When pure anthracene, pure paraffin, water-gas tar distillate No. 2, and semi-asphaltic petroleum were employed, strong pigment growth was noticed in broth containing up to 10 per cent. of antiseptic.

Discussion.

Mr. **Clifford Richardson** said that the data did not seem to be of practical value, since the conditions under which the experiments had been conducted were quite different from those obtaining in practice. In the treatment of timber, at least 12 lbs. per cubic foot of a preservative was ordinarily injected into the wood, and frequently as much as 20. This would amount, in the case of long leaf yellow pine, to 21·6 to 31·6 per cent. of preservative by weight in the wood. In Mr. Weiss' experiments, the amount in no case exceeded 10 per cent. of the medium on which the cultivation was carried out. It was a great question, as demonstrated by service tests, whether the antiseptic properties of preservatives were their most important properties. Water-gas tar was as satisfactory a preservative as coal tar creosote for the protection of piles against the attacks of the teredo. It had also served satisfactorily for preserving wood conduits underground, and wood blocks for paving purposes.

Mr. C. C. **Tutwiler** said that laboratory tests such as carried out by Mr. Weiss were an unsafe guide in the selection of a satisfactory wood preserving material, as was indicated by the known preservative value of carbolineum, naphthalene, water-gas tar, creosote, and crude petroleum. An explanation of the lack of correlation between laboratory results and practical experience might be due to (*a*) a question as to the relative solubility of the antiseptic employed, in the broth or bouillon, (*b*) a possibility of a reduction of the strength of the antiseptic used, owing to its interaction with the proteids of bouillon or broth, or (*c*) the favourable conditions created for the growth of the fungi, which did not represent practical conditions. The test to be of practical value should be carried out using wood itself as the nutrient, and parallel tests run on the following specimens under moisture and temperature conditions conducive to rapid decay: (*a*) Unsterilised wood, (*b*) unsterilised wood treated with the preservative, (*c*) unsterilised wood inoculated with the organism of decay, (*d*) unsterilised wood inoculated with the organism of decay and treated with the preservative, (*e*) sterilised wood, (*f*) sterilised wood treated as in (*b*), (*c*), and (*d*). Tests should be carried out with varying

Mr. **Sumner R. Church** said that one of the most surprising results of this investigation was the low antiseptic value of pure naphthalene. While there had been a tendency on the part of some authorities, in drawing specifications for creosote oil, to restrict the percentage of naphthalene in the oil, the reason for that tendency had been the belief that naphthalene, owing to its somewhat volatile character, would not remain in the wood as long as the high boiling portions of the oil. It was generally conceded that naphthalene was of value as an antiseptic. Possibly naphthalene had associated with it compounds of high antiseptic value, and a test of crude naphthalene might give results quite at variance with those obtained by Mr. Weiss with pure naphthalene. In this connection it was interesting to note the high antiseptic value of quinoline, as shown in Table Number 17. It had been said that the peculiar odour of crude naphthalene was largely due to the presence of small quantities of quinoline. It would be interesting to determine whether oils naturally high in naphthalene contained higher percentages of quinoline than oils low in naphthalene, and whether, in the preparation of pure naphthalene, the quinoline and other basic bodies were removed when the crude naphthalene was passed through the filter press or centrifugal machine, or whether they remained with the naphthalene until its final rectification. Crude anthracene might also possibly contain antiseptic compounds which left it at some stage of its purification. Of all the crystallisable portions of anthracene oil, only 30 per cent., according to Lunge, were real anthracene. Coal tar creosote itself was of as high antiseptic value as phenol or cresol or quinoline. These substances formed, comparatively speaking, a very small percentage of the oil, and a very large portion of the oil consisted of what the author called "neutral liquid hydrocarbons." Either there were some principles or substances in coal tar creosote of very high antiseptic value that had not yet been isolated or determined, or else the substances that made up the creosote were more actively antiseptic in combination than they were apart. The latter was probably the true explanation.

Mr. J. M. Weiss, in reply, said that Mr. Richardson objected that the largest amount of preservative used in the laboratory amounted to only 10 per cent., and that in practice considerably more was injected into the wood. That did not, to his mind, detract from the usefulness of the tests. The object of the paper was not to say the last word on wood preservation, but merely to consider one phase of the subject, namely, the comparative antiseptic value of the oils. It was by no means an assured fact that after some years all the preservative that was originally put in the wood remained there. Therefore, although the first amount might have been sufficient to resist growth, yet, in time, the wood might become susceptible to the attacks of fungi. Moreover, mixtures of over 10 per cent. were not practical to make in the laboratory.

Mr. Tutwiler had taken the results of the Santa Fé test as final. Substances without antiseptic action and used in the maximum amount might, under certain circumstances, act efficiently as a preservative. However, such experiments had not been tried under sufficiently varying conditions to give any conclusive evidence of their general preservative value. Substances which depended only on antiseptic action for their preservative value, such as zinc chloride, etc., gave excellent preservative results. This indicated that antiseptic action was a very important, if not essential, characteristic of a material to be used for general preservation work. As to high naphthalene oils preventing the ravages of the teredo, the case of the teredo and that of wood destroying fungi were in no sense similar, since the teredo was an animal organism, while the fungi were of a vegetable nature, and the material that acted as a deterrent to the animal did not necessarily inhibit vegetable organisms. The statement, that the only essential difference between coal tar creosote and water gas tar distillates was the phenolic content of the former, did not accord with the fact that, in comparing a water gas tar distillate with a neutral coal tar creosote of the same boiling point, they found differences in physical properties such as specific gravity, chemical properties, such as solubility in strong sulphuric acid, and antiseptic properties, as shown in the result of the tests presented. Dr. Baekeland's question, as to whether the presence of phenolic bodies in creosote might injure the strength of the treated timber, was very well answered in Bulletin 39 of the Forest Service, U.S. Department of Agriculture, where it was shown conclusively that there was no considerable influence on the strength of timber by treating timber with creosote. The distillation method employed in the testing of the various oils used was the standard method of the American Railway and Maintenance of Way Association.

Sydney Section.

Meeting held at Sydney on Wednesday, September 20th, 1911.

MR. T. STEEL IN THE CHAIR.

RECENT WORK ON THE AUSTRALIAN PINES.

BY HENRY G. SMITH, F.C.S.

In Australia and Tasmania a considerable proportion of the native trees belong to the natural order *Coniferæ*, the following genera being represented:—*Callitris*; *Actinostrobus*; *Diselma*; *Microcachrys*; *Athrotaxis*; *Araucaria*; *Agathis*; *Dacrydium*; *Pherosphæro*; *Phyllocladus*, and *Podocarpus*. Next to the eucalypts these "pine" trees are, perhaps, of the greatest economic importance, as they are extensively utilised in one way or another in works of construction, for cabinet work and similar uses, and a considerable industry has been, and is carried on with these timbers. It will be noticed that the above list of genera does not include the genus *Pinus*, and not a single representative of this genus has been found either in Australia or Tasmania, nor any other member of the *Abietineæ*. For this reason some objection has been offered to the use of the name "pine" for these Australian trees, but it is the universal custom among the Australian people so to speak of them, and the terms "white pine," "black pine," "hoop pine," "Huon pine," "brown pine," "King William pine," etc. are applied generally to the respective trees in those parts of the country where they occur, and these local names are used with considerable uniformity, so that it is hardly likely that any suggestion in the direction of the use of a new name for these trees would be generally acceptable.[*]

The possible economics of the Australian coniferous trees, other than for timber, was not known, and it was with the endeavour to ascertain, as far as possible, their commercial possibilities in new directions that an extensive research was undertaken. The collection of representative material, for these investigations, from trees extending over such an enormous territory was a task of some magnitude, and naturally the work has taken many years to complete. To enable the synonymy of the various species of *Callitris* alone to be cleared up, necessitated my botanical colleague, Mr. R. T. Baker, F.L.S., visiting all the European herbaria where original specimens are preserved, and no trouble was spared to assure, as far as possible, that the chemical data were obtained from authentic botanical material.

The results of that research were published last year in an extensively illustrated monograph of nearly 500 pages,[†] and it is the chief points of chemical interest which were the outcome of the work, that I purpose now bringing under your notice.

The amount of chemical work necessary in an undertaking of such magnitude was very considerable, but the difficulty of obtaining material in such a sparsely settled country as Australia, and the distances from which material was often received (in some instances several thousands of miles), naturally cause the work and conclusions in some instances to be somewhat incomplete, and much more chemical research is needed to clear up the doubtful points yet remaining. The knowledge concerning the possible economics of this large group of Australian trees has, however, been considerably extended by the work, and the open spaces can be filled in later as opportunity offers.

Order of sequence with the Callitris.

In the work dealing with the eucalypts[‡] it was shown that a remarkable agreement existed between the botanical and chemical characters of the several species, and it was possible, from the data obtained, to group them, and to fairly well arrange the species of these groups in some order of sequence. With the Australian pines the genus containing the most species is *Callitris*, but even in this only 18 species were determined as distinct, so that with this limited number it was hardly possible to tabulate the gradations so completely as was the case with 110 distinct species of *Eucalyptus*. The corresponding botanical characters in *Callitris*, suitable for arrangement on a phyto-chemical classification, were largely microscopic, and therefore, not so easily detected as the macroscopic features of the eucalypts, but even with these restrictions it was possible to arrange the several species of *Callitris* in some order of sequence, based on their botanical and chemical characters. It was found that in this way the *Callitris* divided themselves fairly well into 3 groups :—

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[*] *Agathis robusta* is not spoken of as a "pine," but is known generally as "Queensland kauri."

[†] "A Research on the pines of Australia," by R. T. Baker and H. G. Smith, Government Printer, New South Wales, June, 1910 (see this Journal, 1910, 1276).

[‡] "A Research on Eucalypts, especially in regard to their essential oils," by R. T. Baker and H. G. Smith, Government Printer, N.S.W., 1902. See also this Journal, August 15, 1907.

(*a*) Species with more or less tuberculate fruits and a convex dorsal leaf surface. In the leaf section of these, stone cells are mostly absent, and the predominant limonene in the leaf oils is dextro-rotatory.

(*b*) Species with smooth fruits generally, and angular or rounded dorsal leaf surface. In these the stone cells are in excess of those of the first group, and the predominant limonene in the leaf oils is lævo-rotatory.

(*c*) Species with smooth fruits generally, and angled dorsal leaf surface. In these the stone cells occur plentifully distributed in the leaf tissue, and the principal terpene is pinene.

The maxima of the rotations of the limonenes in the *Callitris* is reached by slow degrees through the several species. The highest dextro-rotation is found in *C. arenosa*, a species growing on the eastern side of the continent, and the maximum lævo-rotation in *C. intratropica*, a species growing on the western and northern parts of Australia. One important result brought out by these researches is the remarkable constancy both in botanical and chemical characters with identical species of *Callitris*, and this result supports very strongly those previously obtained with the eucalypts. It seems conclusive that work undertaken with *naturally growing plants*, based on such principles, is of the greatest help towards clearing up doubtful points in systematic classification, and although the various chemical constituents with the *Callitris* are somewhat general for the whole group, yet they differ in amount with each well defined species, and seem to be characteristic for that particular species wherever it occurs, and some species have a very wide geographical range. It seems, therefore, that the chemical products, manufactured by individual species, grown under natural conditions, have a considerable systematic value, so that their study becomes of importance towards aiding correct classification. Well defined chemical constituents in these plants are as systematically valuable as their morphological characters, and when all available evidence is correlated, the species so founded will be established with much stability. This is particularly well exemplified with the various species of *Eucalyptus*, and the fact is, at the present time in Australia, of considerable economic importance.

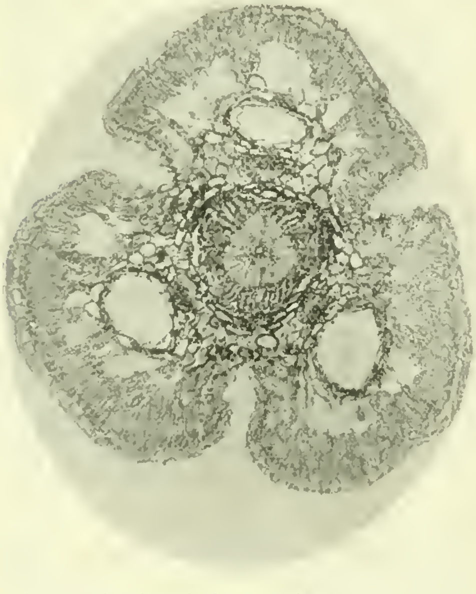
As an illustration of the comparative constancy of the leaf oils of the *Callitris* growing over a considerable area, and collected during several years, the following table is given. The data were obtained with the material of a species having a most extensive range, and the investigation was carried out to assist in deciding this question of chemical uniformity.

Crude leaf oils of Callitris glauca from New South Wales.

No.	Locality and date.	Sp. gr. °C.	Rotation α_D	Refractive index °C.	Ester per cent.	Yield per cent.
1	Narrandera, 25/4/07	0·8729 at 18	+ 27·9°	1·4747 at 18	16·46	0·562
2	Boppy Mountain, 25/5/03	0·8665 ,, 18	+ 31·3°	1·4779 ,, 19	11·966	0·616
3	Trangie, 28/11/02	0·8631 ,, 24	+ 30·8°	1·4755 ,, 20	12·76	0·610
4	Wellington, 17/3/03	0·8659 ,, 17	+ 28·4°	1·4774 ,, 19	12·103	0·635
5	Bylong, 2/5/03	0·8657 ,, 19	+ 31·25°	1·4749 ,, 19	13·274	0·569
6	Tamworth, 3/3/08	0·8665 ,, 24	+ 25·2°	1·472 ,, 24	14·07	0·563
7	Nyngan, 20/12/99	0·8782 ,, 24	+ 22·7°	1·4774 ,, 19	14·21	0·532

Many of these localities are hundreds of miles apart. Taken in conjunction with the constituents, and the botanical characters of the tree, there is no other species of *Callitris* with which these results might be confounded, and the species may, therefore, be considered as definite. The yields of oil were determined from material collected as would be done for commercial distillation.

PLATE 1.



Cross section through decurrent leaves and branchlet of Callitris, with one oil gland in each leaf. Diameter of 6 cm. equals 80 magnification.

General appearance of the leaves of Callitris species. Natural size.

Leaf oils of the Callitris.

These may be classed as "pine-needle oils," and generally their constituents fairly well agree with the class of oils distilled from the fresh needles, twigs, and cones of genera belonging to the *Abietineæ*. The leaf oils or "pine-needle oils" of the *Callitris* contain both active forms of pinene; both active forms of limonene with dipentene; dextro-rotatory borneol and its acetic acid ester; and geraniol and its acetic acid ester. An ester of terpineol, the acid of which is probably butyric, is present in some species, if not in traces in all. Indications of the presence of either sylvestrene, phellandrene, or cineol were not detected in any of the oils.

The most remarkable feature of these leaf oils, and one which distinguishes them from those of the *Abietineæ*, is the marked presence of geraniol and its ester, which, occurring in traces at first, continues to increase in amount through the several species, until at last over 60 per cent. of geranyl acetate, together with about 14 per cent. of free geraniol, are present in the leaf oil of *C. Tasmanica* (the "Oyster Bay pine" of Tasmania, and the corresponding tree of the highlands of New South Wales). It is worthy of notice, too, that as the geranyl acetate increases in amount it pushes out, as it were, the bornyl acetate, until *C. Tasmanica* is reached, in which species it is doubtful if a trace of that ester remains.

The *Callitris* being endemic to Australia, probably explains this peculiarity, and *C. Tasmanica* is the third plant growing in Australia in which over 60 per cent. of geranyl acetate occurs in the leaf oils, the other two being *Eucalyptus Macarthuri* and *Darwinia fascicularis*. When following the increase of geranyl acetate in these oils, the knowledge that this ester is entirely saponified in the cold in two hours with semi-normal alcoholic potash was most helpful, and by this method it was possible also to show after acetylation that the free alcohol, in some species, was geraniol.

The several constituents in *Callitris* leaf oils continue to increase with each well defined species, until a maximum is reached in one of them. The maximum dextro-rotatory pinene occurs in *C. Drummondii*, a Western Australian species, and has a very high specific rotation, $[\alpha]_D+49{\cdot}77°$. The lævo-modification increasing in the other species reduces this activity until with *C. Muelleri*,—a Sydney species—the pinene is only slightly dextro-rotatory.

The dextro-rotatory limonene is at its maximum in *C. arenosa*, a New South Wales and Queensland species, where it occurs with dipentene, and not less than 85 per cent. of the oil of this species consists of the limonenes. The limonenes also occur in considerable amount in the oil of *C. intratropica*, a species of Northern Australia, although in this the predominant form is lævo-rotatory.

Borneol increases in the same ratio but not to the same extent as does the geraniol, and it usually occurs in the form of ester; free borneol is only found to a small extent in any of the species, and the lævo-rotatory form does not seem to occur. A remarkable peculiarity with some *Callitris* species is that the oil from the fruits has a

Table of results with the crude oils of several species of Callitris.

Species.	Locality.	Specific gravity °C.	Rotation α_D	Refractive index °C.	Ester per cent. by boiling.	Ester per cent. by cold saponification.	Yield of oil per cent.	Chief constituents.
C. robusta	Western Australia	0·8825 at 15	+ 10·3	1·4752 at 19	17·35	7·97	0·261	Dextro-rotatory pinene, limonene, and dipentene, Bornyl and geranyl acetates
C. verrucosa ...	Shuttleton, N.S.W.	0·8596 at 23	+ 44·2	1·4809 at 20	3·13	—	0·331	Same as with *C. robusta*, but pinene higher rotation
C. propinqua ..	South Australia	0·8662 at 19	+ 32·4	1·4752 at 19	12·2	8·84	0·41	Similar to *C. glauca*
C. arenosa	Ballina, N.S.W...........	0·8491 at 23	+ 35·8	1·4760 at 23	5·17	—	0·402	Dextro-rotatory limonene and dipentene Bornyl and geranyl acetates
C. intratropica .	Port Darwin	0·8481 at 22	— 21·6	1·4768 at 22	3·81	—	0·11	Lævo-rotatory limonene and dipentene Esters as above
C. calcarata	Western New South Wales.	0·8949 at 17	+ 11·7	1·4747 at 19	46·58	39·4	0·168	Dextro-rotatory pinene, limonene and dipentene Bornyl and geranyl acetates
C. rhomboidea ..	Sydney, N.S.W.	0·8826 at 22	— 19·2	1·4747 at 25	30·43	29·78	0·033	Pinene, lævo-rotatory limonene, and dipentene Geranyl acetate
C. Tasmanica ..	Tasmania	0·8976 at 15	— 5·8	1·4739 at 15	62·75	62·2	0·208	As with *C. rhomboidea*
C. Drummondii	Western Australia	0·8591 at 17	+ 42·2	1·4739 at 19	1·85	—	0·547	Dextro-rotatory pinene, and both esters
C. Muelleri	Sydney, N.S.W.	0·8582 at 24	— 4·7	1·4749 at 20	2·76	—	0·103	Dextro-rotatory pinene, lævo-rotarory limonene and dipentene; both esters
C. oblonga......	Tasmania	0·8735 at 16	+ 38·1	1·4783 at 16	6·05	5·6	0·054	Dextro-rotatory pinene, ester mostly geranyl acetate
C. Macleayana..	Eastern New South Wales	0·8484 at 20	+ 42·5	1·4791 at 20	3·5	3·2	0·172	Dextro-rotatory pinene Dextro-rotatory limonene and dipentene Dextro-rotatory methene ? Geranyl acetate
C. gracilis......	Rylstone District, N.S.W. .	0·8683 at 20	+ 8·6	1·4752 at 20	12·1	—	0·723	Dextro-rotatory pinene Lævo-rotatory limonene and dipentene Esters of borneol, geraniol, and terpineol

rotation in the opposite direction to that from the leaves, even if collected from the same tree. This is particularly the case with *C. robusta* of Western Australia, and *C. verrucosa* of New South Wales (both species having warted fruits). Is it that the formation of resinous bodies in these fruits draws more largely on one active form than on the other? It seems so, particularly as with most other species there are no differences found. The tendency of the crude oils of some species, particularly of the group of which *C. glauca*, the "white pine" of New South Wales, is the type, to deposit resinous bodies on keeping is most marked, and after some time a thick coating of a difficultly soluble resin attaches itself to the bottles. This formation of resin appears to be more a case of polymerisation than oxidation, but this has not yet been settled. Its formation, however, influences the solubility in alcohol of these crude oils, thus rendering this test of but little analytical value. Those oils richest in limonene, and the geraniol oils, do not deposit this resin, so that this feature may perhaps largely account for the differences in solubility in alcohol of the several sandarac resins of the *Callitris*.

Sesquiterpenes, phenols, and allied bodies are not pronounced in these oils, and aldehydes seem to be quite absent.

The peculiar disposition of the oil glands in the leaf structure of *Callitris* species, as shown by the accompanying photograph of the three combined leaves in section, makes the extraction of the oil more difficult than with eucalyptus leaves, and it was necessary to distil for 5 or 6 hours under low pressure steam before all the oil was obtained. This is evidently due to the hidden nature of the oil glands or cavities, which as a rule are situated in the upper portion of the decurrent section.

The ester content in the several oils is a much more constant feature than is the rotation of the terpenes,—particularly limonene—because at certain times one active form is more pronounced than the other, but the general physical characters are not influenced to any great extent by this particular activity of the predominant terpene. The preceding table gives the general results of the oils of the several species, some of which are the mean from different localities. The figures for *C. glauca* are tabulated above. The results by cold saponification are a fair indication of the amount of geranyl acetate present in the oils of particular species.

Leaf oils of genera other than Callitris.

The accompanying series of photographs will show, natural size, the leaf forms characteristic of the following six genera.

The genus *Actinostrobus* of Western Australia is closely related to *Callitris*. The leaf oil of the species *A. pyramidalis* (0·256 per cent.) consists very largely of dextro-rotatory pinene, and limonene appears to be quite absent. The specific rotation for the pinene of this oil is very high, $[\alpha]_D+51{\cdot}64^\circ$. There was 7·6 per cent. of ester, of which 6·93 per cent. was saponified in the cold; geranyl acetate was, therefore, suggested. This indication was followed up in the portion boiling above 215° C., and the alcohol was shown to be largely geraniol.

"King William pine," *Athrotaxis selaginoides*, a tree growing in Tasmania, yielded a leaf oil in small amount (0·076 per cent.), which consisted very largely of dextro-rotatory limonene. This had a very high specific rotation $[\alpha]_D+112{\cdot}2^\circ$. Dipentene was absent, and the tetrabromide prepared from two fractions melted at 104° C. The amount of ester calculated as bornyl acetate was 3 per cent.

Of the two *Araucarias*, only the leaves of the species *Cunninghamii* yielded oil, and even this was very small in amount, only 0·005 per cent. It appeared to consist largely of high boiling terpenes, and contained 1·54 per cent. of ester, calculated as bornyl acetate. The crude oil was insoluble in 10 volumes of 90 per cent. alcohol.

The leaves of the "Huon pine" tree of Tasmania, *Dacrydium Franklini*, yielded 0·5 per cent. of a volatile oil, but little coloured, and quite devoid of both ester and free acid. The methyl ether of eugenol was present, although eugenol itself appeared to be quite absent. The principal constituent seems to be a previously undetected terpene of the $C_{10}H_{16}$ formula. It readily forms a nitrosochloride, melting sharply and with decomposition at 120°—121° C., which is a considerably higher temperature than the melting point of a similar compound with any previously known terpene. As it occurs together with a small quantity of lævo-rotatory pinene and dextro-rotatory limonene, it was not possible to procure it absolutely pure by distillation, and considerable more work will of course be needed. If subsequent researches show it to be new, the name "Dacrydene" has been suggested for it. It is a colourless, very volatile liquid; and the purest product obtainable boiled at 165—166° C.; had specific gravity at 22°/15° C.=0·8524; and a specific rotation $[\alpha]_D+14{\cdot}48$. The odour was less pungent than pinene and more aromatic.

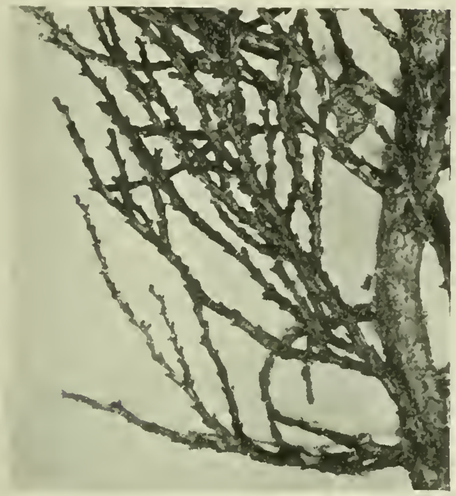
The leaves of the dwarf conifer found on the Blue Mountains of New South Wales—*Pherosphæra Fitzgeraldi*—yielded 0·108 per cent. of a volatile oil, which consisted largely of dextro-rotatory pinene, probably a little limonene or dipentene, and the sesquiterpene cadinene, the latter in some quantity. The amount of ester was very small, practically only in traces. The characteristic compound for cadinene was obtained. The crude oil was not soluble in 10 volumes of 90 per cent. alcohol.

The "celery top pine" of Tasmania—*Phyllocladus rhomboidalis* has a peculiar foliage, the true leaves being like minute bracts, and in the life history of the plant are practically superseded by cladodia. The oil from this portion of the tree is thus of special interest. The yield of oil from material collected as for commercial distillation was 0·215 per cent. It was of a light lemon-yellow colour, was very mobile, and contained but a very small quantity of ester, as the saponification value was only 1·5. After acetylation the saponification value was only 4·5, so that the amount of alcohol present was very small, and it was not possible from the material available to determine its identity. The principal constituent of the oil is lævo-rotatory pinene, and this appears to be the only $C_{10}H_{16}$ terpene present; practically pure pinene can be obtained in quantity from the crude oil by fractional distillation alone. Besides a small quantity of what was probably a sesquiterpene, the oil contained about 3 per cent. of a stearoptene of a peculiar nature. It was somewhat readily obtained pure, by first spreading the residue, after the removal of the terpene, on porous plates for some days, and until quite white. It was then dissolved in hot alcohol, from which it separates on cooling, and afterwards in chloroform, and precipitated by the addition of alcohol. This process was repeated until it was pure. It also readily dissolved in ether, benzene, and petroleum ether. It was a pure white crystalline substance and melted at 95° C., was dextro-rotatory, $[\alpha]_D+16{\cdot}06^\circ$, and had the formula, $C_{20}H_{32}$. The name "phyllocladene" has been suggested for it. Letts (Ber., 13, 793—796) obtained a crystalline substance by treating pinene hydrochloride with sodium, which had the formula, $C_{20}H_{34}$, and melted at 94° C.; and Etard and Meker (Comptes rend., 1898, 126, 526—529) also prepared a substance in a similar manner, which melted at 75° C. and had a specific rotation, $[\alpha]_D+15^\circ{\cdot}27'$. Although these products agree in some respects with phyllocladene, yet, analyses of this substance did not indicate 34 hydrogen atoms. The results pointed to it being a solid diterpene, and as pinene was the only terpene present it is suggested that this stearoptene is derived from two molecules of pinene.

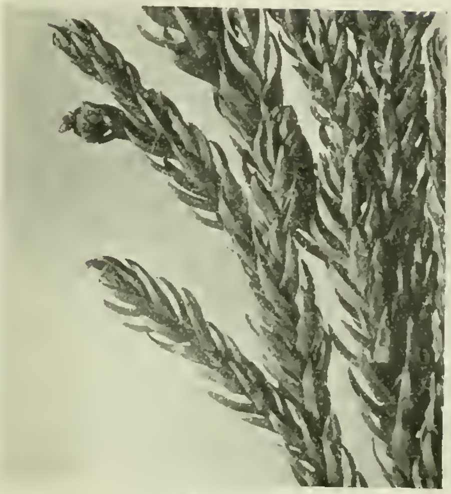
Callitris timber products.

The timber of the *Callitris* trees of Australia is of considerable economic importance, particularly in the interior of the country, where it is largely used for buildings and other purposes. The great value of this timber consists largely in its remarkable resistant properties against the ravages of the termites (white ants), which are great pests in certain parts of Australia. The reason for this immunity is evidently due to the presence in the wood of certain chemical constituents, of which guaiol (a sesquiterpene alcohol) and a phenol are the most important. The wood itself has quite a characteristic and pleasant odour, quite distinct from that of any other timber, and this feature is due entirely to the phenol. Guaiol is

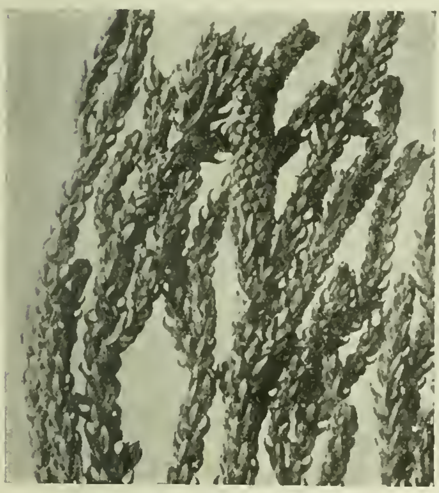
PLATE II.



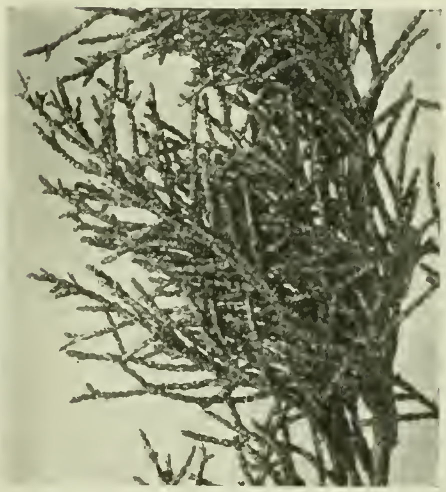
Actinostrobus pyramidalis.



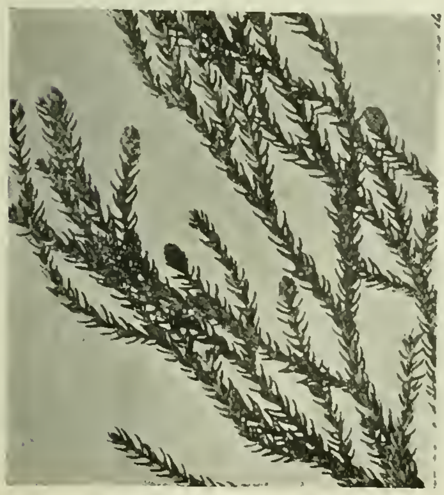
Athrotaxis selaginoides.



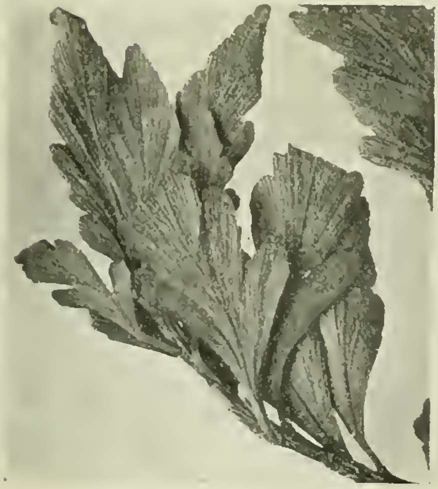
Araucaria Cunninghamii.



Dacrydium Franklini.



Pherosphœra Fitzgeraldi.



Phyllocladus rhomboidalis.

sometimes present in sufficient quantity to enable it to naturally form crystals on the surface of the freshly cut timber. Guaiol was isolated from the oil of guaiac or guaiacum, first prepared commercially by Schimmel und Co., and suggested as a perfumery oil. This oil was distilled from the wood of *Bulnesia sarmienti*, a tree belonging to the N. O. *Zygophyllaceæ*, and known as "Palo balsamo" in Argentina. Guaiol thus occurs in plants so far removed as the *Coniferæ* of Australia and the *Zygophyllaceæ* of South America. It was prepared from the *Callitris* by steam distilling the finely divided wood during several hours. A semi-solid product was thus obtained, which was squeezed through cloth, and most of the crystallised guaiol was thus retained. It was then pressed in absorbent material, and the solid cake repeatedly crystallised from alcohol until pure. The crystals melted at 91° C., were lævo-rotatory $[\alpha]_D - 29°$, and when heated with zinc chloride gave the characteristic blue oil. Analysis showed the formula to be $C_{15}H_{26}O$. Other confirmative tests also agreed with those obtained at the same time with a sample of the original guaiol kindly sent by Schimmel und Co. The somewhat thick and viscous liquid squeezed from the guaiol contained the phenol, and the characteristic odour of the pine wood was most pronounced. Perhaps eventually this oil may be of commercial use in the preparation of substances in which this agreeable and persistent odour is desired. This phenol somewhat resembles carvacrol in appearance, but its reactions, odour, etc. are quite distinct from that substance. Its colour reactions are most pronounced and distinctive. The name "callitrol" has been suggested for it. It seems to be a constant constituent in all *Callitris* timbers, and has been isolated from the most unpromising member of the group, *C. Macleayana*.

The oil of "Huon pine" timber.

The timber of this useful Tasmanian tree, *Dacrydium Franklini*, has a pleasant aromatic odour, so an attempt was made to determine the odoriferous constituent. The crude oil, obtained by steam distilling, for several hours, the finely divided wood, was heavier than water, slightly coloured a yellowish tint, and had an odour indicative of methyleugenol. It was soluble in an equal volume of 70 per cent. alcohol. The specific gravity of the crude oil at 18° C. was 1·035; the rotation $a_D = -1·4°$ and refractive index 1·5373 at 23° C. Both esters and free acid were almost absent, and the saponification number for both together was only 3·1. On distillation no less than 86 per cent. of the total oil came over between 245°—252° C. The analysis of this portion, together with the physical results, the formation of the characteristic bromide, as well as veratric acid on oxidation, showed this portion to consist principally of the methyl ether of eugenol. The results obtained by Zeisel's method with the crude oil indicated that the greater portion consisted of substances with methoxy groups. That the odoriferous principle in "Huon pine" timber is largely methyleugenol was confirmed later, and quite independently, by Schimmel und Co. (Semi-annual Report, Oct., 1910).

Tanning value of Callitris barks.

Although the tannins in the barks of the various species of *Callitris* are usually in agreement with those found in conifer barks of other countries, yet there is considerable variation in the amount of tannin deposited in the barks of the several species, and the chemical results obtained with the tannin in the bark of *Callitris calcarata* ("Black" or "Mountain pine") differ considerably from those of most other species. The reactions of the tannin in the bark of *C. calcarata* are more closely in agreement with those given with the tannin in "Wattle bark," *Acacia* spp., and thus distinguish this bark from that of its congeners. With copper sulphate and ammonia in excess the dense precipitate first formed with the tannin of *C. calcarata* is not dissolved. This is distinctive from the similar reaction with the tannin of *C. glauca* ("White pine"), as the copper salt with the tannin of this species almost entirely dissolved in excess of ammonia. This reaction seems characteristic for the barks of these two trees when they alone are considered, and is a means of distinguishing between them. The tannins in the barks of the other species of *Callitris* are more in agreement with that of *C. glauca* than with that of *C. calcarata*, except perhaps the tannin of *C. arenosa*, which is intermediate between the two. The bark of *C. calcarata* often contains an abundance of an excellent tannin, and as much as 31 or 32 per cent. has been determined in the air-dried bark. As this species usually occurs in hilly country, often growing abundantly on stony ridges of little value for agricultural purposes, and extends over hundreds of square miles of country, it is not difficult to imagine the possibility of easily establishing a permanent plantation of this particular species of *Callitris* for the use of the tanner, as well as for the preparation of "pine needle oil" rich in ester, and for sandarac resin. The secretions of the barks of the *Callitris* are resinous in nature, and for this reason the non-tannin extractive material is at a minimum. As far as investigations have extended there appears to be some diversity in the amount of tannin deposited in the bark of this species under different conditions of soil and location, and efforts will be made to determine the reasons for the deficiency in some cases.

The bark of the most widely extended species, *C. glauca*, does not appear to contain more than about 14 per cent. of tannin in the air-dried bark under the most favourable conditions, but the bark is obtainable in large quantity, which at present is going to waste, so that the possibility of utilising this and similar barks in the preparation of tanning extracts readily suggests itself. The barks of *Callitris* are easily stripped at the proper time of the year, so that the material should be procured cheaply. The tannins are mostly light in colour, and their action on hide rapid and complete. They belong to the catechol group. The following analyses were made with the modern official chromed hide power method, and are for the air-dried barks. A fair section through the whole bark was taken. It will he noticed that all but three were from New South Wales.

			per cent. tannin
C. calcarata,	collected	in June at Warialda.....	30·9
,,	,,	in May at Woodstock ..	31·2
,,	,,	in July at Wyalong	25·2
,,	,,	in March at Grenfell ...	19·0
C. arenosa	,,	in June at Ballina	25·1
C. glauca	,,	in March at Narrandera	14·6
,,	,,	in April ,,	14·6
C. Tasmanica	,,	in Tasmania	17·3
C. propinqua	,,	in South Australia ...	12·6
C. gracilis	,,	at Rylstone	12·3
C. intratropica	,,	at Port Darwin	10·7

The remaining species contained less tannin, or were restricted in area.

The exudations of the Callitris.

The similarity between the sandarac resins of the *Callitris* of Australia and the North African sandarac obtained from *Tetraclinis quadravalvis* has long been known, and Dr. T. A. Henry, in an extensive research on *Callitris* resins (Journ. Chem. Soc., 1901, 1144), demonstrated their relationship chemically. Dr. Henry, however, in adopting the generally accepted idea in Europe that the commercial Australian sandarac was derived from *Callitris verrucosa* was hardly correct, and the same may be said of the statement by Tschirch ("Die Harze und die Harzbehalter," p. 535). *C. verrucosa*, named by Robert Brown about 100 years ago, was one of the first species of this genus discovered. It is practically an inland species and thus difficult of access, is usually a low shrub or stunted tree, but botanically quite a distinct species. The general idea, too, that the Australian sandarac is less soluble in alcohol than the African, does not apply to the resin of *C. verrucosa*, as the sandarac of this species is more readily soluble in alcohol than the African. Some few years ago, when the labour conditions in Australia were not good, a considerable amount of Australian sandarac was collected, and much of this was shipped from Sydney. In the counties of Brisbane, Wellington, and Ashburnham, in New South Wales, particularly, the collecting of this resin was a means of assistance to many families, who sold the resin in small lots to people in the neighbouring towns, for which they obtained from 2d. to 3½d. per pound, according to quality, or say at an average of about 25s. per cwt. Systematic collecting was also undertaken at that time, and I am acquainted with one gentleman who undertook to supply two tons of the resin in one consignment. Practically the whole of the resin collected by these people was from *C. calcarata* and *C. glauca*, the greater portion from the former species. There is little doubt that the material spoken of by Dr. Henry was also obtained from these species, because he mentions the larger sized tears and the less solubility in alcohol, characters peculiar to the resin of these two species. There are very many tons of this resin going to waste every year in New South Wales alone, and it would perhaps not be difficult to build up a trade with this sandarac if those who use it are prepared to pay a fair price, and to create a constant demand. When *C. calcarata* comes to be systematically cultivated the resin will then be collected as a by-product. Up to the present time no method has been successfully devised to cause the exudation to flow as an oleo resin, and only the naturally exuded tears have been collected. The specific gravity of ordinary hard sandarac resins from the various *Callitris* species ranges between 1·079 to 1·069 at 16° C. They are all dextro-rotatory when dissolved in acetone, as is also the African sandarac, and the resins of all the other species are more soluble in alcohol than are those of *C. glauca* and *C. calcarata*.*

The exudations of the Araucarias.

The exudation of *A. Cunninghamii* contains both gum and resin, as well as volatile oil, nitrogenous products, and a substance which contains manganese as a constant constituent, while that of *A. Bidwilli* has, broadly, the same constituents but in very different proportions. Heckel and Schlagdenhauffen (Comptes rend., 105, 359) pointed out that as a general rule the exudations of the *Araucarias* contained gum as well as resin. That a gum was present in the exudations of the Australian representatives of the genus was also previously known. The investigations recently carried out, however, showed that whereas the freshly procured exudation of *A. Cunninghamii* could be collected in a semi-fluid condition, containing 3·8 per cent. of volatile oil, 47 per cent. of resin, and 8 per cent. of gum, that of *A. Bidwilli* could only be collected in the condition of a rapidly hardening gum, which contained only 2·2 per cent. of volatile oil and resin combined, the remainder being almostly entirely gum. The freshly obtained gum of *A. Bidwilli* does not appear to be identical with that of *A. Cunninghamii*, as the former is readily changed, when in aqueous solution, into an insoluble form by agitating with ether, while that of the latter is not so changed. The gum-like exudation of *A. Bidwilli* was amber-coloured, and in appearance resembled some forms of "Wattle gum" (Acacia sp.). It was semi-transparent, brittle, bright in the fracture, very adhesive, and slightly aromatic. It dissolved somewhat readily in water to a turbid, slightly acid solution, and formed a dense precipitate on addition of excess of alcohol, which precipitate, after drying, was again readily soluble in water. The gum of *A. Bidwilli* gave 17·5 per cent. of mucic acid, while that of *A. Cunninghamii* gave 23 per cent., calculated on the air-dried gum. The volatile oil, steam distilled from the diluted exudation of *A. Cunninghamii*, was a colourless, volatile liquid, having a slightly aromatic odour, and recalling perhaps that of the hydrocarbon menthene. The specific gravity at 22° C. = 0·8058; refractive index at 22° C. = 1·457; rotation, $\alpha_D + 3{\cdot}2°$. These results indicated other bodies than terpenes. By fractional distillation a portion was eventually obtained which was a colourless, very volatile liquid boiling at 154°—155° C.; specific gravity at 19° C. = 0·7927; refractive index at 19° C. = 1·4437; was inactive to light, and when dissolved in chloroform and a chloroform solution of bromine added the bromine was not readily absorbed. From these results, together with those of analysis, a saturated hydrocarbon of the formula $C_{10}H_{20}$ was indicated as being present in this exudation. It has been suggested that hexahydrocymene is not found naturally (Heusler, p. 18), and that statement may perhaps still be true if restricted to ordinary essential oils as obtained from the leaf portion of the tree, or from fruits. The material of *A. Cunninghamii*, 680 grams, upon which this research was undertaken, was collected from the stumps of trees recently felled, and had been forced up by root pressure, so that its constituents had been subjected to little alteration at the time of collection. The free volatile acids in the exudation equalled 0·134 per cent. and consisted of both butyric and acetic. The gum boiled out of the exudation and precipitated by alcohol was equal to 8 per cent.; it differed but slightly from that of ordinary gum arabic. The amount of resin from 680 grams of exudation was 320 grams, equal to 47 per cent. It was entirely soluble in 80 per cent. alcohol, and also in acetone, was lævo-rotatory, had specific gravity at 16° C. = 1·061, and an acid number 107. In colour and appearance it much resembled sandarac resin from *Callitris*. It consisted, besides neutral bodies, of two resin acids:—

(*a*) A crystalline one, named "dundathic" acid (14·5 per cent.), melting at 234°—235° C., and having a formula $C_{21}H_{32}O_3$; it was dextro-rotatory, the specific rotation being $[\alpha]_D + 55°$; was practically insoluble in both chloroform and ether, and also in alcoholic potash. (The same resin acid also occurs in the exudation of *Agathis robusta*.)

(*b*) An acid melting when first prepared, at 84°—85° C., present to the extent of over 60 per cent.; was lævo-rotatory $[\alpha]_D = -11{\cdot}25°$; was soluble in the cold in 70 per cent. alcohol; had the formula $C_{20}H_{30}O_2$; and was soluble in alcoholic potash. The neutral bodies had a bitter taste, were strongly lævo-rotatory, and in this respect agreed with the acid of low melting point. The nitrogenous bodies (0·5 per cent.) contained 2·94 per cent. of nitrogen. The manganese compound was almost entirely precipitated with the gum, and it was the darkening of this precipitate as it dried that led to the discovery that manganese is a common constituent in the members of the Australian *Coniferæ*.

The exudations of Agathis robusta.

The freshly exuded oleo-resin of this tree, usually known as "Queensland kauri," was of the consistency of honey and contained a considerable amount of an essential oil. A gum, similar in composition to that of *Araucaria Cunninghamii*, although less in amount (2·37 per cent.) was present. A manganese compound was also detected, and the gum precipitate on drying became considerably darker in colour, through the oxidation of the manganese, than was the case with the corresponding precipitate of *A. Cunninghamii*. Nitrogenous substances were also present, as well as 0·62 per cent. of reducing sugars. The free volatile acids were butyric and acetic, and were present in about the same amount as found in *Araucaria*. The volatile oil, obtained by steam distilling the diluted oleo-resin, consisted almost entirely of pinene, and this steam distilled product may be considered to be an excellent "oil of turpentine." It was present in some quantity (about 14 per cent. by volume). This tree appears to be the only Australian conifer from which "oil of turpentine" agreeing in odour and composition with the commercial article can be distilled. The crude distillate had a specific gravity at 16° C. = 0·8629; rotation $\alpha_D = +20{\cdot}2°$; refractive index 1·4766 at 16° C. On distillation 87 per cent. came over between 155° and 159° C. From the results obtained with the fractions, and the chemical reactions, dextro-rotatory pinene was shown to be the principal constituent of this volatile oil. The more saturated hydrocarbons, similar to those found in the exudation of *Araucaria Cunninghamii* were not detected. The main constituent of the exudation was resin (62 per cent.). It was darker in colour than the resin of *Araucaria*, and was not identical in composition with it. The specific gravity at 17° C. = 1·053; and the acid number was 148. One gram of resin in 10 c.c. acetone was dextro-rotatory, $\alpha_D = +3{\cdot}4°$, which is in the opposite direction to that of the resin of *Araucaria Cunninghamii*. The resin contained, besides neutral bodies, bitter principle, etc., two resin acids:—

(*a*) The crystalline resin acid found in the resin of *Araucaria* (16 per cent.). It melted at 234°—235° C.;

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* The resin of *C. intratropica* was not obtainable.

was dextro-rotatory, $[\alpha]_D + 56{\cdot}25°$; was practically insoluble in both chloroform and ether, and insoluble in alcoholic potash. It had the formula, $C_{21}H_{32}O_3$, and was, therefore, dundathic acid. This resin acid thus occurs in the resins of both *Agathis* and *Araucaria*. The name is derived from "Dundathu pine," one of the local names for *Agathis robusta*.

(*b*) A resin acid of low melting point (about 73 per cent. of the total resin), was soluble in excess of alcoholic potash. It was dextro-rotatory, $[\alpha]_D + 21{\cdot}5°$, the rotation thus being in the opposite direction to the corresponding acid of the resin of *Araucaria*. The formula was $C_{19}H_{28}O_3$. These are the only two resin acids in the resin of *Agathis robusta*. The neutral bodies, after heating on the water-bath till constant in weight, consisted of a soft yellowish resinous mass, with a slight aromatic odour and a very bitter taste. It was strongly dextro-rotatory, and is thus in agreement with that of the most abundant resin acid.

Manganese in Australian pines.

In all parts of the trees of *Callitris* species manganese occurs, although in some portions it is in minute quantities, and is not constant for any particular species at all times. For the most common species in New South Wales, *C. glauca* and *C. calcarata*, the following amounts of manganese were determined in the ash of the particular portion taken :—

C. glauca.	per cent.	*C. calcarata.*	per cent.
Timber	0·058	Timber	0·016
Bark	0·020	Bark	0·013
Leaves.............	0·029		
Seeds	0·023	Seeds	0·029
Seed cases	0·011		

The amount of ash in the seeds of *C. calcarata* was 4·14 per cent., so that the manganese in the air-dried seeds of that species was 0·0012 per cent.

The following method was adopted in the determination of this small amount of manganese: 0·03 grm. of the freshly ignited ash was boiled in a test tube with 2 c.c. of nitric acid, 0·5 grm. of lead peroxide, and 6 c.c. water, until the volume had been reduced about one-fourth. The colour of the solution, when cleared, was then matched by sufficiently diluting a solution of potassium permanganate, 1 grm. per litre, and comparing the colour of the two solutions in tubes of equal diameter. The results were frequently checked by treating similarly, known weights of a manganese salt.

The colour of *Callitris* timber varies much in the same species, but this does not appear to be due to excess of the phenol. The darker timbers always showed the presence of the most manganese, and following this up, it was found, microscopically, that in the darker timbers many more cells were filled with a dark brown substance than was the case with the lighter timbers. For this, and other reasons, it is assumed that this dark substance is a manganese compound of some sort, and not a resin as has been thought previously. That a very small amount of manganese is sufficient to darken considerably a large quantity of material, was shown with the gum precipitates of both *Araucaria Cunninghamii* and *Agathis robusta*, and the air dried, almost black gum, of the latter contained only 0·0046 per cent. of manganese, while that of the former—less darkly coloured—contained 0·0038 per cent. of manganese. Of course it was not possible to show that the dark substance in the cells of these timbers was similar in composition to that of the exudations; for the present, therefore, it remains as an undefined manganese compound. In the timbers of all the other genera of the Australian pines, manganese was found, although in varying amounts, and it thus seems that this element is necessary to the satisfactory growth of this group of trees. A considerable amount of work has been done, during the last few years, on the value of manganese as a stimulant in plant growth, when applied in small quantities. Its toxic action in larger amount has also been determined. What part manganese actually plays, if any, in the growth and distribution of the various species and genera belonging to the Australian pines, is a matter for further research and investigation.

Discussion.

The Chairman referred to the magnificent pioneer work done by the author, which had been rendered possible by his association with Mr. R. T. Baker—a most happy combination of chemist and botanist. As regards the sandarac resin yielded by *Callitris*, the market for this would depend largely on the regularity of supplies, for varnish makers did not like changing from one thing to another; but he was sure that this would yet be on the market as an Australian product. He asked whether the value of borneol lay in its properties as a perfume? And he would like to know whether the condensed water from steam distillation did not yield something dissolved in it?

Professor J. A. Schofield said that with large importations of turpentine into Australia, there was scope for its manufacture from the Queensland kauri. With regard to the presence of manganese in the pines, had the author any idea of the nature of the compound formed? Did it exist as peroxide?

Mr. F. A. Coombs said that if the tannin in *Callitris* bark was similar to that in wattle bark, it was really valuable. The American hemlock was not equal to it, and anything that bleached tannin detracted from the value of the leather. As the proportion found was very high, he would like to know the method of analysis used.

Mr. H. G. Smith, in reply, said that the borneol ester was the odoriferous principle which gave the characteristic odour to the pines. Some oils were soluble in water, such as methyleugenol, which had a specific gravity of 1·46; and it was always necessary to extract from the watery distillate by means of ether or some other solvent. With regard to manganese, experiment had shown that small quantities acted as a stimulant to plant growth, while in excess it was poisonous. Plants therefore excreted it as peroxide, though in the plant it existed as an organic compound. The proportion of tannin had been determined by the official hide powder method. The tannin in *Callitris* bark was similar to that in wattle bark, but quite different from that in hemlock.

Yorkshire Section.

Meeting held on Monday, November 13th, 1911, at Queen's Hotel, Leeds.

MR. GEO. WARD IN THE CHAIR.

SOOT: ITS CHARACTER AND COMPOSITION.

BY PROFESSOR J. B. COHEN, B.SC., PH.D., F.R.S., AND ARTHUR G. RUSTON, B.A., B.SC.

Soot consists mainly of carbon, tar, and ash or mineral matter, together with small quantities of sulphur and nitrogen compounds, and frequently possesses an acid character. The analyses of soot which have been made from time to time show great variations in composition. When one considers the very different conditions under which coal is burnt, it is obvious that the character of the soot must vary. For soot is a product of incomplete combustion and is formed partly by the mechanical removal of dust by the chimney draught and partly by the decomposition of the fuel such as occurs in the process of destructive distillation. It might, therefore, be expected that the higher temperature and stronger draught of a factory furnace would produce a soot more by mechanical removal and less by incomplete combustion than a domestic grate; in other words, a soot containing more ash and less tar. Not only is this the case, but the character of the soot varies with the distance from the grate at which it has been deposited. Still another actor, which will influence the character and composition f the soot will be the kind and variety of coal used.

The following analyses illustrate these facts very clearly. n the case of the soots obtained from the University, the ame coal was burnt under ordinary domestic conditions n one of the class rooms on the ground floor, the chimney f which had previously been swept, and also burnt in he boiler under factory conditions.

Analyses of soot from the University.

	Coal.	Domestic soot.	Boiler soot.		
			Base.	70 ft. up.	Top 110 ft.
	per cent.	per cent.	per cent.	per cent.	per cent.
Carbon	69·30	40·50	16·66	21·80	27·00
Hydrogen	4·89	4·37	0·86	1·44	1·68
Nitrogen	1·39	4·09	0·00	1·18	1·21
Ash	8·48	13·16	75·04	66·04	61·80
Tar	1·64	25·91	0·09	0·80	1·66
Sulphur	1·74	2·99	2·07	2·58	2·84
Chlorine	0·27	5·19	0·11	1·46	1·60
Acidity	0·00	0·37	1·33	0·58	0·56

The differences between the domestic and boiler soots hus obtained from the same coal are striking and instructive. The sample from the base of the boiler chimney s little more than flue dust; practically all the hydrocarbons have been burnt, while what few have volatilised, have at the temperature there prevailing no chance of econdensing. Nitrogen, which is found in soot principally n the form of ammonium chloride or ammonium sulphate, s conspicuous, as one would expect, by its absence. Farther up the chimney, and away from the furnace, with the falling of the temperature, there is an increased carbon content of the soot, and a corresponding increase n the percentages of nitrogen, tar, and chlorine. Some of the hydrocarbons which have escaped combustion now get an opportunity to condense, and part of the ammonium chloride can now sublime. The domestic soot, as compared with the boiler soot, is rich in carbon and the volatile products, such as tar, ammonium chloride and sulphate, and poor in ash. The sample, however, when compared with other domestic soots is found, partly owing to the relatively strong draught, and partly to the poor quality of the coal used, to be rich in ash and in its sulphur contents.

In the case of the soot obtained from the top and bottom of the chimney of a brass foundry in Leeds, burning liquid fuel, we find again the same increase in the carbon content, and in the percentage of nitrogen, tar, sulphur, and chlorine, and decrease in the percentage of ash as we pass from the base to the top of the chimney. The differences here, however, are much more accentuated, the soot obtained from the top of the chimney with its 10½ per cent. of tar and 2½ per cent. of nitrogen, approximating much more closely to a domestic soot. The analysis affords an excellent illustration of the enormous variation in the composition of soot from different fuels burnt under different conditions.

Soot from brass foundry using liquid fuel.

	Bottom.	Top.
	per cent.	per cent.
Carbon	11·36	47·71
Hydrogen	1·03	2·35
Nitrogen	0·11	2·32
Ash	82·16	31·42
Tar	1·02	10·62
Sulphur	2·23	4·36
Chlorine	0·28	1·47
Acidity	0·00	0·65

In the case of the soots obtained from Winston Gardens, the same coal, a good household coal, if anything rather gassy and caky, was burnt in the kitchen and dining room grates, the dining room grate being one that burns the fuel slowly, the kitchen an open grate with strong draught, the fire often roaring up the chimney. The kitchen sample of soot was a mixed sample obtained when the chimney was being swept. Special and separate samples were taken from the dining room chimney every five feet; seven samples in all, the height of the chimney being 36 feet.

Soot from Winston Gardens.

	Coal.	Soot from kitchen.	Soot from dining room.		
			5 ft.	20 ft.	35 ft.
	per cent.	per cent.	per cent.	per cent.	per cent.
Carbon	76·8	52·3	36·5	34·1	37·2
Hydrogen	4·9	3·7	3·5	3·5	3·5
Nitrogen	1·72	4·11	6·89	6·04	5·05
Ash	1·80	17·8	5·09	4·97	4·94
Tar	0·88	12·5	34·9	37·2	40·4
Sulphur	0·79	2·20	2·18	2·56	2·45
Chlorine	0·25	1·35	9·07	6·41	4·96
Acidity.........	0·00	0·28	0·92	0·55	0·92

It will be noticed that the higher temperature of the kitchen fire, and the increased draught, increases the amount of ash, and decreases that of the volatile products, when compared with the dining room sample. Differences, too, will be noticed in the composition of the domestic soot obtained from different heights of the chimney, though the differences are not so well marked, and not always in the same direction as in the case of boiler soots. Thus in all cases the percentage of ash falls as we go farther from the source of combustion; but whereas under boiler conditions at the brass foundry the fall is from 82 to 31 per cent. under the conditions of the sitting-room grate, it is only from 5·09 to 4·94 per cent. In all cases there is an increase in the percentage of tar higher up the chimney, the percentage with a caky coal, and slow combustion grate, rising at the top of a domestic chimney to sometimes as high as 40 per cent. Here again the variation under domestic conditions, between the percentage of tar in the soot obtained from the bottom and top of the chimney is only from 35 to 40 per cent; as compared with 1 to 10 in the case of soots obtained from the top and bottom of the chimney of the brass foundry.

As a general rule, in the case of boiler soots, the percentage of nitrogen, sulphur, and chlorine will increase farther up the chimney; while in the case of domestic soots their percentage will decrease. It is to a large extent a matter of temperature. The ammonium chloride and ammonium sulphate will sublime and settle in the cooler parts of the chimney: the lower the temperature of the fire, and the poorer the draught the sooner they will settle. The position of maximum deposition, say of ammonium chloride, will be higher, the higher the temperature of the fire. In the case of this dining-room chimney that point lay between five and ten feet from the base.

Soot, North Grange Road.

	Coal.	Kitchen.	Study.
	per cent.	per cent.	per cent.
Carbon	76·47	45·91	47·75
Hydrogen	5·22	2·18	4·85
Nitrogen	1·32	2·33	5·57
Ash	2·10	27·34	29·22
Tar	0·92	10·20	15·68
Sulphur	0·99	1·46	2·32
Chlorine	0·27	4·64	6·46
Acidity	0·00	0·00	0·50

The same results, due to the higher temperature of the kitchen fire, and the increased draught are shown by another experiment carried out with soot from another house, burning a different quality of coal. Here again the soot from the study chimney contains more carbon, more nitrogen, more tar, more sulphur, more chlorine, and less ash than the soot from the kitchen chimney.

Soot used as a fertiliser is a substance of considerable* importance to the farmer, its value being due perhaps as much to its physical effects upon the soil as to its fertilising constituents. The dark colour of the soot makes it a very effective absorbent of the sun's rays, so that in sunlight the temperature of the land which has been darkened by a sprinkling of soot, may rise two or three degrees above that of the same land uncoloured. And as the radiation from such darkened soil at low temperatures is not increased in the same proportion, there is no corresponding loss of heat at night from the sooted land to discount its higher temperature by day. Soot is most commonly used by farmers as a top dressing for wheat and other spring corn. These crops are particularly responsive to a small application of active nitrogenous manure in the early months of the year, when the soil is cold and the oxidation of its nitrogenous residues is slow, hence part of the value of the soot. At the same time, the increased temperature of the soil induced by the black colour of the soot is particularly valuable in forwarding the growth both of the plant itself and of the bacteria which are rendering available the reserves of plant food in the soil.

Soot will also help materially to lighten the texture of heavy soils. It is, too, partly owing to its sulphur content, particularly distasteful to slugs and small snails. Many gardeners, in fact, look upon a mixture of soot and lime as an almost infallible means of warding off insect pests from the roots.

The fertilising value of soot, on the other hand, is due to the small and variable proportion of ammonia or ammonium salts which it has absorbed from the gases in the chimney. As nitrogen for manurial purposes is worth, roughly, 12s. a unit, or 6d. a pound, and as there are even in domestic soots variations in the nitrogen content from two up to seven or eight per cent., it follows that the commercial value of such soots will vary roughly from 24s. to £5 a ton. As most of the soot used for manurial purposes is bought locally for from £2—£3 a ton, and as no guarantee is given as to its nitrogen content, the purchaser may or may not be getting value for money at this price.

Fortunately, however, there are indications by means of which its value for manurial purposes can be roughly gauged. As a general rule, the lighter, the more springy and the bulkier the soot, the higher its nitrogen content, and the greater its value as a fertiliser will be.

It will thus be seen that it is much better to buy by the bushel than by the ton, if no guarantee is given, a bushel of domestic soot being worth as a general rule approximately sixpence,† while the ton may be worth anything from 50s. to £4. No good domestic soot should weigh more than 28 lb. to the bushel, and the purchaser should demand that the consignment shall contain at least 4 bushels to the cwt.

Soot applied to the soil in a moderate dressing once in a rotation, as a fertiliser, may be and is of considerable value, but when continuously and generously applied to the leaves of plants its effects are quite different and eminently undesirable. It becomes, therefore, a point of interest and importance to determine the percentage and if possible the amount of soot emitted by factory and domestic chimneys. Of the actual amount of soot emitted from factory chimneys it is clearly impossible to obtain trustworthy data. It will vary with the quality of the coal, the size and structure of the chimney and the method of firing. Estimates have been made by different observers of the amount of coal which escapes combustion, but the experiments, though numerous, are not of a very concordant character. Scheurer-Kestner, in a very careful and elaborate research on flue gases from boiler furnaces, found that the carbon lost as fuel never exceeds 1 per cent., while on the average it is 0·5—0·75 per cent.

In the matter of house fires there is a large mass of trustworthy data in the analyses of the late Sir W. Roberts-Austen undertaken in connection with the London Smoke Abatement Exhibition.* On the average of 40 experiments with different kinds of grate, but burning for the most part the same fuel (Wallsend), be found the percentage loss of the coal as soot was rather over 6 per cent. Although this result can only be regarded as a rough estimate, it shows a remarkable agreement with observations† made by one of us.

The average per cent. of soot passing up the chimney, in 12 analyses including eight of Yorkshire coals, two of Durham coals, and two of Wigan coals amounted to 6·5 per cent. on the carbon burnt. This quantity of 6·5 per cent. seems a very high figure, representing an annual loss of nearly two million tons on the estimated domestic consumption of 32 million tons. It is a significant fact that Sir W. Roberts-Austen found that in one case as much as 2·25 per cent. of soot on the fuel was deposited in the flue itself of an ordinary fireplace, whilst in another case 0·6 per cent. collected in the flue consisting of a sheet iron pipe only 6 ft. long.‡

If then we take 6 per cent. as the minimum loss on the estimated yearly domestic consumption of coal in the United Kingdom, and 0·5 per cent. as the minimum loss on the estimated factory coal consumption we get for the whole country a loss in the form of soot of :—

6 per cent. of estimated domestic coal consumption of 32 million tons	1,920,000
0·5 per cent. of estimated factory coal consumption of 100 million tons	500,000
Or a total of	tons 2,420,000

Manurial value of soot.

	Nitrogen per cent.	Density.	No. of lb. per bushel.	Lb. of nitrogen per bushel of soot.	Value per bushel.	Value per ton.
			a. Boiler.			
University base	0·00	0·447	35·8	0·0	0d.	£0 0 0
,, 70 ft. up	1·18	0·436	34·9	0·5	3d.	£0 14 2
,, top	1·21	0·4293	34·3	0·4	2½d.	£0 14 6
Brass foundry base	0·11	0·7915	63·3	0·07	½d.	£0 1 2
,, ,, top	2·32	0·5017	40·1	0·9	5½d.	£1 7 0
			b. Domestic.			
University	4·09	0·340	27	1·0	6d.	£2 9 1
Winston Gardens kitchen	4·11	0·2748	22	0·9	5½d.	£2 9 4
,, ,, dining room, 5 ft.	6·89	0·2048	16·5	1·1	6½d.	£4 2 8
,, ,, ,, ,, 20 ft.	6·04	0·2450	19·5	1·2	7d.	£3 12 6
,, ,, ,, ,, 35 ft.	5·05	0·2865	23·0	1·2	7d.	£3 0 7
North Grange Road, Kitchen	2·33	0·3265	26·1	0·6	3½d.	£1 7 11
,, ,, ,, study	5·57	0·2368	18·9	1·05	6¼d.	£3 6 10

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* Hall. "Fertilisers and Manures," pp. 68—70.

† See also Harvey J. of Agri. Science, **3**, p. 398.

* Report on the London Smoke Abatement Exhibition of 1884.

† Cohen and Russell, Soc. Chem. Ind., 1896, **15**, 86.

‡ These figures are taken from the Final Report of the Royal Commission on Coal Supplies, 1905, Vol. III., p. 11.

The amount of soot actually present[*] in the air of Leeds has been found by aspirating air for about 6 hrs. daily during May and June, 1897, at the rate of 25—35 cb. ft. over a weighed cotton wool plug. As the result of these experiments we may conclude that the amount of soot present in the air of Leeds is 1·2 mgrms. per 100 cb. ft. Supposing this amount to be uniformly distributed through the atmosphere to a height of 300 feet before being dispersed, it will represent a weight of 2 cwt. of soot, suspended at any moment above an area of 1 sq. mile. If, as has been estimated, the atmosphere is renewed 50 times in 12 hours, the quantity of soot discharged into the air during this period will amount to 5 tons per square mile. Apart from the actual loss of fuel, which is no inconsiderable item, the presence of this large amount of soot on the air must have a very detrimental effect upon the lungs and respiratory organs of town-dwellers. Medical evidence on this point is now being collected.

A portion of the soot thus present in the air is constantly falling, whilst the greater part is blown away, and scattered over the surrounding country.

A fairly accurate estimate of the amount of soot falling in Leeds has been arrived at in two ways, namely, by estimating the solid impurities deposited on snow and by determining the amount of solid matter carried down by rain. In January, 1892, after a fall of snow, which lay on the ground for several consecutive days, a sample covering 1 square yard was carefully removed from a gravestone in the parish churchyard a short time after the fall had ceased. The snow was melted, filtered and the soot present in the sample was estimated. Fresh samples were taken and analysed on the three following days. The weight of soot carried down, as determined from the first sample, was equivalent to 16 cwt. per day to the square mile ; whilst the additional weight of soot which accumulated on each successive day was equivalent to 4 cwt. to the square mile.

By a periodical examination of the rain-water derived from different localities, a fair notion of the relative quantities of these impurities has been ascertained. The results of the experiments, which were continued for 12 months from November, 1907, to October, 1908, are contained in the following table.

Solid impurities in Leeds rain.

Tons per square mile per annum.

		Suspended matter.			
		Carbon	Tar.	Ash.	Total.
1. Leeds Forge ..	industrial	189·6	31·4	318·0	539
2. Hunslet		241·2	19·7	187·2	448·1
3. Beeston Hill ..		87·1	42·6	202·5	332·2
4. Philosophical Hall.	Town .	99·7	22·3	120·6	242·6
5. Headingley	Residential	100·2	12·3	56·9	188·3
6. Armley		98·0	9·7	61·7	169·4
7. Woodhouse Moor.		63·2	9·1	41·7	114·0
8. Kirkstall		52·3	8·0	40·3	100·6
9. Weetwood Lane..		19·2	7·4	15·4	42·0
10. Roundhay		7·7	4·0	14·0	25·7

The average deposit of soot over the whole of Leeds will therefore correspond to at least 220 tons per square mile per annum.

The tar contained in soot adheres so tenaciously to everything that it is not easily removed by the rain.

In order to ascertain the effect of this sticky material in the soot, glass plates, one foot square, were exposed, one in a garden at Pool (nine miles from Leeds), one on the University roof, and one on the roof of the Philosophical Hall (near the centre of the city). The deposit on these plates, after an exposure of a few weeks (loose matter having been washed away by rinsing with water) was analysed and weighed. For one part deposited at Pool, there was ten times that quantity at the University and twenty-four times the amount at the Philosophical Hall.

The experiment was repeated during 1910, plates being exposed at six different stations in Leeds, with the following results :—

	Deposit of tar per sq. ft. in milligrams Mar.—June, 1910.	Deposit of tar per sq. ft. in milligrams June—Sept. 1910.	Deposit of tar per annum in cwt. per sq. mile.
1. Hunslet	52·6	46·5	110
2. Kirkstall	26·2	31·1	64
3. Philosophical Hall	26·4	30·4	68
4. Headingley	11·3	17·2	27
5. Observatory	15·4	9·0	32
6. Roundhay	2·0	2·1	4·5

It will be seen again that the deposit in Hunslet, the most polluted part of Leeds, is roughly twenty-four times the deposit in Roundhay, the least polluted part of Leeds.

The leaves of trees and of evergreens in particular get coated with this black deposit. Unfortunately it does more than blacken the vegetation ; it covers the whole leaf over with a kind of varnish, and fills up the pores or stomata, thus checking the natural process of transpiration and assimilation. It is in fact no uncommon thing to find in the case of leaves of conifers grown in Leeds that 80 per cent. of the stomata are choked up with tar.

Again, the effect of these solid impurities in diminishing the amount of sunlight in our industrial towns, may be gathered from the fact that in 1907 the number of hours of bright sunshine recorded in the centre of Leeds was 1167 as compared with 1402 at Adel, some four miles to the north In other words, the smoke cloud hanging over the centre of the town curtailed the duration of bright sunshine by fully 17 per cent.

If, however, we measure not the number of hours of bright sunshine, but the actual intensity of the light, we find, first, a striking correlation between the amount of soot in the air and the actual intensity of the light, and, second, that the actual intensity of the light is reduced not only by 17 but by fully 40 per cent. The effect of all this curtailment of light upon vegetation is only too obvious.

If the plant obtains the greater part of the material of which it is composed from the air, through the assimilation of carbon dioxide, the measurement of that assimilation by a unit area of the leaf in unit time should give its measurement of effective growth. It was interesting, therefore, to compare this assimilation in the case of laurel leaves of the current year's growth, grown in different parts of Leeds.[*] Taking those grown in Weetwood Lane as the standard, it was found that on the same day, with the same temperature and the same intensity of light, the assimilation of different leaves from the same locality was approximately constant. The rates of assimilation of leaves from the same locality will vary day by day, depending upon the temperature and the intensity of the light. In other words, the cloud of soot and smoke continually hanging over an industrial area, will have in this respect a very marked influence in limiting the growth of plants. If, again, the assimilation of leaves grown in the Weetwood Lane is compared on the same day with that in some more impure district, it is always found that the leaves from the purer district possess the greater power of assimilating carbon dioxide. Using this as our measurement of the growth of plants in different districts, the following values can be given :—

Weetwood Lane,	2½	miles	to the north ;	assimilatory powers,	100
Headingley Hill,	1½	,,	,,	,, ,,	53
University	1	,,	,,	,, ,,	42
City Square, centre of town			,,	,, ,,	12

As was to be expected from the above figures, the laurel plants found in the more polluted areas were all very stunted in size as compared with those growing in the Weetwood Lane district, while in Hunslet, one of the most polluted areas, a two-days' search failed to find any trace of laurels, which had survived the ordeal.

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[*] Cohen, Journal of Soc. Chem. Industry, 1897, 16, 411.

[*] Crowther and Ruston Journal of Agricultural Science, Vol. IV., p. 25.

Again, the samples of soot were nearly all found to be distinctly acid in reaction to methyl orange; thus indicating the presence of free mineral acids. The amounts of these acids thus brought down by the rain were found in the nine polluted parts of Leeds to be as great as 80 pounds per acre. This acid will play an important part in the corrosion of mortar, masonry and iron work in and near towns. According to the experiments of Messrs. Worthington and Rattray, chief engineers of the Midland and of the Lancashire and Yorkshire Railways, the amount of corrosion of iron rails in towns due to this cause is six times that in the country.

The deposition of acid along with soot upon the leaves of plants is probably one of the main causes of the early withering which is so characteristic of many forms of town vegetation. Ash trees in the purer parts of Leeds often retain their leaves six weeks longer than those in the more contaminated districts. A permanent record is kept by the tree itself of its relative yearly growth, and the presence of any inhibiting effect is shown by a diminution in the size of the annual rings.

Free acids have been found to exert a very detrimental effect both upon the quantity and quality of grasses. Thus in every case a larger amount of acidity has meant a decreased yield, an increased fibre content, indicating that the grasses were indigestible, and a decreased protein-content indicating a low feeding value. The effect of the acidity in the soil itself was shown most markedly in the reduction in the number and activity of the soil bacteria, of which the most valuable and at the same time the most sensitive are the nitrifying organisms.

During the last year various vegetables have been grown in different parts of the town, in the same soil, and under the same conditions except atmospheric conditions. The results, so far as they are to hand, prove conclusively that smoke pollution does actually and definitely exert a very prejudicial influence upon garden crops. Thus in the case of radishes, only one-half the crop was secured in Hunslet, and in the case of lettuces only one-quarter the crop that should have been secured had the atmospheric conditions been purer.

Relative total weights of lettuce crops grown in various districts.

Garforth	175
Weetwood	140
Headingley	120
University	104
Park Square	56
Hunslet	44

DISCUSSION.

Mr. G. WARD said that the subject of the paper had been discussed at the last meeting of the British Association, and undoubtedly more energetic action was necessary to suppress the amount of smoke in the air of large towns.

Prof. J. B. COHEN said the course he advocated was that the whole matter should be taken out of the hands of local authorities and put under the same control as that of chemical works. The appointment of Alkali Inspectors had proved, in the long run, a boon to manufactures, and he believed the only satisfactory solution of the problem was to put the matter into the hands of highly educated, well paid, experienced men. They would be able to assist manufacturers to suppress the nuisance without causing them difficulty. If pressure were brought to bear upon those responsible for the smoke of factory and domestic chimneys, he believed the trouble would soon be diminished.

Dr. M. G. CHRISTIE asked if the authors had made any tests as to the amount of fixed nitrogen in soot. Certain nitrogen compounds had no value as fertilising agents. Probably only those present in the form of ammonium salts would be assimilated by plants; although by dry distillation with an admixture of soda-lime the greater portion of its nitrogen could be recovered in the form of ammonia, yet coal showed no value as a nitrogenous fertiliser.

Mr. C. P. FINN asked if there was any difference in the amount of soot carried down during the last exceptionally dry summer and the previous summer, and whether anything remarkable was noticed in the amount of solids and the acidity of such an abnormal rainfall as occurred on June 24th and 25th of the present year?

Mr. J. W. COBB said that they as a Society were interested in the degree of success which remedies possible in practice might expect to achieve. The conversion of solid fuel into gas on the large scale would minimise the soot evil, but there would of course remain the acid impurities in the atmosphere even after perfect smokeless combustion, unless sulphur was removed from the gas by some process. What relative importance did the authors attach to the two impurities, soot and acid?

Mr. A. G. RUSTON, in reply, said there were four factors to be dealt with:—1. Acidity on soil. 2. Acid on leaves. 3. Blocking of stomata. 4. Effect on light. The stopping of soot in the atmosphere removed 3 and 4. The acidity of the soil could be remedied by adding lime. The remaining factor would not then matter so very much. No investigation showing the relative amounts of soot carried down during the last two summers had been made. Practically 96 per cent. of the nitrogen in soot could be distilled off with magnesia and was therefore in the form of ammonium salts and available as a fertiliser. Pyridine bases existed in soot, as Dr. Cohen had found.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Oil separators; Tests of —— made in the Laboratory of the Bavarian Association for the Control of steam-boilers at Munich. Rev. Mét., 1911, 8, 851—863.

A SERIES of experiments was made on the efficiency of the different types of apparatus used for the separation of oil from exhaust steam. The results show that it is possible to reduce the oil content to 10—15 grms. per 1000 kilos. of water, which is sufficient for many purposes. Where, however, the condensed water is to be used for feeding the boilers, a subsequent passage through a suitable filter is essential. Of the different types of apparatus employed, the centrifugal turbine separator proved most satisfactory, the centrifugal apparatus with a fixed helix giving poor results. Two essential features of an efficient separator are that it should work satisfactorily independently of the amount of steam treated, and that the separated oil should be quickly removed from the apparatus. Many of the apparatus of the percussion type proved defective in the latter respect, with the result that a portion of the separated oil was again taken up by the steam. With regard to the kind of oil used, it was found that the separation was more efficient the higher the flash point of the oil. The separation was usually less satisfactory when the lubricating oil contained a fat or fatty oil, mainly owing to the volatilisation of fatty acids. With the turbine separator, however, satisfactory results were obtained with oils containing quantities of fatty oils greater than those ordinarily met with in practice. It is less easy to obtain satisfactory results with superheated than with saturated steam, mainly owing to the higher temperature of the former. Better results would probably be obtained if the lubricating oil were introduced into the coolest part of the cylinder instead of into the steam before its introduction into the cylinder as is usually the case.—A. S.

Patents.

Air and other gases ; Separation of dust and similar impurities from and the humidification of ——. J. Hanna and T. F. Shillington, Belfast. Eng. Pat. 24,704, Oct. 24, 1910.

The dust-laden air is purified by passing it through a screen or filter which is washed intermittently by immersion in a cleansing liquid. The apparatus consists of a gas bell having gauze sides dipping into an annular trough containing the washing liquid and a top in the form of a shallow open tank into which the washing liquid flows. The dust-laden air enters the gas bell from below and passes out through the gauze sides. When the shallow tank fills with liquid, a float therein trips a catch and permits the bell to descend under its own weight, immersing the gauze in the annular trough. At the same time a valve in the bottom of the tank opens and the liquid runs down on to a deflector below, which deflects it to the sides of the bell, thus further washing the gauze and entering the annular trough. As soon as the tank is empty, the bell rises again under the action of balance weights and remains in its upper position until the tank is again full, whereupon the operation is repeated. A centrifugal separator may be combined with the apparatus to remove large particles of dust, etc. In a modification the bell is raised and lowered by means of eccentrics operated by a rotating shaft above the bell.—H. H.

Filters for separating suspended impurities from gas. H. Zschocke, Kaiserslautern, Germany. Eng. Pat. 7640, March 27, 1911.

In a filter having tubular filtering surfaces for separating suspended impurities from gases, the filtering surfaces are cleaned by means of compressed gas blown periodically through in the opposite direction to the normal passage of the gas. This is effected by means of rotating pipes passing axially through each filter and having nozzles throughout their length through which the compressed gas impinges upon the filtering surfaces.—H. H.

Fume-condenser. A. J. Hopper and H. F. Prindle, Oakland, Cal. U.S. Pat. 1,007,356, Oct. 31, 1911.

The fume is drawn into a rotating drum through an opening in the side. The drum is provided with an internal spiral partition, which as the drum rotates, compresses the gas or the fume and discharges it through a cylindrical conduit, connected axially with the drum and terminating in a downward bend, into a liquid contained in a chamber in the upper part of which the rotary drum is situated. —W. H. C.

Furnaces, ovens, chimneys, and the like ; Construction of ——. J. Armstrong, London. Eng. Pat. 24,853. Oct. 26, 1910.

The outside walls of structures subject to heat are formed of concrete blocks having sheets or bands of metal imbedded in them, such metal being prolonged or bent outwards at the corners of the blocks to form projecting lugs which serve for bolting the blocks together. The sheets of metal may be curved when the blocks are to be in compression, or straight when in tension. Buffer spaces, filled for example with asbestos, may be formed in the blocks.—H. H.

Rotary kilns ; Regulation of the air supply to ——. W. Gilbert, London. Eng. Pat. 459, Jan. 7, 1911.

The air supply to a rotary kiln is regulated in accordance with the coal feed by means of a damper placed in the suction or delivery pipe of the air fan. The damper is constructed with two hinged plates the distance between which is automatically controlled by the variable speed apparatus driving the coal feed conveyor.—H. H.

Cooling towers and the like ; Arrangement of filling for ——. O. H. Mueller, London. Eng. Pat. 1123, Jan. 16, 1911.

A filling for cooling towers, etc., is formed of boards arranged edgewise in successive courses at right angles to each other, each board being provided with notches so that the boards of adjacent courses rest over and lock into each other. By this means the boards are held in position and warping is prevented. The notches may be staggered so that the boards in any course do not lie vertically above or below those in the next parallel courses.—H. H.

Filling material for reaction towers, regenerators, and the like. R. Scherfenberg. Ger. Pat. 239,072. April 7, 1910.

The filling material is in the form of triangular prisms, succeeding rows crossing one another at right angles. Fig. 1 shows a method of packing for regenerators and Fig. 2 one for reaction towers ; the prisms, *b*, are reversed with respect to the prisms, *a*.—A. S.

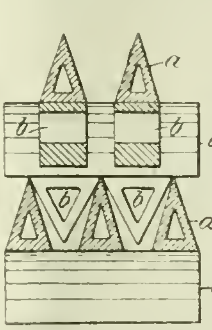


Fig. 2.

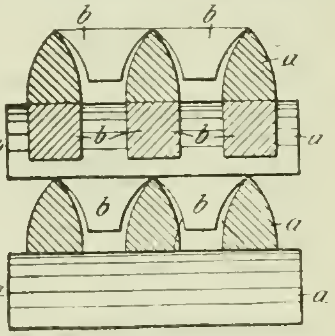


Fig. 1.

Pulverising stone, coal, and other materials ; Machines for ——. G. W. Bousfield, Sandal, Yorks. Eng. Pat. 4767, Feb. 25, 1911.

An apparatus for pulverising stone, etc., consists of a rotating cylindrical drum having : (1), longitudinally arranged ribs or projections on its inner periphery alternating with apertures extending through the wall of the drum, and (2), swinging hammers supported within the drum in such a manner that upon rotation of the drum each hammer is raised by contact with one of the ribs, and upon further rotation falls by gravity upon the material on the next advancing rib to crush it by concussion. The material is ground between the hammer and the rib during the period in which the hammer is being raised.—H. H.

Filtering liquids ; Apparatus for ——. J. Wilson, London. Eng. Pat. 10,413, April 29, 1911.

In a filtering apparatus of the type described in Eng. Pat. 433 of 1910 (this J., 1910, 742), instead of having separate perforated pipes in the filtering troughs for the filtered liquid and cleansing liquid respectively, single pipes are employed with shaped ends opening into the filtrate discharge pipe, and the cleansing liquid is injected into such ends when desired from nozzles which are arranged immediately opposite them and project into the opposite wall of the filtrate discharge pipe.—H. H.

Dryer; Rotary ——. F. B. Giesler. Assignor to The Galland-Henning Pneumatic Malting Drum Mfg. Co., Milwaukee, Wis. U.S. Pat. 1,006,647, Oct 24, 1911.

The drum of the dryer is heated by steam pipes connected with steam chests provided with buckets for discharging the condensed water. The dried material is discharged from an enlarged extension of the drum provided with discharge openings having doors closed by means of springs. —W. H. C.

Evaporating solutions in which salt is precipitated; Process of ——. B. Block, Erfurt, Germany. U.S. Pat. 1,006,823, Oct. 24, 1911.

The solution is pumped under pressure first through a heater and thence through an evaporator where the pressure is reduced and evaporation takes place. Any deposited salts are allowed to settle out and the liquid is pumped again through the system, fresh liquid being taken in by the pump to replace that evaporated. The pressure and speed maintained in the pipes and heater are such that evaporation takes place exclusively in the evaporator.—W. H. C.

Evaporating-pan. O. G. Dasher, Marlow, Ga. U.S. Pat. 1,007,072, Oct. 31, 1911.

A cover in the shape of a flat truncated cone with an opening at the central highest point and an upturned rim round its lower edge is suspended over an evaporating-pan so that its lower edge is just below the upper rim of the pan, between which and the cover, an annular space is left. The foaming juice which escapes through the central opening of the cover flows down the outer surface and is checked by the upstanding rim. It is cooled by the contact with the air and flows over the rim and through the annular space back to the pan.—W. H. C.

Solidifying crystallisable mixtures without substantial crystallisation; Method of ——. F. I. du Pont, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,007,276, Oct. 31, 1911.

The material is subjected to heat and rubbing to remove the solvents, and is then formed into a thin sheet which is chilled and broken up. The broken up material is then reformed into sheets of any desired thickness by pressure. —W. H. C.

Desiccating liquid substances; Apparatus for and method of ——. W. S. Osborne, Assignor to Osborne Desiccating Machinery Co., New York. U.S. Pats. 1,007,381 and 1,007,599, Oct. 31, 1911.

The liquid to be desiccated is discharged through a pipe passing upwards through the bottom of a substantially closed chamber and terminating about the centre of the chamber in a rotating nozzle, which showers the liquid into the chamber in the form of spray. A current of air is delivered through the bottom of the chamber, and is heated by passing over steam coils or other suitable heating device placed in the lower part of the chamber, but above the air inlet. The spray of liquid is caught up by the current of hot air, the moisture is evaporated and the desiccated substance is carried forward by the air current out of the chamber into a settling and separating apparatus.—W. H. C.

Dehydrating apparatus. W. S. Osborne, Assignor to Osborne Desiccating Machinery Co., New York. U.S. Pat. 1,007,382, Oct. 31, 1911.

The apparatus consists of an upright cylinder divided into a number of superposed chambers by horizontal, domed, rotary tables. The material to be dehydrated is spread upon these tables by discharge pipes and dried by a current of hot air or gas which passes over the material from the periphery to the centre of each table. At the centre of each table there is a large opening connected with a central vertical flue through which the exhaust is discharged. The dried film of material is removed from the tables by scrapers.—W. H. C.

Gaseous mixtures; Separation of the constituents of —— *by centrifugal action.* E. Mazza. Fr. Pat. 430,621, June 6, 1911. Under Int. Conv., June 8, 1910.

The gaseous mixture is forced very rapidly through curved passages and collected in two or more portions at different distances from the centre of curvature, the heavier gases being forced by centrifugal action towards the outer part of the curve. One form of apparatus comprises a casing divided into two by a horizontal partition. The gases from the lower compartment pass through short bent pipes mounted on the partition, and a horizontal plate in the delivery end of these pipes directs the heavier gases into the upper compartment, whilst the lighter gases pass to a horizontal outlet channel.—A. T. L.

Filter carbon; Process for manufacturing ——. Richter und Richter, Berlin. Eng. Pat. 24,905, Oct. 26, 1910. Under Int. Conv., Nov. 29, 1909.

See Fr. Pat. 421,829 of 1910; this J., 1911, 407.—T. F. B.

Furnaces; Regenerative ——. F. Bernhardt, Königshütte, Upper Silesia. Eng. Pat. 28,982, Dec. 13, 1910.

See Fr. Pat. 423,577 of 1910; this J., 1911, 605.—T. F. B.

Settling vessels; Compression of precipitates in ——. F. Tiemann, Berlin. U.S. Pat. 1,007,823, Nov. 7, 1911.

See Eng. Pat. 29,581 of 1910; this J., 1911, 1038.—T. F. B.

Improvements in Gay-Lussac and Glover towers, and the like. Eng. Pat. 28,004. *See* VII.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Moisture in fuel; Determination of ——. J. A. P. Crisfield. J. Franklin Inst., 1911, **172**, 495—502.

It is frequently of importance to determine the moisture in a consignment of coal or coke directly on receipt and also at the place of consumption, and determinations in the laboratory made on a selected sample under ordinary conditions may be misleading, owing to loss of moisture from the material due to gradual drying by exposure to the air. A simple apparatus, called the "moisture determinator," is described with which the moisture can be readily determined with a single weighing. 1 lb. of the coal or coke is weighed into a jacketed tube provided with a screw plug at each end, and steam under a definite pressure (corresponding to the temperature it is desired to use, preferably 230° F.) is passed through the jacket. The water vapour expelled from the coal or coke passes over and is condensed in a graduated glass tube surrounded by a cooling jacket; the graduations are so arranged that the percentage can be read off directly. Determinations made with samples of dried coke to which definite quantities of water were added, showed that the apparatus gives concordant results which are 0·13 per cent. lower than the true values. The apparatus can also be used for the determination of moisture in ores, and of water and light oils in tar. —A. S.

Gas manufacture; Liming of coal in ——. J. Paterson. J. Gas Lighting, 1911, **116**, 449—453.

A modification of Cooper's process of introducing lime with the coal into the retorts (see this J., 1883, 372, 438; 1884, 12) has been adopted at Cheltenham with good results. The method adopted is to feed the quicklime on to the coal in the breaker by means of a hopper closed at the bottom by a roller and flexible shoot. A tapping device is provided to keep the lime flowing freely. The roller is driven by gearing from the shaft of the elevator, so that the lime and coal are used in constant proportions. A little steam is admitted under the rollers of the breaker and also into the overhead hoppers in the retort house in order to prevent dust, and the surface of the coal becomes uniformly coated with an adhering layer of lime.

The coal used is a mixture of half South Yorkshire and half Derbyshire coal. During the first five months, the quantity of lime used was 2·01 per cent. of the coal carbonised. The quantity of sulphur compounds in the gas was reduced from 40 to 21·5 grains per 100 cub. ft.; the yield of gas increased by 829 cub. ft. per ton over the average of the preceding three years; the yield of ammonium sulphate increased by 1·88 lb. per ton of coal over the average of the preceding seven years; the yield of tar decreased by 0·9 gall. per ton; and the illuminating power of the gas and the quality of the coke were not impaired. During the next six months, the improvement was maintained and the yield of gas further increased by 162 cub. ft. per ton. The pull in the exhauster house was reduced from 0·11 ins. to about half that amount and a higher carbonising temperature could be attained. Trouble with stopped ascension pipes entirely ceased, except in the case of one retort which was charged by hand with unlimed coal.—A. T. L.

Ethylene hydrocarbons: Polymerisation of—at high temperatures and pressures. W. Ipatiew. Ber., 1911, **44**, 2978—2987.

Ethylene at 70 atmospheres pressure shows signs of polymerisation at 325° C., and at 380°—400° the polymerisation is very rapid. Liquid hydrocarbons are obtained boiling at temperatures ranging from 24° to above 280° C. The lower-boiling fractions contain notable amounts of paraffins, the higher contain both olefines and poly-methylenes. No benzene hydrocarbons were obtained. The polymerisation occurs more readily and at a lower temperature in presence of a little alumina; the products yielded are the same in character, but contain a larger proportion of substances of high boiling-point. In both cases the high-fractions contain some hydrocarbons of higher carbon and lower hydrogen content than the C_nH_{2n} series. Isobutylene yields similar products to ethylene, save that hydrocarbons richer in carbon are not present. The author is of opinion that condensation to hexamethylene is the first stage in all of these actions.—J. T. D.

Hexane and hexamethylene; Decomposition of ——, at high temperatures and pressures. Isomerisation of hexamethylene. W. Ipatiew and N. Dowgelewitsch. Ber., 1911, **44**, 2987—2992.

At ordinary pressure, hexane is decomposed at 710° C., hexamethylene at 750°, yielding between 40 and 50 per cent. of hydrocarbons of the C_nH_{2n} series, 8 to 14 per cent. of hydrogen, and about 40 per cent. of paraffins. Presence of alumina sensibly lowers the temperature of this decomposition. At high pressures the decomposition of hexane is so rapid as to be dangerously explosive. Hexamethylene at 70 atmospheres, heated for some time at 500°—510° C., gave a quantity of gas, nearly all methane and hydrogen, and liquid products, which were separated into ten fractions from 45° to 310° C. All of these contained small amounts of aromatic hydrocarbons. After removal of the hydrocarbons absorbed by sulphuric acid, the first three fractions (45°—80°) were found to contain considerable quantities of methyl-pentamethylene, showing the breaking down of the 6-carbon into the more stable 5-carbon ring.—J.T.D.

Mineral lubricating oils; Effect of added fatty and other oils on the carbonisation of ——. C. E. Waters. J. Ind. Eng. Chem., 1911, **3**, 812—816.

In continuation of previous work (see this J., 1911, 608), the author studied the effect of heating for 5 hours at 250° C., under conditions similar to those previously described, on an engine oil (flash point 140° C. in the Pensky-Martens closed cup apparatus) alone and mixed with fatty oils and other substances. The amounts of "carbonised" matter insoluble in petroleum ether and of the varnish-like coating on the walls of the containing flask were determined. The results are tabulated and show that lubricants containing much soap, rosin, or asphaltum, or which have been exposed to the action of sunlight and air are to be avoided. Addition of such fatty substances as rape oil, lard oil, and tallow to the mineral oil caused a diminution in the amount of matter insoluble in petroleum ether produced on heating, but such additions in practice would cause trouble owing to the corrosive action of liberated fatty acids. Addition of ferric oxide (0·086 grm. per 10 grms. of oil) caused a very large increase in the amount of insoluble matter (compare Worrall and Southcombe, this J., 1900, 525; 1911, 261).—A. S.

Asphaltum; Determination of the softening point of ——. L. Barta. Petroleum, 1911, **7**, 158—159.

The method of Kraemer and Sarnow (this J., 1903, 291) gives discordant results owing to inequalities in the depths of the layers of asphaltum, the differences in two determinations often exceeding 4° C. This drawback is not entirely eliminated by filling the tube to a given mark, as proposed by Margosches (Chem. Revue, 1904, 277), but the following modification gives results agreeing within 1° C. in duplicate determinations, even in the case of soft asphaltum. The sample is melted at about 150° C., and poured into three or four small glass tubes 6 mm. in internal diameter and exactly 5 mm. in length. These have open ground ends and are placed upon a moist glass plate. As soon as the asphaltum has set (with the aid of artificial cooling if necessary), the surface of the column of material is trimmed level with the glass, and the tube is connected by means of rubber tubing with a glass tube about 100 mm. in length and 6 mm. in internal diameter. Five grms. of mercury are now poured on to the top of the asphaltum, and the softening point determined as in the original method, care being taken that the temperature of the water-bath rises uniformly and at the rate of about 2° C. per minute.—C. A. M.

Patents.

Coke; Process of treating ——. H. Spurrier, Detroit, Mich. U.S. Pat. 1,007,153, Oct. 31, 1911.

The coke is moistened with a solution of sodium carbonate of such strength that after drying, the amount of carbonate will be in excess of that required to combine with the sulphur present in the coke.—A. T. L.

Gas generators. E. A. Kunze, Aussig, Bohemia. Eng. Pat. 14,767, June 21, 1911.

The generator is of the kind in which a revolving horizontal cylinder is fed with coal dust by a screw conveyor at one end and with a blast of air at the other end, the gas passing out at the fuel feed end, but the construction is such as to permit the rotation of the cylinder at high speed. The air-supply end of the cylinder is carried by arms formed upon a central hollow shaft. This shaft serves for the passage of air and turns in a bearing which supports that end of the apparatus.—A. T. L.

Gas; Apparatus for manufacturing ——. H. Pettibone, New Rochelle, N.Y., Assignor to the Power and Mining Machinery Co. U.S. Pat. 1,007,385, Oct. 31, 1911.

The air supply, previously heated in a heat-interchanging apparatus by the hot gas produced, is delivered into the centre of the glowing mass of fuel through an annular air pipe which passes down through the top cover of the producer. The air is drawn down through the fuel and the gas is withdrawn near the bottom of the generator chamber. From time to time the air supply and gas outlet mains are closed and air is blown through a special pipe into the lower part of the generator for the purpose of blowing the dust and fine ashes upwards through the bed of fuel and into the air through a purge pipe provided for that purpose.—W. H. C.

Gas producer. E. Dor-Delattre. Fr. Pat. 431,327, June 20, 1911. Under Int. Conv., Aug. 13, 1910.

The lower part of the producer comprises an annular rotating water-trough, serving for the gradual removal of clinker and ash, and a central water-cooled cone, normally stationary, which carries vertical grate-bars projecting downwards from the base of the cone so as to occupy the central space enclosed by the annular trough. This cone is raised and lowered at intervals by means of hydraulic pressure in order to break up the fuel column. —A. T. L.

Gas-purifying material: Revivification of ——, with simultaneous production of sulphur dioxide. K. Burkheiser. Ger. Pat. 239,678, Jan. 4, 1911. Addition to Ger. Pat. 235,870, Sept. 28, 1909.

The air used for the revivification as described in the chief patent (see Fr. Pat. 420,806 of 1910; this J., 1911, 348) is mixed with an inert gas, vapour, or mist, in order to lower its oxygen content and thus retard the oxidation of hydrogen sulphide, whereby a "dead-burning" of the material due to the great heat of the reaction is avoided. In carrying out the process, the air may be charged with steam at a high temperature and introduced into the purifier at a temperature above its dew-point, the material in the purifier being maintained at such a temperature that condensation of water is prevented; or the air may be charged with aqueous mist or fog, which in its evaporation absorbs the heat evolved in the purifier, whilst the water vapour produced dilutes the air.—A. S.

Paraffin or like mixtures; Sweating pans for sweating out substances which melt at different temperatures from crude ——. E. D. Pyzel, Amsterdam. Eng. Pat. 8280 of 1911, date of appl., Sept. 26, 1910.

The patent relates to sweating pans in which the crude paraffin is allowed to set, the pans being then carried on trucks through a long oven so as to obtain products of different melting points. The pans have a bottom of galvanised corrugated plate over which is stretched wire gauze. The gauze is secured to the corrugated plate on three sides by angle irons. The pans are inclined so that the melted products run along the corrugations into drain gutters, and the whole of these gutters discharge into a single vertical collecting pipe.—A. T. L.

Mineral oil residues and tars; Process for separating solid hydrocarbons, such as paraffin, ceresin, and ozokerite, from ——. J. Tanne and G. Oberländer. Ger. Pat. 238,489, Feb. 15, 1911. Addition to Ger. Pat. 236,050, Oct. 8, 1909.

The solid hydrocarbons are separated from mineral oil residues and tars by heating to about 150° C. with from 5 to 50 (preferably 10) per cent. of carbon tetrachloride (see this J., 1909, 84; 1910, 747 and 1367; 1911, 409). —T. F. B.

Peat; Processes for carbonising wet ——. The Peat Coal Investment Co., Ltd. Fr. Pat. 431,364, June 14, 1911.

See Eng. Pat. 6041 of 1910; this J., 1911, 883.—T. F. B.

Gas; Method and apparatus for cleaning ——. H. A. Brassert and A. G. Witting, Chicago. Eng. Pat. 29,196, Dec. 15, 1910. Under Int. Conv., April 4, 1910.

See Fr. Pat. 423,671 of 1910; this J., 1911, 605.—T. F. B.

Liquids [petroleum, etc.]; Process and apparatus for purifying ——. Trumble Refining Co. Fr. Pat. 431,142, June 16, 1911.

See U.S. Pat. 996,736 of 1911; this J., 1911, 1005.—T. F. B.

Rendering candles composed of a mixture of stearine and paraffin wax opaque. Fr. Pat. 431,490. *See* XII.

Apparatus for the observation of gas caps and testing miners' safety lamps. Eng. Pat. 11,696. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Wood-distilling apparatus. T. A. Dungan, Chicago, Ill. U.S. Pat. 1,007,341, Oct. 31, 1911.

The wood is placed in a truck which is run into the distilling chamber on rails. The lower part of the truck has inclined shelves projecting from one side of the car and overhanging one another, and the wood is supported on a grating above the series of shelves. The shelves receive the liquid products dropping from the wood, and hot air passes up between them.—A. T. L.

Incandescent mantles; Manufacture of ——. A. Müller, Berlin. Eng. Pat. 11,904, May 17, 1911. Under Int. Conv., Nov. 12, 1910.

The artificial silk mantles are first impregnated with thorium nitrate and then dipped into a solution of hydrazine or other organic base containing at least two united nitrogen atoms. In this solution a certain quantity of cerium nitrate is dissolved. The hydrazine at once precipitates the thorium hydroxide, but the cerium hydroxide is only slowly precipitated so that after a definite time the proportion of the two hydroxides will be as desired. The mantle is then withdrawn, the excess of solution squeezed out, and dried without washing and burned off in the usual manner.—W. H. C.

Arc lamp electrode. Gebr. Siemens und Co. Fr. Pat. 431,040, June 14, 1911. Under Int. Conv., June 29, 1910.

The patent is for the addition of the fluoride of a rare earth metal and the tungstate or molybdate of an alkaline earth metal to the electrode, whereby a steady white light is obtained with low consumption of energy.—A. T. L.

III.—TAR AND TAR PRODUCTS.

Dehydrogenation [and hydrogenation] by catalysis. N. Zelinsky. Ber., 1911, 44, 3121—3125.

By passing hexamethylene or methylhexamethylene over heated palladium black (prepared by reduction of palladium ammonium chloride, $Pd(NH_4)_2Cl_4$, by formic acid in presence of alkali), the hydrocarbons are readily and smoothly dissociated into hydrogen and benzene or toluene respectively. No dihydro- or tetra-hydro-derivatives of the aromatic hydrocarbons are produced. The dehydrogenation begins at about 170° C. and increases with rise of temperature up to a maximum at 300° C. In one experiment extending for 4 hours 12 mins., a yield of 83·5 per cent. of the theoretical quantity of hydrogen was obtained from about 16 litres of gaseous hexamethylene. The palladium appears to be a specific catalyst for cyclic C_6-hydrocarbons; hexane and pentamethylene hydrocarbons are not dehydrogenised in presence of palladium, at least not at temperatures up to 300° C. At lower temperatures the palladium acts as a catalyst also in the reverse direction, benzene and hydrogen, for example, being rapidly converted into hexamethylene at 100°—110° C. Up to 200° C., hydrogenation, but above that temperature dehydrogenation, predominates. Platinum black prepared in an analogous manner to the palladium black exerts a similar but much less marked action. —A. S.

Phenols; Colourimetric determination of —— in waste liquors. H. Bach. Z. anal. Ch., 1911, 50, 736—740.

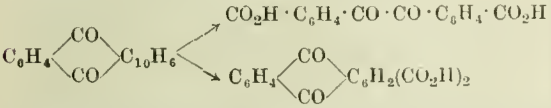
Phenols in the waste liquors from by-product coke-ovens, etc., can be determined rapidly, and with a considerable approach to accuracy, by making use of the well-known colour reaction with Millon's reagent. The process is as follows:—10 c.c. of the liquor are treated in a test-tube with 0·2 c.c. of Millon's reagent and 3 drops of concentrated nitric acid, and heated just to boiling. Should the tint struck be weak or full rose-colour, the colourimetric determination can be carried out as below. Should it be deep red, the liquor must be diluted appropriately. Should it be yellowish or inappreciable, 100 c.c. are acidified with 5 c.c. of strong sulphuric acid and 20 c.c. distilled off. If 10 c.c. of this give no colouration with Millon's reagent, no sensible amount of phenol is present; but if a colour appears, the original liquor must be concentrated as follows: 1 litre is made alkaline by 5—10 c.c. of strong potassium hydroxide, and boiled down to 50 c.c., then transferred completely to a 500 c.c. conical flask with a 150 c.c. mark upon it, cooled, treated with strong sulphuric acid (keeping cool) till strongly acid (15—20 c.c.), diluted to the mark, and 100 c.c. distilled off into a measuring-flask. Of this distillate 10 c.c. are used, and tested with Millon's reagent as above. If the colour struck when hot is yellowish to bright rose, 0·2 to 0·7 mgrm. of phenol is probably present; if bright rose to red 0·8 to 1·8 mgrms.; if red to deep red, 1·8 to 3 mgrms. Suitable quantities of a solution of pure phenol containing 1 mgrm. per c.c. are then placed in test-tubes, diluted to 10 c.c., and treated with Millon's reagent and nitric acid as above. The colours change on cooling, but are permanent when cold, and the requisite comparisons are made half an hour after cooling. With from 0·1 to 1 mgrm. in 10 c.c. differences of from 0·05 to 0·1 mgrm. are perceptible, with 1 to 2 mgrms., differences of 0·25 mgrm., with 2 to 3 mgrms., differences of 0·5 mgrm. More than 3 mgrms. gives a tint too deep for comparison.—J. T. D.

Resorcinol; Study of the bromine and iodometric methods for the determination of ——. C. M. Pence. J. Ind. Eng. Chem., 1911, **3**, 820—822.

The author examined the requisite conditions for accurate results in the determination of resorcinol by means of bromine and potassium iodide. It is stated that the methods of Degener (J. prakt. Chem., [2], **20**, 322) and of Richard (this J., 1902, 423) are inaccurate. The following process is recommended for the determination of resorcinol in the commercial substance. 1·4563 grms. are dissolved in water, and the filtered solution is diluted to 500 c.c. 25 c.c. of the solution are treated with 50 c.c. of *N*/10 bromine solution, 50 c.c. of water, and 5 c.c. of concentrated hydrochloric acid in a stoppered vessel, and after shaking and allowing to stand for 1 minute, 200 c.c. of water and 5 c.c. of a 20 per cent. solution of potassium iodide are added, the whole shaken vigorously and left for 5 minutes. The liberated iodine is then titrated with *N*/10 thiosulphate, with starch as indicator. The number of c.c. of *N*/10 bromine solution consumed, multiplied by 2·5, gives the percentage of resorcinol. A blank determination must always be made.—A. S.

1 : 2-*Benzanthraquinone* (*Naphthanthraquinone*); *Degradation of* —— *to anthraquinone*-1 : 2-*dicarboxylic acid.* R. Scholl and E. Schwinger. Ber., 1911, **44**, 2992—2998.

By means of permanganate naphthanthraquinone can be oxidised in two directions depending on the conditions employed, thus:—



$$C_6H_4\begin{matrix}CO\\CO\end{matrix}C_{10}H_6 \begin{matrix}\nearrow CO_2H\cdot C_6H_4\cdot CO\cdot CO\cdot C_6H_4\cdot CO_2H\\ \searrow C_6H_4\begin{matrix}CO\\CO\end{matrix}C_6H_2(CO_2H)_2\end{matrix}$$

Anthraquinone-1 : 2-dicarboxylic acid is obtained in a yield of 75·5 per cent. of the theoretical by oxidising naphthanthraquinone by the process described in Fr. Pat. 423,986 (this J., 1911, 737). The acid is also produced in less quantity by oxidising naphthanthraquinone with dilute nitric acid at 190°—195° C. Only a small amount of the acid is produced by oxidising in neutral aqueous solution with permanganate, the chief product being diphthalylic acid. Anthraquinone-1 : 2-dicarboxylic acid is converted into anthraquinone by heating with lime and into its anhydride when heated to 250° C. The latter when treated with dry ammonia furnishes the imide. It gives characteristic colourations with sodium hydroxide and hydrosulphite.—J. C. C.

Aniline; Oxidation of ——. *III.* R. Majima and Y. Aoki. Ber., 1911, **44**, 3080—3084. (See also this J., 1910, 1196.)

By the action of lead dioxide or manganese dioxide on aniline, Börnstein in 1901 (this J., 1901, 701) obtained, together with azophenine, a compound to which he ascribed the formula: $C_6H_5.N : C_6H_3(NH_2) : N.C_6H_5$. Since, however, other compounds of similar constitution to this have been found by one of the authors and others to be resistant to dilute acids, whereas Börnstein's compound was described as being extremely sensitive to dilute acids, the authors have repeated the work, and find that the oxidation product in question has the composition, $C_{24}H_{20}N_4$, and not $C_{18}H_{15}N_3$, as given by Börnstein. It is probably 1·5-aminoanilinoquinonedianil: $C_6H_5.N : C_6H_2(NH_2)(NH.C_6H_5) : N.C_6H_5$.—A. S.

Determination of moisture in fuel [*and of water and light oils in tar*]. Crisfield. *See* IIa.

Patents.

γ-*Chloropropylbenzene and its homologues; Process for preparing* ——. E. Merck. Ger. Pat. 239,076, Sept. 21, 1910.

When γ-chloropropylaniline (prepared from N-benzoyltetrahydroquinoline by way of γ-chloropropylbenzanilide) is diazotised and reduced, γ-chloropropylbenzene is produced; its homologues are obtained in a similar manner from homologues of γ-chloropropylaniline. γ-Chloropropylbenzene is an oil of powerful odour, of b. pt. 219°—220° C.; it is of value as a synthetic agent, the chlorine being readily replaced by a cyano-group which can be converted successively into the $CH_2.NH_2$ and CH_2Cl groups, so that the side chain can be extended indefinitely.—T. F. B.

1-*Naphthol*-2-*sulphonic acid; Process for preparing* ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 237,396, July 22, 1910.

When the alkali salts of 1-naphthol-2.4-disulphonic acid or of 1-naphthol-4-sulphonic acid are heated to high temperatures in presence of a suitable diluent, 1-naphthol-2-sulphonic acid is produced.—T. F. B.

4-*Chloro*-1-*hydroxynaphthalene; Process for preparing* ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 240,038, Oct. 26, 1910.

4-Chloro-1-hydroxynaphthalene may be obtained by chlorinating the arylsulphonic esters of α-naphthol and then eliminating the arylsulpho group in the usual manner. —T. F. B.

1-*Naphthol*-2-*sulphonic acid; Manufacture of* ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 2355, Jan. 30, 1911.

See Ger. Pat. 237,396 of 1910; preceding.—T. F. B.

1-*Naphthol*-2-*sulphonic acid; Process for producing* ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 429,999, May 20, 1911. Under Int. Conv., July 21, 1910.

See Ger. Pat. 237,396 of 1910; preceding.—T. F. B.

Anthracene compounds; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 26,336, Nov. 12, 1910.

See Addition of Dec. 16, 1910, to Fr. Pat. 403,205 of 1909; this J., 1911, 738.—T. F. B.

β-Aminoanthraquinone; Process for making an oxidation product of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 431,049, Aug. 30, 1910.

SEE Eng. Pat. 20,109 of 1910; this J., 1911, 796.—T. F. B.

Separating solid hydrocarbons, such as paraffin, ceresin, and ozokerite, from mineral oil residues and tars. Ger. Pat. 238,489. *See* IIA.

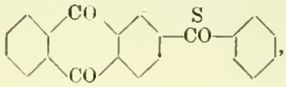
IV.—COLOURING MATTERS AND DYES.

o-Hydroxyazobenzene; A new synthesis of ——. N. N. Woroshtzow. J. prakt. Chem., 1911, **84**, 529—532.

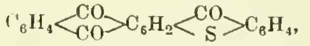
o-HYDROXYAZOBENZENE is produced in good yield by the following series of reactions:—Benzenediazonium chloride is combined in alkaline solution with *p*-acetylaminophenol, yielding *m*-acetylamino-o-hydroxyazobenzene, which on hydrolysis furnishes the corresponding base. On diazotising this and boiling the product with alcohol, o-hydroxyazobenzene is produced.—J. C. C.

Anthraquinonethioxanthones. F. Ullmann and E. Knecht Ber., 1911, **44**, 3125—3132.

THE anthraquinonethioxanthones are prepared by condensing the anthraquinone chloro-derivatives with thiosalicylic acid, whereby anthraquinonethiosalicylic acids are produced, and then treating these with *p*-toluenesulphonyl chloride or phosphorus pentachloride. Anthraquinone-2 : 1-thioxanthone,

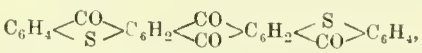


gives with sodium hydroxide and hydrosulphite a blue vat from which cotton is dyed in the same shades; on exposure to the air these turn bright orange. Anthraquinone-1 : 2-thioxanthone,



$$C_6H_4{<}\genfrac{}{}{0pt}{}{CO}{CO}{>}C_6H_2{<}\genfrac{}{}{0pt}{}{CO}{S}{>}C_6H_4,$$

forms yellow needles melting at 278° C. Anthraquinone-2 : 1 : 6 : 5-bisthioxanthone,

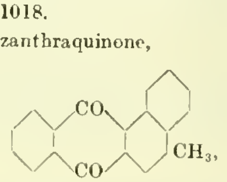


$$C_6H_4{<}\genfrac{}{}{0pt}{}{CO}{S}{>}C_6H_2{<}\genfrac{}{}{0pt}{}{CO}{CO}{>}C_6H_2{<}\genfrac{}{}{0pt}{}{S}{CO}{>}C_6H_4,$$

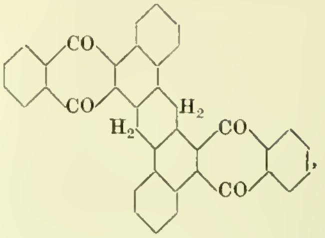
gives a blue violet vat from which cotton is dyed in the same shades; on exposure these become red. Anthraquinone-2 : 1 : 7 : 8-bisthioxanthone gives a blue vat dyeing cotton blue which changes to bluish red on exposure.—J. C. C.

Methyl-1 : 2-benzanthraquinones; Researches in the series of the ——. R. Scholl and W. Tritsch. Monatsh. Chem., 1911, **32**, 997—1018.

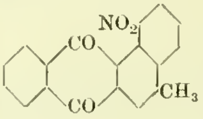
3-Methyl-1 : 2-benzanthraquinone,



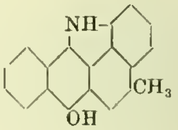
prepared by condensing the ammonium salt of 4-methyl-1-naphthylphenylketone-2′-carboxylic acid by means of concentrated sulphuric acid at 60°—62° C. forms yellow needles, m. pt. 176°—177° C., and with sodium hydrosulphite and hydroxide gives a red vat which has only slight affinity for unmordanted vegetable fibres. 1 : 2 : 1′ : 2′-Dibenzanthraflavone,



is obtained from the compound just described by heating it with potassium hydroxide and ethyl alcohol, together with a little sodium acetate at 160° C. It forms orange needles and gives a yellowish red vat with hydrosulphite and alkali from which cotton is dyed yellow. On exposure to the air or by treatment with hypochlorite solution, the dyeings change to a bright yellowish red with a characteristic salmon-red tinge. When the 4-methyl-1 : 2-benzanthraquinone is melted at 320°—340° C. with alkali hydroxide alone, it yields a vat dyestuff which produces silver grey shades. On bromination 3-methyl-1 : 2-benzanthraquinone yields a penta-bromo-derivative which gives a red vat having only slight affinity for vegetable fibres: the dyeings on exposure and washing turn yellowish brown. On nitration 3-methyl-1 : 2-benzanthraquinone furnishes a nitro-derivative (I) which when boiled with phenylhydrazine gives 3-methyl-O-N-dihydro-2 : 9-(N)-indoleanthrone (II).



(I.)

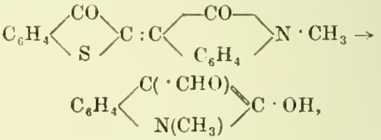


(II.)

The brown alkaline solution of the latter dyes cotton brown shades which on washing turn olive green and on exposure become violet brown. On passing air through the alkaline solution the compound is oxidised to 3-methyl-2 : 9-(N)-indoleanthrone and this can be reduced to the dihydro-compound by phenylhydrazine at the ordinary temperature.—J. C. C.

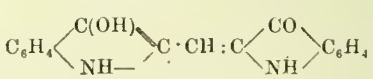
Aldehydes of oxindole, indoxyl and oxythionaphthene. P. Friedländer and S. Kielbasinski. Ber., 1911, **44**, 3098—3108.

INDOXYLALDEHYDE and oxindolealdehyde (compare Friedländer and Schwenk, this J., 1910, 937) have been further characterised by preparation of derivatives and the N-methyl derivative of the latter has been prepared from N-methylthioindigo Scarlet obtained from N-methylisatin and oxythionaphthene) by treatment with potassium hydroxide.



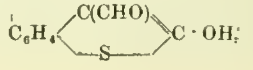
$$C_6H_4{<}\genfrac{}{}{0pt}{}{CO}{S}{>}C:C{<}\genfrac{}{}{0pt}{}{—CO—}{C_6H_4}{>}N\cdot CH_3 \rightarrow C_6H_4{<}\genfrac{}{}{0pt}{}{C(\cdot CHO)}{N(CH_3)}{>}C\cdot OH,$$

When indoxylaldehyde is warmed with 20 per cent. hydrochloric acid, it is converted into a violet dyestuff of the formula,



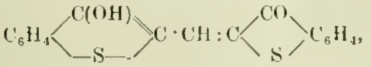
$$C_6H_4{<}\genfrac{}{}{0pt}{}{C(OH)}{NH—}{>}C\cdot CH:C{<}\genfrac{}{}{0pt}{}{CO}{NH}{>}C_6H_4$$

3-Oxythionaphthene-2-aldehyde.



$$C_6H_4{<}\genfrac{}{}{0pt}{}{C(CHO)}{—S—}{>}C\cdot OH;$$

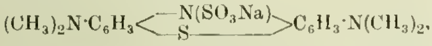
is prepared by treating 2-indole-2-thionaphtheneindigo with concentrated alcoholic potassium hydroxide solution. When its alcoholic solution is treated with dilute sulphuric acid or when an alcoholic solution of equal molecules of 3-oxythionaphthene and 3-oxythionaphthene-2-aldehyde are warmed with concentrated hydrochloric acid, a red dyestuff of the constitution,



is obtained. Oxindole-3-aldehyde and 2-hydroxy-thionaphthene-3-aldehyde (prepared from 2-indole-3-thionaphtheneindigo) give yellowish red tarry condensation products when treated with hydrochloric acid.—J. C. C.

Dyestuffs of various classes ; Action of sulphurous acid and sulphites on ——. H. Weil, K. Dürrschnabel and P. Landauer. Ber., 1911, **44**, 3172—3179.

When sulphur dioxide is passed into an aqueous solution of Methylene Blue, the colour of the latter is not altered at first, but after several days yellow crystals appear. The substance formed seems to contain two Methylene Blue residues and three sulphonic residues, but its constitution has not been ascertained. Neutral sulphites reduced Methylene Blue to the leuco-compound, and sodium bisulphite produced leuco-methylene blue sulphonic acid. In this reaction a sulphamic acid,

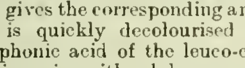


appears to be formed as intermediate product. Nitromethylene Bluo (Methylene Green) is converted by sulphurous acid into the sulphonic acid of the leuco-compound : this on reduction gives the corresponding amino-compound Meldola's Blue is quickly decolourised by sulphurous acid, a monosulphonic acid of the leuco-compound being formed. Indamines give with sulphurous acid or bisulphite leuco-disulphonic acids. Tetramethylated indamine gives a monosulphonic acid. Safranines, Indulines and Rhodamines are not decolourised by sulphurous acid.—J. C. C.

Patents.

Azo dyestuffs ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 21,199, Sept. 12, 1910.

The tetrazo compound of *pp'*-diaminodiphenylurea-*mm'*-disulphonic acid is combined, in acid or neutral solution, with one mol. of 2-amino-8-naphthol-6-sulphonic acid or of its aryl, aralkyl, or alkyl derivatives, and with one mol. of either a β-naphthylaminesulphonic acid or its alkyl or aralkyl derivatives or (in alkaline solution) one mol. of an arylated, aralkylated, or alkylated 2.5.7-aminonaphtholsulphonic acid. Similar products are obtained by combining the above tetrazo compound with two mols. of the same or different β-naphthylaminesulphonic acids or their alkylated derivatives, or by treating with phosgene two mols. of the alkali salts of the azo dyes derived from β-naphthylaminesulphonic acids or their alkyl derivatives of the type,



(where R is the naphthylamine compound), or two different molecules of azo dyes of the same type, but in which R represents also a 2.8.6- or 2.5.7-aminonaphtholsulphonic acid or a derivative of the same. The products dye cotton red to violet-red shades fast to light.—T. F. B.

Tetrakisazo dyestuffs ; Production of new ——. F. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 2797, Feb. 3, 1911.

The dyestuffs are prepared by combining with one molecule of *m*-diamino-diphenyl- or ditolyl-urea, two molecules of an intermediate compound obtained from one molecule of a tetrazo compound of a *p*-diamino of the benzene or diphenyl series and one molecule of a *m*-phenylenediamine- or *m*-tolylenediamine- or a *m*-aminophenol-sulphonic acid. Example 1 : The tetrazo compound from 18·4 kilos. of benzidine is combined with a solution of 18·8 parts of 1 : 3-phenylenediamine-4-sulphonic acid in alkaline solution. The excess of soda is then neutralised and a solution of 17·5 parts of *m*-diaminodiphenylurea hydrochloride is added and then sodium acetate, and the mixture stirred for about one day. The solution is then rendered alkaline and the dyestuff salted out. It dyes unmordanted cotton in orange shades which when diazotised and developed with *m*-phenylenediamine or β-naphthol, turn yellowish brown. In the second example *p*-phenylenediamineazo-*m*-phenylenediaminesulphonic acid is used as the intermediate substance.—J. C. C.

Dyestuffs of the triarylmethane series ; Production of mordant ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 30,106, Dec. 28, 1910.

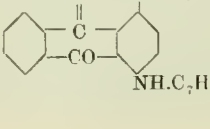
Benzyl-o-hydroxycarboxylic acids in which the methylene group is combined with two different radicles of the benzene series, for example,

$$C_6H_5.CH_2.C_6H_3(OH).CO_2H,$$

are condensed in the presence of oxidising agents with sulphonic or carboxylic acids of phenols or naphthols, either first to leuco-compounds which may then be oxidised, or condensation and oxidation are effected in one operation, or the carbinols of the benzylhydroxycarboxylic acids are condensed with the phenols above mentioned and the leuco-acids then oxidised. Example : 8·5 parts of 2-hydroxy-3-carboxybenzyldiethylaniline, $CO_2H.C_6H_3(OH).CH_2.C_6H_4.N(C_2H_5)_2$ (obtained by heating *o*-chloromethylsalicylic acid with diethylaniline to 100° C.) are oxidised with 160 parts of concentrated sulphuric acid and the necessary amount of nitrosyl chloride at 25°—30° C. Then 4·7 parts of o-cresotic acid are added and the mixture, after the latter acid has disappeared, is oxidised by adding sodium nitrite. The mass is poured on ice and the dyestuff collected. The shades produced from these dyestuffs can either be chromed after dyeing or the dyestuffs can be dyed on chromed wool or the bichromate can be added to the dye-bath. The dyestuff exemplified produces violet shades and a table is given showing the properties of similar dyestuffs produced in an analogous way.—J. C. C.

Wool dyestuff ; Violet ——. P. Thomaschewski, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,004,107, Sept. 26, 1911.

New violet wool dyestuffs are obtained by heating 1-alkylamino-4-arylaminoanthraquinones with urea and a condensing agent, and converting the products into sulphonic acids. Example : 10 parts of 1-methylamino-4-*p*-tolylaminoanthraquinone, 10 parts of urea, 10 parts of ammonium chloride and 60 parts of phenol are boiled together until a sample is soluble in pyridine with a violet colour which is not changed to red by further heating. 100 parts of alcohol are added and the precipitate is collected and washed with alcohol and water. One part of the product thus obtained is dissolved in 10 parts of sulphuric acid monohydrate, fuming sulphuric acid is added until the mixture fumes, and the whole is then heated to 50° C. until a sample is soluble in water. The mass is introduced into 100 parts of ice water, heated, filtered off, neutralised with soda and dried. The dyestuff dyes wool in fast violet shades and has probably the constitution :—



—J. C. C.

Anthraquinone derivatives ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 238,982, July 28, 1910.

When o-diaminoanthraquinones or their derivatives are condensed with aldehydes, a series of very stable, highly coloured derivatives is obtained, some of which may be used as dyes whilst others are readily converted into dyes. They resemble or are identical with the products produced according to Ger. Pat. 238,981 (this J., 1911, 1306).—T. F. B.

Anthracene dyestuffs ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 239,544, July 30, 1910.

When dianthrimides are treated with dehydrating or condensing agents, at ordinary or elevated temperatures, they are converted into a new series of vat dyestuffs ; the reaction is probably akin to that occurring when α-arylaminoanthraquinones are similarly treated, resulting in the production of acridine derivatives (see also U.S. Pat. 996,109 ; this J., 1911, 1109).—T. F. B.

Azo dyestuffs ; New intermediate products for the manufacture of ——. H. Levinstein, J. Baddiley and Levinstein, Ltd., Manchester. Eng. Pat. 26,577, Nov. 16, 1910.

New intermediate products are obtained by combining chloroacetyl chloride with an aminonaphtholsulphonic acid which does not contain the amino-group in either the ortho- or the peri-position to the hydroxyl group, and with a primary aromatic amine other than an aminonaphthol or an aminonaphtholsulphonic acid. According as to which of the two substances is first combined with the chloroacetyl chloride, two series of condensation products can be formed, having the general formulæ :—

$$(a)\ SO_3H.C_{10}H_4(OH)X.NH.CO.CH_2.NH.R$$
$$(b)\ SO_3H.C_{10}H_4(OH)X.NH.CH_2.CO.NH.R$$

The aminonaphtholsulphonic acids mentioned are 2-amino-5-naphthol-7-sulphonic acid and 2-amino-8-naphthol-6-sulphonic acid and the bases aniline, *m*-nitroaniline and *o*-aminobenzoic acid.—J. C. C.

Vat dyestuffs ; Manufacture of new ——. Soc. pour l'Ind. Chim. à Bâle, Basle, Switzerland. Eng. Pat. 22,067, Oct. 6, 1911. Under Int. Conv., Oct. 28, 1910.

The new vat dyestuffs are prepared by halogenating the product of condensation of acenaphthenequinone or a substitution product thereof with an amino-oxythionaphthenecarboxylic acid or an amino-oxythionaphthene. Example 1 : 3·4 parts of the product obtained by condensing acenaphthenequinone with 6-amino-3-oxy-1-thionaphthene in alcohol are introduced into a mixture of 80 parts of 97 per cent. sulphuric acid and 7 parts of bromine at 0° C. After 4—5 hours the temperature is allowed to rise to 20°—25° C., and the mixture is stirred at this temperature for about 10 hours. It is then poured into water, filtered, and the residue washed until neutral. The vat dyeings of the dyestuff produce bright orange shades on cotton and wool. Example 2 : 3·7 parts of the condensation product obtained from 6-amino-3-oxy-1-thionaphthenecarboxylic acid and acenaphthenequinone in acetic anhydride are suspended in 35—40 parts of nitrobenzene, 7 parts of bromine are added, and the mixture is stirred at the ordinary temperature for 12 hours. It is then heated for 1—2 hours at 200°—220° C., and allowed to cool ; the brominated product which has separated is then filtered off. Its vat dyeings have brownish orange tints.—J. C. C.

Dyestuff of the triphenylmethane series ; Red acid —— *and process of making same.* W. Emmerich, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,006,738, Oct. 24, 1911.

One mol. of a benzaldehydedisulphonic acid is condensed with one mol. of a monoalkylated and one mol. of a dialkylated *m*-aminophenol, and after closing the pyrone ring, the leuco compound is oxidised to the dye. The products dye silk pure red shades, whilst leaving cotton uncoloured. The dyestuff from benzaldehyde-2.4-disulphonic acid, monoethyl-*m*-amino-*p*-cresol and diethyl-*m*-aminophenol is specially claimed.—T. F. B.

Dyestuffs easily converted into vats ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 239,338, April 28, 1910. Addition to Ger. Pat. 237,368, Sept. 28, 1909.

By liberating thioindigo and other indigoid dyestuffs from their solutions in sulphuric acid in presence of aromatic sulphonic or carboxylic acids (see Eng. Pats. 18,761 and 20,324 of 1910 ; this J., 1911, 1047 and 1110), the dyestuffs are obtained in a form in which they are much more readily converted into vats than the dyestuffs produced in other ways.—T. F. B.

Indigo in finely-divided condition ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 239,339, Sept. 4, 1910. Addition to Ger. Pat. 237,368, Sept. 28, 1909.

As a variation of the process described in Eng. Pats. 18,761 and 20,324 of 1910 (this J., 1911, 1047, 1110), the indigo may be precipitated from its leuco-compounds or salts in presence of phenols, such as phenol, resorcinol, guaiacol, pyrogallol, 1.4-dihydroxynaphthalene monobenzyl ether, β-hydroxyanthraquinone, α-anthrol, etc. —T. F. B.

Vat dyestuffs of the anthraquinone series ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 239,543, Nov. 2, 1909.

The dyestuffs are obtained by the introduction of aryl, alkyl, acidyl, or anthraquinonyl radicals into the amino-group of 4-amino-1.2-anthraquinone-acridone.—T. F. B.

Vat dyestuffs ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 239,674, March 10, 1910.

The reduction product of α-hydroxyanthraquinone is condensed with a 2.3-diketodihydro-(1)-thionaphthene substituted in the 2-position. From the colour and the insolubility in alkalis of the products, it is concluded that they are indigoid compounds resulting from the union of the thionaphthene nucleus with the β-carbon atom of the reduced hydroxyanthraquinone, the hydroxyl group of which becomes converted at the same time into a keto-group.—T. F. B.

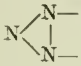
$\beta\beta'$-Dianthraquinonylurea ; Process for preparing halogen substitution products of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 240,192, Feb. 11, 1909.

By treating $\beta\beta'$-dianthraquinonylurea with halogens or substances which liberate halogen, with or without the addition of solvents, halogen derivatives are obtained which may serve as vat dyestuffs. The substance obtained by treating the dianthraquinonylurea with excess of liquid bromine, dyes cotton and wool yellow shades from the hydrosulphite vat.—T. F. B.

Disazo-dyestuffs for wool ; Production of new ——. Act. Ges. f. Anilinfabr. Fr. Pat. 430,962, May 6, 1911. Under Int. Conv., Jan. 31, Feb. 18, March 25, 1911.

Disazo dyestuffs, producing red to deep blue shades on wool in an acid bath, are prepared by diazotising the product of combination of a diazo derivative of an aminodiaryl ether or its sulphonic acids with a benzenoid amine or α-naphthylamine or its derivatives and by combining the intermediate diazo-compound with β-naphthol or its sulphonic or carboxylic derivatives or with 2 : 6- or 2 : 7-dihydroxynaphthalene. Example : 18·5 parts of 2-amino-diphenyl ether are diazotised and mixed with an aqueous neutral solution of 22·3 parts of α-naphthylamine-7-sulphonic acid after which acetate or carbonate of sodium is added. The sodium salt of the monoazo compound is finally made by the action of sodium hydroxide. A solution of 7 parts of sodium nitrite is now added and the mixture poured into hydrochloric acid. The diazo compound is combined with 27 parts of 2-naphthol-6-sulphonic acid in presence of sodium carbonate and the dyestuff is separated by means of salt. A table is given describing other similar dyestuffs.—J. C. C.

Anthraquinone derivatives ; Manufacture of new —— and their application in dyeing and printing. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 431,176, May 8, 1911.

New derivatives of the anthraquinone series, which contain the group,  , are obtained by combining β-diazoanthraquinone or its derivatives with β-naphthylamine or its derivatives, and oxidising the product. Example : 23 parts of β-aminoanthraquinone are dissolved in 100 parts of concentrated sulphuric acid, the solution is diluted with ice and diazotised by adding a solution of 7 parts of sodium nitrite in 100 parts of water. The diazo-solution is poured into a solution of 18·8 parts of β-naphthylamine hydrochloride and the formation of the dyestuff is completed by adding sodium acetate or carbonate or sodium hydroxide. For the oxidation 100 parts of the dry dyestuff are dissolved in 500 parts of nitrobenzene and treated at about 120° C. with a solution of about 100 parts of sodium bichromate in 500 parts of glacial acetic acid, which is added gradually. On cooling the product is collected and washed with alcohol. With alkaline hydrosulphite it gives a violet brown vat from which cotton is dyed in the same shades ; these on oxidation turn yellow and are fast to soap and chlorine. Other examples are also given in the patent.—J. C. C.

Vat [anthracene] dyestuffs ; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 238,980, Sept. 17, 1910.

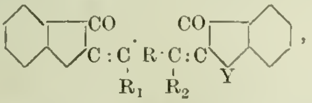
1.1′Dianthraquinonyl-2.2′-dialdehyde or its derivatives (obtained by the action of copper, etc., on two mols. of 1-halogen-anthraquinone-2-aldehydes) are readily converted into vat dyestuffs by treatment with condensing agents, preferably those which have also a reducing action. They may be prepared directly on the fibre as dyes or in the form of their hydro-compounds. They are identical with dyes obtained from 2.2′-dimethyl-1.1′-dianthraquinonyl according to Fr. Pat. 357,239 (this J., 1906, 66).—T. F. B.

Indigo ; Process for halogenating ——. E. Kunz. Ger. Pat. 239,672, Nov. 10, 1909.

Halogen derivatives of indigo may be obtained by electrolysing an anhydrous, melted salt of pyridine or quinoline with a hydrohalogen acid, containing indigo in solution or suspension : the extent of the halogenation may be regulated by varying the time of electrolysis, the composition of the mixture, and the temperature. Owing to the absence of water, no oxidation or reduction process takes place during the halogenation.—T. F. B.

Indigoid dyestuffs ; Process for preparing ——. Kalle und Co. Ger. Pat. 239,916, May 15, 1910.

Indigoid dyestuffs of the general formula,



are obtained by the condensation of two mols. of indoxyl, 3-oxy-(1)-thionaphthene, or their substitution products or analogous compounds, with one mol. of a dialdehyde or a non-cyclic ketone of the fatty or aromatic series, or derivatives of these compounds. Dyestuffs of very varying shades are thus produced.—T. F. B.

Vat dyestuff [naphthindigo] ; Process for preparing a bluish-green ——. Kalle und Co. Ger. Pat. 240,118, June 29, 1910.

Naphthyl-2-thioglycol-3-carboxylic acid is converted into naphthindigo by the same process of ring-formation and oxidation used to convert phenylthioglycol-o-carboxylic acid into indigo. The dyestuff dyes greenish-blue shades which are fast to light and soaping.—T. F. B.

Azo dyestuff ; Manufacture of a substantive ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 18,310, Aug. 2, 1910.

See Addition of Aug. 20, 1910, to Fr. Pat. 424,405 of 1910 ; this J., 1911, 738.—T. F. B.

Vat dyes of the anthracene series ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4608, Feb. 23, 1911.

See Addition of May 18, 1911, to Fr. Pat. 404,345 of 1909 ; this J., 1911, 1306.—T. F. B.

Aminobenzoylaminobenzoyl-2-amino-5-naphthol-7-sulphonic acid. W. Neelmeier, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Re-issue No. 13,304, Oct. 31, 1911, of U.S. Pat. 994,420, June 6, 1911.

See Ger. Pat. 230,595 of 1910 ; this J., 1911, 350.—T. F. B.

Anthraquinone derivatives containing nitrogen ; Manufacture of ——. F. Ullmann, Charlottenburg, Germany. Eng. Pat. 25,183, Oct. 29, 1910. Under Int. Conv., Nov. 12, 1909.

See Fr. Pat. 423,720 of 1910 ; this J., 1911, 613.—T. F. B.

Trisulphonic acids of the safranine series ; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 28,872, Dec. 12, 1910. Under Int. Conv., Feb. 8, 1910.

See Fr. Pat. 426,790 of 1910 ; this J., 1911, 1110.—T. F. B.

Vat dyestuff of the anthraquinone series and process of making same. M. Hessenland, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,002,270, Sept. 5, 1911.

See Ger. Pat. 239,543 of 1909 ; preceding.—T. F. B.

Vat dyestuffs of the anthraquinone series and process of making same. M. Hessenland, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine Germany. U.S. Pat. 1,007,104, Oct. 31, 1911.

See Fr. Pat. 425,742 of 1911 ; this J., 1911, 947.—T. F. B.

Vat dyestuffs ; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 431,122, June 15, 1911. Under Int. Conv., Sept. 12, 1910.

See Eng. Pat. 14,904 of 1911 ; this J., 1911, 1110.—T. F.B.

Indigo ; Process for preparing a new form of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 430,634, Aug. 17, 1910, and First Addition thereto, dated Aug. 20, 1910.

See Eng. Pats. 18,761 and 20,324 of 1910 ; this J., 1911, 1047 and 1110.—T. F. B.

Compounds and colouring matters of the anthracene series ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 894, Jan. 12, 1911.

See Ger. Pat. 237,236 of 1910 ; this J., 1911, 1153.—T.F.B.

Manufacture of Bordeaux red lakes. Fr. Pat. 431,420. *See* XIII.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Wood pulps; Microscopic details of certain ——. J. F. Briggs. World's Paper Trade Rev., 1911; through Papierfabrikant, 1911, **9**, 1340—1341.

Distinction between sulphite and soda coniferous pulps. Owing to the specific nature of the bisulphite process for digesting wood, it can only be applied successfully to woods which are relatively poor in resin and of a uniform pale colour. The soda (sulphate) or sulphite process, on the other hand, is more general in its attack, and breaks down not only the lignocellulose but also dissolves the resins, tannins and colouring matters of the wood. Hence it results that in commercial practice, only conifers of the spruce and fir group (*Picea*, *Abies*, etc.) are available for the manufacture of sulphite pulp, whilst woods of the pine group (*Pinus*) cannot be used and must, therefore, be treated by the soda process. The economic relationships of the two processes are such that the sulphite process will in all cases be preferred to the soda process, if it is technically possible. Hence the rule that all pulps containing pine wood fibres are soda pulps, and conversely, to a certain extent, the majority of pulps containing spruce wood fibres are sulphite pulps. Pine wood fibres are readily distinguished from spruce or fir fibres under the microscope. In addition to the circular pitted pores, common to the tracheids of all conifers, the tracheids of pine wood show large non-pitted pores of square or oblong form with rounded corners. If seen in profile, these large pores have the appearance of deep incisions in the fibre-walls. These large pores occur in single rows of 3—7 and correspond to the points of crossing of the medullary rays. Sulphite pulps never show such pores, but in rare cases soda pulps may be prepared from spruce wood and the large pores are then absent. *American poplar pulp.* The variety of poplar pulp which comes to this country from America is not derived from a poplar, but from the tulip tree (*Liriodendron tulipifera*). It is distinguished from the European poplar or aspen pulp by the presence of fine filaments stretched across the open mouths of the vessels. The vessels of ordinary aspen pulp have perfectly free, open mouths, but those of the American pulp show generally 3—4, but sometimes also a large number, of fine filaments stretched across like the bars of a grid.—J. F. B.

Paper pulps; Microscopy of certain ——. T. F. Hanausek. Papierfabrikant, 1911, **9**, 1402—1403.

Continuing his investigations on tropical paper-making fibres, the author describes the pulps derived from Indian species of poplar and willow. *Pulp from Himalayan poplar* (*Populus ciliata*, Wall). This pulp closely resembles that from the European species; parenchyma cells are rare, whereas vessels are abundant; the libriform cells have vulviform pores parallel or slightly inclined to the axis. The length of the fibres ranges from 0·97 to 1·8 mm., the most general length being 1·35—1·50. Vessels have open ends with long or short projections and three types of pits. This pulp cannot be distinguished with certainty from European poplar (or aspen) pulp. *Pulp from Indian willow* (*Salix tetrasperma*, Roxb.). The pulp has the same general characteristics as poplar pulp, but the vulviform pores of the fibres (libriform cells) are always inclined to the axis. These fibres are frequently forked. Their length most commonly ranges between 1·2 and 1·35 mm. Parenchyma cells, both short and square as well as long and rectangular, are abundant; this feature serves to differentiate the willow pulp from poplar pulp. Its fibres on the whole are shorter than those of poplar. —J. F. B.

Sulphite wood pulp; Stability of ——. Mathéus. Papierfabrikant, 1911, **9**, 1375—1376.

As factors of the permanence of any sample of sulphite wood pulp, have to be taken into account: its tendency to become discoloured and its tendency to become brittle and friable. Discolouration, or change to a yellowish tint, may be determined: (*a*), by the presence of residual impurities from the wood, *e.g.*, resins, of which as much as 1 per cent. may remain, even in bleached pulp; (*b*), by the presence of by-products of the bleaching process, if this has been too severe, owing to high temperature or the action of an acid bleach liquor. A pulp tending to discolouration will give a strongly yellow-coloured extract on treatment with a 5 per cent. solution of sodium hydroxide; it will also turn brown in a comparatively short time when heated in an air-bath at 100°—105° C. The tendency to become brittle may originate either in the sulphite treatment or in the bleaching process, and may be recognised by the ease with which the fibres are broken up when tested between the teeth, and by the large percentage of 'cellulose' soluble in sodium hydroxide. With a very tender pulp, as much as 15—35 per cent. may be soluble in 5 per cent. sodium hydroxide. By a simple treatment with ordinary bleach liquor it is difficult to prepare a pulp sufficiently strong and bright in colour to be suitable for the manufacture of the finest papers. For the sake of strength it is preferable to select for this purpose a pulp prepared by the slow digestion or Mitscherlich process. Bleaching should then be effected in two stages. According to one method, the stuff is treated with about two-thirds of the requisite quantity of bleach liquor, which is then acidified, either by acetic or perhaps preferably with mineral acid. After the bleach is exhausted, the soluble by-products are removed by washing and the final bleaching is effected with the remaining one-third of bleach liquor. The best process, however, is as follows: the pulp, diluted until it contains 20—25 grms. of fibre to the litre, is treated in a closed vessel with chlorine gas for about an hour. The liquid is removed, the pulp is washed and next treated with 1—2·5 per cent. of its weight of sodium hydroxide, either hot or cold. This removes the by-products in the form of a brown extract. After washing, the pulp may be soured with sulphurous acid and again washed. It is finally bleached cold with ordinary bleach liquor.—J. F. B.

Paper specialities. H. Postl. Papierfabrikant, 1911, **9**, 1344—1345.

Italian grocers' paper.—In Italy the vendors of eatables use a thin but heavily loaded paper for wrapping their goods. This paper contains 70 per cent. of mineral loading in the form of barytes. In the manufacture the engines are charged with 30 kilos. of rag-pulp and 200—300 kilos. of barytes, and the mixture is run on the machine. Only about one-third of the mineral employed remains in the paper; the remainder runs into a pit where it is allowed to settle, drained and made ready again for use in the beating engines. German grocers use for the same purpose a thicker paper, containing 30 per cent. of mineral loading, the fibre material being derived from waste papers and shavings from coated "art" papers.

Reinforced paper.—Paper combined with a light textile fabric is best made by pasting the fabric between two layers of finished paper in a separate process. There exists, however, a means for making such papers in a single operation on the paper-machine. The reel of fabric is mounted on a spindle above the slices of the machine, whilst a portion of the paper pulp is diverted, after leaving the strainers, through side-channels which deliver it some little distance in front of the slices. The web of paper is made on the wire in the ordinary way, the fabric is then unreeled and pressed in contact with the paper before it reaches the suction-box; it is carried forward by the pressure of the dandy roll, and the pulp diverted into the side channels is then run over the surface of the web, thus embedding the fabric. The speed of manufacture is very slow and there is some difficulty in disposing of the waste.

Asbestos paper is prepared by beating the long-fibred mineral in a hollander, either alone or with china clay, and running the pulp on a cylinder machine fitted with several light preliminary press-rolls.

"*Window*" *paper* is made in a small mill in Bavaria. It is a half-white, soft paper of substance about 25 grms. per sq. m., and is used for wrapping smallwares and metal goods to protect them from tarnishing and rust. The pulp is composed of half rag and half waste-paper stock, beaten in a small hollander. It is run on a cylinder machine without a dry-end, and reeled up moist on large winders. Here it is cut by the hand-saw into sheets which are dried in packs. The industry is dying out; it is followed only in the winter, requiring frost to make the paper softer and allow the sheets to be separated more easily after drying.—J. F. B.

Sulphite pulp waste lyes; Behaviour of —— with milk of lime. Mathéus. Papierfabrikant, 1911, **9**, 1407.

If cold or hot sulphite waste lye be treated with milk of lime until neutralised, a precipitate is formed containing calcium sulphate, calcium sulphite and calcium salts of organic acids. If more lime be added, the precipitate is increased and the liquid assumes a yellowish colour. On filtering the liquid and adding a further quantity of lime, it is found that a considerable portion of the latter is dissolved. If the yellow lye be then heated, or if more milk of lime be added, a large quantity of a yellow precipitate is suddenly produced and the entire mass forms a thick paste. The liquid portion can be separated by filtration and the precipitate then appears to be composed of very small crystals of the calcium salt or salts of one or several very similar organic compounds. The moist precipitate readily dissolves when acidified with sulphuric acid; when it is decomposed, calcium sulphate separates out and a yellow or brown solution remains. If this be poured slowly into sulphuric acid of 30° Bé., whilst stirring, each drop congeals at once to a flaky grey mass, so that a large quantity of an organic substance is obtained which can be filtered off from the excess of acid. This organic substance when oxidised by nitric acid yields large quantities of crystals of oxalic acid.—J. F. B.

Studies on rosin. Schwalbe and Küderling. *See* XIII.

PATENTS.

Scouring wool, silk waste and fabrics, and products obtained thereby; Process and apparatus for ——. R. A. G. Fabre. Fr. Pat. 430,691, June 8, 1911.

A wire cage, mounted on a perforated hollow horizontal axis and capable of revolving at either a low or a very high speed, is surrounded by an enveloping chamber which is connected with a reservoir. The material to be treated is put into the cage and submitted to the action of a suitable solvent for wool scouring whilst the cage is rotating at the low speed. When the scouring is completed, the supply of solvent is stopped and most of the excess remaining in the material is expelled by changing the driving gear to the high speed, and is collected in the reservoir attached to the outer envelope. Finally, to remove the residue which is not driven out by unaided centrifugal force, steam is delivered into the interior of the rapidly rotating cage through the hollow axis. —P. F. C.

Moistening textile goods; Apparatus for ——. O. Venter, Chemnitz, Germany. Eng. Pat. 7228, Oct. 26, 1910.

This is an apparatus for conditioning textile goods and then determining the amount of water absorbed. The goods are packed in baskets or trucks which are placed on the false bottom of a closed vessel, the space beneath the false bottom being almost filled by a known volume of water. A vacuum is produced inside the vessel and the water is raised to the required temperature by constantly circulating it through a heating system containing a closed steam coil. When the goods have been in the moist atmosphere thus produced for a period sufficiently long to ensure a thorough conditioning, the volume of the water remaining in the vessel is observed after pumping it into a measuring cylinder, and the amount of water absorbed by the material is obtained by difference, a correction being made for the water condensed on the trucks and other parts of the apparatus.—P. F. C.

Precipitation of artificial silk; Process for the ——. R. Pawlikowski. Fr. Pat. 431,074, June 14, 1911.

The coagulation of the cuprammonium-cellulose solution is effected by means of an aqueous solution of an alkali aluminate to which is added: (*a*), a small quantity of free alkali hydroxide to prevent the decomposition of the aluminate by the atmospheric carbon dioxide, and (*b*), 1—5 per cent. of an alkali tartrate, acetate or other suitable substance to prevent the precipitation of aluminium hydroxide by the ammonia liberated during the coagulation process.—P. F. C.

Cellulose esters; Process for the manufacture of ——. C. E. Dreyfus. Fr. Pat. 430,606, June 6, 1911. Under Int. Conv., June 8, 1910.

Cellulose esters can be produced even in the cold by the action of formic acid or the acid chlorides or anhydrides of aliphatic acids on cellulose or its derivatives in the presence of a small quantity of an aliphatic or aromatic ester of sulphuric acid. If the reaction is carried out in the absence of solvents, gelatinous products are obtained; if in the presence of a solvent such as acetic acid or chloroform, viscous solutions are produced which can be directly spun. Example: 10 kilos. of cellulose are mixed with 30 kilos. of acetic anhydride, 30 kilos. of glacial acetic acid and 200 grms. of ethylsulphuric acid, and the mixture is well stirred at the ordinary temperature until complete solution is obtained. The cellulose ester is then precipitated by pouring the solution into water.—P. F. C.

Artificial straw from cellulose, its derivatives or analogous substances; Process of manufacturing ——. P. Girard. Fr. Pat. 430,939, Aug. 26, 1910.

A filament is spun in the tube form from a solution of cellulose or one of its derivatives. This is effected by forcing the solution through a tube into a coagulating bath, the tube being provided along its axis with a metallic needle which does not touch the inner wall of the tube and is heated by electrical means. The diameter of this needle determines the interior diameter of the tubular filament, whilst the heat which comes from it ensures the thorough coagulation of the inner wall of the artificial straw and thus prevents subsequent flattening.—P. F. C.

Cellulose from waste wood, straw and other analogous substances; Process for obtaining ——. F. J. Schreyer. Fr. Pat. 431,044, June 14, 1911. Under Int. Conv., June 19, 1910.

Waste wood, such as small branches, the outer parts of trees, etc., is packed into perforated cylinders which are then placed inside long boilers of 30—50 cm. diameter, and the material is subjected to a boiling process at 15 atmospheres pressure for about an hour with a 2—4 per cent. solution of sodium hydroxide. The object of this process is not to disintegrate the material but to cause the non-fibrous incrustations to swell and partially dissolve whilst leaving the fibrous parts unaffected. The disintegration of the boiled wood and the separation of the fibrous parts of it are then effected mechanically, preferably by placing the boiled material on wire screens and discharging on to it powerful jets of very dilute caustic lye or water. The last traces of impurities are next eliminated from the fibres by treating them first with a very dilute solution of permanganate (0·06 per cent.) and secondly with sulphurous acid. A final washing completes the process. The first process may be replaced by boiling for 15 minutes with the dilute sodium hydroxide solution followed by an immersion in cold lye for some days.—P. F. C.

Pulp for paper-making and like purposes; Manufacture of ——. W. Stocks, London. Eng. Pat. 25,393, Nov. 1, 1910.

The wood of trees of the eucalyptus family is converted into pulp for paper-making and similar purposes. The wood is cut into strips about 6 ft. long and these are crushed and ground into very small fragments by passing between heavy steel rollers. The crushed wood is charged into stationary cylinders in which are situated rotating beaters or pulverising arms. It is treated under high steam pressure by these beaters until the fibres are completely separated. The gums and binding constituents of the wood are so softened by the steam that disintegration is complete in less than an hour.—J. F. B.

Maize straw; Economic and industrial utilisation of ——. [*Fodder and paper pulp*]. B. Dorner, Budapest, Hungary. Eng. Pat. 8638, Apr. 7, 1911.

Maize stems are freed from dirt by treatment in a beating and dusting machine: they are then cut up, steeped in water and shredded into fibres by special tubular refiners. The shredded material is boiled with a dilute solution of acetic acid (0·2—0·4 per cent.) under a pressure not exceeding 3·8 atmospheres, the digesters being arranged in series so that the liquid from one may be used in the next on the counter-current principle. In this way 17—18 per cent. of the straw can be extracted. The material is next boiled with lime water, and, as this becomes neutralised, further small additions of alkaline liquid are made, *e.g.*, milk of lime, a 0·2 per cent. solution of sodium carbonate, or 0·1 per cent. solution of sodium hydroxide. The end of the operation is indicated when neutralisation of the alkali becomes slow. The acid and the alkaline extracts of the stems are evaporated separately to a syrupy consistence, then mixed and absorbed by finely ground maize stems to form a fodder. The extracted material is converted into paper pulp by digestion with sodium hydroxide, the pith cells being separated by treatment on sieves.—J. F. B.

Peat moss ("*sphaigne de tourbe*") *for the manufacture of paper and cardboard; Process and apparatus for the treatment of* ——. A. Remmer and M. Wolsky. Fr. Pat. 431,360, May 17, 1911.

The moss is treated, first with a dilute alkali solution to neutralise the carbonic acid and hydrogen sulphide it contains, and secondly with a solution of alum. The refrigerating effect occurring in the course of this treatment, is said to facilitate the separation of the methane and other gases occluded in the material. These operations are carried out in a paddle washing machine having a sieve-like false bottom. The paddle blades are concave in shape and are enclosed in a drum made of wire-netting.—P. F. C.

Paper testing device. H. E. Eddy, Arlington, Ind., U.S.A. Eng. Pat. 5074, Feb. 28, 1911.

A simplified form of apparatus for testing the "bursting strain" of paper is described. It consists of a support and a casing which can be moved against springs with a reciprocatory motion on the support. The support has an annular corrugated bottom plate mounted on a hinge, so that the paper to be tested may be slipped between the corrugated plate and the bottom of the casing, and there gripped when the casing is pressed down. In the centre of the casing is situated a plunger, which at its lower end is in contact with the paper stretched across the annular plate, and at its upper end is in contact with a rubber diaphragm enclosing a fluid and transmitting its pressure to a pressure gauge which constitutes the upper portion of the casing. When the paper is inserted, the casing is pressed down and the paper exerts a resistance against the plunger, which actuates the pressure gauge until the paper breaks. A check-valve and valved by-pass are arranged so that the fluid remains in the pressure gauge after the paper has broken, and the pointer only returns to zero when the by-pass valve is opened.—J. F. B.

Corks; Process for coating —— *with a resisting neutral layer.* L. Pink, Berlin. Eng. Pat. 2455, Jan. 31, 1911. Under Int. Conv., Feb. 8, 1910.

Corks are coated by dipping them in a solution of cellulose in ammoniacal copper oxide, removing the copper oxide by treatment with acid and converting the coating of cellulose into a parchmentised form by treatment in a bath of sulphuric acid at a concentration of 30—60 per cent. —J. F. B.

Wool; Process for treatment of ——. E. Elsässer, Langerfeld, Germany. U.S. Pat. 1,008,249, Nov. 7, 1911.

See Fr. Pat. 418,082 of 1910; this J., 1911, 20.—T. F. B.

Fibrous materials for bedding, upholstery, and the like purposes; Treatment of ——. W. A. Dickinson, and Lyxhayr, Manufacturers, Ltd., Mitcham. Eng. Pat. 779, Jan. 11, 1911.

See U.S. Pat. 998,237 of 1911; this J., 1911, 1009.—T. F. B.

Artificial silk and other shaped products; Process for preparing from milk a plastic substance suitable for making ——. Naaml. Venn. "Hollandsche Zijde Mij." Fr. Pat. 431,052, June 14, 1911. Under Int. Conv., June 23, 1910.

See Ger. Pat. 236,908 of 1910; this J., 1911, 1050.—T. F. B.

Cellulose threads; Process and apparatus for the production of ——. J. Hübner. Fr. Pat. 431,112, June 15, 1911. Under Int. Conv., June 16, 1910.

See Eng. Pat. 14,559 of 1910; this J., 1911, 888.—T. F. B.

Organic compound [*solution of cellulose esters*]. U.S. Pat. 1,003,438. *See* XIII.

Glyceryl chlorohydroxyisobutyrate: Process for obtaining ——. Fr. Pat. 430,820. *See* XX.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Fur dyeing. E. Schlotthauer. Färber-Zeit., 1911, **22**, 397—400.

In modern fur dyeing, four different classes of work are dealt with. (1) For dyeing solid shades (chiefly blacks) such as are required on Persians or Broadtails, the entire skin is immersed in the dyebath. For the skins named, the logwood-tannin process is used for dyeing blacks; for hare-skins and Thibets, a logwood-turmeric black is used. (2) If the hair is required to be of a different shade from the skin itself, the entire skin is first dyed by the immersion process and a different dye-solution is then applied to the hair by the brushing process. (3) If only the hair is to be dyed, the colour is brushed on. (4) It is often desired to deepen the shade of the extreme tips of the surface hairs. Before dyeing, the furs have to be scoured by treating them with dilute caustic soda or with lime water to which soda ash has been added. The actual dyeing process is made difficult by the extreme care which is necessary to prevent deterioration of the skin. Before reaching the dyer the furs are submitted to one of several preparing processes, of which the alum, chrome, sulphuric acid and common salt, and chamois preparations, and the "*Schrotzurichtung*" are the most important. It is found that skins which have undergone a sulphuric acid-common salt treatment have the least resistance to the shrivelling effect of a hot dye-liquor, and chamois-prepared skins have most resistance. Even with the latter, however, the temperature of the dye-bath should not be allowed to exceed 45° C. The author finds that the shrivelling effect of hot dye-liquor can be diminished by previously treating the furs with formaldehyde. Thus, a chamois-prepared sable which was affected at 52° C., only shrivelled at 69° C. after being treated for three hours with 2 per cent. of a formaldehyde solution (30 per cent.)—P. F. C.

White discharge resist on azo-ground under blue vat dyestuffs. W. Kielbasinski and W. Slosarski. Chem.-Zeit., 1911, **35**, 1282—1283.

The material, which has been dyed with Paranitraniline Red or α-Naphthylamine Claret is printed with a paste containing Rongalite CL, B.A.S.F., or sulphoxylate and Discharge Salt W, B.A.S.F. (a dimethylphenylbenzylammonium salt), dried, and cover-printed with a discharge mixture containing a blue vat dyestuff. It is then steamed for 3 minutes, rinsed in running water, and after the leuco-compound of the vat dyestuff is re-oxidised, s soaped at 50°—60° C. The mixtures used are :—White discharge resist : 400 grms. of Rongalite CL, 160 grms. of water, 400 grms. of kaolin and gum ragacanth (1 : 1) and 40 grms. of 30 per cent. anthraquinone paste. Blue discharge : 35 grms. of Brilliant Indigo 4B Powder, 50 grms. of glycerin, 600 grms. of alkaline thickening, 150 grms. of Rongalite C, and 175 grms. of water. Alkaline thickening : 60 grms. of sodium carbonate Solvay soda), 140 grms. of water, and 800 grms. of British gum (1 : 1).—A. S.

PATENTS.

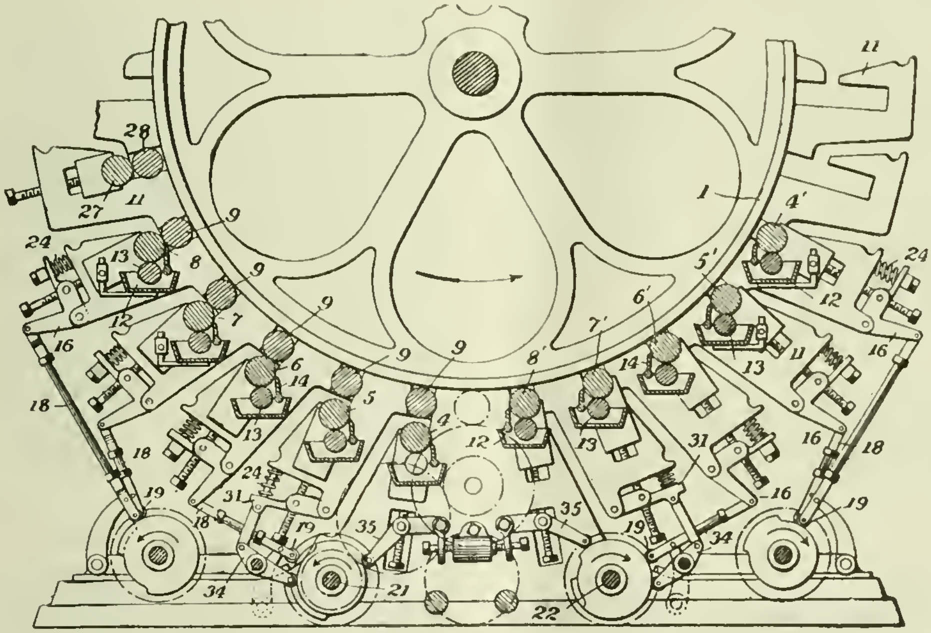
Washing or other treatment of cloth in rope form in bleachworks or elsewhere ; Apparatus to be used in the ——. S. Melling, Whitefield, Lancs. Eng. Pat. 833, Jan. 12., 1911.

In place of the usual peg rail for guiding cloth in the rope orm through bleaching or other machines, a shaft is employed on which are mounted a number of sections made of earthenware, porcelain, enamelled iron or some other uitable material, each section being provided with a mooth and fairly deep annular groove in which the roped loth can run freely. The shaft works in connection with a mechanism which disengages the driving clutch of the machine in the event of the cloth becoming tangled.
—P. F. C.

oxidised by means of permanganate. It is stated that dark shades can be obtained without impairing the lustre, strength, or elasticity of the material.—A. S.

Printing machines ; Fabric ——. A. J. Boult, London. From Eddystone Manufacturing Co., Philadelphia, U.S.A. Eng. Pat. 572, Jan. 9, 1911.

In the figure, 1, is a pressure cylinder which acts as impression roller for a set of printing rollers, 4′, 5′, 6′, 7′ and 8′, whilst a second set of printing rollers, 4, 5, 6, 7 and 8, co-operates with a set of pressure rollers, 9. Each printing roller is provided with a colour box, 12, a colour roller, 13, and a doctor, 14. The bearings of the printing rollers, 4′, 5′, 6′, 6 and 7, are connected with a lever, 16 ; those of 5 and 7′ with a lever, 31 ; and those of 4 and 8′ with a lever, 35. The levers, 16 and 31, are connected by means of levers, 18 and 34, with rollers, 19, which engage with cams mounted on shafts, 20, 21, 22 and 23. The levers, 35, themselves carry rollers, 19, which engage with the cams on shafts, 21 and 22. Springs, 24, (interposed between the frame parts, 11, and the levers, 16, 31) normally draw each printing roller, 4′, 5′, 6′, 7′, 5, 6, 7 or 8, away from its pressure roller and the action of the cams is to nullify the effect of the springs and make the printing rollers act at regular intervals. The levers, 35, for the rollers, 4 and 8¹, are also arranged so that they do not normally touch their pressure rollers. The fabric together with a backing cloth enters the machine between the printing rollers, 4, 5, 6, 7, 8, and their pressure rollers ; it then passes between feed rollers, 27, 28, around the roller, 28, through the nip of the pressure rollers, 9, and the cylinder, 1, then between the pressure cylinder, 1, and the printing rollers, 8′, 7′, 6′, 5′ and 4′. When the fabric reaches a guide roller arranged between the printing roller, 8′, and the pressure roller, 9, of the roller, 4, it separates from the back cloth and is led to the top of the machine, around the cylinder, 1, and between this cylinder and the fabric to be printed. If the groups of rollers, 6, 7, 8, and 6′, 7′, 8′, are engraved with one pattern and the groups, 4, 5 and 4′, 5′, with another, the action of the cams is so adjusted that the finished fabric will have the two designs printed on alternate portions of both surfaces of the cloth and each design will coincide exactly with the same design on the other face.
—P. F. C.



Bleaching process for vegetable tissues, yarns, fibres, and the like. F. Gebauer. Ger. Pat. 238,993, July 10, 1910.

For the separation of impurities from cotton fibres, etc., the latter are subjected, before or after the bowking process, to a carbonisation process in an acid bath, the concentration and temperature of which are so regulated that the fibre itself is not attacked. In order to lessen or prevent attack of the fibre, the material is subjected to the action of steam either during or after the carbonisation process. The action of sulphuric acid of 4° Bé. and steaming for 7 minutes is mentioned.—A. S.

Manganese bronze ; Process for the production of —— on organic fibres. W. Buschhüter. Ger. Pat. 239,308, Nov. 19, 1909.

MANGANOUS hydroxide or other insoluble manganiferous reducing agent is first fixed on the fibre and is then

Printing patterns on fabrics or tissues ; Process for —— and apparatus therefor. M. Ratigoier, Lyons, H. and G. Pervilhac, Villeurbanne, France. Eng. Pat. 10,673, May 2, 1911.

A METAL cylinder engraved in intaglio prints a viscous solution of cellulose, viscose, collodion or the like on to the fabric in the form of a raised pattern. The fabric is then passed underneath a series of printing rollers engraved in relief which apply different colours to selected parts of this pattern. These printing rollers are coupled with one another and with the cylinder by means of gear wheels in order to ensure exact register. The process is specially applicable to the production of lace effects on tulle fabrics.—P. F. C.

Rendering fabrics impermeable and fixing dyed shades ; Process for —— applicable to awning-cloths, packing-canvas, printed fabrics, etc. Soc. Delannoy et Bonte. Fr. Pat. 430,601, Aug. 16, 1910.

A MIXTURE of 3—6 parts of nitrated cotton, 50 parts of ethyl sulphate and 50 parts of alcohol is applied to each side of the fabric and the excess is removed by means of "doctors." The material is then dried. The process can be carried out either in a machine of special construction or in an ordinary sizing machine.—P. F. C.

Fabrics impermeable ; Process for rendering light ——. M. Ratignier and H. Pervilhac et Cie. Fr. Pat. 431,090, Aug. 31, 1910.

THE fabric is impregnated with a solution of gun-cotton in a mixture of alcohol, ether and amyl acetate, and is then allowed to dry.—P. F. C.

Wool ; Process for preventing the liability of —— to shrink whilst retaining the complete structure and softness and combined with the possibility of easily bleaching the same. G. Lumpp, Reutlingen, Germany. Eng. Pat. 13,088, May 31, 1911.

SEE Fr. Pat. 430,279 of 1911 ; this J., 1911, 1309.—T. F. B

Dyeing yarn with colouring matters of the Indanthrene class. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 4595, Feb. 23, 1911.

SEE Addition of March 7, 1911, to Fr. Pat. 359,466 of 1905 ; this J., 1911, 1052.—T. F. B.

Discharge effects on fibre ; Production of —— and pastes to be used therein. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 27,405, Nov. 24, 1910. Addition to Eng. Pat. 30,505, Dec. 30, 1909.

SEE Par. 2 of Third Addition to Fr. Pat. 414,937 of 1910 ; this J., 1911, 617.—T. F. B.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Sulphur in pyrites ; Determination of ——. A. Heczko. Z. anal. Ch., 1911, 50, 748—753.

IN Dennstedt's method of sulphur determination by burning the pyrites in a stream of oxygen, passing the gases formed over hot platinum, and absorbing the sulphur trioxide in heated sodium carbonate contained in boats in the forward portion of the combustion tube, there is always some sulphur trioxide retained by the Jena glass tube, which must in consequence be washed out after each operation, and the washings added to the solution of the contents of the boats for precipitation by barium chloride. The author finds that this troublesome process can be entirely avoided by using a quartz combustion tube, in which case the amount of sulphuric acid retained, if any, is inappreciable. The progress of the combustion can be quite well observed through the translucent tube. The sodium carbonate is dissolved in water, bromine water added, then hydrochloric acid to neutrality. The pyrites residue is dissolved in 2 c.c. of warm concentrated hydrochloric acid, diluted, ammonia added to precipitate the iron, filtered, and the filtrate added to the main solution. This is then made up to 400 c.c., and after addition of 1 c.c. of concentrated hydrochloric acid, heated to boiling, and precipitated by 10 per cent. barium chloride solution added all at once, in quantity about double that required for the sulphur present. The results agree satisfactorily with, but are usually slightly higher than, those obtained by Lunge's method of dissolving in nitrohydrochloric acid, precipitating the iron, and precipitating the filtrate with barium chloride (see this J., 1905, 7).
—J. T. D.

Sodium chloride ; Electrolysis of —— with the mercury cathode. C. A. Peters. Amer. J. Sci., 1911, **32**, 365—385.

THE author has examined in great detail the method described by Hildebrand (this J., 1907, 644), as far as sodium chloride is concerned, using Hildebrand's cell and a silver-plated platinum anode. He finds that silver is always transferred from the anode to the mercury cathode, but that under favourable conditions the amount can be neglected in analytical work. The anode at the end of the operation must be heated (in an appropriate electric furnace, or in a crucible held in an asbestos plate and provided with a divided talc lid to admit the anode stem), to decompose all silver oxide, and after that to fuse the silver chloride. The conditions of work depend on the quantity of salt to be electrolysed : for 50 c.c. of $N/10$ solution (say 0·3 grm. of salt) the process is as follows :—Seal the cell with mercury to a depth of 6—8 mm. ; cover the nickel wire in the outer cell with water, and add 1 c.c. of saturated salt solution ; place the electrolyte in the inner cell, and electrolyse with the bottom of the anode 6—10 mm. above the mercury level. The current should start at 1·2—1·5 amp., and the operation is finished when it is reduced to 0·1 amp. (say 20 minutes, with 200—300 revolutions of anode per minute). Take out the anode, rinse it into the cell, dry and heat as above (not beyond 550° C.), cool and weigh. Titrate the liquid in the cells (contrary to Hildebrand, the author finds the inner liquid to be invariably alkaline) nearly to neutrality to methyl orange with $N/10$ hydrochloric acid, then transfer the whole contents to a separating funnel, shake well to decompose any remaining sodium amalgam, draw off the mercury, and finish the titration, adding acid in slight excess, and titrating back with sodium hydroxide. The results are accurate to within 0·5 mgrm. of chlorine or of sodium. The anode is regenerated by heating for about 20 minutes at 500° C. or a little above in an atmosphere of hydrogen.—J. T. D.

Sulphur production in Sicily. Oil, Paint, and Drug Rep., Nov. 13, 1911. [T.R.]

OF the 420 active sulphur mines in Sicily, the total production from August 1, 1909, to July 31, 1910, was 396,295 tons, against 396,737 tons in the preceding year. The total exports of sulphur from Sicily during the 1909—1910 season amounted to 396,996 tons, 48,251 tons more than in the preceding year. France took 103,655 tons ; Continental Italy, 58,180 tons ; and Germany, 31,099 tons. Austria-Hungary, Russia and Great Britain were also heavy buyers. A considerable decrease was noticed in the exports of sulphur to Australia, which is attributed to the effect of Japanese competition. Sales to South Africa also fell off, due, it is stated, to British competition. While at one time the United States took almost one-third of the total output, this trade has declined steadily since 1905, and amounted to only 13,929 tons in 1910.

Calcium citrate production in Sicily. Chem. Trade J., Nov. 18, 1911. [T.R.]

THE total production of calcium citrate during the working year 1910–11 scarcely reached 4000 tons, while the total sales made by the Citrus Chamber are given at about 6500 tons. The stock of old citrate, which on November 30, 1910, was 5500 tons, will consequently be reduced to some 3000 tons by the end of November, 1911. Very small quantities of concentrated lemon juice were produced, and the stock on hand at the Citrus Chamber is insignificant. The new lemon crop, it is stated, will be even shorter than last year. Nevertheless, it is confidently expected that the Citrus Chamber, which is still carrying a considerable stock of fruit over from last year, will not increase its prices for citrate of lime.

Potash imports into the United States. Oil, Paint, and Drug Rep., Nov. 13, 1911. [T.R.]

The value of the imports of all kinds of potash into the United States during the fiscal year 1911 was $14,000,000, compared with less than $12,000,000 in 1910, less than $4,000,000 in 1900, and less than $2,000,000 in 1890. The principal classes of potash salts imported into the United States are:—Kainit, 1,300,000,000 lb.; potassium chloride, 431,000,000 lb.; potassium sulphate, 106,000,000 lb.; potassium carbonate, 23,000,000 lb.; potassium nitrate, or crude saltpeter, 9,000,000 lb.; caustic potash, 7,000,000 lb.; and all other salts of potash, 6,000,000 lb. Measured by value the largest importations during the year occurred in the chloride, $6,500,000; kainit, $2,266,000; the sulphate, nearly $2,000,000, and the carbonate, $750,000. Germany supplies nearly the whole of these compounds, excepting the nitrate, practically all of which comes from British India.

Potash salts from felspar. E. Hart. Trans. Amer. Ceram. Soc., 1911, **13**, 683—688.

The process is founded on that of Jacobs for obtaining barium salts from the sulphate. Felspar, potassium sulphate and carbon are mixed in the proportion of 4 molecules each of spar and sulphate to 2 atoms of carbon. A small excess of carbon is used to compensate for sulphide remaining in the mixture and for carbon monoxide in the gas. The mixture is heated in an electric furnace, and the melt finely ground and treated with dilute sulphuric acid. The residue is almost pure silica, and the solution contains alum and sulphates of sodium, potassium and ferrous iron. On evaporation, alum and potassium sulphate crystallise out. Carbon is added in such proportions as to convert the sulphate on fusion into potassium carbonate, which reacts with the alumina to form potassium aluminate. Through the water solution of this is passed washed furnace gas containing carbon dioxide. Alumina is precipitated and the alkali carbonates left in solution are crystallised out. The residual solution contains potassium sulphate. The products of the process are therefore silica, alumina, potassium sulphate (taking the place of the imported article) and sodium potassium carbonate. Staley appends a brief historical account of previous processes for the production of potash from felspar.—H. H. S.

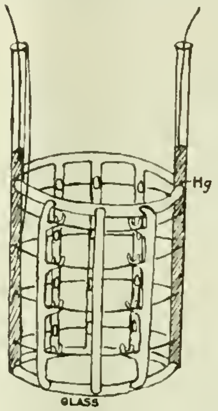
Potassium manganate; Thermal formation of —— from manganese dioxide and potassium hydroxide. F. Bahr and O. Sackur. Z. anorg. Chem., 1911, **73**, 101—124. (See also this J., 1910, 275, 347; 1911, 487.)

The authors have prepared pure potassium manganate, and other products of varying manganese content and varying degree of oxidation, by fusing manganese dioxide with potassium hydroxide. On measuring the dissociation pressure of these products, it is found that rise of temperature causes dissociation of the manganate according to the equation: $2K_2MnO_4=2K_2MnO_3+O_2$, and that the manganite thus produced forms a solid solution with the manganate which becomes saturated at the composition: $3K_2MnO_4,2K_2MnO_3$ (*i.e.*, $Mn_5O_{13},5K_2O$). This explains why in the thermal production of potassium manganate the yield never exceeds 60 per cent., since the product obtained by oxidation with atmospheric oxygen is only the solid solution and not pure manganate. The compound, $Mn_5O_{13},5K_2O$, has no appreciable dissociation pressure at 1000° C. When pure potassium manganate is added to molten potassium hydroxide, it decomposes, until the degree of oxidation of the manganese corresponds with the oxide, Mn_6O_{16}.—W. H. P.

Perchloric acid; Determination of —— in certain perchlorates. H. Golblum. Z. anal. Ch., 1911, **50**, 741—742.

It was found that neutral solutions of nickel and cobalt perchlorates could be completely electrolysed in the cold, using a platinum gauze cathode and a current of not more than 0·1 amp., with 0·2 grm. of salt dissolved in 300 c.c. of water. About 70 hours' passage of the current was requisite, but the weight of metal obtained was exactly that required by theory, and so was the amount of perchloric acid, determined alkalimetrically. This method of analysis is clearly applicable to all perchlorates the metals of which can be deposited electrolytically. Of course, no other chlorine compounds must be present. J. T. D.

Persulphates; Electrolytic production of ——. A. Blumer. Z. Elektrochem., 1911, **17**, 965—966.



The anode used by the author is illustrated in the figure and consists essentially of four rings of platinum wire (total length 96 cm., diameter 0·015 cm.) supported on a glass frame. The anode current density was from 2·5 to 4·9 ampères per sq. cm. With a lead cathode the current yield was only 20·9 per cent., but with a nickel cathode and the addition of strong sulphuric acid, 80—81 per cent. could be obtained. This figure was raised to 95—97·5 per cent. by the use of a diaphragm with a nickel or copper cathode. In the preparation of ammonium persulphate, the addition of potassium ferricyanide and sulphuric acid, without a porous pot, led to a yield of 93·5 per cent. The yields were greatly reduced by addition of aluminium sulphate or cobalt sulphate.—W. H. P.

Thiocyanates; Decomposition of —— with bromine in aqueous solution. [Determination of bromine and thiocyanate.] W. König. J. prakt. Chem., 1911, **84**, 558—560.

When a solution of potassium thiocyanate is added to an aqueous solution of bromine (containing potassium bromide), the reaction which proceeds is expressed by the equation:

$$KSCN+8Br+4H_2O=KBr+BrCN+H_2SO_4+6HBr.$$

The end-point is determined by means of potassium iodide-starch paper. This reaction may be utilised in quantitative analysis: thus (1) a solution of free bromine can be estimated by either thiocyanate solution or potassium hydroxide, and (2) a thiocyanate solution can be estimated either by a solution of bromine or potassium hydroxide. Chlorine acts similarly to bromine in the above reaction, but iodine does not, so that the reaction affords a method of estimating free bromine in the presence of free iodine.—J. C. C.

Limestones; Burning temperature of ——. A. V. Bleininger and W. E. Emley. Trans. Amer. Ceram. Soc., 1911, **13**, 618—638.

The subject is discussed under three headings, the minimum burning temperature of limestone, the permissible maximum burning temperature, and the physical changes accompanying the burning of lime. The minimum dissociation temperature of calcium carbonate was found to be 880° C., and of magnesium carbonate 750° C. The proper burning temperature for a lime may be fixed by a study of its hydration and porosity curves at different temperatures. For pure limestones the maximum temperature permissible is above 1300° C., for impure limestones high in calcium it lies between 1050° C. and 1150° C., for pure magnesian stone between 1000° and 1050° C., and for impure magnesian stone, 900°—1020° C.—H. H. S.

Iron carbonyl; Formation of ——. A. Stoffel. Chem. Weekblad, 1911, **8**, 722—734. Chem. Zentr., 1911, **2**, 1643. (See also this J., 1891, 644; 1892, 750; 1910, 625.)

Carbon monoxide was brought into contact with iron at different temperatures and pressures, and determinations were made of the amount of carbon monoxide taken up by the iron and of the amount of iron carbonyl, $Fe(CO)_5$, present in the form of vapour. At low temperatures, below about 80° C., the reaction was retarded and eventually prevented owing to absorption of the reaction product by the iron, whilst above 80° C. dissociation of the iron carbonyl predominated. The dissociation can be checked by increasing the pressure of the carbon monoxide, but then the absorption increases and interferes with the reaction. Up to 60° C. the temperature has little influence on the reaction, the most favourable temperature being about 40°—50° C. The results show that large quantities of the carbonyl in the form of vapour can never be obtained. Ammonia strongly accelerates the absorption of carbon monoxide by the iron; hydrogen sulphide appears to have little influence.—A. S.

Nickel or platinum, mercury, and sodium chloride; Reactions in a system of ——. C. A. Peters. Amer. J. Sci., 1911. **32**, 386—387.

When a solution of sodium chloride is allowed to stand over mercury with a nickel wire connecting both liquids, crystalline nickelous hydroxide is formed very slowly, and sodium hydroxide is produced at the same time. When platinum is substituted for nickel, mercurous chloride and sodium hydroxide are formed.—J. T. D.

Zirconia; Technical applications of ——. C. R. Böhm. Chem.-Zeit., 1911, **35**, 1261—1262.

A short summary is given of the various technical purposes for which zirconium compounds have been used or may be used in the future (cp. W. Boehm, this J., 1901, 884; Weiss and others, this J., 1910, 150, 218; 1911, 554; Grünwald, this J., 1911, 210). The extreme hardness of zirconium carbide renders it suitable as a polishing material and for cutting glass. Zirconia is a very good insulator, and, mixed with good conducting material, it is used for electrical heating purposes. To prevent disintegration of the iridium in the Heraeus iridium furnace, the iridium bar is glazed by repeatedly coating it with a solution of yttrium and thorium nitrates and then igniting it; the author suggests that in view of the great fire-resisting power of zirconia, it may be advantageous to substitute a suitable zirconium salt for the thorium nitrate used in this treatment. Zirconia has also found application as a substitute for bismuth salts in connection with the use of Röntgen rays for medical purposes. Pure zirconium oxide is a fine white powder which is very suitable for the manufacture of white paint, etc.; it has also been recommended as a non-irritant powder for medicinal purposes, *e.g.*, for covering the surface of wounds.—L. E.

Radium emanation evolved by one of the springs at Colombières-sur-Orb (Hérault); Quantity of ——. J. Danne and V. Crémieu. Comptes rend., 1911, **153**, 870—871.

The gases from the Crémieu spring at Colombières-sur-Orb are found to contain about 95 per cent. of carbon dioxide and a quantity of radium emanation which, expressed in milligram-minutes per 10 litres of gas, amounts to 0·2, or the large total of 860 mgrm.-minutes per 24 hours. The small gaseous residue remaining after absorption of the carbon dioxide contains all the emanation.—F. Soddy.

Radioactive substances; Adsorption of —— *by colloids. (Methods for the concentration and isolation of radioactive substances.)* E. Ebler and M. Fellner. Z. anorg. Chem., 1911, **73**, 1—30.

The authors amplify in this paper experimental work which has previously been described (this J., 1911, 1210) and give a general survey of the part played by adsorption in radioactive phenomena. It is probable that the prevalence of radioactive materials in mineral springs and their sediments, etc., is due in part to adsorption by the inorganic colloids which are always present. Radium salts are readily adsorbed by the colloids of rubber, so much so that special precautions are necessary when radium bromide is kept in an ebonite capsule. An example is given of a capsule from which only 0·32 mgrm. of radium bromide was obtained although it had previously contained some mgrms. When the capsule, the inside of which had become quite spongy, was burnt, the ash yielded 1·82 mgrm. of radium bromide. Radio-lead (radium D, E, and F) can be freed from inactive lead and made richer in radium F (polonium) by fractional adsorption with gelatinous silicic acid. Radium emanation is readily adsorbed by silicic acid gel, and it is more soluble in silicic acid sols than in distilled water. Mixtures of uranium and uranium X can easily be separated by repeated adsorption with silicic acid gel, the uranium X being much more readily adsorbed.—W. H. P.

Diamond; Separation of carbon in the form of ——. W. von Bolton. Z. Elektrochem., 1911, **17**, 971—972.

The author has stated previously that the prolonged action of mercury vapour on hydrocarbons causes the separation of a small quantity of carbon, partly in the form of diamond (this J., 1910, 1062). In order to confirm this observation he has attempted to grow diamond crystals at the expense of carbon produced in this way. Fine diamond powder, which under the microscope appeared almost amorphous, was caused to adhere to the upper portion of the inside wall of a long test-tube by means of a solution of water-glass. In the bottom of the test-tube was placed 50 grms. of a 14 per cent. sodium amalgam. The whole was kept at 100° C. for four weeks while moist coal gas was slowly introduced by means of a tube reaching down to the amalgam. At the end of that time very little black carbon had separated, but on removing and examining the diamond powder, the crystals were observed to have grown very considerably in size. They still retained all the chemical properties of diamond, disappearing when heated in oxygen or when melted with sodium carbonate. The total yield, however, was less than 1 mgrm. and no analysis was possible.
—W. H. P.

Oxidation of nitrogen by the silent electric discharge in the presence of ozone. Ehrlich and Russ. *See* XI.

Patents.

Gases from [pyrites] roasting furnaces; Cooling of hot ——. Ges. der Tentelewschen Chem. Fabrik. Fr. Pat. 431,067, June 14, 1911.

A circular tower built in sections, is surrounded by an annular space for cooling water, which connects with hollow vertical partitions crossing each section, the whole being built of lead and supported over a circular trough in which it is sealed by sulphuric acid. The gases (from pyrites burners, for example) enter from the top and leave at the bottom, whilst the cooling water passes in the opposite direction through the cylindrical jacket and the hollow partitions. The burner gases can be cooled from 500° C. to the ordinary temperature, and all the sulphuric acid fog they contain separated as liquid. The lid of the apparatus is removable, and easy access is thus afforded for cleaning, which, however, is only necessary at long intervals.—J. T. D.

Gay-Lussac and Glover towers; Impts. in —— *and the like towers where gases come in contact with liquids.* W. Green and The Huncoat Plastic Brick and Terra Cotta Co., Ltd., Accrington. Eng. Pat. 28,004, Dec. 2, 1910.

A filling material for towers consisting of tiles, recessed at the corners to take distance pieces by which they are built into successive floors or layers, each tile being provided with channels and troughs on the upper surface, and a series of ribs and channels on the under surface, Each floor is composed of a series of the blocks laid side by side and end to end, and the floors are so arranged that the main openings through the tiles on one floor are above the blank portions of the tiles on the next. The ascending gas is broken up and deviated in its course by the channels and ribs on the the under surfaces of the tiles, and whilst liquid is always lying in the troughs or recesses in the upper surfaces, it is being continually changed by the drip of liquid from above and its flow along the channels. The maximum exposure and contact in the minimum cubic space is thus attained.—J. T. D.

Nitrous gases; Recovery of waste —— in the chamber process of sulphuric acid manufacture. A. Taraud and P. Truchot. 1st Addition, dated Aug. 20, 1910, to Fr. Pat. 425,913, April 18, 1910 (this J., 1911, 1012).

The gases are first washed in one or two towers by water (and in these towers any necessary oxygen is introduced, so as to prolong its contact with the gases), and the acid liquid formed (weak sulphuric acid) is returned to the chambers as a spray. The alkaline washing follows; and the alkaline liquids are also pumped up to reservoirs and returned to the chambers.—J. T. D.

Nitrous gases; Recovery of waste —— in the chamber process of sulphuric acid manufacture. A. Taraud and P. Truchot. Fr. Pat. 431,427, Sept. 10, 1910.

The gases leaving the Gay-Lussac tower are thoroughly washed (by any appropriate means of effecting intimate contact) with an acid solution of a ferrous salt or combination of ferrous salts; the compound of ferrous salt and nitric oxide thus formed is decomposed by heat, and the evolved nitric oxide, together with air, is reintroduced into the chambers.—J. T. D.

Nitric acid; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst on Maine, Germany. Eng. Pat. 19,032, Aug. 24, 1911. Under Int. Conv., April 6, 1911.

In the process of manufacturing nitric acid from oxides of nitrogen and oxygen in presence of water or aqueous solutions, the gas-pressure in the apparatus for elevating or conveying the liquid into the absorption system is obtained by means of oxygen instead of air, and the oxygen so used is afterwards introduced into the absorption system, carrying with it any entrained nitrous gases or vapours, which, in the use of air, would be lost from the process.—J. T. D.

Hydrocyanic acid; Recovery of ——, from certain gases. G. P. Guignard, Melun, and H. L. A. M. Watrigant, Lille, France. Eng. Pat. 14,588, June 20, 1911. Under Int. Conv., Jan. 16, 1911.

The aqueous solution of alkali hydroxide which is usually employed to absorb hydrocyanic acid from gases containing it, is replaced by an alcoholic solution, in which the alkali cyanide formed is but slightly soluble, and thus rapidly deposits and can be removed. From time to time an alkali metal is added, which decomposes the water formed in the reaction, and thus preserves the strength of the alcoholic solvent. Any excess of alkali metal which may react with the alcohol is harmless, for the ethylate formed absorbs the hydrocyanic acid, in the same way as the hydroxide, and the alcohol is then regenerated. —J. T. D.

Sodium or potassium hydroxide; Process of manufacture of —— with simultaneous production of by-products. J. Braunschild and B. Chapiro. Fr. Pat. 431,232, Sept. 5, 1910.

Sodium or potassium compounds (such as sodium carbonate) are heated with oxides of nickel (preferably the higher oxides), and the alkali oxide or hydroxide so formed is separated by solution in water, any gaseous product (carbon dioxide, etc.) being recovered. The lower oxides of nickel remaining as residue are then used again, or are first re-oxidised by roasting. If the lower oxides be employed in the process, or if an alkali nitrate be dealt with, the reaction is aided by the introduction of air or of air and steam. Special reference is made to the decomposition of nitrates, with the production of calcium nitrate from the evolved nitrous gases.—F. Sodn.

Ammonia; Synthetic production of ——, from its elements. A. Matignon. Fr. Pat. 430,595, Aug. 13, 1910.

Nitrogen and hydrogen, in any proportions, are heated under ordinary or increased pressure with zinc in powder or other form, or with palladium or tungsten. The metal acts as a catalyst, and causes the combination of the two gases to form ammonia at a lower temperature than would otherwise be the case.—J. T. D.

Ammonia; Process for producing ——. Badische Anilin und Soda Fabrik. Fr. Pat. 431,295, June 19, 1911. Under Int. Conv., Oct. 21 and Dec. 13, 1910, and Jan. 7, 1911.

See Eng. Pat. 61 of 1911; this J., 1911, 1057. The nitrogen compounds of molybdenum also furnish ammonia when treated with steam, hydrogen, or gases containing hydrogen.—T. F. B.

Ammonia [and hydrogen sulphide] from gases, vapours, and liquids by sulphurous anhydride; Process for the recovery of ——. W. Feld. Fr. Pat. 431,241, June 17, 1911. Under Int. Conv., Feb. 3, 1911.

Gases, vapours, or liquids containing ammonia or hydrogen sulphide, or both, are treated with sulphur dioxide, or with compounds which furnish this substance (in solution or in the gaseous form), in presence of such a quantity of free sulphur, or of substances yielding sulphur, and during such a time, that the recovered ammonia is converted first into thiosulphate and then into polythionate, the latter being finally oxidised to sulphate, with the liberation of sulphur. If hydrogen sulphide be present, the proportions of sulphur dioxide and of ammonia and hydrogen sulphide are so arranged that no sulphite is formed, and, if there be much hydrogen sulphide compared with the ammonia, the supply of sulphur dioxide is preferably so regulated that, for each part by weight of ammonia, at least one part of sulphur is precipitated. If desired, water or liquids containing salts (for example, thiosulphates or polythionates of ammonium or of the alkali or alkaline-earth metals) may be treated alternately with sulphur dioxide and with the gases containing ammonia and hydrogen sulphide, so that a liquor rich in ammonia is obtained, and the thiosulphate is then converted, as before, into polythionate by prolonged treatment with sulphur dioxide, preferably at 40°—65° C., the polythionates being transformed into sulphate by heating to a higher temperature. Free sulphur, or a substance yielding such, is added when the gases do not contain hydrogen sulphide or contain less of this gas than is equivalent to the ammonia present.—F. Sodn.

Ammonium nitrate; Electrolytic production of ——, from hydrated nitric acid. Elektrochem. Werke, G. m. b. H., Berlin. Eng. Pat. 16,426, July 17, 1911. Under Int. Conv., July 16, 1910.

Nitric acid containing less than 30 per cent. of HNO_3 and containing also some 5 per cent. of ammonium nitrate, is electrolysed at the ordinary temperature in a diaphragm cell with an aluminium cathode. In the anode compartment is a mixture of nitrous acid and nitric acid, or solution of nitrogen oxides in nitric acid, which is converted into nitric acid by the anodic oxygen. Fresh nitric acid is added to the cathode compartment as the electrolysis proceeds, till the liquid contains about 40 per cent. of ammonium nitrate, and the process is continued till the cathode liquid is neutralised.—J. T. D.

Sulphides of ammonium; Process of manufacture of ——. H. Gouthière et Cie. and P. Ducancel. Fr. Pat. 431,088, Aug. 31, 1910.

Ammonium carbonate solution is treated with the sulphide of an alkali or alkaline-earth metal, and the ammonium sulphide produced is separated by filtration or distillation.

As an example, gas liquor is subjected to the action of a milk of calcium monosulphide, in the apparatus ordinarily used for the recovery of ammonia.—F. Sodn.

Contact mass; Process of making ——. J. W. Beckman, Niagara Falls, Canada, Assignor to American Cyanamid Co., New York. U.S. Pat. 1,007,516, Oct. 31, 1911.

Suitable proportions of finely powdered silica and cupric oxide are mixed with granular alumina, and heated to a temperature above the melting-point of copper. The silica reacts with a portion of the copper oxide, and the remainder coats the particles of alumina, forming a porous contact mass having the surfaces of its pores coated with films containing copper.—J. T. D.

Nitrogen oxides; Process of forming ——. C. Ellis, Montclair, N.J., Assignor to Ellis-Foster Co. U.S. Pat. 1,007,683, Nov. 7, 1911.

In the process of electrically oxidising nitrogen, the mixture of nitrogen and oxygen, of constant moisture content, and preheated if desired, is caused to travel in a circular or elliptical annulus concentrically but not helically around the arc, in planes practically at right angles to its axis.—J. T. D.

Nitrous products; Process for the absorption and recovery of ——. R. Delplace. Fr. Pat. 431,125, Sept. 1, 1910.

Gases containing nitrous products are brought into contact with a solution of a ferrous salt, preferably pulverised, and the absorbed gases are recovered as nitric oxide by heating the solution. An acid solution of ferrous sulphate, for example, is suitable for the treatment of gases from sulphuric acid chambers, burner gases being subsequently passed through the solution.—F. Sodn.

Aluminium nitride; Process for the manufacture of ——. O. Serpek. Fr. Pat. 430,822, Aug. 23, 1910.

Bauxite or other aluminous material is mixed with carbon and a binding agent, and agglomerated in the usual manner, and the product is treated in a shaft furnace with nitrogen or a gas containing nitrogen which has been previously heated in an electric arc or resistance device.—A. S.

Nitrogen contained in atmospheric air; Process for fixing or combining and utilising [for production of fertilisers] the ——. A. Sinding-Larsen and O. J. Storm. Fr. Pat. 431,182, May 16, 1911. Under Int. Conv., May 26, 1910.

Oxides, preferably those consisting chiefly of silica or titanic acid, are heated to a high temperature, in the presence of a reducing agent, with a substance (*e.g.*, silicon tetrachloride, carbon bisulphide, etc.) which consists of or contains elements capable of forming volatile compounds with silicon or titanium or other element concerned, and the resulting volatile compounds are treated with nitrogen at a high temperature, so as to give a nitrogenous product and a substance to be used again in the first part of the process. For example, a mixture of coke and quartz is heated almost to a white heat, in the presence of nitrogen and chlorine; this leads to the formation of silicon tetrachloride, which reacts with excess of quartz and coke to form the trichloride, and then, by the action of nitrogen, silicon tetrachloride is re-formed, together with a compound containing silicon and nitrogen. Or, chlorine (preferably as carbonyl chloride or silicon tetrachloride) is introduced into the furnace charged as above, and the escaping compounds of silicon and chlorine are liquefied and treated with nitrogen in a separate furnace, the reaction taking place, if desired, in the presence of a suitable quantity of carbon monoxide, sulphur, or other reagent capable of absorbing the liberated chlorine and readily parting with it again; the chlorine or compounds so formed are then returned to the first furnace. Hydrogen may be introduced into the products by employing halogen or sulphur compounds, mixed with compounds of halogen or sulphur with hydrogen.—F. Sodn.

Tartrates; Extraction of —— from solutions obtained by treating materials containing crude tartrate with dilute mineral acids. G. Vigneaux. Fr. Pat. 430,883, June 12, 1911.

The liquids obtained by treating tartaric deposits from wine, etc., with dilute mineral acids, are filtered or decanted from any insoluble portions, and then treated with a metal (preferably iron, zinc, or aluminium) till the acid is neutralised. First acid potassium tartrate, then calcium tartrate, is deposited. The evolved hydrogen exerts a reducing and decolourising action. The liquid may be heated, and an electric current may be passed through, using the metallic plate or rod as anode, to quicken the action.—J. T. D.

Chloride of lime or bleaching powder; Chamber system for the manufacture of ——. Hooker Electrochem. Co. Fr. Pat. 431,398, June 21, 1911.

The chambers are constructed of reinforced concrete or cement and are lined internally with a material, such as paint or varnish containing asphaltum or a suitable hydrocarbon, which is impervious to chlorine; they are so arranged that the lime is exposed as a number of superposed beds in each chamber, and means are provided for mechanically distributing the lime and transferring it from one bed to the next, as also for removing the finished product. The gas is made to circulate systematically through all the chambers of the series, and the temperature is controlled by causing the gases to circulate also through regulators, which are attached to each chamber, and in which the gases may be cooled or heated, according to requirements. The walls and floors of the chambers are made as thin as possible, so as readily to conduct and radiate the heat developed in the reaction.—F. Sodn.

Nitric anhydride in nitric acid monohydrate; Process for making solutions of ——. Elektrochem. Werke. Fr. Pat. 431,006, June 13, 1911. Under Int. Conv., July 16, 1910.

See Eng. Pat. 15,432 of 1911; this J., 1911, 1251.—T. F. B.

Atmospheric nitrogen; Method of and means for binding and utilising ——. A. Sinding-Larsen, Christiania. Eng. Pat. 12,314, May 22, 1911. Under Int. Conv., May 26, 1910.

See Fr. Pat. 431,182 of 1911; preceding.—T. F. B.

Alumina; Process of making pure ——. O. Serpek, Assignor to Soc. Générale des Nitrures, Paris. U.S. Pat. 1,007,495, Oct. 31, 1911.

See Eng. Pat. 13,088 of 1910; this J., 1911, 361.—T. F. B.

Barium oxide; Process of making ——. C. Rollin, Newcastle-on-Tyne. U.S. Pat. 1,008,070, Nov. 7, 1910.

See Eng. Pat. 30,323 of 1909; this J., 1911, 421.—T. F. B.

Ammonium nitrate; Manufacture of —— from ammonium sulphate and sodium nitrate. F. A. Freeth and H. E. Cocksedge. Fr. Pat. 430,931, June 13, 1911.

See Eng. Pat. 16,454 of 1910; this J., 1911, 1013.—T. F. B.

Ammonium nitrate; Manufacture of —— from ammonium bicarbonate or its compounds and sodium nitrate. F. A. Freeth and H. E. Cocksedge. Fr. Pat. 431,058, June 14, 1911.

See Eng. Pat. 16,455 of 1910; this J., 1911, 1013.—T. F. B.

Drying agent; Process of making a ——. Allgem. Ges. f. Chemische Industrie. Fr. Pat. 430,991, June 3, 1911. Under Int. Conv., June 22, 1910.

See Eng. Pat. 13,990 of 1911; this J., 1911, 1313.—T. F. B.

Zinc oxide; Process for extracting ——. G. Evans. Fr. Pat. 431,117, June 15, 1911. Under Int. Conv., July 25, 1910.

See Eng. Pat. 17,587 of 1910; this J., 1911, 1068.—T. F. B.

Hypophosphoric acid and hypophosphates ; Process for making ——. Chem. Fabrik Buckau. Fr. Pat. 431,141, June 16, 1911. Under Int. Conv., June 21, 1910.

See Eng. Pat. 14,420 of 1911 ; this J., 1911, 1210.—T. F. B.

Oxygen and nitrogen ; Process for obtaining ——. G. Kassner, Münster, Germany. Eng. Pat. 12,308, May 22, 1911. Under Int. Conv., May 28, 1910.

See Ger. Pat. 234,849 of 1910 ; this J., 1911, 895.—T. F. B.

Hydrogen ; Process for making —— from silicon and alkaline solutions without the aid of external heat. Consortium f. Elektrochem. Ind. Fr. Pat. 430,740, May 12, 1911. Under Int. Conv., May 14, 1910.

See Eng. Pat. 11,640 of 1911 ; this J., 1911, 1058.—T. F. B.

VIII.—GLASS ; CERAMICS.

Soda-lime glass ; Some experiments on the colour of ——. K. Takahashi. Trans. Amer. Ceram. Soc., 1911, 13, 251—258.

Glass made from sand, soda-ash and lime has always a green tint owing to the presence of iron. This is generally overcome by manganese dioxide, which may act chemically by oxidation or physically by neutralising the green with pink. Smoky flames and organic matter, such as grease or dirt in the glass tanks, tend to reduce the manganese dioxide and this may be remedied by addition of nitre. The use of "powder blue" (a silicate which may contain 6 per cent. of cobalt oxide) cannot overcome the green tint and neutralises red. White oxide of antimony destroys the green colour, the amount recommended being 2 oz. in a batch of 300 lb. Further quantities are not more efficient and above 10 lb. it gives a pale yellow colour. It is used in conjunction with pyrolusite. "Needle antimony" has stronger colouring power than white antimony, possibly due to its content of sulphur. Fluorspar has a good influence on colour and of course softens the glass. Felspar, kaolin and free alumina all increase the green colouration, owing to the action of alumina on iron oxide (see also Appert, this J., 1896, 357). The action of magnesia on colouration is uncertain.
—H. H. S.

Kaolins ; Review of theories of the origin of white residual ——. H. Ries. Trans. Amer. Ceram. Soc., 1911, 13, 51—74.

Six theories are passed in review, both historically and with regard to the arguments for and against. Five agree in ascribing the parentage of kaolin to felspar, and these explain the formation by : (*a*) simple mechanical weathering, (*b*) post-volcanic emanations (sometimes called the pneumatolytic theory), (*c*) ascending spring-waters containing carbon dioxide, (*d*) waters draining from swamps or peat bogs, and charged with humic and carbonic acids, (*e*) sulphuric acid or sulphate solutions. The sixth and last theory treated of regards kaolin as the decomposition product of muscovite. The author himself considers that all the workable deposits of the United States and many in Central Europe have been produced by the action of surface waters, whether entering direct from the surface or filtering first through a swamp or bed of peat.
—H. H. S.

Residual clay ; Chemical and physical processes involved in formation of ——. H. O. Buckman. Trans. Amer. Ceram. Soc., 1911, 13, 336—384.

However original rocks may differ in composition, the residual clays formed by their weathering tend to bear a striking chemical resemblance to each other, owing to the fact that the silicious aluminates are the most resistant constituents of the raw materials. The more basic a rock, the more rapid its decomposition. An increase of soda and potash accelerates weathering, the soda being more effective than the potash in this respect. Similarly lime decreases resistance more than magnesia. Increase of iron in a rock lessens resistance. Increase of alumina, checks decomposition and silica lessens it. The character of the residual clay is governed by the extent to which merely physical forces have aided rock decay. When physical agents predominate, the composition of the residual clay may differ but little from that of the parent rock. Bibliographies are appended on rock-weathering and on analyses of fresh rocks and their residues.—H. H. S.

Clay and kaolin mining in Europe. A. S. Watts. Trans. Amer. Ceram. Soc., 1911, 13, 228—250.

The clay mines of Silesia, Halle, Zettlitz, Pomeisel, St. Yrieux, Devonshire and Cornwall are described and illustrated, and the greater uniformity of European compared with American raw materials as put on the market is emphasised.—H. H. S.

Drying of certain tertiary clays : Experiments on the ——. E. Orton. Trans. Amer. Ceram. Soc., 1911, 13, 765—791.

A broad belt of country east of the Rocky Mountains in the United States and Canada contains little clay but stratified shales which present abnormal difficulties in drying, due to an inordinate stickiness or adhesive quality when made plastic, which results in severe cracking. The usual methods of correcting abnormal shrinkage and drying are three—the use of anti-plastic bodies like sand and grog, of chemical coagulants like sodium carbonate or tannin, and of heat to break down bodies which tend to make the clay impermeable to water. The first two methods were not successful and the pre-heating treatment only partially so, and at temperatures higher than usual. The clays were heated in a rotary drum to 450°—510° C., the duration being critical with a margin of only about 5 minutes in some cases. Analyses of the raw clay and of the same after preheating at 480° C. were as follows :

	Carbon.	Total water.	Water expelled at 105° C.	Water expelled at red heat.
Raw........	1·31	11·25	7·35	3·90
Preheated ..	0·09	7·83	4·73	3·10

From these figures the author deduces that the plastic base is not kaolinite, but some other hydrous aluminium silicate, possibly bentonite.—H. H. S.

Kaolins and clays ; Loss on ignition of ——. R. Rieke. Sprechsaal, 1911, 44, 637—640, 653—655.

The samples were previously dried at 125° C., the difference between the results obtained by this process and by desiccating over strong sulphuric acid for six weeks being extremely small. The losses on ignition were as follow :—

Kaolins.

	Per cent.		Per cent
Amberg kaolin	11·76	Albsheim kaolin ...	13·09
Halle kaolin.........	9·68	Zettlitz kaolin	12·98
Bohemian kaolin....	11·82	Geisenheim kaolin .	6·51
Australian kaolin ...	12·45	Cornwall china clay	12·44
Texas kaolin	14·77	St. Yrieux kaolin ..	10·55

Refractory Plastic Clays.

Lischwitz clay......	13·55	English blue ball clay	9·69
Löthain clay	11·88	English white ball clay	7·86
Halle clay	9·35	Vallendar clay.....	7·04
Meissner clay.......	4·71	Grossalmerod clay.	6·55

Non-Refractory Ferruginous Clays.

Bunzlau plastic clay .	8·29	Karst brick clay...	10·44
Helmstedt clay	8·94	Brazilian clay	2·19
Agram brick clay ..	7·47	Velten clay	contains much $CaCO_3$

Miscellaneous.

Shale containing carbon	20·34	Cornish kaolinised granite	8·50
Bohemian clay-stone	9·35	Berkenfeld felspar .	3·18

Kaolins and refractory clays, if pure, show considerable resemblance in their endothermic reaction at 500° C. The author also discusses the work of Mellor and Holdcroft (see this J., 1911, 804.)—H. H. S.

Clay; Some effects of gypsum on ——. H. E. Kramm. Trans. Amer. Ceram. Soc., 1911, **13**, 689—703.

THE action of lime when present in clay as calcium carbonate is fairly well known (see Rieke, this J., 1907. 18, and Bleininger and Moore, Trans. Amer. Ceram. Soc., 1908, **10**, 314). but lime in the form of gypsum seems to act differently. Gypsum-clay mixtures retain their plasticity at unexpectedly high temperatures; they are still plastic after 8 hours burning at 790° C. The sulphur trioxide of the gypsum is driven off gradually at temperatures up to cone 1, and very rapidly beyond that point, with sudden increase of porosity. At 950° C. it is not possible to drive off all the sulphur trioxide; at 1100° C. it is possible, though slowly. The lime when liberated acts as a flux, but its action is eccentric. Judging from porosity curves, a quantity of lime accumulates until a certain point is reached and then suddenly combines, causing vitrification. The range of mixtures of gypsum and clay experimented with exhibit at high temperatures one point of minimum and two of maximum fusion, the latter being probably eutectic points.—H. H. S.

Clay and flint; Relative solubility of —— *in felspar.* R. C. Purdy. Trans. Amer. Ceram. Soc., 1911, **13**, 479—488.

BINNS (Trans. Amer. Ceram. Soc., **5**, 290), Mellor (Trans. Eng. Ceram. Soc., **6**, 75; also this J., 1909, 474), and Watts (Trans. Amer. Ceram. Soc., **10**, 187), have each stated that clay is more soluble than flint in felspar. The author comes to the opposite conclusion on the following grounds. (1) There is no eutectic between clay and spar, and spar alone deforms easier and earlier and is more liquid in fusion than any clay-spar mixture. But there is a distinct flint-spar eutectic which deforms earlier and is more fluid on fusing than spar alone. (2) On plotting experimental results in a triaxial diagram. it was found that translucency decreases with increase of clay, and lines of equitranslucency radiate from the flint apex towards the felspar corner. (3) The maximum warpage of the eutectic area is little affected by additions of flint but sensibly decreased by increase of clay. (4) Decrease of porosity is more rapid in bodies high in flint than in bodies high in clay. (5) The curves of equi-refractoriness constructed by Simonis show that mixtures of equi-refractoriness can contain more flint than clay. —H. H. S.

Cornish stone; Blistering and bubbling of ——. J. A. Calcott. Trans. Eng. Ceram. Soc., 1910—1911, **10**, 153—154.

THIS effect in pottery is stated to be due to the buff and purple stones being mixed. It is most pronounced when 95 per cent. of purple is mixed with 5 per cent. of buff stone. Purple stone contains about 9 per cent. of alkalis, and buff, 3·5 per cent.—H. H. S.

Vitrification of shale; Function of time in ——. A. V. Bleininger and T. L. Boys. Trans. Amer. Ceram. Soc., 1911, **13**, 387—394.

MELLOR (see this J., 1910, 1381) studied the time effect by burning a sagger body repeatedly at cone 8, and suggested that the change of contraction during each firing is proportional to the square of the contraction yet to be made. The author has constructed porosity-temperature time curves of a paving-brick shale and finds his results not in accordance with Mellor's rule. The rate of vitrification is very much greater at the beginning of the heating and gradually tapers off as it is continued. Experiments on these lines are to be continued with longer time and closer temperature intervals and the heat absorption of clays will be considered.—H. H. S.

[*Ceramics*] *Fluxes and fusion.* R. C. Purdy. Trans. Amer. Ceram. Soc., 1911, **13**, 75—85.

DEFINING a flux as that substance or mixture of substances which in a given mixture is the first to liquefy and become the solvent for the other components, the author attacks the idea that bases are always fluxes. From practical examples he shows that such bases as lime and magnesia often melt in a mixing after silicates which have been introduced as a raw material, *e.g.*, felspar, and after eutectics which are formed and act as secondary fluxes. It is impossible to classify ceramic materials into fluxes and refractories, as an excess of any component above the amount needed to form eutectics causes that component to act as a refractory.—H. H. S.

White ware; Report of Committee on classification of ——. C. Weelans and H. E. Ashley. Trans. Amer. Ceram. Soc., 1911, **13**, 102—110.

As a preliminary to classification, certain standard tests are suggested. *Red ink tests.*—Pieces are to be thoroughly dried and immersed in ink solution for 18 hours, and the depth of penetration noted. The ink solution is composed of 5 grms. of eosin, 25 c.c. of ammonia, and 475 c.c. of water. *Absorption, porosity and specific gravity.*—Samples, dried at 100° C., are placed in a vacuum jar, which is exhausted to a vacuum of 28 inches of mercury. Water is admitted to cover the pieces and they are boiled in vacuum for 5 hours. The weights of the dry and of the wet material and of the material suspended in water are then ascertained and the absorption, etc., calculated. *Translucency.*—Screens of about $\frac{1}{4}$ inch mesh are placed at a distance of 3 inches from an incandescent electric light with a reflector provided and the whiteware samples are held flat against the wires. The smallest mesh distinguishable through a specimen is noted, and the thickness of the piece measured. The translucency is said to be inversely proportional to the thickness. *Crazing.*—This work has not been commenced, but it is proposed to subject the specimens to alternate soaking in a hot solution of salt and drying out in open air. *Hardness* is to be tested by exposure to a sand-blast.—H. H. S.

Coefficient of expansion of certain white ware mixtures, biscuited at cone 10; *Influence of clay, felspar and flint on* ——. R. C. Purdy and A. P. Potts. Trans. Amer. Ceram. Soc., 1911, **13**, 431—468.

THE results of previous investigations may be tabulated as follows:—

Investigators.	Ware.	Temperature range.	Linear coefficient
Deville and Troost	Bayeux porcelain	Not given	0·0000055
Watts	Electric insulator	19°—243°	0·0000054
Holborn and Wien	Berlin porcelain	0°—150°	0·0000044

The authors' object was to test whether Seger's dictum, that crazing and peeling depend on the relative coefficients of expansion of body and glaze, is founded on fact. They conclude that Seger's ideas are neither logical in conception nor in harmony with facts. Difference in expansion is neither the sole nor the most effective cause.—H. H. S.

Porcelain made from European materials; Some coefficient of expansion data on ——. A. S. Watts. Trans. Amer. Ceram. Soc., 1911, **13**. 406—430.

THE materials used were Norwegian felspar, Hohenboeka sand, Zettlitz kaolin, clays from Halle and Lothain, and English china clay. It was found that the coefficient of expansion of a body is increased greatly by substitution of flint for either felspar or clay substance, of finely ground flint for sand not so fine, and of English china clay for kaolin. It is increased slightly by substituting ball clay for kaolin, but is not materially altered by changing kaolin for felspar or flint for pulverised kaolin fired higher than the temperature to which the body is to be taken. The order is therefore—finely ground flint, calcined kaolin, sand, china clay, ball clay, kaolin and felspar. The subsequent discussion was concerned with the cause of dunting. Structural defects and too rapid cooling were agreed to be the most frequent causes. Underfiring is dangerous only when the flint content of the body is too high —H. H. S.

Porcelains; Effect of composition on strength of ——. L. Ogden. Trans. Amer. Ceram. Soc., 1911, **13**, 395—405. (See also E. Ogden, this J., 1905, 265.)

Strength was measured by the abrasion rattler test, conducted in four periods of fifteen minutes each. Shrinkage, absorption and translucency were also measured. The data lead to the conclusions that in porcelains maturing at cone 10, felspar should be not less than 15 per cent. of the rational composition, clay should not exceed 50 per cent., nor should the flint be under 30 per cent. Within these limits, the toughness increases with the proportion of flint whether the felspar or clay be kept constant. If the flint be constant, variation of the other two constituents does not appear to affect toughness. The best proportion of flint is 35 per cent.—H. H. S.

Porcelain; Chemical ——. G. A. Murray. Trans. Amer. Ceram. Soc., 1911, **13**, 585—596. (See also L. Bell, this J., 1908, 565.)

Chemical porcelain is porcelain which in use is designed to meet sudden changes of temperature. The best bodies for this purpose contain 15 per cent. or less of felspar and about 40 per cent. of clay. If the proportion of spar be higher, then a high clay or flint content is better than nearly equal quantities of each. Bodies of relatively high absorption withstand cracking better than those of low absorption, except in the case of bodies high in flint.—H. H. S.

Tiles of six inches and over; Cracking of —— *when drawn from the biscuit oven.* H. Barrett. Trans. Eng. Ceram. Soc., 1910—1911, **10**, 144—146.

Dunting is defined as failure due to strains set up by rapid heating or cooling. Cracking, on the other hand, arises from either the failure of the body to close up while drying or to the rapid escape of steam in the fire. If, in spite of all precautions in drying and firing, cracking still occurs, a plastic must be substituted for a non-plastic clay. The quality of flint used in the body exerts an influence on cracking.—H. H. S.

Glaze construction: volume relationships. II. A. I. Hopkins. Trans. Eng. Ceram. Soc., 1910—1911, **10**, 124—128. (See also this J., 1910, 1381.)

The theory of "oxygen strain" is extended to the sesquioxide and acid components of a glaze. For a Bristol glaze maturing at cone 7, safe strains that will preclude crazing are 1·3779 for an alumina-silica ratio of 1 : 6·25 and 1·4111 for 1·9 : 5. Coloured glazes of good quality may be made from the original glaze by taking into consideration the oxygen strain. If the presence of zinc destroys a colouring effect, substitution of another oxide may mean an increase in the base volume and the alumina-silica ratio must be altered accordingly.—H. H. S.

Glaze defects; Seger's rules for correction of —— *by changing the body.* R. C. Purdy. Trans. Amer. Ceram. Soc., 1911, **13**, 157—209.

Continuing practical trials from former years (see this J., 1905, 1015), the author shows that Seger's rules (Collected Writings, vol. 2, 609, 613, etc.)) cannot be considered as applying rigidly under all circumstances. They are only safe in dealing with white ware. At present it is not possible to formulate rules that have a general application. Seger's rule on the effect of felspar on crazing and peeling applies in few practical bodies unless it is confined only to the substitution of felspar for flint or conversely. In the subsequent discussion the value of rational analysis was questioned.—H. H. S.

Leadless glazes; Notes on ——. P. Bailey. Trans. Eng. Ceram. Soc., 1910—1911, **10**, 129—143.

Leadless glaze shows the effect of variations of temperature during firing more readily than those containing lead, and the margin of safety is therefore more restricted. Owing to the lack of fluidity of leadless glazes, a higher temperature is required than that of ordinary earthenware glost ovens (1050°—1100° C.); fusibility does not necessarily imply fluidity. Leadless glazes tend to become milky and opaque. Glazes used for printed ware have not the surface necessary for use in white ware, and different glazes must therefore be used. Barium, the only base which approaches lead in imparting brilliancy and refractive power to glazes, destroys colours. The manufacture of leadless ware is more uncertain than of lead ware. In the discussion there was a general agreement with the author, but it was pointed out that certain colours, such as copper turquoise blue, cannot be made satisfactorily with lead glazes.—H. H. S.

Porcelain glazes. R. C. Purdy. Trans. Amer. Ceram. Soc., 1911, **13**, 550—584.

Typical formulæ for porcelain glazes are:—*Hard fire* (cone 12—14), (*a*) $0{\cdot}8CaO$, $0{\cdot}2K_2O$, $0{\cdot}8Al_2O_3$, $4{\cdot}4SiO_2$, (*b*) $0{\cdot}7CaO$, $0{\cdot}3K_2O$, $0{\cdot}8Al_2O_3$, $8{\cdot}0SiO_2$; *Medium fire* (cone 8—12), $0{\cdot}35CaO$, $0{\cdot}25K_2O$, $0{\cdot}40ZnO$, $0{\cdot}475Al_2O_3$, $4{\cdot}15SiO_2$, used on one fire ware; $0{\cdot}7CaO$, $0{\cdot}3K_2O$, $0{\cdot}5Al_2O_3$, $4{\cdot}0SiO_2$, used on biscuited ware; *Terracotta*, $0{\cdot}1$—$0{\cdot}7CaO$, $0{\cdot}5$—$0{\cdot}2K_2O$, $0{\cdot}4$—$0{\cdot}1ZnO$, $0{\cdot}55Al_2O_3$, $3{\cdot}3SiO_2$; *Stoneware Bristol*, $0{\cdot}3$—$0{\cdot}15CaO$, $0{\cdot}3$—$0{\cdot}45K_2O$, $0{\cdot}4ZnO$, $0{\cdot}55Al_2O_3$, $3{\cdot}0SiO_2$. The paper deals with the influence of variation in the constituents. Regarding opacity, zinc increases it ($0{\cdot}375ZnO$ with $0{\cdot}5Al_2O_3$, and $0{\cdot}15ZnO$ with $0{\cdot}8Al_2O_3$), lime is neutral, clay increases it, felspar does not. Heat range depends on the ability of the glaze to hold zinc from volatilising, which cannot be prevented in mixtures low in felspar and high in clay. Addition of clay shortens the heat range and decreases fusibility and crazing. The following glazes are recommended, but none of them equal those obtained with a higher silica content, which should be 8 or 10 times the equivalent of alumina. It is considered that Seger's cone mixtures should have some of their lime replaced by potash and zinc.

	CaO	KNaO	ZnO	Al_2O_3	SiO_2
On stoneware (cone 7—10)	0·333	0·333	0·333	0·5	3·0
,, ,, ,,	0·333	0·333	0·333	0·55	3·3
On porcelain (cone 7—12) ..	0·333	0·333	0·333	0·6	3·6
,, ,,	0·15	0·4	0·45	0·5	3·0
,, ,,	0·15	0·4	0·45	0·55	3·3
Porcelain (cone 7—12)	0·15	0·4	0·45	0·6	3·6
,, ,, ,,	0·25	0·5	0·25	0·6	3·6
,, ,, ,,	0·25	0·5	0·25	0·7	4·2
Stoneware (cone 7—10) ...	0·167	0·333	0·5	0·5	3·0
,, ,, ,,	0·167	0·333	0·5	0·55	3·3
,, ,, ,,	0·167	0·333	0·5	0·6	3·6

—H. H. S.

Underglaze colours; Study in —— *with the view of determining the most insoluble and non-volatile underglaze colour composition.* E. T. Montgomery. Trans. Amer. Ceram. Soc., 1911, **13**, 723—730.

Roesler stated, and it was approved by Seger, that a compound of spinel composition ($RO.R_2O_3$) is the most resistant to the solvent action of glaze and therefore was the most suitable for an underglaze frit. The author compounded several metallic oxides and phosphates, viz., chromium oxide and phosphate, cobalt oxide and phosphate, copper oxide, ferric oxide and phosphate, manganese dioxide, and sodium uranate, each with one of the refractory substances, alumina, silica, aluminium phosphate, and kaolin. With the oxides, alumina gave the most refractory frits; with phosphates, silica. In all cases the most refractory frits gave the most insoluble colours. Where the colour is itself refractory, as with chromium trioxide, any of the four refractories may be used. It is possible to get a more refractory strain without damaging the colour by going above the spinel ratio in compounding the frit. Volatilisation appears to be a function of the colouring oxide or phosphate and is not appreciably affected by fritting with a refractory. Except in the case of cobalt, oxides give better colours than phosphates. Cone 10 is recommended as the firing temperature for colour frits.—H. H. S.

Chromium trioxide in [red] glazes; Rôle of ——. E. Büttner. Sprechsaal, 1911, **44**, 669—672.

Starting with the formula: $0{\cdot}6SiO_2$, $0{\cdot}2CrO_3$, $0{\cdot}9PbO$, $0{\cdot}1K_2O$, the author made 77 glazes by varying the raw materials, the relation of base to base, the amount of stain, and by introducing colourless sesqui-oxides, such as alumina and bismuth trioxide, and coloured oxides like those of cobalt, iron, copper and nickel. He concludes that the best red is obtained from the formula: 1—$0{\cdot}6SiO_2$, $0{\cdot}3$—$0{\cdot}15CrO_3$, $0{\cdot}9PbO$, $0{\cdot}1K_2O$. The bases: K_2O, MgO, CaO, BaO, can only be introduced to the extent of 0·1 mol., as chromium trioxide plays the part of an acid only in presence of much lead. Alumina in small quantities, 0·02—0·1 mol., does not disturb the red colouration. Bismuth is as good and boron trioxide better, but the oxides of antimony, arsenic and tin are not favourable. If silica be present in more than 1·0 mol., green and yellow tones ensue, while if it be less than 0·6, the frit becomes soluble in water.—H. H. S.

Cast iron enamels; Comparison of commercial ground coats for ——. J. H. Cox. Trans. Amer. Ceram. Soc., 1911, **13**, 531—549.

The ground coat is defined as a very thin transparent glaze applied to the iron in order to act as bond between metal and enamel and to prevent the iron from oxidising while at the high temperature required for fusing the enamel. It should begin to fuse at dull red heat and remain a good glaze through a considerable heat range. Most ground coats contain borax in order to dissolve metallic oxides from the iron surface, soda as a flux which does not absorb sulphur gases, and red lead as a flux which gives off oxygen and prevents injurious gases from the frit kiln from entering the ground coat. From a series of tests on heat range, bonding power, etc., the conclusions are that the use of cobalt oxide in the undercoat, universal in German practice, is of doubtful value; that clay is a poor material to use in a frit and is not as desirable a raw material as felspar or flint with regard to heat range; that there is no especial advantage in blending raw materials, but there is a decided advantage in blending frits, as the heat range is thereby materially extended. —H. H. S.

Art enamelling on metal; Investigation on ——. J. Minneman. Trans. Amer. Ceram. Soc., 1911, **13**, 514—530.

The author prepared a series of enamels of varying composition and examined them with respect to fusibility, crazing, and durability. From the results obtained, the composition: $0{\cdot}5PbO$, $0{\cdot}5K_2O$, $1{\cdot}5$—$2{\cdot}0SiO_2$ is recommended as an enamel flux. Opacifiers and stains are added to this as desired.—H. H. S.

Sheet steel enamels; Resistance of —— to solution by acetic acid of various strengths. R. D. Landrum. Trans. Amer. Ceram. Soc., 1911, **13**, 494—501.

Basins coated with two soft enamels were subjected to the action of acetic acid of varying strengths, the liquid being evaporated to dryness without boiling vigorously. The residue was then baked for fifteen minutes and the loss in weight of the enamel found. As acetic acid does not form a mixture of constant boiling point with water, it follows that the solution was getting continuously stronger during evaporation. Under these circumstances it was found that 17—22 per cent. acetic acid had the greatest solvent action on enamels, 30 per cent. acid had the same solvent action as 11—6 per cent. acid, 40 per cent. the same as 4—5 per cent., 50 per cent. the same as 2—3 per cent., 60 per cent. the same as 2 per cent., and 70 per cent. the same as 1 per cent. acid, while increasing strengths had less solvent action.—H. H. S.

Burning temperature of limestones. Bleininger and Emley. *See* VII.

Technical applications of zirconia. Böhm. *See* VII.

Effect of temperature on dielectric strength of porcelain insulators. Henderson and Weimer. *See* XI.

Vitrification range and dielectric behaviour of some porcelains. Minneman. *See* XI.

Patents.

Mirrors; Process for the manufacture of ——. W. P. Thompson, Liverpool. From C. Boirre, Saint-Maur, France. Eng. Pat. 28,605, Dec. 8, 1910.

Glass or the like which is to be gilded is washed in a bath containing a soluble salt of mercury, before being immersed in the gold chloride bath, which also contains caustic soda and a reducing agent, such as acetaldehyde, sugar, etc., as used in the ordinary gilding process. The thin layer of gold deposited on the glass is coated with a metallic powder, such as gold, copper, etc., which is suspended in alcohol or spirit, in which gum lac or other varnish is dissolved to act as a binding material, and is sprayed on.—W. C. H.

Silicious bodies [fused quartz]; Method of homogeneous and integral "soldering" of —— with other bodies. A. L. Billon-Daguerre. Fr. Pat. 431,159, Sept. 2, 1910.

In order to unite a silicious to another body, the two surfaces to be joined are coated with a layer of metal, or a compound of the metal, which acts as a solder or flux under the influence of heat. The layer formed preparatory to the soldering consists of a solution with a metallic base, and the thickness of the layer can afterwards be increased by chemical precipitation or by a galvanic deposit. The metals employed are platinum, or other members of that group, chromium, nickel, and compounds of thorium, zirconium, etc.—W. C. H.

Clay; Arrangement for cleaning and sifting ——. M. Bohn. Fr. Pat. 431,283, June 19, 1911.

The apparatus consists of two perforated cylinders, the first of which is provided with an endless screw which continually sweeps over the interior surface of the cylinder. The second cylinder, connected with the first by a narrower portion, contains a hollow shaft of relatively large diameter, which carries on its surface a number of pegs or small blades, the free ends of which touch the interior of the cylinder, and serve to free the refuse material from any adhering clay as much as possible. The pegs or small blades are arranged in a helical line over the surface of the shaft, and are placed in such a way that the surface of the pegs may be inclined at a suitable inclination to their plane of rotation. (See also this J., 1911, 1254.)—W. C. H.

Ceramic slip; Filtration process and apparatus for the filtration of ——. W. Podmore and C. F. Bailey, Stoke-on-Trent. Eng. Pat. 11,163, May 9, 1911.

A layer of slip is caused to pass between a pair of filtering surfaces, and is thus subjected to lateral filtration on both sides, whilst the thickness and rate of flow of the layer are continuously reduced for the purpose of securing a more homogeneous and denser product. A cylinder of perforated metal or wire-gauze is surrounded with a filtering medium, which is held in position by an outer perforated cylinder. Grooves, communicating with the drainage channel of the apparatus, are arranged between the outer surface of the latter cylinder and the inner surface of the cylindrical casing into one end of which the slip is fed. A conveyor is arranged within the filtering cylinder, and consists of a hollow truncated cone or drum, round which a helix is wound. The wall of the drum is perforated and lined with a filtering medium, held in position by a perforated metal lining, and the interior of the drum communicates with the drainage channel. The diameter of the drum continuously increases, and the pitch of the helix decreases, from the inlet towards the outlet of the apparatus, in order to diminish the thickness and rate of flow of the layer of slip.—W. C. H.

Kiln ; Continuous ceramic ——. A. Bracher. Fr. Pat. 431,226, June 17, 1911.

This is a tunnel kiln which slopes downwards slightly from the charging end. The combustion chamber has two grates, on to which the fuel is fed from above, and the air required for combustion is supplied through pipes to the crowns of the fire-holes. Arrangements are provided at four points in each of the grates to distribute oxygen. From the grates the combustible gases pass upwards and are made to circulate through a number of passages in the walls of the combustion chamber, the rate of flow being controlled by dampers, and through channels in the roof of the kiln. The heating chamber has no channels in the roof, and only two channels in the side walls, and the walls and roof of the cooling chamber have none. The combustion chamber is provided with two tubes for the escape of fumes from the enamels during firing, and observation holes are arranged at points along the whole length of the kiln. The articles to be fired are stacked up into rectangular "waggons," the lowest piece of which rests on balls of refractory material laid in grooves along the length of the floor of the tunnel; the ends of the waggons are slotted to fit together, and the whole train is pushed over the rails of balls by means of a handle working a chain of pallets.—W. C. H.

Refractory product and abrasive ; Process of manufacture of a ——. I. Werlein. Fr. Pat. 430,932, Aug. 26, 1910.

A mixture of silica and alumina is heated to a temperature of about 3000° C. for twenty minutes. The mixture may be either natural, such as clay or bauxite, or artificial, such as slag. In this case a quantity of carbon may also be added to the mixture to reduce any admixed oxides, such as oxide of iron, etc.—W. C. H.

Melting glass, metals, or other substances ; Furnaces or ovens for ——. C. Royer, Gisors, France. Eng. Pat. 6441, March 14, 1911.

See Addition of April 23, 1910, to Fr. Pat. 390,102 of 1908; this J., 1910, 1311.—T. F. B.

Beryllia and alumina ; [Abrasive] composition containing ——, *and its manufacture.* The Carborundum Co. Fr. Pat. 431,483, June 22, 1911.

See U.S. Pat. 1,001,571 of 1911; this J., 1911, 1116.
T. F. B.

IX.—BUILDING MATERIALS.

Firebricks ; Behaviour of —— *under load conditions.* A. V. Bleininger and G. H. Brown. Trans. Amer. Ceram. Soc., 1911, 13, 210—225.

The results of the previous paper (this J., 1910, 1309) are confirmed. Under a load of 50 lb. per sq. inch, the bricks being placed on end, no firebrick body can withstand a temperature of 1350° C. if the alkali equivalent be more than 0·225. Silica present in excess of the ratio $Al_2O_3 : 2SiO_2$, makes the alkali content more effective in fluxing power. Thus with $4·4SiO_2$ failure under the load was brought about by $0·17RO$. Experiments at other pressures showed that most firebricks fail under 125 lb. per sq. inch. Plastic clays are not necessarily detrimental if low in alkali. There is no relation between the crushing strength of a brick at 1300° C. and at ordinary temperatures.—H. H. S.

Firebrick ; Cause of permanent expansion in ——. J. M Ogan. Trans. Amer. Ceram. Soc., 1911, 13, 602—611.

The volume of test bricks was found to increase at the same time and at about the same rate as the sealed pore volume increased, and it is concluded that the permanent expansion of firebricks is due to the formation of an impervious bleb structure by "volatilising gases" in the glassy matrix formed by fusion.—H. H. S.

Sand-lime brick ; Chemistry of ——. T. R. Ernest. Trans. Amer. Ceram. Soc., 1911, 13, 648—667.

In his original patents, Michaelis claimed that a hydrated calcium silicate was formed when an intimate mixture of lime and silica was subjected to the action of high-pressure steam for several hours. The author concludes from chemical and microscopical experiments that sand-lime brick made from pure materials consists of sand grains cemented together by a bonding substance. Aside from the calcium hydroxide or carbonate that may be present, this bonding material consists of a mixture of at least two and most likely three calcium silicates, which may be hydrated, the bulk being calcium meta-silicate, $CaSiO_3$ or $CaSiO_3,H_2O$, and the others the ortho- and di-silicate.
—H. H. S.

Paving bricks ; Some observations on the qualities of ——. E. Orton. Trans. Amer. Ceram. Soc., 1911, 13, 792—820.

The rattler test has been subject to wide variations in the hands of different experimenters, but its convenience and its demand for the same qualities needed for street wear, make its retention of importance. The present paper deals with bricks as studied by this test by one investigator. (For improved specification of the test, see Blair and Orton, Amer. Soc. Testing Materials, 11.) The variation in the results obtained in the rattler test with paving bricks from different positions in the kiln need not exceed 3 per cent. Structural causes may also lead to the same difference, or possibly up to 5 per cent., in bricks of the same brand. The output of first-class bricks may vary up to 5 per cent. as measured by this test, and of second-class, up to 8 per cent. A sample should not be ruled out unless 5 or 10 tests of 10 bricks have been made and the average taken. No single standard can be set for the rattler test; the quality of a brick depends on climatic and traffic conditions and on the kind of foundation and mode of laying the street.—H. H. S.

Cement ; Vindication of the Michaëlis boiling test for ——. H. Kühl. Tonind.-Zeit. 1911, 35, 1576—1578.

The period of 28 days prescribed for the cold water test is too long for practical purposes, and also too short to entirely exclude all causes of instability. It has also been shown that cements may be sound, although they contain amounts of calcium sulphate and magnesia that are in excess of the recognised maxima. Any attempt to hasten the volume-constancy test involves the use of high temperatures. The Michaëlis boiling test has the advantage over the Le Chatelier needle-test that it only requires the simplest apparatus. The pats should be left for 24 hours after gauging, and should not be detached from the glass plates, but put edge uppermost into cold water, which is slowly warmed so that it begins to boil in half an hour, and is kept gently boiling for from 4 to 5 hours. During the warming of the water and during the boiling, the pats should be repeatedly withdrawn for a few seconds and examined. By examining cements in this way, the author has divided them into six classes according as (1) The pat adheres to the glass after 5 hours' boiling—the greatest constancy of volume. (2) The pat is loosened from the glass, but still rings, is sharp-angled and free from cracks. (3) The pat leaves the glass during the warming of the water, shows no external changes during the first hour of boiling, but after 5 hours shows small cracks and slight deformation, although it offers considerable resistance to fracture. (4) The pat soon leaves the glass, and after boiling for a short time develops fine cracks; at the end of the boiling it is covered with a network of cracks or shows gaping radial cracks. Its strength is small. (5) The pat soon leaves the glass, and at the beginning of the boiling develops distinct cracks which quickly increase. The pat gradually becomes friable, and falls to pieces. (6) The cement, even during the heating of the water, is covered with cracks, and as soon as boiling begins, breaks up into a slime. Cements which fall into classes 1, 2 and 3 are constant in volume for all practical purposes, and would stand the cold water test. A cement in class 4 is suspicious, must be used carefully, and might not stand the cold water test. Cements in classes 5 and 6 are unsound, and probably would not stand the cold water test.—W. C. H.

Patents.

Concrete ; Lining shafts with ——. Hiltruper Terrazzo und Cementwaarenwerke Act.-Ges., Münster, Germany. Eng. Pat. 24,508, Oct. 21, 1910. Under Int. Conv., Oct. 22, 1909.

The concrete lining sections are formed into a ring upon a platform suspended by cables within the shaft ; the platform is then raised and the concrete ring secured by bolts hanging from a suspension support at the top of the shaft. The spaces between each of the rings and the shaft wall, and the joints between the rings are filled with liquid cement or mortar, which is introduced from the ring of blocks next above, through holes ending on the under side of the lower ribs, formed on the rear surface of the blocks, and also through holes ending in the basal grooves of the blocks. The liquid cement or mortar is prevented from escaping downwards into the shaft by means of a packing of piles, planks or the like, provided at the front with a felt pad, and secured between the bottom of the block and the staging. If the staging is dispensed with, the lining sections, composed of slightly curved concrete slabs provided with a tongue and groove, and a filling hole, are built up upon H-shaped iron rings in the bottom of the shaft.—W. C. H.

Cement or plaster : Manufacture of —— *and structures thereof.* J. H. Lowry, Liverpool. Eng. Pat. 25,142, Oct. 29, 1910.

Coloured blocks or slabs are made by mixing together 14 lb. of cement, 2 oz. of stiff glue, and 1½ lb. of colour, with the requisite quantity of water. The mixture is placed in a mould and the desired quantity of concrete material added, so as to leave a fine cement surface on the blocks, with a centre of concrete. In the case of pavements, the mixture is spread on a layer of concrete material, and before setting, another layer of this is sprinkled over the top.—W. C. H.

Cement or other substances that stiffen or harden ; Apparatus for testing and recording automatically the setting of ——. R. G. Nicol, Aberdeen. Eng. Pat. 26,574, Nov. 16, 1910.

The test piece of cement is placed on a table which has an intermittent rotary and horizontal rectilinear movement imparted to it so that a needle which strikes the upper surface of the test piece moves in a spiral path over the surface. The depth to which the needle penetrates at each blow, the time at which each blow falls, and the temperature, are all recorded on a chart fixed on a drum driven by clockwork.—W. H. C.

Cement. J. Craig and J. M. Ralston. Barrhead, N.B. Eng. Pat. 935, Jan. 13, 1911.

The cement consists of a mixture of whinstone (in the form of dust, powder, or grit), chalk, calcined magnesite, and powdered magnesium chloride. Cold water is added to the mixture to bring it to the proper plastic consistence for working.—W. C. H.

Roads, pathways and the like ; Manufacture and production of material for use in making ——. F. Lennard, London. Eng. Pat. 25,465, Nov. 2, 1910.

In order to utilise for road-making, stones, such as stones from the sea-beach, which in their usual form are not suitable for this purpose, the stones are heated to such an extent that they are fractured, or can be readily fractured or divided, and are then treated with some suitable binding material, preferably tar or pitch, or a mixture of tar and pitch. As a material for surfacing roads, the stones are finely divided, and are then applied to a road or pathway which has been already treated with tar or pitch, or else are mixed with tar or pitch and the mixture applied to the road surface.—W. C. H.

Paving stones and the like prepared from cement and filling materials by pressing ; Process for promoting the hydration of ——. A. Karger. Ger. Pat. 238,330, May 26, 1910.

The mixed raw materials are moistened, filled into a mould, and subjected to a pressure of at least 1000 kilos. per sq. cm.—A. S.

Wood ; Process for the preservation of ——. K. Koenman, Liège, Belgium. Eng. Pat. 8468, April 5, 1911.

See U.S. Pat. 987,888 of 1911 ; this J., 1911, 544. The wood may be finally treated with a bath of tepid water containing 0·5 to 1 per cent. of salicylic acid.—T. F. B.

Wood ; Process of preserving ——. K. Koenman, Bernardsville, N.J., Assignor to F. B. Allen, Bernard township, N.J. U.S. Pat. 1,007,877, Nov. 7, 1911.

Wood is impregnated in a closed vessel with ammonium polysulphide, and oxygen is then drawn through the wood which is finally dried at a high temperature.—W. C. H.

Timber ; Electric process for drying ——. A. U. Alcock, Perth, Western Australia. U.S. Pat. 1,007,513, Oct. 31, 1911.

See Eng. Pat. 25,175 of 1910 ; this J., 1911, 1315.—T.F.B.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Sulphur in pig iron and steel ; Determination of ——. H. Kinder. Stahl u. Eisen, 1911, **31**, 1838—1839.

The iodine solution used in the titration of the sulphur, after precipitating the latter as a sulphide, is well known to be far from being stable. As solutions of permanganate keep their strength much better, it is advantageous to prepare for each determination a fresh solution of iodine by adding standardised permanganate to a solution of potassium iodide, in presence of dilute sulphuric acid. A solution is prepared containing 30 grms. of potassium iodide and 10 grms. of sodium bicarbonate per litre (the sodium bicarbonate is necessary to avoid hydrolysis of the iodide solution). 10 c.c. of this solution acidified with dilute sulphuric acid, are treated with a measured quantity of the permanganate solution, and the liberated iodine is titrated with thiosulphate, the strength of the latter being then adjusted till 1 c.c. equals 1 c.c. of permanganate. The determination of sulphur in iron or steel is carried out as follows : the borings are heated with hydrochloric acid in the usual apparatus, and the gases, after passing through a wash-bottle, are led into 50 c.c. of ammoniacal cadmium chloride solution (20 grms. of cadmium chloride, 400 c.c. of water, and 600 c.c. of ammonia of sp. gr. 0·960). The cadmium sulphide is filtered off, washed, and placed, together with the filter, in a flask in which 10 to 20 c.c. of the iodide solution, 25 c.c. of dilute sulphuric acid, and (from a burette) a sufficient quantity of permanganate, have previously been placed. After shaking, the excess of iodine is titrated with thiosulphate, using starch as an indicator. On the liquid becoming colourless, it is titrated back with a few drops of permanganate till the blue colour just reappears.—R. W. N.

Cupellation. R. C. Benner and M. L. Hartmann. J. Ind. Eng. Chem., 1911, **3**, 805—807.

The authors compared different kinds of cupels with regard to loss of silver, the cupellation being effected in an electrically heated muffle furnace, and the temperature determined by a Le Chatelier platinum iridium pyrometer: 10 grms. of lead and 35—45 mgrms. of silver were taken for each test. It was found that cupels made of different grades and sizes of bone ash gave identical results within the limits of experimental error in regard to loss of silver. The average percentage loss of silver in different cupels under similar conditions was as follows: Morganite, 1·99; bone ash, 2·36; Brownite, 2·89; cement and bone ash (1 : 1), 2·95; Casseite, 3·09; cement, 3·38.—A. S.

Alloys; Pitch of the sound produced by —— and its variation with the temperature. F. Robin. Comptes rend., 1911, **153**, 665—668.

In the case of tuning forks of alloy steels, the author found that chromium raises the pitch of the sound produced whilst nickel lowers it; the pitch is at a minimum in an alloy containing 36 per cent. of nickel. The influence of variation of temperature on the pitch of the sound is discussed, and it is shown that this effect varies considerably according to the nickel content in the case of nickel steels. The following alloy steels (carbon content, about 0·1 per cent.) are recommended for the manufacture of tuning forks practically unaffected by change of temperature within the limits given: 44·5 per cent. of nickel and 2 of manganese (0°—50° C.), 47 per cent. of nickel and 3 of chromium (0°—60° C.), 42·4 of nickel and 1·5 of chromium (0°—100° C.), and 45 per cent. of nickel (0°—100° and 180°—280° C.).—A. S.

Passive nickel and iron; Influence of the magnetic field on ——. H. G. Byers and A. F. Morgan. J. Amer. Chem. Soc., 1911, 33, 1757—1761.

An anode of nickel or iron and a platinum cathode were placed in a test-tube containing an electrolyte (sulphuric or nitric acid, sodium nitrate, or potassium sulphate) and the current density required to render the anode passive measured, both under ordinary conditions, and when the test-tube was placed between the poles of an electro-magnet. It was found that the current density required to render nickel passive is materially increased when the metal is in the magnetic field, and a similar result holds good for iron. Steel is more difficult to render passive when magnetised. Soft steel is affected to a greater extent than hard steel. The positive pole of the magnetised piece of metal is more easily rendered passive than the negative pole.—F. Shdn.

Calcium oxide in lime used in the cyanide process. [*Rough determination of* ——]. L. W. Bahney. Amer. Inst. Min. Eng., Oct., 1911. Min. and Eng. World, Nov. 4, 1911, 911.

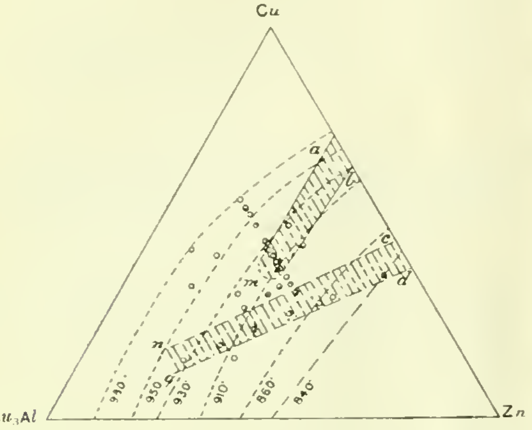
Calcium carbonate and magnesium oxide are useless as protective alkalis, so that a quick method of determining calcium oxide is of importance. The author has obtained results of sufficient accuracy for technical purposes by titrating a "milk" of the sample and water with oxalic acid and phenolphthalein until the pink colour returns only very slowly. The slow return (if any) of the pink colour is due to magnesium oxide, but the end point for the calcium oxide is easily recognised.—B. M. V.

Electrolytic refining [*of silver, gold, and copper*] *at the U.S. Mint, San Francisco.* E. B. Durham. Amer. Inst. Min. Eng., Oct. 1911. Eng. and Min. J., 1911, 92, 901—904 and 950—953.

Electrolytic processes alone are used to refine purchased bullion, which may be as low as 200 fine in precious metals. Silver bullion and gold bullion too low in gold to be used for gold anodes are electrolysed by a current of 8·3 amp. per sq. ft. in an electrolyte containing 3 per cent. of silver as nitrate, 1½ to 2½ per cent. of free nitric acid and a little glue, contained in vertical cells and kept in motion by a glass propellor in the centre of each cell. Crystalline silver is deposited on the pure silver anodes, whence it is removed daily by stripping, and is pure unless the bath becomes too rich in base metals (limit, 8 per cent. of copper). The anode sponge (mainly gold with about 10 per cent. of silver and 1 per cent. of base metals) is knocked off and melted for gold anodes. The slime, anode cores, and the silver obtained from the gold cells (see later) are placed in maple trays lined with "duck" and electrolysed again in horizontal cells, using graphite cathodes and a current density of 14·3 amp. per sq ft. The material left is used for gold anodes. The spent electrolyte from both classes of silver cells has its silver removed by scrap copper and the silver obtained is cast into anodes. The gold anodes are cast from gold bullion and gold products from both silver and gold cells; they may contain 875 parts of gold and 100 to 125 parts of silver per 1000. They are electrolysed twice, the first deposition giving cathodes (which are used as the anodes of the second cells) about 998·7 fine, whilst the final cathodes are about 999·7 fine. The first electrolysis is a substitute for a preliminary boiling in sulphuric acid, but if the original anodes contain under 7 per cent. of silver, a single electrolysis will give a cathode over 999 fine. The original cathodes must be of pure gold as they will not strip. The electrolyte is a solution of gold trichloride containing 7 per cent. of gold in the first cells, 6 per cent. in the second, with 10 to 12 per cent. of free hydrochloric acid in both. The current density is 90 amp. per sq. ft. and the P.D. about 1 volt per cell; a glass propellor is used to circulate the electrolyte. The electrolyte decomposes slowly (probably by replacement of gold by copper), gold passing into the slime. Its strength is determined daily by adding to a portion a known amount of ferrous ammonium sulphate solution more than sufficient to precipitate all the gold, and titrating the excess with permanganate. There must not be less than 4 per cent. of gold or more than 4 per cent. of copper, or the deposited gold will not be compact. Strong gold chloride solution for enriching the electrolyte is made by electrolysing gold bullion in hydrochloric acid, using a porous pot to prevent deposition of gold on the cathode; a hood is necessary as fume is formed. Some of the silver chloride formed on the anodes has to be brushed off at intervals, but most of it drops down as slime. The slime in the first cells may contain 600 parts of gold and 300 parts of silver (as chloride) per 1000, the remainder being mostly lead chloride; in the second cells it may be 960 parts of gold and 40 of silver; the platinum metals go into solution. The slimes are washed in a centrifugal with hot water and then reduced in lead-lined tanks with zinc, a little sulphuric acid being added to start the reaction. (The completeness of the reduction to metallic silver is tested for by taking some of the material, leaching with ammonia, and adding hydrochloric acid.) When reduction is complete, sufficient sulphuric acid is added to dissolve the excess of zinc. This silver goes to the anode baskets of the second silver cells. Spent gold-bearing electrolytes and wash waters have their gold removed by long standing in presence of ferrous sulphate; the precipitated gold is melted into gold anodes. Spent solutions (nearly free from precious metals) from both gold and silver processes have their metallic content precipitated by scrap iron—the iron waters are run to waste—the cement copper is washed, drained, air dried and cast into anodes which will also contain lead, platinum metals and small amounts of gold and silver. These anodes are electrolysed in a solution of 3 per cent. of copper as sulphate and 3 to 4 per cent. of free sulphuric acid. A current of 10 amp. per sq. ft. of cathode and 0·6 volt per cell is used. The cathodes for starting are of sheet lead; when the copper deposit is thick enough, it is stripped off and used alone. The cells are arranged in steps to maintain a circulation of electrolyte, which is returned by a steam ejector. The products are pure copper and a relatively small amount of slime containing gold, silver and platinum metals, which is washed with dilute sulphuric acid, melted and accumulated until sufficient is obtained for recovery of platinum, etc. Spongy products and slime are dried in centrifugal machines sufficiently to be suitable for melting; separate machines are reserved for the products from the different electrolytes. The gold cathodes are dried in a steam-heated room.—B. M. V.

Aluminium brasses; Constitution of the ——. M. Levi-Malvano and M. Marantonio. Gaz. chim. ital., 1911, **41**, II., 282—297.

The authors have made a thermal and micrographic study of the special aluminium brasses. These alloys contain 58—70 per cent. of copper, 1—4 per cent. of aluminium and the remainder zinc. For studies of the binary systems, copper-zinc, copper-aluminium, and zinc-aluminium, see this J., 1905, 972; 1906, 503; 1908, 1066; 1909, 1137; and 1910, 699. The special brasses are all included in the ternary system: Cu-Zn-Cu_3Al. An investigation of binary alloys of zinc and the compound, Cu_3Al, showed that the cooling curve falls from the melting point of Cu_3Al (1020° C.) to that of zinc, and consists of four distinct branches. The alloys consist of several series of solid solutions with two regions of limited miscibility in the solid state. The results of a thermal study of a number of ternary alloys of copper, zinc, and the compound, Cu_3Al, are shown in the triangular diagram (see Fig.), in which the dotted curves represent the temperatures at which solidification begins, and the two enclosed spaces, *amb* and *cnqd*, represent regions of limited miscibility, the extent of which was ascertained by microscopic examination. The alloys which do not come within these spaces acquire a homogeneous structure after more or less prolonged annealing, whilst those which come within either of the spaces remain heterogeneous even after annealing. From an alloy in the space, *amb*, at a certain stage two series of ternary mixed crystals separate, the composition of which changes along the lines *am*, *bm*, in the direction indicated. In the case of alloys in the region, *cnqd*, on the other hand, the composition of the two kinds of ternary mixed crystals which separate, changes in the opposite direction along the lines, *nc* and *qd*. The study of the ternary alloys is being continued especially in the direction of correlating the constitution with the mechanical properties of the alloys and their resistance to corrosion, features which render them so useful in naval construction.—A. S.



Phosphor bronzes; Constitution of ——. M. Levi-Malvano and F. S. Orofino. Gaz. chim. ital., 1911, **41**, II., 297—314.

The authors have made a thermal and micrographic study of the ternary system, Cu-Cu_3Sn-Cu_3P, which includes the commercial phosphor-bronzes. The binary alloys of copper and phosphorus have been examined by Heyn and Bauer (this J., 1906, 1047) and those of copper and tin by Giolitti and Tavanti (this J., 1908, 1155). A study of binary alloys of the two compounds, Cu_3Sn and Cu_3P, showed that these are immiscible in the solid state. The curve representing the beginning of solidification consists of two straight lines intersecting at the eutectic point (22 per cent. of Cu_3P; 650° C.). After a theoretical discussion of the constituents and behaviour on solidification of the ternary alloys, based on the results obtained with the three binary systems, the experimental results of the study of the ternary alloys are tabulated, and a triangular diagram is given showing the temperatures at which crystallisation begins and the eutectic curve. According to the composition of the alloys, the primary crystallisation may be of ternary mixed crystals, of binary mixed crystals of copper and Cu_3Sn, or of the compound, Cu_3P. The ternary mixed crystals may interact with the still liquid alloy to give binary mixed crystals (Cu-Cu_3Sn) and the compound, Cu_3P, and binary mixed crystals (Cu-Cu_3Sn) may interact with the liquid to give other binary mixed crystals (Cu-Cu_3P) and the compound Cu_3P. The possible constituents of the solid alloys are thus ternary mixed crystals, binary mixed crystals of copper and Cu_3Sn or Cu_3P, the compound, Cu_3P, and an eutectic consisting of Cu_3P and mixed crystals. Photomicrographs showing the different constituents are given. The investigation is being continued with the purpose of studying the properties of the ternary mixed crystals, both when pure and when more or less completely transformed into binary mixed crystals.—A. S.

Bronzes; Pouring and melting points of some high-grade ——. C. P. Karr. Trans. Amer. Brass Founders' Assoc., 1911, **5**, 77—84.

The investigation was conducted under ordinary foundry conditions, the alloys employed being bronzes containing from 81 to 88 per cent. of copper with little or no zinc, and yellow brass containing 69 per cent. of copper and 31 of zinc. By means of a Féry pyrometer the temperature of each charge was ascertained at every stage of its transit from the melting-furnace to the mould, these temperatures being subsequently compared with the melting-points of the alloys as determined in the laboratory. The pouring temperatures of two bronzes, each containing about 84 per cent. of copper, were thus found to be 1700° and 1840° F., the melting-points being 1650° and 1735° F. respectively; the corresponding figures for the yellow brass were 1670° and 1640° F. The details and results of the investigation are tabulated, the temperatures given being relative and not absolute.—W. E. F. P.

Manganese bronze; Effect of repeated melting on ——. J. L. Jones. Trans. Amer. Brass Founders' Assoc., 1911, **5**, 125—130.

The ultimate strength, elastic limit, electrical conductivity and hardness of manganese bronze are gradually lowered, although the ductility is not appreciably affected, by repeated melting, notwithstanding the observance of the usual precautions against oxidation. As typical of manganese bronze, the following percentage composition is given: aluminium 0·14, copper 56·61, iron 1·50, lead 0·01, manganese 0·07, tin 1·21, zinc 40·53. The addition of zinc, etc., to the re-melted alloy (to replace oxidation losses) is not recommended.—W. E. F. P.

Zinc [in ores, etc.]; Rapid determination of ——. K. Voigt. Z. angew. Chem., 1911, **24**, 2195—2198.

From 1 to 3 grams of the finely powdered material are heated with 10 c.c. of nitric acid and 30 c.c. of hydrochloric acid; after dilution, 50—60 c.c. of concentrated ammonia are added in order to precipitate the silica, iron, and lead. After quickly boiling, cooling, and diluting with dilute ammonia (1 : 3) to a volume of 300 c.c., the solution is filtered and 100 c.c. of the filtrate are treated with bromine water to precipitate the manganese. Without filtering, about 1 grm. of granulated aluminium is added to the ammoniacal solution to precipitate the copper. 5 c.c. of a solution of sodium sulphite and 1 c.c. of dilute ammonia are then added, the solution is boiled, filtered, and the precipitate washed with a dilute ammoniacal solution of sodium sulphite. The filtrate after neutralising with hydrochloric acid and adding 10 c.c. excess of dilute hydrochloric acid (1 : 3) is titrated by Schaffner's method, using a solution containing 21·63 grms. of potassium ferrocyanide and 14 grms. of sodium sulphite per litre, and an indicator containing 9 grms. of ammonium molybdate per litre which gives a deep red-brown colouration with free hydrochloric acid and potassium ferrocyanide.

The analyses of ten varieties of zinc ores and products are given, the results obtained by the above method not differing from those by the usual gravimetric methods by more than 0·5 per cent.—A. H. C.

Zinc-lead-tin ; The ternary system ——. M. Levi-Malvano and O. Ceccarelli. Gaz. chim. ital., 1911, 41, II., 269—282.

The binary systems, zinc-lead (compare Arnemann, this J., 1910, 698), tin-zinc (see Giolitti and Levi-Malvano, Rend. Soc. Chim. Ital., 1909, II., [1], 38; and Curry, this J., 1909, 1254), and lead-tin (see Degens, this J., 1909, 1041) have been studied previously. The ternary system (see Alder Wright, this J., 1890, 944; 1892, 245) is one in which two liquid phases of limited miscibility occur. The authors examined by the thermal method over 90 ternary alloys; 50 grms. were taken in each case, and the alloys were melted in a porcelain crucible in an electric furnace with a nickel resistance. The results are tabulated and also plotted in a triangular diagram. The curve representing the region of limited miscibility in the liquid condition resembles that described by Alder Wright (*loc. cit.*). This region occupies more than half of the area of the triangle in which the primary crystallisation is that of zinc, but the corresponding temperature limits are comparatively narrow, viz., from 418° to about 360° C., whilst outside the region of limited miscibility, there is a much wider temperature range, viz., from 360° C. to 177° C. (the ternary eutectic point). The authors found the binary eutectic point of tin-zinc alloys to be 198° instead of 190° C. as given by Giolitti and Levi-Malvano (*loc. cit.*). The ternary eutectic consists of about 5 per cent. of zinc, 24 of lead, and 71 of tin. The results of the thermal study were confirmed by micrographic examination; the presence of even small quantities of needle-shaped zinc crystals can be easily distinguished. Six microphotographs are given.—A. S.

Zinc, lead, and tin ; [Hardness of] Alloys of ——. M. Levi-Malvano and O. Ceccarelli. Gaz. chim. ital., 1911, 41, II., 314—318.

By means of the Brinell test, using a pressure of 500 kilos., the authors have determined the hardness of a large number of ternary alloys of zinc, lead, and tin prepared for a previous investigation (see preceding abstract). The results are tabulated and a triangular diagram is given in which curves are drawn through the points representing alloys of approximately equal hardness. Five curves are thus shown corresponding to hardnesses of 8, 11, 13, 15, and 18 respectively. Zinc has the maximum hardness (about 30). Three alloys recommended by Hiorns as being suitable for antifriction bearings, viz. (1), 76 per cent. of tin and 12 per cent. each of zinc and lead; (2). 76 per cent. of lead and 12 per cent. each of zinc and tin; and (3) 45 per cent. each of lead and tin and 10 per cent. of zinc, all lie within the region of primary crystallisation of zinc and near the binary zinc-lead eutectic curve, and would therefore be composed mainly of a ground mass of the zinc-lead eutectic intermixed with a little of the ternary zinc-lead-tin eutectic, with long crystals of zinc disseminated therein.—A. S.

Nickel ; Determination of —— *in alloys.* S. W. Parr and J. M. Lindgren. Trans. Amer. Brass Founders' Assoc., 1911, 5, 120—124.

Referring to the dimethylglyoxime process (this J., 1911, 549) the authors state that nickel may be precipitated in the presence of iron, aluminium and chromium, provided the solution contains sufficient tartaric acid to prevent the precipitation of these metals by ammonia. In a series of determinations upon a steel containing about 1 per cent. of nickel, the result afforded by direct precipitation was practically the same as that obtained by precipitation in the iron-free solution. It was also found that, after precipitation with dimethylglyoxime, nickel may be determined volumetrically by dissolving the precipitate in an excess of standard sulphuric acid and titrating back with standard potassium hydroxide, the end-point being shown by the appearance of a faint yellowish colour in the previously colourless solution. The acid is standardised against pure nickel which is precipitated with dimethylglyoxime and titrated as described.—W. E. F. P.

Tungsten ; Determination of —— *in wolframite in presence of molybdenite.* W. Trautmann. Z. angew. Chem., 1911, 24, 2142—2143.

In analysing wolframite, the small proportion of molybdenum sulphide usually present may, by the following method, be removed before the alkaline fusion, the tedious separation of molybdenum from tungsten at a later stage being thereby avoided. One grm. of the finely powdered sample is gently roasted for 5—10 minutes in a platinum crucible until no further odour of sulphur dioxide is perceptible. The residue is extracted three or four times with warm dilute ammonia which dissolves all the molybdenum trioxide formed during roasting, whilst the wolframite remains unaffected. The liquid is filtered through a small filter paper which is afterwards washed with an ammoniacal solution of ammonium nitrate and then returned to the crucible and ignited. The contents of the crucible are then fused with alkali as usual. The tungstic oxide weighed finally contains, as a rule, only a trace of molybdenum trioxide; the largest amount found by the author was 0·3 per cent., and this was in analysing an ore containing about 7 per cent. of molybdenum glance.—J. H. L.

Determination of moisture in fuel [and ores]. Crisfield. *See* IIa.

Formation of iron carbonyl. Stoffel. *See* VII.

Separation of zirconium from iron and aluminium. Analysis of ferrozirconium. Wunder and Jeanneret. *See* XXIII.

Precipitation of nickel compounds, and the preparation of spongy nickel. Low. *See* XXIII.

Patents.

[Iron] Metals ; Reduction of ——*, from their ores.* A. Berglof, Chicago, Ill., U.S.A. Eng. Pat. 20,115, Aug. 29, 1910. Under Int. Conv., Sept. 3, 1909.

A mixture of the oxidised ore (*e.g.*, iron ore) with the necessary fluxes, but containing no carbonaceous material, is subjected to the action of a reducing gas (free from nitrogen, oxygen and carbon dioxide) while maintained at a relatively low temperature (*e.g.*, 800°—900° C.) by electrical means. When reduction is complete the temperature of the charge is raised to a point (*e.g.*, 1200°—1400° C.) above the melting point of the slag-forming compounds but below that of the metal, the reducing atmosphere being still maintained. After removal of the separated slag, the spongy mass is treated in presses or rolling mills as in the ordinary puddling process for the manufacture of wrought iron. The reducing gas (essentially a mixture of hydrogen, carbon monoxide and hydrocarbons) is prepared in an electrically heated producer which is periodically charged with bituminous coal, the same producer being also employed for the regeneration of the spent gas.—W. E. F. P.

Steel ; Manufacture of ——. T. D. Mackie, London, and G. F. Forwood, Limpsfield, Surrey. Eng. Pats. 22,569, Sept. 29, 1910, and 8498, April 5, 1911.

The molten iron is first blown with air in a converter and then treated with iron oxide in a reverberatory furnace in the usual manner. After removal of the slag, the surface of the metal is blown—while still in the reverberatory—with a reducing gas (such as "blue" water gas), and air is admitted at a point above the gas inlet; the temperature of the charge is thus maintained by the combustion of the gas in the upper part of the furnace. The furnace employed is mounted on trunnions and is of such construction as to form a converter in the vertical, and a reverberatory in the horizontal, position; and it is claimed that castings free from blow-holes are produced by this process.—W. E. F. P.

Iron ; Electrolytic method of refining ——. A. S. Ramage, Buffalo, N.Y. U.S. Pat. 1,007,388, Oct. 31, 1911.

Iron is refined electrolytically by a cyclical process, which consists in electrolysing a solution of a ferrous salt in a cell provided with a diaphragm, and with insoluble anodes, such as lead. The anode liquid is treated with sulphur dioxide, but not sufficiently to effect complete reduction, and the ferric salt is reduced by reaction with impure iron. The iron dissolves in the acid ferric liquor, whilst the solution of metals the sulphides of which are insoluble in dilute mineral acids, is avoided. The liquid is filtered and the resulting ferrous solution is combined with the effluent cathode liquor, and the mixed liquors are returned to the electrolytic cell. A cathode deposit of iron of high purity is obtained.—B. N.

Sodium and potassium ; Manufacture of ——. J. W. Swan, Warlingham, Surrey, and J. A. Kendall, London. Eng. Pat. 25,100, Oct. 28, 1910.

The hydroxide or carbonate of the alkali metal is decomposed by a column of incandescent carbon contained in a vertical, nickel retort which is enclosed in a gas- or oil-fired furnace maintained at the required temperature. The molten alkali compound is fed into the lower part of the retort by means of a vertical side-tube with which the latter is provided ; and the vapour of the alkali metal issuing from the upper part of the retort is condensed in any known manner.—W. E. F. P.

Gold ; Process of recovering fine ——. J. H. Alling, Columbia, Cal., Assignor to Security and Holding Co., San Francisco, Cal. Reissue No. 13,307, Nov. 7, 1911, of U.S. Pat. 947,957, Feb. 1, 1910.

Ore containing gold in a finely-divided state is mixed with an aqueous solution of a chlorine compound, and then immediately caused to flow over a series of mercury cathodes in succession. Currents of electricity are passed through the mixture to the mercury cathodes, the intensity of the currents and amount of chlorine compound in the solution being so regulated that sufficient nascent chlorine is produced to reduce the gold to a condition in which it is readily amalgamated.—A. S.

Gold and silver ; Extraction of —— *from antimony, arsenic, and other ores.* J. Gitsham. Fr. Pat. 430,852, June 10, 1911.

The precious metals are extracted by means of a solution of hydrocyanic acid. The powdered ore, or tailings, is usually acid and is washed with water, or if necessary with dilute alkali. The ore is then treated with dilute cyanide, 0·1 to 3 per cent., the acid remaining in the ore serving to liberate hydrocyanic acid from the solution. If necessary, sulphuric acid is added for this purpose. The solution containing the precious metals is drawn off and made alkaline, and evaporated to suitable strength for the precipitation of the precious metals by zinc. The solution is used again for treating a further quantity of ore.
—A. T. L.

Oxidation and tarnish from silver and silverware, gold and goldware and other metals ; [Electrolytic] Removal of ——. J. M. Neil, Toronto, Canada. Eng. Pat. 5684, March 7, 1911.

The articles are immersed in an alkaline solution, such as sodium carbonate, hydroxide, etc., containing also a metal, such as platinum, magnesium, nickel or aluminium, capable of setting up a voltaic or electrochemical action when the article to be cleaned is brought into contact with such metal during immersion. (Reference is directed to Eng. Pats. 7027 of 1905, 22,625 of 1907, 15,962 of 1908, and 3643 of 1910 ; this J., 1909, 369.)—B. N.

Cupola furnaces. P. Anderson, Arvika, Sweden. Eng. Pat. 18,414, Aug. 15, 1911.

The shaft wall of the furnace is provided, on the inside, with projections through each of which one of the tuyères extends, the open end of each tuyère being covered by a curved wall provided with holes or slots to effect a uniform distribution of the blast. It is claimed that, by this arrangement, such furnaces may be economically operated with a low-pressure blast without any considerable contraction of the shaft at the tuyères.—W. E. F. P.

Furnace ; Reduction ——. E. H. Rothert, Leavenworth, Wash. U.S. Pat. 1,007,606, Oct. 31, 1911.

The furnace comprises two chambers, disposed horizontally, connected at their inner ends, and having vertical passages at the outer ends and passages controlled by dampers connecting the vertical passages with the stack. Recesses are provided in the end walls of the furnace, in communication with the vertical passages. A heater and a deflector, the latter substantially L-shaped, are adapted to be fitted, so as to be removable, in either of the recesses, so that if the heater is placed at one end the deflector is fitted to the opposite end of the furnace. The heater and deflector are thus alternately interchangeable, in order that the direction of the flame through the reduction chambers may be reversed. This admits of alternate thorough reduction of the ore in one chamber, and partial roasting in the other.—B. N.

Manganese and calcium fluoride ; Process for manufacturing metallic ——. W. S. Rockey and H. Eldridge, New York. U.S. Pat. 1,007,734, Nov. 7, 1911.

A mixture of manganese fluoride, calcium fluoride, and metallic calcium is heated, and after the resulting metallic manganese and calcium fluoride have separated from each other, the manganese is allowed to cool while beneath the layer of fluoride.—A. S.

Reduction and smelting of ore ; Process for the ——, *and arrangement therefor.* F. Tharaldsen, Trondhjem, Norway. U.S. Pat. 1,007,990, Nov. 7, 1911.

A charge consisting essentially of ore is fed in at the top of the furnace, and a charge consisting of a mixture of ore and reducing agent is supplied at different levels below the top and down to near the melting zone. This second charge forms a layer of approximately circular shape completely surrounding the first charge during its passage through the shaft of the furnace ; the thickness of the layer increases towards the melting zone in order better to protect the walls of the furnace at that part.—A. S.

Metals containing copper ; Process of briquetting ——. M. Glass, Vienna. U.S. Pat. 1,008,254, Nov. 7, 1911.

Cupriferous metal shavings or the like are treated with ammonia in the presence of copper oxide, then compressed, and slowly heated. If a mixture of a solution of an ammonium salt (ammonium carbonate) with quicklime be used as the source of ammonia, sufficient heat is generated by the slaking of the lime.—A. S.

"*Amphidisation*" ; *Process and apparatus for* ——. [*Copper ores ; Treatment of* ——.] Bradley Copper Process Co., Fr. Pat. 430,692, June 8, 1911.

The patent relates to the treatment of ores for the purpose of separating the metal in the form of a soluble salt. An "amphigen" is defined as an element, *e.g.*, oxygen, which combines with the metal to form either an acid or a base ; an "amphide" is a salt, *e.g.*, copper sulphate, of which the basic and acidic portions each contain an "amphigen" ; and "amphidisation" is the process of producing the "amphide." The process is intended specially for the treatment of low-grade copper ores for the conversion of the copper into the form of a soluble salt, such as copper sulphate. The ore is heated gradually in a current of air so as to oxidise the sulphur and form copper sulphate, and a special apparatus is employed whereby the oxidised ore in cooling gives up its heat to the fresh ore. The apparatus comprises a horizontal rotating drum with a central heating flue and a burner at one end of the flue. The ore is fed into the annular part of the drum by a screw-feed at the other end. The annular space is divided into a series of compartments by vertical partitions with inclined cross-tubes leading from one compartment to the next but one, and the arrangement is such that as the drum rotates, the ore passes towards the hot end of the drum through the first, third, fifth, etc., compartments in succession, and then passes in the reverse direction through the alternate series of compartments to a delivery orifice at the charging end. The air required for oxidation takes the same course.—A. T. L.

Metals ; Separation of non-volatile —— from the gangue, in the treatment of complex ores containing volatile and non-volatile metals. J. Babé. Fr. Pat. 430,591, Aug. 12, 1910.

The metals are precipitated from the fused ore after the volatile metals have been driven off. A mixture of copper, silver and gold is precipitated by the addition of 8—10 per cent. of pyrites. A mixture of gold and silver is precipitated by adding mispickel. Nickel and cobalt are precipitated by means of sodium nitrate and boracite.—A. T. L.

Lead ; Electrolytic separation of ——. J. Matuschek. Ger. Pat. 239,222, June 1, 1910.

The claim is for the use, as electrolyte, of a solution of crystallised basic double salts of nitric and nitrous acids, especially $Pb(NO_3)OH,Pb(NO_2)OH$, with excess of oak bark tannin, a suitable salt, preferably lead nitrate, being added to increase the conductivity of the solution. The ore contained, together with carbon rods, in bags of linen or jute, is used as anode, or large pieces of galena or plates prepared from powdered galena may be used. —A. S.

Lead and zinc ; Treatment of ores containing both ——. J. de Coppet. Fr. Pat. 430,821, Aug. 23, 1910.

Oxide or sulphide ores are treated with a slight excess of dilute sulphuric acid, so as to obtain a residue rich in lead, and a solution containing zinc sulphate. This solution is treated with zinc blende, preferably containing cadmium, in order to precipitate the cadmium and traces of lead, and after standing, the clear solution is filtered off and treated with a current of compressed air. Potassium bichromate may be added, if desired. This process removes hydrogen sulphide from the solution and converts ferrous to ferric salts. Finally, the iron is precipitated by adding powdered calcined calamine. The zinc sulphate solution may now be treated with barium sulphide in order to precipitate a mixture of barium sulphate and zinc sulphide (lithopone).—A. T. L.

Zinc furnace with independent regulated regenerators. A. Folliet-Mieusset. Fr. Pat. 430,942, Jan. 21, 1911.

A crucible furnace comprises two rows of furnace-chambers, set back to back, and constructed so that one or more pairs can be shut down for repairs. A regenerator chamber is arranged beneath each furnace-chamber, one row of regenerators serving for heating the air, whilst the other row is being heated by the products of combustion. The regenerators in each row communicate with one another at the top and bottom alternately. A pair of vertical chambers at one end of the furnace serves as regenerators for heating the gas. The air and gas are distributed to orifices in the roofs of the furnace chambers by the special arrangement described in Fr. Pat. 428,524.—A. T. L.

Alloys. J. F. Duke. Fr. Pat. 430,966, May 10, 1911. Under Int. Conv., Dec. 19, 1910.

Alloys containing copper, nickel, iron, and aluminium have hitherto been unworkable owing to their hardness if the iron exceeded 20 per cent. It is found, however, that an increase in the quantity of iron beyond 25 and up to 50 per cent. gives a softer alloy if the quantity of nickel is also increased. An alloy containing 12 parts of iron, 6 of copper, 4 of nickel and 1 of aluminium all by volume, is white with silvery lustre, is malleable and ductile, and resistant to oxidation and to the action of vegetable acids. The addition of 1—2 per cent. of tin gives a hard alloy.—A. T. L.

Roasting apparatus for ores. Grünewald und Welsch Ges. m.b.H. Ger. Pat. 238,293, Dec. 13, 1910. Addition to Ger. Pat. 232,044, Dec. 21, 1909.

Instead of the special valve casing with annular damper described in the chief patent (this J., 1911, 494), two plates are laid across the top of the collecting chamber into the different compartments of which the gases from the roasting furnace are passed. One of these plates is fixed and the other is movable, and both are provided with slots of suitable shape. By moving one plate relatively to the other, any one of the compartments of the collecting chamber can be placed in communication with either of two pipes for leading away the gases : the gases rich in sulphur dioxide produced in the earlier stages of the roasting can thus be collected apart from the gases poor in sulphur dioxide evolved later.—A. S.

Metals and alloys ; Process of case hardening ——. M. Gräf and O. Peschel, Tegel, Germany. Eng. Pat. 22,581, Sept. 29, 1910.

See Fr. Pat. 421,000 of 1910 ; this J., 1911, 431.—T. F. B.

Steel alloy. W. Beardmore, Glasgow. U.S. Pat. 1,007,055, Oct. 31, 1911.

See Eng. Pat. 14,955 of 1910 ; this J., 1911, 961.—T. F. B.

Iron or steel ; Treatment of —— to prevent the oxidation or rusting thereof. T. W. Coslett, Birmingham. U.S. Pat. 1,007,069, Oct. 31, 1911.

See Eng. Pat. 28,131 of 1909 ; this J., 1911, 92.—T. F. B.

Oxide of zinc for smelting ; Manufacture of ——. R. W. E. MacIvor and W. Hommel, Assignors to The Metals Extraction Corporation, Ltd., London. U.S. Pat. 1,007,124, Oct. 31, 1911.

See Eng. Pat. 19,386 of 1909 ; this J., 1910, 1063.—T. F. B.

Aluminium bronze. P. H. G. Durville, Paris. U.S. Pat. 1,007,548, Oct. 31, 1911.

See Fr. Pat. 411,193 of 1909 ; this J., 1910, 959.—T. F. B.

Sulphide ores or products ; Treatment of ——. E. A. Ashcroft. Fr. Pat. 430,721, March 15, 1911.

See Eng. Pats. 6670, 7329, 7444, and 7536 of 1910 ; this J., 1911, 493, 552, and 553.—T. F. B.

Metals ; Apparatus for melting and mixing —— in a vacuum. W. S. Simpson. Fr. Pat. 430,963, May 8, 1911. Under Int. Conv., May 12, 1910.

See Eng. Pat. 11,832 of 1910 ; this J., 1911, 1020.—T. F. B.

Ores ; Concentration of ——. Minerals Separation, Ltd. Fr. Pat. 430,976, May 18, 1911.

See Eng. Pats. 21,857 and 22,973 of 1910 ; this J., 1911, 1263.—T. F. B.

Molybdenum : Process for making ductile —— and articles obtained therefrom. A. C. Hyde. Fr. Pat. 431,244, June 17, 1911.

See Eng. Pat. 4159 of 1911 ; this J., 1911, 810.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Nitrogen ; Oxidation of —— by the silent electric discharge in the presence of ozone. V. Ehrlich and F. Russ. Monats. Chem., 1911, **32**, 917—996.

By the action of the silent electric discharge on mixtures of oxygen and nitrogen in a closed vessel, the authors have been able to obtain products very rich in nitric oxide as shown in the following table :—

Percentage of oxygen by volume in original mixture.	Maximum percentage of nitric oxide by volume, in the final product.
5	[0·2]
20·8	4·1
50	13·2
75	18·0
91·5	[21]

These yields, much higher than those obtained by Haber and his colleagues (this J., 1908, 27, 1070 ; and 1910, 1257—1258), are not to be attributed to a favourable position of the nitric oxide equilibrium in the reaction : $N_2+O_2\rightleftharpoons 2NO$, but to the combination of electrical and chemical processes in the discharge. In the presence of excess of ozone the nitric oxide is oxidised to nitrogen pentoxide, and thus does not become decomposed again according to the reversible equation. Nitric oxide continues to be formed so long as excess of ozone is present, but when all the ozone is consumed, further discharge results in the decomposition of the nitrogen pentoxide. The nitrogen peroxide thus formed decomposes almost completely till a stationary state is reached, caused on the one hand by the electrical nitric oxide equilibrium corresponding to the experimental conditions, and on the other hand by the velocity of formation of ozone. This explains why small quantities of nitrogen peroxide hinder the formation of ozone by the silent discharge. As the percentage of oxygen in the initial mixture is increased, the available quantity of ozone and consequently the maximum yield of nitric oxide also increase, up to a point where the whole of the nitrogen is oxidised. In mixtures still richer in oxygen a stationary state is reached where nitrogen pentoxide and ozone are both present. Under given electrical conditions the velocity of formation of the nitric oxide is almost constant, and independent of the composition of the mixture. The velocity of formation of the ozone increases as the percentage of oxygen is raised. The mixtures which are poor in nitrogen exhibit, however, a retardation owing to the decreased conductivity of the gas. Variation in the electrical conditions for a given mixture affects the formation of both ozone and nitric oxide in the same sense, so that the general course of reaction is the same.—W. H. P.

Porcelain insulators ; Effect of temperature on dielectric strength of ——. C. E. Henderson and G. O. Weimer. Trans. Amer. Ceram. Soc., 1911, **13**, 469—478.

A PORCELAIN insulator of the composition : Tennessee ball clay, No. 7, 27 per cent. ; Tenn. ball clay, No. 3, 6 per cent. ; Georgia kaolin, 16 ; American eureka flint, 16 ; American eureka felspar, 35 per cent., was found to become a conductor at or about 400° F.—H. H. S.

Porcelains ; Note on vitrification range and dielectric behaviour of some ——. J. Minneman. Trans. Amer. Ceram. Soc., 1911, **13**, 704—705. (See Bleininger and Stull, this J., 1910, 1309.)

FATIGUE must be taken into account in the testing of insulators at a given voltage. If a piece be subjected to a given voltage for 5 minutes it is possible that puncture may occur at the last moment. For this reason a high factor of safety must be used.—H. H. S.

Electrolysis of sodium chloride with the mercury cathode. Peters. *See* VII.

Determination of perchloric acid in certain perchlorates. Golblum. *See* VII.

Electrolytic production of persulphates. Blumer. *See* VII.

Technical applications of zirconia. Böhm. *See* VII.

Electrolytic reduction of ketones. Tafel. *See* XX.

PATENTS.

Electrolytic apparatus. G. O. Seward and F. von Kügelgen, Holcombs Rock, Va., Assignors to Virginia Laboratory Co., New York. U.S. Pat. 1,007,897. Nov. 7, 1911.

THE cathode chamber is bounded by a chilled salt-incrusted partition at and below the surface of the electrolyte. The cathode extends upwards within this chamber and its active surface is confined within the vertical projections of the boundaries of the cathode chamber, so that fused metal rising from the cathode collects within the chamber. A discharge conduit extending vertically downwards from the cathode chamber has a lip at the top ; so that the fused metal overflowing from the chamber into the conduit, will fall freely without coming into contact with the wall of the conduit.—A. S.

Diaphragm ; Porous —— *designed for electrolysis, and process of manufacture.* O. Dieffenbach. Fr. Pat. 430,613. June 6, 1911.

THE diaphragm is constructed of cement and asbestos, the fibres of the latter being disposed parallel to the plane of the plate. The manufacture is carried out in one of the forms of apparatus employed for the manufacture of pasteboard or wall coverings, but with the difference that the material is not submitted, before hardening, to compression, or only to a slight compression.—B. N.

Furnace ; Electric radiation ——. Gebr. Siemens und Co. Fr. Pat. 431,243, June 17, 1911. Under Int. Conv., Aug. 29, 1910 and March 17, 1911.

THE furnace is provided with a heating rod surrounded by a non-metallic tube, the latter having an internal diameter sensibly greater than the diameter of the rod so as to allow for expansion, and mounted in such a manner that the two extremities of the rod may expand freely within the tube. The heating rod, *a'*, (see Fig. 1) of carbon,

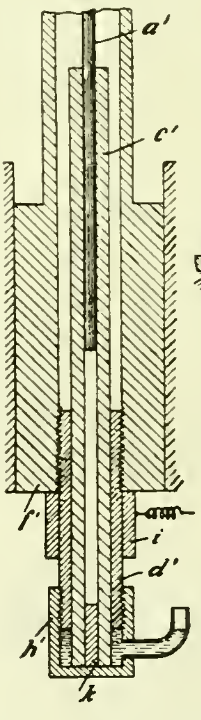


FIG. 1.

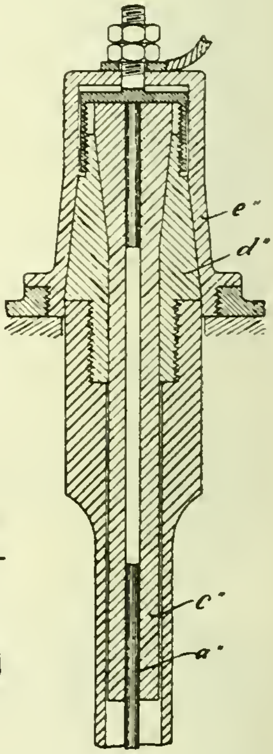


FIG. 2.

within the tube, c', is surrounded by a metal tube, d, which at its upper end fits into the tube, f', and at its lower end is provided with a cap, h', containing a liquid, and a stopper, k, in order to keep the internal portions air-tight. The current is brought to the metal tube, d, by the collar, i. An alternative form, designed to facilitate the removal of the rod, is described, in which the heating rod, a'', fits into the tube, c'', provided with a conical end fitting into the conical lining of a metal mounting tube, d''. The exterior of the latter is conical in form, and is surrounded by a cap, e'', on which is mounted the terminal for conveying the current.—B. N.

Furnaces; Electric ——. W. E. Lake, London. From J. E. Florence, New York. Eng. Pat. 8998, April 11, 1911.

See Fr. Pat. 428,370 of 1911; this J., 1911, 1169.—T. F. B.

Electric flaming arcs for carrying out gas reactions; Method of producing disc-like ——. Elektrochem. Werke G. m. b. H., Berlin, and F. Rothe, Dessau, Germany. Eng. Pat. 13,335, June 2, 1911. Under Int. Conv., July 8, 1910.

See Fr. Pat. 429,910 of 1911; this J., 1911, 1321.—T.F.B.

Electro-osmotic treatment of finely-divided substances; Process for the ——. B. Schwerin. Fr. Pat. 430,768, May 31, 1911.

See Eng. Pat. 11,626 of 1911; this J., 1911, 1168.—T.F.B.

Electrolytic production of ammonium nitrate from hydrated nitric acid. Eng. Pat. 16,426. *See* VII.

Process of forming nitrogen oxides. U.S. Pat. 1,007,683. *See* VII.

XII.—FATS; OILS; WAXES.

Hydnocarpus fat. K. Lendrich, E. Koch, and L. Schwarz. Z. Unters. Nahr. Genussm., 1911, 22, 441—458.

The fat used in the preparation of a certain class of margarine which has recently caused cases of poisoning (this J., 1911, 104, 139) yielded results on analysis which corresponded with those given by the fats from species of *Hydnocarpus*; the fat is known by the name of "cardamom" fat, or maratti fat, and differs from other vegetable fats in that it contains fatty acids of the composition, $C_nH_{2n-4}O_2$. Acids of this formula, named chaulmoogric acid and hydnocarpic acid, have been previously isolated and identified (see this J., 1905, 741). The fat does not contain fatty acids of the formulæ, $C_nH_{2n}O_2$ and $C_nH_{2n-2}O_2$; the absence of palmitic acid is noteworthy, as Power and Barrowcliff found this acid to be present in *Taraktogenos* (*Hydnocarpus*) *Kurzii* and *H. anthelmintica* fats, but not in *H. Wightiana* fat (this J., 1905, 741). The external appearance of the seeds of *H. Wightiana* and *H. venenata* (*inebrians*) closely resembles that of Ceylon cardamoms (see this J., 1911, 293). When administered to dogs, *Hydnocarpus* (cardamom) fat produces irritation of the mucous membrane of the stomach and causes vomiting; in many cases the symptoms are of a grave nature and are accompanied by convulsions. The authors have also examined the fats separated in the laboratory from the seeds of *H. anthelmintica* and *H. alpina*; both fats acted as emetics when administered to dogs. *H. alpina* fat consists of a yellowish, butter-like substance having the following physical and chemical characters: butyro-refractometer at 40° C., 67·5; acid value, 5·6; saponification value, 209·06; iodine value, 84·5; $[\alpha]_D^{21} = +49·0$. It closely resembles the fats obtained from the other members of the *Hydnocarpus* species. The authors do not agree with the statement made by Thoms and Müller (Z. Unters. Nahr. Genussm., 1911, 22, 226) that "cardamom" fat is obtained from the seeds of *Taraktogenos* (*Hydnocarpus*) *Kurzii*; (See also this J., 1911, 918.)—W. P. S.

Fats; Synthesis of —— *by the action of enzymes.* F. L. Dunlap and L. O. Gilbert. J. Amer. Chem. Soc., 1911, 33, 1787—1791.

Glycerin, oleic acid, flaxseed and powdered castor beans freed from oil were triturated till an emulsion was formed, which was then divided among several flasks. The acid was determined in one of the flasks, the other flasks being reserved for the determination of the acid on succeeding days. The blank experiment was made in the same way, the amount of castor bean being replaced by flaxseed. The emulsion was "broken" by means of ether and titrated with standard alcoholic potash. In the experiments where the castor bean was used, there was a marked and steady decrease of the amount of oleic acid, showing that the enzyme of the bean has synthetic power.—F. Shdn.

Effect of added fatty and other oils on the carbonisation of mineral lubricating oils. Waters. *See* IIa.

Oil and chemical Industry in Marseilles. Oil, Paint, and Drug Rep., Nov. 13, 1911. [T.R.]

The value of the output of the Marseilles vegetable-oil mills (including oil-cake) for 1905 was $34,740,000, as compared with $67,550,000 in 1910; the output of the soap factories for 1905 was $10,610,000, as compared with $14,475,000 in 1910; the chemical industries had an output in 1905 of $6,560,000, as compared with $9,264,000 in 1910; compound lard and margarine factories, $5,790,000 in 1905, while in 1910 the output was valued at $6,755,000; the output of the sulphur refineries for 1905 was $1,544,000, compared with $1,930,000 in 1910.

Soap industry of the United States. Oil, Paint, and Drug Rep., Nov. 13, 1911. [T.R.]

The general summary of the thirteenth census of establishments engaged in the manufacture of soap shows increases in all the items at the census of 1909, as compared with that for 1904, except in number of establishments, which decreased from 436 to 420 or 4 per cent. The capital invested increased 31 per cent.; the gross value of products 63 per cent.; cost of materials, 65 per cent.; value added by manufacture, 59 per cent.; average number of wage earners employed during the year, 18 per cent.; amount paid for wages, 31 per cent.; number of salaried officials and clerks, 66 per cent.; amount paid in salaries, 57 per cent.; miscellaneous expenses, 40 per cent.; primary horsepower, 40 per cent. The capital invested as reported in 1909 was $71,951,000, against $54,816,000 in 1904. The value of products was $111,358,000 in 1909, and $68,275,000 in 1904. The average per establishment was approximately $265,000 in 1909 and $157,000 in 1904. The cost of materials used was $72,179,000 in 1909, as against $43,626,000 in 1904.

Belgian soap duties. Oil, Paint, and Drug Rep., Nov. 13, 1911. [T.R.]

After June 1, 1912, the Belgian soap duties will be collected under a new schedule. The existing duty of 12 per cent. ad valorem on perfumed or toilet soaps will be superseded by specific duties as follows:—Common soaps, per 100 kilos, 7 fr.; soap creams, hard soaps for shaving, liquid soaps and soaps in powder, imported in small receptacles, the combined weight of the receptacle and contents not exceeding 250 grms., 60 fr.; soap creams and liquid soaps, imported in receptacles which, with their contents, weigh more than 250 grms., 30 fr.; medicinal soaps (including medicinal soaps in balls, bars or cakes, and medicinal soaps in powder), 40 fr.; soaps in balls, bars or cakes, imported in boxes containing not more than three pieces; wrapped soaps; soap in leaves, 40 fr. Articles not specially mentioned, 18 fr.

Soap ; Duty on —— under new Dutch tariff. Oil, Paint, and Drug Rep., Nov. 13, 1911. [T.R.]

The proposed Dutch tariff contains new duties on imported soap, and these duties are so heavy, especially on cheap soaps, which are very largely imported into Holland, as to be practically prohibitive. The Dutch soapmakers are in the main opposed to the new tariff, as although the enhanced duties will tend to keep out foreign soaps they will also increase the cost of all the raw materials of the industry, such as fats, perfumes, etc. Moreover, the Dutch soapmakers fear the establishment of soapworks in Holland by foreign manufacturers whose business is threatened. The tariff will be discussed at the autumn session of the Second Chamber.

Patents.

Oil extracting machinery. E. Evans, Liscard, Cheshire. Eng. Pat. 24,111, Oct. 18, 1910.

The oleaginous material is carried upon a travelling roller bed between a movable endless pressing device and stationary tables, the pressing device and travelling bed being borne upon drums the axes of which coincide. In this way the material is subjected to a gradually increasing pressure, which reaches a maximum for a given distance prior to the discharge of the oil-cake, etc. —C. A. M.

Cottonseed oil ; Process of refining crude ——. J. C. Chisholm, Dallas, Texas. U.S. Pat. 1,007,642, Oct. 31, 1911.

The oil is heated to a temperature of about 80° F. and neutralised by the addition of an alkali silicate, the temperature being then maintained at from 75° to 90° F., until the soap separates from the oil. An aqueous solution of an alkali hydroxide is now added until the mixture exhibits the required colour, a further quantity of alkali hydroxide being next added and the mixture heated to from 100° to 120° F. until the soap stock settles completely from the oil. The latter is then drawn off. —W. P. S.

Fats and oils ; Process of decolourising ——. Badische Anilin und Soda Fabrik. Fr. Pat. 431,294, June 19, 1911. Under Int. Conv., Mar. 27, 1911.

Animal or vegetable fats and oils are treated with solutions of hydrosulphites or compounds of hydrosulphites with aldehydes and ketones, or the corresponding sulphoxylates, in the presence of alkaline agents.—C. A. M.

Olives, oleaginous seeds, and their residues ; Process and apparatus for treating ——. J. A. Bernardini. Fr. Pat. 431,351, Sept. 8, 1910.

The oleaginous material and especially the residue from the first pressing of olives, is mechanically agitated and subjected to the action of a constant current of hot water, the oily pulp which rises to the surface being carried over into decantation tanks and expressed, whilst the residue is extracted with solvents. A special form of apparatus for this purpose is claimed.—C. A. M.

Candles composed of a mixture of stearine and paraffin wax ; Process for rendering —— opaque. G. Moretti. Fr. Pat. 431,490, June 22, 1911.

Candles containing even over 98 per cent. of paraffin wax may be rendered opaque by the addition of from 1 to 6 per cent. of "denatured" ethyl or methyl alcohol (90 to 95 per cent.), prior to solidification of the mixture of stearine and paraffin wax. The proportion of alcohol is varied according to the degree of opacity desired.—C.A.M.

Glycerin ; Process of, and apparatus for, the production of polymerised ——. Nobel's Explosives Co., Ltd., Glasgow, W. Rintoul and A. G. Innes, Stevenston, Ayrshire. Eng. Pat. 24,608, Oct. 24, 1910.

Glycerin is polymerised by being heated at the ordinary pressure, or thereabouts, to a temperature above 200° C. but well below 275° C. (*e.g.* 245° to 250° C.), with or without the addition of substances to accelerate the polymerisation. Thus a current of vapour or gas (*e.g.* carbon dioxide), preferably devoid of oxidising tendency, may be blown through the hot glycerin to remove the liberated water as soon as it is formed, and this process is also advantageous in polymerisation at the usual (boiling) temperature. In an apparatus claimed for this process, even distribution of the gas and effective stirring of the liquid are produced by introducing the gas through a pipe or pipes terminating in perforated rings of different diameter.—C. A. M.

Soap ; Process for making crude-oil ——. O. Cassel, Vienna. U.S. Pat. 1,007,531, Oct. 31, 1911.

See Eng. Pat. 14,844 of 1910 ; this J., 1911, 435.—T.F.B.

Soaps and cleansing compounds containing organic chloro-compounds ; Manufacture of ——. G. Koller. Fr. Pat. 431,409, June 21, 1911. Under Int. Conv., June 25, 1910.

See Eng. Pat. 15,288 of 1910 ; this J., 1911, 967.—T. F. B.

Solidified [essential] oil. U.S. Pat. 1,006,736. *See* XX.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Boron ultramarines ; Various coloured ——. J. Hoffmann. Chem. Ind., 1911. 34, 699—705.

Boron ultramarines, in which boric anhydride takes the place of the silica and alumina of ordinary ultramarine, are found to resemble the latter very closely in properties and reactions. Thus, sulphidic alkali biborates, $R_2B_4O_7$, which are yellow or brown, are converted by the withdrawal of sodium, into green boron ultramarines (considered to be a mixture of yellow biborates and blue triborates) and then further into blue ultramarine, the boric acid content of which may vary considerably ($R_2B_6O_{10}$ to $R_2B_{10}O_{16}$) without marked effect on the colour. Potassium and lithium boron ultramarines have been prepared, in addition to the sodium product, and the sulphur has been replaced by selenium and tellurium, to give substances which owe their colour to free selenium and tellurium respectively. In summing up, it is pointed out that analogous coloured products are obtained with aluminium silicate, boric anhydride, phosphoric anhydride, and sulphuric acid, and the results of the investigation, in conjunction with those previously published (this J., 1910, 1066) are taken to indicate that the colour of ultramarines is due to the presence of colloidal sulphur, rather than to the formation of a definite compound.—F. Sodn.

Turpentine oil. P. van der Wielen. Pharm. Weekblad, 1911, No. 35. Perfumery and Essent. Oil Rec., 1911, **2**, 256—257.

Several tests are suggested as being useful in detecting adulteration of oil of turpentine. The sulphuric acid test is modified as follows. 20 c.c. of the oil are shaken with 80 c.c. of sulphuric acid of sp. gr. 1·698 for 5 minutes and allowed to stand for an hour with occasional shaking. 300 c.c. of water are then added and the mixture distilled, the distillate being collected in a 100 c.c. flask with a graduated neck till the flask is filled. The oil which distils is measured, and dried with calcium chloride. The refractive indices of the distillate and of the original oil are then determined at 17·5° C. A mixture of equal volumes of the distillate and of aniline is made and the temperature at which the mixture becomes turbid is ascertained. A number of samples of oil of turpentine were examined in this way as well as common adulterants, and the results are tabulated.—F. Shdn.

Resin of the Norway spruce fir (Picea excelsa, L. K.); Chemical investigation of the ——. J. Köhler. Arkiv för Kemi, Min. och Geol., 4, [5]. Chem. Zentr., 1911, 2, 1598—1600.

l-PIMARIC acid has hitherto only been found in pine resin (galipot) and only on one occasion even in that substance. The author has found, however, that it occurs generally in the resin of the Norway spruce fir, usually together with slightly lævo-rotatory, readily soluble and oxidisable acids, probably sapinic acids. It is found nearly pure in the form of well developed crystals, in the "winter resin" (compare this J., 1906, 644) on the upper half of the trunks of the trees. From an examination of the pure acid, the author confirms the formula, $C_{20}H_{30}O_2$, but states that the rotatory power is higher than that given hitherto. On melting, *l*-pimaric acid is partially transformed into colophonic acids, the degree of transformation being greater, the more rapid the heating: both an inactive and a lævo-rotatory colophonic acid are produced, the latter being identical with the α-colophonic acid from sapinic acid (*loc. cit.*). The colophonic acids are themselves not stable, being changed, on heating, into other colophonic acids of different rotatory power and solubility. A general property of the colophonic acids, distinguishing them from the natural resin acids (pimaric and sapinic acids), is their capacity of gelatinising on treatment with ammonia. The production of colophonic acids (abietic acid) from *l*-pimaric acid as well as from the widely different sapinic acids, shows that they form a common transformation product of natural resin acids, and this throws light on the conflicting statements as to the occurrence of abietic acid in natural resins; the results obtained in a particular case would depend upon whether the material examined were a natural resin or the colophony prepared therefrom, and upon the temperature attained in the preparation of the colophony, and would differ also in the case of resins from different trees or from different parts of the same tree. The following classification of resin acids is given:—(A). Natural resin acids: I. Pimaric acids, which are not oxidised on exposure to the air and are relatively stable on heating. II. Sapinic acids, which are easily oxidised by air and are very sensitive to heat. (B). Colophonic acids, formed from both pimaric and sapinic acids on heating: I. Lævo-rotatory α-colophonic acids. II. Dextro-rotatory β-colophonic acids. Both of these latter are easily oxidised by air, and when heated are transformed into other acids of the same group. III. Optically-inactive colophonic acids. The colophonic acids are distinguished from the natural resin acids by their behaviour with ammonia (see above). —A. S.

Rosin; Studies on ——. C. G. Schwalbe and E. Küderling. Wochenbl. Papierfab., 1911, 42, 4197—4199, 4303—4307.

THE authors have analysed a large number of samples of rosin of American, French and Greek origin, determining melting point, acid value, unsaponifiable matter and matter insoluble in light petroleum. They have likewise tested samples of "weathered" rosin, *i.e.*, rosin modified by exposure to sunlight and air. As regards melting point, the limits of variation for normal rosin are from 65·6° to 76° C., which limits are not sufficiently wide to make the melting point a serious factor in the value of the rosin for paper-sizing. Badly "weathered" rosin shows higher melting points, *e.g.*, up to 77·5° C. Acid values ranged for American from 11·11 to 12·22, for French from 11·77 to 12·13, for Greek from 12·09 to 12·36, and for "weathered" samples from 11·63 to 12·15. The acid value of pure sylvic acid is 13·2, and the "unsaponifiable" is calculated from the difference between 100 and the saponification value calculated in terms of sylvic acid. Under these circumstances this item is of little importance, since it is doubtful how far it really represents unsaponifiable matter. The matter insoluble in petroleum spirit, of which badly "weathered" samples were found to contain up to 88 per cent., probably represents an oxidation product of the true rosin; it is friable and devoid of sizing properties, hence the proportion should be as low as possible. The samples tested showed for this residue: American 1·82—5·76, French 0·11—4·16 and Greek 1·27—6·74 per cent. For the determination of this constituent, 5—10 grms. of finely powdered rosin are digested with 300—400 c.c. of cold petroleum spirit for two days, the spirit being changed twice; the undissolved residue is filtered off and dried at 100° C. until the weight is constant, which takes about 10 hours. The matter insoluble in petroleum spirit has a higher but variable melting point (above 100° C.) and a lower acid value than the original rosin. It is formed very rapidly when powdered rosin is exposed to sunlight; it also separates in flakes when a solution of rosin in petroleum spirit is shaken with air. So far as could be ascertained, the presence of oil of turpentine has no influence in the production of this undesirable constituent. In the analysis of rosin size, it is better to dry the separated rosin at 100° C. rather than at 105° C.; constant weight is more rapidly attained at the lower temperature, but even then the rosin is sensibly modified after drying, showing a lower acid value and a higher percentage of residue insoluble in petroleum than the original sample. —J. F. B.

Technical applications of zirconia. Böhm. *See* VII.

Oil of Douglas fir: a preliminary study of its composition and properties. Benson and Darrin. *See* XX.

PATENTS.

Zinc oxide and sulphide; Process for the production of pure white —— from impure raw material. E. Flügger. Fr. Pat. 430,965, May 8, 1911. Under Int. Conv., May 9 and July 15, 1910.

A SOLUTION of alkali zincate obtained by any suitable method from the raw material is treated with zinc dust (say 0·1 to 0·2 per cent.) in sufficient quantity to precipitate but not to displace foreign metals, the solution filtered from the precipitate, and the zinc precipitated from the filtrate as oxide by the addition of water (at about 80° C.) or as hydroxide (at a lower temperature) or as sulphide by means of hydrogen sulphide. Or the raw material may be boiled with a 50 per cent. (or stronger) solution or sodium or potassium hydroxide, until a clear solution of zincate containing foreign bodies, and especially lead, in suspension, is obtained. This is filtered and the zinc precipitated by the addition of water. Or, again, the zincate solution may be obtained by treating the material with such a quantity of alkaline lye that more than half of the alkali combines with the zinc, after which the liquid is filtered, and water added to precipitate zinc oxide.—C. A. M.

Minerals containing sulphides; Method and apparatus for treating —— to separate the sulphur and for the manufacture of sublimed lead sulphate and zinc oxide. E. E. Banes. Fr. Pat. 431,280, June 19, 1911. Under Int. Conv., June 30, 1910.

THE pulverised mineral containing *e.g.* lead sulphide is introduced in regulated quantities into a furnace containing an oxidising atmosphere, and passes on its way through the inner cone of a blast flame projecting inwards through the side of the furnace. The lead thus volatilised is completely converted into a basic sulphate ($Pb_3S_2O_9$), the vapours of which are conducted into a condensing chamber, together with the zinc oxide formed from any zinc present. In the type of apparatus claimed for this process, the blast flames are arranged on opposite sides of the furnace, with pipes above them for the introduction of hot and cold air.—C. A. M.

Bordeaux-red lakes; Manufacture of ——. Wülfing, Dahl und Co. Fr. Pat. 431,420, June 21, 1911.

LAKES insoluble in oil, fast to light, and possessing good covering power are prepared from the azo-dyestuff obtained by combining diazotised α-naphthylamine with 1-naphthol-4-sulphonic acid. A paste containing 2½ kilos. of the sodium salt of this dyestuff is mixed with water, 100 kilos.

of barium sulphite are added and then a solution of ½ kilo. of calcium chloride in about 10 litres of water and the whole is boiled for some minutes. Alternatively 1 kilo. of crystallised barium chloride may be used instead of the calcium chloride.—J. C. C.

Organic compound [solution of cellulose esters] and process of making the same. W. F. Doerflinger, Brooklyn, Assignor to The Perry-Austen Manuf. Co., Grassmere, N.Y. U.S. Pat. 1,003,438, Sept. 19, 1911.

When fatty acid esters of cellulose (such as cellulose acetate) are dissolved in diacetone-alcohol and acetone, solutions are obtained which are suitable for use as varnishes, lacquers, etc. The solutions may also contain nitrocellulose.—T. F. B.

Betuline; Process of treating ——. J. R. Köhler. Fr. Pat. 431,198, June 12, 1911. Under Int. Conv., July 12, 1910.

Betuline is heated alone or in a solvent at a temperature above its melting point until it loses its power of crystallisation and no longer separates out on cooling a hot concentrated solution. On solidification it then forms a hard vitreous mass, and is suitable for the manufacture of varnishes, etc. Discolouration is obviated by heating the betuline *in vacuo* or in an atmosphere of an inert gas. A variation of the process is to heat the betuline until it is partially transformed and to complete the process in a suitable solvent.—C. A. M.

Pine oil, turpentine oil, etc.; Process for purifying crude ——. J. Schindelmeiser. Ger. Pat. 239,546, Aug. 26, 1910.

Crude pine oil, turpentine oil, etc., is heated under pressure with aqueous or gaseous ammonia, and the pinene is separated by distillation from the impurities which have been converted into non-volatile compounds. It is stated that by working under pressure, not only the acids and phenols, but also the aldehydic and ketonic impurities are converted into non-volatile compounds. —T. F. B.

Zinc oxide and zinc sulphide [pigments]; Manufacture of ——. A. J. Boult, London. From E. Flügger, Hamburg, Germany. Eng. Pat. 11,103, May 8, 1911.

See Fr. Pat. 430,965 of 1911; preceding.—T. F. B.

Solutions [of cellulose esters] suitable for use as lacquers, varnishes, etc.; Process for preparing ——. W. F. Doerflinger. Fr. Pat. 429,754, May 16, 1911.

See U.S. Pat. 1,003,438 of 1911; preceding.—T. F. B.

Treatment of ores containing both lead and zinc. Fr. Pat. 430,821. *See* X.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Patents.

Caoutchouc; Manufacture of synthetic —— and the like. F. E. Matthews and E. H. Strange, London. Eng. Pat. 24,790, Oct. 25, 1910.

To bring about the polymerisation of divinyl, isoprene, or homologues or derivatives thereof, these hydrocarbons are brought into contact with an alkali metal, or an alkaline earth metal, or an alloy or mixture or amalgam of any of such metals, in the presence or absence of any other metal or alloy. Metallic sodium or potassium are especially suited to the purpose. For example, twenty parts by weight of isoprene are brought into contact with one part by weight of metallic sodium. A small quantity of the sodium goes into solution, and after some time the liquid thickens and on further standing, at the ordinary temperature, it becomes solid. The unpolymerised portions are removed, *e.g.*, by steam distillation or extraction with acetone. The solid substance has the properties of caoutchouc. When potassium is used it is advisable to have present also some other metal to moderate its action. Products obtained from some of the higher homologues and derivatives of isoprene are harder than, and do not possess all the characteristics of actual caoutchouc. —E. W. L.

Rubber; Apparatus for treating powdered vulcanised ——. Sir C. Lawes-Wittewronge, Rothamsted, Herts. Eng. Pat. 25,308, Oct. 31, 1910. Under Int. Conv., March 1, 1910. (See also this J., 1906, 895.)

The powdered vulcanised rubber is forced by means of a piston, actuated by means of a hydraulic ram, into a "vulcanising chamber," kept at the requisite temperature (*e.g.*, by means of an oil bath), in which it becomes plastic, but assumes no particular form, and thence into the matrix which gives it the required shape. The vulcanising chamber is provided with perforated partitions, through which the rubber passes, and which assist in mixing it thoroughly.—E. W. L.

India-rubber substitute and the like; Manufacture of ——. J. Turns, Newcastle-on-Tyne. Eng. Pat. 26,093, Nov. 9, 1910.

Vegetable or animal gelatin is treated with a mixture of a phenol and an alkali, the two latter being present in equimolecular proportions; in some cases a lac resin and other ingredients are also added. For example, 94 parts of carbolic acid crystals, 56 parts of potassium hydroxide, 70 parts of gelatin, 50 parts of glue, 10 parts of resin and 100 or more parts of water are digested at 80°—120° F. for about 48 hours, the mixture being stirred at intervals. A very thick creamy mass is thus obtained. The free acid in the mass is now neutralised with about two per cent. of the total weight of the mass of ammonia, and the mass is washed with cold water, coagulated by repeated applications of a solution of alum (8 : 1), and again washed until a ropy, cellular or spongy mass remains. This mass is kneaded until most of the moisture is expelled, and then is further dried at 200° F. for about an hour, after which it is masticated in the same manner as natural rubber, and sulphur and other ingredients added. The masticated product is stored in a cool, dark place, under pressure, for some days, to mature.—E. W. L.

Caoutchouc; Process for making —— from isoprene. A. Heinemann. Fr. Pat. 430,658, June 7, 1911. Under Int. Conv., June 10, 1910.

See Eng. Pats. 14,041 and 24,237 of 1910; this J., 1911, 909.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Tannin analysis solutions; Filtration of —— under reduced pressure. C. R. Oberfell. J. Amer. Leather Chem. Assoc., 1911, 6, 505—508.

The use of alundum dishes (see this J., 1911, 686) for filtering tannin solutions under pressure, is described. The alundum dish is fitted into a funnel by means of a rubber ring and the funnel fits into a vacuum flask. Comparative experiments using the alundum and the official method of filtration give results in close agreement and also show that alundum does not absorb tannin and is capable of rapid manipulation. The dish can be used over again after treatment with hot water or after ignition.—J. R. B.

Tanning; Influence of time in ——. J. B. Owen. Leather, 1911, **3**, 875—876.

The differences between leathers tanned by quick and by slow tannages and their causes are discussed. As the hides enter the weak acid tan liquors, the acids quickly penetrate the hide, remove the lime, and maintain the plumpness, whilst the small amount of tannin is taken up by the surface of the hide. As the strength of the liquors increases, the increasing quantities of acid keep the hides plump and the tan gradually penetrates until the fibres of the hide are evenly coloured or until the hide is "struck through." Up to this point nearly all the tannin which has been absorbed will have combined with the fibre, but after this point most of the tannin which is taken up does not combine with the fibre but remains in the free state and can be washed out by water. In the quick tannages the strength of the liquors is rapidly increased, so that the amount of tannin absorbed but not combined is very great, but in the slower processes, further changes take place in the nature of the tannin absorbed, some of it being transformed into insoluble forms, such as ellagitannic acid or bloom, which are deposited on the fibres and tend to produce weight, firmness, and waterproofness, and are the cause of the differences between quickly tanned and slowly tanned leathers.—J. R. B.

Tannery control; Weighing hides in water as a means of ——. J. G. Parker and J. R. Blockey. Leather, 1911, **3**, 872—873.

Hides in the limed state are usually weighed in air in the tannery. This weight includes not only the amount of hide substance or the amount of leather-forming substance, but also the moisture which has been taken up by the hides in the liming process. This weight therefore does not form a reliable basis on which to calculate the percentages of the finished weight, because it does not give a sufficiently exact indication of what the finished weight will be. By weighing the hides suspended in water, the weight obtained is the weight of the actual hide substance, less the weight of the water displaced by the hide. By multiplying this weight by a factor, the actual weight of the leather-forming substance can be determined. This water weight does not take into account the amount of the water in the pelt and thus is a better indication of the finished weight. A table is given showing the much better agreement of the percentages of the finished weight calculated on the water weight of the pelt than on the pelt air weight, *e.g.*, three hides which weighed in air, 50, 54 and 59 lb. respectively showed a finished weight of 31 lb. in each case, whereas the water weights were also very similar, being 4 lb., 3 lb. 15 oz., and 4 lb. 1 oz., showing that the water weight gives a better indication of the finished weight than the pelt air weight gives.—J. R. B.

Fur dyeing. Schlotthauer. *See* VI.

Patent.

Horn or like substance; Manufacture of ——. J. W. Cox, London. Eng. Pat. 29,075, Dec. 14, 1910.

Six parts of finely divided raw horn meal are thoroughly mixed with one part of blood, with the aid of heat. The superfluous water is removed from the mixture, *e.g.*, by passing it, when cool, between rollers under pressure. The cake thus obtained is broken up, and the mass heated at about 125° C. for 30 to 90 minutes in completely filled moulds, under a pressure of 2 to 5 tons per sq. in. The moulded mass is preferably allowed to cool under pressure, to avoid cracking. The product is black in colour. Milk may sometimes be incorporated, with advantage, and, when a highly waterproof product is desired, shellac, gum, bitumen, etc. Turpentine may also be sometimes added with advantage.—E. W. L.

XVI.—SOILS; FERTILISERS.

Soil surveys and soil analyses. A. D. Hall and E. J. Russell. J. Agric. Sci., 1911, 4, 182—223.

The principles which determine the methods of soil analysis, both chemical and mechanical, in making a soil survey so as to bring out the correlation of certain crops and modes of farming with soils of given composition are discussed at length, particularly with reference to the soils of the south-east of England which forms a well-defined geological unit. The chemical analysis of soil does not deal with the whole of the soil but aims at determining the amounts of various constituents extracted by acids under certain arbitrary conditions. Mechanical analysis deals with the whole of the soil, which is sorted out into fractions of varying sizes. From the results of the mechanical analysis the water relationships of the soil can be explained with some degree of completeness and some of the peculiarities observed in cultivation accounted for; it is possible further to attribute defects either to the soil or to the system of management adopted. Mechanical analysis must always be supplemented by a knowledge of the amount of organic matter and calcium carbonate present. There is a close correlation between potash, alumina and clay; ferric oxide is always less than 5 per cent. in amount and has no close connection with fertility. The ratio of lime to magnesia has no general significance. Nitrogen is closely correlated with organic matter, *i.e.*, the loss on ignition. The total phosphoric acid does not vary much, but the available phosphoric acid varies greatly with the management. Four chemical types of soil are recognisable: (1), chalk soils; (2), acid humus or peat soils; (3), neutral humus soils; (4), mineral soils, *i.e.*, sands, loams, and clays. Mechanical analysis gives useful indications with the last group only, but since agricultural soils belong so largely to this group the method is really applicable in by far the great majority of cases. There is some evidence of dissimilarity of the clays, which fall into two types. In general the alumina is about one-third of the clay in amount and the potash roughly one-tenth of the alumina; in abnormal clay, however, very different relationships obtain. It is desirable to accumulate further evidence on this point. The soil sent to an analyst is usually exceptional and must be compared by him with the typical sample both chemically and mechanically. This necessitates a complete knowledge of the typical soil of the formation; to effect this, information must be obtained during the survey that will show the effect of various manures on the typical soil. The analyst must study further the water supply and other factors which affect productiveness. Great stress is laid on the need of properly conducted soil surveys, as without them the analysis of a single sample of soil cannot be properly interpreted.—E. F. A.

Calcium carbonate; Formation of —— *in the soil by bacteria.* C. T. Gimingham. J. Agric. Sci., 1911, 4, 145—149.

Soil organisms are concerned in the oxidation to carbonate of the calcium salts of organic acids such as oxalic, which are formed in considerable quantities in plant tissues. A large number of bacteria, yeasts, and moulds, tested in pure culture all appeared unable to decompose the oxalate, but it was found possible to isolate from soil pure cultures of six types of bacteria possessing this property. The presence of oxygen is essential for the formation of carbonate, the crystals appearing first always at the edge of the culture solutions where the liquid touched the glass. The rate at which any one of the organisms acted varied considerably at different times.
—E. F. A.

Field trials; Experimental error of ——. W. B. Mercer and A. D. Hall. J. Agric. Sci., 1911, 4, 107—132.

As the result of very full experiments made at Rothamsted with mangolds and with wheat, the following general conclusions are drawn. In all field trials there will be an experimental error due to so many incalculable factors that it may be described as casual. The error diminishes with the size of the plot but the reduction is small when the plot exceeds one-fortieth of an acre. It is further diminished by increasing the number of plots similarly treated and scattering them about the area, but there is little gained by increasing the number above five. This reduces the experimental error to within 2 per cent. of the result; it does not eliminate variations due to season. To do this the trials must be continued for several years and repeated on several soils to eliminate the variations caused by the type of soil.—E. F. A.

Plants; Favourable effect on the vital activity of lower and higher —— of small quantities of toxic substances. E. B. Fred. Zentr. Bakt. u. Parasitenk., 1911, II. Abt., 31, 185—245. Chem. Zentr., 1911, **2**, 1651—1652.

From the results of his experiments, the author concludes that the favourable effect on plant growth of small quantities of antiseptics (carbon bisulphide, ether) is due to their stimulating action on the plants themselves and on the lower organisms present in the soil. It is regarded as an example of the well-known physiological rule that substances which, in larger quantities, act as poisons to an organism, stimulate the vital activity of the organism when used in small quantities.—A. S.

Nitrolim [crude calcium cyanamide]; Storage of —— in the tropics. C. J. Milo. Mededeelingen van het Proefstat. voor de Java-Suikerind., 1911, 311—363. Chem. Zentr., 1911, **2**, 1655—1656.

If a filtered concentrated solution of nitrolim be allowed to stand for some days, a crystalline basic calcium salt, $C(:N.CaOH)_2+6H_2O$, separates. The formation of this salt proceeds according to the equations:—

$$2CaCN_2+2H_2O=Ca(N:C:NH)_2+Ca(OH)_2;$$
$$2Ca(N:C:NH)_2+2H_2O=C(:N.CaOH)_2+3CN.NH_2$$

Nitrolim decomposes in a similar manner when kept for a long time in a warm moist atmosphere, the basic calcium salt, cyanamide, dicyandiamide, and urea being produced. —A. S.

Purification and agricultural utilisation of sewage. Müntz and Lainé. *See* XIXb.

Patents.

Fertiliser and process of making the same from natural phosphate. S. B. Newberry and H. N. Barrett. Fr. Pats. 430,850 and 430,997, June 10, 1911.

(1) A citrate-soluble phosphate may be obtained by mixing natural phosphate with from 5 to 24 per cent. of its weight of sodium sulphate or potassium sulphate, and heating the mixture to a temperature between 1370° and 1650° C. for from 30 minutes to 1 hour. (2) Natural phosphate, consisting principally of insoluble calcium phosphate, is converted into a citrate-soluble phosphate by heating it to a temperature of from 1370° to 1650° C., after it has been mixed with a small quantity of phosphoric acid, alkali phosphate, alkali silicate, or the like. (See also U.S. Pat. 972,567 of 1910, this J., 1910, 1262.)—W.P.S.

Fertilisers; Manufacture of ——. L. R. Coates, Baltimore. Re-issue No. 13,302, Oct. 31, 1911, of U.S. Pat. 971,830, Oct. 4, 1910.

See this J., 1910, 1262.—T. F. B.

Ammonium nitrate; Process for making —— and mixing it with other salts for use in agriculture. S. A. Cobbett. Fr. Pat. 431,193, June 6, 1911.

See Eng. Pat. 5657 of 1910; this J., 1911, 955.—T. F. B.

Fixing or combining and utilising [for production of fertilisers] the nitrogen contained in air. Fr. Pat. 431,182. *See* VII.

Purifying and utilising sewage. Fr. Pat. 430,925. *See* XIXb.

XVII.—SUGARS; STARCHES; GUMS.

Sucrose and its decomposition products; Behaviour of —— on heating. J. E. Duschsky. Z. Ver. deut. Zuckerind., 1911, 989—1005.

With the object of obtaining an insight into the behaviour of sugar solutions during the several stages of beet sugar manufacture, the author has previously carried out a number of laboratory experiments studying the effect of prolonged heating on pure solutions of dextrose and lævulose (this J., 1911, 971) and of sucrose (this J., 1911, 1177). He now gives an account of investigations, made in a Russian refinery, for the purpose of determining whether under the ordinary conditions of working an appreciable destruction of sucrose, as indicated by an increase of reducing sugars, does occur. In the melting department, the sugar was treated in the following different ways: (1) the "blow-up" was filled with sweet-water, and the sugar added whilst passing in open exhaust steam; (2) the "blow-up" was filled with pure water, and the sugar added whilst passing in open exhaust steam; (3) the "blow-up" was filled with pure water, which was heated to boiling point by exhaust steam before adding the sugar, heating being discontinued while dissolving, but started again when adjusting the density and temperature; (4) the "blow-up" was filled with pure water, and the sugar added whilst heating with open direct steam at 50 lb. pressure; and (5) the "blow-up" was first filled with pure water, which was heated to boiling point by open direct steam before adding the sugar, heating being discontinued while dissolving, but started again to adjust the density and temperature. On then comparing the reducing sugars in the liquor with that previously present in the raw sugar used (the results being referred to 100 parts of dry substance), it was found that the greatest increase had occurred in procedure (1), in which sweet-water had been employed, this result being due to the fact that the sweet-water not only contained a small amount of reducing substances, but was acid, inversion thus being caused. In the case of procedures (2), (3), and (4), the increase in the content of reducing sugars was less; while in (5), in which direct steam was used, the increase was inconsiderable, which, according to the author, is to be attributed to the shorter period of time necessary for solution, only 13 minutes being required, as compared with 24 in procedure (1). The behaviour of the liquors on being passed over animal charcoal was then examined, but here it was impossible to detect any increase of reducing sugars in the liquors entering and leaving the cisterns. During boiling in the pans, in which direct steam at 55—58 lb. in the coils, and exhaust steam at 11—15 lb. in the false bottom, was used, there was no appreciable increase of reducing sugars, as indicated by the gravimetric method of determination by Fehling's solution. In the author's opinion however, it is not necessarily to be concluded from the cupric-reducing value that at the relatively high temperature of boiling no decomposition whatever occurs; for it is known that lævulose, one of the primary decomposition products of sucrose, readily undergoes further transformation, losing its cupric-reducing power. Other parts of the refinery in which evidence of an increase in the reducing sugars was carefully sought were the fill-house, the liquoring department, and the drying rooms, but in each case negative results were obtained.—J. P. O.

Sucrose; Direct determination of —— in all products containing more or less reducing sugars: destruction of reducing sugars. H. Pellet and P. Lemeland. Int. Sugar J., 1911, 13, 616—618.

One of the authors (this J., 1910, 1220), and Jolles (this J., 1910, 1467), have described polarimetric methods for determining the sucrose in products containing reducing sugars, in which the latter are destroyed by heating with a solution of potassium or sodium hydroxide. Although these methods give accurate results, as compared with the double polarisation (Clerget) process, they are very tedious, and cannot be considered as practical. With the object of rendering them suitable for routine control work, the authors have made a number of experiments, as the result of which they have adopted the following procedure: A solution of the product containing not more than 5 per cent. of reducing sugars is prepared. Of this, 50 c.c. are placed in a 300 c.c. flask, 7·5 c.c. of sodium hydroxide solution (36° Bé.), 75 c.c. of (12 vol.) hydrogen peroxide, and 60 c.c. of water added, and the flask placed in a boiling water-bath for 20 minutes. At the end of this time, the contents of the flask are cooled, neutralised with acetic acid, defecated with basic lead acetate solution (36° Bé.), and diluted to the mark. After filtering, the liquid is polarised, and in doing this it is preferable to use an acid solution, 50 c.c. of the filtrate being acidified with 1 c.c. of glacial acetic acid, and made up to 55 c.c. Sometimes, however, the influence of the lead salt is inappreciable, and the alkaline and acid polarisations give the same reading. The process is said to give concordant figures, that also agree well with those found by the double polarisation (Clerget) method. When experimenting with pure solutions it was found that if the amount of alkali prescribed, viz., 7·5 c.c. of sodium hydroxide (36° Bé.), be made to react upon a solution of sucrose in the absence of reducing sugars, there is a slight destruction of the sucrose. When, however, reducing sugars are also present, no decomposition occurs, a large proportion of the sodium hydroxide then being neutralised by the acids formed. The process may be applied to beet products containing both raffinose and reducing sugars, the trisaccharide being unaffected by the heating with sodium hydroxide, provided the conditions prescribed be adhered to.—J. P. O.

Reducing sugars ; Determination of —— in [beet] molasses. O. Schrefeld. Z. Ver. deut. Zuckerind., 1911, 982—989.

For determining reducing sugars by the standard Herzfeld gravimetric method, either the Herzfeld or the Baumann copper tables may be used, depending upon whether 10 or 5 grms. of the sample are taken for analysis. Since in both these tables account is taken of the reducing power of the sucrose contained in pure products like raw sugars, in strictly accurate work they are not applicable to beet molasses, which contains on an average only 50 per cent. of sucrose. Working in exactly the same way as Herzfeld and Baumann, the author has therefore constructed the following copper table, using 5 grms. of sample, and boiling for 2 minutes :—

Copper, mgrms.	Reducing sugars, per cent.	Copper, mgrms.	Reducing sugars, per cent.	Copper, mgrms.	Reducing sugars, per cent.
27	0·05	125	1·09	225	2·22
30	0·08	130	1·14	230	2·28
35	0·13	135	1·20	235	2·34
40	0·18	140	1·25	240	2·40
45	0·24	145	1·31	245	2·46
50	0·29	150	1·37	250	2·52
55	0·34	155	1·42	255	2·57
60	0·39	160	1·48	260	2·63
65	0·44	165	1·53	265	2·69
70	0·50	170	1·59	270	2·75
75	0·55	175	1·65	275	2·81
80	0·60	180	1·70	280	2·87
85	0·66	185	1·76	285	2·94
90	0·71	190	1·82	290	3·00
95	0·76	195	1·87	295	3·06
100	0·82	200	1·93	300	3·12
105	0·87	205	1·99	305	3·18
110	0·93	210	2·05	310	3·24
115	0·98	215	2·10	315	3·30
120	1·03	220	2·16	320	3·36

For determining the sucrose in beet molasses, the following procedure is recommended : 22 grms. of the sample are washed into a 200 c.c. flask, normal lead acetate solution (exactly neutral to sensitive litmus paper) is added until a precipitate is no longer produced, the liquid made up to the mark, well mixed, and filtered. Of the filtrate, 100 c.c. are placed in a 110 c.c. flask, the excess of lead salt precipitated by saturated sodium carbonate solution, the liquid made up to the 110 c.c. mark, shaken, and filtered. 50 c.c. of the clear filtrate are boiled with 50 c.c. of Fehling's solution for 2 minutes, Herzfeld's procedure being subsequently followed. The cuprous oxide precipitated is either weighed as such, or, preferably, is reduced to copper, the corresponding amount of reducing sugars present being then read from the table given above.
—J. P. O.

Patents.

Steeping grain ; Process of —— in the manufacture of starch, and steeping apparatus. F. L. Jefferies, Granite City, Ill., Assignor to Corn Products Refining Co. U.S. Pats. 1,007,782 and 1,007,783, Nov. 7, 1911.

1. Portions of steeping liquid are brought into contact with a series of portions of grain, and are moved from one portion of grain to another in such order that, as the portions of liquid become richer in the soluble substances of the grain, they are applied to grain relatively fresher. The liquid is withdrawn from the system when it reaches the maximum concentration, and each time that a portion of liquid is moved from steep to steep, a fully steeped portion of grain is cut out, and a fresh portion introduced into the system. 2. The apparatus includes a number of steep tanks, two change cisterns and a discharge tank. A conduit leading to the change cisterns and to the discharge tank has branches leading out of the steep tanks, and a conduit leading from the change cisterns, has branches leading to the steep tanks. A conduit with branches to each steep tank serves to supply the tanks with fresh liquid as desired, and a conduit, leading from the bottom of each steep tank to the top thereof, serves to maintain separate circulations through the tanks individually.—L. E.

Starch ; Process and apparatus for washing, separating, and concentrating ——. F. L. Jefferies, Granite City, Ill., Assignor to Corn Products Refining Co. U.S. Pats. 1,007,784 and 1,007,785, Nov. 7, 1911.

I. Amylaceous grain is finely divided, mixed with a liquid, and subjected to a succession of separating operations in rotary "reels." Fresh washing liquid is introduced into the system at the last operation of the series and is used progressively on material which is successively fresher. The liquid is finally withdrawn as a concentrated starch liquor, and is then subjected to a separating operation to remove the smaller particles of foreign matter. 2. The apparatus includes a series of "reels," through which the material to be treated and the washing liquid are passed in opposite directions, and a corresponding series of change vessels from which the "reels" are respectively supplied. Means are provided for conducting the tailings from the "reels" to the change vessels of the "reels" respectively next subsequent in the series, and for conducting the liquor from the "reels" to the change vessels of the "reels" respectively next precedent in the series. Screening mechanism is provided for effecting separation between the constituents of the concentrated liquor withdrawn from the "reels."
—L. E.

XVIII.—FERMENTATION INDUSTRIES.

Diastase ; Researches on ——. T. Chrzakzcz. Z. Spiritusind., 1911, 34, 545.

Continuing his investigation of the liquefying and saccharifying powers of diastase (see this J., 1910, 103, 583), the author now gives the results of experiments with purified diastase, the former experiments having been made with extracts from malted grains. By treating diastase with ammonium sulphate in concentrations varying from 15 to 35 per cent., it was found that products could be precipitated fractionally from the diastase which had different properties ; the first fraction exhibited considerably stronger liquefying power than the later fractions. The middle fractions possessed the greater saccharifying power, the first and last fractions being the feeblest in this respect, but with each fraction the saccharifying power varied very considerably. The experiments led to the conclusion : (1), that diastase consists, fundamentally, of two different substances, one of which liquefies, and the other saccharifies, starch ; (2), that, as the fractions of the saccharifying portion of diastase differ so widely in their properties, the saccharifying enzyme is a complex body. (See Brown and Morris, this J., 1885, 682 ; 1895, 288. Also Ling and Davis, this J., 1902, 1088.)
—W. P. S.

Beer; Influence of brewing waters of high sulphate-content on the quality and colour of the ——. K. Maurer. Z. ges. Brauw., 1911, **34**, 589.

The author criticises the opinion, which is generally held, that water of very high sulphate-content is unsuitable for brewing purposes, and instances a brewery where beer of excellent flavour and high stability is prepared with water of sulphate-content equivalent to the very high proportion of 34·75 grms. of sulphuric anhydride per hectolitre. The beer prepared with this water is found to be distinctly lighter in colour than that prepared with a water of sulphate-content equivalent to 4·03 grms. of sulphuric anhydride per hl. Again, if two samples of a beer are saturated at the ordinary temperature with sodium sulphate and chloride respectively, and kept, together with a sample of the untreated beer, in a dark place for 4—5 days, it will then be found that each of the treated samples is lighter in colour than the untreated sample, and that the sample treated with sodium sulphate is lightest. Hence, it appears that water of very high sulphate-content is specially suitable for brewing very pale beers.—L. E.

Beer; Production of —— *with de-carbonated water.* W. Rochlitzer. Woch. Brau., 1911, **28**, 541—543.

The production of pale beers of the Pilsen type requires a brewing water relatively free from carbonates. Where calcareous waters only are available, a partial precipitation of carbonates may be effected by boiling, but this treatment removes very little magnesium carbonate, which, from the brewing standpoint, is more undesirable than calcium carbonate. By boiling the water under pressure, as suggested by Jalowetz and Richter, the precipitation of calcium and magnesium compounds is much more complete, and apparatus has been constructed for the production of de-carbonated water by this process. The author has found that water so treated gives excellent results in the preparation of pale beers. Saccharification is more rapid during mashing, a higher extract-yield is obtained, the wort is lighter in colour and possesses a greater acidity, and the finished beers are better as regards flavour and foam-holding capacity, than when the brewing water used is de-carbonated by boiling under atmospheric pressure.—J. H. L.

Fermented alcoholic beverages; Presence of furfural as an indication of adulteration of ——. V. Pasquero and A. Cappa. Gaz. chim. ital., 1911, **41**, II., 349—358.

It is shown that the distillate obtained from beer and from genuine white and red wines is free from furfural if the alcoholic liquid before distillation be neutralised with magnesium carbonate (see Pasquero and Cavagnari, Atti della Soc. Lig. di Scienze, Nat., 1909, 20). If, however, caramel be added to the neutralised alcoholic liquid, then furfural is always present in the distillate and can be detected by means of the aniline acetate test. Since caramel is very frequently added to mask adulteration, the presence of furfural in the distillate from the neutralised liquid may be regarded as an indication of probable adulteration and of the necessity of a complete analysis of the sample.—A. S.

Patents.

Fermentation; Process of —— *for obtaining any fermented beverage or condiment, and any spirit, by utilising the action of suitable biological agents.* Soc. Franc des Distilleries de l'Indo-Chine. Fr. Pat. 430,673, June 21, 1910.

The must is saccharified and fermented under conditions which preclude contamination with foreign organisms. A certain quantity of the fermented must is treated, under the most suitable conditions, with bacteria, mycodermæ, vibrio bacilli, etc., or with such organisms successively in the order found to be most favourable, the product thus obtained being mixed with the remainder of the fermented must. In this way, the maximum yield is obtained and the product contains those substances characteristic of certain spontaneous fermentations.—L. E.

Distillation of fermented liquids derived from maize, manioc, beetroots, rice, etc.; Apparatus for continuous ——. A. Lefebvre. Fr. Pat. 431,424, June 21, 1911.

The apparatus includes a column fitted with rectifying plates and a central, vertical rotatable shaft which carries as many cross-pieces as there are plates. Each cross-piece carries four horizontal hollow branches, and the lower surface of each branch is provided with a number of outlets, the ends of which are immersed in the liquid on the plate beneath. The liquid to be treated descends from plate to plate by overflows situated at the peripheries of the plates. Steam is introduced at the bottom of the column and passes through openings in the lowest cross-piece into the branches attached to this cross-piece, and thence by the outlets into the liquid on the lowest rectifying plate. The vapours from this plate pass upwards through openings in the second cross-piece to the corresponding branches and so on. The outlets above mentioned have notched walls so that the vapour is introduced into the liquid on the plates in the form of very numerous, small bubbles.—L. E.

Distillation process [for alcoholic liquids]. F. Pampe, Halle on Saale, Germany. U.S. Pat. 1,007,967, Nov. 7, 1911.

See Eng. Pat. 5930 of 1905; this J., 1905, 1025.—T. F. B.

Extraction of tartrates from solutions obtained by treating materials containing crude tartrate with dilute mineral acids. Fr. Pat. 430,883. *See* VII.

Apparatus for the sterilisation of milk, beer, water, etc., by ultra-violet rays. Eng. Pat. 16,110. *See* XIXb.

XIXa.—FOODS.

Food analysis; International Conference on ——. Analyst, 1911, **36**, 536—539.

At a Conference held in Paris in June last, at which representatives of Argentina, Belgium, Bulgaria, China, Denmark, France, Great Britain, Greece, Holland, Hungary, Italy, Mexico, Norway, Portugal, Sweden, Switzerland, and Uruguay were present, a set of 23 rules was adopted for the unification of the methods of expressing analytical results obtained in the analysis of foodstuffs. These rules are given in full, and it is stated that the letters "C.I." may be used to indicate that the results are expressed in conformity with them.—A. S.

Gliadin or alcohol-soluble protein in wheat flour; Determination of ——. R. Hoaglund. J. Ind. Eng. Chem., 1911, **3**, 838—842.

The usual method for the determination of gliadin consists in frequent agitation for several hours of a weighed quantity of the flour with 70 cent. alcohol. The author shows that the greatest amount of protein is extracted by alcohol of from 45—55 per cent. by weight concentration, and that continuous agitation for 60—90 minutes in a shaking machine gives just as high results as are obtained after 12—24 hours by the usual method. The following process is recommended:—2 grms. of the flour are mixed with 100 c.c. of neutral alcohol of exactly 50 per cent. by weight concentration in an 8-oz. bottle, which is then shaken for 1 hour in a shaking apparatus. The mixture is afterwards centrifuged for 10 mins., filtered, and the nitrogen in an aliquot part of the filtrate determined by the Kjeldahl method. A blank determination is also made.—A. S.

Benzoic acid in coffee extract; Detection of ——. H. C. Lythgoe and C. E. Marsh. J. Ind. Eng. Chem., 1911, **3**, 842.

When the ether extract of coffee or of pure coffee extract is tested with ferric chloride in the manner usual for the detection of benzoic acid, a precipitate is obtained which differs from ferric benzoate in colour, and yields crystals different from those of benzoic acid on sublimation.

The ammonium salt of the substance which produces this precipitate is distinguished from ammonium benzoate in that it gives precipitates with salts of manganese, nickel, magnesium, calcium, barium, and strontium. For the detection of benzoic acid in coffee extract, the acid solution is extracted several times with ether, and the ether extract is washed with water and extracted with ammonia. The ammoniacal solution is evaporated to a small volume, with addition of ammonia to prevent development of acidity, and treated with a solution of manganese sulphate. It is then filtered, and the filtrate tested for benzoic acid by means of ferric chloride and subsequent sublimation of benzoic acid from the ferric benzoate. For the determination of benzoic acid, the method of E. Clark (Science, Aug. 20, 1909, 253) is used.—A. S.

Saponin and glycyrrhizin in lemonade; Detection of —— by means of Vamvakas' and Frehse's methods. A. Behre. Z. Unters. Nahr. Genussm., 1911, 22, 498—506.

THE results of an investigation carried out by the author show that the two methods mentioned in the title are untrustworthy for the detection of saponin and glycyrrhizin in lemonade. Vamvakas' test (Z. Unters. Nahr. Genussm., 1907, **13**, 271) which depends upon the formation of a brown or grey coloured precipitate when saponin or glycyrrhizin is treated with Nessler's reagent, was found to yield positive results both with lemonades containing these substances and with others which were free from them. The test was applied to the substances after they had been precipitated from the lemonade as their lead compounds, and the latter decomposed with hydrogen sulphide. As regards Frehse's test (this J., 1899, 780), the author finds that pure saponin is not soluble in ethyl acetate (the solvent recommended for its extraction) and that only in the case of impure saponins is a residue obtained which yields a colour reaction with sulphuric acid. Pure saponin, however, gives a violet colouration when treated directly with sulphuric acid.—W. P. S.

Hydnocarpus fat. Lendrich and others. *See* XII.

Determination of malic acid. Dunbar and Bacon. *See* XX.

PATENTS.

Flour; Process of improving ——. F. Tildesley, A. B. Ritchie, and E. J. Watkins, London. Eng. Pat. 25,091, Oct. 28, 1910.

THE flour is treated with a solution containing a mixture of glycerophosphoric acid and glycerochlorhydrin; other esters prepared from phosphoric, phosphorous, hydrochloric, or other acids, and ethyl alcohol, glycol, or glycerol may also be employed.—W. P. S.

Floury constituents of middlings and the like; Processes for extracting and utilising the ——. C. E. and L. J. Walpole, Westbury-on-Trym. Eng. Pats. 28,847, Dec. 13, 1910, and 6763, Mar. 17, 1911.

MIDDLINGS are agitated with a comparatively large quantity of cold water and the mixture is passed through a sieve so as to separate the bran. The latter is washed with a second quantity of water, again passed through the sieve, and the united liquors containing the floury constituents are then filtered or submitted to centrifugal action. The separated water is evaporated and the residue of soluble salts is added to the moist floury constituents. The residue of salts may also be burnt and the ash added to the paste.—W. P. S.

Cocoa; Manufacture of ——. J. S. Petzholdt., Döhlen-Potschappel, Germany. Eng. Pat. 16,431, July 17, 1911. Under Int. Conv., Oct. 26, 1910.

AN apparatus for the treatment of liquid cocoa mass consists of a cup-shaped centrifugal drum surrounded by an outer casing which is provided with a steam or hot water-jacket. The cocoa mass is introduced into the drum and when the latter is rotated, the material is thrown against the heated sides of the casing. Curved blades are fitted in the drum to aid in expelling the material, and other blades on the outer side of the drum force the material collecting at the bottom of the casing into the drum through an opening at the bottom. In this way the material is continually passed through the drum and thrown against the heated sides of the casing. The material is discharged through a valved pipe leading from the lower part of the casing. Several of the enclosed drums may be mounted one above the other and the material passed successively through them.—W. P. S.

Cocoa powder and cocoa [cacao] butter; Process of producing ——. H. E. Cooke, jun., Chicago, Ill. U.S. Pat. 1,006,913, Oct. 24, 1911.

ROASTED cacao beans are decorticated and then pressed to such an extent that the resulting mass may be ground to a powder. The treatment is purely mechanical and chemicals are not employed.—W. P. S.

Leguminous matter; Treatment of —— and of soja (Glycine hispida) in particular for the manufacture of sauces and condiments. R. B. Ransford, London. From Soc. Franç. des Distilleries de l'Indo-Chine, Paris. Eng. Pat. 20,520, Sept. 2, 1910.

SEE Fr. Pat. 415,026 of 1909; this J., 1910, 1267.—T. F. B.

Coffee beans; Method of and apparatus for treating ——. L. Klein, Strassburg, Germany. Eng. Pat. 24,793, Oct. 25, 1910.

SEE Fr. Pat. 409,700 of 1909 and Additions thereto; this J., 1910, 779, 837, 1130, and 1404.—T. F. B.

Utilisation of maize straw. [Fodder and paper pulp]. Eng. Pat. 8638. *See* V.

Apparatus for the sterilisation of milk, beer, water, etc., by ultra-violet rays. Eng. Pat. 16,110. *See* XIXB.

XIXB.—WATER PURIFICATION; SANITATION.

Sewage; Purification and agricultural utilisation of ——. A. Müntz and E. Lainé. Bull. Soc. d'Encouragement, 1911, **116**, 133—166.

THE first part of the paper is a résumé of the authors' work on the loss of nitrogen in bacteria beds and in land treatment (see this J., 1911, 506, 707). In support of their conclusions as to part of the loss being due to the reduction of the nitrate formed, they bubbled air through settled sewage to which potassium nitrate had been added and found that 15 per cent. of the nitrate was decomposed, while without the current of air the nitrate was reduced to nitrite. When the sewage containing the potassium nitrate was allowed to stand in a vacuum and the gases given off collected, it was found that the volume of the gaseous nitrogen was almost the exact equivalent of the weight of nitric nitrogen lost and that it contained traces of nitrous oxide. Rise of temperature had considerable influence in increasing the rapidity of the reduction of the nitrate. In the second part of the paper the agricultural use of sewage is discussed. Experiments were made as to the distribution of the fertilising elements of sewage in the layers of the soil. A plot of land was irrigated with sewage for seven months and it was found that nearly all the nitrogen passed away in the drainage water, only the nitrogen in the suspended organic matter being retained mechanically in the top 10 cm. of the soil, which it is necessary to incorporate with the adjacent layer in order to keep the soil permeable. The phosphoric acid is retained exclusively in the top layer, while the potash, lime and magnesia pass partially into the lower layers where they are absorbed to some extent, the remainder passing into the drainage water. The quantity of sewage required for irrigation purposes is shown to be 3—4 thousand cub. metres per hectare for natural uncultivated land, although even in this amount the nitrogen would be excessive, whereas in practice often ten times this amount is applied. The fertilising elements in sewage are not present in suitable proportions, and the nitrogen being in greatest excess, it is preferable to add phosphate to the land and to apply the sewage in smaller quantity. If the subject could be considered purely from the agricultural point of view, instead of from the public health standpoint, a much larger area of land could be put under cultivation by irrigation of sewage.—J. H. J.

Nitrates in water; The phenolsulphonic acid method for the determination of ——. A. E. Johnson. Chem. News, 1911, **104**, 235.

CHAMOT, Pratt, and Redfield recommend the use of fuming sulphuric acid in the preparation of the phenolsulphonic acid reagent (this J., 1911, 442). In a former paper (Chem. News, 1890, **61**, 15), the author has described a method of making the reagent, in which concentrated sulphuric acid and phenol are heated together for 8 hours, and a little concentrated hydrochloric acid then added. The author finds the reagent made in this way very satisfactory; the same results are given by a newly prepared solution as by one that has been made for several months; the reagent never gives rise to a green tinge, even when warmed with the water residue, but produces a more or less deep red colour, according to the amount of nitrates present; reaction with the residue is complete without the necessity of rubbing with a glass rod; 1 c.c. suffices to determine nitric nitrogen up to about 1·5 parts per 100,000. Instead of slowly adding a strong solution of potassium hydroxide until the maximum colour is developed, in making the final colour comparison, the author suggests that the same amount should be added in each test. The amount to add would be determined for a given solution of potassium hydroxide by finding the amount necessary to develop the maximum colour when treating the residue of 1 c.c. of the standard potassium nitrate solution.—T. ST.

Arsenites; Oxidation of —— *to arsenates in cattle-dipping tanks.* W. F. Cooper and G. A. Freak. J. Agric. Sci., 1911, **4**, 177—181.

BRUNNICH (Australian Assoc. for Advancement of Science, 1909) has traced the gradual loss of efficiency of alkaline arsenite dipping baths to the oxidation of arsenite to arsenate. The oxidation is accelerated by the presence of tar products. The authors' experiments show that the oxidation in presence of wood tar is considerably greater than that which occurs in presence of cresylic acids; this is of importance in view of the fact that the Queensland Government official dip contains a large proportion of Stockholm tar. In order to be effective as a tick-killer the bath must contain not less than 1 part (by weight) of arsenious oxide in 500 parts of water. A loss of 10 per cent. by oxidation will greatly lower the efficacy of the dip. The results emphasise the need for official periodic analyses.—E. F. A.

PATENTS.

Water, sewage, and other fluids; Means for adding chemicals to ——. A. J. and P. A. G. Bell, Manchester. Eng. Pat. 29,322, Dec. 17, 1910.

THE chemicals are delivered from reagent tanks through pipes fitted with ball-valves into smaller tanks whence the solutions are discharged by means of measuring wheels and buckets into a third tank. The measuring wheels are operated by means of a turbine fitted in the main supplying the water to be treated. From this third tank the reagent solutions are pumped into the liquid under treatment, the pumps being operated by suitable independent means. Should the supply of chemical solution fail, water is admitted into the third tank through a valve fitted with a ball-float.—W. P. S.

Suspended solids, grease, and the like; Apparatus for separation of —— *from waste liquids.* R. H. Machell and R. H. Garvie, Dewsbury, Yorks. Eng. Pat. 3065, Feb. 7, 1911.

A CLOSED tank, having a conical bottom, is divided into two compartments by means of a partition extending from the top to nearly the bottom of the tank, so as to form a narrow chamber at one side of the latter. The waste liquid is admitted to a small chamber at one side of the tank, rises thence through a pipe reaching nearly to the top of the narrow compartment, passes downwards and under the lower edge of the partition, and rises in the main compartment. At the commencement of the treatment, the whole apparatus is filled with water. The grease, etc., rises to the top of the liquid in the main compartment, whilst the liquid or aqueous portion leaves the tank through a pipe extending from a point below the grease level to the bottom of the tank, where it discharges into a small outlet chamber. The upper end of the outlet pipe is covered with a dome so that the whole apparatus acts as a siphon, and the inlet and outlet pipes are fitted with valves, that on the outlet pipe being operated by a ball-float fitted in a small chamber supplied with liquid from the inlet chamber. The sludge which settles at the bottom of the tank is removed through a central pipe, compressed air being admitted to the apparatus for this purpose while the inlet and outlet pipes are closed, and the grease is drawn off through a tap at the side of the tank.—W. P. S.

Water and sewage purification. C. R. Darnall, Washington, D.C. U.S. Pat. 1,007,542, Oct. 31, 1911.

AN apparatus for treating water, etc., with chlorine comprises a mixing tank, to which the water and chlorine are admitted, and means for adjusting the quantity of gas to the volume of the water to be treated. Devices are provided for maintaining a constant pressure in the gas-supply pipe, and for automatically cutting off the supply of chlorine should the flow of water cease.—W. P. S.

Water and sewage; Process of purifying ——. C. R. Darnall, Washington, D.C. U.S. Pat. 1,007,647, Oct. 31, 1911.

THE water or sewage is treated with small quantities of chlorine gas which is introduced under a uniformly low pressure and "in a direction out of coincidence with the direction of the flow of water."—W. P. S.

Sewage; Process of purifying and utilising ——. A. Brosseau. Fr. Pat. 430,925, June 7, 1911.

THE sewage is treated with lime, allowed to settle, and the liquid portion is passed through filter beds composed of peat mixed with natural phosphate, this filtering material having been mixed previously with matters containing nitrifying and other bacteria. When exhausted, the filtering material is available as a fertiliser.—W. P. S.

Water; Apparatus for sterilising —— *by means of ozonised air.* Siemens und Halske Akt.-Ges. Fr. Pat. 431,402, June 21, 1911. Under Int. Conv., July 26, 1910.

IN order to prevent corrosion of the metallic parts of pumps, compressors, etc., employed in apparatus for treating water with ozonised air, small quantities of water are admitted to the pumps at the same time that the ozonised air is introduced into the apparatus. (See also Eng. Pat. 17,787 of 1910; this J., 1911, 442.)—W. P. S.

Milk, beer, water, or other liquids; Apparatus for the sterilisation of —— *by means of the ultra-violet rays.* W. R. Walkey, London. Eng. Pat. 16,110, July 12, 1911.

THE liquid is allowed to flow from perforated distributing pipes over inclined quartz plates and thence downwards over the surface of two or more corrugated metal plates. These plates are arranged around a mercury vapour lamp and the liquid is collected in a suitable trough placed below the lower edges of the plates.—W. P. S.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Assay processes of the United States Pharmacopœia. A. R. L. Dohme and H. Engelhardt. Amer. J. Pharm., 1911, 83, 517—525.

From the point of view of accuracy. the aliquot part method is preferable to the percolation method in assaying the active principles of most drugs. Whenever possible alkaloids should be estimated by titration, cochineal being the best indicator. Keller's aliquot part process gives very good results for aconite root. A mixture of ether and chloroform together with sodium bicarbonate is used for extracting the drug, and ether alone for the final extraction of the alkaloid, after having made the acid solution alkaline with sodium bicarbonate. For extract of aconite, the method recommended is to dissolve 2 grms. in 10 c.c. of dilute alcohol, transfer to a separator, make alkaline with sodium bicarbonate and shake out several times with ether. The alkaloids are removed from the latter by means of acidulated water. The aqueous extract is made alkaline with sodium bicarbonate and the alkaloids taken up with ether, which can be filtered and evaporated. The fluid extract is assayed by the above process, using 10 c.c. 100 c.c. of the tincture of aconite are evaporated at a temperature not above 60° C., and the residue taken up with alcohol. Fromme's process in which hydrochloric acid is used, gives good results for cinchona. The alkaloidal residue must be dried below 60° or 70° C.; it should be treated with ether two or three times to remove chloroform, and the weight controlled by titration. With regard to *Nux vomica* and its preparations, determinations of the total alkaloids are more reliable than determinations of the strychnine alone. Dry egg albumin is to be preferred to albumin from fresh eggs in the assay process of pepsin.—F. Shdn.

Nicotine content of some German tobaccos and the distribution of nicotine in the plant. R. Gaze. Apoth.-Zeit., 1911, 26, 938—939.

The alkaloidal content of tobacco plants varies with individual plants of the same race, whether the leaves are compared or the axial centres of the different plants. The culminating point or apex of the axis contains less alkaloid than the other portions thereof.—F. Shdn.

bis-Apomethylbrucine; Derivatives of ——. II. Leuchs and R. Anderson. Ber., 1911, 44, 3040—3049. (See this J., 1911, 1029.)

When *bis*-apomethylbrucine is boiled with acetic anhydride and sodium acetate, a diacetyl derivative is produced, which crystallises from light petroleum in slightly yellow needles, m. pt. 232°—233° C. The base was treated at —5° C. with concentrated nitric acid, cooled further and diluted, when the nitrate of nitro-*bis*-apomethylbrucine, $C_{21}H_{19}O_6N_3,HNO_3$, separated. When warmed with dilute nitric acid, this nitro-compound passes into cacotheline. *bis*-Apomethylbrucine when warmed with dilute nitric acid also gives rise to cacotheline. The methiodide of *bis*-apomethylbrucine decomposes towards 280° C. The dimethyl sulphate of brucine is produced when dimethyl sulphate is allowed to act upon *bis*-apomethylbrucine dissolved in strong sodium hydroxide solution: it melts with decomposition at 268° C. Upon heating with sodium hydroxide solution, methylbrucine is produced, which, when crystallised from water and acetone, has the composition, $C_{24}H_{30}O_5N_2.5H_2O$, and decomposes towards 300° C. after rapid heating. The acetyl derivative of methylbrucine melts at 157°—158° C. When methylbrucine is warmed with dilute nitric acid, the methyl nitrate of the cacotheline base is produced, decomposing at 280° C.

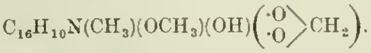
—F. Shdn.

Brucinesulphonic acid; The isolation of a fourth ——. H. Leuchs and W. Geiger. Ber., 1911, 44, 3049—3051.

By the interaction of brucine, manganese dioxide and sulphur dioxide, three brucinesulphonic acids have already been isolated (this J., 1909, 1163). A fourth modification has now been separated from the products of the reaction, in which it is formed in very small quantities. One part of the acid dissolves in 170 parts of boiling water, and in alkaline solution it has $[\alpha]_D = -122°$.—F. Shdn.

Corydalis alkaloids. Bulbocapnine. J. Gadamer and F. Kuntze. Arch. Pharm., 1911, 249, 598—637.

The different groupings in the bulbocapnine molecule are represented by the following formula:—



$$C_{16}H_{10}N(CH_3)(OCH_3)(OH)\left(\begin{matrix}\cdot O\\ \cdot O\end{matrix}\!\!>CH_2\right).$$

Its constitution has been determined by exhaustive methylation, and it is shown to be closely related in structure to apomorphine. The following compounds were prepared amongst many others. The methyl ether melts at 130°—131° C. and has $[\alpha]_D = +247{\cdot}2°$ in chloroform at 20° C. The racemic form of this substance melts at 136° C., and *l*-bulbocapnine methyl ether melts at 131° C. and has $[\alpha]_D = -246{\cdot}5°$ in chloroform at 20° C. Monobenzoylbulbocapnine melts at 202°—203° C. and has $[\alpha]_D = +92{\cdot}7°$ in chloroform at 20° C. The methyl ether of bulbocapnimethine is a liquid, but the corresponding methiodide is solid. Under the action of sodium hydroxide the methiodide passes into 3.4-dimethoxy-5.6-dioxymethylene-8-vinylphenanthrene, m. pt. 101° C., indicating the nature of the nucleus in the original alkaloid.

—F. Shdn.

Gentian root; The presence of sucrose in —— *dried in the air without fermentation.* M. Bridel. J. Pharm. Chim., 1911, 4, 455—458. (See this J., 1911, 766, and 1910, 295.)

Gentian root dried without fermentation was extracted with alcohol and the dry extract treated with ethyl acetate to remove glucosides. After treating the extract with a little water, it was boiled with 95 per cent. alcohol, allowed to stand several days and the clear liquid poured off. The liquid was evaporated to dryness under reduced pressure, and treated further with alcohol, when crystals of sucrose separated. No gentianose was obtained.

—F. Shdn.

Bear's whortleberry; Application of the biochemical method to the analysis of ——. A. Fichtenholz. J. Pharm. Chim., 1911, 4, 441—446.

The dried leaves of the bear's whortleberry (*Arctostaphylos Uvaursi* L., *Ericaceæ*) were extracted with alcohol, the extract evaporated, taken up with water and purified by means of basic lead acetate. The optical rotation of the solution was observed before and after treatment with invertase, and again after subsequent treatment with emulsin. The reducing power towards Fehling's solution was also determined. One sample of the dry leaves was found to contain about 8·5 per cent. of arbutin, and 6·396 per cent. of reducing substances calculated as glucose. Methylarbutin was also present. Another sample contained 4·42 per cent. of reducing substances and about 9·20 per cent. of glucosides. (See this J., 1910, 295 and 1908, 1038.)—F. Shdn.

Clavicepsin: a new glucoside from Secale cornutum. F. Marino-Zuco and V. Pasquero. Gaz. chim. ital., 1911, 41, II., 368—374.

Finely ground ergot of rye was extracted in a Soxhlet apparatus with 95 per cent. alcohol, the alcoholic extract was distilled, and the syrupy residue was treated with water, when it separated into two layers—a dark red solution and a brown resinous substance. The dark red solution when purified by repeated treatment with animal charcoal, concentrated, and left for five days in a desiccator, deposited a crystalline substance, which was identified as a new glucoside. This new substance, *clavicepsin*, $C_{18}H_{34}O_{16}.2H_2O$, is easily soluble in water, slightly soluble in alcohol, insoluble in ether, petroleum spirit, and chloroform. It crystallises from water in stellate groups of needles, m. pt. 91° C. The water of crystallisation is lost on prolonged standing *in vacuo* or on drying at 100°—105° C.; the anhydrous substance melts at 198° C. Clavicepsin is strongly dextro-rotatory ($[\alpha]_D^{20°} = +142·27°$) and does not reduce Fehling's solution. It is not hydrolysed by emulsin, but is readily hydrolysed by mineral acids, yielding two molecules of dextrose and one of mannitol. Clavicepsin has been found in ergot of rye from different places and collected in different years: the yield varies from 1 to 2·5 per cent., but is usually between 1·5 and 2 per cent.—A. S.

Gynocardin; Decomposition of —— by the enzyme of the leaves of Pangium edule. A. W. K. de Jong. Rec. Trav. Chim. Pays-Bas., 1911, **30**. 220—222.

When gynocardin is hydrolysed by the enzyme of *Pangium edule*, dextrose, hydrocyanic acid and a diketone, $C_3H_8O_4$, are produced. The latter forms a hydrazone, m. pt. 177° C. During the hydrolysis a portion of the hydrocyanic acid becomes combined with the ketonic body. —F. Shdn.

Saponins. E. Winterstein and H. Blau. Z. physiol. Chem., 1911, **65**, 410—442.

The authors have investigated the products obtained by the acid hydrolysis of the saponins prepared from Algerian soap berries (the fruit of *Sapindus utilis*) and horse-chestnuts. *Saponin obtained from Sapindus utilis.*—On hydrolysis with sulphuric acid, this saponin yields lævulose, arabinose, and rhamnose, but no galactose, and probably no dextrose; lævulose is split off even by the action of dilute mineral acids and at the ordinary temperature. On protracted hydrolysis with dilute sulphuric acid (1—5 per cent. concentration) at the ordinary temperature, an amorphous product is precipitated. In respect of its properties, this product stands between saponin and sapogenin, and resembles the latter more closely according as a stronger hydrolytic agent is used in its preparation; it is distinguished from both saponin and sapogenin, however, by its ready solubility in absolute alcohol, acetone, and methyl acetate. On further hydrolysis, by heating with more concentrated acid, the amorphous product yields arabinose, rhamnose, and sapogenin, 32·13, 12·35, and 57·15 per cent. respectively of these substances being obtained from the amorphous product in one experiment. Pure sapogenin crystallises from 95 per cent. alcohol in the form of snow-white, shining crystals, and melts, without decomposition, to a colourless oil at 319°—320° C. It dissolves slowly in dilute alkalis and is re-precipitated on addition of acid; it dissolves in concentrated sulphuric acid with an orange-red colour which becomes violet-red on warming the solution, and it dissolves in concentrated nitric acid with a reddish-brown colour. Elementary analysis and a molecular weight determination show that sapogenin has the formula, $C_{18}H_{28}O_3$; it yields a monomethyl derivative (m. pt., 204°—205° C.) and a monacetyl derivative (m. pt., 155° C.). On heating sapogenin with zinc dust, a light yellow oil, which appears to consist of hydrocarbons of high molecular weight, is formed together with a gas which probably consists in part of butylene. *Saponin obtained from horse-chestnuts.*—On hydrolysis with dilute sulphuric acid, this saponin yields arabinose, dextrose, lævulose, and a sapogenin; the latter has not been closely investigated.—On acetylation, and hydrolysis of the acetyl products, both saponins undergo considerable alteration.—L. E.

Ambergris. C. and R. C. Treatt. Perfumery and Essent. Oil Rec., 1911, **2**, 252—253.

Ambergris appears to be a morbid product of the cachalot or sperm-whale. Indigestible fragments of cuttle-fish beaks are swallowed by the whale causing, it is supposed, irritation in the intestine. This causes a secretion which forms round the fragment as a nucleus. The beaks of cuttle-fish are invariably found in large unbroken pieces of ambergris. The sp. gr. of ambergris is about 0·91. According to John, it contains 85 per cent. of ambrein, a substance crystallisable from alcohol, and 2·5 per cent. of benzoic acid. After crystallisation, ambrein is brilliant, pale in colour and of little odour. Ambergris is of two kinds, black and grey, the latter being the more valuable. The black variety is a ductile viscid mass which can be moulded and has a somewhat harsher odour. Grey ambergris is solid, opaque and of a pale grey colour, sometimes intermixed with yellow or reddish striæ. The fracture has a fine granular surface and shows traces of a lamellar structure round a central nucleus. Lumps weighing as much as 130 and 274 lb. have been found. —F. Shdn.

Essential oils; Some observations upon plants for —— and their oils. [*Singapore and Java patchouli oils.*] A. W. K. de Jong. Rec. Trav. Chim. Pays-Bas, 1911, **30**, 211—219.

The essential oil of Singapore patchouli oil (*Pogostemon stomentosus* Hassk ?) is formed in the three leaves of the tops of the branches, and the quantity decreases only slightly as the leaves become older. With the Java patchouli the quantity of oil decreases after the three youngest leaves of each branch. (See this J., 1910, 111.) —F. Shdn.

Citrus oils in the Philippine Islands and the essential oils of Clausena anisum-olens and Ocimum sanctum. B. T. Brooks. Perfumery and Essent. Oil Rec., 1911, **2**, 264—265.

Sweet orange oil, practically identical with that of commerce, was obtained from the peel of *Citrus reticulata* Blanco, known locally as "naranjita" or "sintones," and from *Citrus aurantium* Blanco, known locally as "cajel." The leaves of *Citrus decumana* Murr. (locally "lucban," "naranja," or "suja") gave a yield of 1·7 per cent. of oil on distilling with steam, the thorny variety being used. This had the sp. gr. 0·8700 at 30°/30° C., $\alpha_D = +22·9°$ at 30° C., and $n_D = 1·4644$ at 30° C. The ester value was 10·0 and the oil was miscible with 70 per cent. alcohol. The oil contained citral (trace), dipentene and linalool. When the leaves of *Clausena anisum-olens* Blanco were distilled, 1·15 per cent. of oil with a faint anise odour was obtained. It had the sp. gr. 0·963 at 30°/30° C., $n_D = 1·5235$ at 30° C., saponification value 3·6, and optical activity, *nil*. The principal constituent is methyl-chavicol. Cineol and linalool were found to be present in the essential oil of *Ocimum sanctum* L.—F. Shdn.

Peppermint oil from the Caucasus. J. Maisit. Arch. Pharm., 1911. **249**, 637—640.

The peppermint oil was obtained from plants grown at a height of about 1500 ft. above sea-level in the Sotschi district of the Black Sea department of the Russian Caucasus. The plants were the "black" variety of the English peppermint, and the yield of oil was 1·6—1·7 per cent. Oil obtained from plants a year old had the following characters:—sp. gr. at 20° C., 0·912; $[\alpha]_D = -19·407°$ at 20° C.; acid value, 0·57; free menthol, 42·44 per cent., and total menthol, 49·17 per cent. Another sample obtained from two-year-old plants had practically the same characters. 83—82 per cent. of both oils distilled between 193° and 240° C.—F. Shdn.

Mandarine orange oil; Adulterated ——. E. J. Parry. Perfumery and Essent. Oil Rec., 1911, **2**, 257.

Pure mandarine orange oil should have a sp. gr. of 0·854 to 0·858 and an optical rotation of +67° to +73°. If distilled under reduced pressure till 50 per cent. has passed over, the optical rotation should be increased by at least 3° (Berté). Five genuine samples had the following characters:—

Sp. gr. at 15° C.	Rotation.	Rotation ot distillate.	Refractive index.
0·8550	+ 71°	+ 74·50°	1·4773
0·8586	+ 69·30°	+ 73°	1·4770
0·8580	+ 70°	+ 74°	1·4775
0·8572	+ 70·25°	+ 73°	1·4769
0·8564	+ 72°	+ 74·50°	—

Three adulterated specimens had the following characters :

Sp. gr. at 15° C.	Rotation.	Rotation of distillate.	Refractive index.
0·853	+ 65°	+ 67°	1·4756
0·858	+ 75°	+ 78·25°	1·4760
0·8575	+ 76°	+ 79°	1·4758

The first of these was probably adulterated with lemon terpenes, the other two with ordinary orange oil.—F. Shdn.

Champaca oil. B. T. Brooks. J. Amer. Chem. Soc., 1911, 33, 1763—1772.

True champaca oil is prepared from the flowers of *Michelia champaca* L. and should not be confused with "champaca wood oil" distilled from the wood of *Bulnesia sarmienta* Lor. The sesquiterpene alcohol, champacol or guaiol, which is characteristic of the latter oil does not occur in true champaca oil. The differences between the essential oils of *Michelia champaca* L. and *M. longifolia* L. are clearly shown. The value of champaca oil is largely due to the presence of phenylethyl alcohol and its esters. The most characteristic compound in the oil from the flowers of *M. longifolia* L. is the methyl or ethyl ester of methylethyl acetic acid. Champaca oil contains an unstable ketone, which appears to be the succinic acid ester of a ketone alcohol and ethyl alcohol. This has the composition $C_{10}H_{12}O_2$, melts at 165°—166° C., polymerises at this temperature and yields an amorphous substance melting at 335°—340° C. It has $[a]_D = +82·5°$ in alcohol. The flowers of both species contain an oxidising ketone.—F. Shdn.

Oil of Douglas fir : a preliminary study of its composition and properties. H. K. Benson and M. Darrin. J. Ind. Eng. Chem., 1911, 3, 818—820.

When crude turpentine from Douglas fir (compare this J., 1911, 1304) is distilled with low-pressure steam for the production of oil of turpentine, a residue is left consisting of a clear viscous yellow oil (fir oil), similar in appearance to the pine oil from pine turpentine. The latter oil has been shown by Walker (Massachusetts Inst. of Technol. Bull., Sept., 1905) and by Teeple (this J., 1908, 346) to consist largely of terpineol. A sample of fir oil examined by the authors had the following characters :—$[a]^{20}_D = —37·6°$; $n^{20}_D = 1·4818$: acid value, 1·55 ; saponification value, 11·1 ; iodine value, 185 ; m.pt., below —40° C. ; solubility in 70 per cent. alcohol, 49 : 100 From a study of its composition and behaviour on fractional distillation, and the fact that it readily yields terpin hydrate when treated with 5 per cent. sulphuric acid, it is concluded that the oil consists to the extent of at least one-third of terpineol, and that it could be substituted for pine oil in the commercial applications of the latter.—A. S.

Cyanamide salts ; Alkylation of commercial ——. W. Traube and A. Engelhardt. Ber., 1911, 44, 3149—3152.

By the action of alkyl halides or dialkyl sulphates, in presence of water or alcohol, not only commercial disodium cyanamide but also crude calcium cyanamide (nitrolim) readily yield the corresponding dialkylcyanamides, and as the latter are readily converted into dialkylamines by acids or alkalis, a new method for the preparation of the latter is provided. 88 grms. of finely ground nitrolim (55 per cent. of calcium cyanamide) are suspended in 100 c.c. of water in a copper flask, and 160 grms. of dimethyl sulphate are added gradually, with continuous agitation. The flask is provided with a reflux condenser connected with a receiver containing 100 c.c. of 20 per cent. hydrochloric acid. The mixture is boiled for half an hour, and then, after reversing the condenser, 100 grms. of solid sodium hydroxide are added and steam heated to 110° C. is passed through until the distillate passing over is only very faintly alkaline. The receiver now contains a mixture of ammonium chloride and dimethylamine hydrochloride with excess of acid. This is evaporated to dryness and the dimethylamine hydrochloride is extracted from the dry residue with chloroform free from alcohol in a Soxhlet apparatus. In three experiments yields of 35, 35·3, and 40·1 grms. (70—80 per cent. of the theoretical quantity) were obtained.—A.S.

Cinnamic acid in aqueous solution by means of bromine ; Determination of ——. A. W. K. de Jong. Rec. Trav. Chim. Pays-Bas, 1911, 30, 223—224.

Cinnamic acid in a finely divided condition can be made to combine quantitatively with bromine in aqueous solution. For this purpose the acid should be dissolved in sodium hydroxide solution and precipitated by the addition of hydrochloric acid. Bromine, in aqueous solution of *N*/50 strength, is then added till a yellow colouration is produced, which persists for 5 minutes. Excess of potassium iodide is added and the free iodine titrated. (See also this J., 1910, 112.)—F. Shdn.

Salicylic acid ; Kobert's reagent as a test for ——. J. McCrae. Analyst, 1911, 36, 540—541.

Kobert's reagent (3 drops of formaldehyde solution in 3 c.c. of sulphuric acid) for the detection of morphine also yields a characteristic rose colouration with salicylic acid or salicylates; the colouration develops most readily when about 0·02 mgrm. of salicylic acid is dissolved in 2 drops of sulphuric acid, and a drop of the reagent then added. The same result is obtained in the case of acetyl-salicylic acid (aspirin) and salol. Sulphuric acid alone gives a red colouration with salicin, but the colour obtained with Kobert's reagent is deeper and richer. Kobert's reagent also gives the following colourations with other substances :—phenol, red-violet ; catechol, violet ; resorcinol, deep orange-brown ; quinol, dirty greenish-brown ; pyrogallol, brown ; a-naphthol, dirty green ; β-naphthol, dirty brown ; mandelic acid, yellow ; cinnamic acid, brown.—W. P. S.

Malic acid ; Determination of ——. P. B. Dunbar and R. F. Bacon. J. Ind. Eng. Chem., 1911, 3, 826—831.

The method proposed by the authors depends on the fact that addition of uranyl acetate to a neutralised solution of malic acid increases its optical rotation by about 28° Ventzke for each part per cent. of malic acid in the solution. In the absence of *d*-tartaric acid, which is the only other common acid affected in a similar manner, the solution of malic acid (of 0·2—2·5 per cent. concentration) is treated with uranyl acetate (sufficient to leave a small quantity undissolved) and after standing for 2 hours with frequent shaking, the filtered solution is polarised : the difference between this reading and that obtained with the original solution gives the percentage of malic acid when multiplied by 0·036. The error rarely exceeds 5 per cent. of the total malic acid present. If the solution contain more than 10 per cent. of reducing sugars, with less than 0·25 per cent. of malic acid, the results may be affected by the action of uranyl acetate on the rotation of the sugars. In such cases the malic acid is precipitated from a portion of the solution as lead malate, and the filtrate from this is treated with uranyl acetate and polarised, this reading instead of the reading obtained with the untreated solution being subtracted from the reading obtained with the solution containing malic acid and uranyl acetate. (Compare Yoder, this J., 1911, 1177.)—A. S.

Ketones ; Electrolytic reduction of ——. J. Tafel. Z. Elektrochem., 1911, 17, 972—976.

Acetone and methyl-ethyl ketone in sulphuric acid solution, are reduced readily at a cadmium cathode, with a moderate expenditure of current, mainly to the corresponding hydrocarbons (propane and butane). The propane produced from acetone is free from propylene and hexane. In the case of the higher aliphatic ketones similar reduction is only successful with the application of considerably higher currents. A good yield of propane can also be obtained from acetone with a mercury or a lead cathode. Isopropyl alcohol is practically unaffected under conditions which allow of the rapid reduction of acetone.—W. H. P.

Alcoholates; Metallic ——. E. Chablay. Comptes rend., 1911, **153**, 953—955.

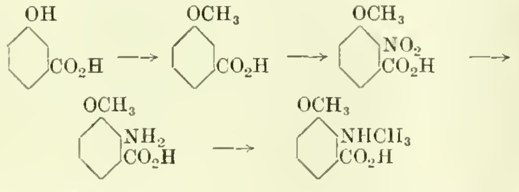
Calcium alcoholates may be prepared by the interaction of calcium nitrate dissolved in liquid ammonia with an alkali alcoholate, or by the action of calcium ammonium on the alcohol. In the first way the methoxide and ethoxide, in the second the *iso*butyloxide and amyloxide have been obtained. Barium methoxide, which is readily obtained, crystallises in fine needles; strontium methoxide and ethoxide are similar. The alcoholates of lead with the four alcohols are obtained by double decomposition of a lead salt and sodium alcoholate in liquid ammonia; they are all colourless products very sensitive to warmth and moisture.—E. F. A.

Calabar beans; Chemical examination of ——. A. H. Salway. Chem. Soc. Proc., 1911, 27, 273—274.

In connection with the preparation of a quantity of the alkaloid physostigmine (eserine), the opportunity was taken for a more complete examination of the other constituents of Calabar beans. The physostigmine, $C_{15}H_{21}O_2N_3$, thus obtained, melted at 86—87° C., whereas the recorded melting point of this alkaloid is 105—106° C., which was found to agree with a pure commercial specimen of physostigmine. This discrepancy was proved to be due to the fact that the alkaloid is dimorphous. In addition to the above alkaloid, the following compounds were isolated: A new alkaloid, ***physovenine***, $C_{14}H_{18}O_3N_2$ (m. pt. 123° C.); a new dihydric alcohol, ***calabarol***, $C_{33}H_{36}O_4$ (m. pt. 245°), which yields a *dibenzoyl* derivative, melting at 195°—196° C.; trifolianol, $C_{21}H_{36}O_4$; and palmitic, stearic, behenic, oleic, and linolic acids. A considerable amount of sugar was also present, which yielded *d*-phenylglucosazone (m.pt. 205° C.). The alkaloid eseramine (m.pt. 245° C.) and the compounds designated as stigmasterol, $C_{30}H_{48}O$, and sitosterol, $C_{27}H_{46}O$, which had previously been isolated from Calabar beans, were also obtained. It was, however, not found possible to confirm the statements respecting the presence in Calabar beans of the alkaloids designated as "eseridine" and "*iso*physostigmine" respectively.

Damasceninic acid (2-methylamino-3-methoxybenzoic acid; The synthesis of ——. A. J. Ewins. Chem. Soc. Proc., 1911, 27, 277.

The alkaloid damascenine is readily converted into the isomeric damasceninic acid (Pommerehne, Arch. Pharm., 1900, 238, 531). The latter was shown to be 2-methylamino-3-methoxybenzoic acid by Keller, who unsuccessfully attempted its synthesis from methylanthranilic acid (this J., 1908, 295). The acid has now been synthesised from *m*-hydroxybenzoic acid by a series of reactions represented as follows:—



Since damasceninic acid can be reconverted into the original alkaloid (Keller, *loc. cit.*), the synthesis of the latter is virtually accomplished.

Origanum hirtum, Link; The essential oil of ——. S. S. Pickles. Chem. Soc. Proc., 1911, 27, 284.

The *Origanum* oils are mostly obtained from countries bordering on the Mediterranean, and the two chief varieties known in commerce are (1) Trieste origanum oil, and (2) Smyrna origanum oil. It has long been assumed that the former is the product of *O. hirtum*, Link, and an oil was examined by Jahns in 1879 (Arch. Pharm., 1879, 215, 1) which was obtained from a plant identified by Griesbach as *O. hirtum*, Lk. This oil consisted mostly of carvacrol, no thymol being found in it. Early in the present year a consignment of herb described as "Origanum plant" was received at the Imperial Institute from the Trieste Commercial Museum. Specimens of this material were identified at the Royal Gardens, Kew, as *O. hirtum*, Link. On chemical examination, however, the phenolic constituents of the oil obtained from this plant by distillation with steam were found to consist almost entirely of thymol, carvacrol being apparently absent. The dry plant yielded 3·3 per cent. of a pale yellow oil, which possessed a pronounced odour of thymol and a burning taste. It gave the following results on examination: sp. gr. at 15° C., 0·9440; α_D (in 100 mm. tube) $+0°24'$. The oil was soluble to a clear solution in 2·8 parts of 70 per cent. alcohol. An estimation of the phenols present by absorption in dilute sodium hydroxide solution gave 64·4 per cent. by volume, equivalent to 66—67 per cent. by weight. A determination of the thymol present by conversion of the latter into its iodine derivation gave 68·4 per cent. of thymol (by weight). On seeding the original oil with a crystal of pure thymol, it rapidly deposited large quantities of this substance in beautiful crystals and in an approximately pure condition. The phenolic portion of the oil separated by means of sodium hydroxide solidified completely. Traces of another phenolic substance which gave a deep red colouration with ferric chloride were also observed. This oil appears to be very similar to one recently examined by Schimmel & Co. (Report, October, 1911, 63).

Dalmatian white thyme; The essential oil of ——. S. S. Pickles. Chem. Soc. Proc., 1911, 27, 285.

A supply of this herb has recently been received at the Imperial Institute from the Commercial Museum of Trieste. Specimens of the plant were submitted to the Royal Gardens, Kew, for botanical examination, and it was there identified as *Satureia*, sp. The dry herb, when distilled in a current of steam, yielded 1·64 per cent. of an oil possessing the characteristic odour of carvacrol. It had a sharp, burning taste, and a golden yellow-colour. The oil had sp. gr. at 15° C., 0·9548, $\alpha_D = -1°3'$, and contained 68·75 per cent. of phenolic constituents, mostly carvacrol (nitroso-compound, m.pt. 153°—154°). The oil was soluble to a clear solution in 2·7 parts of 70 per cent. alcohol. The non-phenolic constituents of the oil are under examination. This oil appears to be very similar to one recently examined by Schimmel & Co. (Report, October, 1911, 109).

Nux vomica production. Oil, Paint, and Drug Rep. [T.R.]

The average yearly production of nux vomica seeds throughout India is estimated at 40,000 hundredweight, valued at $100,000. The following table shows the quantity and value of the exports from Madras, Bengal and Bombay presidencies during the fiscal years ended March 31, 1910 and 1911:—

	1909–10		1910–11	
	cwt.	value.	cwt.	value.
From Madras ...	34,767	$50,688	39,537	$58,067
Bengal..........	3,878	$4,987	10,473	$13,175
Bombay	1,309	$2,712	1,308	$2,539

The United States and the United Kingdom take most of the production.

The nux vomica tree is of natural growth over nearly all of Southern Annam, Cochin China, Cambodia and Laos. The seeds are gathered by the natives, sold to Chinese traders, who in turn sell to exporters. Exports from the district amounted to 200 metric tons in 1909, 180 tons in 1910, and 140 tons during the first half of 1911. The value of the seeds is not stated separately in the export statistics.

During the nine months ended March 31, 1911, 547 cwt. of nux vomica seed were exported from Ceylon, the value of which is placed by the Customs at $1064. The United States took 381 cwt., the United Kingdom 151 cwt., and British India 15 cwt.

Bromine and iodometric methods for the determination of resorcinol. Pence. *See* III.

Technical application of zirconia. Böhm. *See* VII.

Patents.

Epichlorhydrin ; Process for preparing —— from dichlorhydrin and alkalis. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 239,077, July 31, 1910.

Dichlorhydrin is converted into epichlorhydrin by treatment with alkaline saponifying agents of a concentration not greatly exceeding *N*/5 : under these conditions hydrochloric acid is readily eliminated from the dichlorhydrin, and no decomposition of the epichlorhydrin results. —T. F. B.

Glyceryl chlorohydroxyisobutyrate ; Process for obtaining ——. Poulenc frères, and E. Fourneau. Fr. Pat. 430,820, Aug. 23, 1910.

The chlorohydroxy-*iso*-butyric ester of glycerol, valuable in preparing plastic substances by reason of its powers of dissolving cellulose esters, is obtained by heating chlorohydroxy-*iso*-butyric acid with excess of glycerol in presence of suitable quantities of mineral acid. It is a colourless, syrupy liquid, of b. pt. 136° C. (21 mm.), slightly soluble in water, but soluble in alcohol and ether.—T. F. B.

Dimorphinic ester of glycerol ; Process for obtaining the ——. Poulenc frères, and E. Fourneau Fr. Pat. 430,819, Aug. 23, 1910.

The dimorphinic ester of glycerol,

$$(C_{17}H_{18}NO_2.OCH_2)_2CHOH,$$

is obtained by the action of epichlorhydrin or dichlorhydrin on sodium morphine in presence of absolute alcohol. It is a voluminous, amorphous powder, readily soluble in alcohol, but slightly soluble in acetone, ether, benzene, and water, and insoluble in alkalis. It forms a sulphate readily soluble in water.—T. F. B.

Organic mercury compounds ; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 28,583, Dec. 8, 1910.

Phenylprazolones which have a free methylene group readily react with mercury compounds forming derivatives in which the mercury is combined with the pyrazolone nucleus in such a manner that it is not split off by the action of alkalis. The compounds may be prepared by the action of mercuric chloride or acetate or the mercury derivatives of alanine, glycocoll, etc., on a solution in alkali of the phenylpyrazolone derivative ; or the pyrazolone derivatives may be treated with mercuric oxide in presence of water, alcohol, or acetone. Six examples are given, showing the preparation of the mercury derivatives of 1-phenyl-3-methyl-5-pyrazolone and of its *p*-nitro and *p*-amino derivatives and its *m*- and *p*-sulphonic acids. Various proportions of mercury may be introduced into the pyrazolone nucleus by varying the amount of mercury compound used. The products possess germicidal powers and are available for use in medicine.—T. F. B.

Oils containing colloidal mercury ; Preparation of ——. A. Dering. Ger. Pat. 239,681, Feb. 12, 1911.

Mercury salts, such as mercuric chloride, are heated with oils containing triglycerides, and the products are purified by dissolving in ether and washing with water. They are applicable in medicine for the treatment of plague.—A. S.

Pharmaceutical products ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co. Eng. Pat. 3594, Feb. 13, 1911.

Products which have lower melting points than cholesterol esters themselves are obtained by mixing with such esters the esters of higher fatty acids. Thus, a mixture of two parts of cholesteryl oleate with one part of ethyl oleate melts at 29° C., whilst that with one part of ethyl palmitate melts at 31° C. Such mixtures can be introduced into the human body without requiring the use of much solvent, since, when melted, they remain liquid for a considerable time.—T. F. B.

Hydrogen peroxide compounds [with urea, etc.] ; Process for the preparation of stable and solid ——. W. P. Thompson, Liverpool. From Chem. Fabr. Gedeon Richter, Budapest. Eng. Pat. 14,502, June 19, 1911.

The unstable compounds of hydrogen peroxide with urea, acetamide, urethane, succinamide, asparagine, mannitol, erythritol, pinacone, or betaine may be rendered much more stable by adding to them small quantities of organic or inorganic acids or their acid salts. For example, the compound of hydrogen peroxide with urea may be rendered stable, for six months or longer, by addition of 0·1 per cent. of citric acid, 0·2 per cent. of tannin, 0·5 per cent. of boric acid, or 0·3 per cent. of sodium hydrogen sulphate.—T. F. B.

Pharmaceutical product from the suprarenal glands and process of obtaining the same. W. Ohliger, Assignor to F. Stearns and Co., Detroit. U.S. Pat. 1,003,646, Sept. 19, 1911.

Suprarenal glands are extracted by means of alcohol and trichloracetic acid, the extract is boiled to precipitate some of the inactive constituents, and then concentrated and treated with a suitable soluble salt to precipitate the remainder of the inactive substances ; the excess of salts is then removed by means of a volatile precipitant. All the above steps are carried out in presence of a "non-suprarenal reducing agent."—T. F. B.

Oil ; Solidified [essential] ——. C. Ellis, Montclair, Assignor to Ellis-Foster Co. U.S. Pat. 1,006,736, Oct. 24, 1911.

An anhydrous, gelatinous composition is obtained by incorporating soap with at least an equal quantity of an essential oil.—T. F. B.

Acid chlorides resulting from the elimination of hydrochloric acid from two or more molecules of urea chloride ; Process for preparing ——. Verein. Chininfabr. Zimmer und Co. Ger. Pat. 238,961, Sept. 12, 1909.

When urea chloride is heated to suitable temperatures, the elements of hydrochloric acid are eliminated from two or more mols., resulting in the formation of acid chlorides, such as allophanic acid chloride, $NH_2.CO.NH.COCl$, and biuret carbonic acid chloride, $C_2H_4N_3O_2.COCl$.—T. F. B.

Bromo-acylisourea ethers ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 240,353, Sept. 1, 1910.

Bromodiethylacetyl-*iso*-urea ethers are obtained by the action of bromodiethylacetyl halides on the ethers of *iso*-urea or their salts in presence of alkaline substances. The products possess sedative properties.—T. F. B.

Hexamethylenetetramine borocitrates ; Process for preparing ——. Athenstädt und Redeker. Ger. Pat. 238,962, Oct. 23, 1910.

When hexamethylenetetramine, boric acid, and citric acid are allowed to react, with or without solvents, complex salts are obtained, the composition of which depends on the proportions of the components. They are all white, stable substances, readily soluble in water, and possess diuretic properties and are solvents of uric acid.—T. F. B.

Organic compounds containing arsenic ; Process for preparing ——. R. Wolffenstein. Ger. Pat. 239,073, June 6, 1910.

In the known processes for preparing arsenic compounds from organic substances containing acid groupings, the high temperatures necessary result in the reduction of the arsenic acid group. It is now proposed to form such compounds by the action of silver arsenate on halogen derivatives of the organic compounds containing acid radicals. The application of the process to the preparation of arsenic acid derivatives of erucic acid, lecithin, and *o*-iodophenol-*p*-sulphonic acid, is described in full.—T. F. B.

Codeine with diethylbarbituric acid; Process for preparing a compound of ——. Knoll und Co. Ger. Pat. 239,313, Aug. 13, 1910.

MOLECULAR proportions of codeine and diethylbarbituric acid, or their salts, interact, with or without the aid of solvents, to form a crystalline compound possessing soporific and anodyne properties.—T. F. B.

Alum stone; Process for the preparation of ——. M. Lehmann und Co. Ger. Pat. 239,559, Nov. 3, 1910.

IN addition to the usual aromatic and disinfecting substances, aluminium sulphate is also added to the alum during the melting process, and the fused mass is poured into moulds filled with pieces of alum, air being excluded as far as possible.—A. S.

Tubercle bacilli preparations; Process for obtaining therapeutically active ——. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 239,560, Oct. 20, 1910.

TUBERCLE bacilli carefully freed from the culture medium are dried in a rarefied atmosphere, and then kept in an exsiccator protected from light until they have become incapable of developing and have lost their pathogenic properties. They are then worked up into emulsions or other preparations in the usual manner.—A. S.

Cinnamic acid esters of polyhydric alcohols; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 239,650. Oct. 25. 1910. Addition to Ger. Pat. 235,357, May 19, 1910 (see this J., 1911, 1088).

THE esters in question are obtained by heating cinnamic acid esters of halogen-substituted alcohols with aqueous solutions of salts of weak acids, preferably under pressure. Thus, cinnamic acid β-chloroethyl ester, $C_6H_5.CH:CH.COOCH_2.CH_2Cl$, may be converted into monocinnamic acid glycol ester by heating with sodium acetate and acetic acid; in a similar manner monocinnamic acid glycerol ester is obtained from cinnamic acid γ-chlorohydroxypropyl ester.—T. F. B.

Aldehydes from aromatic hydrocarbons or their substitution products, or from alcohols; Process for preparing ——. A. Loewenthal. Ger. Pat. 239,651, June 25, 1909.

AROMATIC hydrocarbons or alcohols are oxidised to aldehydes by means of oxygen or gases containing oxygen, in presence of a contact substance consisting of the residue resulting from the reduction of the salts of chromic acid with volatile bases. For example, the contact mass may be obtained by moistening with methyl alcohol and igniting ammonium chromate or a double ammonium chromate.—T. F. B.

Meto [hydr] oxyhydrocinnamic acid; Manufacture of derivatives of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 26,676, Nov. 16, 1910.

SEE Ger. Pat. 234,852 of 1910; this J., 1911, 923.—T. F. B.

Santalol compound. F. S. Mason, New York. U.S. Pat. 1,007,587, Oct. 31, 1911.

SEE Eng. Pat. 7721 of 1910; this J., 1911, 307.—T. F. B.

Isoprene; Process for preparing ——. A. Heinemann. Fr. Pat. 430,657, June 7, 1911. Under Int. Conv., June 10, 1910.

SEE Eng. Pats. 14,040 and 24,236 of 1910; this J., 1911, 909.—T. F. B.

Pinacone from acetone; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 431,185, May 17, 1911. Under Int. Conv., June 2, 1910.

SEE Eng. Pat. 411 of 1911; this J., 1911, 508.—T. F. B

Hydrogen peroxide [with urea, etc.]; Process for obtaining stable, solid preparations from ——. Chem. Fabr. Gedeon Richter. Fr. Pat. 431,338, June 20, 1911.

SEE Eng. Pat. 14,502 of 1911; preceding.—T. F. B.

Purifying crude pine oil, turpentine oil, etc. Ger. Pat. 239,546. *See* XIII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Autochrome plates; Sensitisation of ——. Bull. Soc. Franç. Phot., 1911, **57**, 382—393.

IN a series of papers by Simmen, J. Thovert, E. Vallot, and V. Palocsay, processes are described for increasing the sensitiveness of autochrome plates by a preliminary treatment with pinachrome, alone or mixed with pinacyanol and pinaverdol. It is claimed that the exposures required for plates thus treated are only one-fourth or one-fifth of those necessary for untreated plates. Descriptions of the preparation of the requisite screens are also given. —T. F. B.

Contratypes [reversed images]; Production of —— *by development after fixation.* A. and L. Lumière and A. Seyewetz. Bull. Soc. Franç. Phot., 1911, **57**, 373—376.

(1) RAPID plates are developed, preferably with diaminophenol, for about four times the normal period, and the reduced silver is dissolved in a solution containing 0·1 per cent. of potassium permanganate and 1 per cent. of sulphuric acid; the plate is then bleached by means of dilute sodium bisulphite solution, fixed in 10 per cent. thiosulphate, washed, and redeveloped in a solution containing mercuric bromide, metol, and sodium sulphite. (2) The plates are strongly developed as above, washed, backed with an opaque backing (*e.g.*, of black paper), and exposed to light; the silver image is then dissolved by means of the above acid permanganate solution, and the plate is bleached, fixed, washed, and redeveloped as above, the last operation requiring from 1 to 1½ hours. Both these processes give reversed images practically free from fog. Bichromate, which is frequently used to dissolve the silver, cannot be employed in this process, owing to its destructive action on the invisible image remaining after fixation.—T. F. B.

Palladium toning. Ky. Phot. Welt, 1911, 60. Bull. Soc. Franç. Phot., 1911, **57**, 392.

SILVER chloride prints, printed somewhat deeper than the final shade required, are immersed for six minutes in a 3 per cent. solution of common salt, rinsed, and toned in a bath consisting of 1 per cent. solution of palladium-potassium chloride, 5 c.c.; sodium chloride, 0·8 grm.; oxalic acid, 1 grm.; water, 100 to 200 c.c. The stronger solutions give brown, black-brown, and black tones, whilst the more dilute ones produce sepia shades. Fixation is effected by thiosulphate as usual.—T. F. B.

PATENTS.

Dry plates with collodion emulsions; Process for making sensitive ——. E. Albert. Ger. Pat. 237,877, Nov. 13, 1910.

PLATES are coated with collodion emulsions in the usual manner, and after the emulsion has set, the plates are dried by centrifugal means over electrically heated bodies. By this means, the damage caused to the emulsion by the dust present in hot air or other gases is avoided.—T. F. B.

Silver bromide, chlorobromide, or chloride images; Process for producing brown-toned ——. Rheinische Emulsions-Papier-Fabrik A.-G. Ger. Pat. 238,513, Sept. 21, 1910.

PHOTOGRAPHIC silver images are toned to brown shades by treating them with solutions of selenium or selenium compounds in aqueous solutions of alkali sulphides, ammonium sulphide, or other sulphides or polysulphides. —T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Mining explosives. Mines and Quarries, Report for 1910. Part II. [Cd. 5940].

In the following tables lists are given of the quantities of the principal explosives used in the mines of this country during 1910 under the Coal Mines Regulation Act and the Metalliferous Mines Act, and in quarries under the Quarries Act, in 1910. The tables also give the relative proportions of each explosive to the total used.

Table I.

Permitted explosives.

Name of explosive.	Quantity used, lb.	Name of explosive.	Quantity used, lb.
Bobbinite	1,128,926	Fracturite	48,624
Samsonite	1,071,143	Steelite	44,032‡
Monobel powder ..	706,295	Amvis	29,616
Arkite	687,393	Dominite	27,246
Ammonite	621,801	Tutol	25,142
Rippite	540,354	Kolax	22,865
Westfalite	461,330	Minite	18,586
Bellite	448,952	Normanite	10,576
Roburite	446,120*	Cambrite, 7615 ..	21,064
Carbonite	322,910	Dragonite, 5550 .	
Ammonal	257,776†	Nobel ammonia powder, 2900..	
Stowite	214,222	Kynite, 2470 ...	
Faversham powder.	177,949	Albionite, 954 ..	
Excellite	177,582	Russelite, 620 ...	
Rexite	173,095	Britonite, 383 ...	
Abbcite	169,575	Arctic carbonite, 230	
Cornish powder ...	147,955	Pitsea powder, 110	
Swalite	117,561	Rendite, 106	
Permonite.........	116,277	Clydite, 101	
Negro powder	90,958	Dreadnought powder, 25	
St. Helens powder	90,017		
Celtite	78,274		
Stomonal	63,277		
Oaklite	50,389	Total.........	8,607,882

* Includes Roburite. † Includes ammonal not permitted.
‡ Includes steelite.

Table II.

All explosives.

Name of explosive.	Quantity used, lb.
Permitted explosives, as in Table I.	8,607,882
Gunpowder..................................	17,664,483
Gelignite	3,039,256
Gelignite dynamite...........................	494,560
Blasting gelatine............................	257,756
Blastine	165,456
Cheddite	123,584
Saxonite	118,886
Various	66,258
Total	30,538,121

Determination of perchloric acid in certain perchlorates. . Golblum. *See* VII.

Patents.

Explosive charges; Method and apparatus for the preparation of ——. A. Kowatsch. Fr. Pat. 436,944, March 20, 1911.

A process for the preparation of explosive charges in such a way that they are only completely made up after loading into the borehole of the mine. The process is carried out by the aid of one of the following devices: (*a*) A stopper is used, closely sealing the borehole; it is provided with a hole for the fuse or electric wires, and other holes for the introduction of the necessary ingredients, and for the escape of air or other gases produced during the mixing of the charges. (*b*) A stopper may also be provided with two sets of electric wires, one for the detonator, and one attached to a device for breaking a glass vessel containing the liquid ingredient of the explosive.—G. W. McD.

Matches of all kinds; Method of manufacture of ——. D. Vénot and L. F. Chasseigne. Fr. Pat. 430,714, Aug. 20, 1910.

The match head composition consists of sulphur (65 parts), powdered glass (10), and amorphous phosphorus (25 parts). The match sticks are dipped in the composition at a temperature of 140°—160° C.—G. W. McD.

Fume-destroying composition. S. W. Young, Palo Alto, Assignor to Globe Chemical Works, San Francisco. U.S. Pat. 1,007,409, Oct. 31, 1911.

See Eng. Pat. 11,495 of 1911; this J., 1911, 1281.—T.F.B.

Process of, and apparatus for, the production of polymerised glycerin. Eng. Pat. 24,608. *See* XII.

XXIII.—ANALYTICAL PROCESSES.

Standard acid; Simplified method of standardising —— *without the help of standard alkali.* F. Klinkerfues. Chem.-Zeit., 1911, 35, 1274.

A known weight of pure ammonium sulphate is decomposed as in Kjeldahl's method, using a water-cooled condenser for the distillation process and a deficiency of the roughly standard acid to receive the ammonia; the excess of the latter is then titrated with the same acid, and the exact strength is calculated from the total volume of acid required.—F. Sodn.

Volumetric analysis; Physico-chemical ——. *III. Precipitation accompanied by determination of difference of potential. IV. Determination of copper and silver. V. Determination and separation of halides.* P. Dutoit and G. von Weisse. J. Chim. phys., 1911, 9, 579—640. (See also this J., 1910, 454.)

III. The authors have devised an electrometric method of studying precipitation reactions, with a view to the volumetric determination of certain metals in solutions of their salts. The potentials of the solution against an electrode of the metal are plotted as ordinates with the quantities of precipitant added as abscissæ. A sharp double inflexion can be read from the curve to mark the end-point. In practice it is most convenient to use a platinum electrode, polarised with a very weak current, which can only remove extremely small quantities of the metal from solution. Vigorous stirring is necessary in order to keep the concentration of the ions of the metal uniform throughout the liquid. The authors have illustrated the conditions of the method by considering the effect of various influences on the determination of copper by potassium ferrocyanide and they draw special attention to the need for eliminating several possibilities of error. They conclude from their experiments that although the point of double inflexion may be very well defined, it does not always correspond with the theoretical end-point, and that in each particular case it is necessary to determine:—(1) The nature of the foreign substances which can affect the electrometric end-point. Numerous foreign substances displace the copper ferrocyanide end-point, whilst chlorides, although they affect the absolute values of the potential, increase the sharpness of the double inflexion, unless they are present in relatively large quantities. (2) The effect of the polarising current. This is not merely what might be deduced from Faraday's law. Unless the density of the current has a certain minimum value, no clear inflexion is obtained. If the current is made too large, however, a considerable displacement is obtained. (3) The most favourable concentrations for the electrometric analysis. Dilution has a considerable effect on the end-point, but in some cases this method of analysis, properly controlled, is specially valuable for very dilute solutions. In general it is found that the greater the adsorbing power of a precipitate, the greater will be the effect produced by small deviations from standard conditions. IV. The electrometric method of analysis may be used in the quantitative determination of copper and silver as sulphides in solutions containing at least 0·02 grm. of metal per litre. The solution to be analysed must be neutralised with sodium hydroxide and then acidified with acetic acid. The polarising current should be very small (less than 10^{-4} ampère). It is remarkable that the titre of an alkali sulphide solution determined electrometrically by means of a standard copper solution differs from that determined by a silver solution. Unless the sulphide is very pure, its titre also undergoes considerable change on keeping. It is therefore necessary to use very pure sulphide and to standardise the solution with the particular metal which is to be determined. By the use of additional precautions in standardisation, etc., it is possible to extend the operation of the method to such small concentrations as 0·1 to 0·2 mgrm. of metal per litre, which will allow of the rapid determination of traces of copper in foodstuffs, etc. V. The electrometric method also gives good results in the determination of halides with silver nitrate as precipitant. Chlorides can be determined in solutions containing as little as 10—20 mgrms. per litre, while with bromides and iodides the dilution may be even greater. From a mixture of halides two sharp points of double inflexion are obtained. The first corresponds with the complete precipitation of the iodides, while the second indicates the precipitation of all the halides. The inflexion representing the removal of bromides is apparent but not well defined. Iodides may be determined with great accuracy even in the presence of enormous excess of chlorides (600 times by weight). The process is specially applicable to such special cases as the determination of iodine in urine, and the estimation of small quantities of chlorides in chlorates.—W. H. P.

Fluorine; A simplified test for ——. E. Rupp. Z. Unters. Nahr. Genussm., 1911, **22**, 496—497.

The ash of the substance to be tested for the presence of fluorides is placed in a small platinum or lead crucible and moistened with 3 drops of water and 1 c.c. of sulphuric acid. The top of the crucible is closed by means of a rubber stopper through which passes a short length of glass rod; the lower end of this rod is moistened with a drop of water, and the contents of the crucible are heated. During the heating, the drop of water evaporates and, should fluorine be present in the ash under examination, the rod becomes coated with a film consisting of silica, sodium silicofluoride, and calcium silicofluoride resulting from the interaction of the hydrofluoric acid, the glass, and the water. When only traces of fluoride are suspected to be present, the part of the glass rod, below the rubber stopper may be covered with a piece of rubber tubing, leaving only the end of the rod uncovered; in this way, the action of the hydrofluoric acid is concentrated on a small surface of glass.—W. P. S.

Nickel compounds; Precipitation of —— and the preparation of spongy nickel. W. H. Low. Analyst, 1911, **36**, 539—540.

Whilst neither ammonia nor hydrazine hydroxide alone precipitates nickel completely from solutions of its salts, the author finds that if the filtrate from the ammonia precipitation be treated with hydrazine hydroxide, the quantity of nickel still remaining in the solution is precipitated. In other words, hydrazine hydroxide precipitates nickel completely from solutions containing ammonium salts. Ammonia, however, will not cause a complete precipitation from solutions containing hydrazine compounds. The precipitate produced by ammonia or hydrazine may be reduced to spongy nickel by heating in hydrogen; the spongy nickel thus obtained is free from fixed alkali.—W. P. S.

Zirconium; Separation of —— from iron and aluminium. New method for the analysis of ferrozirconium. M. Wunder and B. Jeanneret. Z. anal. Ch., 1911, **50**, 733—735.

Zirconium dioxide when fused with sodium carbonate is absolutely unattacked; and if the fusion be boiled for some time with water and 1 grm. additional of sodium carbonate (which aids in securing a clear filtrate), filtered, and the residual oxide washed, it may be boiled with hydrochloric acid (1 : 1) without any being dissolved. For the separation of zirconium from iron and aluminium, the mixed oxides are fused in a platinum crucible with 6 grms. of sodium carbonate, the fusion is taken up with water, and, after adding 1 grm. of sodium carbonate, boiled for a few minutes. It is then filtered (in presence of much aluminium or chromium the filter is incinerated and the residue again fused, extracted, and filtered) and washed. The aluminium in the filtrate is precipitated by ammonia. The residue on the filter is treated with hot hydrochloric acid (1 : 1) till the iron is all dissolved; the iron is then determined in any of the usual ways, and the remaining zirconia ignited with the filter in a platinum crucible till constant in weight.

For the analysis of ferrozirconium, the alloy is heated on the water-bath with bromine and hydrochloric acid till completely decomposed, the solution evaporated to dryness and heated to 110° C., taken up with hydrochloric acid and the silica filtered off. The filtrate is precipitated with ammonia, and the precipitate is mixed with any residue from the treatment of the silica with hydrofluoric acid, ignited, and the mixed oxides treated for the separation of zirconium, iron, and aluminium according to the process described above. It is well to drive off the excess of bromine before evaporating to dryness. This is rapidly effected by adding nitric acid.

Zirconium carbides can be decomposed and analysed in the same way.—J. T. D.

Determination of moisture in fuel. Crisfield. *See* IIa.

Determination of the softening point of asphaltum. Barta. *See* IIa.

Colourimetric determination of phenols in waste liquors. Bach. *See* III.

Bromine and iodometric methods for the determination of resorcinol. Pence. *See* III.

Determination of sulphur in pyrites. Heczko. *See* VII.

Electrolysis of sodium chloride with the mercury cathode. Peters. *See* VII.

Determination of perchloric acid in certain perchlorates. Golblum. *See* VII

Decomposition of thiocyanates with bromine in aqueous solution. [Determination of bromine and thiocyanate.] König. *See* VII.

Determination of sulphur in iron and steel. Kinder. *See* X.

[Determination of] calcium oxide in lime used in the cyanide process. Bahney. *See* X.

Cupellation. Benner and Hartmann. *See* X.

Determination of nickel in alloys. Parr and Lindgren. *See* X.

Rapid determination of zinc [in ores, etc.]. Voigt. *See* X.

Determining tungsten in wolframite in presence of molybdenite. Trautmann. *See* X.

Turpentine oil. Van der Wielen. *See* XIII.

Studies on rosin. Schwalbe and Küderling. *See* XIII.

Filtration of tannin analysis solutions under reduced pressure. Oberfell. *See* XV.

Weighing hides in water as a means of tannery control. Parker and Blockey. *See* XV.

Soil surveys and soil analyses. Hall and Russell. *See* XVI.

Experimental error of field trials. Mercer and Hall. *See* XVI.

Direct determination of sucrose in all products containing reducing sugars. Pellet and Lemeland. *See* XVII.

Determination of reducing sugars in [beet] molasses. Schrefeld. *See* XVII.

Presence of furfural as an indication of adulteration of fermented alcoholic beverages. Pasquero and Cappa *See* XVIII.

International Conference on food analysis. *See* XIXa.

Determination of gliadin or alcohol soluble protein in wheat flour. Hoaglund. *See* XIXa.

Detection of benzoic acid in coffee extract. Lythgoe and Marsh. *See* XIXa.

Detection of saponin and glycyrrhizin in lemonade. Behre. *See* XIXa.

The phenolsulphonic acid method for the determination of nitrates in water. Johnson. *See* XIXb.

Assay processes of U.S. Pharmacopœia. Dohme and Engelhardt. *See* XX.

Kobert's reagent as a test for salicylic acid. McCrae. *See* XX.

Determination of cinnamic acid in aqueous solution by bromine. De Jong. *See* XX.

Determination of malic acid. Dunbar and Bacon. *See* XX.

Patents.

Safety lamps; Apparatus for the observation of gas caps and testing miners' ——. O. Oldam, Denton, Lancashire. Eng. Pat. 11,696, Nov. 15, 1910.

The safety lamp to be tested is placed on a table within a chamber provided with glass sides. A current of gas and air in any desired proportions, with or without the addition of coal dust, is made and driven by a fan through the test chamber. The table on which the lamp stands is rotated and may be tilted so that the current may be made to strike the gauze all round and at any desired angle.—W. H. C.

Turbidity of a medium; Method of measuring the ——. E. Schlesinger. Ger. Pat. 237,470, Aug. 3, 1910.

The medium to be examined is contained within a conical or wedge-shaped vessel, and between it and the source of light is interposed a test-object composed of a plate provided with openings or the like for the transmission of light (*e.g.*, a screen or grating). The test-object is then viewed through the medium, the turbidity of which is to be measured.—A. S.

Paper testing device. Eng. Pat. 5074. *See* V.

Apparatus for testing and recording automatically the setting of cement, etc. Eng. Pat. 26,574. *See* IX.

XXIV.—MISCELLANEOUS ABSTRACTS.

Hydrogen peroxide; Formation of —— by the silent electric discharge. A. Besson. Comptes rend., 1911, **153**, 877—879.

Hydrogen peroxide is formed by the action of the silent discharge on moist rarefied air at a low temperature, and, since these are the conditions which obtain in the upper regions of the atmosphere, it is thought probable that part, at any rate, of the hydrogen peroxide found in rain is produced by electrical means.—F. Sodn.

Thorium; Biological action of ——. W. von Bolton. Z. Elektrochem., 1911, **17**, 816—817.

Purified metallic thorium was placed in stoppered glass bottles together with distilled water which had been exposed to the air. After six months, a slimy growth was observed on the thorium, and that this was due to bacteria was confirmed by cultures on gelatin. After a further six months, it was found that the bacteria were dead, cultures on gelatin giving negative results. In similar experiments with silver, copper, iron, platinum, aluminium, magnesium, mercury, zinc, and tin, no bacterial growth was observed. It is concluded that thorium or one of its disintegration products first stimulates the vital activity of bacterial spores, etc., but on more prolonged action, destroys them. Metallic thorium has also an injurious action on the growth of grass. On animal life, on the other hand, metallic thorium and thoria have a distinctly beneficial effect. Purified sea sand alone and mixed with varying proportions of metallic thorium or thorium oxide was placed in vessels with sea water and the action on the simplest vertebrate (*Amphioxus lanceolatus*) was studied. It was found that under similar conditions, the fish lived much longer in the vessels containing thorium, and that the favourable effect increased with the amount of thorium present; metallic thorium had a greater effect than thorium oxide.—A. S.

Enzymes in bamboo shoots. K. Kato. Z. physiol. Chem., 1911, **65**, 456—474. (Cp. Totani, this J., 1911, 243.)

The juice expressed from decorticated and finely divided bamboo shoots is found to contain the following enzymes—1. Nuclease. 2. Desamidases (amidase) which rapidly decompose urea with liberation of ammonia and slowly decompose asparagine, but do not appear to attack glycine (cp. Effront, this J., 1908, 462; Takeuchi, this J., 1910, 36). 3. An enzyme which attacks fibrin; the nature of this enzyme has not yet been determined. 4. Amylolytic enzymes which hydrolyse starch and form dextrose as end-product; as to whether these enzymes consist of a mixture of diastase, maltase and glucase has not yet been ascertained. 5. An enzyme, resembling emulsin, which decomposes amygdalin into benzaldehyde, hydrocyanic acid, and dextrose. 6. An enzyme which decomposes salicin into saligenin and sugar; as to whether this enzyme is identical with emulsin, or is a specific enzyme, salicase (cp. Sigmund, this J., 1909, 258), remains to be determined.—L. E.

Enzymes; Mechanism of the destruction of —— by light. H. Agulhon. Comptes rend., 1911, **153**, 979—982. (See also this J., 1911, 380).

Visible light destroys some enzymes (invertase, laccase, tyrosinase) only in presence of oxygen; it causes oxidation and probably leads to the formation of a peroxide when oxygen is available. Ultra-violet light, which is more active, is able to decompose water forming hydrogen peroxide; it then destroys enzymes in aqueous solution even in the absence of oxygen and the oxidising action is still greater when oxygen is present. With ultra-violet rays the presence of water is necessary; tyrosine dissolved in glycerin of 30° Baumé and exposed in quartz tubes is not attacked; this is not due to the opacity of glycerin for the radiation. Emulsin is more sensitive to the visible rays and is attacked to some extent on exposure in a vacuum. Catalase is even more sensitive to the action of visible light in the absence of oxygen, but on the other hand the action of ultra-violet light on it is diminished markedly by the absence of oxygen. These conclusions differ from those of Battelli and Stern (Compt. rend. Soc. Biol., 1910, **68**, 1040), and of Zeller and Jodlbauer (Biochem. Zeits., 1908, **8**, 84): this is probably owing to the very small quantities of enzymes dealt with and the great influence of impurities. Rennin is not attacked by the visible rays; ultra-violet light destroys it equally in presence or absence of oxygen (compare *loc. cit.*). As regards their behaviour towards light three types of enzyme may be distinguished: the question is raised whether the differences are due to the presence of other substances or to the nature of the substrate.—E. F. A.

German Imperial Chemical Institute. Chem. Ind. 1911, **34**, 588—589. [T.R.]

At a recent meeting of the Association for the Protection of the Interests of the German Chemical Industry it was announced that the proposal to create an Imperial Chemical Institute is about to be realised. The Prussian Government has ceded the necessary property in Dahlem, near Berlin, and the erection of the building will be taken in hand at once. The Kaiser Wilhelm Gesellschaft for the Advancement of Science, founded on the occasion of the centenary of the Berlin University, will contribute the sum of £10,000 towards the cost of building and will make an annual grant of £3000. The Officiating Committee of Management is to consist of five members, of which one is chosen by the Prussian Exchequer, two by the Verein Chem. Reichsanstalt, and two by the Kaiser Wilhelm Gesellschaft; but of the latter, one must belong also to the Ver. Chem. Reichsanstalt. Of these, the following have been already chosen: Messrs. Emil Fischer, von Brüning, Nernst, and Oppenheim. The Administrative Council is to consist of nineteen members. The Council of Science will consist of six representatives of learned societies. The Imperial Chemical Institute, which was specially formed by members of the chemical industry with the ultimate object of establishing a central research institute, will contribute £45,000 towards the cost of the building and equipment in addition to an annual grant of £3000. The director of the Institute will also occupy a chair as professor in the University of Berlin. The Society has collected over £55,000, and the costs incurred by the creation of this central chemical institute will fall entirely upon the chemical and pharmaceutical manufacturers of the country.

U.S. Bureau of Chemistry; Work of the —— during 1910. Oil, Paint, and Drug Rep., Nov. 13, 1911. [T.R.]

The inspection force of the Bureau of Chemistry, Department of Agriculture, collected 9500 official samples of foods and drugs during the past fiscal year, of which 3280 interstate samples were found to be legal and 3113 misbranded or adulterated, while 503 check analyses were made to insure that correct results were obtained before recommending action on the samples. In connection with this work, 5370 hearings were held, less than half being by correspondence. There were 96,129 floor inspections made of imported products, of which over half were made at New York. A total of 9,698 imported foods and drugs were analysed at these ports, of which number 3085 were adjudged adulterated or misbranded and 1268 were released without prejudice to future shipments. The miscellaneous samples examined at the branches aggregated 1406, making a total of 18,000 samples.

Books Received.

Year-Book of Pharmacy, comprising Abstracts of Papers relating to Pharmacy, Materia Medica, and Chemistry contributed to British and Foreign Journals from July 1, 1910, to June 30, 1911, with the Transactions of the British Pharmaceutical Conference, at the Forty-eighth Annual Meeting held in Portsmouth, July, 1911. Editor of Abstracts: J. O. Braithwaite. Editor of Transactions: Horace Finnemore. J. and A. Churchill, 7, Great Marlborough Street, London. 1911. Price 10s. 6d.

A Textbook of Practical Chemistry for Technical Institutes. By A. E. Dunstan, D.Sc., and F. B. Thole, B.Sc. Methuen and Company, Ltd., 36, Essex Street, W.C. London, 1911. Price 3s. 6d.

8vo volume, containing 329 pages of subject matter, with 51 illustrations, a series of tables, and an alphabetical index of subjects. The contents are classified as follows:—I. Dry tests. II. Reactions of the ions. III. and IV. Reactions of the commoner positive ions, and of the commoner acids and their negative ions. V. Reactions of the "rare" elements. VI. and VII. Volumetric and gravimetric analysis. VIII. and IX. Gravimetric estimation of the commoner positive and negative radicals. X. Complete quantitative analysis of mixtures and compounds. XI. Simple gasometry. XII. Tests for the elements in organic compounds. XIII. Quantitative estimation of the elements in organic compounds. XIV. Common organic estimations. XV. Common operations in organic chemistry. XVI. Identification of simple organic substances. XVII. Separation and identification of mixtures. XVIII. Physico-chemical determinations.

Experiments in Organic Chemistry. A Laboratory Manual designed to accompany Outlines of Organic Chemistry. By F. J. Moore, Ph.D. Assoc. Professor of Organic Chemistry in the Massachusetts Institute of Technology. First Edition. John Wiley and Sons. New York. 1911. Price 2s. Chapman and Hall, Ltd., London.

Small 8vo volume, containing 27 pages, and an alphabetical index. Instead of in chapters, the text is divided into "Exercises," of which there are fifteen. The character of these exercises may be judged by the following examples:—I. Test for nitrogen in an organic substance. II. Ethyl alcohol, preparation by fermentation. Flash-point test. III. Ethyl alcohol-iodoform test. IV. Preparation of ethyl bromide. V. Formic and acetic acids. VI. Acetyl chloride. VII. Preparation of ethyl acetate. Saponification. VIII. Aldehydes. Acetone. IX. Oxalic acid from sugar, etc. X. Preparation and properties of ethylene, etc. XI. Constituents of milk. Saponification of butter. XII. Inversion of sugar. Cellulose, etc. XIII. Nitrobenzene. Aniline. XIV. Phenol. XV. Parafuchsine. Picric acid. Methyl Orange. Phenolphthalein. Fluorescein. Indigo. Alizarin.

The Colloidal and Crystalloidal State of Matter. By Dr. Paul Rohland, A.O. Professor at the Technische Hochschule, Stuttgart. Translated by W. J. Britland and H. E. Potts. Constable and Co., Ltd. 10, Orange Street, Leicester Square, London, W.C. 1911. Price 4s.

8vo, containing 48 pages of subject matter, and alphabetical indexes of authors and subjects.

Beiträge zur Technologie der Seife auf kolloidchemischer Grundlage, I. Von Dr. J. Leimdörfer, Professor an d. Kol. und Tech. Versuchsanstalt f. Oel-u. Fettind. in Budapest. Sonderausgabe aus Kolloidchemische Beihefte-Monographien zur reinen und angewandten Kolloidchemie. Herausgegeben von Dr. W. Ostwald. Bd. II. Theodor Steinkopff's Verlag. Dresden. 1911. Price M. 1.80.

8vo volume, containing 56 pages of subject matter with 16 illustrations, and two photolithograph plates. The subject matter is subdivided thus:—I. General. II. Behaviour of oils and fats during the saponification reaction.

III. Coagulation phenomena. IV. The three dispersion media of soaps: alcohol, water, and glycerol, and their functions, &c. V. Technological examination of the values of soaps. VI. Economic value of the investigations.

Farbstofftabellen. Von Gustav Schultz, Professor f. Chemischen Technologie an d. Tech. Hochschule zu München. Fünfte umgearbeitete und stark vermehrte Auflage der Tabellarischen Uebersicht der im Handel befindlichen künstlichen organischen Farbstoffe von Gustav Schultz und Paul Julius. I. Lieferung. Weidmannsche Buchhandlung., Zimmerstr. 94, Berlin, S.W. 68. 1911. Price M. 3 net.

This first part of the new edition of the Schultz and Julius Tables, contains 40 pages of subject matter, consisting of tables with:—I. The Nitroso- or Quinone-oximedyestuffs. II. Nitro dyestuffs. III. Stilbene dyestuffs. IV. Pyrazolone dyestuffs, and V. Azo dyestuffs.

Die Zeresinfabrikation. (Monographien über chemisch-technische Fabrikations-Methoden). Bd. XXII. Von Ing.-Chemiker Dr. Béla-Lach. W. Knapp's Verlag. Halle a. S. 1911. Price M. 9.60.

8vo volume, containing 204 pages of subject matter with 49 illustrations, and alphabetical indexes of authors and subjects. The subject matter is classified as follows:—I. Earth-wax or ozokerite. (i). Its occurrence and origin. (ii). Its exploitation and preparation. (iii). Its fusion. (iv). The testing and examination of ozokerite. II. (i). Manufacture of ceresin. (ii). Extraction of the press residues. (iii). The decolourising materials. (iv). Further treatment of ceresin. (v). Ingredients mixed with ceresin, or adulterants. (vi). Use of ceresin. (vii). Methods of examining ceresin. (viii). Construction of ceresin works.

Handbuch der Mineralchemie. Herausgegeben von Hofrat Prof. Dr. C. Doelter. Vier Bände. Mit vielen Abbildungen, Tabellen und Diagrammen. Theodor Steinkopff's Verlag. Dresden, 1911. Price M. 6.50.

The present issue forms Part 3 of volume I. of the above work, and it contains 161 pages of subject matter. The subjects relate to:—I. Calcite. II. Aragonite. III. Hydrates of calcium carbonate. IV. Calcium-magnesium carbonate. V. Manganese carbonate. VI. Ferrous carbonate (Siderite). VII. Cobalt carbonate. VIII. Zinc carbonate. IX. Nickel-hydroxycarbonate. X. Copper carbonate (Malachite). XI. Strontium carbonate; together with analytical figures under each head.

Subject List of Works on Peat, Destructive Distillation, Artificial Lighting, Mineral Oils and Waxes, Gas Lighting, and Acetylene in the Library of the Patent Office. [Patent Office Library: Subject Lists. New Series. Y K—Y M.] Published at the Patent Office, 25, Southampton Buildings, London, W.C. Price 6d.

Mines and Quarries. General Report and Statistics for 1910, by the Chief Inspector of Mines. Part II. —Labour. [Cd. 5940.], Wyman and Sons, Fetter Lane, E.C. Price 1s. 9d.

This publication contains a general report and statistics relating to persons employed and accidents at mines and quarries in the United Kingdom, and to the enforcement of the Mines and Quarries Acts.

Opere Scelte di Amedeo Avogadro. By Prof. Icilio Guareschi. Unione Tipografico-Editrice Torinese, Corso Raffaello 28, Torino, Italy. Price 20 lire.

4to volume of 473 pages together with a bibliography and index. The work contains reprints of all the more important scientific papers of Avogadro.

*New Books.

Allen's Commercial Organic Analysis. Vol. 5. 4th ed. Entirely re-written. 8vo, pp. 614. Churchill. London. 1911. Net 21s.

Asch, W., u. D. *Asch*, Drs.: Die Silicate in chemischer u. technischer Beziehung. Unter Zugrundelegg. der seitens der philosoph. Fakultät der Universität Göttingen preisgekrönten Hexit-Pentit-Theorie nebst Umwandlg. derselben in e. allgemeine stereochem. Theorie. (XV. 409 S.). gr. 8°. Berlin. J. Springer. 1911. M. 16; cloth M. 18.

Bailey, G. H., and H. W. *Bausor*: Senior Chemistry. (Cambridge Senior Local Examinations.) Cr. 8vo, pp. viii—509. Clive. London. 1911. 4s. 6d.

Corbin, H. E., and A. M. *Stewart*: A Handbook of Physics and Chemistry. 4th Ed. Cr. 8vo, pp. 528. Churchill. London. 1911. Net 7s. 6d.

Darling, C. R.: Pyrometry: a Practical Treatise on the Measurement of High Temperatures. Cr. 8vo, pp. 22. Spon. London. 1911. Net 5s.

Delbrück, M., u. *Hayduck*: Die Gärungsführung in Brauerei, Brennerei u. Pressbefefabrik auf Grund der Arbeiten u. Erfahrungen des Instituts f. Gärungsgewerbe in Berlin. (X, 225 S. m. 6 Abbildgn.) gr. 8°. Berlin. P. Parey. 1911. Cloth M. 8.

Dobson, E.: A Rudimentary Treatise on the Manufacture of Bricks and Tiles. 12th Ed. (Weales' Series.) 12mo, pp. 282. Crosby Lockwood. London. 1911. 3s.

Fahrion, Dr. W.: Die Chemie der trocknenden Öle. (VIII. 298 S. m. 9 Fig.) 8°. Berlin. J. Springer. 1911. M. 10, cloth M. 11.

Friend, J. N.: Elementary Domestic Chemistry. With 55 Diagrams. Cr. 8vo, pp. x—182. Allman. London. 1911. 2s. 6d.

Hintz, Prof. E.: Chemische Untersuchung der Mineralquelle zu Fachingen, "königl. Fachingen." Ausgeführt im chem. Laboratorium Fresenius. (19 S.) gr. 8°. Wiesbaden. C. W. Kreidel. 1911. 80 Pf.

Jahrbuch der österreichischen Berg- u. Hüttenwerke, Maschinen- u. Metallwarenfabriken. [Aus: "Jahrb. d. österr. Industrie."] Hrsg. v. Rud. Hanel. Jahrg. 1911. (XVI S., S. 221—690, 27—88, 295—420 u. 2209—2751.) 8°. Wien, Compassverlag. 1911. Cloth M. 6.60.

Jahrbuch der österreichischen Textil-Industrie. [Aus: "Jahrb. der österr. Industrie."] Hrsg. v. Rud. Hanel. Jahrg. 1911. (XII S., S. 1655—1968, 195—239, 547—582 u. 2209—2751.) 8°. Wien, Compassverlag. 1911. Cloth M. 5.40.

Jahrbuch der österreichischen Bau- u. keramischen Industrie (Industrie der Steine u. Erden, Glas u. Porzellan). [Aus: "Jahrb. d. österr. Industrie."] Hrsg. v. Rud. Hanel. Jahrg. 1911. (IX, 228 S., S. 5—28, 257—296 u. 2209—2751.) 8°. Wien, Compassverlag. 1911. Cloth M. 4.60.

Jahrbuch der österreichischen chemischen Industrie (chemische Industrie, Gaswerke, Gummi, Zelluloid, Petroleum, Kerzen, Seifen u. Eiswerke). [Aus: "Jahrb. der österr. Industrie."] Hrsg. v. Rud. Hanel. Jahrg. 1911. (XII S., S. 855—1045, 101—136, 447—486 u. 2209—2751.) 8°. Wien, Compassverlag. 1911. Cloth M. 4.60.

Jahrbuch der österreichischen Getränke-Industrie (Brauereien, Mälzereien, Brennereien, Likör-, Sodawasser- u. Fruchtsaft Fabriken). [Aus: "Jahrb. d. österr. Industrie."] Hrsg. v. Rud. Hanel. Jahrg. 1911. (VII S., S. 691—857, 88—101, 404—447 u. 2209—2751.) 8°. Wien, Compassverlag. 1911. Cloth M. 4.60.

Jahrbuch der österreichischen Leder- u. Lederwaren-Industrie. [Aus: "Jahrb. d. osterr. Industrie."] Hrsg. v. Rud. Hanel. Jahrg. 1911. (VII S., S. 1415—1524, 167—182 u. 2209—2751.) 8°. Wien, Compassverlag. 1911. Cloth M. 4.60.

Jahrbuch der österreichischen Mühlen-, Teigwaren-, Reisschäl- u. Stärke-Industrie. [Aus: "Jahrb. d. österr. Industrie."] Hrsg. v. Rud. Hanel. Jahrg. 1911. (VII S., S. 1039—1156, 135—150 u. 2209—2751.) 8°. Wien, Compassverlag. 1911. Cloth M. 4.60.

Jahrbuch der österreichischen Papier- u. Druck-Industrie. [Aus: "Jahrb. d. österr. Industrie."] Hrsg. v Rud

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Jahrbuch f. das Berg- u. Hüttenwesen im Königr. Sachsen. Jahrg. 1911. (Statistik vom J. 1910.) Auf Anordng. des königl. Finanzministeriums hrsg. v. Geh. Bergr. C. Menzel. (VIII, 112, 305, 46 u. 7 S. m. 20 Taf. u. 1 Karte.) Lex. 8°. Freiberg, Craz & Gerlach. 1911. M. 12.

Jahresbericht üb. die Fortschritte in der Lehre v. den Gärungs-Organismen u. Enzymen. Unter Mitwirkg. v. Fachgenossen bearb. u. hrsg. Prof. Koch. 19. Jahrg. 1908. (VIII, 670 S.) gr. 8°. Leipzig. S. Hirzel. 1911. M. 24.

Kusserow, Dr. R. : Mitteilungen f. Brennerei u. Presshefefabrikation. Nebst Anh. : Adressbuch f. Lieferanten. f. das Brennereigewerbe. Nr. 40 u. 41. Juni u. Septbr., 1911. (13 u. 12 S.) kl. 8°. Sachsenhausen (Mark, Chausseestr. 8), Selbstverlag. Each 50 Pf.

Lebbin, Dr. G. : Allgemeine Nahrungsmittelkunde. Ein Hand-, Lehr- u. Nachschlagebuch f. Nahrungsmittelgewerbetreibende, Chemiker, Tierärzte, Mediziner, Apotheker, Verwaltungs- u. Justizbeamte. (XI, 543 S. u. 8 S. m Abbildgn. u farb. Taf.) gr. 8°. Berlin L Simion Nachf. 1911. M. 12.50 ; cloth M. 14.

Lodge, R. W. : Notes on assaying and metallurgical laboratory experiments. 3rd ed., rev. and corrected. N.Y., Wiley. 1911. c. 11+317 p. il. 8°, $3.

Massart, E. : Production et valeur de l'argent, du plomb et du zinc, in-8°. Paris, 1911. 2 fr. 50. Ch. Béranger.

Neave, G. B., and *Helibron*, I. M. : The Identification of Organic Compounds. Cr. 8vo., pp. viii—103. Constable. London, 1911. Net 4s.

Noyes, W. A. : The elements of qualitative analysis. 6th ed. ; rev. in collaboration with the author by G. McP. Smith. N.Y., Holt. 1911. c. '87-'11. 5+133 p. $1.10.

Ochs, R. : Einführung in die Chemie. Ein Lehr- u. Experimentierbuch. Mit 218 Textfig. u. 1 (farb.) Spektraltaf. (VIII, 502 S.) gr. 8°. Berlin, J. Springer. 1911. Cloth M. 6.

Piek, G. : Textiltechnische Möglichkeiten. Anregungen zur Förderg. der deutschen Textilindustrie. Mit e. Vorwort v. Dr. Leon Zeitlin. (46 S.) gr. 8°. Berlin, F. Hirschberg & Co. 1911. M. 1.80.

Rimbach, E. : Praktisch-chemische Anfangsübungen. Für den Gebrauch im chem. Institut der Universität Bonn. Als Mskr. gedr. 2. Aufl. (VII, 173 S.) gr. 8°. Bonn, F. Cohen. 1912. M. 3.50.

Ristenpart, Dr. E. : Das Wasser in der Textil-Industrie. [Aus : "Die Textil-Industrie."] (91 S. m. 32 Abbildgn.) gr. 8°. Leipzig, M. v. Criegern. 1911. M. 1.

Sachsse, R., u. P. *Habernoll*, Drs. : Kurzgefasster Leitfaden der landwirtschaftlichen Chemie. 2., verb. Aufl. (VIII., 189 S. m. 60 Abbildgn.) 8°. Bautzen, E. Hübner. 1911. Cloth M. 2.

Samitca, E. R. : Notes sur la conservation des traverses en hêtre par l'imprégnation économique et spécialement par le procédé Rüping, 45 figs., 32 pl. in-18. Dunot et Pinat, Paris. 1911. 6 fr.

Spencer, J. F. : An Experimental Course of Physical Chemistry. Pt. 1. Statical Experiments. Cr. 8vo, pp. 242. Bell, London. 1911. 3s. 6d.

Spiel, Dr. H. : Uber die Bildung v. Stickoxyden bei der stillen elektrischen Entladung im Siemensrohr. (V, 55 S. m. 4 Taf.) gr. 8°. Wien, A. Hölder. 1911. M. 1.40.

Treadwell. Prof. F. P. : Kurzes Lehrbuch der analytischen Chemie in 2 Bdn. I. Bd. Qualitative Analyse Mit 25 Abbildgn. u. 3 (farb.) Spektraltaf. 7., verm. v. verb. Aufl. (XV, 512 S.) 8°. Wien, F. Deuticke. 1911. M. 10 ; cloth M. 11.50.

Ulivi, P. L. : Industria frigorifera. 2a ediz. riveduta e ampliata. Milano, 16° fig , p. xvi., 272, con 28 tabelle. (Man. Hoepli). 1911. Lire 3.

Vocabolario tecnico illustrato nelle sei lingue : italiana, tedesca, inglese, francese, russa, spagnuola. Vol. XI : Siderurgia. Milano, 16°, p. xii, 786. M. Hoepli. 1911. Lire 12.50.

*Dissertations.

[Prices vary, ranging from two to three shillings.]

Arnhold, W. : Ueber das Verhalten des Gerbstoffes bei Gunnera. Kiel. 1911. 41 S. 8°.

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Loessner, F. : Ueber Reaktionen der unterphosphorigen Säure und Wasserstoffverbindungen der Schwermetalle. Leipzig. 1911. 91 S. 12 Fig. im Text. 8°.

Maxted, E. B. : Ueber die Nitride von Eisen, Nickel und Kobalt. Ueber das Bleicoulometer. Berlin. 1911. 49 S. 12 Fig. i. T. 8°.

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Saegmüller, G. M. : Ueber Phosphorescenz von Gläsern. Jena. 1911. 22 S. m. 32 Fig. 8°.

Schmidt, W. : Kurze Darstellung der Phänomene der Gärung und ihrer Beziehungen zur Praxis. II. Teil. Krumau. 1911. 19 S. 8°.

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Unna, E. : Synthese einiger neuer Galactoside. Berlin. 1911. 38 S. 8°.

Vetter, F. A. : Beiträge zur Kenntnis der Abscheidungen des kohlensauren Kalkes aus Bicarbonatlösungen. Jena. 1910. 64 S. I. Taf. m. 10 Fig. 8°.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding lists can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

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Patent Specifications may be purchased at the Sale Branch of the Patent Office, Quality Court, Chancery Lane, London, W.C., fifteen days after the date on which acceptance of the complete specification is advertised. The price is 8d. each.

I.—GENERAL PLANT; MACHINERY.

Applications.

25,251. Disdier. Drying apparatus for sticky or pitchy substances.* Nov. 13.

25,336. Puech and Chabal. Filters. [Fr. Appl., Dec. 22, 1910.]* Nov. 14.

25,393. Smallwood. Method and apparatus for heating, drying, roasting, calcining, etc. Nov. 15.

25,484. Mader and Mader. Drying and desiccating apparatus. Nov. 15.

25,652. Horner (Hunter). Apparatus for separating and washing slimes. Nov. 17.

25,800. Fernbach. Vacuum concentrating apparatus. Nov. 18.

25,962. Barker (Weber and Co.). Constant temperature baths.* Nov. 21.

26,177. Roberts. Grading or classifying powdered substances, liquids, etc. Nov. 23.

26,319. Allen and Co., Ltd., and Parker. Mills for grinding, crushing, sifting, separating, or mixing materials. Nov. 24.

26,339. Clegg. Filters. Nov. 24.

26,378. Frick. *See under* IX.

Complete Specifications Accepted.

21,849 (1910). Humphrey. Methods and apparatus for raising or forcing liquids. Nov. 29.

24,473 (1910). Lillie. Evaporating apparatus. Nov. 29.

24,543 (1910). Podmore and Bailey. Filtering apparatus. Nov. 22.

27,200 (1910). Hart. Condensing and cooling apparatus. Nov. 22.

II.—FUEL; GAS; MINERAL OILS AND WAXES; DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

25,380. De Fazi. Production of combustible gas. Nov. 14.

25,381 and 25,382. De Fazi. Removal of sulphur from mineral oils. Nov. 14.

25,496. De Fazi. Treatment of crude mineral oils. Nov. 15.

25,615. Harrison. *See under* XII.

25,699. De Fazi. Apparatus for treating oils. Nov. 17.

25,736. Climie. Gas producers.* Nov. 18.

25,960. Gohmann. Regenerative coke ovens and the like.* Nov. 21.

26,267. Oliver Arc Lamp, Ltd., Oliver, and Pell. Compositions for electrodes for flame arc lamps. Nov. 23.

26,349. Rigby and Testrup. Utilisation of peat. Nov. 24.

26,437. De Fazi. Treatment of mineral oils. [Addition to No. 25,178 of 1911.] Nov. 25.

Complete Specifications Accepted.

22,835 (1910). Zimmer and Forwood. Manufacture of fuel briquettes and the like. Nov. 22.

26,744 (1910). Cowper-Coles. Production of smokeless fuel briquettes. Nov. 22.

8725 (1911). Koppers. Convertible gas retorts and coke ovens. Nov. 22.

10,651 (1911). Stanley (Morris). Manufacture of artificial fuel. Nov. 29.

12,251 (1911). Koppers. Separating and regenerating washing oils used to separate benzol from gases. Nov. 22.

13,021 (1911). British Thomson-Houston Co. (General Electric Co.). Electric conductors for use as incandescing bodies for lamps, furnaces, etc. Nov. 22.

16,027 (1911). Green. Gas producers. Nov. 22.

III.—TAR AND TAR PRODUCTS.

Application.

26,029. Aylsworth. *See under* XIII.

IV.—COLOURING MATTERS AND DYES.

Applications.

25,457. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of sulphurised dyestuffs. Nov. 15.

25,660. Moeller (Vidal). Production of colouring matter for animal fibres. Nov. 17.

25,677. Johnson (Badische Anilin und Soda Fabrik). Manufacture of vat colouring matters of the anthracene series. Nov. 17.

25,875. Newton (Bayer und Co.). Manufacture of vat dyestuffs. Nov. 20.

25,903. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters. Nov. 20.

26,343. Hodgson, and Lord Mayor, Aldermen, and Citizens of Bradford. Manufacture of new bases and of colouring matters. Nov. 24.

Complete Specifications Accepted.

29,368 (1910). Imray (Soc. of Chem. Ind. in Basle). Manufacture of condensation products and dyestuffs from indigo or its substitution products. Nov. 29.

30,104 (1910). Newton (Bayer und Co.). Manufacture of sulphur dyestuffs. Nov. 29.

6267 (1911). Johnson (Badische Anilin und Soda Fabrik). *See under* VI.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

25,255. Herz. Production of pulp from fibres, waste paper, wood, etc. [Fr. Appl., Nov. 12, 1910.]* Nov. 13.

25,437. Brown. Manufacture of paper. Nov. 15.

25,532. Knecht, Perl, and Spence and Sons, Ltd. Preparation of solvents for cellulose. Nov. 16.

25,533. Knecht, Perl, and Spence and Sons, Ltd. Cellulose solutions. Nov. 16.

25,731. Bailey. Machines for extracting moisture from piece goods in open width. Nov. 18.

25,893. Soc. Chim. des Usines du Rhône. Acetylation of cellulosic materials. [Ger. Appl., Dec. 14, 1910.]* Nov. 20.

26,019. Kurtz-Hähnle. Production of paper pulp from old paper and removing ink or colour from the old paper.* Nov. 21.

26,043. McRae and Malcolmson. Production of paper. [Divided Appl. on No. 14,871 of 1911.]* Nov. 21.

26,276. Smith, and Taylor and Parsons, Ltd. Testing ovens for ascertaining the amount of moisture in wool, yarn, wood pulp, paper, etc. Nov. 24.

Complete Specifications Accepted.

27,283 (1910). De Medveczky. Collodion or celluloid composition. Nov. 22.

11,728 (1911). Doerflinger. Production of solutions of cellulose esters. Nov. 22.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

25,206. Knecht and Hübner. Treatment of cotton goods prior to bleaching, mercerising, dyeing, etc. Nov. 13.

25,245. Lilienfeld. Finishing, filling, loading, or dressing textile fabrics and spun goods. [Austrian Appl., Nov. 12, 1910.]* Nov. 13.

25,268. Ratignier, and Pervilhac et Cie. Method and apparatus for biasing fabrics. [Fr. Appl., Dec. 29, 1910.]* Nov. 13.

25,534. Knecht, and Spence and Sons, Ltd. Metallised textile and other fibres and fabrics. Nov. 16.

25,732. Brittain, Briggs, and Gemmell. Waterproofing yarns and fabrics. Nov. 18.

25,933. Green. Application of a differential gear drive to dyeing jiggers, bleaching jiggers, souring machines, kiers, etc. Nov. 21.

26,097. Krosnowski. Apparatus for dyeing, steaming, bucking, bleaching, and impregnating cotton fabrics.* Nov. 22.

26,328. Schmid frères. Soaping textile materials. [Fr. Appl., Nov. 26, 1910.]* Nov. 24.

Complete Specifications Accepted.

26,789 (1910). Muskett, and Rubber Substitute (1910), Ltd. Waterproofing solutions. Nov. 22.

1247 (1911). Rachou and Chaumat. Process and apparatus for indigo dyeing. Nov. 29.

6267 (1911). Johnson (Badische Anilin und Soda Fabrik). Production of colouring-matters on the fibre. Nov. 22.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

25,252. Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia. Nov. 13.

25,454. Fritzsche. Separation of sulphur from sulphuretted hydrogen and gases containing it. Nov. 15.

25,506. Ashcroft. *See under* X.

25,556. Buckle. Production of ammonia from nitrolime. Nov. 16.

25,573. Corsat. Manufacture of cream of tartar. [Fr. Appl., Nov. 19, 1910.]* Nov. 16.

25,580. Ashcroft. *See under* XI.

25,681. Härden. Production of hydrogen peroxide. Nov. 17.

25,757. Mühlbauer. Manufacture of minium. [Austrian Appl., Dec. 3, 1910.]* Nov. 18.

25,891. Ellis (Chem. Fabr. von Heyden). Manufacture of alkali amide.* Nov. 20.

25,919. Rees, and Metals Extraction Corporation, Ltd. Deposition of metallic salts from solutions. Nov. 20.

26,320. Thwaites. Treatment of copper liquors. Nov. 24.

26,429. England. Production of sulphate of ammonia Nov. 25.

Complete Specifications Accepted.

21,628 (1910). Heys (Nitrogen Co.). Process for producing cyanogen compounds and the like. Nov. 29.

26,765 (1910). Ellis (Chem. Fabr. von Heyden). Manufacture of anhydrous hydrosulphites. Nov. 29.

26,777 (1910) and 15,181 (1911). Perret. Extraction of compounds of vanadium, molybdenum, tungsten, and similar metals. Nov. 29.

8503 (1911). Bergius. Preparation of superoxides of the alkaline-earths. Nov. 29.

15,188 (1911). Soc. Anon. des Usines de Rioupéroux. Effecting the peroxidation of alkali metals. Nov. 22.

VIII.—GLASS; CERAMICS.

Application.

25,925. James (Ges. f. Elektrotechnische Industrie). Continuous production of transparent glass plates.* Nov. 20.

IX.—BUILDING MATERIALS.

Applications.

26,209. Craig and Ralston. Cement. [Addition to No. 935 of 1911.] Nov. 23.

26,268. Hasselmann. Process of preserving wood. [Addition to No. 12,587 of 1909.]* Nov. 23.

26,378. Frick. Production of bricks and furnace linings of magnesite. Nov. 25.

Complete Specifications Accepted.

648 (1911). Gilbert. Mixers for Portland cement and the like. Nov. 29.

1278 (1911). Arnott and Weston. Preparation of materials for laying dust. Nov. 22.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

25,228. Wigg. Obtaining metals from solutions Nov. 13.

25,369. Murex Magnetic Co., Ltd., and Lockwood. Magnetic preparation or oiling of ores, etc.* Nov. 14.

25,443. Scherfenberg. Process and apparatus for roasting ore.* Nov. 15.

25,506. Ashcroft. Treatment of sulphide ores or metal-bearing solutions and production of ammonia or ammonium salts. Nov. 15.

25,652. Horner (Hunter). *See under* I.

25,658. Woltereck. Reduction of metallic oxides in ores. Nov. 17.

25,659. Woltereck. Treatment of silicates of nickel, cobalt, and copper in the ore. Nov. 17.

25,697. Minerals Separation, Ltd. (Nutter). Treatment of complex sulphide ores, concentrates, etc. Nov. 17.

25,702. Hannover. Production of porous metals and alloys.* Nov. 17.

25,862. Aktiebolaget Elektrometall. Method and furnace for reducing or smelting ore with electric current. [Swed. Appl., Nov. 25, 1910.]* Nov. 20.

25,915. Hiorth. Process in the refining of iron and steel. [Appl. in Norway, Nov. 22, 1910.]* Nov. 20.

26,025. Mehner. Production of the alkali metals.* Nov. 21.

26,034. Head. Refining iron and manufacture of steel. Nov. 21.

26,128. Wright. Metallurgical treatment of pyrites or other iron sulphides. Nov. 22.

26,184. Stobie. Metallurgical furnaces. Nov. 23.

26,379. Frick. Method of recarburising in electric furnaces. Nov. 25.

26,381. Frick. Method of electric reduction of oxides. Nov. 25.

Complete Specifications Accepted.

23,744 (1910). Cowper-Coles, and Metalloids, Ltd. Scaling and annealing metals. Nov. 22.

23,870 (1910). Minerals Separation, Ltd. (Lavers). Ore concentration. Nov. 22.

23,949 (1910). Nutter and others. Ore concentration. Nov. 22.

26,262 (1910). Holloway. Ore dressing. Nov. 22.

26,356 (1910). Roux. Process for the transmutation of metals. Nov. 22.

26,788 (1910). Moulden and Webster. Zinc distillation. Nov. 22.

29,084 (1910). Seligman, and A.-G. f. Autogene Aluminium Schweissung. Welding of aluminium. Nov. 22.

4171 (1911). Rousseau. Crucible furnaces. Nov. 22.

5140 (1911). Helfenstein. Smelting furnace with electric refining hearths connected thereto. Nov. 29.

9941 (1911). Spezialfabr. f. Aluminiumspülen u. Leitungen. Securing insulating films or coatings on coils especially of aluminium and its alloys. Nov. 29.

12,214 (1911). Beskow and Ramén. Mechanical roasting furnaces. Nov. 22.

16,294 (1911). Michelin. Coating iron or steel. Nov. 22.

XI.—ELECTRO-CHEMISTRY.

Applications.

25,580. Ashcroft. Electrolysis of fused salts and anodes therefor. Nov. 16.

25,672. Specialfabr. f. Aluminium-Spülen u. Leitungen. Insulation of electrical conductors, coils, etc. [Ger. Appl., Nov. 21, 1910.]* Nov. 17.

25,890. Méttler. Electric furnace.* Nov. 20.

26,371. Helfenstein. Process for carrying out gas reactions in an electric furnace. [Austrian Appl., Nov. 26, 1910.]* Nov. 25.

26,380. Frick. Electric arc furnaces. Nov. 25.

26,382. Frick. Electric reduction furnaces. Nov. 25.

Complete Specifications Accepted.

27,562 (1910). Von Brockdorff. Electrical apparatus for heating or electrolysing liquids. Nov. 22.

60 (1911). Johnson (Badische Anilin und Soda Fabrik). Electrical purification of gases. Nov. 29.

13,021 (1911). British Thomson-Houston Co. (General Electric Co.). *See under* II.

16,902 (1911). Chem. Fabr. Buckau. Manufacture of magnetite electrodes. Nov. 29.

21,600 (1911). Knowles. Apparatus for purifying electrolytic gases. Nov. 22.

XII.—FATS; OILS; WAXES.

Applications.

25,326. Wimmer and Higgins. Reduction or hydrogenation of organic compounds such as fatty acids or their compounds. [Ger. Appl., March 11, 1911.]* Nov. 14.

25,672. Harrison. Apparatus for directly purifying and restoring oils. Nov. 17.

25,699. De Fazi. *See under* II.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

25,721. Johannes. Treatment of lac. [Divided Appl. on No. 26,759 of 1910.]* Nov. 17.

25,757. Mühlbauer. *See under* VII.

26,029. Aylsworth. Phenolic condensation products. [U.S. Appl., March 11, 1911.]* Nov. 21.

26,195. Tourneur (Herissen). Hygienic paint. Nov. 23.

Complete Specification Accepted.

26,759 (1910). Johannes. Treatment of lac. Nov. 29.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

25,256. Davidson. Extraction or coagulation of indiarubber from the latex. Nov. 13.

25,805. Plinatus. Manufacture of rubber substitutes. [Ger. Appl., March 18, 1911.]* Nov. 18.

25,894. Reynaud. Manufacture of indiarubber.* Nov. 20.

Complete Specifications Accepted.

11,624 (1911). Pfleumer. Manufacture of hot vulcanised froth from indiarubber, guttapercha, and balata. Nov. 29.

15,945 (1911). Marks (Dusseldorf Celluloid-Fabrik). Manufacture of plastic products resembling guttapercha. Nov. 29.

XV.—LEATHER; BONE; HORN; GLUE.

Application.

26,105. Macdonald. Treatment of leather. Nov. 22.

XVI.—SOILS; FERTILISERS.

Complete Specification Accepted.

19,045 (1911). Dunham. Treatment of phosphorites or phosphate rock to render same suitable for fertilising purposes. Nov. 29.

XVII.—SUGARS; STARCHES; GUMS.

Applications.

25,250. Disdier. Treatment of sugar cane.* Nov. 13.

25,749. Greenwood. Manufacture of mucilaginous products. Nov. 18.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

25,570. Pohl. Process for the promotion of fermentation. [Ger. Appl., Nov. 17, 1910.]* Nov. 16.

25,600. Dunstan. *See under* XIX.

25,879. Yenjo. *See under* XIX.

Complete Specification Accepted.

12,350 (1911). Wallerstein. Treatment of beer or ale. Nov. 22.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

25,600. Dunstan. Preparation of food extract from yeast. Nov. 16.

25,632 and 25,633. Evans (Neff and Brandes). Treatment of water. [Divided Appls. on No. 26,877 of 1910.]* Nov. 17.

25,879. Yenjo. Production of digestive ferment. [Appl. in Japan, Dec. 5, 1910.]* Nov. 20.

26,282. Corbett. Sewage purification works. Nov. 24.

Complete Specifications Accepted.

24,025 (1910). Billon-Daguerre. Producing and utilising hyper-ultraviolet radiations of short wave length for sterilising purposes. Nov. 29.

27,218 (1910). McClelland. Sterilising milk. Nov. 29.

9047 (1911). Triquet. Apparatus for sterilising liquids by ultra-violet rays. Nov. 22.

14,114 (1911). Howe and Davis. Artificial human milk. Nov. 29.

21,829 (1911). Helbronner and von Recklinghausen. Apparatus for sterilising liquids by ultra-violet rays. Nov. 22.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

25,246. Lilienfeld. Manufacture of sulphur derivatives from glycerine. [Austrian Appl., Nov. 12, 1910.]* Nov. 13.

25,326. Wimmer and Higgins. *See under* XII.

25,375. Keller and Taaffe. Extraction of nicotine. Nov. 14.

26,036. Sprengstoffwerke Dr. R. Nahnsen und Co. Preparation of monochlorhydrin. [Ger. Appl., Feb. 11, 1911.]* Nov. 21.

26,140. Viquerat. Antitoxins.* Nov. 22.

26,160. Sefton-Jones (Wülfing). Production of crystalline compounds of citric acid and hexamethylenetetramine.* Nov. 22.

26,234. Everard. Production of nicotine from tobacco.* Nov. 23.

Complete Specifications Accepted.

7591 (1911). Newton (Bayer und Co.). Manufacture of pharmaceutical products. Nov. 22.

9740 (1911). Meister, Lucius, und Brüning. Manufacture of 1-*p*-dimethylaminophenyl-2.3.4-trimethyl-5-pyrazolone. Nov. 29.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

25,271. Burnside. Preparation of papers, etc., for photographic printing. Nov. 14.

XXII.—EXPLOSIVES; MATCHES.

Application.

25,359. Fortuna-Werke A. Hirth. Apparatus for mixing and pressing smokeless powder. [Ger. Appl. Jan. 23, 1911.]* Nov. 14.

Complete Specification Accepted.

6956 (1911). Bichel. Explosive charges for projectiles, mines, torpedoes, etc. Nov. 29.

XXIII.—ANALYTICAL PROCESSES.

Applications.

25,261. Arndt. Apparatus for testing air or other gases and liquids. [Divided Appl. on No. 27,253 of 1910.]* Nov. 13.

25,265. Costa. Acoustic pyrometers.* Nov. 13.

25,543. Robb. Lubricant tester. Nov. 16.

25,587. Cambridge Scientific Instrument Co., and Whipple. Calorimeters.* Nov. 16.

Complete Specifications Accepted.

27,253 (1910) and 18,502 and 25,261 (1911). Arndt. Apparatus for testing air or other gases. Nov. 29.

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Birmingham Section.

Meeting held at Birmingham University on Thursday, October 19th, 1911.

MR. E. C. ROSSITER IN THE CHAIR.

THE INFLUENCE OF MINERAL INGREDIENTS ON THE PROPERTIES OF RUBBER.

BY CLAYTON BEADLE AND HENRY P. STEVENS, M.A., PH.D., F.I.C.

Part I.

The influence of progressive additions of zinc oxide and talc.

Introductory.—Each of the minerals commonly employed in compounding rubber contributes in its own peculiar fashion to the properties of the resulting vulcanised rubber. A few figures have been published and reference may be made to the work of Heintzerling and Pahl, Ditmar and others. Heintzerling and Pahl, who did most work on this subject, varied the nature of the ingredients rather than the proportions, and in many cases the compounds were so complex that no exact conclusions can be drawn from the results.

We have been engaged in studying the effect of different proportions of mineral ingredients, and the machine designed by Professor Schwartz of Manchester (The Testing of Rubber for Electrical Work, p. 725), (this J., 1910, 223) has enabled us to produce in a simple form a fairly comprehensive record of the physical properties of various compounded rubbers.

Experimental methods and results.—Schwartz has shown that the hysteresis curves obtained with his machine give more consistent results than tests made by us on the same specimens for elongation and load at rupture (*loc. cit.* p. 730). The specimens tested consisted of a series in which the rubber contents were progressively diminished and replaced by oil substitutes so that the amount of mineral filling remained constant throughout the series.

In the present experiments two series of mixings were made up, corresponding exactly with one another, containing one hundred parts of rubber and five parts of sulphur; in addition to which the first series contained zinc oxide in increasing proportions and the second series talc. Zinc oxide is known to have a marked and generally desirable effect on vulcanised rubber goods, and probably acts as a sulphur carrier, while talc was chosen as being an inert substance, and not likely to act in any way other than as a filler. In all cases the same rubber, a high class Para grade, was employed.

As a guide to the chemical changes taking place, we extracted a portion of each vulcanised specimen for eight hours in a Soxhlet's apparatus, and then determined the free sulphur in the acetone extract. These figures, expressed as percentages on the rubber and subtracted from the percentage of total sulphur employed, give the percentage of sulphur in combination with the rubber (and minerals) after vulcanisation. The results obtained are given in the third column.

Reference number.	Rubber.	Sulphur.	Pts. Zinc Oxide.	Combined sulphur per cent. on rubber.
1897	100	5	—	2·42
1898	100	5	½	2·68
1899	100	5	2	2·68
1900	100	5	5	2·73
1901	100	5	15	2·75
1902	100	5	40	2·80
1903	100	5	75	2·81
Mean of Zinc Oxide Compounds				2·74

Reference number.	Rubber.	Sulphur	Pts. Talc. per 100 pts. rubber.	Combined sulphur per cent. on rubber.
1904	100	5	—	2·40
1905	100	5	½	2·56
1906	100	5	2	2·55
1907	100	5	5	2·62
1908	100	5	15	2·53
1909	100	5	40	2·69
1910	100	5	75	2·60
Mean of Talc Compounds				2·59

It will be seen that numbers 1897 and 1904 are identical in composition, but were made up separately and the accordance shown in the results is a guide as to the degree of accuracy obtained by our method in the physical measurements as carried out on different samples of raw rubber.

The mixings were made exactly as in the factory, the greatest care being taken to preserve uniform conditions throughout. The rubbers in sheet form, 1 to 1·5 mm. thick, were wrapped together between layers of cloth round the same drum and cured together in steam. The specimens were vulcanised for three hours at 30 lbs. pressure. This cure was ascertained by preliminary tests and found to be suitable.

All samples were tested seven days later in the Schwartz machine by stretching five times to a given maximum load of 200 grams. per sq. mm. cross sectional area of the test piece, thereby tracing five successive cycles (*loc. cit.*, p. 715). The successive cycle test is conveniently tabulated as shown in the accompanying diagrams I. and II. by plotting the maximum extension for each cycle against the logarithms of the numbers of the cycles. Each sample of rubber is

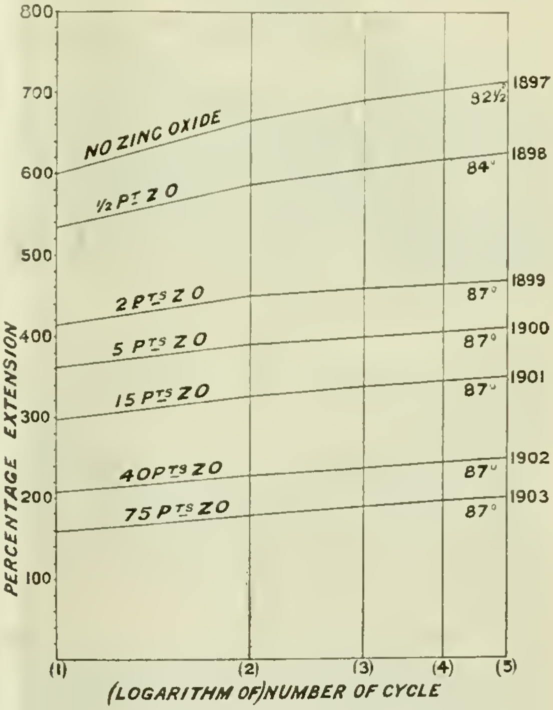

Diagram I.

Illustrating the effect of increasing proportions of zinc oxide on the cyclic extensions.

then represented as an approximately straight line. The nearer this line is to the base line of the diagram the greater is the resistance to stretching corresponding to the toughness or stiffness of the rubber. Also the smaller the angle produced by this line with the horizontal, the less is the effect produced on the extension by previous stretching—thus giving some measure of the elastic fatigue produced in the rubber. Obviously, a rubber on which previous stretching has had no effect in lessening resistance to stretching would be represented in the diagram by a horizontal line. The slope of this line will therefore be a valuable indication of the quality of the rubber. This may be conveniently expressed as

$$\frac{\text{Length of specimen at 5th cycle—length at 1st cycle}}{\log 5}$$

when 5 cycles are made and the original length of the specimen is taken as 100. This expression embodies the slope of the line and is independent of the dimensions of the chart.

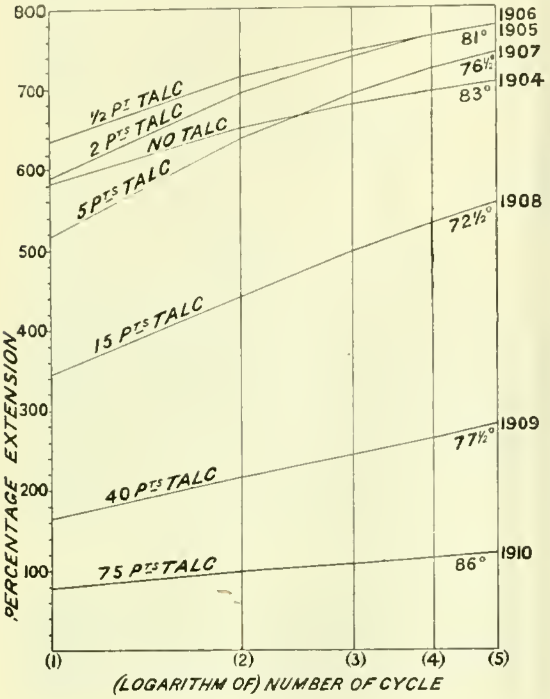

Diagram II.

Illustrating the effect of increasing proportions of talc on the cyclic extensions.

After stretching, the test piece remains to some extent distorted, and the extension remainder, or as we express it, "cyclic remainder," if measured after the five cycles have been completed, is expressed as a percentage on the length of the test piece before stretching. Diagrams III. and IV. show the effect of increasing quantities of the minerals on :—

(1) The extension limit with a given load in the first cycle.

(2) The extension limit with the same load in the fifth cycle.

(3) The cyclic remainder taken immediately after completion of the fifth cycle.

(4) The sub-permanent set produced by stretching the specimen to four times its original length for 24 hours, and measuring the increase in length 6 hours after release.

In these tests the results are all expressed as percentages of the original length. Test (4) differs in principle from that employed in measuring the cyclic remainder in the hysteresis experiments in that the stretching is much more prolonged and a longer time is given for recovery. Moreover, the samples are stretched to the same limit of elongation and not of load as in the hysteresis experiments.

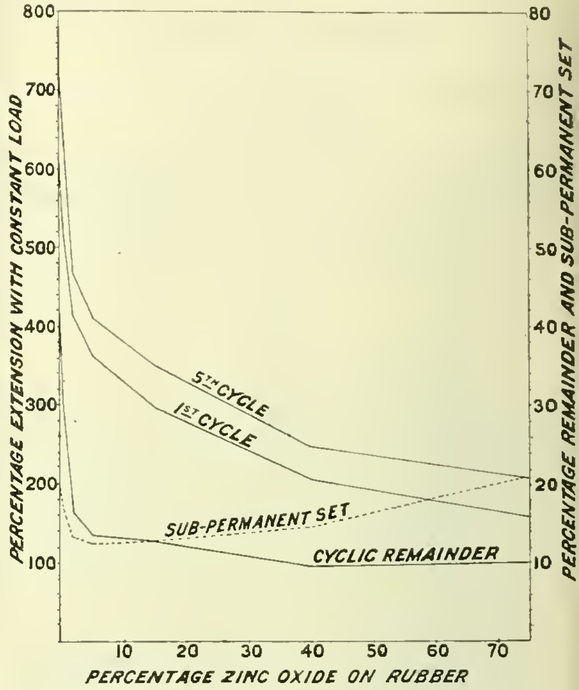

Diagram III.

Illustrating the effect of increasing proportions of zinc oxide on the cyclic extensions, cyclic remainder and sub-permanent set.

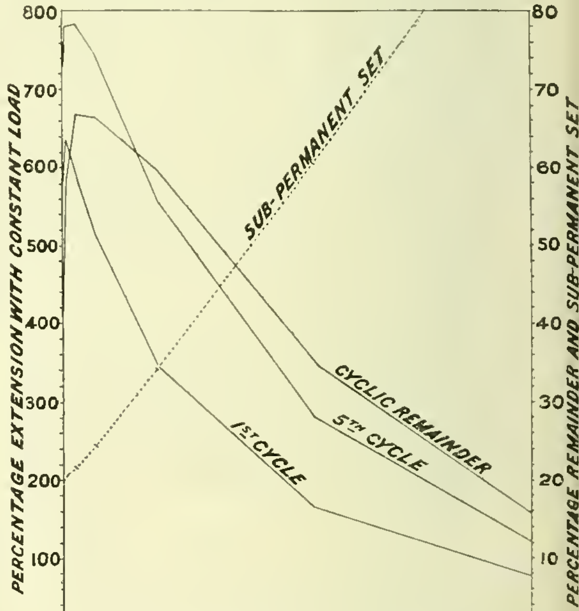

Diagram IV.

Illustrating the effect of increasing proportions of talc on the cyclic extensions, cyclic remainder and sub-permanent set.

Consideration of results.—A mere glance at the Diagrams I. to IV. is sufficient to show that there is a marked difference between zinc oxide and talc as ingredients of rubber mixings in their effects on the properties of the vulcanised compound.

Taking first the series containing zinc oxide, it will be noted that even so small a quantity as ½ per cent. produces a marked effect in a direction that may be regarded as an improvement in quality. That is to say, the rubber is tougher and is more resistant to stretching. It is also less affected by stretching, whether this be measured by the angle made in Diagram I., 96½° as against 97½°, or by the cyclic remainder 15·2 per cent. as against 20·4 per cent. or as the sub-permanent set after stretching for 24 hours giving the figure 8·6 per cent. as against 9·5 per cent.

Further additions of zinc oxide produce the same effect to a less and less extent, but in a perfectly regular manner, as will be seen by the regular form of the curves in Diagram III. When we reach the maximum proportions of zinc oxide we find that further additions are practically without influence except on the sub-permanent set, where the effect is the reverse of that produced by small proportions, and the figure begins to increase rapidly. This effect is largely due to the fact that all the samples in this test were stretched to the same extension limit and not to the same load limit as in the hysteresis experiments, with the result that the more highly mineralised specimens were in reality subjected to a much greater strain and therefore severer treatment. This test, which is based on the Admiralty Specifications, would be much improved if a load limit were substituted for an extension limit or if the extensions were so adjusted as to represent in each case a given fraction of the elongation at rupture. The test, as it stands, however, brings out an interesting relationship, as will be seen when we consider the talc compounded rubbers.

Passing to the sulphur estimations, it will be seen that the addition of very small quantities of zinc oxide is accompanied by an immediate increase in the combined sulphur and that further additions of larger quantities of zinc oxide produce a similar effect but to a relatively much smaller extent. One-half per cent. of zinc oxide causes an increase of 0·26 per cent. in combined sulphur and seventy-five per cent. a further 0·13 per cent.

We now come to a consideration of Diagrams II. and IV. showing the effect of increasing proportions of talc which may be assumed as inert both as regards rubber and sulphur.

In contrasting the behaviour of talc with zinc oxide it must not be forgotten that, so far as these substances act as inert fillers, the effect of talc, weight for weight, must be considerably greater than that of zinc oxide, as its specific gravity is only about 2·7 as against 5·6 for zinc oxide.

Taking first Diagram II., and comparing the effect produced by small proportions of talc with the corresponding proportions of zinc oxide (Diagram I.), the action is seen to be of a very different character. The addition of talc cannot be said to improve the quality of the rubber. The action is rather the reverse. Up to five parts of talc, the resistance to stretching is actually decreased and the lines run with a steeper slope (Diagram II.) showing that the talc compounded rubbers are more sensitive to mechanical treatment by stretching than the pure rubber or those compounded with zinc oxide. With each increase in the proportion of talc the effect produced is less marked, but 40 and 70 parts of talc have a greater effect in hardening the rubber than the same proportions of zinc oxide, corresponding to the greater bulking effect of the talc.

A comparison of the actual hysteresis extension curves produced in the Schwartz machine is interesting as showing the different types of curves produced by zinc oxide and talc compounded rubbers respectively. In the former (Fig. 2) the first stage* has the typical convex form of high class soft rubbers (Fig. 1) followed by the linear and, in the third stage, by the concave form. The same holds good for the talc compounded rubbers when the proportion of talc is very small; but with 15 parts of talc to 100 parts of rubber the curves end in the second, or linear stage, the third or concave stage having disappeared. With 40 parts of talc (Fig. 3) the first stage only remains and the extension curve is convex throughout.

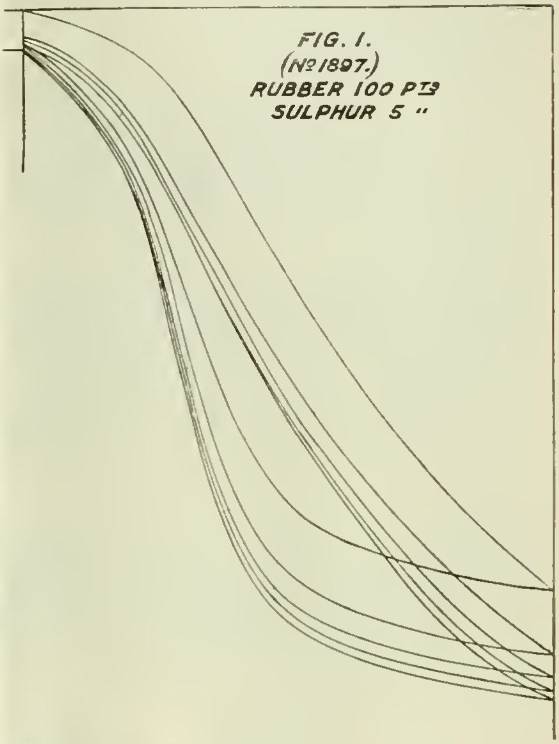

FIG. 1.
(No. 1897.)
RUBBER 100 PTS
SULPHUR 5 "

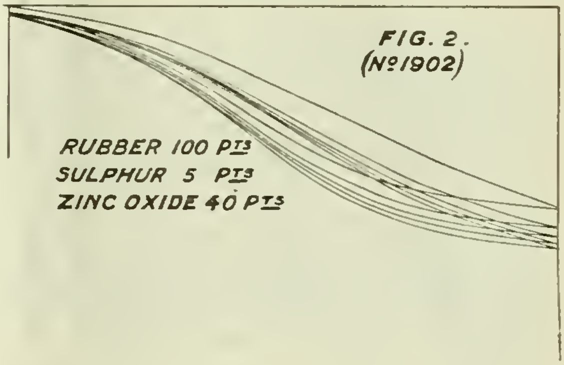

FIG. 2.
(No. 1902)
RUBBER 100 PTS
SULPHUR 5 PTS
ZINC OXIDE 40 PTS

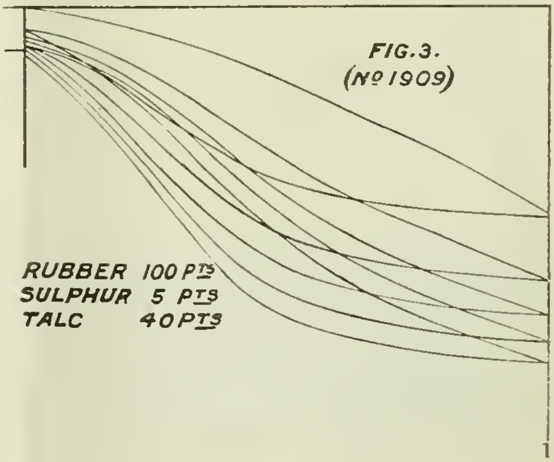

FIG. 3.
(No. 1909)
RUBBER 100 PTS
SULPHUR 5 PTS
TALC 40 PTS

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* *Loc. cit.*, p. 704.

Turning now to Diagram IV., it is seen that the extensions at 1st and 5th cycles and cyclic remainder are greater with small additions of talc than with rubber compounded with sulphur only, and all three curves take a turn upwards before descending again, instead of a sharp fall from the start as in the zinc oxide compounded samples.

Finally, the sub-permanent set for constant extension limit (4) shows an increase almost exactly proportional to the amount of talc contained in the compound. This is seen by the curve (see dotted line, Diagram IV.), which is practically a straight line sloping steeply in an upward direction. This may be contrasted with the corresponding curve for the zinc oxide compounds, which first falls steeply and then rises again at a gentle slope (see dotted line, Diagram II.).

The straight line referred to is an interesting feature of this class of compounded rubbers which we are investigating further.

The figures for combined sulphur show an increase with increasing proportions of talc, but the percentage of sulphur in combination would appear to remain lower than with the corresponding zinc oxide compounds. This relation is difficult to explain. If zinc oxide acts as a sulphur carrier and aids combination between the rubber and sulphur, we can only conclude that talc acts in a similar capacity but to a lesser extent in spite of its generally inert chemical nature.

It will be seen that one-half per cent. of talc increase the proportion of combined sulphur by 0·16 per cent., as against 0·26 per cent. in the case of zinc oxide. The analytical figures are not so regular with these talc compounded rubbers as with those of the zinc oxide series, but taking the average we get 2·59 per cent. sulphur in combination in the talc compounds as against 2·74 per cent. in the zinc oxide compounds and 2·41 per cent. in the rubbers compounded of sulphur and rubber only.

Part II.

The influence of progressive additions of magnesia.

It is well known that magnesia, even in small quantities, has a marked toughening action on vulcanised rubber compounds, and for this reason it is found to be of great service in compounding the lower grade rubbers which are often very resinous and tend particularly to soft products.

This series of experiments was carried out exactly as in Part I., but the raw rubber employed, although a Para grade, was a little inferior in quality. The mixings consisted of rubber, sulphur and zinc oxide—the two former always in the same proportions as before, viz., 5 parts of sulphur to 100 parts of rubber. The total mineral matter also remained the same throughout, but small portions of the zinc oxide were progressively replaced by magnesia. The composition and reference numbers and percentage of combined sulphur in the vulcanised rubbers were as follows :—

Reference number.	Rubber.	Sulphur.	Zinc Oxide.	Magnesia.	Combined sulphur per cent. on rubber.
1867	60	3	37	—	2·75
1868	60	3	36	1	4·37
1869	60	3	35	2	4·77
1870	60	3	34	3	4·83

Diagram V. gives the hysteresis effects. The replacement of one part of zinc oxide by the same weight of magnesia increases the resistance to stretching to the extent of about 120 per cent. and also increases the power of recovery, the line making a smaller angle with the horizontal.

The replacement of two parts of zinc oxide by magnesia has a considerable, but relatively much smaller effect, and with three parts the effect is relatively quite small. This is seen also in diagram VI. The curves made by the descending lines running nearly horizontal at the lower ends, and therefore the replacement of three parts of zinc oxide by magnesia in a total of one hundred parts of compound produces practically the maximum effect obtainable. The cyclic remainder is also shown in diagram VI. and takes the form of a similar curve running parallel with the others and almost horizontal in the last stages.

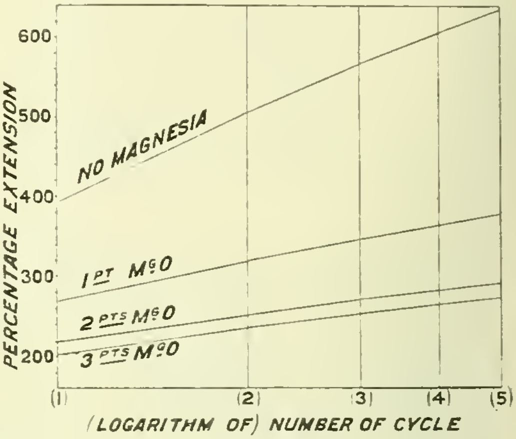


Diagram V.

Illustrating the effect of increasing proportions of magnesia on the cyclic tensions.

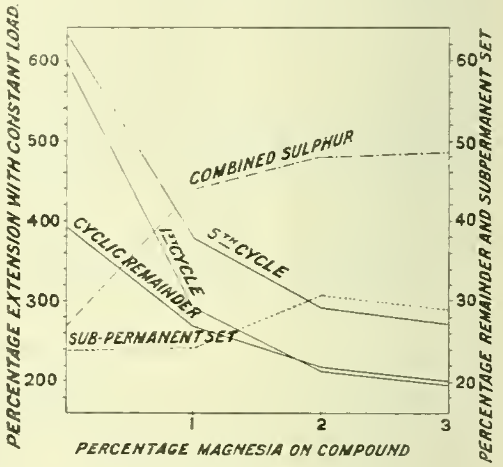


Diagram VI.

Illustrating the effect of increasing proportions of magnesia on the cyclic extensions, cyclic remainder and sub-permanent set.

The figures obtained for sub-permanent set are shown as a dotted line in diagram VI. The figures show an increasing value which tends to decrease again after two to three parts of magnesia have been used. This increased set is due to the greater resistance to stretching exerted by the magnesia compounded rubbers, as these require a greater force to stretch them to the same extension limit; consequently this test is more severe on the more resistant rubbers and these show up to a disadvantage as compared with the tests with a load limit.

The results obtained with these various mixings show that an increase in combined sulphur is accompanied in many case by a toughening of the rubber, and this is quite marked in the zinc oxide and magnesia series, the percentage extension with constant load increasing roughly proportionally with the percentage of combined sulphur. On the other hand, in the talc compounded rubbers we have increased percentages of sulphur in combination without improvement, and in some cases with actual inferiority of the vulcanised rubber.

We are indebted to our assistants for their help in carrying out the tests, to Miss A. Borrowman for making the sulphur estimations, and to Mr. J. Jacques for the physical tests.

Discussion.

The Chairman, referring to the combination of sulphur with rubber containing zinc oxide, asked by what method Dr. Stevens determined how much sulphur was combined with the rubber, and how much with zinc?

Dr. H. P. Stevens, in reply, said it was not known whether the sulphur was wholly combined with rubber, or partly with zinc. Probably, a little sulphur did combine with the zinc. It was difficult to know how best to tackle the problem. As to the curious effect of talc in increasing the distensibility of rubber, Ditmar made experiments with several minerals, using relatively large proportions, whereas they started with no mineral at all, and then used very small proportions, ½ per cent., 2 per cent., and 5 per cent. If they had started with 5 per cent. of mineral, they would not have noted the increase in distensibility. He believed that Ditmar worked with small quantities of rubber (5 grms.), but to get uniform reliable results a larger quantity—about ½ lb.—was necessary. The danger with a small quantity was that of overworking the rubber. As to the "pull" per sq. inch they had not given it in sq. inches, but in sq. millimetres. It was 200 g. per sq. inch. With the machines there was a little difficulty in determining accurately the maximum load at which they were working. Dr. Stevens illustrated the principle of the machine showing the method of testing the movement of the spring and the stretching of the rubber. To test the accuracy of the process they took a sheet of rubber, cut it into two parts, and mixed each half separately with the sulphur and minerals. The two compounds were then vulcanised side by side and tested separately. The difference between the figures obtained with samples was under 1 per cent., so that with care the method was very accurate. It was a better method for comparing rubbers than the tensile strength; for with modern machines, the latter method gave differences of as much as 50 per cent. between two test pieces cut from the same sheet. It was a simple matter to make a calculation as to the pull on the cross sectional area at full extension because rubber did not alter in volume when stretched.

NOTE ON THE EFFECT OF REWORKING TYPICAL PARA RUBBERS.

BY CLAYTON BEADLE AND HENRY P. STEVENS, M.A. PH.D., F.I.C.

It is well known that, in the ordinary making up processes in a rubber factory, a large part of the calendered sheet is cut to waste and this waste must be reworked to calender again, so that eventually a portion of the original compound may have to be so treated many times before it can be regarded as completely used up.

Obviously the effect of this reworking on the physical properties of the vulcanised rubber is a matter of considerable practical importance. The rubber which is but little affected by reworking offers considerable advantages over one that shows greater deterioration.

We considered it of interest to test the effect of reworking on three typical Para rubbers as shown by hysteresis tests.

The following typical rubbers were chosen:—

(1) A sample of fine pale plantation crepe, (2) a sample of fine hard para supplied to us in a washed and dried condition by a manufacturer as a particularly strong sample, (3) a sample of good quality Malay "smoked sheet."

The samples were masticated and mixed under uniform conditions, the mix chosen being the Admiralty 8a. Portions of the compound were reworked in the mixing rolls for one hour and these (1a, 2a and 3a) cured between cloth alongside of the original samples 1, 2 and 3.

We have plotted the results as in the preceding paper and we also give a table showing the percentage changes in the values obtained due to the reworking.

	Samples.		
	1.	2.	3.
Percentage increase in Extension Limit with given load in first cycle	15·3	12·6	6·2
Percentage increase in Extension Limit with given load in fifth cycle	16·7	13·6	7·6
Percentage increase in cyclic remainder ..	41·8	58·1	33·8

A consideration of the diagrams and the figures in this table show that reworking had the least effect on the sample of smoked sheet, which was therefore the best sample from this point of view.

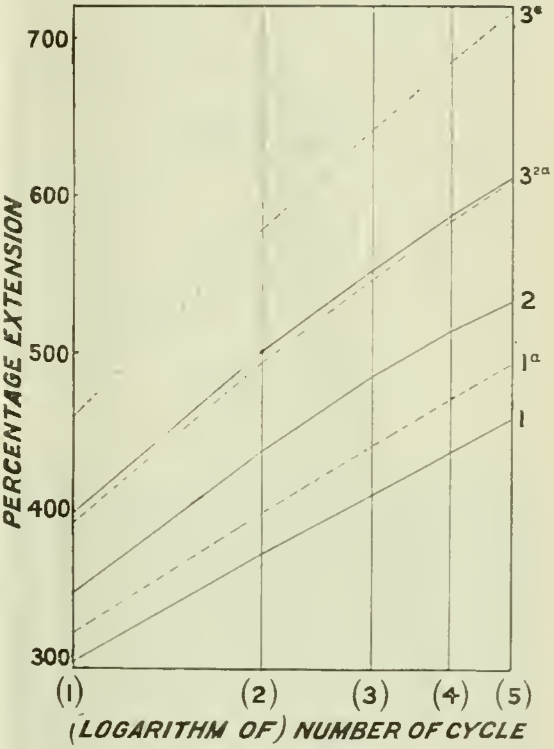


Diagram illustrating the effect of reworking Para rubbers.

It may be stated incidentally, that this sample was also the best rubber of the three, basing results on the above tests. Of the other two samples the pale crepe lost most in the matter of resistance to stretching (elastic strength), whereas the fine hard para lost most as regards recovery after stretching (elastic recovery).

Discussion.

The Chairman said that he was much impressed by the author's suggestion that in the reworking of rubbers the standard of quality suffered only to the extent of from 10 to 15 per cent. Many who used motors doubtless wished that such economy in loss applied to motor car tyres.

Mr. H. L. Heathcote said that he did not remember any case of a mineral ingredient increasing the "stretch" of a given load. That observation was, he believed, quite new. Ditmar, who made a number of experiments on mineral ingredients, found that "distensibility" was diminished even when an inactive substance like powdered glass was used. It seemed to him important in such experiments to record not only the pull per sq. inch on the original section, but the pull per sq. inch on the final section.

Dr. H. P. Stevens, in reply, regretted the Chairman had misunderstood him with reference to the reworking of rubber. He did not refer to the reworking of vulcanised rubber, but to unvulcanised. It applied only to the new waste rubber which accrued in the cutting up of the calendered sheets. In the stamping out of rubber for heels, pads or soles of boots, for instance, there was necessarily a lot of such waste, which was taken back to the machine, softened and calendered, and converted into a new sheet of rubber. This second treatment had a prejudicial effect on the rubber substance; such rubber in the case, for instance, of cut sheet formed second quality. The first quality was the rubber from the original sheet; and the second quality the sheet rubber made from the reworked material. It was important, when comparing rubbers, to know their value under reworking treatment; and from this point of view one type of plantation rubber gave better results than fine hard Para rubber.

London Section.

Meeting held at Burlington House on Monday, November 6th, 1911.

MR. E. GRANT HOOPER IN THE CHAIR.

DEFLOCCULATION.

BY DR. E. G. ACHESON.

(Abstract.)

The author in seeking to utilise commercially graphite artificially prepared by his process, was led to attempt the manufacture of graphite crucibles. Finding that American clays were deficient in binding power and that the clays used as plastic materials in the United States were imported from Europe, he investigated the causes of the difference in physical properties of the European sedimentary clays and the American residual ones. He came to the conclusion that the presence of organic matter in the water in which clays were borne to their place of deposition had a "deflocculating" effect on the relatively coarse granules, causing their disintegration into more minute particles. His researches in this direction have already been described in some detail in his address at the presentation of the Perkin medal (this J., 1910, 246). The production in 1906 of a soft graphite (*loc. cit.*) led to the application to this material of deflocculation, which the author considers may be best described as the reverse of flocculation, which is defined as "the union of small particles into granular aggregates or compound particles." In the subdivision of such compound particles the resultant units are so small as to pass through the best filter paper.

Experiments with the author's graphite lubricants, Aquadag and Oildag, were shown and the differences between deflocculated materials and the same materials reflocculated by the influence of electrolytes were demonstrated by him. Measurements of the deflocculated particles by Mr. J. Alexander were referred to. The particles were found to be in a true colloidal state, being in rapid motion, and their average size in linear dimensions was estimated by Mr. Alexander at 75 millimicrons. The probability of the molecular condition of these particles was suggested.

The part played in many natural processes by the deflocculating power of organic matter in solution was suggested by the author in 1910 (*loc. cit.*), and he again indicated the various directions in which such deflocculative action probably occurred.

The experiments of Prof. C. F. Mabery with deflocculated Acheson graphite in both water and oil—Aquadag and Oildag—show that they are valuable lubricating materials, and practical experience has in many cases confirmed the results of these small-scale experiments. Latterly, Aquadag has been found useful as a "cutting compound" in metal turning and boring. Tools lubricated with this material last many times as long without resharpening as if the usual "cutting compounds" were used.

The author pointed out that the consumption of lubricating oils was increasing so rapidly that a shortage might not become unlikely in the not too far distant future. He therefore hoped, on the strength of Professor Mabery's report, that he had succeeded in prolonging the life of the mineral oil industry by supplying an article which did five times the amount of work, weight for weight, done by the present lubricants.

The author concluded with the following apt quotation: "It is generally the fellow who doesn't know any better who does the thing that can't be done. He doesn't know that it can't be done, so he goes ahead and does it."

Discussion.

The Chairman said that although Dr. Acheson had confined his attention more especially to the lubrication film, his work in connection with deflocculation might have in the future considerable importance in connection with brick-making and ceramics, which had only been touched upon incidentally. In connection with lubrication there were two points on which he would like to hear something more. Assuming that the rôle of a lubricant was simply to keep two surfaces apart, possibly some of the other deflocculated substances referred to might serve for that purpose. Had Dr. Acheson compared graphite with some of these other substances, and if so, could he state their relative efficiency as antifriction agents? The second point had to do with the increased efficiency of the special cutting tool which had been mentioned. With a cutting or drilling machine, lubrication was not exactly wanted at the cutting face though behind the cutting face there might be friction to be avoided if possible. He would like to get some explanation of the increased efficiency of the tool when, the only useful effect of the anti-friction agent appeared to be behind the cutting edge. On visiting some large engineering works recently he had been struck by the fact that quite a considerable stream of oil was kept running over the surface, being cut or drilled by fast machines, and he was under the impression that the use of this relatively large quantity of oil was merely with the object of keeping down the temperature. On the general subject that had been brought before them that evening he thought that consideration and discussion might proceed under two heads. First, was graphite under these conditions colloidal, or did the term deflocculated used by the author more properly and correctly represent its state? And, secondly, there was the important practical question of the actual and relative efficiency as lubricants of deflocculated graphite in the form of Aquadag and Oildag. On this latter point he thought that the testimony which would most appeal to them was that furnished by the carefully recorded results of responsible investigators. Though undoubtedly not of immediate importance, they could not afford to ignore the possibility in this mechanical age of a continuous increase in the demand for lubricants and the probability of a considerable diminution of the quantity and ultimate exhaustion of the mineral oils now available. Very few users of lubricants would desire to go back to the substances which were employed in the days before petroleum was known, and if so they would be the more likely to give full consideration to the claim that the preparations brought before them were more efficient lubricants than those with which they were now familiar.

Dr. Messel asked whether the graphite in Aquadag would not separate out in cold weather, especially when the water froze.

Mr. L. **Archbutt** said it struck him in reading the account of Dr. Mabery's work, that in the machine which was used by Professor Carpenter there must have been a good deal of solid friction, and if so one could understand that a lubricant containing graphite in the form in which it was deposited as a film on the rubbing surfaces must necessarily largely reduce the friction. He had not seen or read any account of experiments in which there was every reason to believe the friction really was film friction, such as Professor Osborne Reynolds and Mr. Beauchamp Tower had shown them must take place for lubrication to be most effective. That is to say, under the conditions of perfect lubrication there was a complete film of oil between the bearings and the journal, and the whole of the friction was due to the viscosity of the oil. He had not seen any experiments in which it was quite certain those were the conditions which obtained, and in which the influence of deflocculated graphite had been clearly shown. It might be that only having read Professor Mabery's papers and not having seen the machine he had formed a wrong impression, and perhaps Dr. Acheson could throw a little further light on the point. He would also like to hear the results of any experiments showing what effect the addition of deflocculated graphite in the small proportion used had on the viscosity of the oil as measured in an absolute viscometer. His interests in connection with lubrication were chiefly concerned with the lubrication of railway vehicles and locomotives, in which an enormous amount of oil was used and a great deal wasted. In the axles of railway coaches and waggons the oil was retained and did not get wasted to the same extent as it did on locomotives. On locomotives the conditions were such that a great deal of the oil that was dropped on to the journals and friction surfaces ran away to the ground. It was, therefore, necessary to have a very cheap lubricant, and he thought at the present time the price at which " oildag " was supplied prohibited its being used for that purpose to any great extent. For cylinders it could be used, and for cylinders using superheated steam he should think there was a great field for it. Those who were familiar with the lubrication of a locomotive knew that for all the ordinary bearings the oil was lifted from a reservoir through a worsted trimming called a syphon, from which it dropped on to the journal. The question became very important: would the graphite rise through the worsted trimming and be carried over or would it remain behind in the reservoir? He had made some experiments to ascertain what would occur, and he thought the results might interest Dr. Acheson if he had not already made such experiments. The oils used were first of all a pure mineral oil which Dr. Acheson would know under the name of red engine oil, which was one of the Standard Oil Company's products, and secondly, the same oil mixed with 15 per cent. of rape oil. Both oils were mixed with " oildag " in the proper proportions, and the percentages of graphite in the mixtures were 0·176 and 0·172 per cent. respectively. Each mixture was put into a lubricator, and the oil was collected which was syphoned over by the worsted trimming after it had been working for an hour, and the graphite was found to be 0·162 and 0·181 per cent.; that was to say within the limits of error the graphite had passed over without any diminution. The experiment was then carried on for a further five hours, and at the end of that time the percentages of graphite in the oil siphoned over were found to be 0·163 and 0·171, so that in five hours the worsted had continued to syphon over the oil and graphite without separation. That was a very remarkable result.

Mr. G. T. **Holloway** said that he would confine his remarks to the question of clay and minerals generally, and particularly to the reversal of the operation of deflocculation, *i.e.*, to the flocculation of suspended particles. This was, perhaps, of even more importance to the mining man and those who were interested in the dressing of minerals. Dr. Acheson had told them that sedimentary clays were usually the most plastic, those which were found *in situ* being inferior in that respect. This was doubtless true to a great extent as regards ordinary clay, but it could scarcely be regarded as correct in connection with china clay. All the china clay of Cornwall, for instance, was obtained from decomposed granitic material which was found *in situ*, and it was the most plastic china clay in the world. The waters of the St. Austell district, from which practically the whole of the Cornish china clay was obtained, were distinctly alkaline and were free from the electrolytes which the lecturer had shown them were so effective in precipitating what might be called " colloidal clay." In working these china clay deposits, they were broken down, carried by a stream of water through devious paths, pumped up, settled in a series of depositing pits and finally carried, as a cream, to the drying floors. In this way they received a considerable amount of water treatment and acquired or retained a high degree of plasticity. Many attempts had been made in Cornwall and elsewhere to improve the colour of china clay by chemical means and some of them were effective, although distinctly expensive. The principal objection to many of them was the fact that they generally employed an electrolyte which decreased the plasticity of the clay so much (although the colour was improved) that its binding value and covering power, *i.e.*, its value for ceramic and paper making purposes, etc., were much reduced.

Regarding the dressing of minerals (which was perhaps as a business matter, as important a point as could be brought out in connection with the paper, apart from the question of graphite for lubrication), the bearing of the lecturer's remarks was particularly important in connection with the treatment of " slimes." If the slimy matter in a mineral which had to be dressed and which was commonly regarded as being of a colloidal nature, were treated with an electrolyte, the material became flocculated and to a great extent lost its slimy nature. As everyone knew, the use of an electrolyte such as lime was commonly employed in the treatment of gold ore, to neutralise acidity and, incidentally, to deposit the slime, but he was not aware that flocculation, under the present meaning of the term, had been employed as a step in the removal of heavy material from light ones by ordinary dressing operations. He thought that would be a very important reversal of the principle of deflocculation. He did not know whether the Egyptians could claim greater antiquity for bricks made without straw than the Chinese could for vermilion, or the Indians, Japanese and Chinese for Indian ink, but he thought that, if Dr. Acheson searched through the old descriptions of the manufacture of these materials, he would find some interesting records in which, although tannin was not used, gums and many curiously compounded mixtures, having probably a very similar action, were used. The materials used were chosen for no *apparent* reason, and were incorporated in a manner which was more of the nature of mixing than of grinding. Brief descriptions of the native methods of making vermilion and Indian ink would be found in Thorpe's Dictionary of Applied Chemistry, and he thought that the wonderful power, possessed by Indian ink, of remaining in suspension, especially considering the manner in which it was prepared from lamp black, might be explained on somewhat the same lines as appeared to be the explanation in the case of Acheson's deflocculated graphite.

Mr. **Hatschek** said there were two statements which he had found it exceedingly difficult to reconcile. One was the ultra-microscopic measurements made by Mr. Alexander, which showed that the particles in deflocculated graphite were 75 $\mu\mu$. dia. From the demonstration he should have thought they were probably bigger, because the minimum size at which particles produced turbidity had generally been put at 100 $\mu\mu$. That, however, depended on the opacity of the substance, the refractive index and other factors. Dr. Acheson had suggested the probability that the graphite was broken up into molecules. He must say that those two statements appeared to him to be irreconcileable. A very large number of experiments had been made by the most distinguished investigators, beginning with Plateau and Bunsen and ending with Lord Rayleigh, on the thickness of thinnest films. He thought the smallest figure found was that obtained by Wiener for the finest perceptible silver films, which was 0·2 $\mu\mu$. That was 1/375 of the dimension of the graphite particles. It was extremely improbable that the silver film consisted of one molecule only, but supposing it did that would be the ratio, and the ratio of the masses would be the cube of that. That was, roughly speaking, 64,000,000, if they took 400 instead of 375, which he thought was a very considerable divergence. He admitted that they knew nothing about the graphite molecule, which was regrettable, but it was very improbable that it should be of such unusual dimensions. The impression that the phenomenon of precipitation or flocculation by electrolytes was confined to colloids, of course was not correct. The sedimentation or flocculation of coarse suspensions (and by coarse suspensions they meant suspensions which if left to themselves would settle in a comparatively short time) was a phenomenon which had been known and investigated carefully for about 60 years. In 1851 Scheerer in the "Annalen der Physik" had given the results of experiments made on suspensions of quartz particles, the sedimentation of which was much accelerated by acids and also a number of salts. In 1866 Schulze gave the results of similar experiments, and in 1870 Schloesing in the "Comptes rendus" gave the results of experiments on soil suspensions; he had found that if water free from carbon dioxide was run through soil it came out turbid, but if it contained carbon dioxide it was clear. This author also called attention to the probability that that phenomenon accounted for the sedimentation of matter carried into the sea by rivers. The effect of carbon dioxide was, of course, classical. In Graham's investigation of colloidal silica, some specimens could not be precipitated except by extraordinary quantities of hydrochloric acid, but were precipitated by bubbling carbon dioxide through them. But the history of precipitation came down to more recent times. In 1886 Barus published in one of the bulletins of the U.S. Geological Survey the results of a very large number of experiments on suspended mineral matter. The results of course were all uniform: electrolytes precipitated them, but a large number of non-electrolytes had no effect. In 1893 Bodlaender published a series of researches, which were now classical, on clay suspensions. Their importance was due to the fact that they established for coarse suspensions certain relations between different electrolytes, and especially between the efficacy of cations of different valency, which had also been established in the case of colloidal solutions, and had come to be known as "Hardy's Rule" of precipitation. In this connection he might mention that, if Dr. Acheson had tried on his "Aquadag" aluminium chloride or any other salt of a trivalent metal, instead of hydrochloric acid, the result would probably not have been quite so satisfactory; but that, of course, was known in connection with all suspensions.

Mr. J. Veitch Wilson said that his investigation had been more concerned with the practical and the commercial than with the scientific aspect of the subject to which their attention had been chiefly directed on this occasion. As he listened to the paper a few points had occurred to him. In regard to one of these, the use of lubricants at the cutting edge in cutting tools, he had been much interested in and entirely sympathetic with the Chairman's very pertinent remarks. The subject was one to which he had lately given considerable attention, and, in his dealings with practical men, it had been impressed upon him that successful lubrication at the cutting edge would impair the efficiency of the tool. It is generally accepted by engineers that graphite, as they had heretofore known it, was a very useful lubricant under certain conditions. It seemed to him, however, that it was rather as an aid to lubrication, than as a lubricant itself, that its value appeared. Its advantages consisted in filling up irregularities in metallic bearings, but even the most perfect surfaces could not dispense with oil and it was difficult to realise that any quantity or quality of graphite could be as finely divided, without "shearing" as a film of oil.

He was tempted to wonder, by the experiments which had been shown, by the information which had been given and particularly that regarding the origin of "D.A.G.," whether it was really such a graphite as they had known in the past, or whether it was a different material altogether which acted in the same manner and gave the same effective results as the graphite with which they had been previously acquainted.

Dr. Acheson recommended his deflocculated graphite for internal combustion engines. In the earlier days of the motor-car trade the engineers objected to all kinds of fatty oils, as being liable to produce gummy and carbonaceous deposits, and they adopted pure mineral oils regarding them as free from this tendency. But deposits continued and were only overcome when, and to the extent that, mineral oils were replaced by or mixed with refined vegetable oils. Various fatty oils such as rape, olive, castor, sperm and some other oils might be burned in open lamps (Miller's) without smoke, while mineral oils of any kind, under similar conditions, produced volumes of dense smoke, unconsumed carbon. Recourse had therefore been had to the fatty oils which had been relegated to the shelf, and now, when important events or trials were undertaken, castor oil, pure and simple, was adopted for several aeroplane engines, and for some cars, while compounds of vegetable and mineral oils are preferred when it was desired to get the best out of any engine. Dr. Acheson told them that his deflocculated graphite would not produce such deposits and cited the experience of American motorists in support of his contention. But as the graphite was not likely to be burnt away, or volatilised, as oil might be, one was tempted to wonder what became of it in a petrol engine and how it would behave in a British engine. Dr. Acheson recommended his "D.A.G." for ball-bearings, but the best possible authorities (such as Messrs. Hoffmann), consider graphite a dangerous thing to use on such fine surfaces. The ideal lubricant for such bearings was a solidified oil or grease, chemically neutral, and free from mechanical impurities and from moisture, the principal function of such a material being not so much lubrication as the exclusion of air, water and dirt from the ball race. What effect would "Aquadag" have on metallic bearings when it was the sole lubricant used?

Mr. Walter F. Reid did not think many of those present would have endeavoured to make almost pure graphite from a material containing 40 per cent. impurity to begin with. They would probably have used the purest carbon obtainable and would have found it did not conduct electricity, and they would have failed. For years he remembered carborundum was not known to English mechanics when it was being used practically in every factory in the United States, and it had only in the last two or three years become generally known in this country. He remembered many years ago in the Argentine when Europeans first started brick-making, all the natives said, "You will fail if you try to make bricks from the clay down below. You must use the black earth on the top. If you do not use the clay mixed with organic matter from the surface you will not get good bricks," and it was only when they started a factory making over a million bricks a month by machinery that they believed it could be done. He understood that the Chinese used organic matter mixed with their china clay long before the birth of Christ, and they stored it for a great number of years in a cellar underground mixed with this organic material which enabled them to get the beautiful thin vessels which were the admiration of our forefathers, and which were only just beginning to be accurately copied. It was an actual result they obtained, and they did not quite know why. One writer on the subject had not been mentioned, and he thought he should not be omitted because his book was the most interesting book on the subject. That was Bischoff's Chemical Geology. They would find there very interesting data with regard to the deposition of clay matters in rivers. The whole of the London clay had been deposited in brackish water at the place of contact with a river which flowed from the north into the ocean. Dr. Acheson had not given the reason why it should be so, but clearly the salts in the sea water neutralised the effect of the organic matter in the rivers. Why it was they did not know, and here was a subject for the scientific man with time and leisure to work out.

Dr. Ernst Brühl wrote that the remarks of Mr. Holloway regarding the flocculation and deflocculation of clay and ore slimes reminded him of a difficulty which he had experienced in obtaining uniformly sized particles of emery for some metallographic researches. With ordinary water, he found separation by suspension practically impossible, but when, at the suggestion of Le Chatelier, he employed distilled water to which he had added 0·1 per cent. of ammonia in the form of ordinary ammonia solution, the suspension of the particles was much more prolonged and it was possible to separate them more completely. After each size had been poured off, he found that the material, which normally deposited extremely slowly, perhaps only after some weeks, was rapidly settled by the addition of an acid, as in the case of Dr. Acheson's deflocculated graphite. He attributed the efficiency of the alkaline solution partly to the overcoming of the surface tension of the particles and partly to difference in viscosity.

In some other cases, spirits of turpentine or glycerine were found preferable to water for such separation of different sized particles. He would refer also to such material as Berlin blue which, itself insoluble in water, is stated to become soluble, or at least to remain in suspension, when treated with molybdic acid and water. This solution or apparent solution could be precipitated by the addition of a strong acid, and could be again rendered soluble by washing.

Dr. Acheson, in reply, said he felt that it might be possible to use other colloidal bodies than graphite in lubrication, but he had made no experiments in that line.

He had had no practical experience of the use of graphite as a cutting compound, but many others were meeting with great success, using the Aquadag mixed with their ordinary cutting compounds; for example, one manufacturing concern in Chicago, after approximately one year's experimenting with Aquadag, had adopted it throughout their works.

From his experience he found that no injury was produced by cold on deflocculated graphite when diffused in oil, but cold resulted in the complete ruin of Aquadag (concentrated). When Aquadag was cooled to a point below 35° F., flocculation of the graphite would occur with resultant sedimentation. He was now endeavouring to overcome this difficulty by putting the Aquadag into glass jars with rubber gasquets, and these, after being warmed, were placed in felt-lined cases and passed on to the Express Companies for quick delivery to the consumer. He did not feel competent to discuss the results of Prof. Mabery; their experiments were carried out on a Carpenter oil testing machine. He had no evidence that the viscosity of a lubricant was increased as a result of the presence of the graphite; the actual amount of graphite in five gallons of oil was approximately one cubic inch, so it was scarcely to be expected that the viscosity would be materially increased. Regarding the cost of Oildag, he said that the market value of the oil saved as a result of mixing the Oildag in the oil, more than paid the cost of the Oildag. For instance, the presence of the deflocculated graphite in one gallon of oil would make it the equivalent of 2½ to 3 gallons of such oil alone, while, at the same time, the deflocculated graphite added to the oil would cost less than one gallon of the oil. The amount of lubricating oil produced in 1908 was 1,281,700,000 gallons. If that amount were sold at 1s. per gallon (in some countries the cost would be over 1s., and in all countries the higher grades were considerably over 1s.) the total value of the year's production would amount to more than £60,000,000. By introducing Oildag, the outside cost, including the Oildag, would be reduced as a result of the decrease of the oil consumption by approximately one-third of the amount. There were many theories about "suspension and diffusion." The word "suspension" was first used by his Company when referring to his deflocculated graphite, but realising that it would lead to the belief that something was being "held up," he had substituted the word "diffusion." He kneaded or masticated 750 lb. of graphite in his mills for a considerable time, after which it was mixed with large volumes of water, and allowed to stand for three weeks, during which time all particles that were not properly deflocculated became tailings, the part remaining in the water being then run off, and passed through a filter-press, thus obtaining a paste, which he termed "Aquadag Paste," carrying about 50 per cent. of water and 50 per cent. of graphite. After deflocculating 750 lb. of graphite he had found that no less than 50 lb. had disappeared. On diluting a small amount of the product that was being masticated in a mill and heating it on a water bath, a very volatile, light straw-coloured liquid having a strong aromatic odour was found in the condenser attached. He had succeeded in producing the same effects with natural graphite but not so easily, owing to the fact that his artificial product was not nearly so dense, as a result of the volatilisation of the carbonaceous impurities in the charge of his furnace. As a practical application of deflocculated graphite, he cited its use in an automobile, using one gallon of oil in lubricating its four cylinders while travelling 200 miles. This gallon of oil during 200 miles was able to pass the piston rings into the combustion chamber of the motor, and considerable amounts of carbon were liberated, which filled the spark plugs, produced black vapours from the machine, and were in other ways injurious. When Oildag was used for lubricating the cylinders, one gallon was sufficient for 750 miles, and then owing to this decreased rate of escape of lubricating oil into the combustion chamber, the liberated carbon was entirely taken care of by the exhaust, and all smutting of the spark plugs, and pitting of the valves were practically eliminated. This decreased consumption of lubricant he attributed to the production of a veneer of graphite on the cylinder walls and piston rings, with the result that a closer fit of the piston rings to the cylinder walls was obtained, so that while the oil was just as freely splashed up on to the walls of the cylinders, it was just as completely wiped back by the return stroke into the crank case. This increased fit between the cylinder walls and the piston rings conversely prevented the escape of gas in combustion between the cylinders and piston rings, thus resulting in a corresponding saving of power or energy generated by the combustion of a given amount of gasoline. A lubricating body must move within itself, but must also have sufficient viscosity to avoid its final film being broken when subjected to pressure of the bearing surfaces. He believed that the mechanical world, twenty years from to-day, would look back, and say: "How foolish for these men to have tried to efficiently lubricate and effectually separate two metal surfaces with a liquid." If all present lubricants were liquids, irrespective of their viscosity, if sufficient time were given, the metals would come into contact, but if a colloid were introduced into the liquid, there was present a solid which would fill up all pores, produce a veneer, and absolutely and effectively prevent the metals from coming into contact, and, he believed that in twenty years the scientific world would not think of using anything else for the purpose of lubrication.

Meeting held at Burlington House, on Monday, 4th December, 1911.

MR. E. GRANT HOOPER IN THE CHAIR.

THE PHYSICAL PROPERTIES OF CLAYS.

BY WALTER C. HANCOCK, B.A. (CANTAB.), F.I.C.

The study of the physical properties of clays has not received as much attention in England as it has on the Continent and in the United States. In many cases, where a fresh source of clay has to be examined, a sample is merely subjected to an ultimate chemical analysis, and though the information thus obtained is useful on certain points, no idea is gained of the actual working properties of the clay. In some branches of manufacture, this want has been met to an extent by the "rational" analysis, which is really a chemical method of separating the main mineral constituents into three classes, viz., "Clay substance," Quartz and Felspar, or "Acid silicates." The actual working properties of a clay, however, can only be judged from definite measurements of such properties as plasticity, shrinkage, behaviour on firing, etc., and a full investigation of a clay should include the ultimate and rational analyses and determinations of the physical properties. The following table shows that two clays may have very similar chemical and mineralogical composition but differ widely in physical properties.

Ultimate analyses.

	No. 89.	No. 96.
Silica	51·5	52·0
Alumina	32·7	30·3
Combined water	9·5	10·6
Alkalies	3·2	·6
Balance	3·1	6·5
	100·0	100·0

Rational analyses.

Clay substance	71·9	85·4
Quartz	24·7	13·4
Felspar	3·4	1·2
	100·0	100·0

Physical properties.

Plasticity number	35·2	14·3
Shrinkage on drying	4·1	3·1
Tensile strength	37·5 lb.	42·0 lb.
Texture :—		
"Clay"	29·3	17·0
"Silt"	27·0	6·8
"Dust sand"	10·4	8·2
"Sand"	33·3	68·0
Shrinkage on firing (1300°C.)	14·1	8·0
Tensile strength	136·0 lb.	153·0 lb.
Porosity	11·0%	5·2%
Fusibility	Cone 28	Cone 29

No. 89 is a very plastic pottery clay and No. 96 a coarse-grained fireclay very deficient in plasticity.

The results of a large number of American clays on these lines have been published in Reports issued not only by The United States Geological Survey but also by the Surveys of many of the individual States of the Union, and recently several English clays have been examined under the direction of The Geological Surveys of England and Wales and of Scotland. The ultimate chemical analyses were made at the Survey Laboratory in Jermyn Street, the results of the rational analyses were embodied in a paper to this Society (March 7, 1910), and the present paper deals with the physical tests carried out on these clays. As far as I am aware these records constitute the first published results of such investigations, though at present no attempt has been made to examine English clays as a whole and only some china, stoneware, "ball" and fireclays have been tested.

The provisional scheme of physical tests adopted after consultation with the authorities on the Survey was practically that followed by the United States Survey, and embraces the general properties on which information would be required. The scheme has been regarded as provisional and left susceptible of modification as experience might direct.

The tests fall naturally under two heads: (a) tests on the raw or unburnt clay and (b) tests on the fired clay, and include :—

(A)	Specific gravity	(B)	Specific gravity
	Plasticity		—
	Shrinkage on drying		Shrinkage on firing
	Tensile strength		Tensile strength
	Texture, or size of grain		—
	—		Porosity
	—		Fusibility

Obviously there are a number of other physical properties, a knowledge of which would be useful for particular purposes, such as specific heat, capacity for heat, conductivity for heat and electricity, and expansion on heating, but these refer to the application of clays to special uses.

Specific gravity.—This can be easily taken with an ordinary specific gravity bottle with attention to one or two details. In the natural state clays retain a certain amount of moisture, which must be removed by drying at 100° C., and also occluded air. The amount of air may be decreased by using fairly finely crushed clay, but the last traces must be removed by exhaustion with a pump. The average figure obtained was 2·6 to 2·7 in the clays tested. In some cases the specific gravity is about 0·1 lower in the thoroughly fired material, but does not seem to be so in the more silicious clays.

Plasticity.—The production, by admixture of a suitable quantity of water, of a plastic mass that can be moulded into any desired shape which is retained on drying is one of the fundamental facts on which the applicability of clays depends. In a proper working condition a lump of "tempered" clay can be rolled in the hands without sticking to them, and the "feel" of the clay is really a good criterion as to whether the sample is plastic or not, though of course not susceptible of measurement. The measurement of plasticity is in fact one of the most difficult, and several methods have been suggested. One consists in determining the quantity of aplastic material, such as sand of a standard size of grain, that can be added to a definite amount of a clay without seriously impairing the plasticity for practical purposes. The determination of the length, or weight, of a thread of clay that can be expressed from a die without fracture has also been taken as a measure of the plasticity, but is really rather a measure of the tensile strength of moist clay, and any imperfections in the surface skin of the thread would easily vitiate the results. Several processes are based on the assumption that the plasticity varies directly as the amount of water required to bring the clay into a proper working condition. Wheeler (Missouri Geol. Survey) gives the following quantities of water required for maximum plasticity in the classes of clay mentioned :—

	Per cent.
Loess or brick clay	16—19
Fire or potters' „	15—33
Flint clay	15—24
Kaolins	18—35
Shales	14—25

Though the range in these different classes is very wide, the percentage of water required by any particular clay is fairly constant, and affords the simplest means of arriving at a numerical value for the plasticity. In order to bring different samples under the same conditions, the clay is worked up with more or less water, by repeated trials, until a Vicat needle of 1 sq. mm. area penetrates a lump of tempered clay 4 cms. thick in 5 minutes. The lump is then dried at 100° C. and the percentage of water, calculated on the weight of dry clay, gives the "Plasticity number," thus :—

$$\text{Plasticity number} = \frac{\text{Weight of water}}{\text{Weight of dry clay}} \times 100$$

According to Grout, plasticity may be expressed as the product of "compression strength" (measured by a Vicat needle) and "amount of possible flow," determined by the increase in the area of the head of a test rod of the clay when compressed to the point of fracture (this J., 1905, 1087). Recently the amount of organic and inorganic colloid matter in clays has been proposed as a measure of the plasticity.

Shrinkage on drying and firing.—These characteristics are easily measured by making small blocks from a properly tempered mass of clay, and after removing them from the mould, allowing them to dry gradually in the air, and measuring the contraction in length. A convenient size for the mould is 9 by 4·5 by 2 cms. Instead of working with a tempered mass, the clay may be reduced to a thin paste or "slip" which can be poured into a plaster mould and allowed to set, but the former method more nearly approaches the conditions of manufacturing processes in cases where clay and not a "body" is concerned. In either case the amount of water mixed with the clay should be determined by drying a known volume of the thin paste, or by weighing the blocks when first made and when dry, so that the shrinkage may be referred to the amount of water used. The shrinkage does not necessarily vary directly with the amount of water present in the clay, as it is influenced by other factors, especially the texture of the clay, but at the same time it is affected to a considerable extent by the amount of water. The same blocks can afterwards be used for determining the further contraction on firing, which may be referred either to the original wet length or to the air dry length. The temperature to which the blocks are fired should always be recorded, because the contraction in many cases increases very considerably at high temperatures. Several blocks should be tested and withdrawn from the furnace at different temperatures, in order to determine the temperature most suitable for firing the particular clay.

Tensile strength.—The method of measuring the tensile strength of Portland cement is applicable to clays. Briquettes are made in a standard mould from a mass of properly tempered clay, allowed to dry thoroughly in the air, and then fractured in any of the ordinary cement testing machines. As clay contracts on drying the area of the plane of fracture must be measured in order to express the tensile strength in, say, pounds per square inch. Great care must be exercised in moulding and handling blocks and briquettes to avoid any shock or distortion, which impair the results far more than would be suspected. The mean of several test-pieces should be taken, and in the case of fired tests the temperature of firing should be given.

Texture or size of grain.—Clays are aggregates of mineral grains of varying sizes, and for some purposes a knowledge of the sizes and proportional amounts of different groups of the grains is useful. The separation of the grains into groups of particular sizes is effected by methods similar to those used in the "mechanical analysis of soils," and described in detail in many books on agricultural analysis. The particles are separated by some process based on sedimentation or elutriation and the apparatus devised by Schoene is frequently used. The rates of flow of water generally adopted are given in the following table, together with the limiting sizes of the particles in each group :—

Rates.	Diam. of grains.
0·018 mm. per sec.	0·0 —0·01 mm.
0·70 ,, ,, ,,	0·01 —0·025 ,,
1·50 ,, ,, ,,	0·025—0·04 ,,

The residue left in the apparatus consists of grains whose diameters range from 0·04 to 0·2 mm., as particles larger than 0·2 are separated by preliminary sieving. The water containing the finest particles or "clay" is generally run to waste, but if collected and allowed to settle for some time, 98 to 100 per cent. of the material taken can be recovered and weighed. Before the sample is introduced into the apparatus it must be thoroughly disintegrated : this is effected by boiling for some time with water, with or without preliminary treatment of the sample with very dilute hydrochloric acid and ammonia, supplemented by careful rubbing with a rubber-tipped pestle, or by prolonged shaking. The weights of the fractions collected are expressed as percentages, and in this connection it may be pointed out that by mere inspection of the results it is almost impossible to say which of two samples is the finer as a whole. This difficulty has been overcome by calculating a quantity known as the "Total surface factor" originated by Jackson, and modified by Purdy. It is based on the assumption, not very far from the truth, that the particles are approximately spherical, and consequently the areas of their surfaces vary inversely as their diameters. The mean diameters of the above four groups are 0·005, 0·0175, 0·0325, and 0·12 mm. respectively, and may be taken to represent the average diameter of all the particles in each group. Purdy inverts these numbers and obtains a "surface factor" for each group thus :—

$$\frac{1}{0{\cdot}005} = 200{\cdot}0$$
$$\frac{1}{0{\cdot}0175} = 57{\cdot}1$$
$$\frac{1}{0{\cdot}0325} = 30{\cdot}7$$
$$\frac{1}{0{\cdot}120} = 8{\cdot}3$$

The "total surface factor" is obtained by multiplying the weight of each fraction by the surface factor of that group and adding the products. The following example (No. 97) may be quoted :—

"Clay"	35·0 × 200 =	7000·00
"Silt"	2·4 × 57·1 =	137·04
"Dust sand"	11·2 × 30·7 =	343·82
"Sand"	51·4 × 8·3 =	426·62
	100·0	7907·48

The "total surface factor" is taken as 7907, and in this way it is easy to compare the fineness of a number of different samples.

Porosity.—This can be conveniently determined on the blocks used for measuring the contraction on firing at various temperatures. A dry block, fired at a known temperature, is immersed in water for say 24 hours, so that the upper surface is just exposed—to allow of the escape of air-bubbles—and then weighed after removing the excess surface moisture with a cloth. The increase in weight, calculated as a percentage on the weight of the dry block, expresses the porosity.

Fusibility.—This is usually measured by determining the temperature at which small cones or pyramids of a clay fuse. The temperatures may be measured in some cases by a thermo-couple or electric resistance pyrometer or by comparison with Seger cones ; the latter method has the advantage that these readings are readily recognised in technical work. Below about 1500° C. sufficient heat can be obtained by the use of coal gas and a good air-blast, and higher temperatures by substituting compressed oxygen for air, though in that case especially there is danger of local heating. Other experimenters favour the use of electric furnaces, either of the resistance or arc type, but any detailed discussion of the various furnaces is beyond the scope of the present paper. (See Dunn, this J., 1904, 1132, and Hereaus, 1905, 133). The changes occurring during firing, such as dehydration, incipient and complete vitrification, softening and final fusion need not be entered into here.

Conclusion.—In conclusion a brief explanation may be given of the practical value and bearing of these tests. The amount of plasticity controls the size and complexity of form of articles made from clay, and as measured above, the "plasticity number" approximately represents the quantity of water required for "tempering" (neglecting the moisture naturally present in the clay). This has a very practical bearing, as the tempering water has to be removed in the form of vapour, before the article is ready for the kiln, and gives an idea of the length of time that will be necessary for the drying stage. The amount of water is somewhat surprising when it is remembered that a ton of clay which requires 30 per cent. of water for tempering gives off about 6 cwt. of water during drying. The air- and fire-shrinkages are necessary factors which a manufacturer must take into account in making articles to required sizes. The tensile strength of raw clay gives an idea of the amount of aplastic material, such as ground flint, felspar, etc., that can be added without impairing the working properties, and also the resistance to breakage that a clay article will offer during the necessary handling in the processes of manufacture. Measurements of the tensile strength after burning indicate the strength of the material for various uses. The most suitable temperature for firing a clay, the colour developed, and any tendency to warp or crack can be judged from the fired test-pieces used for measuring the fire-shrinkage and tensile strength. Texture influences most of the working properties of a clay, and has a bearing on other problems, such as the adhesion of salt-glazes, etc. At present comparatively few results are available, but when more have been accumulated they may serve as a useful guide, for example, in the blending of clays to meet special requirements. The porosity developed at a particular temperature governs the amount of water absorbed which is an important feature, for instance, in the case of bricks exposed to the weather, not only on account of the moisture they retain but also of their power of resistance to fracture through frost. In certain classes of goods a high porosity is desired, whilst in others it is to be avoided, as in crucibles for molten metals and glass. The necessity for knowing the fusibility is obvious since clay goods are so extensively employed in operations where high temperatures have to be resisted.

The following table gives some results obtained on four clays :—

	China.	Ball.	Stoneware.	Fireclay.
Plasticity number	34·0	38·9	26·0	14·0
Air-shrinkage	2·5	4·9	4·3	3·1
Tensile strength..	9·0	5·0	7·3	29·5
Texture :—				
Clay substance.	74·0	74·3	69·4	36·0
Silt	14·4	6·3	11·5	2·4
Dust sand	7·3	7·6	9·9	11·2
Sand	4·3	11·8	9·2	50·4
Fire-shrinkage (1300)	9·8	8·4	8·3	6·7
Tensile strength..	720·0	165·0?	240·0	110·0 ?
Porosity	15·5	20·1	6·7	6·1
Fusibility........	1700° C	1630° C	1580° C	—

In the present paper it has been impossible to give more than a brief survey of the physical properties of clays, and no attempt has been made to discuss them in detail or to trace the influence exerted by variations in the methods of carrying out the tests.

I wish to express my thanks to my friend, Mr. John Dalton, for his assistance in preparing this paper.

Discussion.

The Chairman said that in two of the analyses which Mr. Hancock had placed before them, the alkalis amounted in one case to something like 3 per cent., and in the other to a fraction of 1 per cent. If he remembered rightly the two cones representing the fusibility of the two clays were 28 and 29, which he imagined meant that the temperatures were close together. Would it not have been expected that such a difference in the alkalis would make more difference in the fusibility ?

Dr. R. Lessing said that the author obtained this porosity figure by the water absorption test alone. He (Dr. Lessing) found, and he believed a great many other workers had found, that the water absorption gave low results. In the case of fireclays and fireclay goods, the porosity figure had been limited in standard specifications of various public bodies, for instance, the Institution of Gas Engineers ; because the degree of porosity was always closely connected with the degree of resistance to changes of temperature. The coarser the grain of a clay body the less liable it was to crack on rapid heating or rapid cooling, and he had found it was only possible to obtain a full figure by absorbing the water *in vacuo*. It would be very useful to know details of procedure in that respect in order to compare the results of different workers. With regard to the refractoriness, he believed that Mr. Hancock's explanation would be that one could not entirely go by the alkali contents of two different clays in determining the fusibility. They had to take into consideration the other fluxes as well, and also the ratio of silica to alumina in the clay. But the important point was rather how the refractoriness was determined. The method of heating and the atmosphere in which the test cone was placed would have a considerable bearing on the result. The clays for which figures were given were not very refractory, for the highest melting point was at cone 29, which was much below the melting point of best fireclays, the British fireclays melting as high as 32 on the average, and the best fireclays at cone 34 or 35, always taking the temperature of incipient fusion as standard. He had tried to apply coal gas only, both with induced draught and with air and gas compression, a rather higher compression than the author obtained, by means of a specially constructed blower, but he could not obtain the regular results that could be obtained by the old fashioned Deville furnace, or an electric resistance furnace, at least not for the highest temperatures required. He would have liked to have heard something about the property of clays to form a liquid by a slight addition of electrolytes and protecting colloids. Lately the casting method in preference to the moulding method had been extended very largely to refractory materials ; that was to say, fireclays containing very coarse grained burnt "grog." and it was interesting to see that a clay, tempered with the amount of water only that was necessary for moulding—about 15 to 20 per cent. as against 30 per cent. mentioned by the author—by a very slight addition of alkali, turned into a fluid mass. It would have been interesting to have determined the amount of casting property of the clay examined. That factor was very important, because there were now quite a number of works both on the Continent and in this country which used that method on the very largest scale. Clays differed very greatly in respect of their casting properties, probably owing to the presence of colloidal bodies, especially humic acid, in the various clays. Although it was hardly possible to find that by chemical means, physical tests would show that.

Mr. J. W. Hinchley asked whether the author had found that variations in the amount of working of the clay, or in the rate of drying of the test pieces, had any influence on their tensile strength. It was generally understood that working the clay increased its plasticity, and in his experience heavy pressure, if applied for a sufficient time, gave the same result. The effect on the Vicat needle test was very marked. The most important point to him was the influence of the rate of drying on the condition of the test pieces. For the tensile strength test to have any reliability at all, the drying must be so slow, that is, the contraction so uniform throughout the mass of the test piece, as to avoid all internal stresses.

Dr. A. B. Searle asked whether Mr. Hancock really considered that the plasticity results he had obtained by the Vicat needle method were at all comparable to what was understood as "plasticity" by commercial users of clay ; because he noticed that the plasticity "numbers" were china clay 34, ball clay 38, and fireclay much lower, whereas the ordinary users of clay considered china clay was only very slightly plastic, and that ball clay was one of the most highly plastic clays with which they were acquainted. To have the first two numbers so close together and fireclay in an anomolous position struck one as being very curious. There were, in fact, many puzzling things in the results stated by Mr. Hancock which he (Dr. Searle) believed were really due to the inaccurate manner in which the tests were made. There was an important error in nearly every test used, in so far as he could judge from the meagre information supplied as to details of the tests. He supported what Dr. Lessing had said about the erroneous methods of testing porosity and fusibility ; these had been shown in the "Clayworker's Handbook" and elsewhere.

He also called attention to a statement to the effect that if a brick was sufficiently fine in texture to prevent the admission of water, the possibility of its destruction by frost was avoided. He thought that statement should have been considerably modified. Bricks could be destroyed by frost, even when they were of an extremely fine texture ; it was not the fineness of the texture, but the absence of pores which made them frost-proof, but that was not the full explanation, as completely impervious bricks were occasionally damaged by frost. So far as he had studied them, the results obtained by Mr. Hancock in the various physical tests did not appear to agree with those of the chemical results, and to some extent the physical tests did not agree with each other. There must be some reason for that, and he inquired how Mr. Hancock could explain it. Mr. Hancock had suggested that the surface factor was perfectly easy to use. At the same time he omitted all recognition of the fact that sand had a different specific gravity from clay, and that the various portions separated by elutriation had each a different specific gravity, so that by neglecting that factor in each case the results were not strictly comparable when the clays were different in nature. This had been shown by Mellor to be an inherent weakness in the Jackson-Purdy surface factor as used by Mr. Hancock.

Mr. Hancock in reply to the question raised by the Chairman, as to the fusibility of the two clays (Nos. 89 and 96), said there was certainly a very considerable difference in the alkali content between 3·2 and ·6; but there was no reason to doubt the accuracy of these results as far as the chemical analyses were concerned. The fusibility was controlled by a large number of other factors. The alkalis, as Dr. Lessing had pointed out, were not the only fluxing materials present. There were titanium and iron oxides, and magnesia; they all had a more or less fluxing effect. In addition to that there was the question of the texture of the two materials. It had been shown conclusively by Ries and others that clays with a finer texture fused much more easily than those with coarser grain.

As to Dr. Lessing's remarks, he said his object that evening had been to give as briefly as he could a general account of the various properties of clay, which it was useful to investigate. It was impossible to enter into any details. He quite agreed with Dr. Lessing that for accurate porosity results one must resort to other means, such as exhaustion of the air. There was also the question whether the blocks should be immersed in boiling water, or in water which was afterwards raised to boiling point, how long they should be immersed in the liquid, and so forth. With regard to the refractory determinations, the particular samples which he quoted were simply measured by means of Seger cones enclosed in a crucible and heated up with the clays in an ordinary injector furnace. That was the only means he had at his disposal at the time. He quite agreed that for strictly accurate results one must resort to much more elaborate methods. Dr. Lessing had already anticipated his reply in one respect with regard to the casting properties of clay, and the colloid condition. He had a number of experiments on hand which possibly he might be able to publish at a later date. Mr. Hinchley had raised a very important point which he (the author) had omitted to mention, that was the influence of rate of drying on the tensile strength. There was no doubt that the tensile strength was affected very considerably by the rate of drying; but it must be remembered that in the case of these small briquets 2½ or 3 inches long that did not produce anything like the effect it did on a manufacturing scale. These briquets were allowed to dry for a time under a bell jar in an atmosphere more or less saturated with moisture, and the amount of moisture gradually diminished. But of course when one came to deal with blocks weighing half a ton or more, one had to take great precautions in order to ensure safe drying. As to the effect of pressure on the working properties and tensile strength of clays, Mr. Hinchley had mentioned an extremely interesting point. It was recognised that the working properties of clay were improved by long tempering; in fact it was the custom in some cases to work a clay up to a plastic condition, dry it, and again work it up. Dr. Searle had attacked the question of the "plasticity number" as determined by the Vicat needle. He (the author) pointed out that it was based upon the assumption, not necessarily correct, that the water taken up by the clay to render it plastic, was a measure of the plasticity. China clay, as Dr. Searle had pointed out, was a notable exception. China clay was not plastic; though it took up a large quantity of tempering water, it had an entirely different "feel" from a really plastic clay. He was much obliged to Dr. Searle for having raised the point, as it might be extremely misleading. He knew quite well that in the calculation of the surface factor specific gravity had been omitted by Jackson. But for ordinary practical purposes he thought that one got a very fair idea of the general fineness of ground material from the surface factor. For example, in comparing one clay with another, he did not think the difference in specific gravity of the different fractions was very great, though he had never actually determined it. If one were dealing with a mixture of materials as in a pottery body and comparing that with a similar mixture the specific gravities of the various fractions would be approximately the same in both mixtures. He thought originally Jackson introduced the surface factor for the purpose of comparing the fineness of different samples of some particular material, *e.g.*, ground flint, in which case the effect of the specific gravity would be largely diminished.

THE VALUE OF THE NON-TANS IN TANNING MATERIALS AND EXTRACTS.

BY DR. J. GORDON PARKER AND J. R. BLOCKEY, M.SC.

The experiments recorded in this paper were undertaken as an attempt to determine what influence the non-tanning matters in an extract or material, have on the penetration of the tanning matters, on the increase in weight of leather and what leather forming properties the "non-tans" possess. This subject has been investigated by one of us by experiments on a practical scale (Journal of the Society of Chemical Industry, March 31st, 1910), but it had not been determined by chemical methods what part the non-tans actually played. In the paper referred to, it is stated that "This question has become more acute of late years, owing to the introduction of closed autoclaves for the extraction of the wood in the manufacture of extracts, instead of open extraction vats. This has resulted in the manufacture of what are commonly called 'pressure extracts,' *i.e.*, extracts which are manufactured by extracting the material from which they are made under pressure of one or two atmospheres." The result of this pressure extraction is that there is a greater yield of soluble substances, but also a decomposition of a certain amount of tannic acid. This shows itself in the analysis, for in the extract obtained by pressure extraction, the amount of non-tans is very much higher than in the extract obtained by open extraction. It is sometimes claimed that this higher percentage of non-tans penetrates the fibres of the leather and thus gives a higher yield. This is particularly the case, it is stated, with drum tannage. The object of this investigation was, therefore, to find out how far the non-tans in an extract do actually penetrate the fibres and give weight to the leather. From the experiments already published it was concluded that as regards actual tanning of leather, better results were obtained both for weight and firmness with an extract containing a low percentage of non-tans, or at least, it was claimed that the higher percentage of non-tans had not in any way contributed either to weight or firmness.

In the following experiments, pieces of pelt were tanned out in liquors made from various extracts. These liquors were made to contain varying percentages of non-tans by the addition of "non-tanning" matters separated from the original extract. Liquors were thus obtained containing the same percentage of tannin, but varying percentages of non-tans. By tanning out pieces of pelt in these liquors the influence of the amount of non-tans on the rate of penetration of the tan and on the yield of leather could be ascertained.

A. *Experiments with chestnut extract.*

The first series of experiments was carried out on a well-known chestnut extract. This extract gave the following figures on analysis by the official I.A.L.T.C. method:—

	Per cent.
Tanning matters	28·6
Non-tanning matters	12·5
Insoluble	·9
Water..............	58·0
	100·0

A solution containing nothing but non-tanning matter was made from this extract as follows:—

320 grams of the extract were dissolved in 2 litres of distilled water and 2 litres of 5 per cent. gelatine solution

were added. This caused the precipitation of most of the tanning matters. The completion of the detannisation was effected by churning with chromed hide powder as in the ordinary I.A.L.T.C. method of tannin analysis. Total detannisation cannot be effected with gelatine alone as the end point is not at all defined, but by adding too little gelatine to precipitate the whole of the tannin and then completing the detannisation with hide powder, results were obtained which agree fairly closely with the results to be expected from the official analysis of the extract. That is, the amount of "non-tans" in the resulting solution was nearly the amount calculated from the original analysis. In this way a solution containing one per cent. of non-tanning matters was obtained.

By means of distilled water and of this solution of non-tans, solutions of the extract were made as follows :—

A. 210 grams extract dissolved in 2 litres of water giving a solution of 3 per cent. of tans, and 1·31 per cent. non-tans and of Barkometer strength of 15°.

B. 210 grams extract dissolved in 1 litre of water and 1 litre of the non-tan solution, giving a solution of 3 per cent. of tan, 1·81 per cent. non-tans and of Barkometer strength of 17°.

C. 210 grams extract dissolved in 2 litres of the non-tans solution, giving a solution of 3 per cent. of tan, 2·31 per cent. of non-tans and Barkometer 19°.

Calculated back on the original extract the figures give :—

	Per cent. of tan.	Per cent. of non-tans.
A	28·6	12·5
B	28·6	17·3
C	28·6	22·0

Pieces of pelt from a butt in as uniform a condition as possible were cut up into strips of 2 in. by 4 in. and delimed with boracic acid. Three of these pieces were taken for each test. Tannage was commenced in liquors of ½ per cent. of tan and was continued until no further absorption took place, finally finishing the tannage in liquors containing 3 per cent. of tan. The liquors were strengthened up gradually and uniformly for the three tests. The pieces were tanned in jars which were put in a rotating churn for several hours per day, the tannage taking three weeks. At the end of this time the pieces were taken out, scoured, oiled, partially dried, rolled and dried out. Samples were taken during the tannage and analysed and the finished leathers were analysed. The following table shows the amount of absorbed matter per 100 parts of original hide :—

A	After 3 days.	After 10 days.	After 21 days.
A	59·7	87·3	98·0
B	52·5	85·0	96·0
C	51·3	85·0	96·4

It will be seen from these figures that the amount absorbed with an excess of non-tans is less than with no added non-tans, a result in accordance with Stiasny's work (Collegium, 1909, p. 395). At first the penetration is considerably retarded but the total amount absorbed after complete tannage is almost the same. To see if the tan which had been absorbed had actually combined with the hide fibre the resulting leathers were analysed with the following results :—

	Moisture.	Matter washed out by water.	Mineral matter.	Hide substance.	Combined tannin.	Degree of tannage.
A. No. added non-tans..	14·0	12·6	0·8	42·6	30·0	70·4
B. 5 per cent. non-tans added ..	14·0	13·0	0·8	43·1	39·1	67·5
C. 10 per cent. non-tans added ..	14·0	13·3	0·8	43·0	28·9	67·2

Although the total amounts of leather formed from the three solutions do not vary very much, it will be seen that the quality of the leather produced is not the same in each case. The figures in the second column give the amount of soluble matter in the leather, *i.e.*, the amount of matter which can be washed out by water. The leather tanned with the excess of the non-tans contains more of this than the others do.

The figures in the last column give the amounts of tanning matter actually combined with 100 parts of hide fibre, and the "degree of tannage" is the best criterion of the amount of actual tannage which has taken place. It will be observed that the most thorough tannage has taken place when there was no excess of non-tans, and it appears that the non-tans have a retarding influence on the penetration of the tannins.

A further series of experiments were made on the same extract and in the same way as the above, with the exception that the pieces of leather were not tanned in rotating jars but merely by suspension. This was to make the two series run as parallel as possible to the drum method, and to the ordinary suspension method of tannage, respectively. The strengths of liquors were the same as for the previous tests and the time of tannage was the same. The results of the analysis of the resulting leather were as follows :—

	Moisture.	Mineral matter.	Matter washed out by water.	Hide substance.	Combined tannin.	Degree of tannage.
A. With no added non-tans	14·0	1·0	12·1	44·8	28·1	62·7
B. With 5 per cent added non-tans	14·0	1·0	12·3	45·6	27·1	59·4
C. With 10 per cent. added non-tans	14·0	1·0	12·3	46·5	26·2	56·4

In this "still" tannage the amount of water soluble matter is about the same for each case, but the degree of tannage shows even wider divergencies than is the case of the "drum tannage," a difference of 6 existing between the degrees of tannage of the leather tanned with no added non-tans, and of the leather tanned with 10 per cent. of added non-tans.

B. *Tests with oakwood extract.*

The oakwood extract used was one well known on the market. The I.A.L.T.C. method of analysis gave :—

	per cent.
Tannin	29·0
Non-tannin	14·7
Insoluble	0·2
Water	56·1
	100·0

A solution containing only non-tans was made as before by detannising first with gelatine and finally with chromed hide powder. In this way a 1 per cent. solution of non-tans was prepared. With distilled water and with this solution of non-tans, liquors containing the same percentage of tan but different percentages of non-tans were obtained :—

	Per cent of tan.	Per cent. of non-tan.	Barkometer.
A.	3·0	1·5	18°
B.	3·0	2·0	20°
C.	3·0	2·9	24°

Calculated back on the original extract the figures give :—

	Per cent. of tan.	Per cent. of non-tans.
A.	29·0	14·7
B.	29·0	19·5
C.	29·0	28·0

Pieces of pelt were taken as before, cut into strips, delimed and tanned in liquors made from the above solutions. Tannage was commenced in liquors containing 0·5 per cent. of tan and finished in liquors containing 3 per cent. of tan, the liquors being uniformly strengthened for the three tests. The resulting leathers were finished and dried out as before and on analysis gave the following figures :—

	Moisture.	Mineral Matters.	Water soluble matter.	Hide substance.	Combined tannin.	Degree of tannage.
A. No. added non-tans	14·0	·4	15·2	47·2	23·2	49·2
B. 5 per cent. non-tans added	14·0	·4	15·3	47·5	22·8	48·0
C. 13 per cent. added non-tans	14·0	·4	15·3	49·0	21·3	43·5

The amount of water soluble matter is the same in each case, but the amount of tan actually combined with hide fibre shows very great variations. Here again the presence of the additional non-tans exerts a retarding influence on the penetration of the tan.

Still tannage.

A similar series of experiments was conducted, tanning out the pieces of leather by suspension only without giving any "drumming." The results were very similar to the above and the non-tans played the same part in reducing the amount of tan combined with the fibres.

C. A third series was carried out to bring the conditions as close as possible to the conditions which actually obtain in practice.

It might be argued that the above experiments do not give a fair indication of what is likely to take place in practice. The chief objection which could be urged, would be that the tannage was conducted in liquors which contained no natural acids. To meet this objection the following plan was adopted :—A solution of non-tanning matters was made from the same chestnut extract as in the first series (A). and solutions of the same percentage of tan but different percentages of non-tans were prepared as before, but to each of these solutions was added the same quantity of a tan liquor taken from a top suspender liquor and containing a fair amount of acidity. The addition of such a liquor made the resulting liquors more closely approach the liquors actually used in practice.

Solutions were thus made as follows :—

	Per cent. of tan.	Per cent. of non-tans.
A.	3·0	1·31
B.	3·0	1·81
C.	3·0	2·31

and to 2 litres of each of these solutions was added 500 c.c. of suspended liquor of acidity 10 c.c.=15 c.c. $N/20$ lime water.

Pieces of pelt were taken as before and tanned out in the above solutions. After tanning they were taken out and finished as before and analysed. Two series were performed, one in rotating jars and the other by suspension. The leathers tanned in the first series, *i.e.*, by the drum tannage gave the following results on analysis :—

	Moisture.	Mineral ash.	Water soluble matter.	Hide substance.	Combined tannin.	Degree of tannage.
A. No added non-tans	14·0	·7	11·1	48·1	26·1	54·3
B. 5 per cent. added non-tans	14·0	·8	10·9	47·7	26·6	55·8
C. 10 per cent. added non-tans	14·0	·6	10·7	49·5	25·2	50·9

The same general effect is apparent as in the first series although not to such a large extent. The difference in the degrees of tannage between the leather tanned with no added non-tans and with 10 per cent. added non-tans, is 3½ in favour of the former.

A similar series to the above was performed but the pieces were tanned by suspension instead of by the drum :—

	Moisture.	Mineral ash.	Water soluble matter.	Hide substance.	Combined tannin.	Degree of tannage.
A. No added non-tans	14·0	·6	9·2	48·4	27·8	57·4
B. 5 per cent. added non-tans	14·0	·4	8·8	51·4	25·4	49·4
C. 10 per cent. added non-tans	14·0	·4	9·8	50·8	25·0	49·0

The effect of the non-tans on the penetration of the tannin was more marked than with the drum tannage, there being a difference of 8 between the degrees of tannage produced by solutions A and C.

It appears from all the above experiments that the non-tanning matters have a retarding influence on the penetration of the tan and that the total yield of leather is reduced.

One influence of the non-tanning matters is in the production of acidity. Some of the liquors used in the above tests were allowed to stand, and the amount of acid developed was measured from time to time. In every case the amount of acid was greatest in the liquors with the most non-tans. The following table shows the results of two of the series :—

1. *Chestnut.*

	c.c.s. of $N/20$ lime water per 10 c.c.s. liquor.	
	After 1 month.	After 2 months.
A.	6·4	6·6
B.	7·0	7·3
C.	7·5	8·1

2. *Oakwood.*

	c.c.s. of $N/20$ lime water per 10 c.c.s. liquor.	
	After 1 month.	After 2 months.
A.	5·0	5·8
B.	5·8	6·9
C.	8·5	9·5

The effect is the one naturally to be expected, that the non-tans produce acids by fermentation.

DISCUSSION.

The CHAIRMAN said that the paper claimed to have established two points. First, that the absorption of tannin was delayed by the presence of non-tanning materials, and secondly, that the non-tans were not absorbed. It seemed to him that the first contention was clearly proved, for on the results obtained there was evidence of a retardation of the absorption of the tannin. But on the second point he desired to ask whether there was not sufficient variation in the non-tannin substances to make it a matter for consideration how the non-tans with which they experimented should be prepared. The authors had prepared their non-tans by removing the tannins by means of hide. Was there not a danger that by selective absorption the more readily available non-tans had also been removed ? If so, the rate of absorption of the residual non-tans would not be that of what might be termed a whole extract.

Mr. C. F. CROSS said that the authors would agree there must be a linking series of carbohydrate bodies derived from the parent wood (or bark) substances which undoubtedly played a very direct and specific part in tanning processes. It was also clear that by removing them, as had been done in this case, the tanning liquors were fractionated in a very artificial way, consequently the incidence of the argument was limited to a technical point as between himself and extractors. He thought Dr. Parker would admit there was a larger question remaining to be solved by tanners: that was, what was the function in the tanning process of this series of colloidal carbohydrate "non-tans" which existed in association with the aromatic tanning bodies and in the plant, and what useful modifications of the process might be expected from additions of such non-tans ?

Mr. W. P. DREAPER asked Dr. Parker exactly what he thought was the part played by gallic acid. Under modern conditions of analysis in tanning, the whole trend seemed to be to prevent the absorption of gallic acid by the material which was used to determine the percentage (say 30 per cent.) of "tannin" present. Some few years ago Mr. Wilson and he (this Journal, 1906, 25, 515) had read a paper dealing with the absorption of gallic acid by tannic acid coagulum, and they proved, in addition to the fact that gallic acid was absorbed, it materially altered the physical nature of the coagulum. If the authors were working in the presence of gallic acid and calling the non-tans something which was minus gallic acid, were they correct in making the tests recorded and assuming, as the Chairman said, that the non-tans dealt with in this paper really represented the ordinary non-tans as gauged by analysis or actual working ?

Dr. S. RIDEAL said it seemed to him that the question was, whether it was necessary to form a definite compound of the tannin with the hide substance in the finished article, or whether the leather user was content to buy a product which had weight and other desirable properties. If the 70·4, the 67·5, and the 67·2 were the ultimate percentages they could get by the introduction of tannin into the hide substance, and those figures practically represented the finished product, it was obvious that the first one, the 70·4, was a better tannage than the one with 67·2 ; but as they had all three been done at the same time, and the weight in the second and third was less, some of the other substances had gone in to make up the 100 per cent. of the total weight, and one would like to know, before passing a final opinion, what the general physical properties of these finished products were, and not simply base an opinion on the percentage of tannin in the three. He would have liked to have known something of their tensile strengths and their waterproof capacities, their loss of weight on wearing, and attrition tests before giving a definite answer to that particular question.

Mr. J. R. BLOCKEY, in reply, said their method of preparing the non-tans was to take a solution containing the extract as it was and detan it, first with gelatin and then with hide powder, so that the final product was similar to that obtained in tannin analyses, and the whole question was to see if the non-tans, as given by analysis, really did affect the penetration of the tans. The differences between some of the tanning and non-tanning matters were not so well known that any very definite distinction could be drawn between them except by the method of the hide powder analysis, and he thought in that case it had been clearly shown, as given by this means of differentiating them from the tannins, that the non-tans did retard the penetration of the tans. It was unfair to compare these non-tanning matters with others, say, the new colloids, which made leather but which were supposed to be non-tans according to analysis, because in this case the medium was a water solution, and in the case of the new materials the tannage is conducted without the medium of water. With regard to some of the physical properties of leather, in addition to the degrees of tannage which were usually accepted by a chemist as giving a fair indication of the quality of the leather, they also measured the amount of soluble matter in the leather, that was, the amount of matter which could be washed out by the ordinary method of washing with water, and in most cases they found relatively more soluble matter was washed out in those cases where they had the most non-tans. That was generally taken to mean that the leather was less waterproof. The samples they had dealt with were too small to attempt any method of determining the wearing properties ; but they took the soluble matter and degree of tannage as a fair indication of the quality of the leather. One point which had been urged before was, that in a drum tannage, probably the increase in the quantity of the non-tans would have a greater effect than in a "still" tannage ; that was by simply suspending the hides in liquors, and in the drum tannage, the tannage by mechanical motion. It had been said that perhaps in the drum tannage more of the non-tans would penetrate than in the still tannage. As a matter of fact, their degrees of tannage showed the same variations as in the still tannage, but in the drum tannage they got a higher amount of soluble matter in the leather than by the still tannage, and the amount of water-soluble matter was higher in the case where they got the most non-tans.

Dr. GORDON PARKER, in reply, said the amount of soluble matter washed out in A was 12·6 per cent. ; in B, 13 per cent., and in C, 13·3 per cent. The difference was very small, but when worked out on percentage it made a greater difference. In one case there were 170 parts of leather substance, in another 167½, and in the third 167¼. Of the 170, 12½ were washed out, and dealing with a much lesser amount of leather, 13 ; so that really the result was magnified in that way, and that should be taken into consideration. In answer to the Chairman's point as to whether the non-tans were absorbed, he did not think the matter was definitely settled yet. Certain non-tannins undoubtedly were absorbed. Non-tannins were distinctly advantageous to the tan. Their chief advantage undoubtedly was the formation of acids which plumped and swelled the fibrous tissue so that it might easily absorb the tannic acid, but whether the glucosides and some of the substances which were naturally present in wood extracts (made by extraction under pressure) were absorbed was questionable, because they had tried on many occasions in their experimental tannery, where they tanned some 20 hides a week, to find out, by taking the liquors high up in the tanyard and following them right down, where there was a loss of the non-tanning matters. That had been tried not only at their experimental yard, but at many others, and the non-tannins were not found to decrease in any appreciable quantity other than in the formation of acids, which were produced by natural fermentation. Mr. Cross had raised practically a new point in tanning. They had gradually had forced upon them in the last two or three years newer substances which, for want of a better name (and perhaps it was as good a name as any) they termed colloidal tans, and there was no doubt that some of the present ideas of tanning would have to be modified. There was no doubt that some of the tannins which Mr. Cross had been experimenting with recently had, if not a future before them, at least a very great interest, and it was a matter of interest to those engaged in the industry whether those products were going to find a niche in the tanning industry or not. Personally, he would welcome them if they produced a better leather than was produced at the present time. There was no doubt that the gallic acid, which was present in these extracts originally, was removed by means of gelatin, and the final detannisation by means of hide powder. No one could deny that gallic acid, did assist in tanning, but leather could not be made from gallic acid. Another unfortunate fact about gallic acid was that it actually dissolved leather, especially at the early stages. If the early liquors in a tanyard contained a high proportion of gallic acid they were actually going to dissolve a certain amount of leather-forming material and turn it down the drain. That was a matter the tannery chemist had to watch. He said that Dr. Rideal's criticisms were very pertinent as to what quality of leather was produced. He was afraid that he must refer Dr. Rideal to the previous paper, which was done on a practical scale with some tons of leather. In that case they had gone into the physical tests very carefully, but in the case of the present experiments there were only some 400 or 500 grams of leather contained in each series; therefore it was not possible to carry out the physical tests. But from the ordinary judgment of the leather, they found that certainly the best leather, from the point of view of appearance, was produced from those solutions which contained the lower proportion of non-tannins. On the other hand, the colour was better in those that contained the higher proportion of non-tans, but he thought that almost followed naturally. The importance of the subject was, perhaps, going to be greater with the introduction of the newer bodies, which were coming along very fast.

THE RAPID ESTIMATION OF CARBON MONOXIDE.

BY LEONARD A. LEVY, M.A.(CANTAB.), B.SC. (LOND.), F.I.C.

In numerous instances in which the examination of a mixture of gases containing carbon monoxide is required, a knowledge of the percentage of this gas is sufficient to check the course of the reaction which gives rise to the gases under examination.

The absorption methods usually employed demand time and skill, and the absorbent employed—cuprous chloride solution—neither gives a sharp reaction nor indicates very small percentages. Methods for combustion also require considerable skill, and are somewhat lengthy. A colourimetric method capable of 0·3 per cent. accuracy, would be sufficient for the majority of technical purposes. Of the colourimetric methods for the estimation of carbon monoxide published, none are sufficiently simple and accurate for industrial purposes.

Winkler (Zeitsch. Analyt. Chemie, 1889) has suggested that the depth of colour of the black cloud of reduced palladium, formed when gas containing carbon monoxide is shaken up with a solution of cuprous chloride and palladium chloride, may afford an approximate means of estimating the quantity present. Potain and Drouin (Compt. rend. **126**, p. 938), employ the progressive loss of colour experienced by palladium chloride solution on reduction by carbon monoxide in an attempt to estimate this gas. Various attempts have also been made to utilise the change of colour exhibited by dilute blood solution and the reduction of ammoniacal silver oxide for this purpose, but all these methods are vitiated by the presence of other reducing gases and exhibit other defects. It was therefore decided to experiment with other reagents.

I.—Gold chloride.—Donau (Akad. Wiss. Wien Sitz. Ber. **114**, p. 79 to 84) found that a dilute solution of gold chloride is reduced by carbon monoxide giving a solution of colloidal gold. The colour of chloride gold solution is a very pale yellow, after reduction it is ruby red. Two arrangements of this reaction suggest themselves :—

(*a*) The gas is aspirated through a fixed volume of gold chloride solution at a standard rate and the process continued until the tint of the reduced solution exactly matches a standard comparison colour. The volume of the gas passing through the liquid is a measure of the percentage of carbon monoxide.

(*b*) A known volume of gas is drawn through a fixed volume of gold chloride solution which is contained in a glass bottomed tube fitted with a micrometre eyepiece, the latter being screwed up until the colour displayed by the solution exactly matches a standard. The micrometer head is graduated empirically against gases of known content of carbon monoxide.

These methods of analysis would be valueless if other gases capable of reducing the gold chloride solution with the production of colloidal gold, were present; experiments were therefore made with the following results :—

(*a*) Oxygen, nitrogen, hydrogen, carbon dioxide, marsh gas, have no action.

(*b*) Ethylene, sulphur dioxide, reduce without the formation of colloidal gold ;

(*c*) Hydrogen sulphide gives a brown colour and ammonia a yellow precipitate :

(*d*) Acetylene gives a red solution of colloidal gold.

Thus acetylene and hydrogen sulphide are the only gases likely to interfere with the test. The following observations are an indication of the possibilities of this method. The gas used was the mixed coal and water gas from the laboratory supply.

Percentage CO.	c.c.'s of gas aspirated.	Time.
12·2	129	14 mins.
12·2	130	13 ,,
12·2	125	11 ,,
11·8	134	14 ,,
11·8	137	14 ,,
11·8	136	13 ,,
11·4	140	14 ,,
11·4	138	14 ,,
11·4	141	14 ,,

The above results indicate that a difference of 0·5 per cent. should be readily detected by this method. Regarded purely as an analytical method the reaction exhibits several intrinsic defects which led to the experiments being abandoned in favour of the method which was subsequently adopted. The principal difficulties are :—

(1) The vessel containing the gold chloride solution must be thoroughly rinsed out with distilled water, as traces of electrolytes coagulate colloidal gold causing the colour, exhibited by the solution, to become violet.

(2) The matching liquid will vary in colour according to the light in which it is viewed, and different matching solutions are required for use by daylight and by artificial light. Furthermore there is always a degree of uncertainty in the matching of two colours by different observers.

(3) The test is purely empirical.

II. Selective oxidation by iodine pentoxide.—Gautier (Compt. rend., **126**, p. 793) has employed the selective oxidation of carbon monoxide by heated iodine pentoxide, for the accurate estimation of traces of this gas in air. The amount of gas is determined by an observation of the iodine liberated. The following method, based upon this reaction, has been developed. The carbon monoxide to be estimated is selectively oxidised to carbon dioxide, and the oxidised gas is aspirated through a fixed volume of standard baryta solution coloured by phenolphthalein. The solution becomes colourless when the baryta is completely neutralised: this colour change therefore corresponds to a fixed volume of carbon dioxide, *i.e.*, to the same fixed volume of carbon monoxide. An observation of the volume of gas required to effect this decolourisation gives the percentage required.

In order that the analysis may be simple, rapid, and accurate, attention to certain points must be given.

(1) Unsaturated hydrocarbons are oxidised by iodine pentoxide and must therefore be removed prior to the oxidation. Gautier (Compt. rend., **126**, p. 931) states that traces of ethylene diminish the oxidation of carbon monoxide by this reagent. His experiments were made at a low temperature—60° to 100° C.—and the author has found that this inhibitory action is not noticeable if the oxidation be effected at 170° C. A strong solution of bromine in potassium bromide was found to be the most efficient absorbent. The unsaturated hydrocarbons are completely absorbed provided that the rate of bubbling is not greater than about 2 litres per hour. Bromine vapour is subsequently removed by a 1 in 2 solution of caustic potash, which also serves to absorb any carbon dioxide which might have been present in the original gas. These absorbents are contained in a special form of bottle designed to give a long passage through the liquid with but slight introduction of hydrostatic pressure.

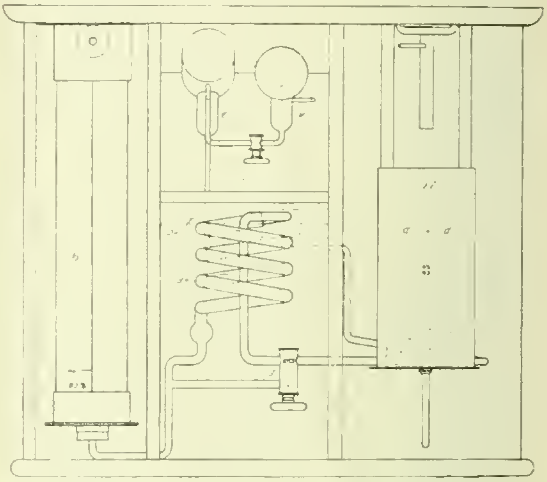
(2) After its passage through the absorbing solutions, the gas must be well dried as otherwise the oxidation is incomplete. This is effected by passing over phosphorus pentoxide contained in a glass tube 1 inch in diameter and 4 inches long. If sulphuric acid be employed its use introduces additional hydrostatic pressure and there is also the possibility of the sulphuric acid being drawn back into the potash solution should the apparatus be used carelessly.

It seems very probable that the inhibitory action of ethylene upon the oxidation may be due to the water produced by its own oxidation, seeing that it does not take place at 170° C., *i.e.*, above the temperature of dehydration of iodic acid.

(3) The iodine liberated by the reduction of the pentoxide must be removed, as otherwise it would speedily choke up the leading tubes. The iodine pentoxide, mixed with small pieces of ignited asbestos in order to render the column of solid pervious to the passage of the gas, is contained in a U tube, which is fused to another similar tube containing copper turnings. Copper filings answer very well at first, but after the tube has been in use for some time, it offers a very great resistance to the passage of the gas, and finally becomes completely stopped up. The compound U tube is contained in an air oven maintained at 160° to 180° C.; the iodine liberated combines completely with the copper turnings.

(4) The form of the "decolorisation vessel" is very important. The carbon dioxide must be completely absorbed, and at the same time the solution must be thoroughly well mixed up by the passage of the gas, as otherwise the titration of the gas would be inaccurate. If a vertical cylinder be employed, the absorption is only about two-thirds complete; no matter what form the inlet orifice may take. An ordinary Winkler absorption coil is unsatisfactory as the mixing is very incomplete and a progressive decolourisation proceeds up the tube, with the result that the bottom portion of the liquid is neutralised and saturated with carbon dioxide before the top portion has been brought into use. A considerable number of trials were necessary before a satisfactory shape was arrived at. The form finally adopted is similar to a Winkler coil, except that the slopes of the individual coils are considerably steeper. In this form of decolorisation vessel the solution is well mixed up by the passage of the gas and numerous experiments have proved that the absorption is complete. The inlet tube is fitted with a rubber cork in order to facilitate rapid washing after use. The strength of the baryta solution in the coil is such that it is exactly neutralised by the passage of 20 c.c. of carbon dioxide measured at 60° F. and 30 inches pressure.

The gas to be analysed is therefore drawn successively through the absorbents for the removal of unsaturated hydrocarbons and carbon dioxide, the drying tube, the oxidation tube and the decolourisation vessel. A three-way tap is interposed between the two latter so that the gas may be bye-passed until the commencement of a test. The internal air spaces are kept as small as possible so that the passage of 100 c.c. of gas is sufficient to displace completely the residual gas in the apparatus.



Apparatus for the rapid estimation of carbon monoxide.

The apparatus is manufactured and supplied by Messrs. Alexander Wright and Co., Ltd., Westminster.

The gas is drawn through by the flow of water from an aspirator; the volume of water which flows out is obviously equal to the total volume of gas passing through the apparatus.

Let this volume be V c.c.; then as V c.c. contain 20 c.c. of carbon monoxide, the percentage of the latter is $\frac{2000}{V}$. For practical use the aspirator from which the water flows is graduated directly in percentages of carbon monoxide. The reading on the aspirator can be divided by the tabular number (or multiplied by the aerothormeter number) in cases where a greater degree of accuracy is requisite.

Experiments with gas of high carbon monoxide content.

The following table gives some results obtained with mixed coal gas and water gas; the analyses were carefully performed with an accurate Hempel apparatus, and two cuprous chloride pipettes were employed for the absorption of carbon monoxide. Three observations on the same gas are recorded in each case.

Percentage CO by analysis.	Percentage by colour test	Difference.
14·1	13·9	—0·2
14·1	13·6	—0·5
14·1	13·6	—0·5
13·2	13·1	—0·1
13·2	13·1	—0·1
13·2	13	—0·2

Percentage CO by analysis.	Percentage by colour test	Difference.
13·1	13·4	+0·3
13·1	13·4	+0·3
13·1	12·9	—0·2
12·2	12·4	+0·2
12·2	12·4	+0·2
12·2	12	—0·2
17·4	17·1	—0·3
17·4	17·1	—0·3
17·4	17	—0·4

The results invariably agree to within about 0·3 per cent. with analyses made with the most accurate forms of apparatus.

Experiments with gas of low carbon monoxide content.

When the gas contains but little carbon monoxide, the baryta solution is diluted so that it is neutralised by the passage of 2 c.c. of carbon dioxide. Known volumes of coal gas (of known carbon monoxide content) and air were mixed together and the percentage of carbon monoxide was calculated.

Percentage CO calculated	Percentage by Bunte	Percentage by test
1·7	1·6	1·3
0·8	0·7	0·4
1·2	1·3	1·0

The above results indicate that the absorption of carbon dioxide by the more dilute baryta solution is not quite complete.

This incomplete absorption can be corrected for by suitably decreasing the strength of the baryta.

The following method can be employed to give accurate results for gases containing only traces of carbon monoxide. The gas is drawn by means of a filter pump through a meter and then through the apparatus. A strong solution of baryta is employed. After a certain period, depending upon the amount of gas oxidised, the pump is stopped and the excess of baryta is back-titrated with oxalic acid. This method should be of value in the analysis of fumes from gas stoves, mine air and air from lime kilns, etc.

The apparatus is arranged in a portable form as shown in the illustration. It can readily be carried from place to place as the total weight is only about 12 lb.

The total decolourisation, when the concentrated baryta solution is employed, takes place during the passage of about 10 c.c. of gas containing 20 per cent. of carbon monoxide; or during the passage of 2 c.c. of carbon dioxide. The "decolourisation vessel" coil is mounted in an observation box and is viewed against a piece of white opal glass. It is very easily noticed and different observers obtain identical readings. The speed of aspiration is about 200 c.c. in 6 mins., and this volume corresponds to a gas containing 10 per cent. of carbon monoxide. If the percentage is higher the time required for an estimation will be still less.

The standard baryta solution is stored in a Winchester quart fitted with a special burette arranged so as to deliver the solution without any contact with the atmosphere. The actual arrangement adopted is well known.

Experiments are now being made on similar lines for the rapid estimation of fire-damp in mine air. The preliminary results are most promising.

Discussion.

The **Chairman** said there would be general agreement that the apparatus before them was very neat and probably exceedingly useful. When Mr. Levy spoke of a comparison "by analysis," did he mean a determination by combustion or by titration of the iodine set free? His own experience had been limited to the method in which the freed iodine was determined. That he had found extremely useful and satisfactory working with iodine pentoxide in a U tube, which was maintained at a temperature of 150° to 160° C. by being immersed in an oil bath. The process and apparatus brought before them now in which the carbon dioxide was determined was designed, he gathered, not so much for laboratory work as for technical use by non-chemists.

Mr. J. H. **Coste** said he was not quite in sympathy with preparing these arrangements for non-skilled people. He did not think there was much difficulty as a rule in absorbing fairly large quantities of carbon monoxide by ammoniacal cuprous chloride, which was apparently a more rapid and better absorbent than an acid solution. There was one defect in Mr. Levy's method, that its accuracy was less as the quantity of carbon monoxide in a mixture became greater, which he thought was a distinct inconvenience, as he absorbed a fixed quantity of carbon monoxide, and when there was a great deal carbon monoxide in the gas a smaller quantity of gas was passed, and consequently the measurement was less sensitive. When the quantity of carbon monoxide was small, he could conceive there might be some difficulty owing to the alkalinity of the glass, and those who had worked with the Petenkoffer method knew that at times introduced great difficulties, and the plan proposed by Letts and Blake to cover the inside of the vessel used with paraffin wax was not very practicable because the co-efficient of expansion of that material was very different from that of ordinary glass. Had Mr. Levy found any difficulty with that? It might be that he was using rather good glass.

Mr. **Arnold Philip** said he had carried out many experiments with the Levy and Pécoul apparatus in which the amount of free iodine liberated was determined and very minute quantities of carbon monoxide could be measured with moderate accuracy. The lowest amount which he understood the author could measure was about 0·4 parts per cent. and the accuracy for this amount was only of the order of 30 per cent. Air containing 0·4 per cent. of carbon monoxide was of course highly poisonous. Was it not possible to obtain a much more sensitive determination? It was such a sensitive and accurate method for which he was in search. It was necessary for measuring small traces of carbon monoxide in after-damp in coal mines, in the air of submarines where exhaust gas leakage took place, and for spaces where leakage of producer gas could occur, etc.

Dr. Haldane's method of testing with blood solutions he had found to give approximately correct results when using fresh solutions of human blood. That was not always conveniently obtainable, and if defibrinated ox blood was used he found the results most unsatisfactory. He had been told that this was due to microbic infection, and that to get satisfactory results the blood must in the first case be collected in specially sterilised tubes and under other special precautions. This procedure was practically impossible except at the expenditure of excessive time and trouble. He wished particularly to insist on the very great importance which attached to obtaining some accurate method of test for the presence of very small proportions of carbon monoxide. He believed that the Levy-Pécoul method was first published in France. He had found that by its use one could determine minute quantities of carbon monoxide but not with very great accuracy; he hoped that what was evidently a modification of the original Levy and Pécoul method now described by Mr. Levy might render it possible, in spite of what he had understood the author to say, to obtain accurate determinations of minute quantities.

Dr. G. **Martin** strongly doubted the advisability of making men who were not trained chemists carry out chemical tests. His own experience was that the results were never satisfactory, and that there was a liability to enormous errors owing to defective manipulation. In the present case such errors might possibly be attended with serious results. In the apparatus under discussion he thought that the preparation, preservation and use of the necessary solutions would require the attention of a properly qualified chemist, and in such hands, no doubt, the instrument would give valuable results. The fundamental idea was certainly an ingenious one, and the apparatus was neat.

Mr. G. N. Huntly said it was remarkable how this method of determining carbon monoxide had escaped getting into the text-books, although it was described over twenty years ago. Some years ago he had had occasion to investigate the method, but the results did not bear very directly on Mr. Levy's paper, since he was concerned with quantities of the order of 0·001 per cent., not 0·5 per cent., and went for the iodine rather than the carbon dioxide formed. If the iodine were used as the measure of the carbon monoxide then the process was certainly not one for an unskilled person. The reaction was quantitative at 100° C., and there was no necessity to go higher. It was a weak point of the process that ethylene and acetylene must be completely removed, although by determining both the iodine and carbon dioxide produced, the completeness of their removal could be tested. He distrusted the minimetric method used by Mr. Levy; similar methods proposed for the determination of carbon dioxide in air were unreliable, but it was quite possible that the special form of absorption tube proposed by the author overcame these difficulties. One of the simplest and most perfect forms of absorption tube was that of Arnold described in his book on Steel Works Analysis, 1895, p. 38.

Mr. Levy, in reply to the Chairman, said the analyses to which he referred were those of the carbon monoxide in a given sample of stored gas compared with the result obtained on his apparatus. He used to employ an oil bath, but after he had had a tube working continuously in another form of apparatus for three days some flaw developed, the oil got inside the tube, the apparatus being wrecked. He had therefore given it up in favour of an air-bath, which was quite satisfactory. His apparatus was meant to replace the Orsat apparatus, where the determination of the carbon monoxide was the chief essential. The results given by his apparatus were far more reliable than those of the Orsat, but it was not intended to give the value of the carbon monoxide to the accuracy of 0·1 or 0·2. With ordinary care the estimation would be accurate to within 0·4 per cent. He had heard from many people, and it had also been his experience, that the results when the Orsat apparatus was employed were never very satisfactory, and they became progressively worse. Of course, there was usually only one absorption tube on the apparatus, and repeated treatment of the gas by the reagent gave a continuously greater absorption. The alkalinity of the glass, no doubt, affected the determination if the apparatus were employed for very delicate determinations; but as already stated it was not quite what it was meant to cover. The colorimetric estimation of the iodine liberated absorbed in chloroform had the objection which was attached to all colorimetric estimations, namely, the difficulty of accurate matching. The same objection applied to Haldane's method with blood. In that case the colour changed from yellow to pink, and it was rather difficult to see when the pink colour exactly matched the standard colour. He had never been able to repeat the observations under different conditions of light, etc., The objections to the use of fuming sulphuric acid as an absorbent for removing the ethylene, especially in any apparatus of the description he showed, was first of all the liability of the leading tubes to choke up owing to the charring of the organic matter, and secondly, it was rather a dangerous reagent, whereas the potassium bromide solution of bromine was comparatively harmless. If one desired to use the method described for the estimation of minute traces of carbon monoxide, he would suggest using a stronger solution of baryta and back-titrating the unneutralised alkali by an equivalent oxalic acid solution. In the method described it had not been intended to give any idea of the percentage of carbon monoxide in a gas which contained less than 0·1 per cent., and although it was quite reliable up to that limit, he recommended the method of back-titration already mentioned for very small quantities. People who were not chemists had to make these tests, such as engineers who had control of steam plants and producer plants. They frequently desired to know the percentage of carbon monoxide and dioxide in the gas they had to examine, and they were generally accustomed to employ the Orsat apparatus for that purpose. He believed that this apparatus was absolutely useless for carbon monoxide, and the test which he had laid before them was really meant more than anything else to replace the Orsat so far as carbon monoxide was concerned, when that was the constituent in which the observer was chiefly interested.

Manchester Section

Meeting held at the Grand Hotel on Friday, December 1st, 1911.

DR. G. J. FOWLER IN THE CHAIR.

NOTE ON A BOILER SCALE CONSISTING OF SILICATE OF ZINC.

BY HAROLD LOWE, M.Sc., A.I.C., AND W. F. LOWE, A.R.S.M., F.I.C.

The occurrence of a boiler scale consisting chiefly of silicate of zinc appears to be unusual, at least we have not been able to find any account of such a scale, and it therefore appears to be of sufficient interest to record it.

It was obtained from the hot water pipes of a large country house, where much trouble had been caused by the furring of the pipes, which in three years had become choked with the scale deposited in them.

One of us was consulted on the matter, and an analysis was made of the water that was said to be causing the trouble. This was from a spring and was of considerable organic purity; it was slightly alkaline in reaction and very soft, the total hardness being 2·27 degrees and the total solid matter in solution 6·3 grains per gallon. It contained :—

	In parts per 100,000 of water.
Silica	1·06
Ferric oxide	·06
Lime	1·16
Magnesia	·76
Potassium and sodium chorides	3·80
Sulphur trioxide	1·02
Nitrogen pentoxide	·93
Chlorine	1·65

The only noticeable constituent is the silica, but this is not present in an unusual quantity, as the amount is about the average in spring waters.

As the composition of the water did not explain the cause of the difficulty a portion of the scale was obtained and an analysis made of it.

It was brownish grey in colour and was very hard, so that it could only with difficulty be scratched with a knife; it was found to consist of silicate of zinc with very small quantities of iron, lime, magnesia, and copper, and the result of the complete analysis was the following :—

Moisture	1·50
Combined water and organic matter	8·60
Silica	19·10
Zinc oxide	62 88
Calcium oxide	1·05
Magnesium oxide	2·23
Alumina	1·50
Ferric oxide	·70
Copper oxide	·42
Carbon dioxide	2·17
	100·15

It was found on inquiry that the cold water supply was stored in a galvanised iron tank, and as this was the only place where the water came in contact with zinc, and the water itself was perfectly free from any trace of this metal, the whole of the oxide of zinc in the scale must have been dissolved from the zinc coating of the tank.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—
English.—8*d.* each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1*s.* each, to the Secretary of the Society.
French.—1 fr. 05 c. each, as follows: Patents dated 1902 to 1907 inclusive, Belin et Cie., 56, Rue des Francs Bourgeois, Paris (3e.); Patents from 1908 to date, L'Imprimerie Nationale, 87, Rue Vieille du Temple, Paris.
German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

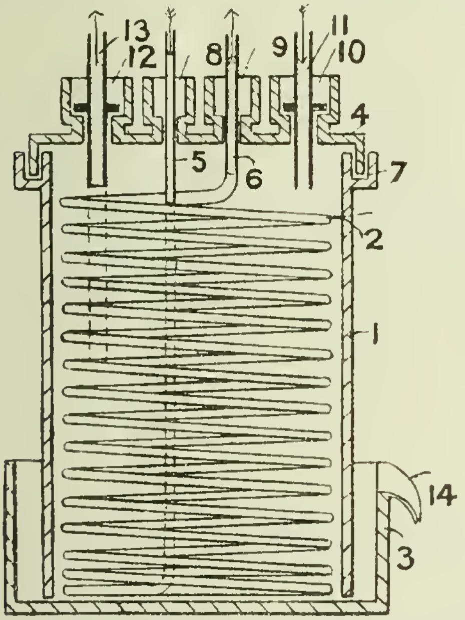
Patents.

Filters. I. A. Averine, Moscow, Russia. Eng. Pat. 25,682, Nov. 4, 1910.

In filters, in which the liquid to be filtered is sprayed over the unsubmerged surface of the sand of the filter from a distributing chamber, fed by siphon tubes depending from an annular vessel, supplied with the liquid to be filtered, the ends of the siphon tubes are bent back so that the reaction of the liquid flowing from them causes the distributing chamber and siphon tubes to rotate.—W. H. C.

Condensing and cooling apparatus. W. B. Hart, Manchester. Eng. Pat. 27,200, Nov. 23, 1910.

The apparatus in one form is shown in the diagram. The cylindrical bottomless casing, 1, is provided with a lute, 7, at the top, into which fits the cover, 4, which is made with four cup-shaped openings, 8, 9, 10, and 12, to form lutes for the pipes, 5, 6, 11, and 13; the cooling medium circulates inside the coil, 2, entering by the pipe, 5, passing straight to the bottom and leaving by the pipe, 6. The cylindrical casing rests in the cylindrical trough, 3, which is provided with a spout, 14. In the form shown, which is particularly intended for the condensation of vapours, the vapour enters by the pipe, 11, is condensed on the coil, 2, and the condensed liquid collects at the bottom and passes under the lower edge of the casing into the trough, 3, and flows over at the spout, 14, any uncondensed gases leaving by the pipe, 13; to admit of the passage of a greater volume of liquid, the lower edge of the casing may be notched or serrated. When intended for the cooling of liquid, the outer trough is made much deeper, the lip, 14, being nearly on a level with the inlet pipe; in some cases the cover may be dispensed with. When used for condensing the products of sublimation, the casing, 1, is luted or jointed by asbestos or by some of the already condensed material to the bottom of the trough, 3. (Several diagrams are given showing how this may be done.) Several units may be used in series and the apparatus, which is easily taken to pieces, may be made of any suitable material including silica ware. The invention may be adapted for use with refrigeration plants.—B. G. McL.



Mixing concrete, powders, and the like; Machine for ——. F. Johnson and E. Smailes, Hull. Eng. Pat. 30,043, Dec. 28, 1910.

The machine consists of a horizontal cylindrical vessel with a rotatable shaft running longitudinally through it, such shaft carrying arms upon which are mounted rocking levers which carry mixing blades at one end. The opposite ends of the levers are connected by springs with the rigid arms in such a manner that the mixing blades are normally held in contact with the walls of the containing vessel but are able to give to any undue pressure resulting from a hard substance getting between the inner wall of the vessel and the blades.—H. H.

Ammonia and other gas compressors. R. Sinclair, Sydney, N.S.W. Eng. Pat. 30,083, Dec. 28, 1910. Under Int. Conv., Feb. 10, 1910.

The auxiliary compression chamber having a non-return suction valve is connected backwardly with the main compression cylinder only when the piston is at the forward end of the stroke.—W. H. C.

Heat of waste industrial water and other liquids; Process and apparatus for the utilisation of ——. H. M. Liese, Hamburg. Eng. Pat. 1832, Jan. 24, 1911. Under Int. Conv., Jan. 26, 1910.

The process is adapted for recovering heat from waste liquids containing suspended or dissolved matter which would deposit on cooling, and consists in bringing heat-exchanging surfaces into contact with steam generated from the liquid by a reduction of pressure, so that no deposit or incrustation is formed upon them. The waste liquid is passed through the lower portions of a series of chambers in the upper portions of which are situated vessels or coils containing the liquid to be heated or other heat-exchanging devices. The chambers may be arranged side by side or vertically one above the other, and are shaped in such a manner that a large surface of the waste liquid is exposed to the influence of the reduced pressure in each chamber before passing on to the next chamber. The suction pipes for maintaining the reduced pressure are connected with the tops of the chambers.—H. H.

Drawing liquids or gases containing an emanation; Device for ——. F. Dautwitz, F. Wanz, and F. Wanz, Vienna. Eng. Pat. 12,132, May 19, 1911.

Liquids or gases containing an emanation are supplied from a vessel which is provided inside with an inflatable rubber bag or with a piston which occupies the space vacated by the liquid or gas, so as to prevent the remaining liquid or gas from coming into contact with air, which otherwise would be drawn in. A by-pass tube leads to a small vessel containing a radio-active substance and fitted with a collapsible bulb by means of which the liquid or gas can be pumped through such vessel to renew the radio-active properties from time to time.—H. H.

Distillation; System for ——. J. M. W. Kitchen, East Orange, N.J. U.S. Pat. 1,008,273, Nov. 7, 1911.

SEVERAL vertical stills each having the form of a tubular condenser are arranged in series in separate chambers. Heated gases from a furnace are drawn through the chambers in succession by a fan fixed between the last chamber and the chimney, and the oil or other fluid to be distilled is circulated through the system of stills in the opposite direction; it enters the lower chamber of the end still, and passes up through the pipes, the portion remaining unvolatilised passing on to the lower chamber of the next still and so on through the system. The gases and vapours given off are passed through condensers and the uncondensable gas separated and utilised in an explosion engine. The power produced is used in a pump to compress the steam given off from the condensers and the steam so compressed is again used to produce motive power.—W. H. C.

Kiln; Rotary ——. P. T. Lindhard, Assignor to F. L. Smidth and Co., New York. U.S. Pat. 1,008,974, Nov. 14, 1911.

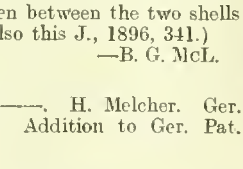
THE lower end of the kiln is prolonged to form a rotary cooling chamber, from which the material is taken by a conveyor to a double bin with gates for each part. The lower end of the kiln is surrounded by a hood into which cooling air is forced by a blower, the hood and the cooling chamber being surrounded by a casing.—A. T. L.

Drying apparatus. F. H. Cummer, Assignor to The F. D. Cummer and Son Co., Cleveland, Ohio. U.S. Pat. 1,009,225, Nov. 21, 1911.

DRYING cylinders having inlet openings along the sides are provided with internal hoods over the openings; these hoods consist essentially of three parts, two substantially concentric shells and a guiding plate, so arranged that the material on entering passes first between the guiding plate and the inner of the two shells in a direction parallel to the periphery and then between the two shells in the reverse direction. (See also this J., 1896, 341.) —B. G. McL.

Crystallising vessels; Floor for ——. H. Melcher. Ger. Pat. 239,906, Oct. 15, 1910. Addition to Ger. Pat. 212,589, Aug. 11, 1908.

A MODIFICATION of the apparatus described in the chief patent (this J., 1909, 1078) designed to prevent the crystals, as far as possible, from being injured by rubbing against the wall of the vessel. The lower part of the crystallising vessel, K, is provided with two tangential, overlapping plates, *a*, *b*, of which *b* is in the form of a ring, whilst *a* has the shape of an inverted funnel opening into the pipe, *c*. Circulation takes place in the direction indicated by the arrows.—A. S.



Slime; Process for the dehydration of ——. G. Doering and M. Ziegler. Ger. Pat. 239,996, May 28, 1910.

THE slime is passed continuously through the central tapering passage of a filter, in which the filtering material consists of slabs of porous stone enclosed on the outside by a support or casing of cast iron. The slabs of porous stone are provided with channels for the discharge of liquid.—A. S.

Classifying solid materials; Apparatus for ——. R. E. Trottier, Puteaux, France. Eng. Pat. 15,371, July 1, 1911. Under Int. Conv., July 6, 1910.

SEE Fr. Pat. 429,117 of 1910; this J., 1911, 1240.—T. F. B.

Distilling apparatus. W. S. Simpson, London. U.S. Pat. 1,008,869, Nov. 14, 1911.

SEE Fr. Pat. 414,634 of 1910; this J., 1910, 1190.—T. F. B.

Measuring gaseous fluids; Automatic recording apparatus for ——. C. F. Simon, Assignor to Chem. Fabr. Rhenania, Stolberg, Germany. U.S. Pat. 1,009,448, Nov. 21, 1911.

SEE Eng. Pat. 19,169 of 1909; this J., 1910, 1144.—T. F. B.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Ammonia recovery process; The direct —— *for gas-works.* A. Fürth. J. Gasbeleucht., 1911, **54**, 1030—1034.

THE direct process of ammonia recovery which has been largely adopted in connection with coke ovens, has not yet made any considerable progress in the closely allied industry of the manufacture of illuminating gas. The author compares the relative advantages of the Otto and the Koppers systems of direct ammonia recovery under the conditions prevailing in the latter industry. In the Otto system, the hot gas (up to 160° C.) is freed from tar by a liquor jet injector and a Pelouze extractor and then passed direct to the saturator. Even under these conditions, however, it is necessary to supply additional heat to prevent dilution of the liquor in the saturator and thus allow of the separation of solid ammonium sulphate. In the Koppers system the tar is separated by condensation and the condensed liquor is distilled with lime in a column apparatus; the evolved ammonia is added to the crude gas on its way to the condenser. The cooled gas from the condenser is passed through a tar extractor and then through a heat interchanger where, by means of the hot crude gas, it is heated to a temperature (65°—70° C.) considerably above its dew-point, and then passes direct to the saturator. The ammonium sulphate is of a much better colour when the Koppers system is used than with the Otto system, and there is no trouble from naphthalene stoppages. Moreover with the Otto process, in the case of coals containing much chlorine, ammonium chloride is produced, part of which remains in the tar and is lost, while part is decomposed in the saturator, yielding hydrochloric acid, which corrodes the metal parts of the apparatus. It would not be possible in most cases to adapt the Otto system to existing gas works owing to the space required and the necessity of installing the plant quite close to the retort house in order to avoid cooling of the gas. The author concludes that the Koppers system is better adapted than the Otto process for gas works. Advantages of the direct process of ammonia recovery are a 5 per cent. increase in the yield of ammonia and decreased labour charges, whilst as Schreiber (J. Gasbeleucht., 1910, 244) has already shown, neither the calorific nor illuminating power of the gas is affected.—A. S.

Petroleum industry; Importance of colloid chemistry for the ——. E. Pyhälä. Z. Chem. Ind. Kolloide, 1911, **9**, 209—216.

CRUDE petroleums are colloidal sols in which the dispersed phase is frequently composed of both solid (mineral gels, asphaltic substances, colouring matters, etc.) and liquid (saline solutions) particles, and according as one or other of these predominate, the sol has the characters of a suspensoid or of an emulsoid. In both cases the dispersed phase can be separated by centrifuging or by addition of electrolytes, a much larger quantity of electrolyte being required in the case of the emulsoid sols. The emulsoid

sols show the characteristic great increase of viscosity with increase in the concentration of the dispersed phase; this increase is so marked that frequently the sols gelatinise when the concentration of the dispersed phase amounts to 50—60 per cent. The author points out how colloid-chemical processes must be taken into consideration in all stages of the petroleum industry from the question of the origin of the petroleum to the treatment of the waste liquors. With regard to the origin of petroleum it must always be borne in mind that characteristic constituents may be partly or completely removed from the petroleum by adsorption and capillary processes whilst it is passing from its place of origin through mineral gels in the different strata of the earth's crust to the place where it is discovered. As an example of how the colloidal character of the products is of influence, it is pointed out that in the preparation of the so-called consistent greases (usually calcium and magnesium or sodium soaps swollen in mineral oil), the desired consistence can be obtained directly with a proper method of cooling, whereas otherwise the product must be treated in a homogenising apparatus. In this latter case, however, the mechanical treatment destroys the inner structure of the mass, and it is found that a larger proportion of fat is then required to obtain a given consistence. The production of persistent emulsions in the refining of petroleum distillates is a problem to be attacked from the colloid-chemical point of view. In the treatment of acid lubricating oils with alkali, a tendency to the formation of a persistent emulsion is indicated by the appearance of whitish bands or strips and gradual thickening of the oil. If the addition of alkali be continued, a stable emulsion is produced, but if it be discontinued, whilst the oil is still faintly acid, the whitish bands disappear on shaking, and further alkali can then be added without danger of producing a persistent emulsion.
—A. S.

Bituminous road binders; Methods for the examination of ——. P. Hubbard and C. S. Reeve. U.S. Dept. Agric., Office of Public Roads. Bull. No. 38, July 27, 1911.

In addition to the tests mentioned previously (see this J., 1911, 201), descriptions are given of the methods for determining the viscosity (in an Engler viscosimeter), the content of fixed carbon, and the content of paraffin scale, and for the extraction of bituminous aggregates and the grading of and determination of voids in the mineral matter separated.—A. S.

High-pressure gas application [*for melting metals*]. Smith. *See* X.

ERRATUM.

This Journal, Feb. 28, 1911, page 201, col. 2, line 30 from top, for "1910, 710," read "1909, 710."

PATENTS.

Retort furnaces and the like; Chambers and passages for mixing the heating gases and combustion air in ——. Ofenbau-Ges. m. b. H., Munich, Germany. Eng. Pat. 15,287, June 30, 1911. Under Int. Conv., Aug. 11, 1910.

To ensure thorough mixing of the heating gases and the air, with gradual combustion, and uniform heating of the flues, each heating flue comprises parallel air and gas flues separated by a partition having inclined, stepped, or curved passages through it, with sharp edges projecting into the path of the air and gases. Both air and gas are thus repeatedly diverted from one flue into the other and are thoroughly but gradually mixed.—A. T. L.

Gas producers. H. J. Green, Birkenhead. Eng. Pat. 16,027, July 11, 1911.

The patent relates to producers of the down-draught type and of the type in which the upper part works with a down-draught and the lower part with an up-draught, the gas outlet being situated in an intermediate position, and the object is to facilitate the conversion of the volatile constituents of the coal into fixed gases. According to the invention, vertical recesses are formed in the upper part of the walls of the producer so as to provide an easy path for the distillation products to a lower part of the fuel column where a zone or zones of high temperature is maintained by the admission of an additional air blast. In a producer for gasifying small coal, the recesses take the form of vertical passages in the lining communicating with the fuel chamber by a series of ports.—A. T. L.

Producer gas apparatus. J. M. W. Kitchen, East Orange, N.J. U.S. Pat. 1,008,274, Nov. 7, 1911.

The apparatus consists of a cylindrical fuel container lined with refractory material and resting on a square base. The base is constructed so that either side can be removed to allow of the introduction or withdrawal of the grate or fuel support, which is located within the base but rests on a sub-base beneath, which also acts as a water-sealed ash-pit.—W. H. C.

Gas; Process of making ——, *and regulating pressure in gas producing apparatus.* H. L. Doherty, New York. U.S. Pats. 1,008,448, 1,008,449 and 1,008,450, Nov. 14, 1911.

(1) The fresh coal which is fed on to the fuel bed of the producer is subjected to a downwardly directed flame of producer gas, whilst air and steam are passed through the lower part of the fuel column and the gases are drawn off at an intermediate point. (2) In order to maintain atmospheric pressure at a given point in the fuel column of a producer, the gases are drawn from the producer by an exhauster, and the air is forced in by a blower, the action of the blower and of the exhauster being regulated so as to give the desired effect. (3) In a down-draught producer the fresh coal is charged in small quantities on to the top of the fuel bed, and producer gas with steam and an excess of air is admitted above the fuel bed so that the fresh coal is subjected to a downwardly directed flame, the distillation gases are burned, and the coke is converted to producer gas. The gas is drawn off at the lower end of the fuel column and passes through a continuous regenerator in which the air for the producer is heated and charged with steam.—A. T. L.

Gas producer. A. M. Levin, Chicago, Ill. U.S. Pat. 1,008,833, Nov. 14, 1911.

The producer is of the up-draught type with a lower main producer chamber and an upper portion of smaller diameter forming a distillation chamber for the raw fuel. The gas passes from the upper part of the main producer chamber through vertical tubes arranged in the water space of an annular boiler surrounding the upper part of the producer. Air is admitted to the distillation chamber through a central vertical down-pipe which delivers near the lower end of this chamber, and an up-draught is maintained through both the lower and upper chambers by a fan which draws the distillation gases from above the fuel column and delivers them to a burner at the lower part of the main producer chamber. This burner comprises air and gas heating chambers and a combustion chamber, so that the gas is partially burned and heated before entering the producer chamber. The fan is regulated automatically by the pressures at the gas outlet and above the fuel column.—A. T. L.

Oil; Means for transporting ——. E. N. Mills, Oakland, Cal., Assignor to C. E. Hailstone, Los Angeles, Cal., U.S.A. U.S. Pat. 1,007,788, Nov. 7, 1911.

The oil is impregnated with minute bubbles of air, and is then forced through a pipe by means of pressure other than that of the air.—C. A. M.

[*Mineral*] *Oil and pigment.* E. W. Enequist, Brooklyn, N.Y. U.S. Pat. 1,009,708, Nov. 21, 1911.

A quantity of melted "petroleum tailings" is dissolved in an equal quantity of a light hydrocarbon oil of density 48°—60° Bé. and b. pt. 150°—300° F., the solution is allowed to settle, and the pigment precipitate is separated.
—A. S.

Artificial fuel; Manufacture of ——. J. J. Shedlock, Little Bentley, Essex. Eng. Pat. 26,512, Nov. 15, 1910.

See Fr. Pat. 425,227 of 1911; this J., 1911, 881.—T. F. B.

Coke-oven. A. O. Jones, Whitley Bay. U.S. Pat. 1,008,718, Nov. 14, 1911.

See Eng. Pat. 17,732 of 1910; this J., 1911, 881.—T.F.B.

Coke ovens; Vertical ——. A. O. Jones. Fr. Pat. 432,330, July 18, 1911. Under Int. Conv., July 26, 1910.

See Eng. Pat. 17,732 of 1910; this J., 1911, 881.—T.F.B.

Gas retorts and coke ovens; Convertible ——. H. Koppers, Essen on Ruhr, Germany. Eng. Pat. 8725, April 7, 1911. Under Int. Conv., April 15, 1910.

See Fr. Pat. 424,747 of 1911; this J., 1911, 735.—T. F. B.

Gas producer. O. A. Gobbe, Assignor to E. Gobbe, Jumet, Belgium. U.S. Pat. 1,009,064, Nov. 21, 1911.

See Fr. Pat. 402,767 of 1909; this J., 1909, 1187.—T.F.B.

Washing oils used for separating benzol from gases; Method of separating and regenerating ——. H. Koppers, Essen on Ruhr, Germany. Eng. Pat. 12,251, May 20, 1911.

See Fr. Pat. 429,671 of 1911; this J., 1911, 1244.—T.F.B.

Gas analysing apparatus. Eng. Pat. 27,545. *See* XXIII.

Calorimeter. U.S. Pat. 1,008,065. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Wood distillation in Sweden. Oil, Paint, and Drug Rep., Dec. 4, 1911. [T.R.]

The chief products obtained from the destructive distillation of wood are charcoals, wood naphtha of 64°, methyl alcohol free from acetone, pyroligneous acid, technical and crystallised acetic acid, formaldehyde, creosote, carbonates of creosote and guaiacol, turpentine, lampblack, tar oil, carbolineum, pitch, etc. Little effort is made to go further in the isolation of the other constituents of wood tar, or to use those separated for the manufacture of other derivatives.

Forty years ago factories were started in Sweden for the destructive distillation of the stumps of spruce and other conifers, to secure more particularly the crude wood oil, used in place of turpentine. This branch of manufacture has not been very successful, as it has not been possible to free the product from a pronounced burnt odour. At present six small factories carry on this distillation. The production of resin and turpentine is very limited for a country so rich in conifers as Sweden. There is an annual import of 400 tons of turpentine.

Decolourising charcoal from sulphite pulp waste lyes. Mathéus. *See* V.

Patents.

Gas obtained by the distillation or carbonisation of coal or other carbonaceous materials; Treatment of —— and apparatus therefor. G. Wilton, London. Eng. Pats. 18,174, July 30, 1910, and 24,035, Oct. 17, 1910.

The hot gas is conducted directly from the hydraulic main to the bottom of a washing tower of the type described in Eng. Pat. 24,832 of 1910. Tar and liquor are fed into the upper part of the tower and flow down from chamber to chamber to the outlet. The upper chambers of the tower are cooled by water circulated through pipes provided for that purpose, but the lower chambers are not cooled. The upper part of the column serves to condense the ammonia water, benzol and tar, and the lower part to re-volatilise the light benzol and ammonia, so that after equilibrium has been established, the ammonia and benzol go forward with the gas which is passed through sulphuric acid in a direct recovery saturator and the ammonia is recovered as sulphate. Any ammonia liquor coming from the bottom of the column may be treated to convert the fixed into free ammonia and then returned to a hot part of the column or to the hydraulic main. Paraffin oil or other naphthalene solvent may be fed into the upper part of the column to absorb naphthalene, any benzol that may have been absorbed being re-volatilised in the lower hot portion of the column.—W. H. C.

Ammonia in shape of a sulphate destitute of tar; Process for the direct extraction of —— from the gases of distillation of coal, peat, wood and the like. H. Püning, Münster, Germany. Eng. Pat. 22,357, Oct. 10, 1911. Under Int. Conv., Oct. 10, 1910.

Gases from the distillation of coal, peat, etc., are freed from tar-fog by a high-tension electric discharge (supplied by the aid of points or edges) and are then led into sulphuric acid.—F. Sodn.

Arc lamp electrodes. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 17,723, Aug. 3, 1911.

Claim is made for the production of a flaming or luminous arc by introducing the light-giving material, *e.g.*, titanium carbide into one electrode and a steadying material, *e.g.*, potassium biborate, into the other electrode.—W. H. C.

Incandescent electric lamps; Metallic filaments for ——. K. Farkas, Assignor to G. V. Williams, New York. U.S. Pats. 1,008,806 and 1,008,807, Nov. 14, 1911.

(1) Filaments made with a glutinous organic binding material are embedded in a finely powdered mixture of aluminium oxide and cerium oxide, and heated to about 2200° F., with exclusion of air, in order to remove the carbon and other impurities. (2) The heating is carried first to 1500° F. *in vacuo*, and afterwards to 2200° F. in the presence of oxygen.—A. T. L.

Carbonisation; Processes of ——. F. W. Burstall. Fr. Pat. 431,581, June 24, 1911. Under Int. Conv., July 30, 1910.

See Eng. Pat. 18,148 of 1910; this J., 1911, 410.—T. F. B.

Arc-lamp electrode. G. Egly, Treptow, Assignor to Gebr. Siemens und Co., Berlin. U.S. Pat. 1,009,291, Nov. 21, 1911.

See Eng. Pat. 23,171 of 1909; this J., 1910, 79.—T. F. B.

Incandescence mantles from artificial silk; Process for making —— by precipitating thorium and cerium oxides by means of organic bases. A. Müller. Fr. Pat. 431,907, May 17, 1911. Under Int. Conv., Nov. 12, 1910.

See Eng. Pat. 11,904 of 1911; this J., 1911, 1368.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Phenol and para-cresol; Determination of —— in mixtures. H. Ditz and F. Bardach. Biochem. Zeits., 1911, 37, 272—312.

A reply to criticisms by Siegfried and Zimmermann (Biochem. Zeits., 1910, 368) of Ditz and Cedivoda's method for determining phenol and *p*-cresol (Z. angew. Chem., 1899, 873, 897; see also Ditz, this J., 1901, 73, 394). The unsatisfactory results obtained are shown to be due to departures from the original method. Details of a series of determinations by the authors are given showing the accuracy of the method, which is also stated to be simpler and more exact than that proposed by Siegfried and Zimmermann (*loc. cit.*).—A. Sbld.

IV.—COLOURING MATTERS AND DYES.

Madder and alizarin lakes and their modern substitutes. Mayer. *See* XIII.

p-Nitranilinearsinic acid. Benda. *See* XX.

Patents.

Leuco compounds of the indigo series; Process for preparing ——. W. Holtschmidt. Ger. Pats. 231,325 and 239,834, Feb. 23 and April 25, 1909.

(1) Indigo and similar compounds can be readily reduced to the corresponding leuco derivatives by means of zinc dust or other finely-divided metal and ammonia, in presence of alcohol, preferably at the ordinary temperature. In order to obtain the best results, it is advisable to use a considerable excess of ammonia, so as to dissolve as completely as possible the reduction products. The advantages of the process rest in the ease with which the ammonia, alcohol, and zinc dust can be recovered; the zinc dust is regenerated by heating with carbonaceous material. (2) The alcohol may be replaced wholly or in part by an indifferent organic solvent, such as ether or petroleum, in which case a small quantity of water is added to the mixture. In place of using the metals in the finely divided condition, zinc, iron, aluminium, etc., may be employed in any other suitable form, such as in the form of metallic "couples."—T. F. B.

Vat dyestuffs of the anthracene series; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 240,080, March 27, 1910.

The dyes are prepared from di- or tri-anthrimides by treatment with aluminium chloride. The dyes from αα-dianthrimide and 1·5-di-αα-anthriminoanthraquinone respectively give red vats from which cotton is dyed in fast brown or brownish yellow shades.—A. S.

Bromnaphthalene-1-diazo-2-oxide-4-sulphonic acid; Manufacture of —— *and of ortho-oxyazo colouring matters derived therefrom.* G. B. Ellis, London. From Chemical Works formerly Sandoz, Basle, Switzerland. Eng. Pat. 3508, Feb. 11, 1911.

See Fr. Pat. 425,837 of 1911; this J., 1911, 947.—T. F. B.

Vat dyes of the anthraquinone series. W. Herzberg and W. Bruck, Schöneberg, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,008,906, Nov. 14, 1911.

See Eng. Pat. 22,780 of 1910; this J., 1911, 276.—T. F. B.

Vat dyes of the anthraquinone series. W. Herzberg and W. Bruck, Schöneberg, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U. S. Pat. 1,008,908, Nov. 14, 1911.

See Fr. Pat. 427,479 of 1911; this J., 1911, 1111.—T. F. B.

Monoazo dye. W. Herzberg and M. Ronus, Berlin, and F. Schwabe, Charlottenburg, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,008,907, Nov. 14, 1911.

See Fr. Pat. 429,529 of 1911; this J., 1911, 1205.—T. F. B.

Azo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Third Addition, dated May 24, 1911, to Fr. Pat. 414,294, March 11, 1910. Under Int. Conv., July 4, 1910.

See Eng. Pat. 17,105 of 1910; this J., 1911, 483.—T. F. B.

Azo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 431,543, June 23, 1911. Under Int. Conv., Aug. 2, 1910.

See Eng. Pat. 9259 of 1911; this J., 1911, 1112.—T. F. B.

Chrome dyestuffs of the triphenylmethane series; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 432,234, June 21, 1911. Under Int. Conv., July 4, 1910.

See Ger. Pat. 238,487 of 1910; this J., 1911, 1306.—T. F. B.

Anthraquinone derivatives; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 432,279, July 17, 1911. Under Int. Conv., July 26 and 27, 1910.

See Ger. Pats. 238,981 and 238,982 of 1910; this J., 1911, 1306 and 1372.—T. F. B.

Vat [anthracene] dyestuffs; Process for preparing ——. L. Cassella und Co. First Addition, dated Aug. 22, 1910, to Fr. Pat. 427,268, May 23, 1910.

See Eng. Pat. 22,306 of 1910; this J., 1911, 531.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Degumming of silks by the froth of soap solutions. G. Colombo and G. Baroni. Rev. Gen. Mat. Col., 1911, 15, 342—348.

Schmid Frères patented a machine (Fr. Pat. 375,173 of 1904; this J., 1905, 24) for degumming silk by hanging it in the froth arising from a boiling soap solution. The authors have compared this process, which is being extensively used in the industry, with the ordinary process of boiling the silk in a soap solution. They have arrived at the following conclusions :—(*a*) The froth method extracts the sericin from raw silk as completely as the immersion process, but the silk loses less weight because a small quantity of soap remains on the material. (*b*) The process is completed more quickly with the new than with the old method. (*c*) The influence of hard water is no greater with the "froth" process than with the ordinary process. (*d*) If the silk has been treated with soaps, fatty substances, or other agents to facilitate the working of the fibre and subsequently conditioned, the froth method like the ordinary soaping process is not so efficient. (*e*) The strength and elasticity of the fibre and its behaviour towards weighting substances or dyestuff solutions are the same after both processes. (*f*) The froth process leaves the fibre in a better condition as regards handle and lustre. Moreover, the fibres, being less agitated during the process, are in a better condition for subsequent working.—P. F. C.

Weighted silks; Comparative effect of thiourea and hydroxylamine on the preservation of ——. P. Sisley. Rev. Gen. Mat. Col., 1911, 15, 337—340.

Under the influence of atmospheric conditions weighted silk becomes weak and if it is exposed to light the tendering of the fibre is greatly accelerated. The author found that ammonium thiocyanate, thiourea and salts of hydroxylamine prevented to a great extent the tendering due to the action of light. Thus a fabric which was weakened to the amount of 40 per cent. after exposure to light for three weeks, lost only 18 per cent. when previously impregnated with a 3 per cent. solution of ammonium thiocyanate or thiourea, whilst the same silk impregnated with a 3 per cent. solution of hydroxylamine was practically unimpaired after the same exposure. Further experiments proved, however, that hydroxylamine and its salts are unable to prevent the tendering due to other agencies such as heat or exposure to air. For example, a weighted silk which lost 64 per cent. of its strength when heated to 50°—55° C. for 5 days, lost 63 per cent. when previously impregnated with a hydroxylamine salt, but only 10 and 11 per cent. when impregnated with 3 per cent. solutions of ammonium thiocyanate and thiourea respectively. The author explains these phenomena in the following way. The tendering of weighted silks produced by exposure to light is due to the oxidation of the fibre by stannic hydroxide and since hydroxylamine is readily oxidised by stannous salts, it prevents the tendering of the fibre by taking up the oxygen liberated by the decomposition of the stannic hydroxide under the influence of light. The tendering produced by heat or by exposure to air (in the absence of light) is due, on the other hand, to traces of iron or copper which act as oxidation catalysts. Since hydroxylamine does not oxidise ferrous or cuprous salts, it is unable to prevent this form of tendering; thiocyanates or thiourea, however, are effective since they combine with iron and copper to form stable and inactive compounds.—P. F. C.

Paper pulps; The microscopy of certain ——. T. F. Hanausek. Papierfabrikant, 1911, **9**, 1464—1465.

Giant spear grass grows in the Terai district of India; the central portion of the stem is very pithy and the pulp shows a high percentage of medullary cells. The fibres of the pulp may be divided into two classes: those of 11 to 14 μ in breadth and up to 4·72 mm. in length, and those up to 34·5 μ in breadth, which are generally short, up to 0·75 mm. in length. The longer type of fibre excels in length that of all other celluloses of the straw group, which should prove a favourable factor in the commercial utilisation of this pulp. Parenchyma cells of various sorts are abundant. Epidermis cells are relatively scarce; some of these are elongated, with only slightly undulated edges; others are short with longitudinal edges more strongly bulged. This pulp shows no specific histological characteristics by which it may be accurately differentiated from other celluloses of the straw group; the only positive clue is afforded by the considerable length of the fibres. According to its microscopic appearance the pulp of the giant spear grass should give excellent paper-making material, combining fineness, uniformity and strength. *Kaing grass* is the reed (*Phragmites Karka* Trin.) of the Indian monsoon region. The fibres show great variations in length, ranging from 0·5 to 2·9 mm.; frequent values being 2·0—2·2 mm. The breadth varies from 9·2 to 25μ. As the stem is hollow, the proportion of parenchyma cells is much lower than in the case of spear grass. The large bag-shaped parenchyma cells are striking, resembling those found in wheat and rye straw pulps and measuring 0·36 × 0·096 mm. Epidermis cells are fairly abundant, some being of great length, up to 0·82 mm, with low-undulating longitudinal edges. This cellulose also has no specific characteristics differentiating it from other pulps of the group. The yield of pulp, according to Raitt, is only about 34 per cent., but it is of excellent quality and abundant supplies of the material appear to be available. —J. F. B.

Talc in paper manufacture; Use and valuation of ——. Wittel and Welwart. Wochenbl. Papierfab., 1911, 4578—4580.

The purest grades of talcstone are found in Styria: the stone is sorted according to colour and quality and then ground. Although talc is essentially a magnesium silicate, a small proportion of the magnesium is always replaced by aluminium. Calcium carbonate, iron oxide and sand occur as impurities. For paper-making purposes the iron oxide should not exceed 1—2 per cent. and the calcium carbonate should not exceed 3—4 per cent., except for use in wrapping papers and cover boards. Talc is frequently adulterated with barytes, up to 20—35 per cent., which, on account of the high specific gravity of this mineral, is very objectionable. The presence of 6—8 per cent. of calcium carbonate cannot always be regarded as an adulteration, since it is not easy to separate the talcstone completely from limestone; samples containing 10 per cent. of calcium carbonate however, would not be suitable for sized papers. The proportion of carbonate can be deduced approximately from the loss of weight on treatment with dilute acid; the loss suffered by the talc itself under standard conditions is 0·3—0·4 per cent. The extraction is made as follows: 0·8—1·0 grm. of the talc powder is treated with 200 c.c. of water and 2·5—3 c.c. of hydrochloric acid (sp. gr. 1·12); the mixture is boiled gently for 15—20 minutes and filtered through a tared filter. Talc imparts excellent qualities to printing papers; it improves the colour, surface, handle and rattle, and the printing type is worn away less rapidly; it "carries" well in the pulp, about 85 per cent. remaining in the paper; it is also used for the fire-proofing and water-proofing of textiles and paper. In the valuation of talc, the whiteness is estimated by comparison with standard samples. Tests should also be made for the determination of gypsum, calcium carbonate and iron: mica is detected by examination with illumination in two planes. The specific gravity of the mineral should be 2·6—2·8; the normal loss on ignition is about 4 per cent., the moisture in the air-dry state only a few per cent.; the size of the largest particles of the powdered talc should not exceed 0·2 mm.—J. F. B.

Roofing-felt boards; Standard specifications for [German] ——. Papierfabrikant, 1911, **9**, 1440.

Under the auspices of the K. Preuss. Materialprüfungsamt, an agreement has been arrived at between the German Societies representing the manufacturers and the impregnators of roofing-felt boards on the following specifications for boards intended for this purpose:—For this kind of board the only raw materials permitted are: rags, fibrous wastes from the textile industries and waste papers. Selection and blending of these materials are left to the manufacturers; the direct addition of mechanical wood pulp, peat, sawdust and mineral loadings is forbidden. The percentage of ash and moisture in the air-dry board must not exceed 12. Any boards which absorb less than 120 per cent. of ordinary anthracene oil at the room-temperature are to be regarded as defective. Boards of normal substance (333 grms.) and over must show a breaking strain of at least 4 kilos. on a strip 15 mm. wide cut in the machine direction. These specifications at present relate only to boards up to No. 150 (150 sq. m.=50 kilos.) —J. F. B.

Sulphite pulp waste lyes; Decolourising charcoal from ——. Mathéus. Papierfabrikant, 1911, **9**, 1435.

The sulphite waste lyes, either fresh or freed from sulphur dioxide by boiling, are neutralised, preferably by milk of lime, in a suitable vessel. The liquor is then concentrated to a thick syrup, and this is further evaporated in flat vessels until it swells up and solidifies on cooling to a brittle and readily friable mass. The powdered product is next heated with exclusion of air to produce destructive distillation, and an extremely porous charcoal is obtained, possessing good decolourising properties, and capable of serving as a substitute for bone charcoal. At the same time a distillate is obtained closely resembling the distillate from wood.—J. F. B.

Behaviour of some metallic hydroxides with alkylenediamine solutions. Traube. *See* VII.

Patents.

Hair from haircloth; Process of separating ——. M. Brodkowsky, Assignor to H. Schlomovitz, Milwaukee, Wis. U.S. Pat. 1,009,019, Nov. 14, 1911.

For the purpose of separating hair from haircloth, the fabric is steeped in a solution of carbolic acid, dried by heat until the vegetable fibres are weakened and rendered brittle, and then agitated in order to disintegrate the vegetable fibres and to free the hair therefrom.—J. F. B.

Nitrated cellulose; Manufacture of ——. A. M. Hart, London. Eng. Pat. 18,606, Aug. 6, 1910.

Nitrated products are obtained from fibres derived from a variety of plants, such as ***Poseidonia Australia***, Ak. (the *Calotropis gigantea*) and "hemp," such as Sanseviera, after purification by soaking in water or by treatment with dilute alkali. The material is then steeped in dilute sulphuric acid, washed and dried. It is nitrated by the standard methods.—B. N.

Paper; Process of removing ink from ——. J. E. Bonser, Abilene, Tex. U.S. Pat. 1,008,779, Nov. 14, 1911.

FOR removing the ink from printed papers, the paper is reduced to a pulp, which is then macerated with a mixture of oil of turpentine, soap, and water; it is boiled and the scum is removed. The pulp is next treated with a preparation of carbolic acid and water, drained, treated with a solution of sodium carbonate and neutralised, *e.g.*, with sulphuric acid. The neutralised solution containing the pulp is finally subjected to electrolysis.—J. F. B.

Cellulose; Treatment of ——. H. Peters, Assignor to H. W. Cullum, London. U.S. Pats. 1,008,489 and 1,008,557, Nov. 14, 1911.

(1). THE process consists in first heating the cellulose with an oil or with glycerin below the boiling point, and subsequently treating the cellulose with a solution of formic acid and palmitic acid in a volatile solvent, *e.g.*, alcohol, and then subjecting the resulting product to the action of an acetylating bath containing acetic anhydride, an alkali acetate, sulphuric acid and a condensing agent. (2). The cellulose is heated with a "chlorhydrin body containing palmitic acid" and the excess is removed; the product is then treated with a solution of formic acid and a volatile solvent, and this product is subjected to the action of an acetylating bath.—J. F. B.

Cellulose solution containing cuprous oxide; Process for preparing a stable ——. T. Eck. Ger. Pat. 240,082, May 22, 1909.

WASHED cupric hydroxide is reduced in the cold by means of a suitable reducing agent, cotton is impregnated with the resulting hydroxide paste, and solution is effected by means of ammonia. Solutions obtained in this manner may contain from 20 to 40 per cent. of cupro-ammonium hydroxide; a content of 10 per cent. is, however, sufficient to ensure complete stability.—T. F. B.

Cellulose products containing little oxycellulose; Process for preparing —— *from cellulose cuprammonium solutions containing copper tetramine sulphate.* Hanauer Kunstseidefabrik. Ger. Pat. 240,242, May 30, 1908.

CELLULOSE threads, etc., containing only small quantities of oxycellulose, and therefore of increased tenacity, are obtained by heating, during or after the process, cellulose cuprammonium solutions which have been saturated, or nearly saturated, with copper tetramine sulphate. The temperature employed should not exceed 40° or 50° C. This heating process is of service in causing the cellulose cuprammonium solution to furnish by coagulation more valuable cellulose products than would otherwise be obtained.—T. F. B.

Paper, etc.; Composition for sizing ——. C. Ellis, Montclair, N.J., Assignor to Ellis-Foster Co. U.S. Pat. 1,007,681, Nov. 7, 1911.

THE composition consists of an unsaponifiable or nearly unsaponifiable resin (*e.g.*, "Jellutong resin") incorporated with an alkali resinate or other resinate soluble in water. The size is miscible with water.—C. A. M.

Textile and cellulosic plants of all kinds; Process for degumming and de-incrusting ——. L. Peufaillit. Fr. Pat. 431,988, June 28, 1911.

SEE Eng. Pat. 22,869 of 1910; this J., 1911, 1307.—T. F. B.

Artificial threads; Process for making ——. J. C. Hartogs. Fr. Pat. 432,400, July 20, 1911. Under Int. Conv., Aug. 18, 1910.

SEE Ger. Pat. 237,744 of 1910; this J., 1911, 1249.—T.F.B.

Cellulose esters; Solutions of —— *and process for producing the same.* W. F. Doerflinger, New York. Eng. Pat. 11,728, May 15, 1911.

SEE U.S. Pat. 1,003,438 of 1911; this J., 1911, 1398. —T. F. B.

Cellulose compound. W. H. Walker, Newton, Mass. U.S. Pat. 1,009,116, Nov. 21, 1911.

SEE Fr. Pat. 417,319 of 1910; this J., 1911, 19.—T. F. B.

Peat; Process for making moulded or compressed articles of ——. R. Pearson and H. S. Stoneham. Fr. Pat. 431,660, June 27, 1911.

SEE Eng. Pats. 1046 and 3130 of 1911; this J., 1911, 1207. —T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Stains produced by the caustic soda contained in electrolytic hypochlorite; Dark ——. J. Donninelli. Rev. Gen. Mat. Col., 1911, 15, 341—342.

WHEN dyed in ecru shades, fabrics containing effect threads dyed with vat dyestuffs, developed dark irregular patches of indefinite outline. The previous history of the material was as follows:—After removing most of the size, the fabric was boiled without pressure in a dilute solution of sodium carbonate (sodium hydroxide could not be used on account of its action on the effect threads), then thoroughly bleached with electrolytic hypochlorite, washed, soured, again washed, and then dyed with direct colours. Local overbleaching was excluded as a possible cause of the stains, because the affected parts were dyed darker than the rest of the material and were not at all tender. The electrolytic hypochlorite was then analysed and was found to contain 9 per cent. of active chlorine and 25 per cent. of sodium hydroxide. Moreover, the stains disappeared on treating the cloth with caustic soda of 10° B. and the "cobbled" fabric when stripped with hydrosulphite and re-dyed, became perfectly even in shade. It is concluded that the stains were produced by insufficient washing and souring after the bleaching process. This left free sodium hydroxide from the hypochlorite on some parts of the material. These patches thus acquired a greater affinity for dyestuffs than the rest of the material and gave rise to dark stains after dyeing.—P. F. C.

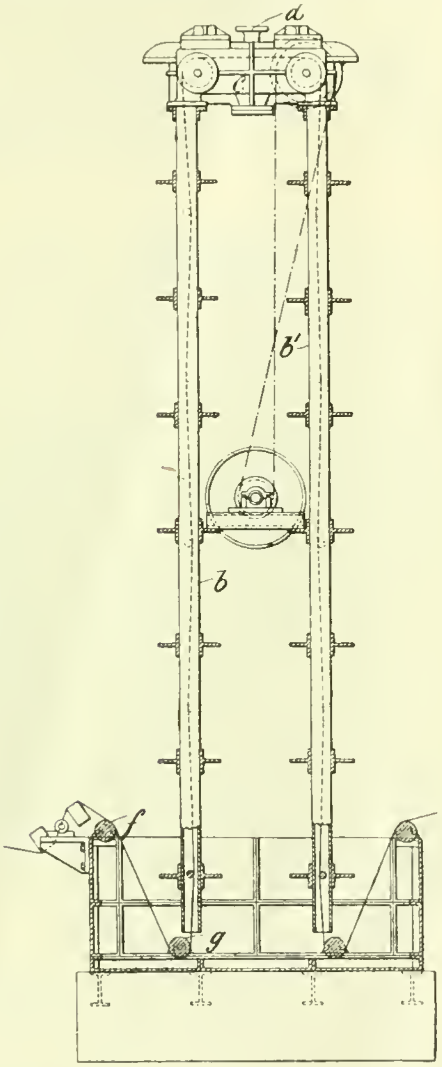
Manganese bronze. E. Siefert. Z. Farben-Ind., 1911, 10, 341—342.

THE author states that he has used since 1903 a process similar to that recently described in Ger. Pat. 239,308 (this J., 1911, 1377). It is, however, too costly to effect the oxidation of the manganous hydroxide entirely by permanganate, as in Dépierre's process (see this J., 1891, 361) and hence a preliminary oxidation by means of air is employed, which is carried so far that the consumption of permanganate is only about 10 per cent. of the quantity necessary theoretically for the oxidation of manganous oxide to manganese dioxide. A much deeper shade is obtained than that produced when bleaching powder is used as oxidising agent, and the difference is greater than can be attributed to the extra manganese dioxide from the permanganate itself. The process used by the author consists in padding the material (cotton) in the hot flue in a solution of 200 grms. of crystallised manganous chloride in 1 litre of water, then passing it in the open width through a hot alkali lye of 18° B. for 10 mins., squeezing, lightly rinsing, again squeezing, and exposing to air as in the oxidation of indigo white or in an ageing apparatus. The material is now given a short passage, preferably in the open width, through a solution of calcium permanganate (25 grms. per litre) in a small vat, then exposed to the air for a short time, washed, and dried.—A. S.

Patents.

Textile fabrics with liquids; Treatment of ——. The Bradford Dyers' Association, Ltd., T. Whitaker and J. Graham, Bradford. Eng. Pat. 29,381, Dec. 17, 1910.

The fabric is led continuously into the liquid, then into a vessel from which the air is exhausted, and finally through the liquid again. The material passes over the rollers, *f* and *g*, into the liquid in the trough, and then through the vertical chamber, *b*, the horizontal chamber, *e*, and the vertical chamber, *b'*, each chamber being wide enough to allow of the passage of a fabric of full width. The air is exhausted through *d*, thus causing the liquid to rise in the vertical chambers, or the trough may contain mercury, in which case provision is made for the supply of liquid to the chambers above the mercury. In order to diminish the quantity of mercury used, an arrangement is employed for diminishing the cross-sectional area of the tube.—B. N.



Blue shades on wool; Production of ——. P. A. Newton, London. From F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 9432, April 18, 1911.

Blue shades on wool, in the presence of a chrome mordant, are obtained by the one bath method with the azo-dye produced from diazotised 4-chloro-2-aminophenol-6-sulphonic acid and β-naphthol.—B.N.

Textile material [warp chains]; Process of conditioning [and dyeing] ——. J. E. Palmer, Middletown, Conn. U.S. Pat. 1,008,613, Nov. 14, 1911.

A chain of spun warp composed of a series of spun warp strands is twisted about its longitudinal axis at infrequent intervals, *e.g.*, at intervals of about one yard, merely with the object of holding the strands of warp collected. The twisted chain is then subjected to the uniform action of a treating liquid, *e.g.*, a dye-bath, and after treatment it is again untwisted.—J. F. B.

Dyeings; Process for producing fast ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 240,265, Oct. 7, 1909.

Indanthrenes or their derivatives, alkylated in the imino group, are reduced by alkaline agents to leuco compounds, which are fixed on the fibre at low temperatures and then oxidised to the dyestuff. Other dyestuffs which are fixed in the same manner (*e.g.*, benzoylamino-anthraquinones) may be added to the vat.—T. F. B.

Red reserves under aniline black by means of the nitrosamine of p-nitro-o-anisidine; Process for producing ——. Fabr. de Prod. Chim. de Thann et de Mulhouse. Ger. Pat. 240,197, March 25, 1911.

A thickened alkaline mixture of the nitrosamine of *p*-nitro-*o*-anisidine with β-naphthol, which may also contain a small quantity of a substance which will liberate an acid, is mixed with calcium or magnesium carbonate in the finest possible state of subdivision; this mixture is printed on the fibre, and after the development of the azo-dyestuff an aniline black solution is applied, and the further treatments carried out as usual. The finely divided carbonate, whilst being an efficient reserve for the aniline black, does not in any way prevent the formation of the azo-dyestuff.—T. F. B.

Waterproofing of fabrics, yarns and other materials. A. M. Hart, London. Eng. Pat. 18,607, Aug. 6, 1910.

Non-explosive nitrated cellulose (prepared as described in Eng. Pat. 18,606, 1910; see page 1446) is dissolved in ether, methylated spirit, and "lucrate" oil (see Eng. Pat. 11,340 of 1909). To render the material non-inflammable, sodium tungstate in fine powder is mixed with the "lucrate" oil, and for colouring purposes, finely-ground pigment mixed with methylated spirit so as to form a smooth paste, is added.—B. N.

Waterproofing solutions. E. A. Muskett and Rubber Substitute (1910), Ltd., London. Eng. Pat. 26,789, Nov. 17, 1910.

From 1 to 10 per cent. of finely divided cotton is mixed with menhaden oil, the mixture churned, and about 3 per cent. of chloride of sulphur diluted with its own bulk of a volatile hydrocarbon such as petrol, is added. The mass is churned till the cotton in the oil dissolves completely, and a further quantity of about 4 to 5 per cent. of chloride of sulphur, diluted as above described, is added and again churned. About 15 per cent. of precipitated chalk is added to neutralise any acid, and, after further mixing, 20 per cent. of "painters' driers" is thoroughly incorporated.—B. N.

Fabrics; Treatment [bleaching] of ——. A. Huillard, Paris. U.S. Pat. 1,008,413, Nov. 14, 1911.

See Fr. Pat. 401,690 of 1909; this J., 1909, 1122.—T. F. B.

[Azo] colouring matters on the fibre; Production of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 6267, March 13, 1911.

See Fr. Pat. 427,882 of 1911; this J., 1911, 1156.—T. F. B.

Dyeing; Apparatus for piece ——. A. Rutler. Fr. Pat. 431,514, June 22, 1911.

See U.S. Pat. 1,005,888 of 1911; this J., 1911, 1310.—T. F. B.

Washing, dyeing, and softening ; Machines for ——. W. G. Gibbins. Fr. Pat. 431,673, June 28, 1911. Under Int. Conv., July 2, 1910.

See Eng. Pat. 15,871 of 1910 ; this J., 1911, 127.—T. F. B.

Dry dyeing ; Process for ——. L. Cassella und Co. Fr. Pat. 432,184, Sept. 28, 1910.

See Eng. Pat. 22,876 of 1910 ; this J., 1911, 889.—T. F. B.

Fabrics ; Transformation of [producing an undulated surface on] composite ——. M. Ratignier, and H. Pervilhac et Cie. Fr. Pat. 432,185, Sept. 28, 1910.

See Eng. Pat. 16,723 of 1911 ; this J., 1911, 1310.—T. F. B.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Sulphuric acid manufacture ; The Opl tower process of —— at Hruschau. E. Hartmann. Z. angew. Chem., 1911, **24**, 2302—2305.

A short review of early attempts to make sulphuric acid in towers is given. None of these were successful, but the invention of the Lunge-Rohrmann plate-tower gave hopes of a more successful application of the principle. The system at Hruschau, which has now worked satisfactorily for four years, consists of six towers, the first three of which form sulphuric acid in the same way as the ordinary Glover tower, whilst the other three function as Gay-Lussac towers, and remove the nitrogen oxides from the tho gases passing through them. In the climate of Central Europe only the first three towers need the protection of a screen or shelter built around them, the other three being erected in the open air. The towers themselves are built similarly as far as strength is concerned, to ordinary Glover or Gay-Lussac towers, and are arranged internally so as to subdivide the gases passing through as completely as possible. There are no reservoirs on top of the towers, but each is fed directly by an elevator from a series of reservoirs on the ground level—the acid from towers 1, 2, 3, being fed into towers, 6, 5, 4 respectively, and inversely. The pipes leading to towers 3, 4, 5, 6, are furnished with cooling arrangements. The surplus acid from towers 2 to 5 collects in a common tank with the whole of the acid from tower 6, and is finally passed through tower 1, which it leaves at a sp. gr. of 1·7. The progress of the gases through the system is aided by a fan at the end of tower 6, beyond which the gases pass through a coke-box on top of the tower to remove any acid fog, and leave the system containing not more acidity than the equivalent of 0·5 grm. of sulphuric anhydride per cub. m. (0·22 grain per cub. ft.). This system produces daily 18,000 kilos. of acid of sp. gr. 1·7, and has a total volume of 600 cub. m., thus producing 30 kilos. of acid of 1·7, or 37 kilos, of 1·58 sp. gr. per cub. m. per day (0·53 cub. ft. and 0·43 cub. ft. per lb. respectively) ; of the whole, towers 1, 2, 3 produce about 20, 30 and 50 per cent. respectively—the other towers are simply denitrators. The nitre-consumption is 0·75 per cent. of nitric acid of 1·33 sp. gr. reckoned on the acid at chamber strength. The power needed is about 3 kilowatts ; about 4000 cub. m. of air are compressed to 2½ atmospheres, and 200—400 cub. m. of cooling water are needed daily. The total cost of the erection, including the shelter for the three first towers, was M. 100,000—110,000 (£5000—£5500), and the ground required about 320 sq. metres (380 sq. yards).—J. T. D.

Sulphuric, nitric, and mixed acids in the United States ; Production of ——. U.S. Census Bureau Report. Oil, Paint, and Drug Rep., Nov. 27, 1911. [T.R.]

The total production of sulphuric acid, reduced to 50 degrees Baume, was 2,797,723 tons in 1909 and 1,869,446 in 1904. Of this total, 933,848 tons were reported in 1909, and 467,614 in 1904, by establishments making it as a chief product ; 621,801 tons in 1909 and 433,377 in 1904, by establishments engaged primarily in the manufacture of other products ; and 1,242,074 tons in 1909 and 968,455 in 1904, were made and consumed in establishments where manufactured.

The total production of nitric acid was 138,086,565 lb. in 1909 and 108,380,387 in 1904. Of this total, 8,396,326 lb. were reported in 1909 and 30,306,555 in 1904, by establishments making it as a chief product ; 18,929,620 lb. in 1909 and 15,927,526 in 1904 by establishments engaged primarily in the manufacture of other products ; and 110,760,619 lb. in 1909 and 62,146,306 in 1904, were made and consumed in establishments where manufactured.

The total quantity of mixed acid manufactured in 1909 cannot be shown, because the amount, made and consumed in establishments where manufactured was not reported ; but the quantity manufactured by establishments making it as a chief product and by those reporting it as a by-product was 57,182,168 lb. in 1909, compared with 65,331,327 in 1904. The production of establishments making mixed acid as a chief product was 45,361,626 lb. in 1909 and 42,812,894 in 1904.

A comparative summary follows, giving the general statistics for the industry in 1904 and 1909 :—

	Census.	
	1909.	1904.
Number of establishments....	42	32
Capital	$18,726,000	$12,762,000
Cost of materials	$5,386,000	$4,973,000
Salaries and wages	$2,046,000	$2,062,000
Salaries	$551,000	$556,000
Wages	$1,495,000	$1,506,000
Miscellaneous expenses	$916,000	$713,000
Value of products	$9,884,000	$9,053,000
Value added by manufacture (products less cost of materials)	$4,498,000	$4,080,000
Employes—		
Number of salaried officials and clerks	330	308
Average number of wage-earners employed during the year................	2,252	2,447
Primary horse power	6,494	5,416

Metallic hydroxides ; Behaviour of some —— with alkylenediamine solutions. W. Traube. Ber., 1911, **44**, 3319—3324.

Although copper hydroxide is only slightly soluble in aqueous solutions of primary aliphatic amines, and is insoluble in solutions of secondary aliphatic amines, it dissolves readily in solutions of primary diamines, yielding solutions containing 14 per cent. and more of the hydroxide. The dissolving of the copper hydroxide in the diamine solution always occurs in the same molecular proportions, irrespective of the concentration of the diamine solution or the method of preparation of the hydroxide. Copper hydroxide dissolves in ethylenediamine solutions with evolution of heat, forming a solution of the compound, $[Cu(C_2H_8N_2)_2](OH)_2$. This substance has not been isolated, as on evaporation of the solution, it decomposes into the diamine and copper hydroxide. The solution is dark blue-violet in colour, and on long standing deposits a small amount of cuprous oxide. It possesses in a high degree the property of dissolving cellulose, a solution made by saturating even a 6 per cent. solution of ethylenediamine with copper hydroxide being capable of dissolving considerable quantities. It is thus far superior in this respect to a solution of copper hydroxide in aqueous ammonia. In making use of this property, it is best to saturate the cellulose first with the ethylenediamine solution, and then to add the necessary copper hydroxide. The cellulose may be precipitated from the solution by acids and alkalis, and eventually by the addition of sugar and similar bodies. Homologues of ethylenediamine form analogous compounds. Ethylenediamine forms similar compounds with hydroxides of nickel, cobalt, zinc and cadmium, and with the oxides of silver and mercury. The formulæ of the nickel, zinc and silver compounds are respectively: $[Ni(C_2H_8N_2)_3](OH)_2$, $[Zn(C_2H_8N_2)_6](OH)_2$, $[Ag(C_2H_8N_2)_3]OH$. The solution of the silver compound is formed by shaking an aqueous solution of ethylenediamine with an excess of pure silver oxide. In the case of nickel and zinc, the pure metals are used in an atmosphere of oxygen free from carbon dioxide. The nickel compound gives a clear bright or deep dark-violet solution according to the concentration, and the zinc compound a colourless solution. The nickel compound was also prepared, in other ways, but it contained in each case the same molecular proportion of metal and base. A solution containing 6 per cent. of nickel hydroxide can be obtained without difficulty.—T. St.

Oxygenated compounds of iodine; Action of hydrogen peroxide on ——. V. Auger. Comptes rend., 1911, **153**, 1005—1007.

Normal alkali periodates are reduced to iodates with the liberation of two atoms of oxygen by hydrogen peroxide. Basic sodium periodate yields a larger proportion of oxygen than the normal salt owing to the catalytic action of the sodium oxide; whilst dipotassium periodate behaves in a similar fashion, though the reduction takes place more rapidly. In the case of periodic acid the results vary with the conditions. Thus on treating a 0·2 per cent. solution of the acid with a 3 per cent. solution of hydrogen peroxide, two atoms of oxygen are liberated for each mol. of periodic acid. After removal of a trace of liberated iodine, the iodate may be determined as silver iodate. On the other hand if the solutions of periodic acid and hydrogen peroxide are concentrated, a considerable quantity of iodine is precipitated, and the reaction is not complete. A saturated solution of sodium iodate is at first very slowly reduced (to sodium iodide), by 3 per cent. hydrogen peroxide, but gradually the reaction is accelerated until, after about 10 hours, on adding hydrogen peroxide to bring the strength to 3 per cent., oxygen is liberated at the rate of 5 c.c. per minute. Cold solutions of hydrogen peroxide (from 30 to 0·3 per cent.) slowly decompose solutions of iodic acid containing less than 0·6 per cent., with the liberation of iodine; but solutions of iodic acid above 0·8 per cent. strength decompose hydrogen peroxide more or less rapidly, though the liquid remains colourless owing to the liberated iodine being oxidised again to iodic acid (see also this J., 1911, 487).—C. A. M.

Radium emanation; Solubility of ——. Application of Henry's law at low partial pressures. R. W. Boyle. Phil. Mag., 1911, 22, 840—854.

Experiments on the solubility of radium emanation in water and other liquids are described showing that Henry's law is valid: at any one temperature the coefficient of solubility (*i.e.*, the ratio of the concentration of the emanation in the liquid to its concentration in the gas acting as a carrier) is independent of the concentration of the emanation, and of the nature and pressure of the other gas, and depends only on the nature of the absorbing liquid. In comparison with many ordinary gases the emanation is fairly soluble in water, as the following figures show, the temperature chosen being 14° C. Coefficients of solubility: hydrogen, 0·02; nitrogen, 0·02; oxygen, 0·04; ethylene, 0·17; nitric oxide, 0·28; nitrous oxide, 0·81; carbon dioxide, 1·1; hydrogen sulphide, 3·3; radium emanation, 0·303. As to variation by temperature, the emanation coefficient at 0° C. is 0·507 and at 40° is 0·153. At 14° C. a quantity of emanation will distribute itself between equal volumes of water and gas so that about one-quarter will go to the water and three-quarters to the gas: at 0° C. one-third will go to the water and two-thirds to the gas. Mercury does not absorb the emanation; sea-water of sp. gr. 1·022 at 14° C. absorbs about 0·84 times as strongly as water. Organic liquids absorb very strongly. At 14° C. ethyl alcohol (absolute) absorbs 24 times, amyl alcohol 31 times, and toluene 45 times as strongly as water.—R. C. P.

Gaseous condensable compound, explosive at low temperatures, produced from carbon bisulphide vapour by the action of the silent electric discharge. II. J. Dewar and H. O. Jones. Roy. Soc. Proc., 1911, A85, 574—588.

Further experiments on the action of the silent electric discharge on a rapid current of carbon bisulphide vapour at low pressure are described (see this J., 1910, 563). In one experiment indications were obtained that the transformation of the primary reaction product into the brown solid only takes place in contact with solid surfaces. A partial separation of carbon bisulphide from the reaction product can be effected by means of shredded rubber. The properties of the brown solid agree generally with those of the polymeric modification of carbon monosulphide produced by the interaction of thiophosgene and nickel carbonyl (see this J., 1910, 487. 755). The differences observed are such as would be produced by a difference in the degree of polymerisation.—A. S.

Solid oxygen; Production of —— by the evaporation of the liquid. J. Dewar. Roy. Soc. Proc., 1911, A85, 589—597.

Owing to its small vapour pressure at the melting point, it is not possible, with the degree of exhaustion attainable with ordinary air pumps, to obtain solid oxygen by evaporation of the liquid, as in the case of hydrogen or nitrogen. Experiments are now described, however, showing that if pure liquid oxygen, contained in a properly isolated vessel, be subjected to the exhaust produced by a quantity of charcoal kept at about the temperature of boiling oxygen, the pressure is lowered to such an extent that the oxygen solidifies to a transparent jelly. The vapour pressure at the melting point appears to be between 1·115 and 1·125 mm. Taking 1·12 mm. as the correct value, the melting point of oxygen, as calculated in the manner described by Rankine or by Willard Gibbs, is 53°—55° abs., which is considerably higher than the figure (46° abs.) given by Estrecker. A direct determination of the melting point by means of a small hydrogen gas thermometer gave the value 54° abs.—A. S.

Past, present, and future of the gold-mining industry of the Transvaal. [*Use of potassium permanganate and bleaching powder for destroying cyanide.*] Hatch. *See* X.

Patents.

Soda from black-ash and the recovery of sulphur from black-ash waste; Manufacture of ——. A. Carey and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 7404, March 24, 1911.

Liquors from the carbonators are so treated that the bicarbonates present are destroyed (for example, by the addition of sodium or calcium hydroxide), and the treated liquors are then used instead of water in the black-ash vats. —F. Sodn.

Oxides of nitrogen; Process for conversion of lower —— to higher oxides of nitrogen. F. Sparre, Assignor to The E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,008,383, Nov. 14, 1911.

A current of electricity is passed through a solution of oxides of nitrogen and through water containing an electrolyte (for instance, acidulated water), between electrodes placed in the respective solutions, the current density at the electrode in the solution of oxides of nitrogen being high (preferably above 100 amps. per sq. dm.) and that at the electrode in the water being low.—F. Sodn.

Lead salts [*from lead fume*]; *Process of making ——.* L. S. Hughes, Assignor to Picher Lead Co., Joplin, Mo. U.S. Pat. 1,008,412, Nov. 14. 1911.

Lead fume is roasted and then treated with acid to dissolve the contained lead oxide, after which the undissolved residue is separated and the lead salt recovered from the solution.—F. Sodn.

Zinc sulpho-amide ; Process of making ——. S. Peacock, Chicago, Ill., Assignor to The Southern Electro-Chemical Co., New York. U.S. Pat. 1,009,558, Nov. 21, 1911.

Zinc sulphide is heated in an atmosphere of nitrogen to a temperature above 800° C., whereby zinc sulpho-amide and sulphur nitride are produced. (See also following abstract.)—A. S.

Sulphides, phosphides, etc. ; [*Electric*] *Furnace for treating* —— *in atmospheres of various gases.* S. Peacock, Chicago, Ill., Assignor to The Southern Electro-Chemical Co., New York. U.S. Pat. 1,009,559, Nov. 21, 1911.

The furnace consists of a water-jacketed rotating casing, the inclination of which can be varied, and which is provided with a gas inlet. The material to be treated is delivered to and withdrawn from the furnace by separate conveyors. Heating is effected by means of a spiral resistor within the furnace, the resistor being supported by clamps connected with spokes which are attached to insulated rings on the outside of the furnace chamber. —A. S.

Salts ; Process of rendering commercial —— *non-deliquescent.* S. Peacock, Chicago, Ill. U.S. Pat. 1,009,560, Nov. 21, 1911.

Commercial salts composed of non-deliquescent constituents mixed with impurities containing deliquescent salts are subjected to the action of ammonia gas at a temperature (about 180° C.) high enough to prevent the formation of "basic ammonia salts." The material is stirred whilst being treated with the gas.—A. S.

Calcium cyanamide ; Process of making ——. F. S. Washburn, Nashville, Tenn., Assignor to American Cyanamid Co., Baltimore, Md. U.S. Pat. 1,009,705, Nov. 21, 1911.

An increased yield of calcium cyanamide of better quality than that usually produced, is claimed to be obtained by surrounding a mass of finely-divided calcium carbide with a combustible envelope, and whilst providing and maintaining a free passage for nitrogen through the mass, heating it, in presence of nitrogen, to a temperature sufficient to carbonise the envelope and induce the formation of calcium cyanamide.—A. S.

Reduction of chemical compounds by high temperatures. [*Preparation of boron, etc.*] Comp. Franç. pour l'Exploit. des Proc. Thomson-Houston. Fr. Pat. 432,189, July 13, 1911.

The process is intended for the production of refractory elements, especially boron. It consists essentially in mixing the vapour of a volatile compound of the element with a reducing gas, such as hydrogen, and bringing the mixture in contact with the surface of a thin tube of refractory material heated electrically to a high temperature, on which the element is then deposited ; the tube of refractory material is subsequently removed or destroyed by mechanical means. If the deposit is produced on the outer surface of the tube, a tube of the element in question is obtained, whilst if the deposit is produced on the inner surface of the tube, a rod may be obtained. Besides boron, compounds of boron with carbon, and other elements such as titanium, thorium, tungsten, uranium, molybdenum, etc., may be prepared in this way.—A. S.

Hydrogen peroxide ; Apparatus for the production of ——. Hydrorion Internat. Wäscherei Maschinen Ges. Fr. Pat. 432,235, June 22, 1911.

The apparatus is for use in the production of hydrogen peroxide by the interaction of sodium peroxide and water. The water is contained in a water-jacketed vessel in the lower part of a casing, the receptacle for the sodium peroxide being mounted in the upper part. A central vertical spindle extends through the casing and is provided with an arrangement for stirring the water. The vessel containing the sodium peroxide has a conical lower part, provided with an opening through which the peroxide falls into the water. In this opening is a grinding device operated by means of suitable gearing from the central spindle. A spring percussion device is also provided, which is operated by a projecting peg on the central spindle in such a way that the vessel containing the sodium peroxide periodically receives blows, whereby the peroxide is prevented from agglomerating and so stopping the discharge opening.—A. S.

Calcium phosphide from lime and phosphorus ; Manufacture of ——. Chem. Fabr. "Vahrenwald" Ges. m. b. H. Ger. Pat. 240,189, Aug. 3, 1909.

A vessel of refractory material is charged with alternate layers of pieces of lime and red phosphorus, and is then closed and heated to redness.—A. S.

Barium oxide ; Production of porous —— *by heating a mixture of barium carbonate and charcoal.* H. Schulze. Ger. Pat. 240,267, Jan. 26, 1907.

A free space is left between the reaction mixture and the charcoal lining of the walls of the containing vessel.—A. S.

Sulphur ; Mining ——. H. Frasch, New York, Assignor to The Frasch Sulphur Process Co. U.S. Pat. 1,008,319, Nov. 14, 1911.

A well is sunk into an underground deposit, and a retaining wall is formed about the well hole by introducing sand or other suitable perforated lining ; the sulphur is then liquefied within the retaining wall (for instance, by introducing hot water which is allowed to flow away underground) and is removed in the liquid state.—F. Sodn.

Nitric acid ; Process of concentrating ——. E. Brauer, Leipzig, Germany. U.S. Pat. 1,008,690, Nov. 14, 1911.

See Ger. Pat. 222,680 of 1909 ; this J., 1910, 879.—T. F. B.

Nitric acid ; Process of concentrating ——. R. Sohlman, Bofors, Sweden, and C. O. Lundholm, Ardeer, Scotland. U.S. Pat. 1,009,197, Nov. 21, 1911.

See Fr. Pat. 402,079 of 1909 ; this J., 1909, 1197.—T. F. B.

Acids ; Process of concentrating ——. R. Sohlman, Bofors, Sweden, and W. A. Wilson, Ardeer, Scotland. U.S. Pat. 1,009,196, Nov. 21, 1911.

See Fr. Pat. 402,078 of 1909 ; this J., 1909, 1197.—T. F. B.

Alkali metals ; Process for effecting the peroxidation of the ——. Soc. Anon. des Usines de Rioupéroux, Rioupéroux, France. Eng. Pat. 15,188, June 29, 1911. Under Int. Conv., July 11, 1910.

See Fr. Pat. 429,269 of 1910 ; this J., 1911, 1212.—T. F. B.

Sodium perborate ; Process for preparing —— *from hydrogen peroxide.* Consortium f. Elektrochem. Industrie G. m. b. H. Fr. Pat. 431,595, June 24, 1911. Under Int. Conv., June 28, 1910.

See Ger. Pat. 237,608 of 1910 ; this J., 1911, 1161.—T. F. B.

[*Cyanogen*] *compounds ; Electrolytic process of producing* ——. C. E. Acker, Ossining, Assignor to The Nitrogen Co., New York. Reissue No. 13,316, Nov. 21, 1911, of U.S. Pat. 914,100, March 2, 1909.

See this J., 1910, 371.—T. F. B.

Calcium cyanamide ; Process of making ——. K. Schick, Siegen, Germany. U.S. Pat., 1,008,927, Nov. 14, 1911.

See Fr. Pat. 430,060 of 1911 ; this J., 1911, 1313.—T.F.B.

Bleach-chamber [*for making bleaching powder*]. C. W. Marsh, Niagara Falls, Assignor to Hooker Electrochemical Co., New York. U.S. Pat. 1,007,366, Oct. 31, 1911.

See Fr. Pat. 431,398 of 1911; this J., 1911, 1382.—T. F. B.

Ferric oxide; Manufacture of ——. J. Gill, Pendleton. U.S. Pat. 1,008,321, Nov. 14, 1911.

See Eng. Pat. 5618 of 1909; this J., 1910, 223.—T. F. B.

Sulphur dioxide; Process of making ——. F. Meyer, Assignor to R. Wedekind und Co., Uerdingen on Rhine, Germany. U.S. Pat. 1,008,847, Nov. 14, 1911.

See Fr. Pat. 419,871 of 1910; this J., 1911, 210.—T. F. B.

Alkaline chlorides; Apparatus for mercurial decomposition of ——. R. Frank, Grunewald, Germany. U.S. Pat. 1,009,061, Nov. 21, 1911.

See Fr. Pat. 429,869 of 1911; this J., 1911, 1312.—B. N.

Ammonium nitrate from aqueous nitric acid; Electrolytic process for making ——. Elektrochem. Werke. Fr. Pat. 432,252, July 13, 1911. Under Int. Conv., July 16, 1910.

See Eng. Pat. 16,426 of 1911; this J., 1911, 1381.—T. F. B.

Direct extraction of ammonia in shape of a sulphate destitute of tar from the gases of distillation of coal, peat, etc. Eng. Pat. 22,357. *See* IIb.

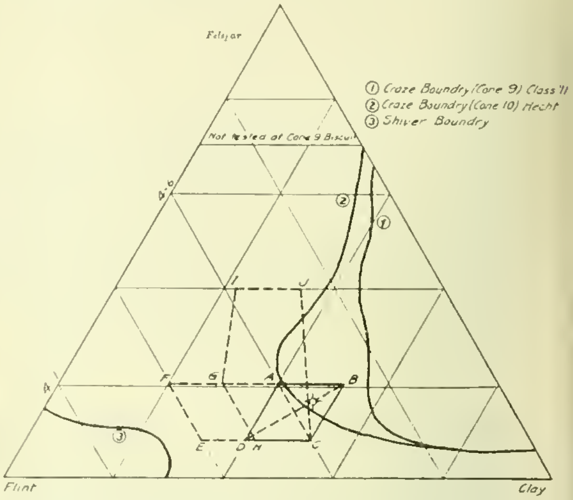
VIII.—GLASS; CERAMICS.

Felspar; Effect of —— *on kaolin in burning.* J. Keele. Trans. Amer. Ceram. Soc., 1911, 13, 731—745.

The addition of felspar to china clays within the range used in pottery bodies causes decrease of porosity, the vitrification being more rapid and complete with fine-grained spar. If coarser in grain than 150-mesh, no amount of spar gives a vitrified body within the temperatures used. Contraction does not appear to be regular, which may be due to the development of gas bubbles in the body at points where contraction was expected. Fluxing begins between cones 05 and 1. The action that goes on in the heated body appears to be the gradual absorption of kaolin by the molten spar. Twenty per cent. of 200-mesh spar causes the same degree of vitrification as 40 per cent. of 40-mesh. If present in coarse grains the spar has to flow to fill the pores of the body, but if finely ground it has merely to soften in position. Time also has its effect on vitrification.—H. H. S.

Glazed whiteware bodies made from clay, felspar and flint; Range in composition of ——. R. C. Purdy. Trans. Amer. Ceram. Soc., 1911, 13, 86—96.

The classification of pottery bodies on the basis of their relative absorption is regarded by the author as untenable and misleading. The real criteria should be working properties, colour, translucency and glaze fit. He groups white bodies as follows: (A) Porcelain, china, belleek; (B) General white ware and decorative ware; (C) Majolica (in its modern sense of coloured glazes); (D) Wall tile and dry-pressed electrical insulators. The limits of body composition are not widely separated from: 12 parts of clay, 9 of flint, 4 of felspar, for the reasons that (*a*) sufficient clay must be present to make the body plastic, yet not enough to cause excessive shrinkage: (*b*) felspar must be sufficient to produce vitrification but not so high as to cause warping; (*c*) flint and china clay should be as high as possible in order to give whiteness and surface texture. The following diagram summarises the results, ABCD marking the practical range in composition, of which ACD is the better part—


Felspar
① Craze Boundry (Cone 9) Class 'I
② Craze Boundry (Cone 10) Hecht
③ Shiver Boundry
Not tested at Cone 9 Biscuit
A-6
A
F
G
A
B
I
J
E
D
H
C
①
②
③
Flint
Clay

The possible variation is narrow and the difference in manufacturers' formulæ lies more in the combination of brands of clays, spars and flints rather than in the total clay or felspar content as expressed by rational analysis. —H. H. S.

[*Pottery*] *Chrome-alumina colours; Notes on* ——. A. S. Watts. Trans. Amer. Ceram. Soc., 1911, 13, 301—305.

Attempts to reproduce chrome pink with a purple tendency resulted in the following stains, calcined at cones 18—22:—(*a*) Al_2O_3 83·62, Cr_2O_3 9·34, B_2O_3 7·04 per cent.; (*b*) Al_2O_3 82·26, Cr_2O_3 17·74 per cent.; (*c*) Al_2O_3 87·64, Cr_2O_3 7·06, B_2O_3 5·31, per cent.; (*d*) Al_2O_3 81·3, Cr_2O_3 8·7, ZnO 10·0 per cent.; (*e*) Al_2O_3 73·92, Cr_2O_3 7·93, ZnO 18·14 per cent.; (*f*) Al_2O_3 81·3, Cr_2O_3 8·7, TiO_2 10·0 per cent. They were ground with equal parts of kaolin and used on porcelain biscuit as underglaze colours at cones 12—16. For softer glazes they are not applicable as the ingredients of such glazes destroy the stain. The study as made was divided into three series: (1) aluminium hydroxide and chromic oxide ground together and calcined, (2) the same with the addition of boric acid before grinding, (3) aluminium sulphate and potassium bichromate dissolved together in hydrochloric acid and precipitated together by ammonia in presence of alcohol. the precipitate, which is sky-blue in colour, being probably a chromous rather than a chromic hydroxide. The glaze trials showed that powders calcined at cone 18 were much pinker than those at cone 22. The second series gave the best colour; then came the first, while the third yielded very pale colours. Attempts to improve the colour of the first series by increasing the alumina content proved futile. The effect of zinc oxide is noticeably weakened by the presence of boric oxide. Titania substituted for boric oxide gives a purplish brown.—H. H. S.

Patents.

Filtering apparatus [*for pottery slip*]. W. Podmore, Porthill, and C. F. Bailey, Stoke-on-Trent, Staffs. Eng. Pat. 24,543 of 1910, date of appl., Apr. 22, 1911.

For the filtration of pottery slip and the like, a vertical filter (see Eng. Pat. 1024 of 1864) is employed which consists of a cylindrical filtering medium surrounded by an annular casing to convey away the filtrate; the material is fed in at the top and drawn downwards by means of a centrally disposed drum, rotated from below by bevel gearing, the diameter of the drum being less at the upper than at the lower end: the surface of the drum is provided with a conveying spiral. According to the present patent the filter with casing device is vertically divided into two semi-cylindrical portions which may be drawn apart for cleaning by means of screw mechanism.—B. G. McL.

Silicious articles; Superficial metallisation of ——. P. Marino, London. Eng. Pat. 14,033, June 13, 1911.

With the object of rendering the surface electrically conducting (for purposes of electro-deposition) the article—which should be absorbent and free from enamel—is first coated with a solution of silver fluoride, then subjected to the action of a stream of coal-gas, and finally heated to about 50° C. in the vapour of carbon bisulphide. The adherence of the deposit so obtained is increased by friction with a rapidly rotating wire brush.—W. E. F. P.

Furnaces for making tiles, pottery, and analogous articles. C. Dressler. Fr. Pat. 432,427, July 21, 1911. Under Int. Conv., July 29, 1910.

See Eng. Pat. 18,114 of 1910; this J., 1911, 1254.—T. F. B.

Wire; "Enamelling" ——. A. Costar, Whiston, D. Bates, Huyton, and British Insulated and Helsby Cables, Ltd., Prescot. Eng. Pat. 26,142, Nov. 10, 1910.

See Fr. Pat. 429,528 of 1911; this J., 1911, 1223.—T. F. B.

IX.—BUILDING MATERIALS.

Portland cement clinker; Constitution of ——. E. Jänecke. Chem.-Zeit., 1911, **35**, 1289—1291.

An examination of the system: $CaO—SiO_2—Al_2O_3—Fe_2O_3$ has led the author to the conclusion that cement clinker contains the compounds,

$8CaO,2SiO_2,Al_2O_3$(alite); $2CaO,SiO_2$; $3CaO,Fe_2O_3$,

and free lime, the first being the chief constituent and the last sometimes absent. Alite, which, contrary to the view of Shepherd and Rankin (this J., 1911, 543), has been proved to be a definite compound, by a study of its cooling curve and by microscopic examination, has been isolated as a greenish white substance, melting sharply at 1382° C. and reacting readily with water, with the separation of calcium hydroxide. This is regarded as the most important reaction taking place when water acts on cement clinker. —F. Sodn.

Cement and concrete; Effect of admixture of alum and soap on the properties of ——. Z. Ver. deut. Ing.; through Papierfabrikant, 1901, **9**, 1435.

Tests have been published in "Beton und Eisen," 1911, No. 16, on Sylvester's process for making mortar and concrete water-resistant by adding to the mass, when mixing, solutions of alum and soap, or by repeatedly coating the hardened mortar or concrete with hot solutions of soap and alum alternately. It is claimed that this treatment under favourable conditions renders the cement absolutely waterproof. It is not stated how long the effects obtained by Sylvester's treatment last, and, according to the present article, it would appear that the material which has been thus treated loses more or less in strength when the soap and alum have been incorporated with the mass. Also the setting of the cement is influenced thereby. During hot weather it is scarcely possible to mix these ingredients with the cement without causing its immediate setting.—J. F. B.

Methods for the examination of bituminous road binders. Hubbard and Reeve. *See* IIa.

Patents.

Brick; Process of burning ——. J. H. Bach, Chicago, Ill. U.S. Pat. 1,008,300, Nov. 14, 1911.

The bricks are suitably stacked in a kiln which is then fired in successive sections. As the burning in any section proceeds, the natural draught at first employed is replaced by a forced draught, the conditions being so adjusted that the carbonaceous matter in the material is completely consumed by the time the bricks attain the desired temperature. Uniformity of working is effected by maintaining the vapour and heat zones in approximately constant relation to each other throughout the firing of the whole kiln.—W. E. F. P.

Wood; Preservation of ——. Höntsch und Co. Ger. Pat. 239,697, Aug. 28, 1910. Addition to Ger. Pat. 237,150, June 2, 1910 (this J., 1911, 1118).

Acetone oil alone may be used instead of a mixture of acetone oil and rosin for impregnating wood, especially if the wood is not subsequently to be exposed to the direct action of the sun.—A. S.

Wood, etc.; Impregnation of ——. M. Rüping, Assignor to Hulsberg und Co., Ges. m. b. H., Charlottenburg, Germany. U.S. Pat. 1,008,864, Nov. 14, 1911.

See Addition of Sept. 27, 1904, to Fr. Pat. 319,758 of 1902; this J., 1905, 278.—T. F. B.

Machine for mixing concrete, powders, and the like. Eng. Pat. 30,043. *See* I.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron carbide; Solubility curve of —— *in γ-iron.* N. J. Wark. Metallurgie, 1911, **8**, 704—713.

Suitable proportions of Swedish cast iron and nail iron were melted in a magnesite crucible so as to yield ten samples of steels containing from 1·98 to 1·21 per cent. of carbon, 0·09 to 0·07 of manganese, 0·05 to 0·03 of silicon, and free from sulphur, phosphorus, and copper. After being drawn into wire, pieces one gram in weight were heated to a temperature of 1140° C. in a salt bath, cooled to 1120° C. and held at this temperature for ten minutes, when they were quenched. The microscopical structure of each is discussed and illustrated by microphotographs. The observation of Gutowksy (this J., 1911, 91) that the mixed crystals saturated at **1130**° C., contained 1·7 per cent. of carbon, is confirmed. The solubility curve of cementite in γ-iron is shown by microscopical examination to be higher than that given by the pyrometric method, and in the immediate neighbourhood of the curve equilibrium is completely established between the homogeneous solution and cementite in a space of ten minutes during cooling.—A. H. C.

Failures [of metals]; Micrographic examination of ——. J. S. G. Primrose. Engineering, Dec. 1, 1911, 748—750.

Examples are given of the advantages of the employment of the microscope in addition to chemical analysis and mechanical tests in the examination of metals. In the case of fractures, not only can the examination be made right up to the fracture itself, but incorrect heat treatment or the presence of fatigue may be readily detected. Microphotographs are given illustrating the causes of a number of failures, in iron and steel, which were only revealed by this method of analysis. These include the fracture of a wrought iron angle bar which caused a boiler explosion, a mild steel plate which fractured on bending although the test piece had passed the specification tests, a locomotive axle which broke while the engine was travelling at express speed, and a motor car steering rod the fracture of which was shown to be due to imperfect case-hardening. Attention is also called to the fact that a piece of work may often be examined by the microscope before putting the material into service in order to determine whether it is in the proper structural condition for use.—A. H. C.

Gold-mining industry of the Witwatersrand, Transvaal; Past, present, and future of the ——. F. H. Hatch. (James Forrest Lecture.) Proc. Inst. Civil Eng., 1910—1911, 186, Part iv., 30 pp.

In most modern plants the ore-pulp from the stamps and tube-mills is separated into sand and slime in a conical collector or diaphragm-cone (a conical vessel having a disc disposed near the bottom). The slime overflows at the top, and the sand is drawn off at the bottom as a thickened pulp, which after passing through a second washing cone, contains less than 1 per cent. of slime and about 30 per cent. of water. This passes over a slowly-rotating horizontal vacuum filter, and then, with less than 12 per cent. of water, passes to a launder where it is mixed with cyanide solution and is subsequently delivered to the cyanide vats. The treatment of the slimes has been greatly facilitated by the introduction of air-agitation tanks and vacuum filters. For the precipitation of the gold from the cyanide solutions, zinc shavings are still preferred for rich solutions, but for weak solutions, such as are obtained in the treatment of slimes, the use of zinc dust is extending. The total ore-treatment cost is about 3s. 6d. per ton of ore, and the recovery is 93—96 per cent. Recently, exhausted sands from the residue dumps or from current operations have been used for filling in abandoned stopes and other working places in the mines. "At first it was feared that the cyanide remaining in the sands would be dangerous to the mine-workers, but a little research has eliminated this source of danger. The percentage of moisture in the pulp, as it comes from the thickening cones, is 12 per cent., and consists of water containing up to 0·02 per cent. of cyanide." By treating this thickened sand-pulp with a 5 per cent. solution of potassium permanganate, or of chloride of lime, it is found that the percentage of cyanide in the moisture of the sands can be reduced to less than 0·0025. With sands thus treated, it has not been possible to detect cyanide in the effluent water from the sand-packs underground, or hydrocyanic acid in the air of the stopes being filled.—A. S.

Gold ores, monazite, and wolframite; Practical and laboratory experience in the preparation of ——. F. Friese. Oester. Zeits. Berg. u. Hüttenw., 1911, 59, 243—250, 257—263, 272—276, 284—288.

The composition is given of a number of gold ores of South American origin including alluvial gold, gold-bearing pyrites, and quartz, and tables and curves showing the results of experiments carried out in order to determine the influence of the gangues in the treatment of the ores by the various methods used for gold extraction, such as amalgamation, chlorination, cyanidation, and extraction with thiosulphate and bromine. Particular attention was paid to the influence of palladium in the cyanide process. The minerals usually found associated with monazite are enumerated and tables are given of the results of experiments with the six different methods that are in use for the separation of monazite from these minerals. The separation of wolframite is also discussed.—A. H. C.

Bullion; The melting of ——, *and electric gas-fired furnaces for* ——. E. Rigg, Superintendent of the Operat. Dept. of the Mint. [Report. Cd. 5862.]

Experiments on the use of gas and oil in melting bullion have been on trial at the Royal Mint since early in 1909, and many designs for furnaces of various sizes have been made, as well as the testing of a number of burners for obtaining high temperatures, some being specially designed, while others were of patterns already in use in various trades. Electric furnaces were also tried, but apart from the prohibitive cost of working, this type of furnace does not lend itself to the melting of precious metals where for accounting purposes the entire charge must be recovered daily, and also it is not possible to stir the alloy effectively.

In the new Silver Melting House, which was taken into use in February last, there are 16 gas-fired furnaces, each capable of taking a 400 lb. crucible and fitted with Brayshaw burners. These furnaces have a maximum capacity of 2¾ tons of sterling silver or 2¼ tons of bronze per melt, and four such melts of silver or three of bronze can be made in an ordinary working day of ten hours. The substitution of gas for coke has been accompanied by several incidental economies, and the charge for fuel averages about 4½d. per cwt. of standard gold bullion as against 7d. when coke was used. In this figure the cost of warming the furnace in the morning is omitted, but even if this be included the cost rarely exceeds 5d. per cwt. on a day's work.

Copper ore; Direct smelting of argentiferous ——, *at Rio Blanco, Chile.* I. D. Ossa. Met. and Chem. Eng., 1911, 9, 630—631.

The ore, containing from 45 to 50 per cent. of silica, 8 to 12 of lime, 7 to 11 of iron, 4 to 6 of sulphur, 7 to 10 of alumina, 1·5 to 3 of lead, 8·9 to 12 of copper, 0·1 of arsenic and from 700 to 800 grms. of silver per ton, was smelted in a cylindrical blast-furnace having a deep inner crucible. Coke was employed as fuel, the fluxes being dolomitic limestone containing 8—10 per cent. of barytes, and old reverberatory slags containing 2·5 per cent. of copper and 150 grms. of silver per ton; the ore and fluxes were mixed in such proportions as to produce a calcium bisilicate slag, and, during the smelting, cooling in the crucible was reduced by increasing the blast. The capacity of the furnace was 20 tons per day, and the products obtained were metallic copper of 90 per cent. purity (25 per cent. of the total copper being obtained in this form) and a matte containing 75 per cent. of copper with from 7 to 9 kilos. of silver per ton; the slag contained only 0·15 per cent. of copper, this low slag loss being attributed to the unusual depth of the crucible of the furnace. In a 10 days' run the ratio of values recovered to total costs was 1·7 : 1·0 and the author is of opinion that the relative costs would be largely reduced by the employment of more suitable fluxes.—W. E. F. P.

Colloidal copper; Preparation of ——. J. Gaube du Gers and W. Kopaczewski. Z. Chem. Ind. Kolloide, 1911, 9, 239—240.

Twenty grams of powdered egg albumin are mixed with 20 c.c. of a 15 per cent. solution of sodium hydroxide and then diluted to 1 litre. The mixture is heated to boiling, filtered from coagulated albumin, again heated to boiling, and a 1 per cent. solution of copper sulphate added drop by drop. The liquid becomes red, then violet, and finally reddish-brown, whereupon a precipitate begins to separate. The addition of the copper solution is stopped before this stage is reached, and the reddish-brown solution is immediately subjected to dialysis, and subsequently filtered. The colloidal copper albuminate sol thus obtained is almost neutral (a red solution is slightly and a violet solution strongly alkaline). It can be evaporated to dryness first by gentle heating on the water-bath and then *in vacuo* over sulphuric acid, yielding reddish brown scales very sparingly soluble in water. Red colloidal gold can be obtained in a somewhat similar manner.—A. S.

Bismuthides and intermetallic compounds. A. C. Vournasos. Ber., 1911, 44, 3266—3271.

The method described previously (this J., 1911, 491) for the preparation of alkali bismuthides is general for metals and metalloids which melt below 400° C. Sodium bismuthide, Na_3Bi, dissolves in melted bismuth, finally forming a eutectic of the composition, $Na_3Bi + 5Bi$. Both it and the corresponding potassium compound, K_3Bi, oxidise in the air, quickly changing to black powders consisting of alkali and bismuth suboxide. When the dry compounds are exposed to quite dry air, they burst into flame, forming alkali bismuthates, dark-yellow in colour. When the potassium compound is heated to 380°—400° C. in a stream of quite pure and dry hydrogen, hydrogen is taken up and the substance becomes phosphorescent. If the temperature is then raised to 700° C., the potassium vapourises and bismuth hydride is left. This compound is a gray amorphous powder which becomes phosphorescent when warmed. In a stream of dry oxygen it burns to water and bismuth oxide. In this way the composition was found to correspond to the formula, BiH_3.—T. St.

Mineral production of the United Kingdom in 1910. [Cd. 5977.] [T.R.]

The following table, showing the quantity and value (definitive figures) of the minerals produced in the United Kingdom in 1910, as compared with 1909, is taken from the General Report with Statistics on Mines and Quarries, 1910, Part III. (price 1s. 5d.) :—

Description of mineral.	1909.		1910.	
	Quantity.	Value at the mines and quarries.	Quantity.	Value at the mines and quarries.
	Tons.	£	Tons.	£
Alum shale	9,120	915	6,674	667
Arsenical pyrites	179	408	944	876
Arsenic	2,880	28,187	2,153	17,602
Barium (compounds)	41,766	40,528	44,667	43,909
Bauxite	9,500	2,408	3,792	882
Bog ore	2,676	669	2,562	640
Chalk	4,436,923	175,020	4,631,432	183,057
Chert, flint, jasper, etc.	52,225	11,654	73,904	12,795
Clay and shale	14,067,810	1,718,056	14,090,320	1,761,410
Coal	263,774,312	106,274,900	264,433,028	108,377,567
Copper ore	3,531	13,859	3,986	14,922
Copper precipitate	186	5,495	192	5,980
Diatomite	240	120	—	—
Fluorspar	42,483	16,029	61,621	20,678
Gold ore	5,538	3,817	6,154	7,509
Gravel and sand	2,164,837	159,441	2,199,852	164,281
Gypsum	238,996	85,943	255,559	98,242
Igneous rocks	6,283,297	1,235,046	6,608,705	1,263,410
Iron ore	14,804,382*	3,678,802	15,226,015*	4,022,269
Iron pyrites	8,429	3,819	9,380	4,018
Lead ore	29,744	259,254	28,534	232,346
Limestone (other than chalk)	11,811,122	1,226,967	12,512,736	1,296,169
Manganese ore	2,768	2,243	5,467	4,673
Mica	23,927	8,225	21,743	9,341
Natural gas ....cubic feet	236,800	Not stated.	262,000	Not stated.
Ochre, umber, etc.	16,313	15,180	16,515	15,377
Oil shale	2,967,057	815,937	3,130,280	860,827
Phosphate of lime	4	6	—	—
Salt	1,818,519	542,324	2,050,630	581,504
Sandstone	4,600,084	1,339,106	4,386,281	1,300,705
Slate	402,184	1,007,013	416,324	1,063,994
Sulphate of strontia	14,042	10,532	4,761	3,570
Tin ore (dressed)	8,289	617,376	7,572	655,871
Uranium ore	6	Not stated.	76	Not stated.
Wolfram ore	376	28,340†	274	27,093†
Zinc ore	9,902	49,320	11,238	52,398
Total values	—	119,376,939	—	122,105,582

* Exclusive of 457 tons in 1909 and 395 tons in 1910 of micaceous iron ore, used for paint, and placed under the heading "Ochre, umber, etc."

† Value of 333 tons only for 1909 and of 254 tons only for 1910.

The increase in the total value of the minerals raised during the year is mainly accounted for by the increased value of coal. The average price of coal was 8s. 2·36d. per ton in 1910, as compared with 8s. 0·7d. in 1909.

High-pressure gas; Application of —— [*for melting metals*]. E. W. Smith. J. Gas Lighting, 1911, **116**, 699—702. (See also Onslow, this J., 1910, 395.)

The author first describes some tests with gas governors of the diaphragm type in which the variation of the outlet pressure is very small even with a widely varying consumption of gas. The following results showing the advantages of gas-fired over coke-fired furnaces for melting brass are given :—

	Gas-fired furnaces.		Coke-fired furnaces.	
	s.	d.	s.	d.
Cost of pots, per cwt.	0	4	0	5
Cost of metal lost, per cwt.	0	10½	1	4½
Fuel cost	0	7½	0	4½
Total cost	1	10	2	2

The best dimensions for crucible furnaces "for all metals up to German silver" are :—Distance of the centre-line of the burner from the tangent to the inside of the furnace, 1 inch; distance of the centre-line of the burner from the bottom of the furnace, 2½ inches; height of the crucible stand, 3 inches; flue area, 6 in. by 4 in. tapered to the damper; thickness (minimum) of brickwork 9 inches. The face of the burner should be in line with the tangent to the furnace, and full way, 3 in. by 3 in., allowed from the burner to the furnace interior.

Dimensions.

Crucibles.			Cylindrical furnace.		Gas consumption per hour for copper.
Capacity, Copper.	Height.	External diameter at top.	Interior.		
			Height.	Diameter.	
Lb.	Ins.	Ins.	Ins.	Ins.	Cub. ft.
60	11¾	7¾	27	10	200
120	15¼	9¾	33	12¼	400
140	16¼	10	33	12½	425
160	17½	10¼	33	12¾	450
200	17½	11⅛	33	13¼	490

For annealing, low-pressure gas is recommended.—W. H. C.

Metals: Electrolytic corrosion of some ——. G. R. White. J. of Phys. Chem., 1911, **15**, 723—792.

The author has studied the electrolytic corrosion of zinc, copper, nickel, tin, iron and cadmium, when these metals are made anodes in solutions of sodium chloride, sulphate, nitrate, acetate and tartrate, containing 75 grms. of salt per litre. The metals corroded to different extents in different solutions, although the same metal often corroded to the same extent in two and sometimes in three electrolytes. The corrosion in some cases corresponded very closely with the theoretical amount calculated from the current, but it was often very much less and occasionally very much greater. When the corrosion was very much less than the theoretical, it was found that further action was prevented by the formation of a hydroxide or oxide film on the anode. In some cases the formation of this film could be detected by a marked increase in the resistance of the circuit. When corrosion was greater than the theoretical quantity, the excess was not found to be due to loss of metal by mechanical disintegration. It is probable that in such cases the metal went into solution in a subvalent form. On this assumption it has been necessary to postulate monovalent forms of tin and of cadmium. In some cases excess corrosion could be accounted for by chemical action of the solvent on the metal. The effect of changing the concentration to 25 grms. per litre was not very considerable except in those cases (*e.g.*, in the tartrate solutions) where the protecting film was more easily deposited from a dilute solution. The effect of variation in current density was irregular: in some cases corrosion increased and in others it decreased with a decrease in the current density. In nearly all the solutions the filtered liquid was alkaline after electrolysis, and in some cases metal was deposited at the cathode. The effect of the liberated gases was always to bring about some reduction at the cathode, and nitrite was always formed in the nitrate solutions. This nitrite did not, however, account for any excess corrosion observed in such solutions. The electrode surface was a very important factor in the experiments and great care was taken in cleaning before electrolysis. Even then it was not possible to duplicate the results exactly. The use of freshly deposited electrolytic copper did not lead to the production of a uniform anode.—W. H. P.

Patents.

Iron or steel ; Furnaces for the direct production of ——, from ores. W. S. Simpson and H. Oviatt, London. Eng. Pat. 18,679, Aug. 8, 1910.

In an open-hearth furnace of the Siemens type, the hearth is constructed of ground chromite, hot-rammed with a minimum quantity of tar or other binding material. A series of flues, through which heated gases are conducted, is embedded or formed in the hearth; and it is claimed that ore-charges may thus be subjected to temperatures exceeding 1600° C. without erosion of the hearth material.—W. E. F. P.

Iron and steel articles ; Process for hardening ——. J. K. Boczogo, I. Hollaki and A. Duffek, Budapest. Eng. Pat. 11,205, May 9, 1911.

The articles, embedded in slag, sand, or other neutral, granular material, are heated in an atmosphere of the gas obtained by "roasting" the dried and ground seeds of leguminous plants. The gas is considered suitable for use when it will burn freely.—W. E. F. P.

Iron ; Method of producing practically pure ——. A. Smith, Tarentum, Pa., Assignor to The Allegheny Steel Co. U.S. Pat. 1,008,377, Nov. 14, 1911.

After treatment of the crude iron in the basic open-hearth, the deoxidation of the metal is effected by the introduction of wood into the molten bath.—W. E. F. P

Steel ; Manufacture of ——. P. H. Dudley, New York. U.S. Pat. 1,009,707, Nov. 21, 1911.

The molten metal after being blown in the usual way is re-carburised by means of spiegeleisen, and after being allowed to stand to allow the slag to rise, is poured into the teeming ladle, and a subsidiary de-oxidising agent, preferably 0·1 to 0·5 per cent. of ferrotitanium, introduced below the slag, before teeming is proceeded with.—A. S.

Blast air ; Treatment of ——. L. Franck, Differdingen, Luxemburg. Eng. Pat. 26,869, Nov. 18, 1910. Under Int. Conv., March 21, 1910.

In a process for enriching blast air with oxygen, the air, previously dried and freed from carbon dioxide, is heated to a temperature of from 600° to 900° C. and passed over barium dioxide. The regeneration of the latter is effected by means of air at a suitable lower temperature.—W.E.F.P.

Iron or steel ; Process for coating [galvanising] ——. A. J. Michelin, Paris. Eng. Pat. 16,294, July 14, 1911.

The iron or steel article having been cleaned with acid and washed with water, is heated to a temperature below the volatilising point of zinc, in contact with a mixture in the form of a fine powder, composed of 80 parts by weight of commercial zinc white, 12 parts of potassium carbonate, and 24 parts of charcoal. The effect of the potassium carbonate is to lower the temperature at which the action can take place. Uniformity of heating is attained by giving a slow movement of rotation to the receiver, which is made of metal and is preferably cylindrical in shape. The length of treatment depends on the thickness of coating desired.—T. St.

Zinc anodes in the form of plates, rods, etc. ; Preparation of ——. L. Sänger. Ger. Pat. 240,630, Oct. 23, 1910.

Claim is made for the use of the following alloys for the preparation of anodes for use in electrolytic galvanising. (1) Zinc, 98·5—99·5 ; lead, 0·1—1·25 ; iron, 0·1—0·2 ; and copper, 0·01—0·10 per cent. (2). Zinc, 97·0—99·5 ; lead, 0·1—1·5 ; iron, 0·1—0·5 ; and tin, 0·5—2·0 per cent. (3). Zinc, 97·0—99·5; lead, 0·1—1·5; iron, 0·1—0·5; tin, 0·1—2·0 ; and carbon, 0·1—0·5 per cent. (4). Zinc, 96·0—99·5 ; lead, 0·1—1·5 ; iron, 0·1—0·5 ; tin, 0·1—2·0 ; carbon, 0·1—0·5 ; and aluminium, 0·05—0·50 per cent. Anodes prepared from these alloys are said to be more durable than zinc anodes during the electrolysis and to maintain their form until reduced to the thinness of paper.—A. S.

Aluminium ; Welding of ——. R. Seligman, London, and Akt.-Ges. für Autogene Aluminium Schweissung, Zurich, Switzerland. Eng. Pat. 29,084, Dec. 14, 1910.

Processes for the autogenous welding of aluminium with the use of a special flux consisting of a mixture or mixtures of chlorides or bromides of alkali metals and additions of fluorides have already been devised by Schoop (see this J., 1907, 828; 1909, 26; 1910, 96.). Claim is here made for the use in such mixtures of chlorides of alkaline earths. Calcium chloride is the most advantageous, since it is cheaper than the alkali chlorides or bromides which it replaces in the mixture. Satisfactory results are produced by a mixture of 60 parts of potassium chloride, 6 parts of cryolite, and 30 parts of calcium chloride, but the proportions may be varied within considerable limits, the best proportions depending on the nature of the welding flame and the character of the work to be done.—T. St.

Zinc ; Production of ——, and other metals. A. B. Pescatore, London. Eng. Pat. 29,839, Dec. 22, 1910.

Oxidised zinc ore, or complex zinc-lead ore, is treated in a shaft furnace provided with electrical heating means at the middle portion, and with tuyères at the bottom. In addition to the usual outlet at the top of the furnace, a duct is provided at the middle through which the volatilised metal, together with part of the furnace gas, is conveyed to the condensing chamber. Coke or anthracite is employed as fuel, and the blast is so regulated that the gas traversing the electrically heated reducing zone is mainly composed of carbon monoxide and nitrogen: the proportion of gas passing to the top of the shaft is controlled by means of the valved pipes connecting the upper outlet of the furnace with the outlet of the condenser. After purification, the gas from the condenser is used for generating the electric energy employed in the process. —W. E. F. P.

Zinc ores, especially mixed sulphides of lead and zinc; Process for the treatment of ——. W. Witter. Ger. Pat. 240,365, Oct. 19, 1909.

A MIXTURE of the ore with metallic iron or with iron oxide and the quantity of carbon necessary for its reduction, is heated to about 1200° C. on a layer of molten slag in a gas-heated reverberatory furnace as described in Ger. Pat. 232,097 (see Fr. Pat. 408,612 of 1909; this J., 1910, 635). Special claim is made for the reduction of molten zinciferous slags from other metallurgical operations by means of metallic iron in a reverberatory furnace.—A. S.

Metallurgical products and the like containing zinc, cadmium, and lead in the metallic state or as oxides; Lixiviation of —— *by means of acid.* A. Wiedemann. Ger. Pat. 240,366, July 22, 1910.

THE claim is for the lixiviation of the materials mentioned in the title with the solution containing sulphuric acid, zinc, and cadmium obtained from the washing towers used for the purification of the burner gases in the manufacture of sulphuric acid by the contact process. This solution contains 25—30 per cent. of sulphuric acid and varying amounts of zinc and cadmium, and in itself has no special value. When used as described, not only is the sulphuric acid utilised, but the zinc and cadmium are recovered along with the metal values present in the materials treated.—A. S.

Lead-silver-zinc ores, argentiferous lead ores, and silver ores; Process for the treatment of —— *by means of zinc and melts containing zinc chloride.* E. Langguth. Ger. Pat. 240,768, March 23, 1911.

THE process for the treatment of the materials mentioned in the title with fused zinc chloride or a fused mixture of zinc chloride and alkali chloride, and reduction of the lead chloride and silver chloride produced, by means of zinc, has usually been carried out in a single vessel, and the whole of the lead subsequently subjected to a desilverising process. According to the present patent, the process is conducted in a series of superposed vessels in such a manner that lead rich in silver is obtained in the upper vessels, and lead poor in silver or free from silver in the lower ones.—A. S.

Furnaces; Crucible ——. L. Rousseau, Argenteuil, France. Eng. Pat. 4171, Feb. 18, 1911.

THE air required for the combustion of the generator gas is previously heated by passing it through a recuperator, which is itself heated by the exhaust gases from the furnace, and consists of several pipes connected together. Two conduits convey the hot air into the conduit through which the generator gas is passing, and these conduits are arranged so as to ensure complete combustion of the generator gas, and so that combustion largely takes place in a cavity situated beneath the crucible. Any metal which has escaped from the crucible is thereby kept in the molten state, and can be run off and recovered by means of a suitable channel.—T. St.

Furnaces; Mechanical roasting ——. K. J. Beskow and A. Ramén, Helsingborg, Sweden. Eng. Pat. 12,214, May 20, 1911. Under Int. Conv., Aug. 18, 1910.

THIS invention relates to the supporting of the stirring arms in large mechanical roasting furnaces, wherein the ore is stirred by means of projections attached to horizontal arms which are rotated by means of a vertical shaft. Its object is to reduce the stresses in the arms, and to allow of the latter being conveniently replaced without stopping the working of the furnace. The arms are accordingly not connected directly with the vertical shaft, but are made hollow, and are threaded on to holders, which are themselves removably mounted on the vertical shaft. This is accomplished by giving the holders an elbow shape, so that the inner ends are bent down and fit into pockets in the shaft, whilst the outer parts acquire a horizontal position. The holders, which are thus prevented by their own weight from getting out of position, are made long enough to give considerable support to the stirring arms and being protected by the latter against wearing or corrosion, may be made of more expensive material such as "special" steel, which possesses great strength at the temperature prevailing in the furnace. The holders and arms are provided respectively with shoulders and abutments which engage and thus secure the arms in position. When it is desired to place a new arm on a holder, the latter is brought opposite to an opening in the masonry which is normally closed by a door. A long iron tube is then introduced into the furnace and its inner end fixed to the extremity of the holder which is tapered for the purpose. The outer end of the tube projects beyond the furnace and on it the new arm is threaded and worked along until it is locked in position on the holder. The tube is then withdrawn. Where the temperature of the furnace is specially high, the holders may be made hollow to allow of the circulation of water or other cooling medium.—T. St.

Magnetically separating materials [*ores*]*; Processes and apparatus for* ——. S. Brück, Berlin. Eng. Pat. 11,898, May 17, 1911. Under Int. Conv., May 17, 1910.

THE materials to be separated are carried by a current of water, air, or other medium over a uniformly magnetised surface in such manner that any particles not attracted at any point along the surface remain within the field of the magnet until they leave at the exit end of the separator. The separator may take the form of a rectilinear or spiral channel in which the uniform magnetic field is produced by an electromagnet running in the direction of the channel, or it may be a cylindrical vessel having the electromagnet arranged as a spiral either outside or inside the vessel, the material being supplied in such a direction that it moves in a similar spiral direction through the apparatus. —H. H.

Metal; Process of accelerating the elimination of occluded slag from molten ——. R. Lock, Tarentum, Pa. U.S. Pat. 1,008,420, Nov. 14, 1911.

THE molten metal is poured in a thin stream from the tapping ladle into a second receptacle to which a preheated "slag-removing agent" is gradually and simultaneously supplied.—W. E. F. P.

Alloys of copper or iron with sodium or potassium; Preparation of stanniferous ——. Sand- und Steinzeugwerke C. Grosspeter, Ges. m. b. H. Ger. Pat. 240,452, July 17, 1910.

AN alloy of the alkali metal with tin, produced by known methods, is melted, and molten iron or copper is added to it in the form of a thin stream.—A. S.

Steel; Process for hardening shaped pieces of ——. J. W. Gebhard. Fr. Pat. 431,846, July 3, 1911.

SEE U.S. Pat. 997,801 of 1911; this J., 1911, 1019.—T. F. B.

Metals; Process for the transmutation of ——. M. Roux, Les Sables d'Olonne, France. Eng. Pat. 26,356, Nov. 12, 1910.

SEE Fr. Pat. 420,535 of 1909 and Addition thereto; this J., 1911, 370.—T. F. B.

Zinc distillation. J. C. Moulden and H. W. Webster, Seaton Carew. Eng. Pat. 26,788, Nov. 17, 1910.

SEE Fr. Pat. 423,912 of 1910; this J., 1911, 630.—T. F. B.

Ore products; Apparatus for treating crushed —— *for the recovery of the metal contents thereof.* A. J. Arbuckle, Johannesburg. U.S. Pat. 1,008,513, Nov. 14, 1911.

SEE Fr. Pat. 414,459 of 1910; this J., 1910, 1211.—T. F. B.

Ore products; Means for separating liquids from crushed ——. W. A. Caldecott, Johannesburg. U.S. Pat. 1,008,524, Nov. 14, 1911.

SEE Eng. Pat. 29,755 of 1909; this J., 1910, 1190.—T. F. B.

Ore-roasting furnace. T. Edwards, Ballarat, Victoria. U.S. Pat. 1,008,892, Nov. 14, 1911.

See Eng. Pat. 21,198 of 1910 ; this J., 1911, 367.—T. F. B.

Metals ; Process for coating metals with ——. C. F. Burgess. Fr. Pat. 431,600, June 26, 1911.

See Eng. Pat. 5811 of 1911 ; this J., 1911, 1219.—T. F. B.

Metals ; Process for the electrodeposition of all ——. A. Rodeck. Fr. Pat. 431,699, June 7, 1911. Under Int. Conv., June 10, 1910, and March 16, 1911.

See Eng. Pat. 13,808 of 1911 ; this J., 1911, 1222.—T. F. B.

Furnaces for roasting ores ; Mechanical ——. J. Harris. Fr. Pat. 432,121, May 27, 1911.

See Eng. Pat. 23,331 of 1910 ; this J., 1911, 963.—T. F. B.

Amalgamator for recovering metal values from ore pulp ; Agitating and concentrating ——. R. Luckenbach. Fr. Pat. 432,277, July 17, 1911.

See Eng. Pat. 2963 of 1911 ; this J., 1911, 1020.—T. F. B.

Superficial metallisation of silicious articles. Eng. Pat. 14,033. *See* VIII.

Reduction of chemical compounds by high temperatures. Fr. Pat. 432,189. *See* VII.

XI.—ELECTRO-CHEMISTRY.

Electric laboratory furnace with winding of common metal [nickel]. L. Ubbelohde. Z. Elektrochem., 1911, **17**, 1002—1003.

The author proposes to surround the nickel winding with carbon to prevent oxidation of the metal at high temperatures (see also Lorenz and Hevesy, this J., 1910, 435; and Seibert, this J., 1911, 631). A reducing atmosphere is thus maintained and the carbon can be renewed periodically. Apart from its smaller price, nickel has certain advantages over platinum for use in electric resistance furnaces, since its resistance does not vary so considerably with temperature. It is therefore not necessary to use extra resistance in the earlier stages of the heating, and the high temperature is reached more rapidly. There is also a considerable economy in current consumption when the furnace has to be kept for some time at constant temperature.—W. H. P.

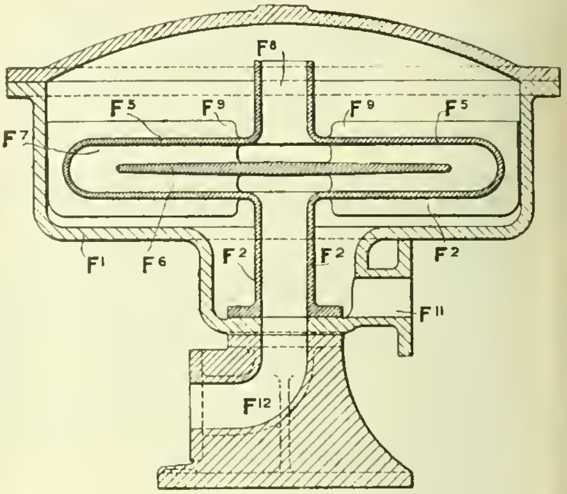
Patents.

Electrolytic gases ; Purification of ——. A. E. Knowles, Wolverhampton. Eng. Pat. 27,264, Nov. 23, 1910.

The electrolytic gases are each separately purified by passing through a purifier containing a catalytic agent, which brings about the chemical combination of hydrogen and oxygen with the formation of water. Explosion traps are placed on the inlet and outlet sides of the purifier, the water formed in the latter condensing in the trap on the outlet side. From this trap the water overflows through a communicating tube to the trap on the inlet side of the purifier, thus forming a water seal in the traps on each side.—B. N.

Electrolytic gases ; Apparatus for the purification of ——. A. E. Knowles, Wolverhampton. Eng. Pat. 21,600 of 1911 ; date of appl., Nov. 23, 1910.

The apparatus is used for the purification of the gases produced by the electrolysis of water, a purifier being employed for each gas, so that in the one case hydrogen is collected, the oxygen being dealt with as an impurity and eliminated in the purifier, and in the other case the impurity of hydrogen is eliminated from the oxygen. The gases enter the purifier through the inlet, F^{12}, and pass through the vertical tube, F^2, into the flat circular chamber, F^5. In this chamber, a disc, F^6, is supported by radial webs, F^7, thus dividing the chamber into radial pockets above and below the disc, the gases passing through the lower pockets, around the edge of the disc, and into the upper pockets. On the outer surface of the chamber, F^5, are radial webs, F^9, which extend to the walls of the outer chamber, F^1. Suitable grids of porcelain, in the form of segments of a circle, rest horizontally upon the webs, F^9, and around the outlet tube, F^8, and upon these the contact material acting as the catalytic agent is spread, so that the gas in its downward passage passes through the material. The hot gas, before making its escape by the tube, F^{11}, serves to heat the webs, F^9, the chamber, F^5, and the inlet tube, F^2, thus giving a preliminary heating to the gas in its upward passage before it comes into contact with the catalytic agent.—B. N.



Electrolytic apparatus. H. Croston, Assignor to General Chemical Co., New York. U.S. Pat. 1,009,133, Nov. 21, 1911.

The apparatus comprises a tank containing the electrolyte, an anode, and a body of mercury forming the cathode. A scraper, arranged to reciprocate horizontally adjacent to the bottom of the tank, projects into the mercury so as to produce circulation in the latter. The scraper is hinged on a carrier, so that it swings on a horizontal axis, the carrier being provided with a stop, so as to arrest the swinging of the scraper when in an approximately vertical position when moving in one direction. The scraper thus carries the mercury forward, but in the return movement swings into a raised inoperative position. Two scrapers may be arranged in the same tank, one being inoperative during movement in one direction, and the second inoperative when moving in the opposite direction. —B. N.

Electrolysis of saline solutions ; Process for the ——. M. Stefani. Ger. Pat. 239,063, Nov. 24, 1908.

In the process claimed, the electrodes are disposed in a substantially horizontal position, and a layer of a material not attacked by the electrolyte is interposed between the anode and cathode. The process is intended for use in cases where, without separation of the electrolyte into anode and cathode liquids, it is desired to prevent a substance present in the nascent condition at one electrode from acting chemically on another substance produced in the electrolysis. This may be effected, for example, by surrounding the electrode in question with broken glass or porcelain, or small glass beads, whereby circulation of the electrolyte in the immediate vicinity of the electrode is prevented, without any considerable resistance being offered to the passage of the current or to the diffusion of gas. In this way any gas present at the electrode in the nascent (ionised) condition, forms inert molecules before it comes in contact with the electrolyte to any appreciable extent.—A. S.

Heating or electrolysis of liquids; Electrical apparatus for the ——. R. F. von Brockdorff, Berlin. Eng. Pat. 27,562, Nov. 26, 1910.

The outer vessel, *k*, forms one electrode (Fig. 1), and the carbon rod, *a*, which may be adjusted vertically in the clamps, *a′*, forms the second electrode. The latter is surrounded by a non-conducting tube, *b*, open at its lower end, and provided with perforations, *f*. Between the electrode, *a*, and the tube, *b*, is a second narrower tube, *g*, which is adjustable, and is suspended by the clamp, *g′*, on a cap, *k′*. The direction of the current from the electrode, *a*, to the outer vessel is shown by the arrows, *c* and *h*. The total resistance to the current is thus the sum of two liquid columns arranged in parallel, viz., a cylindrical column, *e*, and an annular column, *i*, both of which may be suitably varied by relative adjustment of the electrode, *a*, and the tubes, *g* and *b*. The heat produced in the column of liquid causes the latter to rise in the tube, *b*, and pass out through the openings, *f*. The bottom of the tube, *b*, may also be partially closed by a conical valve, adjustable vertically, thus varying the cross-sectional area of the lower end of the tube. In the alternative form (Fig. 2), the electrode, *l*, consists of a number of plates surrounded by an insulating box, *m*, and the latter is attached to a member, *n*, passing through a stuffing-box, o, so that the box, *m*, and contents may be withdrawn from the boiler, *v*. The interior of the box communicates with the water in the boiler by means of tubes, *p*, bent so as to give the necessary length, each being provided with a cut-off valve, *q*, operated from outside the boiler. A number of tubes, *s*, each provided with a cut-off valve, *u*, make communication between the box and tubes, *p*, and the water in the upper part of the boiler. Each tube, *s*, is conically formed, in order to conduct away the large quantity of steam formed in the tubes without interrupting the upward flow of the water. A tube, *t*, also conducts steam from the box, *m*, to the steam chamber above, thus avoiding overloading of the tubes, *s*.—B. N.

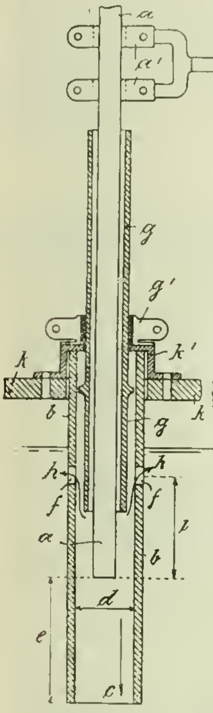


Fig. 1.

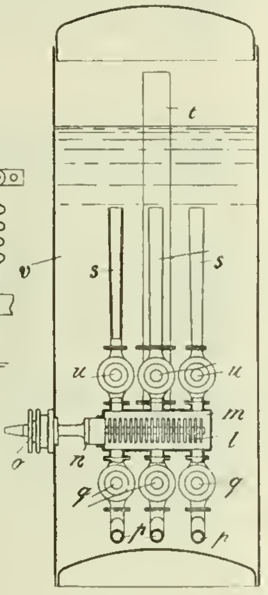


Fig. 2.

Batteries; Galvanic ——. Elektrizitäts-A. G. Hydrawerk Berlin. Eng. Pat. 6664, March 16, 1911. Under Int. Conv., June 23, 1910.

Substances are added to the solid electrolyte mass in order to destroy its friability and render it cohesive, for example, zinc sulphate, sodium thiosulphate, etc., may be used, which are so little hygroscopic that they do not destroy the friability of the electrolyte during the filling, but by the liberation gradually of water of crystallisation the mass is rendered cohesive. Substances, with a melting point below the temperature at which other ingredients of the element are injuriously affected, may be used, and by heating the mass at a suitable time the substances become liquid.—B. N.

Electrode; Storage-battery —— and process of making it. W. Morrison, Des Moines, Iowa. U.S. Pats. 1,008,852, 1,008,853, and 1,008,854, Nov. 14, 1911.

(1) The electrode comprises a body of formed active material, which is interpenetrated with and bonded by an absorbed skeleton, sponge, or film of a desiccated solution of nitrocellulose or celluloid. (2) The electrodes of lead peroxide are first formed, and the pores of the material filled with a desiccated and vulcanised solution of rubber, and the solvent then eliminated. (3) The active material is first intimately mingled with lead oxide, a chromium salt and glycerin, these substances acting as a permanent binder.—B. N.

Batteries; Regeneration and utilisation of residues of elements of ——. Chem. Fabr. Griesheim Elektron. Fr. Pat. 430,741, May 12, 1911. Under Int. Conv., June 3, 1910.

The process is applied to cells of the Leclanché type, in which the electrolyte is composed of zinc chloride and ammonium chloride. The manganese dioxide used as the depolarising body is reduced during the action, and insoluble basic salts of zinc or hydroxides are formed. The depolarising body is submitted to oxidation by means of chlorine, the mass being meanwhile agitated. The basic salts are converted into zinc hypochlorite, and this in the nascent state reacts with the lower oxide of manganese, thus re-forming manganese dioxide and regenerating zinc chloride, which can be again used as the electrolyte.—B. N.

Furnace; Electric ——. W. C. Arsem, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 1,009,625, Nov. 21, 1911.

The furnace comprises an air-tight envelope which is surrounded by a cooling fluid, and within the envelope is a closed crucible, the vapours from the latter being conducted to a condensing chamber in contact with the envelope and cooling fluid. The crucible is supported on a platform between a number of graphite grids, which are electrically connected, and a heat-insulating screen, which is in part removable to give access to the heat zone, surrounds the carbon grids.—B. N.

Electrolyte for aluminium cells. F. W. Peek, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,008,860, Nov. 14, 1911.

See Eng. Pat. 6872 of 1909; this J., 1910, 221.—T. F. B.

Insulating compound. L. E. Barringer, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,009,630, Nov. 21, 1911.

See Eng. Pat. 10,036 of 1905; this J., 1906, 700.—T. F. B

Magnetite electrodes; Process for making ——. Chem. Fabr. Buckau. Fr. Pat. 432,419, July 21, 1911. Under Int. Conv., July 22, 1910.

See Ger. Pat. 235,307 of 1910; this J., 1911, 1021.—T.F.B.

Conversion of lower oxides of nitrogen into higher oxides. U.S. Pat. 1,008,383. *See* VII.

[*Electric*] *Furnace for treating sulphides, phosphides, etc., in atmospheres of various gases.* U.S. Pat. 1,009,559. *See* VII.

XII.—FATS; OILS; WAXES.

Oils from plants belonging to the order Papilionaceae. C. Grimme. Pharm. Zentralh., 1911, **52**, 1141—1149. Chem. Zentr., 1911, **2**, 1739—1740.

In addition to the results given previously (this J., 1911, 496), the oils from sixteen other kinds of seeds, used as foodstuffs in Germany and German colonies, have been examined. The oils, which were all of a non-drying character, were obtained by extraction with ether.

Oils.

Oil from:—	Yield.	Sp. gr.	Solidif. pt.	Refractive index.	Acid value.	Saponif. value.	Iodine value.	Fatty acids.	Glycerol.	Unsaponifiable matter.
	per cent.		° C.					per cent.	per cent.	per cent.
Cicer arietinum, L. (chick-pea)	5·1	0·9184 (15°)	—15	1·4717 (30°)	6·9	182·6	118·5	92·62	9·59	1·08
Pisum sativum, L. (common pea)	1·0	0·9193 (15°)	—12	1·4766 (35°)	6·2	184·5	106·0	92·68	9·74	1·32
Vicia Faba, L. var. *major* (broad bean)	1·07	0·9175 (15°)	—11	1·4756 (30°)	12·7	184·7	99·6	91·81	9·40	1·94
Vicia sativa, L. (vetch)	1·05	0·9204 (20°)	—8	1·4795 (30°)	17·5	180·5	107·2	90·69	8·91	2·20
Vicia sepium, L. (bush vetch)	1·4	0·9208 (15°)	—8	1·4748 (40°)	13·3	183·1	111·0	91·81	9·28	2·04
Lens esculenta, Mőnch. (lentil)	0·83	0·9211 (25°)	—6	1·4766 (40°)	13·1	182·4	100·4	92·06	9·25	1·78
Cajanus indicus, Spreng. (pigeon-pea)	1·22	0·9198 (25°)	—2	1·4633 (35°)	3·6	188·2	102·7	91·31	10·09	2·33
Phaseolus Mungo, L. (Mungo bean)	1·85	0·9266 (25°)	±0	1·4640 (45°)	10·2	187·5	111·3	92·13	9·91	1·27
Phaseolus vulgaris albus, Haberle (haricot bean)	1·32	0·9179 (15°)	—4	1·4789 (45°)	7·0	189·2	135·7	87·51	9·96	5·85
Phaseolus coccineus, Lam. (scarlet runner)	1·83	0·9198 (15°)	—12	1·4760 (40°)	15·2	189·6	141·2	91·95	9·53	1·69
Phaseolus lunatus, L. (moon-bean)	1·0	0·9212 (25°)	1	1·4772 (40°)	5·9	189·3	99·8	92·32	10·02	0·98
Phaseolus inamoenus, L.	1·26	0·9206 (25°)	—2	1·4646 (45°)	4·1	188·7	118·9	92·23	10·09	1·11
Dolichos Lablab, L.	1·42	0·9192 (25°)	—2	1·4710 (45°)	6·9	187·5	94·4	91·86	9·87	1·54
Vigna catjang, Endl.	1·28	0·9228 (25°)	—2	1·4672 (40°)	59·1	185·6	100·8	93·79	6·91	1·69
Canavalia ensiformis, D.C. (fetich-bean)	2·81	0·9169 (15°)	—7	1·4685 (45°)	25·9	186·5	86·1	92·78	8·78	1·29
Voandzeia subterranea, Thon.	6·24	0·9176 (15°)	2	1·4626 (40°)	11·8	184·1	112·0	92·30	9·42	1·38

Fatty acids.

Oil from:—	Melting point.	Solidif. point.	Refractive index.	Neutralisation value.	Iodine value (Wijs).	Mean molecular weight.
	° C.	° C.				
Cicer arietinum, L.	18—21	15—16	1·4587 (40°)	189·4	120·3	296·5
Pisum sativum, L.	26—27	24—25	1·4659 (35°)	183·5	108·4	306·1
Vicia Faba, L. var. *major*	25—26	22—23	1·4679 (35°)	183·3	102·0	306·4
Vicia sativa, L.	30—32	26—28	1·4704 (35°)	180·8	105·8	310·6
Vicia sepium, L.	33—34	30—31	1·4704 (35°)	185·9	111·9	302·1
Lens esculenta, Mőnch.	25—26	22—23	1·4698 (40°)	182·0	103·0	308·6
Cajanus indicus, Spreng.	29—31	24—25	1·4691 (35°)	185·7	104·0	302·5
Phaseolus Mungo, L.	32—33	27—28	1·4723 (40°)	185·8	114·2	302·4
Phaseolus vulgaris albus, Haberle	22—23	19	1·4679 (40°)	180·5	136·0	311·0
Phaseolus coccineus, Lam.	14—15	13	1·4653 (40°)	187·0	143·6	300·3
Phaseolus lunatus, L.	29—31	26	1·4704 (45°)	188·2	101·6	298·4
Phaseolus inamoenus, L.	26—27	23	1·4640 (44°)	182·8	121·7	307·2
Dolichos Lablab, L.	35—36	33	1·4633 (45°)	180·0	97·0	312·0
Vigna catjang, Endl.	35—36	32	1·4620 (40°)	189·4	99·4	296·5
Canavalia ensiformis, D.C.	32—34	29	1·4593 (45°)	189·0	92·3	297·1
Voandzeia subterraneo, Thon.	26—27	22	1·4566 (45°)	185·1	112·8	303·4

—A. S.

Sesamum seed; Cultivation, production, and utilisation of ——. Bull. Imp. Inst., 1911, **9**, 259—272.

The article comprises sections on the cultivation of the plant in different parts of the world, the utilisation of the seed, and the characters of the oil and press-cake. The most important European market for sesamum seed is Marseilles, and the imports of the seed at that port from the principal sources of supply are shown in the following table:—

	1905.	1906.	1907.	1908.	1909.
	tons.	tons.	tons.	tons.	tons.
India	39,660	31,618	60,556	17,470	40,852
Bassorah	10	1281	346	732	129
China	2400	20,444	2616	21,818	20,290
Levant	3696	6665	3486	324	1772
Africa	830	1408	1472	1405	1044

—A. S.

Carbon bisulphide in oils; Detection of ——. E. Milliau. Comptes rend., 1911, **153**, 1021—1023.

Twenty-five grms. of the oil are saponified in the cold with 10 c.c. of concentrated aqueous potassium hydroxide solution, the soap is dissolved in about 150 c.c. of warm water, a pinch of sodium bicarbonate added, and the liquid treated with 20 c.c. of hydrochloric acid. Oils containing as little as 0·5 part per 1000 of carbon bisulphide emit gas which reacts with lead acetate paper under these conditions. No colouration is given, however, by oils which have previously been heated for an hour at 130° C. Another sensitive test is to distil 50 grms. of the oil with 10 c.c. of amyl alcohol and to collect the first 5 c.c. of distillate. A mixture of 4 parts by volume of this distillate, 1 part of neutralised kapok oil, and a few centigrms. of powdered sulphur is then heated in a sealed tube in boiling water. Olive oil containing 0·1 per cent. of carbon bisulphide gives a deep red colouration. Cotton-seed oil used instead of kapok oil in the test, gives a similar but fainter reaction. The reducing agents in cotton-seed and kapok oils cannot be separated by distillation. As in the case of the other test, the reaction is prevented by heating the oil at 130° C.—C. A. M.

Beeswax from Northern Nigeria. Bull. Imp. Inst., 1911 **9**, 236—240.

Seven samples of beeswax, stated to have been obtained from the Lapai and Zungeru districts of the Niger Province, were examined. The results obtained with the samples after they had been refined in the laboratory, are shown in the table :—

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
M. pt.	64·5°—65°. C	63·5°—64° C.	63° C.	63·5°—64° C.	63·5°—64° C.	63·5° C.	64° C.
Acid value	—	15·8	19·7	18·7	20·0	15·6	16·3
Ester value	—	78·0	76·3	76·6	75·3	78·4	77·2
Ratio number	—	4·9	3·9	4·1	3·7	5·0	4·7
Iodine value	—	9·3	5·9	5·9	7·5	9·5	8·1

Samples Nos. 2, 3, 4, 5, 6 and 7 were valued at £6 17s. 6d., £7 5s. to £7 10s., £6 17s. 6d., £6 15s., £6 17s. 6d., and £7 respectively per cwt., compared with £7 5s. to £8 2s. 6d. for Jamaica beeswax. Large quantities of beeswax are stated to be available in Northern Nigeria, and in some districts rail transport is already provided.—A. S.

Determination of water in butter. Rivett. *See* XIXa.

Composition of pear and apple seeds. Huber. *See* XIXa.

Patents.

Unsaturated fatty acids or their glycerides; Conversion of —— into saturated compounds. J. Crosfield and Sons, Ltd., and K. E. Markel, Warrington. Eng. Pat. 30,282, Dec. 30, 1910.

The catalytic agent used for the reduction (see Eng. Pat. 1515 of 1903; this J., 1904, 26) is distributed over suitable porous material such as pumice stone.—C. A. M.

Fatty acids or their glycerides; Method of saturating —— with hydrogen. E. C. Kayser, Assignor to The Proctor and Gamble Co., Cincinnati, Ohio. U.S. Pat. 1,008,474, Nov. 14, 1911.

The hydrogenation of fatty acids and their esters is effected by heating with hydrogen a mixture of the fatty acid or ester and a pulverulent catalyser, consisting of a light, voluminous, finely-divided, inert support, impregnated with nickel or other active metal. Intimate contact between the reacting substances may be brought about by mechanical sub-division of the acid, or ester, and the catalyser, in an atmosphere of hydrogen, or by repeatedly projecting or propelling the mixture into an atmosphere of compressed hydrogen.—E. W. L.

Soap powder; Process of making ——. C. Ellis, Montclair, N.J., Assignor to Ellis-Foster Co. U.S. Pat. 1,007,680, Nov. 7, 1911.

A readily soluble non-coherent soap powder is obtained by saponifying cocoanut oil or other glyceride with about twice the amount of alkali (caustic soda or potash) to combine with the fatty acids, after which free fatty acids are added to neutralise the excess of alkali, and the mixture crutched in the presence of air, until its volume is practically doubled, and then dried and ground to a fine powder.—C. A. M.

Waterproofing solutions. Eng. Pat. 26,789. *See* VI.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Madder and alizarin lakes and their modern substitutes. C. Mayer. Chem.-Zeit., 1911, **35**, 1353—1354.

The author gives a summary of the history and properties of madder and alizarin lakes and stress is laid on the expert knowledge and skill required in their manufacture. For the preparation of good substitutes the following coal-tar dyestuffs are recommended: Lithol Red and Scarlet, Brilliant Red R, Lake Red, Permanent Red 6B, and more particularly Pigment Rubin and Lithol Rubin (which require the use of Turkey Red oil). (See also this J., 1906, 980; 1909, 1245.) For very fine artists' colours, however, preference is still given to the madder lakes, the prices of which are given as follows :—Madder carmine, 200 francs per kilo. (£3 12s. per lb.), purple, red, and pink lakes, 150 francs per kilo. (£2 14s. per lb.) (See also this J., 1911, 635.)—A. Sbld.

Patents.

Paint; Method of making ——. A. S. Ramage, Buffalo, N.Y. U.S. Pat. 1,008,434, Nov. 14, 1911.

Paint is made by compounding a pigment with a metallic soap in presence of water, and then displacing water from the resulting mass by mixing it with oil or other paint vehicle. Or the soap may be prepared from the pigment itself if, for example, a basic lead pigment be employed, by mixing it with an organic radicle capable of yielding insoluble lead soaps. Or the pigment may be mixed with a soluble soap and the latter converted into an insoluble soap by the addition of a suitable precipitant.—E. W. L.

Masses for casting and coating; Manufacture of ——. S. von Medveczky. Ger. Pat. 239,773, Oct. 30, 1910.

A concentrated solution of a soluble silicate, especially sodium or potassium silicate, is mixed with freshly prepared celloidin and boiled until the latter has dissolved as completely as possible. The very viscous liquid thus obtained can be used for coating or impregnating different materials and also for preparing moulded articles, having, it is claimed, the properties both of glass and of celluloid. —A. S.

Betulin; Method of making —— suitable for the production of coating compositions. J. R. Köhler, Stockholm. Eng. Pat. 14,768, June 21, 1911. Under Int. Conv., July 12, 1910.

See Fr. Pat. 431,198 of 1911; this J., 1911, 1398.—T. F. B.

[Mineral] Oil and pigment. U.S. Pat. 1,009,708. *See* IIa.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Hevea latex; Adsorption of acids by the colloids of dialysed ——. W. Crossley. India Rubber J., 1911, **42**, 1293—1294, 1341—1342.

The experiments were made on a sample of *Hevea* latex from Ceylon, containing 16·16 per cent. of rubber, which was dialysed in a viscose bag. The dialysed latex (sp. gr. 0·984 at 15° C.) contained 12 per cent. of total colloids, and 10 c.c. required only 2 drops of $N/10$ sodium hydroxide for neutralisation. A measured volume of this latex was placed inside a parchment cylinder closed at one end, and a certain amount of $N/10$ acid (acetic, trichloracetic, formic, hydrochloric and sulphuric acids were used) was added. A measured volume of water was placed in a bottle outside this cylinder, and diffusion was allowed to proceed for 48 hours, when acid equilibrium was attained on each side of the membrane. A fixed volume of the outer liquid was then titrated and the total free acid was calculated on this basis. The difference between this value and the acid originally added was taken to represent acid absorbed by the colloids of the latex. It was found that adsorption did occur, and that the amount adsorbed increased with the amount added, but not in a direct ratio. Within the limited range of the experiments the exponential law, typical of adsorption phenomena, was found to hold. It was shown by re-dialysis experiments that the adsorbed acid was very firmly retained, so that it may conceivably affect the physical properties of the finished rubber. The maximum of adsorption was always found at acidities which were too great to give clear separation into serum and clot.—H. E. P.

Calcium pinate; Products of the destructive distillation of ——. Bonsdorff. *See* XX.

Patents.

Rubber and other gums; Apparatus for extracting —— from plants, barks, fibres and the like, and for cleansing crude rubber and the like. R. Haddan, London. From L. Guiguet, Lyon-Villeurbanne, France. Eng. Pat. 18,375, Aug. 3, 1910.

By running the conical agglomerators described in Eng. Pat. 9064 of 1909 (this J., 1910, 579) in series, it has been found that the rubber which emerges from the first machine in the form of nodules is, by passage through the second, converted into coherent worm-like masses, which can be quickly separated from the waste material, without appreciable loss, by washing on comparatively coarse screens or sieves. In the apparatus described, two parallel series of two such agglomerators deliver their material into a common washing apparatus—consisting of a conical drum with a periphery of perforated zinc, wire gauze, etc.—arranged in a median position with respect to the agglomerators.—E. W. L.

India-rubber; Extraction of ——. W. Hiestrich Nachf., Hamburg, Germany. Eng. Pat. 17,124, April 27, 1911. Under Int. Conv., Dec. 20, 1910. Addition to Eng. Pat. 10,216 of 1911, dated July 23, 1910.

The cover of the apparatus for the extraction of resins from india-rubber, described in the main patent, is provided with a form of air-lock, for filling purposes, consisting of a rotary spider working air-tight within a casing, by means of which it is possible to introduce material, such as rubber, into the apparatus without bringing the contents into direct communication with the external air. To do this the lid of the spider casing is opened and the material is shaken into one of the quadrants of the spider. The lid is then closed and the spider rotated, when the material falls into the extraction vessel.—E. W. L.

India-rubber; Extraction of ——. W. Hiestrich Nachf., Hamburg, Germany. Eng. Pat. 17,125, April 27, 1911. Under Int. Conv., Dec. 20, 1910. Addition to Eng. Pat. 10,216 of 1911, dated July 23, 1910.

Baffle-plates are introduced between the sieve and the knives described in the main patent to prevent the particles of rubber from being forced into the meshes of the sieve.
—E. W. L.

Rubber latex; Machine for converting —— into sheets of crude rubber. F. E. Mellinger and H. H. Markley, Lumija, Mexico. U.S. Pat. 1,008,607, Nov. 14, 1911.

Latex is supplied intermittently from a vat to the periphery of a rotating drum which is heated from the inside. As each coating of latex dries, a further coating is run on to its surface from the vat, until a sheet of the desired thickness is obtained.—E. W. L.

Rubber; Process of desulphurising and devulcanising ——. W. W. Wildman and J. Christy, Akron, Ohio, U.S.A. Eng. Pat. 12,477, May 23, 1911.

See U.S. Pat. 993,485 of 1911; this J., 1911, 817.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Birch: Chemical investigation of the substances contained in ——. G. Grasser. Collegium, 1911, 393—402, 405—425.

Two kilos. of the leaves of *Betula alba* were extracted in a Soxhlet apparatus with 3 litres of ethyl alcohol, which was found to be the best solvent, until the material was completely decolourised. By distilling off the solvent, 240 grms. of crude dry extract were obtained. This was separated into various constituents by treatment with cold alcohol, ethyl ether and dilute caustic potash solution and sulphuric acid, and the constituents purified by further treatment and their solubility in various liquids observed, together with their behaviour with various reagents. The fraction of the extract dissolved by ether contained a wax-like, dark green mass of a resinous character, soluble in petroleum ether, which was found to have the composition, $C_{39}H_{68}O_2(OH)COOH$, and yielded substitution products with metallic salts of the type, $C_{39}H_{68}O_2(OH)COO{\cdot}Cu{\cdot}COO(OH)O_2H_{68}C_{39}$. The ethyl ester and also the acid chloride and amide were prepared from it. By oxidation with fuming nitric acid, butyric acid was produced. The research showed that the substances which can be isolated unchanged from the young leaves of the birch consist principally of a resin, besides tannins of the pyrocatechol group and indifferent colouring matters. The absence of betulin and other glucosides in the leaves shows that these are derivatives of the compounds found and occur in older parts of the plant and particularly in the bark. The dry-distillation of the resin from the leaves yields an odorous oil similar to that obtained from the bark, which shows that it has already the specific character of the birch product, its odour being similar to that conferred on Russian leather by tanning with birch bark.—D. J. L.

Patents.

Tanning of hides and skins; Means for facilitating the ——. E. Wilson, Liverpool. Eng. Pat. 8070, March 31, 1911.

A device for tanning hides or skins by causing a continuous circulation of the tanning liquor. The hides to be tanned are attached to poles, which are made to rest upon the top edges of two boards or partitions, the boards or partitions being hinged to the bottom of the pit so that an alternating or reciprocating movement can be imparted to them. This causes the liquor to be continually circulated throughout the pit, ensuring a liquor of uniform strength.—J. R. B.

Glue; Dechroming of chrome-tanned leather and the like for the preparation of ——. S. R. Trotman, Nottingham. Eng. Pats. 5676, March 7, and 12,393, May 23, 1911.

The leather is cut into small pieces, soaked in dilute acids or lime water and treated with sodium peroxide or other substance capable of yielding hydrogen peroxide. The hydrogen peroxide in presence of the sodium hydroxide converts the chromic oxide in the leather into sodium chromate. The goods are then thoroughly washed with water and the chromate recovered and the residual leather treated in the usual way for the preparation of glue. The treatment of vegetable-tanned leather proceeds upon similar lines, the preliminary detannisation being effected with a weak alkali, and the further detannisation with sodium peroxide.—J. R. B.

Glue from bones; Apparatus for the manufacture of ——. E. Dorenburg. Ger. Pat. 239,676, Jan. 20, 1911.

The pipes through which the glue solution flows from one digester to another or to the glue-boiler, pass through the covers of the digesters and extend downwards nearly to the bottom. The cocks or valves on the pipes are above the boilers, and suitable connections are provided so that the pipes can also be used for the introduction of steam or of hot or cold water into the digesters.—A. S.

XVI.—SOILS ; FERTILISERS.

Soils ; Hygroscopic moisture of —— . C. B. Lipman and L. T. Sharp. J. of Phys. Chem., 1911, **15**, 709—722.

In determining the hygroscopic coefficient of a soil it is necessary to work with a very thin layer, if equilibrium is to be attained under practical conditions. A layer as nearly as possible 1 mm. thick has been found the best. The method originally devised by Hilgard consists in sifting a quantity of the air-dried soil to be tested, in a layer 1 mm. thick on to a piece of glazed paper. This is placed in a box lined with wet blotting paper, the soil being situated within about 1 inch of a layer of water on the bottom of the box. The box is placed in a cellar where the temperature is constant and after an exposure of about 8 hrs. the sample is quickly transferred to a weighing bottle and weighed. The stopper is then removed and the bottle heated to 105°—110° C. till the weight is constant. Working in this way with a saturated atmosphere, the authors have established that a rise in temperature is accompanied by a greater absorption of hygroscopic moisture and *vice versa*. These changes do not take place according to any definite law. The hygroscopic moisture of a soil has a definite practical importance, particularly in arid regions, where it protects the plants from the scorching action of hot dry winds. Experiments were carried out in an incubator with artificial regulation of temperature, as well as under natural variations in the room. The results were similar in both cases, although the total absorptions and the variations with temperature were smaller in the incubator.—W. H. P.

Fertiliser experiments in New Jersey. Oil, Paint, and Drug Rep., Nov. 27, 1911. [T.R.]

The New Jersey Agricultural Experiment Station has recently issued Bulletin No. 240, which is devoted to the analysis and valuation of fertilisers which have been made in 1911. The bulletin contains the analyses and valuations of 368 commercial brands, thirty-two special compounds, eleven home mixtures, and 177 fertiliser supplies. The analysis of each of these is given, the calculations showing what should be the money value per ton of each compound. For the purpose of making these computations the department has adopted the following table of values for the basic materials :—

	Cents per pound.
Nitrogen in nitrates	16
Nitrogen in ammonium salts	16
Organic nitrogen in fine ground fish meat and blood	23
Organic nitrogen in cottonseed meal and castor pomace	21
Organic nitrogen in fine bone and tankage and in mixed fertilisers	20
Organic nitrogen in coarse bone and tankage	15
Phosphoric acid, soluble in water	4½
Phosphoric acid, soluble in ammonium citrate	4½
Phosphoric acid in fine bone and tankage	4
Phosphoric acid in cottonseed meal and castor pomace	4
Phosphoric acid in coarse bone, tankage and ashes	3½
Phosphoric acid, insoluble in water and in ammonium citrate	2
Potash in high-grade sulphate, and in forms free from muriate (chlorides)	5
Potash in muriate	4¼
Potash in cottonseed meal and castor pomace	5

Patent.

Colloidal silver : Employment of —— in agriculture. A. Lumière. Fr. Pat. 431,617, Sept. 15, 1910.

The claim is for the use of colloidal silver, alone or mixed with other substances, as a fungicide, especially for the treatment of cryptogamic diseases of the vine.—A. S.

XVII.—SUGARS ; STARCHES ; GUMS.

Sugar cane experiments in the Leeward Islands. Experiments conducted at Antigua and St. Kitts in the season 1909—1910. *Part I. Experiments with varieties of sugar-cane. Part II. Manurial experiments.* H. A. Tempany. Report to Imperial Dept. Agric., West Indies, Barbados, 1911.

I. A lengthy series of experiments having as their object the introduction of the most promising new varieties of plant and ratoon canes has been made. With plant canes, in Antigua, the best results for the different varieties, stated in (*a*) the yield of cane in tons per acre, and (*b*) pounds of sucrose in the juice per acre, were as follows : Barbados seedling, 4596, (*a*) 33·2, (*b*) 7290 ; Sealy Seedling, (*a*) 31·5, (*b*) 7300 ; Demerara seedling, 625, (*a*) 32·4, (*b*) 6360 ; B. 156, (*a*) 28·3, (*b*) 6140 ; B. 208, (*a*) 25·5, (*b*) 6540 ; D. 109, B. 306, and B. 376 likewise gave a good yield per acre, and a high sucrose content. B. 1753, B. 3696 and B. 1528 showed promise, and ratooned well ; but B. 1355, D. 848, and D. 1111, although they have good characteristics as plant canes, exhibit less favourable behaviour when ratooned, so that caution should be adopted in dealing with them. In St. Kitts, also with plant canes, the best results obtained were : B. 1753, (*a*) 43·9, (*b*) 9750 ; D. 109, (*a*) 33·2, (*b*) 8010 ; D. 116, (*a*) 31·9, (*b*) 7970 ; B. 254, (*a*) 32·0, (*b*) 7840 ; while others, in order of the yield of sucrose per acre, were : B. 208, B. 4596, Sealy Seedling, White Transparent, and D. 2190. As to ratoon canes, in Antigua, the best figures found were : Sealy Seedling, (*b*) 4050 ; B. 306, (*b*) 3970 ; B. 156, (*b*) 3880 ; B. 109, (*b*) 3760 ; and D. 95, (*b*) 3720. It is remarked that Sealy Seedling, on account of its characteristics as a plant and ratoon cane, and its hardy resistant habit, may be regarded as the best all-round cane of which the author has had experience. In St. Kitts, also with ratoon canes, the best results were as follows : B. 1753, (*a*) 43·9, (*b*) 9750 ; D. 109, (*a*) 33·2, (*b*) 8010 ; D. 116, (*a*) 31·9, (*b*) 7970 ; and B. 254, (*a*) 32·0, (*b*) 7840. Some notes on new varieties of cane, and particulars regarding the acreage under cultivation in Antigua and St. Kitts are appended to the report.

II. Experiments with ratoon canes, which had received no artificial manure as plant canes, indicate that sodium nitrate and ammonium sulphate especially the former, either in conjunction with potash and phosphate, or alone, will give a profitable increase of yield, provided the rainfall is favourable. Beneficial effects from the application of these manures in a bad season to a crop of first ratoons may be felt in the following season by a crop of second ratoons, but in such cases the total benefit received should be measured by the sum of increases experienced in the two seasons. It is, however, pointed out that this does not involve the advocacy of the practice of growing second ratoon canes. Comparative field trials, also on ratoon canes, were made with calcium nitrate and "nitrolim," in conjunction with potash and phosphate, and without, when it was found that the calcium nitrate gave augmented returns, whereas the "nitrolim" did not increase the yields appreciably, giving lower values than those resulting from the application of ammonium sulphate or of sodium nitrate. Manurial experiments with exhausted molasses were also conducted, the material being applied to each cane hole at the rate of (*a*) 200 and (*b*) 400 gallons per acre, when increases of 0·7 and 2·2 tons of cane per acre respectively, as the mean of two seasons' results were obtained (cf. also Peck, this J., 1910, 1467).—J. P. O.

Sugars ; Determination of —— in natural products. C. Neuberg and M. Ishida. Biochem. Zeits., 1911, **37**, 142—169.

Proteins and their decomposition products, alkaloids, purine bases, nucleic acids, phosphatides (lecithin, etc.) and many colouring matters are removed from solution almost completely by precipitation with mercuric acetate solution, followed, after filtration, by a further precipitation with phosphotungstic acid. The authors recommend these two precipitants for the removal of optically-active nitrogenous matters from solutions of natural products in which sugars have to be determined. Experiments carried out with solutions of dextrose, lævulose, sucrose, maltose, and raffinose containing also proteolytic products, show that the latter can be removed so completely that they do not influence the optical rotation of the sugars, and the precipitates do not carry down sugars with them. *d*-Glucosamine is not precipitated by these reagents. The solution to be analysed must, if acid, be exactly neutralised with sodium carbonate. The mercuric acetate solution used is of 50 per cent. concentration, and is made by dissolving the commercial salt in water at temperatures not exceeding 40° C. The phosphotungstic acid solution has no appreciable hydrolytic action on the sugars within one hour, provided it contains no free mineral acid. It is of 25 per cent. concentration and may be prepared as follows:—200 grms. of pure crystallised sodium tungstate are dissolved in hot water and 5 grms. of solid phosphoric acid are added with stirring. As soon as a clear liquid has been obtained it is mixed, in the cold, with 58 grms. of concentrated sulphuric acid previously diluted with 60 c.c. of water, and the whole is then concentrated to 290 c.c. on a water bath. The product is cooled, if possible by means of ice, until the separation of sodium sulphate is complete, when the liquid is poured off from the crystals and diluted with an equal volume of water. It must be colourless or possess only a faint yellowish tint, and should be kept in a brown bottle away from the light. It is not advisable to prepare large quantities at a time. The application of the method to the determination of sugar in molasses is described.—J. H. L.

Beet sugar factory; Undetermined losses of the ——. H. Pellet. Sucr. Belge, 1911, **40**, 3—8.

IN previous articles (this J., 1911, 822, 1273), the author has shown that in beetroot products certain non-sugar substances, such as glutamine, glutamic acid, asparagine, and aspartic acid, vitiate the determination of sucrose by the double polarisation (Clerget) method, as ordinarily carried out. He now states that the true sucrose content of beetroot juices, syrups, and molasses can be obtained by a modification of the double polarisation method, in which the direct polarisation is taken with a solution containing free acid, either sulphurous or hydrochloric acid, instead of with one that is strongly alkaline with basic lead acetate, the influence of the defecant in affecting the non-sugars thus being obviated. In the sulphurous acid (Pellet) modification, defecation with basic lead acetate is carried out in the usual way, after which 50 c.c. of the alkaline liquid are treated with excess of sulphur dioxide, made up to 100 c.c., mixed, and filtered. For the direct polarisation, this solution is read in the 400 mm. tube; while for the inversion reading, 50 c.c. are inverted with 5 c.c. of concentrated hydrochloric acid in the ordinary way. It has been proved that sulphurous acid affects the rotation of the non-sugars to practically the same extent as hydrochloric acid, so that the change of rotation on inversion may be taken to be due only to the sucrose present. In the hydrochloric acid (Andrlik) modification, the direct reading is taken in the presence of 5 c.c. of hydrochloric acid, urea being added to inhibit inversion when reading, and as there is then the same amount of hydrochloric acid present in the liquids used for both direct and inversion readings, the difference of polarisation represents sucrose alone. Attention is drawn to the experiments of Ogilvie (this J., 1911, 62), who has shown that double polarisation values obtained by the use of invertase as hydrolyst do not agree with those found by the ordinary procedure, but are in accordance with those found by taking the direct reading in an acid solution, thus confirming the author's experience. Other sources of error in carrying out the double polarisation method are mentioned, amongst which are: (1) reading the direct polarisation at a different temperature to the inversion polarisation; (2) using the constant 144, when working by the original Clerget procedure with liquids of low sucrose concentration, whereas the correct constant should be determined, or Deerr's table (this J., 1910, 1123) used; (3) the use of one of the special appliances for increasing the illumination, readjusting the zero; and (4) the neutralisation of a portion of the hydrochloric acid for inversion by the lead salt used for defecation, whereas the amount added should be such that there is present 5 c.c. of free concentrated hydrochloric acid. If the various sources of error pointed out, especially that due to the presence of the optically-active non-sugars, be obviated, the author considers that little will then be heard of so-called "undetermined losses" in the beetroot sugar factory.—J. P. O.

Yield of the sugar-beet in Europe. J. Roy. Soc. Arts, 1911, **60**, 60. [T.R.]

THE statistics given below are based on the average production of sugar during the last five years in ten of the principal beet-growing countries of Europe.

Country.	Yield of raw sugar.	Percentage sugar obtained.	Weight of crop.	
	Per acre. Cwt.		Per acre. Tons.	Cwts.
Germany	39·0	16·32	11	19
Sweden	34·6	14·95	11	10
Belgium	33·7	14·90	11	10
Denmark	33·3	13·97	11	19
Austria-Hungary	32·3	15·84	10	4
Holland	31·3	14·96	10	9
Italy	29·4	12·13	12	2
France	28·0	13·18	10	12
Spain	27·9	12·34	11	6
Russia	19·4	15·57	6	5

Sugar house work: Results of chemical control in ——. K. Kaiser. Centr. Zuckerind., 1911, **20**, 13—16.

IN the spring of the present year, the Anhalt Beet Sugar Factory Managers' Society undertook an inquiry into the results of chemical control during the past six years in ten sugar-houses represented by them, and a summary of the results is now published by the author. All the calculations of yield are based on original massecuite, the amount of which was found simply by adding together the weights of the several products. Complete data could only be obtained in the case of three factories, designated as E, G, and H, while the others contributed to the inquiry as fully as possible. Although the figures for the polarisation and water content of the massecuite are not of any special interest, those for the ash are striking, and show considerable variations, not only from year to year in the same factory, but also amongst the different houses during the same season. The highest average figure for the six years is 2·62, and the lowest 1·64 per cent. In factory E, the highest was 1·97 in 1906, and the lowest 1·64 in 1910; in G, the highest was 1·98 in 1909, and the lowest 1·79 in 1907; while in H, on the other hand, the ash content gradually diminished from year to year, being highest with 2·62 in 1905, and lowest with 2·04 in 1910. Quotient of purity values showed comparatively small variations, the highest average figure for all being 95·1, and the lowest 92·8 per cent. E showed 94·1—95·1; G, 93·5—94·3; and H, 92·8—94·2 per cent. In the values for the rendement of the massecuite, appreciable differences were again observed, with the highest average value of 83·7, and the lowest of 76·1. E had 81·0—83·7; G, 80·3—82·2; and H, 76·1—80·3. From year to year, the rendement had gradually increased in factory H; whereas in E and G decreases were observed in 1906, 1908, and 1909, which alterations are to be traced to variations in the quality of the root, and to the operation of diffusion, and not to the new system of returning the waste waters (*cf.*, this J., 1910, 228), since all three used it. As to the yield of total sugar from the massecuite in the three factories, exceptional variations were observed, the highest figure being 91·0, and the lowest 84·8 per cent. In E it was 88·7—91·0; in G, 87·6—90·1; and in H, 84·8—89·7 per cent. Molasses yields from massecuite showed similar changes, viz., between 8·9 and 15·2 per cent., E having 8·9—11·3; G, 9·9—12·4; and H, 10·3—15·2 per cent. Comparison of the actual and calculated yields of total sugar from the massecuite in all three cases showed a striking concordance, the two sets of figures being almost identical, which experience is directly contrary to that obtaining in the refinery. Coming to a comparison of the yields of the various products from all ten factories, it is shown that the average for the several houses varied between the following limits: for first sugar, 76·9—86·6; for after-product, 3·5—9·7; for total sugar, 82·3—90·8; and for molasses, 9·2—17·7 per cent. A number of tabulated results are also given showing in the cases of all ten factories the rendement of the first and after-product sugars; the sugar-content and quotient of the molasses; and the ash and rendement values of the molasses. In conclusion, for each year from 1905—1910 inclusive, for all ten factories, the figures are given for the composition of the massecuite and the yield of first and after-product sugars, and of molasses.—J. P. O.

Sugar factories; Hydrosulphites in ——. Action of hydrosulphites on raw diffusion juices. J. Weisberg. Bull. Assoc. Chim. Sucr., 1911, **29**, 278—282.

Within the last few years it has been proposed to treat raw sugar juices with calcium or sodium hydrosulphite in order to reduce the amount of lime required for defecation (see Descamps, this J., 1911, 823). Experiments carried out by Nowakowski and Muszynski show that the removal of nitrogenous and pectin substances from the juices is not more complete by this method than by defecation with lime alone; and it was found also, when working on a large scale, that the use of hydrosulphites does not permit of any considerable reduction in the quantity of lime required.—J. H. L.

Patents.

Crystalliser, especially for massecuite. H. Eberhardt. Maschinen- und Armaturenfabrik. Ger. Pat. 238,949, July 2, 1909.

The crystallising vessel consists of a cylinder mounted so as to rotate about its short transverse axis. The cylinder has also a central longitudinal spindle which passes through an opening in the transverse shaft, and is provided with stirring mechanism, for example, a number of radial arms, the ends of which are connected by helical strips. Outside the crystalliser, the longitudinal spindle is fitted with a star-wheel, which, as the cylinder rotates about its transverse axis, comes in contact periodically with a fixed peg, whereby the stirring mechanism is set in motion.—A. S.

Manufacture of cattle food [from molasses]. Eng. Pat. 12,895. *See* XIXa.

XVIII.—FERMENTATION INDUSTRIES.

Starch; Limits of the diastatic hydrolysis of ——. H. van Laer. Bull. Soc. Chim. Belg., 1911, **25**, 393—401. (Compare this J., 1911, 1024.)

Whereas Henri has expressed the rate of formation of maltose from starch by a logarithmic law, H. T. Brown and Glendinning (this J., 1902, 419) obtained a series of increasing values for the velocity constant, K, calculated by this law. The difference in the two cases is not due to the experimental temperature nor to the nature of the diastase selected, but the end point chosen as representing complete hydrolysis was different in the two researches. Brown and Glendinning consider conversion complete when the cupric-reducing power expressed as maltose corresponds to 80 per cent. of the starch. Henri selected an end point corresponding to 64—65 per cent. conversion; their figures are discussed from this point of view. Henri has chosen enzyme preparations either too weak or in too small a quantity. The quality of the diastase is shown to have a marked effect on the position of the end point; with some preparations 92 per cent. conversion is obtained in 6 hours. Soluble starch contains aggregates which are converted into maltose by one diastase and not by another, and also aggregates hydrolysed at 50° C. and not attacked at 25° C. The disagreement in previous researches is, however, not explained by differences in the limits of hydrolysis.—E. F. A.

Yeasts; The power of assimilating various carbohydrates exhibited by different ——. P. Lindner. Woch. Brau., 1911, **28**, 561—563.

The investigation of the assimilating power of different yeasts in respect of various carbohydrates, recently carried out by Lindner and Saito (this J., 1910, 1221), has now been supplemented by the study of 60 further organisms related to yeasts. Besides the carbohydrates used in the earlier experiments, melibiose and galactose were employed in the present investigation. The results are tabulated, and the organisms are numbered to correspond with a similar series of experiments on the fermentative powers of yeasts (see this J., 1900, 741; 1901, 141; 1911, 301).—J. H. L.

Yeast fermentation without sugar. VI. C. Neuberg and L. Karczag. Biochem. Zeits., 1911, **37**, 170—176.

It has already been shown that pyruvic and oxalacetic acids are decomposed by yeast into carbon dioxide and acetaldehyde (see this J., 1911, 379, 705, 1179). The experiments have now been extended to other keto-acids closely related to various natural products, viz., acetonedicarboxylic, chelidonic, dihydroxytartaric, benzoylacetic, phenylpyruvic and *p*-hydroxyphenylpyruvic acids, and also to acetylenedicarboxylic acid. The last-named acid gave a doubtful result and benzoylacetic acid a negative result, but in all the other cases fermentation was observed. The *α*-keto-acids appear to be fermented with special facility, and their decomposition takes a course (elimination of carbon dioxide and formation of aldehydes) quite different from that followed when fermentation occurs in presence of sugar (see Neubauer and Fromherz, this J., 1911, 231).—J. H. L.

Wine; Determination of the acidity of ——. F. Repiton. Ann. Falsif., 1911, **4**, 578—580.

Phenolphthalein indicates the point of complete neutralisation of the acidity of wine, and is the only synthetic indicator prescribed in the official (French) method of analysis; it serves excellently for white wine, but with red wine, the determination of the neutral point is difficult. Fluoresceïn is open to the same objection and has the further disadvantage that the change in colour (to a fine green fluorescence) occurs before the acidity is completely neutralised. With a mixture of both indicators in certain proportions, however, the point of complete neutralisation is sharply shown by the appearance of a red colouration in a green medium; solutions of the indicators are prepared as follows:—Seven grms. of phenolphthalein are dissolved, at the ordinary temperature, to saturation, in 90 c.c. of 95 per cent. alcohol, and 1·2 grms. of fluoresceïn are dissolved at the ordinary temperature in 100 c.c. of the same solvent, both solutions being filtered through extracted filter papers. The following procedure is employed in determining the total acidity of red wine:—Five c.c. of the clear or filtered wine are treated with 5 and 3 drops of the solutions of phenolphthalein and fluoresceïn respectively. The liquid is heated on the water-bath just to boiling, and is then treated with 5 c.c. of previously boiled and cooled distilled water. The mixture will have a temperature of about 50° C., and is titrated at this temperature (which has been found to be the most suitable) with *N*/20 sodium or potassium hydroxide. The number of c.c. of alkali used, multiplied by 0·49, gives the total acidity of the wine expressed in grms. of sulphuric acid per litre.—L. E.

Wines; The diseases of red ——. The different varieties of "casse." P. C. Mestre. Bull. Assoc. Chim. Sucr., 1911, **29**, 282—303.

According to the author, the most serious form of the disease of wines known as "casse" is due to the presence of an enzyme probably produced by the fungus *Botrytis cinerea*. The best remedy is pasteurisation of affected wines, immediately preceded by treatment with small quantities of sulphur dioxide or potassium metabisulphite. —J. H. L.

Alcohol from wood waste and sulphite lyes in Sweden. T. H. Norton. U.S. Cons. Reps., Nov., 1911. [T.R.]

The profitable utilisation of the exhaust lyes drawn off from sulphite boilers has always been a problem. For every ton of cellulose made by this process there are 10 tons of these lyes. They contain one-half of the weight of the wood originally introduced into the boilers. Among the matters present are dextrose and various other sugars, xylose, acetic acid, tannic acid, nitrogen compounds, resins, etc., as well as the calcium lignin-sulphonate, the chief product of the reaction. Of the sugars present most are susceptible of fermentation. They constitute about 1 per cent. of the lyes. The liquid is first neutralised with calcium carbonate, after which yeast is introduced. When the fermentation is complete the alcohol produced is secured in the ordinary manner. The process yields 6 gallons of alcohol (100 per cent.) for 1000 gallons of lye. About 14 gallons are secured for every ton of cellulose. Methyl alcohol and other volatile compounds are contained in this crude alcohol. It is used as denatured alcohol for heating and technical purposes. The excise rates in Sweden have been adjusted so as to aid this new industry. If the process were extended to all Swedish sulphite works the annual output would be about 3,500,000 gallons. It is doubtful whether a sufficient demand exists for this grade of alcohol to furnish a home market for such an amount. German chemists are sceptical as to the possibility of producing the alcohol economically under existing conditions in the Empire, where, on the basis of the Swedish results, over 800,000 gallons could be produced annually.

In the attempt to manufacture alcohol directly from wood, investigation so far has been directed to the simple reaction involved in combining one molecule of water with one molecule of cellulose, and thereby producing dextrose, from which alcohol is obtained by fermentation. By treatment with sulphuric acid under pressure, this change can be readily effected. From ordinary wood, alcohol amounting to 5 or 6 per cent. of the original weight can be thus secured. Pure cellulose yields 15 per cent.

Denatured alcohol in U.S.A. Rept. of Commissioner of Internal Revenue. Oil, Paint, and Drug Rep., Nov. 27, 1911.

The total collections on distilled spirits during the fiscal year 1910—1911 amounted to $148,060,212, in which is included the tax on alcohol. The withdrawals of alcohol for the purpose of denaturing, upon which no taxes were paid, amounted to 11,062,060 proof gallons during the fiscal year, and there remained at the end of the year in bonded warehouses 2,213,390 proof gallons. While these withdrawals are a slight increase over the previous year, it is the opinion of the commissioner that the cost of installing distilleries and the high degree of skill required to produce a grade of alcohol suitable for denaturing are likely to prevent any important distillery from operating under the statutes authorising them. The use of denatured alcohol is expected to increase, and it is suggested that a nominal tax be imposed, to pay the Government's expense in preventing the abuse of the privilege under which the product is manufactured. This suggestion is made in spite of the fact that few frauds were discovered during the past year.

Alcohol producers in the United States; Tax on ——. Oil, Paint, and Drug Rep., Dec. 4, 1912. [T.R.]

The United States Circuit Court of Appeals for the Third District sustains the contention of the Government that any recovery of alcohol in processes of manufacture constitutes a rectifying of spirits, and shall be subjected to the United States tax of $200.

Patents.

Beer or ale; Treatment of ——. L. Wallerstein, New York. Eng. Pat. 12,350, May 22, 1911.

See U.S. Pats. 995,820, 995,824, 995,825, and 995,826 of 1911; this J., 1911, 916.—T. F. B.

Malt beverages; Manufacture of ——. R. Wahl, Chicago. Reissue No. 13,315, dated Nov. 14, 1911, of U.S. Pat. 979,810, Dec. 27, 1910.

See this J., 1911, 148.—T. F. B.

XIXa.—FOODS.

Ropiness in bread; Watkins' method of detecting the bacillus causing ——. H. Kühl. Chem.-Zeit., 1911, **35**, 1321—1322.

Watkins' method of detecting *B. mesentericus* in flour (this J., 1906, 350) gives very good results when slightly modified as follows: A 1 per cent. suspension of the flour is heated in boiling water for three-quarters of an hour and quantities of ½, 1, 1½, etc., c.c. transferred to a series of sterilised test-tubes containing 10 grms. of rye flour moistened with 10 c.c. of water. These are set aside at 25° C. and examined after 24 and 36 hours, when the presence of ropiness is shown by the development of the characteristic ester-like odour and the physical characteristics of ropiness. Pure cultures are obtained by inoculating from these tubes on to sterilised potato slices in Petri dishes. Details are given of the practical testing of the method. Owing to the substitution of pressed yeast for the acid leaven, ropiness is stated to be on the increase.—E. F. A.

Butter; Determination of water in ——. A. C. D. Rivett. Chem. News, 1911, **104**, 261—263.

Ten grms. of the butter are placed in a glass tube, about 4 grms. of calcium carbide introduced into a side tube on the first tube, and the top of the latter is closed by means of a glass vessel containing glasswool sprinkled with carbide. Of the weighed apparatus that part containing the butter is immersed in hot water and a portion of the carbide is shaken out of the side tube and on to the melted butter. The acetylene evolved passes upwards through the glass wool and escapes through a tube at the top of the apparatus, the loss in weight corresponding with that of the acetylene produced, and thus of the water in the butter.—W. P. S.

Pear and apple seeds; Chemical composition of ——. P. Huber. Landw. Vers.-Stat., 1911, **75**, 443—461. Chem. Zentr., 1911, **2**, 1704—1705.

The results of the analysis of the kernels and outer skins of pear and apple seeds are tabulated. The kernels contain a considerable quantity of a fatty oil, that from pear seeds (33·14 and 36·46 per cent. reckoned on the dry substance in two different kinds) having the sp. gr. 0·9247, and iodine value, 127; and that from apple seeds (32·7 per cent.) having the sp. gr. 0·9237, and iodine value 121. —A. S.

Cocoa and cocoa preparations; Detection of shell in ——. C. Ulrich. Arch. Pharm., 1911, **249**, 524—597.

A study of the existing processes for the determination of shell in cocoa preparations has led to the following conclusions:—1. With the introduction of modern machinery which is capable of reducing the cocoa essence to a very fine powder, the detection of shell by the microscope becomes uncertain; no accurate estimate of the proportion present is possible (this J., 1909, 134). 2. The elutriation process of Filsinger and Drawe (Z. öffentl. Chem., 1899, **5**, 27, and 1903, **9**, 161, yields fairly accurate results when, as was formerly the practice, the nib and shell were ground together, the resulting particles of shell being considerably larger than those of the nib; with both constituents in the same fine state of subdivision the method gives good results if the factor 1·43, by which the weight of the shell is multiplied to allow for that part of the shell which is soluble in water, is replaced by the factor 1·72; the method has the advantage of rapidity. 3. The method of flotation in a solution of calcium chloride of known density proposed by Goske is valueless (this J., 1910, 369 and 1129, and 1911, 643). 4. The methods hitherto proposed which are based on differences in chemical composition of the nib and the shell, *e.g.*, the proportions of soluble silicic acid (Z. Unters. Nahr. u. Genussm., 1906, **12**, 95 and Z. öffentl. Chem., 1908, **14**, 166), the alkalinity of the ash and content of total albumin (this J., 1905, 341), the iodine value of the fat (Z. öffentl. Chem., 1901, **7**, 500), the content of crude fibre or cellulose (this J., 1890, 421 and 978 ; 1892, 944 ; 1906, 1069 and Z. Unters. Nahr. Genussm., 1898, **3**, 1 ; 1903, **8**, 769 ; 1906, **12**, 159 ; 1907, **13**, 265 ; and Schweiz. Woch. Chem. Pharm., 1902, 462), and the pentosan and methyl-pentosan content (this J., 1901, 396 ; 1902, 875 ; 1903, 114) are either valueless or not sufficiently delicate to detect relatively small proportions of shell.

The author proposes the following new process which is based on the fact that the colouring matter "cocoa-red" is present only in the nibs ; this may be readily extracted by organic acids, precipitated and determined :—1 grm. of the material, freed from fat and moisture and very finely powdered, is boiled for 3 hours with 120 c.c. of acetic acid (50 to 51 per cent.) under a reflux condenser ; after cooling, the mixture is made up to 150 c.c. at 15° C. with water, well shaken and allowed to stand for at least 12 hours. The liquid is then filtered through a dry paper into a dry flask and 135 c.c. (equal to 0·9 grm. of the original material) of the filtrate are mixed with 5 c.c. of concentrated hydrochloric acid and 20 c.c. of a 20 per cent. solution of ferric chloride ; the liquid is now boiled for ten minutes under a reflux condenser and then rapidly cooled and after standing for at least six hours, the precipitate is collected on a weighed filter, washed with hot water till free from iron, dried for six hours at 105° C. and weighed, the weight being calculated as a percentage on the dry, fat-free substance. The method was tested on a large number of specimens of cocoa nibs of varied origin, together with mixtures of cocoa nibs such as would obtain in commercial cocoa essences and on mixtures of these with known percentages of shell ; the results with the pure cocoa nibs are shown in the table. The figures obtained for mixtures of the individual cocoas with 10 per cent. of shell closely agreed with the calculated figures, the maximum mean deviation being 0·08 on the mean figure for original nib. It will be seen that with the exception of the high figures obtained with Guayaquil cocoas and the low figures with Bahia cocoas, considerable uniformity exists and, as essences made from either of these cocoas alone or indeed from any single cocoa are not usually placed upon the market, more general uniformity will be attained from mixtures of several cocoas of different origin ; this has been shown to be the case. The author states that under these conditions an admixture of 10 per cent. of shell and upwards can be determined ; 30 per cent. of shell added to a pure Guayaquil cocoa would yield results which would be reported as 10 per cent. of shell.—B. G. McL.

Average amount of ferric chloride precipitate.

Cocoa.	From roasted nibs, calculated on :—			From unroasted nibs, calculated on :—		
	Number of analyses.	Dry, fat-free material.	Original nib.	Number of analyses.	Dry, fat-free material.	Original nib.
		per cent.	per cent.		per cent.	per cent.
Guayaquil	12	16·11	7·479	3	16·67	7·312
Trinidad	12	14·11	6·143	3	—	—
Accra	6	13·52	6·337	3	14·82	6·294
Ariba	18	13·50	6·998	3	12·82	5·842
Bahia	14	11·39	5·474	3	12·40	5·591
Ceylon	6	13·79	6·450	—	—	—
Samoa	12	14·34	6·698	3	14·90	6·492
S. Thomé	18	13·75	6·119	3	13·26	5·913

Cultivation, production, and utilisation of sesamum seed. *See* XII.

Oils from plants belonging to the order Papilionaceae. Grimme. *See* XII.

Patents.

Cattle food [from molasses] ; Manufacture of ——. A. Roberti, Waremme, Belgium. Eng. Pat. 12,895, May 29, 1911.

In the manufacture of fodder by the process described in Eng. Pat. 9987 of 1910 (this J., 1911, 707), "molasses straw" is prepared by superheating the molasses or sugar until almost dehydrated and then projecting it in as fine drops as possible on to straw, etc., which has previously been ground and shredded. The mixture is heated and mixed in a suitable apparatus, after which it is ready for immediate packing. If peat moss is used in place of straw, a preparation containing much more sugar than usual is obtained, and the method may be used for transporting molasses in sacks or loose without heating or fermentation. —C. A. M.

Edible pastes ; Process for drying ——. F. M. Gregg, Cleveland, Ohio. U.S. Pat. 1,007,940, Nov. 7, 1911.

The paste is subjected *in vacuo* to temperatures which are alternately raised and lowered, whilst means are provided for removing the moisture, after which a constant temperature is maintained until drying is complete. —C. A. M.

Cacao ; Process and apparatus far treating fluid ——. I. S. Petzholdt Maschinenfabrik. Fr. Pat. 432,101, July 10, 1911. Under Int. Conv., Oct. 26, 1910.

See Eng. Pat. 16,431 of 1911 ; this J., 1911, 1403.—T. F. B.

XIXB.—WATER PURIFICATION ; SANITATION.

Patents.

Water softening and filtering apparatus under pressure. J. S. and F. S. Pearson, Liscard, Cheshire. Eng. Pat. 18,984, Aug. 24, 1911.

The water is passed through a hydraulic meter of the usual piston type and is thence delivered through a pipe containing baffle-plates into the filtering part of the apparatus. During its passage through the pipe provided with the baffle-plates, the water is mixed with suitable reagents, the latter being obtained from reagent tanks and pumped into the pipe by means of a small pump operated by the piston-rod of the meter. The treated water enters the top of the filtering chamber, flows downwards through a conical chamber in the same, then upwards through filters placed between the external wall of the cone and the outer wall of the filter chamber, and is next conducted to a second filter situated in a lower compartment of the filtering chamber. After passing downwards through this filter, the water is drawn off at the bottom of the apparatus. Steam may be admitted to the water at a point near that at which the reagents are introduced. The water is supplied to the apparatus under pressure produced by pumps or by allowing the water to flow from raised tanks, cisterns, etc.—W. P. S.

Disinfectant ; Process for preparing a soluble and stable —— containing formaldehyde and mineral, tar, or resin oil or tar in emulsion. A.-G. f. Asphaltierung und Dachbedeckung vorm. Johannes Jeserich. Ger. Pat. 240,482, May 1, 1910.

The disinfectant is produced by mixing a solution of a caseinate with a nearly neutralised sulphonic acid obtained by treating castor oil or similar oil with sulphuric acid, and then formaldehyde and a mineral, tar, or resin oil are successively incorporated with the mixture. The products are stable and soluble in water.—T. F. B.

Sterilising liquids by means of ultra-violet rays ; Apparatus for ——. Banque du Radium, Paris. Eng. Pat. 14,912, June 26, 1911. Under Int. Conv., June 27, 1910.

See Fr. Pat. 428,666 of 1910 ; this J., 1911, 1183.—T. F. B.

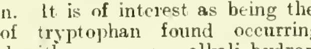
Water and sewage ; Process and apparatus for purifying ——. C. R. Darnall. Fr. Pat. 432,003, July 6, 1911.

See U.S. Pats. 1,007,542 and 1,007,647 of 1911 ; this J., 1911, 1404.—T. F. B.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

Hypaphorine ; Preparation of the betaine of tryptophan and its identity with the alkaloid ——. P. van Romburgh and G. Barger. Chem. Soc. Trans., 1911, 99, 2068—2071.

By the interaction of tryptophan with methyl iodide and sodium hydroxide, the iodide of α-trimethylamino-β-indolepropionate is produced, and this when warmed on the water-bath for a few minutes with a 1 per cent. solution of sodium hydroxide, yields hypaphorine, a base isolated by Greshoff (Mededeelingen uit's Lands Plantentuin. 1890, 7, 29) from the seeds of *Erythrina Hypaphorus*, Boerl. This method of preparation shows that hypaphorine is α-trimethyl-β-indolepropiobetaine,



$$C_6H_4\left\langle\begin{array}{l}\text{C}\cdot\text{CH}_2\cdot\text{CH}\text{——CO} \\ \text{NH}\cdot\text{CH}\quad\ \text{N(CH}_3)_3\cdot\text{O}\end{array}\right.$$

It is easily soluble in water and has no pronounced physiological action. It is of interest as being the first simple derivative of tryptophan found occurring naturally. When heated with an aqueous alkali hydroxide solution, it yields trimethylamine and indole.—A. S.

Gentiopicrin ; Action of emulsin on —— in presence of alcohol. E. Bourquelot and M. Bridel. J. Pharm. Chim., 1911, 4, 385.

Emulsin, in powder form, hydrolyses gentiopicrin even when the glucoside is dissolved in 90 per cent. alcohol, although the enzyme is not soluble in alcohol of 60 per cent. strength, or above. Hydrolysis in an alcoholic medium is arrested as soon as a certain proportion of the glucoside has been decomposed. This is not due however to the enzyme being destroyed by the alcohol, since it may be kept in 80 per cent. alcohol for three months without being harmed. The proportion of glucoside hydrolysed thus, is less in a stronger than in a weaker alcoholic medium. Emulsin begins to pass into solution in 50 per cent. alcohol, in which medium it effects only slight hydrolysis : the activity increases as the alcoholic strength decreases. It is possible that other glucosides may be hydrolysed in cold alcohol by emulsin, in a similar manner. —J. O. B.

Xanthotoxin ; Constitution of —— and its relation to bergapten. H. Thoms. Ber., 1911, 44, 3325—3332. (See this J., 1911, 710.)

In addition to the derivatives of xanthotoxin described in a previous communication (*loc. cit.*), further derivatives have now been made. When treated with methyl iodide in an alkaline methyl alcoholic solution, methylxanthotoxinic acid, $C_{12}H_{11}O_3COOH$, is produced, m. pt. 114°—117° C. The methyl ester melts at 44° C. After fusion with potassium hydroxide, pyrogallolcarboxylic acid was isolated. The isomeric bergapten from bergamot oil yields phloroglucinol under these circumstances. A constitutional formula is given, which is based on these data. Both xanthotoxin and bergapten are fish-poisons. —F. Shdn.

Camphor cultivation in German East Africa. Der Pflanzer, 1911, 7, 133. Bull. Imp. Inst., 1911, 9, 287.

Specimens of camphor and camphor oil produced at the Biological-Agricultural Institute, Amani (see this J., 1910, 899 ; 1911, 831) have been examined. If the crude camphor were more carefully prepared, it would command about the same price as crude Japanese camphor. The steam-distilled camphor contained 15 per cent. of impurities, chiefly water, and it would probably be more profitable to export the crude camphor than to re-distil it locally. The camphor oil contained 48 per cent. of camphor and was valued at M. 120 per 100 kilos. (£3 per cwt.) as compared with "light Japanese" camphor oil at M. 70 per 100 kilos. (£1 15s. per cwt.).—A. S.

Calcium pinate ; Products of the destructive distillation of ——. W. Bonsdorff. Ber., 1911, 44, 3208—3210.

By destructive distillation of calcium pinate an oil was obtained, which after purification by fractionation under diminished pressure, gave with semicarbazide a semicarbazone melting at 159°—161° C. When again liberated from the semicarbazone, the ketone, $C_8H_{12}O$, was obtained as a colourless liquid of sp. gr. 0·9355 at 20°/4° C., b. pt. 69°—71° C. at 8 mm., $n_D = 1{\cdot}46660$. The molecular refraction and dispersion of the ketone indicate that it is an unsaturated compound, and the author concludes that on distillation, the four-carbon ring of the calcium pinate is ruptured and an unsaturated ketone, (1)-isopropylene-(2)-ketopentamethylene is produced.—A. S.

p-Nitranilinearsinic acid. L. Benda. Ber., 1911, 44, 3293—3297.

The author has shown previously (Ber., 1908, 41, 1673) that aromatic amines having a free para-position always yield the *p*-aminoarylarsinic acids together with secondary *pp′*-diaminodiarylarsinic acids (this J., 1908, 830). If the para-position is already occupied, either no arsinic acid derivative is produced or else very small quantities of the *o*-aminoarylarsinic acid are obtained (Ber., 1909, 42, 3619). It has now been found that *p*-nitraniline is an exception to this rule, for on heating with arsenic acid it is readily converted into an arsinic acid derivative, the AsO_3H_2 group entering the position ortho to the amino group. The *p*-nitranilinearsinic acid (5-nitro-2-aminophenylarsinic acid) melts at 235°—236° C. with decomposition. It yields an easily soluble diazo-compound which combines readily with the usual azo dyestuff components. When heated with potassium hydroxide solution it yields the 5-nitro-2-hydroxyphenylarsinic acid (m. pt. 247°—248° C. with decomposition) ; the latter on nitration forms 5.3-dinitro-2-hydroxyphenylarsinic acid (m. pt. 237° C.), whilst when reduced with a powerful reducing agent, such as sodium hydrosulphite, it yields 5.5′-diamino-2.2′-dihydroxyarsenobenzene, the dihydrochloride of which is isomeric with salvarsan : the alkaline solution of the diamino-compound when oxidised together with *p*-xylenol by means of sodium hypochlorite gives a cornflower-blue solution of the corresponding indophenolarsinic acid. —A. S.

p-Phenylenediamine arsinic acid. L. Benda. Ber., 1911, 44, 3300—3304.

By reduction of an alkaline (to turmeric) solution of *p*-nitranilinearsinic acid with ferrous hydroxide, *p*-

phenylenediaminearsinic acid (5.2-diaminophenylarsinic acid) is produced, which decomposes on heating to 210°—215° C. *p*-Phenylenediaminearsinic acid is a valuable raw material for the preparation of hitherto unattainable organic arsenic compounds. An account of its biological properties will be published by Ehrlich. An attempt to prepare the unknown *o*-arsanilic (*o*-aminophenylarsinic) acid by diazotising the diamino-compound and then eliminating the diazo-group led instead to *m*-arsanilic acid. In the separation of aminoarylarsinic acids from complex mixtures, a method which has proved very useful consists in first diazotising, and then combining the diazo-compound with β-naphthol to form a sparingly soluble azo dyestuff, which is filtered off, purified, and subsequently reduced by means of sodium hydrosulphite.—A. S.

o-Aminophenylarsinic acid (*o-arsanilic acid*). L. Benda. Ber., 1911, 44, 3304—3308.

The hitherto unknown o-arsanilic acid has been prepared from *p*-nitranilinearsinic acid (see above) by first converting the latter into its oxalyl compound by means of oxalic acid, reducing this with iron powder to the corresponding amino-compound, eliminating the amino-group by diazotising and heating with copper and alcohol, and hydrolysing the resulting *o*-oxanilide-*o*,*o*-diarsinic acid by means of sulphuric acid. o-Arsanilic acid (o-aminophenylarsinic acid) melts at 153° C. with decomposition; it is much more easily soluble in water than the meta- and para- acids, and the arsenic acid residue is more easily eliminated from it than from the isomeric acids. It is more toxic than the para-acid, but this cannot be attributed to the fact that the arsenic acid residue is easily separated, for the meta-acid, in which the arsenic acid residue is most firmly combined is as poisonous as the para-acid. When reduced with hydrosulphite, the ortho-acid yields o.o-diaminoarsenobenzene, and its diazo-compound can be readily converted into the easily soluble o-hydroxyphenylarsinic acid. The three isomeric aminophenylarsinic acids can be readily distinguished by diazotising, placing a drop of the diazo-solution on filter paper, and adding an alkaline solution of β-naphthol. An orange dyestuff is produced in each case, but on adding a drop of *N*/1 sodium hydroxide solution, a dirty red to violet red colour is produced with the meta- and para- acids, whilst the orange colour becomes yellower or is scarcely affected in the case of the ortho-acid. The *o*- and *p*-sulphanilic acids and *o*- and *p*-aminobenzoic acids can be distinguished in a similar manner. The therapeutic properties of *o*-aminophenylarsinic acid will be described elsewhere.—A. S.

Lecithin; Determination of ——. C. Virchow. Chem.-Zeit., 1911, 35, 913—914.

One grm. of the material is extracted thrice in succession with 10 c.c. of boiling absolute alcohol; the alcoholic extracts are filtered into a tared flask, and the insoluble residue is washed with more absolute alcohol until the total filtrate measures from 50 to 60 c.c. The alcohol is then distilled off, the residue weighed, and extracted with about 10 c.c. of anhydrous ether. The ethereal lecithin solution is passed through an asbestos filter, the residue washed thrice, and the ether distilled off. The residue is again weighed, oxidised with 3 or 4 c.c. of fuming nitric acid, and the solution evaporated in a platinum dish on the water-bath. The oxidation residue is then fused with sodium carbonate, and the phosphoric acid in the product is determined, in the usual manner, as magnesium pyrophosphate. From the amount thus found, the equivalent of lecithin is calculated.—J. O. B.

Acid anhydrides; Action of some acyl chlorides on potassium nitrate and the formation of ——. O. Diels and H. Okada. Ber., 1911, 44, 3333—3336.

A mixture of acetyl chloride and acetyl nitrate on heating yields acetic anhydride, with evolution of chlorine and oxides of nitrogen. Hence the reaction between acyl chlorides and potassium nitrate is regarded as proceeding in the two stages: (1) $CH_3{\cdot}COCl+KNO_3=CH_3CO{\cdot}O{\cdot}NO_2+KCl$; (2) $6CH_3{\cdot}COCl+2CH_3{\cdot}CO{\cdot}O{\cdot}NO_2=4(CH_3{\cdot}CO)_2O+2NOCl+2Cl_2$; or combined: $8CH_3{\cdot}COCl+2KNO_3=4(CH_3{\cdot}CO)_2O+2KCl+2NOCl+2Cl_2$. If proportions corresponding with the last equation be taken, almost quantitative yields of the acid anhydride are obtained. 120 grms. of acetyl chloride and 20 grms. of powdered potassium nitrate were heated in a flask fitted with a reflux condenser until gas was no longer evolved, then cooled, treated with 50 c.c. of anhydrous ether, filtered, and the insoluble potassium chloride washed with ether. The ethereal solution yielded 34 grms. of acetic anhydride or 85 per cent. of the theoretical quantity. The preparation of chloroacetic and benzoic anhydrides is also described.—A. S.

The eucalyptus oil industry of Australia. Oil, Paint, and Drug Rep., Nov. 27, 1911. [T.R.]

A report has been presented to the New South Wales Government on the present state of the eucalyptus oil industry in the colony by Mr. H. G. Smith, the curator of the Technological Museum in Sydney. The following are the principal points emphasised by this report:—(1) In Victoria the distilling plants are larger than in New South Wales, and the method of distillation is by passing steam from boilers through wooden vats holding the leaves. (2) In South Australia, where a large amount of oil is distilled, crude direct stills are used, as is the case generally in New South Wales. (3) The demand for low grade oil for mining purposes is likely to increase, especially if its production can be cheapened, in order to meet competition with other oils. (4) Many economies could be effected by working on a larger scale and by collecting the leaves by machinery. (5) If some form of cultivation were adopted so as to concentrate the required species over given areas, economy in production would result. (6) Some form of government control is necessary, and areas for eucalyptus distillation granted on terms, as is done in Victoria. Without this security capital will not be forthcoming. (7) Although the crude methods of distillation will be difficult to supersede, since they provide an easy method for individual families to earn a living, it will eventually become necessary to improve them if the industry is to remain remunerative. (8) The high lands of the Dividing Range, from Crookwell to the Victorian border, in which area the species yielding phellandrene grow so plentifully, might with advantage be set aside for eucalyptus oil distillation, as the land is of little value for agricultural purposes. By planting this area with *Eucalyptus amygdalina*, *E. dives*, and similar species, and placing the industry under government control, a great augmentation in supplies should take place, and employment be given to a large number of workers. (9) The success of eucalyptus oil in foreign countries for mineral separation will depend entirely on its cheapness, because local demands will be met, if possible, by the distillation of local material, and although this may not be so good for the purpose, it will yet be found to answer sufficiently well if eucalyptus oil were too dear.

Chemical investigation of the substances contained in birch. Grasser. *See* XV.

Determination of ferrous ions with iodine. Romijn. *See* XXIII.

Patents.

Chlorides of carbon: Apparatus for producing ——. J. MacKaye, Cambridge, Assignor to Stone and Webster, Boston, Mass. U.S. Pat. 1,009,428, Nov. 21, 1911.

The apparatus consists of a reaction chamber filled with porous material resistant to corrosion, and provided with an internal source of heat; the reaction chamber is supplied with branches, also filled with porous material, through which the natural gas or methane and chlorine are introduced in definite proportions. A cooling apparatus is supplied round the portion of the reaction chamber between the heated zone and the mixing zone, and suitable means are provided for collecting the products of the reaction.—T. F. B.

Extract of Cascara sagrada ; Process for preparing a purified ——. A. Dieffenbach. Ger. Pat. 240,407, Feb. 9, 1911.

Extracts of the drug are saturated with salt in aqueous solution, and the salt is removed as completely as possible from the clarified extract solution, which is then evaporated in the usual manner to the required concentration. Extracts obtained in this manner give perfectly clear solutions in water, which give no precipitate with hydrochloric or sulphuric acid, and only very slight precipitates with tannin solutions.—T. F. B.

Pharmaceutical products [phenylalkylacetic acid derivatives] ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 7591, March 27, 1911.

See U.S. Pat. 996,096 of 1911 ; this J., 1911, 1087.—T.F.B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Blue photographic pictures ; Process of toning ——. P. Rehländer, Charlottenburg, Assignor to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 1,009,100, Nov. 21, 1911.

Blue prints which have been toned by means of a solution of potassium ferricyanide and a ferric salt, are treated with a dilute solution containing not more than 5 per cent. of a thiosulphate and not more than 0·5 to 1 per cent. of potassium ferricyanide. In carrying out the process, the print may be removed from the first bath and again introduced into it after it has received the necessary addition of thiosulphate.—T. F. B.

Photography ; Coloured screens for use in ——. H. W. H. Palmer. Fr. Pat. 431,991, July 5, 1911.

See Eng. Pat. 8761 of 1910 ; this J., 1911, 924.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Explosion ; Circumstances attending an —— of partly manufactured Erin Gelignite and Arkite, which occurred on the 4th August, 1911, *at the Works of Messrs. Kynoch, Ltd., at Ferrybank, near Arklow, in the County of Wicklow.* Major H. Coningham, H.M. Inspector of Explosives, [Cd. 5974.]

The explosion occurred at a bogie which had on it 535 lb. of a hand-mixed jelly of nitroglycerin and collodion cotton. The explosive was contained in boxes made of wood and lined with brass, turned over on the upper edges and secured by means of wooden strips screwed on. One or more of the boxes also probably had the brass carried up and over the outside of the corners. The explosion occurred immediately past one of the points where the tram lines branched off, and a crater was formed 3 feet 3 inches deep in the middle, 22 feet long and 17 feet broad. Major Coningham considers that the most probable explanation of the accident is that the points were in the half-way position, the bogie was derailed, and one or more of the boxes either collided or fell off the bogie. In either case he considers that it is probable that there was a film of jelly or nitroglycerin on the box at the point of impact. The following recommendations are made : (1) Boxes with brass binding on the external corners should not be used for the conveyance of partly manufactured gelatinous explosives in a factory. (2) The boxes should be so constructed as to prevent, as far as possible, those surfaces which are liable to have explosive on them from coming in contact with one another, or with supports on the bogie. (3) The bogies used for the conveyance of partly manufactured gelatinous explosives in a factory should have supports at the ends or some device so designed as to prevent the boxes from falling off in the event of the bogie being suddenly checked. (4) Points should be so arranged, by means of a counterweight or some similar device, as always to be in bearing with one line or the other. With regard to these recommendations Messrs. Kynoch have withdrawn the brass bindings from the external corners of all boxes which had them. They have also adopted end supports on all their bogies running between the expense magazines and machine mixing houses, as well as between the hand mixing houses and expense magazines, and also between the nitrocotton stoves and expense magazines. The flat platform bogies are now only used between the packing houses and the main magazines and between those magazines and the loading quay. The Company have carried out a series of experiments in order to ascertain the precautions to be taken to prevent, as far as possible, the collision of boxes when being conveyed on a bogie and the means to be adopted to improve the safety of the transit of explosives in the works. As a result of these experiments they have adopted a box with a rubber insertion between the woodwork of the top edge of the box and the under side of the brass overlap. On the upper side of the overlap a thick projecting pad of rubber, supported by a wooden batten, is provided to act as a cushion between boxes and also as a lip to catch any drip which might come over when emptying the contents. The cement track throughout the full length of the points has been replaced by a wooden platform, and the Company will adopt a weighted lever for all their tramway points at the factory.—G. W. McD.

Patents.

Explosive and method of producing same and its ingredients [butylene-glycol]. H. Hibbert, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,008,333, Nov. 14, 1911.

Butylene-glycol is produced by condensing acetaldehyde to acetaldol in the presence of ice in contact with the acetaldehyde. A strong aqueous solution of potassium carbonate is gradually added and the temperature is slowly raised to 15° C. The liquid is then diluted by the addition of not more than 15 parts of water at 15° C. It is then very slightly acidified and then without isolating the acetaldol, reducing its solution to butylene-glycol by means of aluminium amalgam.—G. W. McD.

Explosive. M. F. Lindsley, Kings Mills, Ohio, Assignor to The King Powder Co., Cincinnati, Ohio. U.S. Pat. 1,008,725, Nov. 14, 1911.

Nitrobenzene (20 parts) is added to a granular mixture of starch and cellulose (100 parts). The grains so treated are immersed in a mixture of sulphuric acid (2 parts) and nitric acid (1 part). After nitration the grains are washed, neutralised, dried, and treated with a solution of a metallic nitrate, and finally waterproofed with nitrobenzene.
—G. W. McD.

Smokeless gunpowder ; Process of manufacture of ——. F. A. Ritschke, Geesthacht on Elbe, Germany, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,009,577, Nov. 21, 1911.

See Addition of Sept. 29, 1910, to Fr. Pat. 410,239 of 1909 ; this J., 1911, 448.—T. F. B.

Manufacture of nitrated cellulose. Eng. Pat. 18,606. *See* V.

XXIII.—ANALYTICAL PROCESSES.

Methyl red (p-dimethylaminoazobenzene-o-carboxylic acid) ; Use of —— for the colourimetric determination of hydrogen ions. S. Palitzsch. Biochem. Zeits., 1911, 37, 131—141.

Methyl red, or *p*-dimethylaminoazobenzene-*o*-carboxylic acid, first prepared by Rupp and Loose (this J., 1908, 1223), forms a very suitable indicator for the colourimetric measurement of the concentration of hydrogen ions between the limits represented by $p^{+}_{H}=4{\cdot}2$ and $p^{+}_{H}=6{\cdot}3$ (see Sörensen, this J., 1909, 950). In strongly acid solutions it is reddish violet in colour; in weakly acid, neutral, or alkaline solutions it is yellow. The colour transition between the limits of acidity mentioned above is so striking that a difference of 0·1 in the value of p^{+}_{H} within these limits is easily recognised. The indicator solution used by the author contains 0·1 grm. of methyl red in 300 c.c. of alcohol and 200 c.c. of water. 2—4 drops of this are added to 10 c.c. of the liquid to be tested, and the tint of the latter is then matched against similar acid solutions of known ionic concentration. The colour does not change within several days. The presence of neutral salts (sodium chloride) affects the tint to only a slight extent, often within the limits of experimental error. Methyl Red can moreover be used in presence of proteins and their decomposition products, which is not the case with many other indicators.—J. H. L.

Ferrous ions; Determination of —— with iodine. C. Romijn. Chem.-Zeit., 1911, 35, 1300.

Rupp's method of determining ferrous iron (this J., 1903, 230) is modified as follows:—The iron preparation is dissolved in sufficient sulphuric or hydrochloric acid to introduce an excess equal to about 20 c.c. of $N/1$ acid, and the solution is added to a mixture of 20 c.c. of $N/10$ iodine solution and 5 grms. of powdered sodium pyrophosphate; the mixture is then shaken until the latter has entirely or almost entirely dissolved, and after 5 minutes, the free iodine is titrated with $N/10$ thiosulphate (of which 1 c.c. corresponds to 27·8 mgrms. of crystallised ferrous sulphate); the colour change with starch is very sharp, since the solution of ferric sodium pyrophosphate is nearly colourless. The method is specially suitable for the testing of pharmaceutical preparations, such as Blaud's pill, which cannot be titrated with permanganate.—F. Sodn.

Methods for the examination of bituminous road binders. Hubbard and Reeve. *See* IIa.

Determination of phenol and p-cresol in mixtures. Ditz and Bardach. *See* III.

Use and valuation of talc in paper manufacture. Wittel and Welwart. *See* V.

Detection of carbon bisulphide in oils. Milliau. *See* XII.

Determination of sugars in natural products. Neuberg and Ishida. *See* XVII.

Undetermined losses of the sugar factory. Pellet. *See* XVII.

Determination of the acidity of wine. Repiton. *See* XVIII.

Watkins' method of detecting the bacilli causing ropiness in bread. Kühl. *See* XIXa.

Determination of water in butter. Rivett. *See* XIXa.

Detection of shell in cocoa and cocoa preparations. Ulrich. *See* XIXa.

Determination of lecithin. Virchow. *See* XX.

Patents.

Gas analysing apparatus. A. E. Knowles, Wolverhampton. Eng. Pat. 27,545, Nov. 26, 1910.

A burette connected through a tap at the lower end with a levelling reservoir, has a tap (or taps) at the upper end through which it may be connected in turn with the gas supply, the atmosphere and a pipette of which the lower end opens in a vessel containing the reagent. This vessel stands on a platform which is hinged for convenience in exchanging the vessel for one containing another reagent. —W. P. S.

Colorimeter. S. A. Reeve, New Haven, Conn., Assignor to Rotary Meter Co., New York. U.S. Pat. 1,008,065, Nov. 7, 1911.

The conduits through which the currents of gas and air are supplied to the combustion chamber of the calorimeter, as well as the conduit through which the products of combustion are discharged, are provided with meters. The movements of the three meters are so combined that they indicate the calorific value on a dial.—W. H. C.

Composition of liquids; Apparatus for the continuous determination of the ——. F. Graafen and O. Friese. Ger Pat. 239,886, Dec. 24, 1910.

Measured quantities of the liquid under examination and of a suitable reagent are brought together in a reaction chamber, whereby a gas is evolved, the volume of which is indicated on a suitable recording device. The arrangements for the continuous measurement of definite volumes of the liquid and of the reagent, and the devices (cocks, valves, liquid-seals, or the like) for controlling the delivery of the liquid and of the reagent to the reaction-chamber and the discharge of the gas therefrom, are all operated automatically and either directly or indirectly from a single driving arrangement.—A. S.

Albumin in liquids, particularly in urine; Apparatus for the determination of ——. A. Kwilecki. Fr. Pat. 431,506, June 22, 1911. Under Int. Conv., June 23, 1910.

See Eng. Pat. 14,720 of 1911; this J., 1911, 1093.—T.F.B.

Dangerous gases; Apparatus for indicating the presence of ——. F. J. Turquand and W. E. Gray. Fr. Pat. 432,071, July 8, 1911.

See Eng. Pats. 8582 and 17,146 of 1910; this J., 1911, 1031.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Ultra-violet rays and their practical applications. D. Berthelot. Soc. Ing. Civil de France, Procès-Verbal, 1911, No. 15, 147—154.

The author divides ultra-violet rays into four classes as follows:—(1). Solar ultra-violet rays (wave length $\lambda=0{\cdot}4$—$0{\cdot}3\mu$), comprising those ultra-violet rays which reach the surface of the earth from the sun. These rays have not a destructive action on organisms, but act chemically and physiologically in a manner not greatly differing from that of the violet and blue rays of the visible spectrum. (2). Medium ultra-violet rays (wave length $\lambda=0{\cdot}3$—$0{\cdot}2\mu$). These rays exert a germicidal action, whilst chemically they play a similar part to many enzymes and catalysers in effecting decompositions; they produce numerous chemical reactions, mostly of an exothermic irreversible character (see Berthelot and Gaudechon (this J., 1910, 725, 754, 1080; 1911, 108, 377, 1086). They are used on the large scale for bleaching olive oil. (3). Extreme known ultra-violet rays (wave length $\lambda=0{\cdot}2$—$0{\cdot}15\ \mu$). These possess similar germicidal properties to the rays of the preceding class, but chemically they act synthetically, producing reversible reactions of an endothermic character. With the aid of these rays, it has been found possible to effect syntheses of carbohydrates, and of formamide, which may be regarded as the prototype of the class of proteins (see Berthelot and Gaudechon, this J., 1910, 904, 1080). (4). Unknown ultra-violet rays (wave length $\lambda=0{\cdot}15$—$0{\cdot}1\mu$). Only the existence of these rays is known, but nothing as to their properties, for they are absorbed by all substances, even by the thinnest film of gas. The rays belonging to classes

(2) and (3) are produced for technical purposes by arc lamps and by quartz mercury vapour lamps, the latter of which are coming more and more into use. The rays are used in medicine for the treatment of skin diseases and for destroying pathogenic organisms. They are also being used extensively for the sterilisation of water and for similar purposes (see this J., 1911, 1027, 1276, 1330).
—A. S.

Physical properties of bodies ; General relation between ——. G. Ter Gazarian. Comptes rend., 1911, **153**, 871—874 and 1071—1074.

The author has collected the data expressing the following physical properties and their variation with temperature, for a large number of substances :—density, viscosity, capillarity, surface energy, heat of vaporisation and rectilinear diameter. From a consideration of the figures he deduces the following law. The quotients of the numbers representing any one of these properties for any pair of substances, taken at temperatures equidistant from the respective critical temperatures, vary with temperature in a linear manner. The exactness of the law is illustrated in the case of each property, by a consideration of the data for several pairs of substances.—W. H. P.

Trade Report.

Chemical industries of Sweden. T. H. Norton. U.S. Cons. Rept., Nov., 1911.

The chemical industry of Sweden is confined to inorganic branches, with 256 chemical works. Sulphuric acid is made largely in connection with the manufacture of superphosphate. In seven factories, with thirty-nine workmen, there was an annual output of 35,108 metric tons.* The output nearly covers the domestic demand. There is but one factory for caustic soda and bleaching powder. Potassium chlorate is now one of the leading staple products of Sweden. The electrolytic process by which it is produced was devised in 1893 by O. Carlson, who started the first electrochemical establishment in Sweden. In 1900 the two factories employed 215 workmen, and the chlorate produced was valued at £43,000. In 1909 imports of chlorate had sunk to 207 tons, and the Swedish factories were exporting annually 1400 tons. The industry uses potassium chloride from Stassfurt as its raw material.

Carlson's method is an advance upon former processes for the electrolysis of alkali chlorides, as he does not use diaphragms in the electrolytic bath and maintains a continuous operation. Cathodes of iron are employed, but the anodes, which were originally of carbon, are now of platinum-iridium gauze. Formerly the baths were kept slightly alkaline by additions of caustic potash or lime. Now they are kept slightly acid, as free hypochlorous acid favours the formation of chlorate. Small amounts of potassium bichromate are also added to prevent the reduction on the cathode of the potassium hypochlorite primarily formed.

Starch is manufactured on a somewhat extensive scale, chiefly from potatoes. There are 95 factories, producing a total of 7850 tons annually. This meets the entire domestic demand. A large share of the product is converted into glucose and used for conserves. Glue and gelatin are likewise produced in quantity nearly sufficient to meet domestic needs. There are 13 factories, employing 223 workmen, and producing wares valued annually at £60,000. Yeast is made in several factories, the annual output being 2785 tons.

In 1900 there were fourteen oil factories, employing 159 operatives. The annual product was 11,736 tons of oil cake and 4418 tons of linseed and rape oil, as well as small quantities of fish oil and train oil. In 1909 Sweden imported 16,904 tons of animal and vegetable oils, 872 tons of train oil, 684 tons of oleine, and 8017 tons of fats. The soap industry is highly developed. There are forty-two factories producing annually 13,000 tons of soft soap and 3700 tons of hard soap. Excellent toilet soap is manufactured in a few establishments. Imports of soap are relatively small. In some factories the production of scents is also extensive, the annual output being valued at £40,000. This is about six times the value of the imports of scents.

The candle industry is so developed that it practically supplies the domestic demand. There are three factories employing 312 workmen. The annual product, which includes also stearine, is valued at £1,238,000. The imports are insignificant.

The domestic demand for varnish is very nearly covered by Swedish works. They number fifteen and employ 91 workmen.

The manufacture of cement has grown rapidly of late years and is now an exporting industry. In six works 1336 operatives are employed. The annual output of 126,000 tons has a value of £230,000. About one-third of this is exported, chiefly to the adjacent countries.

There are Swedish concerns engaged in the manufacture of lactic acid, lanoline, fruit essences, cosmetics, and pharmaceutical preparations. Liquid carbonic acid is made in three factories, the total annual output being 415 tons.

Customs Tariff of Australia.

Certain amendments, some of which affect the chemical trade, have been made in the Commonwealth Customs Tariff, with effect from Dec. 1, 1911. A statement giving these alterations in detail may be found on pages 484—501 of the Board of Trade Journal, Dec. 7, 1911.

Books Received.

Analytical Chemistry. By F. P. Treadwell, Ph.D., Professor of Analytical Chemistry in the Polytechnic Institute of Zürich. Authorised Translation from the German by Wm. T. Hall, Assist. Prof. of Chemistry, Massachusetts Inst. of Technology. Vol. II. Quantitative Analysis. Third Edition, revised and enlarged. John Wiley and Sons, New York, U.S.A. 1911. Price 17s. net. Chapman and Hall, Ltd., London.

8vo volume, containing 857 pages of subject matter, with 126 illustrations, tables of chemical factors, logarithms, and a coloured plate of arsenic standards. There are also alphabetical indexes of names of authors, and subjects. The contents are as follows :—I. Introduction. Part I. Gravimetric determination of the metals. Groups V (Alkalis), IV (Alkaline Earths), III, II, and I.—Gravimetric Determination of the Metalloids (Groups I., II., III, IV, V, VI, VII). Part II. Volumetric Analysis : (i), Acidimetry and alkalimetry. (ii), Oxidation and reduction methods. (iii), Precipitation analysis. Part III. Gas Analysis.

Chemistry for Engineers and Manufacturers. A Practical Textbook, by Bertram Blount and A. G. Bloxam. Volume I.—Chemistry of Engineering, Building and Metallurgy. Second Edition, revised and enlarged. Chas. Griffin and Co., Ltd., Exeter Street, Strand, London, W.C. 1911. Price 14s.

8vo volume, containing 367 pages of subject matter, with 55 illustrations, and an alphabetical index of subjects. The contents are arranged as follows :—Part I. Chemistry of the chief materials of construction. II. Chemistry of the sources of energy (Solid fuels. Liquid fuels. Gaseous fuels. Electric heating. Refrigeration. Natural forms of kinetic energy). III. Chemistry of steam-raising. IV. Chemistry of lubricants and lubrication. Part II. Metallurgy. Metalliferous ores. Metallurgical processes. Metals difficult of reduction are considered together. They are :—Aluminium, Magnesium, Calcium, Manganese, Chromium, Molybdenum, Tungsten, Vanadium, Tantalum, Sodium, Potassium.

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* Metric ton=2204·6 lb.

Transactions of the American Institute of Chemical Engineers. Volume III. 1910. [Office of the Secretary, Polytechnic Institute, Brooklyn, N.Y.] D. Van Nostrand Company, New York. 1911. E. and F. N. Spon, Ltd., 57, Haymarket, London. Spon and Chamberlain, 123, Liberty Street, New York.

8vo volume, containing 398 pages of subject matter (Transactions, addresses, and papers read before the Institute and discussed), with an alphabetical index of names and subjects. There is a frontispiece (President F. W. Frerichs), and the papers, etc., are illustrated with figures, plans, tables and maps.

The Lay-out, Design and Construction of Chemical and Metallurgical Plants. Detailed descriptions and illustrations of actual lay-outs and constructions of acid, alkali, fertiliser, brick, cement, gas, coke, and other plants, of spelter and copper works, gold and silver mills, etc. A handbook for engineers, chemists, metallurgists, manufacturers, superintendents and students. By Oskar Nagel, Ph.D. Published by the author, P.O. Box 385, New York. Vacher and Sons, Ltd., Westminster House, Great Smith Street, Westminster, London. 1911. Price 8s. 6d. net.

8vo volume, containing 201 pages of subject matter, with 172 illustrations, and indexes of illustrations, and subjects. The contents are arranged as follows :—I. Factory construction. II. Lay-out, design and construction of spelter plants. III. Portland cement plants. IV. Steel and iron plants. V. Coke plants ; Ammonia and benzol recovery. VI. Cyanide plants. VII. Silver refineries. VIII. Sampling plants. IX. Stamp mills. X. Concentrating mills. XI. Copper smelters. XII. Machine peat factories. XIII. Gas plants. XIV. Water purifying plants. XV. Drying plants. XVI. Acid plants. XVII. Alkali plants. XVIII. Paint mills. XIX. Fertiliser plants. XX. Brick plants. XXI. Sugar and alcohol plants. XXII. The science of business.

Fortschritte der Farbenchemie von 1908—1910. Von Prof. Dr. E. Grandmougin. (Sonderabdruck aus der "Chemiker-Zeitung," 1911, No. 121. S. 1126.) Verlag der Chemiker-Zeitung. Otto von Halem, Cöthen (Anhalt). 1911.

Pamphlet of 48 pages, being a reprint of Grandmougin's article on the "Advance of the Chemistry of the Dyestuffs from 1908—1911."

The Heat Treatment of Tool Steel. An illustrated description of the physical changes and properties induced in tool steel by heating and cooling operations. By Harry Brearley. Longmans, Green, and Co., 39, Paternoster Row, London. 1911. Price 10s. 6d. Also New York, Bombay, and Calcutta.

8vo volume, containing 152 pages of subject matter, with 73 illustrations, six tables of thermometric degrees, tensile stress constants, weight of steel bars per linear foot in pounds, and of reliable melting points (metals), etc. The subject matter is classified as follows :—I. Structure and classification. II. Fractures and external appearance. III. Forging tool steel. IV. Annealing tool steel. V. Physical changes in steel on heating and cooling. VI. Hardening of steel. VII. Tempering and straightening. VIII. Hardening typical tools. IX. Defective tools. X. Hardening plant. XI. Pyrometers. XII. Case hardening. XIII. Alloy steels. XIV. Appendix.

Die Bedeutung des Sauerstoffs in der Färberei. Von P. G. Unna und L. Golodetz. Leopold Voss' Verlag, Leipzig und Hamburg. 1912. Price M. 4.

8vo volume, containing 128 pages of subject matter, sub-divided and classified as follows :—I. The secret of Methyl Green (P. G. Unna). II. The oxidising and reducing properties of our microscopical reagents (L. Golodetz). III. Methods of dyeing from the points of view of oxidation and reduction. IV. Analysis of the Methyl-Green—Pyronine dyeing and its improvement by the action of mordants (P. G. Unna). V. Concluding considerations.

Handbook of Chemical Patents. How procured, requisites of, and other information concerning chemical patents in the United States and abroad. By Hugo Mock, Attorney at Law. Mason, Fenwick and Lawrence, St. Paul Building, New York and Washington, D.C. 1911. Unbound, free of charge to members of this Society. Bound (Morocco leather), 1s.

Rather over pocket-book size, and containing 35 pages of subject matter, classified in eight chapters, headed as follows :—I. Do chemical patents pay ? II. Suggestions to inventors. III. Patent office procedure. IV. The patent application. V. Infringement. VI. Chemical patents in foreign countries. VII. The title to inventions : Shoprights. VIII. Trade marks and trade names for chemical products.

Die Kolloide in Biologie und Medizin. Von Prof. Dr. H. Bechold. Theodor Steinkopff's Verlag, Dresden. 1912. Price M. 14. Bound (cloth), M. 15.50.

8vo volume, containing 408 pages of subject matter, with 52 illustrations, numerous tables and two plates. There are also alphabetical indexes of names and sources of information, and of subjects. The work is divided into four parts, again sub-divided into chapters :—Part I. Introduction to Colloid Investigation : (i), What are colloids ? (ii), Limiting surfaces. (iii), Size of particles. Molecular weight. Osmotic pressure. Conductivity. (iv), Phenomena of motion. (v), The question of form in colloids. (vi), Optical and electrical properties of colloids. (vii), Methods of investigation. Part II. The Biocolloids. (i), Carbohydrates. (ii), Lipoids. (iii), Albuminous bodies. (iv), The foodstuffs. (v), Enzymes. (vi), Immunity reactions. Part III. The Living Organism as a Colloidal System. (i), Distribution and change of matter. (ii), Form, its construction, alterations, growth and development. (iii), The cell. (iv), Movements of the organisms. (v), Blood, Breathing, etc. (vi), Resorption and Secretion. (vii), Secretions and excretions. (viii), The nerve. The integument. Part IV. (i), Toxicology and Pharmacology. (ii), Technical microscopy.

Handbuch der Chemie und Technologie der Oele und Fette. Chemie, Analyse, Gewinnung und Verarbeitung der Oele, Fette, Wachse, und Harze. In vier Bänden. Unter Mitwirkung von vier und fünfzig Mitarbeitern. Herausgegeben von Dr. L. Ubbelohde und Dr. F. Goldschmidt. III. Band, 2 Abteilung. S. Hirzel's Verlag, 2, Königstr., Leipzig. 1911. Price M. 34.

Large 8vo volume, containing 740 pages of subject matter, with 225 illustrations, and alphabetical indexes of names and subjects. It forms the second part of the 3rd volume, the first part having appeared in 1910 (see this J., 1910, 1232). Part V. The Physical Chemistry of Saponification and the Soaps. (i), Theory of saponification of the fats. (ii), Physical chemistry of the soaps. (iii), The colloid-chemical principles of soap manufacture. Part VI. General Technology of Soaps. (i), Historical development of soap manufacture. (ii), Raw materials used. Inorganic raw and other materials used in soap manufacture. (iii), Machinery and apparatus used. (iv), Conditions of working in fat, acid and soap factories in their hygienic aspect. (v), Methods of saponification employed. Part VII. Special Technology of the Soaps. (i), Manufacture of hard soaps. (ii), Manufacture of soft soaps. (iii), Manufacture of soap powders. (iv), Textile soaps. (v), Toilet soaps. (vi), Medicinal soaps. (vii), Calculations in the soap factory. Part VIII. Soap Analysis. Part IX. Economic Development of the Soap, Candle, and Glycerin Industry. (i), Economic development and position of the German soap industry. (ii), Economic development and position of the German stearine industry. (iii), The soap and candle industry in Austro-Hungary. (iv), Soap, candle and glycerin industry in France. (v), Soap, candle, and glycerin industry in Great Britain. (vi), Soap and candle industry in Italy.

Tonindustrie-Kalender für 1912. Verlag der Tonindustrie-Zeitung, G. m. b. H., Berlin, N.W. 21.

Pocket-book size, and compiled in three parts, Part I. serving as almanack and notebook, with pencil, blank pages, etc.; also furnished with tabulated data at the end, formulæ and molecular weights of the most important substance for the chemist and worker in clays, etc., and blank pages for laboratory notes. It is bound in waterproof cloth. Part II. contains a concise record of all data likely to prove useful to the chemical engineer and manager in the preparation of clays, pottery and building materials. Such data include melting points, fuels, calorific values, explosives, protection from lead diseases and accidents, tabulated data relating to logarithms, rates of day wages, and wages by the hour, weights and measures, also foreign money tables. There are 134 pages of matter, and an alphabetical index. Part III. contains 261 pages of subject matter, and may be divided into two parts: *the first*, an index of books and works of reference recommended, on all subjects relating to the clay, pottery, and building material industry, and arranged alphabetically; *the second*, a directory with names and addresses of firms furnishing all requisite articles and materials, but arranged alphabetically as regards the materials, etc., referred to.

Résumé of Producer-Gas Investigations, October 1, 1904—June 30, 1910. By R. H. Fernald and C. D. Smith. Bulletin 13, U.S. Bureau of Mines, 1911.

The tests made are of two classes: (1), those made with the pressure-producer used at St. Louis and Norfolk, Va., and (2), those made with the down draught producer plant at Pittsburgh. Detailed accounts of the tests of groups (1) and (2) form Parts II. and III. respectively of this report, Part I. consisting of a discussion of producer gas and producer-gas plants. The results achieved are so full of promise as to call for more extended research. The efficiencies obtained show the possibilities of the gas-producer as a factor in reducing waste and conserving fuel resources.

Mines and Quarries: General Report, with Statistics, for 1910. By the Chief Inspector of Mines. Part III.—Output. [Cd. 5977.] Price 1s. 5d. (see page 1455).

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

Patent Specifications may be purchased at the Sale Branch of the Patent Office, Quality Court, Chancery Lane, London, W.C., fifteen days after the date on which acceptance of the complete specification is advertised. The price is 8d. each.

I.—GENERAL PLANT; MACHINERY.

Applications.

26,533. France. Kilns, furnaces, etc. Nov. 27.

26,625. Freygang. Process and apparatus for filtering liquids. Nov. 28.

26,677. Heenan and Froude, Ltd., and Leask. Furnaces. Nov. 29.

26,710. Tiemann. *See under* XVII.

26,829. Humphrey and Rusdell. Raising or forcing liquids. Nov. 30.

26,993. Anderson and Meikle. Distilling or evaporating apparatus. Dec. 2.

27,019. Hebb, and Slag Power, Ltd. *See under* X.

27,072. Sumner. Machine for facilitating the interaction of gas and liquid. Dec. 4.

27,277. Higgins. Mixing apparatus. Dec. 5.

27,305. Bennis and Harris. Furnaces. Dec. 5.

27,369. Schwarz. Chamber kilns.* Dec. 6.

27,422. McClelland. Apparatus for heating, evaporating, volatilising, or distilling liquids. Dec. 7.

27,689. White and Arnold. Apparatus for treating smoke and fumes from furnaces, etc. Dec. 9.

27,696. Theisen. Apparatus for purifying, cooling, and washing gases. [Addition to No. 22,433 of 1910.]* Dec. 9.

Complete Specifications Accepted.

28,086 (1910). Parsons and Cook. Condensing plant. Dec. 13.

28,376 (1910). Nutter, and Minerals Separation, Ltd. Valves for controlling the flow of thick pulpy material. Dec. 6.

1336 (1911). Candy. Filters. Dec. 6.

3600 (1911). Dexter. Drying machines having steam-heated cylinders. Dec. 6.

11,309 (1911). Sutcliffe. Kilns. Dec. 6.

II.—FUEL; GAS; MINERAL OILS AND WAXES; DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

26,692. Faraday. Manufacture of briquets. Nov. 29.

26,730. Frick. Method of cleaning gases. Nov. 29.

26,731. Frick. Production of charcoal or coke with recovery of by-products. Nov. 29.

26,848. Graham. Utilisation of waste furnace gases in combustion of fuel. Nov. 30.

26,854. Henderson. Preparation of metallic filaments for incandescent lamps. [U.S. Appl., Dec. 5, 1910.]* Nov. 30.

26,979. Davidson and Liversedge. Gas scrubber. Dec. 2.

27,005. Barbet. Apparatus for the continuous distillation and purification of crude petroleum, coal tar, etc. [Fr. Appl., Dec. 3, 1910.]* Dec. 2.

27,261. Pintsch A.-G. Incandescent filaments for electric lamps. [Ger. Appl., Nov. 17, 1911.]* Dec. 5.

27,290. Grote. Manufacture of metal filaments for electric lamps. Dec. 5.

27,313. Lewis. Manufacture of incandescence mantles. Dec. 6.

27,354. Zdanowich. Manufacture of incandescence gas mantles. Dec. 6.

27,360. Krause. *See under* X.

27,378. Guebels. Manufacture of coke.* Dec. 6.

27,533. Bone and McCourt. Combustion of liquid fuel. Dec. 8.

27,534 and 27,535. Bone and McCourt. Gasification and combustion of liquid fuel. Dec. 8.

27,612. Southey. Production of gaseous fuel. Dec. 8.

27,620. British Thomson-Houston Co. (General Electric Co.). Electrodes. Dec. 8.

27,703. King. Treatment of petroleum derivatives for use as fuel in internal-combustion engines. Dec. 9.

Complete Specifications Accepted.

21,429 (1910). Pyle and Crate. Coke ovens, gas retorts, etc. Dec. 6.

27,843 (1910). Lamkin and Godwin. Manufacture and use of oil gas. Dec. 6.

28,178 (1910). Wallbaum. *See under* III.

29,247 (1910). Wetter (Naamlooze Vennootschap Briquet Co.). Manufacture of fuel blocks or briquettes. Dec. 6.

710 (1911). British Thomson-Houston Co. (General Electric Co.). Arc lamp electrodes. Dec. 6.

1847 (1911). Milbourne and Turner. Gas retorts. Dec. 6.

2590 (1911). Deval. *See under* XXIII.

3150 (1911). Bleichert. Quenching and removing coke. Dec. 13.

9550 (1911). Birault and Riché. Production of combustible gases from house refuse. Dec. 13.

13,817 (1911). Gebr. Siemens und Co. Arc lamp electrodes. Dec. 6.

14,735 (1911). Hiby. Regenerative coke ovens. Dec. 6.

17,690 (1911). Schiff. Carbon electrodes for arc lamps. Dec. 13.

23,468 (1911). Wallbaum. *See under* III.

III.—TAR AND TAR PRODUCTS.

Application.

27,005. Barbet. *See under* II.

Complete Specifications Accepted.

28,178 (1910) and 23,468 (1911). Wallbaum. Manufacture and use of emulsion products from asphalt, coal tar pitch, petroleum pitch, paraffin, montan wax, and Japan wax. Dec. 13.

9520 (1911). Flurscheim. Manufacture of nitro derivatives of aniline and its homologues. Dec. 13.

IV.—COLOURING MATTERS AND DYES.

Applications.

26,944. Newton (Bayer und Co.). Manufacture of violet to blue wool dyestuffs. Dec. 1.

27,067. Levinstein, Levinstein, Ltd., and Barnett. Dyestuffs and intermediate products therefor. Dec. 4.

27,113. Newton (Bayer und Co.). Manufacture of vat dyestuffs of the anthraquinone series. Dec. 4.

27,379. Meister, Lucius, und Brüning. Manufacture of leuco compounds of certain dyestuffs. [Ger. Appl., Dec. 12, 1910.]* Dec. 6.

Complete Specifications Accepted.

27,861 (1910). Newton (Bayer und Co.). Manufacture of azo dyestuffs for cotton. Dec. 13.

8069 (1911). Holliday and Sons, Ltd., Turner, and Dean. Manufacture of black colouring matters. Dec. 6.

12,010 (1911). Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of anthraquinone derivatives and their use in dyeing and printing. Dec. 6.

15,979 (1911). Soc. of Chem. Industry in Basle, and others. Manufacture of sulphurised vat dyestuffs of the anthracene series. Dec. 13.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

26,514. Petrelius. Production of designs on paper, etc.* Nov. 27.

26,614. Baekeland. Manufacture of cardboard or the like. [U.S. Appl., Nov. 30, 1910.]* Nov. 28.

26,824. Denso and Jirotka. Method of producing wood pulp. Nov. 30.

26,894. Fulton. Apparatus for treating fabrics, yarns, etc. Dec. 1.

Complete Specifications Accepted.

25,019 (1910). Hutchinson, and Lloyd, Ltd. Paper-making machinery. Dec. 6.

27,570 (1910). Del Prato. Treatment of vegetable fibres. Dec. 6.

28,193 (1910). Silberrad. Isolation of cellulose and fibrous materials from plants. Dec. 13.

29,553 (1910). Barat. Preparation of milk of resin for sizing paper. Dec. 13.

1303 (1911). Marr. Apparatus for drying sized yarns. Dec. 6.

15,105 (1911). Jirotka. Apparatus for producing wood pulp. Dec. 6.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

26,576. Pilz. Production of fast brown resists on the vegetable fibres of articles dyed by the Prud'homme process. [Austrian Appl., Dec. 19, 1910.]* Nov. 28.

26,584. Liddle (Psarski Dyeing Machine Co.). Dyeing machines.* Nov. 28.

26,622 and 26,623. Anderson, and Anderson, Anderson, and Anderson, Ltd. Waterproof fabrics. Nov. 28.

26,894. Fulton. *See under* V.

27,720. Zocheddu. Process and apparatus for dry-cleaning fabrics, etc. Dec. 9.

Complete Specifications Accepted.

11,320 (1911). Smith. Compositions for fireproofing and preserving fabrics, wood, etc. Dec. 13.

12,010 (1911). Bloxam (Chem. Fabr. Griesheim-Elektron). *See under* IV.

12,157 (1911). Johnson (Badische Anilin und Soda Fabrik). *See under* VII.

13,482 (1911). Prianichnikov. Cop tubes. Dec. 13.

17,864 (1911). Bright and Bros., Ltd., and Oldroyd. Treatment of raised cotton goods to reduce their inflammability. Dec. 13.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

26,749. Badische Anilin und Soda Fabrik. Manufacture of ammonia. [Ger. Appl., Nov. 29, 1910.]* Nov. 29.

26,816. Crowther. Production and storage of silicon tetrafluoride. [Addition to No. 22,101 of 1910.] Nov. 30.

26,960. Stanek. *See under* XX.

27,217. Sands, Gourlay, and Jackson. Apparatus for mixing and dissolving lime.* Dec. 5.

27,606. Metzl. Process for reducing stannic oxide. Dec. 8.

27,691. Woltereck and Moeller. Process for burning lime and plaster of Paris. Dec. 9.

27,692. Woltereck and Moeller. Production of sulphuric acid. Dec. 9.

27,693. Woltereck and Moeller. Production of nitric and hydrochloric acids. Dec. 9.

Complete Specifications Accepted.

22,745 (1910). Heys (Nitrogen Co.). Manufacture of nitrogen compounds. Dec. 13.

28,261 (1910). Johnson (Chem. Fabr. Griesheim-Elektron). Manufacture of alkali sulphides and alkaline earth sulphides. Dec. 13.

28,534 (1910). Barton. Manufacture of hydrogen. Dec. 13.

29,906 (1910). Hale and Scott. Recovery of corrosive acids from their absorbents. Dec. 13.

30,354 (1910). Eckford. *See under* XIII.

6562 (1911). Overton. *See under* XX.

9623 (1911). Jaubert. Preparation of hydrogen by auto-combustion. Dec. 6.

12,157 (1911). Johnson (Badische Anilin und Soda Fabrik). Manufacture of zinc formaldehyde sulphoxylate. Dec. 6.

VIII.—GLASS; CERAMICS.

Application.

26,602. Miller. *See under* X.

Complete Specification Accepted.

18,856 (1911). Benedictus. Strengthened glass. Dec. 6.

IX.—BUILDING MATERIALS.

Applications.

26,521. Botson and Borlée. Manufacture of artificial stones. [Divided Appl. on No. 14,435 of 1911.] Nov. 27.

26,539. Botson and Borlée. Manufacture of artificial marble. [Divided Appl. on No. 14,435 of 1911.] Nov. 27.

26,704. Schol. Manufacture of light slabs, bricks, etc., from blast-furnace slag.* Nov. 29.

26,941. Spooner. Process of waterproofing cement substances. Dec. 1.

27,363. Morton. Artificially seasoning or drying wood or timber. Dec. 6.

Complete Specifications Accepted.

28,284 (1910). Hemingway. Preserving or treating stone and like building materials, and producing cement. Dec. 6.

11,320 (1911). Smith. *See under* VI.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

26,484. Cowper-Coles. Rendering iron surfaces non-corrosive. Nov. 27.

26,602. Miller. Electroplating on enamel or other vitrifiable substances. Nov. 28.

26,644. Richards. Recovery of tin from ores, etc.* Nov. 28.

26,733. Frick. Treatment of sulphides for the recovery of sulphur and the production of matte. Nov. 29.

26,734. Frick. Production of sponge iron directly from the ore. Nov. 29.

26,856. Fischer. Forming bars and blocks of chemically pure metals having a high melting point.* Nov. 30.

26,860. Murex Magnetic Co., Ltd., and Lockwood. Treatment of ores. Nov. 30.

26,913. Cowper-Coles. Electrodeposition of metals. Dec. 1.

27,019. Hebb, and Slag Power, Ltd. Utilising the heat contained in molten slag, metals, etc. Dec. 2.

27,020. Simpson and Oviatt. Welding copper on iron or steel. Dec. 2.

27,149. Moore. Manufacture of manganese steel.* Dec. 4.

27,151. Sefton-Jones (Grohmann und Co.). Manufacture of iron articles which will withstand the action of acids and heating.* Dec. 4.

27,175. Brown and Foulkes. Coating iron, steel, etc., with other metals or alloys. Dec. 5.

27,260. Pintsch A.-G. Process for reducing tungsten oxides. [Ger. Appl., Nov. 7, 1911.]* Dec. 5.

27,342 to 27,345. Mackay. Processes of extracting metals from ores.* Dec. 6.

27,360. Krause. Tungsten wire especially suitable for electric lamp filaments. [Ger. Appl., March 2, 1911.]* Dec. 6.

27,377. Fischer and Schudel. Manufacture of electric steel castings. [Ger. Appl., Dec. 7, 1910.]* Dec. 6.

27,382. Hutton. Aluminium or aluminium alloys. Dec. 6.

27,400. Deutsch-Luxembergische Bergwerks- u. Hütten-A.-G. Production of high-grade steel and slag rich in soluble phosphates in an open hearth or electric furnace. [Addition to No. 19,640 of 1911.]* Dec. 6.

27,411. Llangguth. Treatment of lead-silver-zinc ores, lead ores containing silver, and silver ores. [Ger. Appl., March 22, 1911.]* Dec. 6.

27,451. Brackelsberg. Recovery of arsenic, antimony, copper, lead, zinc, sulphur, etc., from ores and products, especially those used in smelting iron and manganese-iron. [Ger. Appl., Dec. 9, 1910.]* Dec. 7.

27,606. Metzl. *See under* VII.

Complete Specifications Accepted.

21,260 (1910). King's Norton Metal Co., Bayliss, and Brownsdon. Production of metallic coatings on non-metallic surfaces. Dec. 6.

28,274 (1910). Bradley. Extraction of metals from ores. Dec. 13.

5015 (1911). Allison (International Metal Products Co.). Alloys and the manufacture thereof. Dec. 13.

XI.—ELECTRO-CHEMISTRY.

Applications.

26,566. Zyttkowski. Accumulator plate and its manufacture.* Nov. 27.

26,732. Frick. Method of maintaining the walls of electric induction furnaces. Nov. 29.

Complete Specifications Accepted.

28,069 (1910). Thomas. Electrically insulating compound and process of preparing it. Dec. 6.

28,352 (1910). Mershon. Forming dielectric films in aluminium and other electrolytic cells. Dec. 13.

XII.—FATS; OILS; WAXES.

Applications.

26,646. Stock. Shaving soap. Nov. 28.

26,958. Thompson (Groeben). Washing compositions or detergents. [Addition to No. 4111 of 1911.] Dec. 1.

27,138. Westphal. Production of an artificial fat of the flavour of goose fat.* Dec. 4.

27,244. Petroff. Process for splitting fats and fatty oils into glycerine and fatty acids. Dec. 5.

27,297. Krebitz and Vogl. Deglycerinising and heating lime soaps and other soaps insoluble in water. [Ger. Appl., Dec. 13, 1910.]* Dec. 5.

27,487. Schmitt. *See under* XIX.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

26,959. Bremer Linoleumwerke Delmenhorst. Manufacture of linoleum, lincrusta, etc. [Ger. Appl., Dec. 27, 1910.]* Dec. 1.

27,579. Tye. Cleansing gum copal from sand and other earthy and deleterious substances. Dec. 8.

Complete Specifications Accepted.

28,491 (1910). Kunisch and Brunn. Manufacture of substitutes for amber, etc. Dec. 13.

28,553 (1910). Meurant. Manufacture of white pigments. Dec. 13.

30,354 (1910) and 17,256 (1911). Eckford. Manufacture of lead oxide and apparatus therefor. Dec. 13.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

26,935. Olsson. Manufacture of elastic materials. Dec. 1.

27,361. Bayer und Co. Manufacture of caoutchouc, its homologues and analogues. [Ger. Appl., March 23, 1911.]* Dec. 6.

27,424. Sutton. Apparatus for smoking and coagulating rubber latex. Dec. 7.

27,664 and 27,666. Byrne. Curing raw indiarubber. Dec. 9.

27,665. Byrne. Process and apparatus for curing raw indiarubber. Dec. 9.

Complete Specification Accepted.

13,009 (1911). Schopper. Apparatus for testing the elasticity of rubber and other materials. Dec. 6.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

26,750. Hanson, Edwards, and Jones. Apparatus for treating tan waste and other plastic materials.* Nov. 29.

27,266. Feldmann. *See under* XVI.

Complete Specifications Accepted.

19,853 (1910). Kelly. Flexible composition or glue. Dec. 6.

16,810 (1911). Hartmann. Hardening and waterproofing skins. Dec. 6.

XVI.—SOILS; FERTILISERS.

Applications.

26,845. Coates. Fertilisers and process of making same.* Nov. 30.

27,266. Feldmann. Manufacture of nitrogenous manure from leather. Dec. 5.

XVII.—SUGARS; STARCHES; GUMS.

Application.

26,710. Tiemann. Concentrating and crystallising apparatus, especially for sugar manufacture. [Ger. Appl., Jan. 6, 1911.]* Nov. 29.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

27,572. Ohlhaver. Manufacture of dried yeast. [Ger. Appl., March 1, 1911.]* Dec. 8.

27,573. Ohlhaver. Maintaining the vitality of the active organisms in dried yeasts. [Ger. Appl., March 1, 1911.]* Dec. 8.

27,574. Ohlhaver. Increasing the raising power of dried yeast. [Ger. Appl., March 1, 1911.]* Dec. 8.

27,711. Field. Manufacture of yeast. Dec. 9.

Complete Specifications Accepted.

27,845 (1910). Kruis. Manufacture of dry yeast. Dec. 6.

14,510 (1911). Gibaudan, and Comp. pour la Fabr. des Compteurs et Matérial d'Usines à Gaz. Alcohol meter. Dec. 6.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

26,694. Rulke. Manufacture of disinfectant substances. [Ger. Appl., Dec. 15, 1910.]* Nov. 29.

26,927. Dibdin. Sedimentation tanks for treating sewage, etc. Dec. 1.

26,952. Ellis (Chem. Werke vorm. Dr. H. Byk). Manufacture of baking powders.* Dec. 1.

27,054. Wood and Hellings. Purification of waste liquors. Dec. 4.

27,138. Westphal. *See under* XII.

27,366. Renoncé. Apparatus for sterilising fluids by rays of short wave length. [Fr. Appl., Dec. 6, 1910.]* Dec. 6.

27,487. Schmitt. Production of food fats such as margarine, etc. [Ger. Appl., Jan. 16, 1911.]* Dec. 7.

27,670. Bromet. Straining and drying sewage sludge. Dec. 9.

Complete Specifications Accepted.

28,434 (1910). Grossmann. Treatment of sewage sludge. Dec. 6.

4127 (1911). Otto. Apparatus for producing sterilising agents in liquid-sterilising plants. Dec. 6.

9214 (1911). Bray, Curtis, and Waugh. Flavouring preparation. Dec. 13.

9550 (1911). Birault and Riché. *See under* II.

29,363 (1911). Neumann. Apparatus for refining chocolate masses, etc. Dec. 6.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

26,503. Newton (Bayer und Co.). Manufacture of esters. Nov. 27.

26,960. Stanek. Manufacture of stable compounds of hydrogen peroxide with organic substances. [Austrian. Appl., Jan. 23, 1911.]* Dec. 1.

27,100. Wellcome and Remfry. Manufacture of a therapeutic compound. Dec. 4.

27,112. Newton (Bayer und Co.). Manufacture of therapeutic compounds. Dec. 4.

27,348. Grossmann, and Terpol A.-G. Manufacture of aromatic oils.* Dec. 6.

27,387. Johnson (Badische Anilin und Soda Fabrik). Manufacture of 1.3-butadiene and derivatives. Dec. 6.

27,562. Wolffenstein. Salicylic acid esters.* Dec. 8.

Complete Specifications Accepted.

6562 (1911). Overton. Preparation of tincture or an aqueous solution of iodine. Dec. 6.

11.736 (1911). Scheitlin. Production of compounds from blood or constituents of blood. Dec. 6.

19,391 (1911). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of glycerophosphoric acid. Dec. 13.

20.242 (1911). Chem. Fabr. vorm. Dr. H. Byk. Manufacture of a stable preparation of hydrogen peroxide and urea. Dec. 6.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

27,589. Kelly. Photographic chemicals. Dec. 8.

XXII.—EXPLOSIVES; MATCHES.

Complete Specification Accepted.

28,122 (1910) and 5201 (1911). Johnson. Blasting. Dec. 13.

XXIII.—ANALYTICAL PROCESSES.

Application.

27,281. Philip and Steele. Detectors of combustible gases. Dec. 5.

Complete Specification Accepted.

2590 (1911). Deval. Apparatus for testing the atmosphere of coal mines. Dec. 13.

LIST OF PAST PRESIDENTS, COUNCIL, AND OFFICERS.

Past Presidents.

Rt. Hon. Sir Henry Roscoe, LLD., F.R.S.	1881—1882.
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†Sir Wm. H. Perkin, LL.D., Ph.D., F.R.S.	1884—1885.
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Prof. Ira Remsen	1909—1910.

† Deceased.

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Dr. Milton L. Hersey, P.O. Box 554, Montreal, Canada.
D. Lloyd Howard, City Mills, Stratford, E.
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Dr. Julius Raschen, The Highlands, Runcorn, Cheshire.

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Secretary .. F. R. O'Shaughnessy, Tyburn, near Birmingham.

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Secretary .. W. Roscoe Hardwick, 13, Batavia Buildings, Hackins Hey, Liverpool.

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Chas. G. Cresswell, Palace Chambers, Westminster, S.W. (Telegraphic address :—59, Palatable, London ; Telephone No., 715, Victoria).

Editor.

Watson Smith, 34, Upper Park Road, Haverstock Hill, London, N.W.

LIST OF MEMBERS.

THE MEMBERSHIP ON FEBRUARY 28TH, 1911 = 4240.

NOTE: "O.M." MEANS ORIGINAL MEMBER.

A

1908. Abelli, Dr. Modesto, Avigliana, Torino, Italy, Director of Nobel Explosive Works.

1903. Abraham, Herbert, 13, West 89th Street, New York City, U.S.A., Chemist.

1909. Acheson, Dr. Edward G., Niagara Falls, N.Y., U.S.A., President, Acheson Oildag Co.

1902. Acker, Chas. E., 80, Main Street, Ossining, N.Y., U.S.A., Manufacturer.

1903. Ackermann, Franz W., 86, Pierrepoint Street, Brooklyn, N.Y., U.S.A., Chemist.

1909. Acott, Richard H., c/o Porter Fibre Bottle Co., Lewiston, N.Y., U.S.A., Chemist.

1903. Acton, J. Rowland, India Store Depot, Belvedere Road, London, S.E., Civil Servant.

1911. Acton, Leonard T., Continental Mexican Rubber Co., Apartado 176, Torreon, Coahuila, Mexico, Chemist.

1910. Adam, A. L. K., c/o Dalgety and Co., Ltd., 15, Bent Street, Sydney, N.S.W., Australia, Analytical Chemist.

1907. Adam, Wm. A., c/o Mander Bros., Wolverhampton, Chemist.

1892. Adams, Arthur, Kelvin House, Edgbaston Road, Smethwick, near Birmingham, Science Lecturer.

1909. Adams, Chas., c/o John Cowan Co., Ltd., 9, Dalhousie Street, Montreal, Canada, Chemical Works Manager.

1911. Adams, E. Bryan, Prospect House, Cliffe at Hoo, Kent, Chemist.

1897. Adams, Thos. H., Newtongrange, Manor Road, Borrowash, near Derby, Analyst.

1895. Adamson, G. P., The Baker and Adamson Chemical Co., Easton, Pa., U.S.A., Manufacturing Chemist.

1891. Adcock, S. R., St. Helens Smelting Co., Ltd., Atlas Court, St. Helens, Lancashire, Analytical Chemist.

1901. Addison, Leonard, c/o Messrs. Burt, Boulton, and Haywood, Selzaete, Belgium, Chemist.

1898. Adgate, M., Naugatuck, Conn., U.S.A., Chemist.

1896. Adler, Dr. Leon N., Adler Colour and Chemical Works, 100, William Street, New York City, U.S.A., Manufacturing Chemist.

1907. Adley, Geo. S., Storer's Wharf, Poplar, London, E., Varnish Manufacturer.

1888. Adriance, Dr. John S., Williams College, Williamstown, Mass., U.S.A., Analytical Chemist.

1899. Adrot, Léon, 16, Palmer Avenue, Port Richmond, N.Y., U.S.A., Chemist.

1891. Airedale, Rt. Hon. Lord, Gledhow Hall, and (Jnls.) Monkbridge Iron and Steel Co., Ltd., Leeds, Iron and Steel Manufacturer.

1886. Aitken, J. B., Gerard's Fold Chemical Works, Widnes, Chemical Manufacturer.

1910. Aitken, Dr. J. M., Elm Cottage, Bothwell, N.B., Chemist.

1884. Akitt, Thos., Headrigg Lodge, Annan, N.B., Chemist.

1883 Albright, G. S., Bromesberrow Place, Ledbury, Chemical Manufacturer.

O.M. Albright, W. A., 29, Frederick Road, Edgbaston, Birmingham, Chemical Manufacturer.

1906. Alcock, Frank H., 9, Broad Street Corner, Birmingham, Analyst.

1907. Alcock, J.E., 51, Gill Street, Moston Lane, Blackley, Manchester, Chemist.

1902. Alden, Frederick W., 500, Madison Street, Waukesha, Wis., U.S.A., Chemist.

1898. Alden, John, Chemical Laboratory, Pacific Mills, Lawrence, Mass., U.S.A., Chemist.

1900. Aldrich, Roger C., c/o Franklin H. Kalbfleisch Co., Elizabeth, N.J., U.S.A., Mechanical Engineer.

1890. Aldrick, Edwin John, 53, Alpha Road, West Ferry Road, Millwall, E., Works Sub-Manager.

1909. Alén, Dr. J. E., Stadskemistens Laboratorium, Göteborg, Sweden, Public Analyst.

1899. Alexander, D. Basil W., 1000, Date Street, Los Angeles, Cal., U.S.A., Chemist.

1900. Alexander, Jerome, c/o National Gum and Mica Co., 502–510, West 45th Street, New York City, U.S.A., Chemist.

1883. Alexander, W. T., Crumnock, Eccles, Manchester, Drysalter.

1906. Allan, David, c/o Price's Patent Candle Co., Ltd., Belmont Works, Battersea, S.W., Chemist.

1891. Allan, F. H. Tielke, Ellesmere, Robin Hood, near Wakefield, Analytical Chemist.

1898. Allan, John, 77, Northen Grove, West Didsbury, Manchester, Chemist.

1909. Allan, Maurice, 95, Burford Street, Nottingham, Soapmaker.

1907. Allard, M. L., c/o Gutta Percha and Rubber Manufacturing Co., West Lodge Avenue, Toronto, Canada, Chemist.

1902. Allbright, Wm. B., 4937, Madison Avenue, Chicago, Ill., U.S.A., Chemical Engineer.

O.M. Alldred, C. H., 8, St. Margaret's Road, Plumstead Common, Kent, Analytical Chemist.

1898. Alleman, Dr. Gellert, Swarthmore College, Swarthmore, Pa., U.S.A., Professor of Chemistry.

1903. Allen, Chas. A., Fulwood, Sunnyhurst, Darwen, Lancashire, Chemist.

1911. Allen, Henry L., Nobel's Explosives Co., Ltd., Stevenston, Ayrshire, Chemist.

1911. Allen, Irving C., U.S. Bureau of Mines, Pittsburg, Pa., U.S.A., Chemist.

O.M. Allen, J., 164, Upper North Street, Poplar, E., Manufacturing Chemist.

1889. Allen, R. L., Hillside, and (Journals) c/o Brunner, Mond and Co., Ltd., Sandbach, Cheshire, Analytical Chemist.

1908. Allen, Simeon C., 81, Lake Avenue, Rochester, N.Y., U.S.A., Consulting Chemist.

1900. Allen, Wilfrid T., Allington, Bexley, Kent, Director.

1904. Allen, Wm. R., 709, Power Building, Montreal, Canada, Chemical Manufacturer.

1893. Allerton, Rt. Hon. Lord, F.R.S. (Journals), Allerton Hall, near Leeds; and c/o W. L. Jackson and Sons, Ltd., Buslingthorpe, Leeds, Tanner.

O.M. Allhusen, A., Gateshead-on-Tyne, Chemical Manufacturer.

1886. Allibon, G. H., Mayfield, Balmoral, Belfast, Ireland, Chemical Works Manager.

1905. Allpass, Jas., c/o The Clayton Aniline Co., Ltd., Clayton, Manchester, Secretary.

1889. Alpiar, Agop, Smyrna, Asia Minor, Morphia Manufacturer.

1899. Alsop, Wm. K., Ridgway, Pa., U.S.A., Chemist.

1904. Alton, W. Lester, 42, The Manor House, Marylebone, London, N.W., Chemist.

1910. Amin, Bhailal D., The Alembic Chemical Works Co., Ltd., Baroda, India, Chemical Agent.

1905. Amory, L. H., c/o Messrs. J. Heathcoat and Co., Tiverton, Devon, Lace Manufacturer.

1910. Anderson, Jas. R. V., School of Mines, Bendigo, Victoria, Australia, Lecturer in Chemistry and Metallurgy.

1900. Anderson, Jas. W., Denmark House, London Road, Northfleet, Kent, Analytical Chemist.

1889. Anderson, Robt. T. R., 42, Roslea Drive, Dennistoun, Glasgow, Technical Chemist.

1894. Anderson, Dr. W. Carrick, 7, Scott Street, Garnet Hill, Glasgow, Consulting Chemist.

1905. Andreae, Dr. E. P., c/o British Glanzstoff Manufacturing Co., Ltd., Flint, North Wales, Chemist.

1907. Andrews, Chas. T., Chemist.

1889. Andrews, Clement W., c/o The John Crerar Library, Wabash Avenue and Washington Street, Chicago, Ill., U.S.A., Librarian.

1904. Andrews, Geo. D., c/o J. & J. Colman, Ltd., Carrow Works, Norwich, Chemist.

1903. Andrews, Wm. H., 79, Tonawanda Street, Buffalo, N.Y., U.S.A., Manager (Varnish Works).

1903. Anfilogoff, N. A., Christine House, High View Avenue, Grays, and (Journals) Central Wharf, Bow, E., Chemist.

O.M. Angell, J., 6, Beaconsfield, Derby Road, Withington, Manchester, Chemical Lecturer.

1892. Annandale, C. J. R., 126, Earnsdale Road, Darwen, Lancs., Paper Maker.

1883. Annandale, Jas. H., Polton Paper Works, Midlothian, N.B., Paper Maker.

1894. Ansbacher, L. A., 253, Broadway, New York City, U.S.A., Colour Manufacturer.

1902. Anthony, John, 82, Bay Street, Toronto, Canada.

1904. Appleby, Jos., Farnley, Moor Lane, Great Crosby, Liverpool, Flour Miller.

1895. Appleby, Prof. W. R., 911, 5th Street S.E., Minneapolis, Minn., U.S.A., Professor of Mining and Metallurgy.

1907. Appleton, Francis H., jun., P.O. Box 815, Franklin, Mass., U.S.A., Rubber Manufacturer.

1894. Appleton, H. A., 63, Rosedale Road, Forest Gate, E., Analytical Chemist.

1900. Appleyard, Geo. H., Arnold House, Burton Road, Hornsea, East Yorks, Chemist.

1905. Appleyard, Jas. R., Royal Technical Institute, Salford, Lecturer.

O.M. Archbutt, Leonard, The Yews, Madeley Street, Derby, Analytical Chemist.

1899. Archdale, T. Henry, 77, Queen's Road, Blackburn, Manager of Tar and Ammonia Works.

1904. Archdale, Wm., 21, Oldham Road, Miles Platting, Manchester, Manager of Chemical Works.

1908. Archibald, E. M. B., Electrical Engineer.

1909. Archibald, H., Parkhead Forge, Glasgow, Metallurgical Engineer.

1901. Ardagh, Edw. G. R., Faculty of Applied Science, University of Toronto, Canada, Chemist.

1900. Ardern, Edw., Holm Leigh, Queen's Road, Urmston, Manchester, Chemist.

1907. Armstrong, Chas. F., c/o Cawnpore Sugar Works, Ltd., Marhourah Factory P.O., Chupra, Sarun, India, Technical Chemist.

1902. Armstrong, Edward E., Pennsylvania Salt Manufacturing Co., Natrona, Pa., U.S.A., Manufacturing Chemist.

1905. Armstrong, Dr. E. Frankland, 98, London Road, Reading, Works Chemist.

1899. Armstrong, Richard, Saul Street Soap Works, Preston, Lancashire, Soap Manufacturer.

1905. Armstrong, Theodore, 115, Chestnut Street, Philadelphia, Pa., U.S.A., President, Penn. Salt Manufacturing Co.

1905. Arnold, Frank L., 32, School Street, North Woburn, Mass., U.S.A., Chemist.

1901. Arnold, G. Edmund, 6, Kingsfield Terrace, Faversham; Kent, Manager (Cotton Powder Co., Ltd.).

1911. Arnold, Prof. J. O., The University, St. George's Square, Sheffield, Prof. of Metallurgy.

1899. Arnott, Dr. G. W. Campbell, c/o Fertiliser Manufacturers' Association, 79, Mark Lane, London, E.C., Agricultural Chemist.

1903. Arnott, J. S., Moros, 42, 2°, Gijon, Spain, Chemist and Metallurgist.

1911. Asahina, Koju, Japanische Botschaftkanzlei, Blumeshof 12, Berlin, Germany, Chemist.

1901. Asano, K., Ashio Copper Mine, Shimozuke, Japan, Consulting Mining Chemist.

1906. Ash, Chas. S., 180, Townsend Street, San Francisco, Cal., U.S.A., Chemist.

1908. Ashbury, J. W., c/o John Brown and Co., Ltd., Laboratory, Atlas Works, Sheffield, Chief Chemist.

1903. Ashley, Frank R., c/o Western Chemical Manufacturing Co., Denver, Colo., U.S.A., Manufacturing Chemist.

1890. Ashton-Bost, W. D. *See* Bost, W. D. Ashton.

1885. Ashwell, J. H., Bleacher and Dyer.

1894. Ashworth, Arthur, Fernhill Chemical Works, Bury, Lancs., Chemical Manufacturer.

1908. Ashworth, D. Irving, P.O. Box 38, Wappingers Falls, N.Y., U.S.A., Chemist.

1908. Asmus, Grover E., 4011, Hudson Boulevard, West Hoboken, N.J., U.S.A., Chemist.

1907. Aspey, Urban, jun., New Station Soap Works, School Close, and (Journals) 11, Neville Street, Leeds, Works Manager and Chemist.

1898. Aspinall, Thos., 62, Gilnow Road, Bolton, Analytical and Manufacturing Chemist.

1900. Aston, Bernard C., 71, Devon Street, Wellington, New Zealand, Chemist.

1891. Atkins, C. E., Teigngrace, Bycullah Park, Enfield, N., Chronometer Maker.

1885. Atkinson, A. J., 44, Stuart Street, Cardiff, Analytical Chemist.

1900. Atkinson, Jno. W., Betteravia, Cal., U.S.A., Chemist.

1905. Atteaux, F. E., 176, Purchase Street, Boston, Mass., U.S.A., Dyestuff Importer.

O.M. Attfield, Dr. J., F.R.S., Ashlands, Watford, Herts.

1900. Atwood, Frank W., 216, Milk Street, Boston, Mass., U.S.A., Chemist.

1895. Auchterlonie, Wm., c/o Clark Thread Co., Newark, N.J., U.S.A., Dyeworks Manager.

1907. Auchu, Henry, Emporium, Pa., U.S.A., Explosives Manufacturer.

1901. Auden, Dr. H. A., 13, Broughton Drive, Grassendale, Liverpool, Chemist.

1897. Auger, Chas. L., 425, Park Avenue, Paterson, N.J., U.S.A., Silk Dyer.

1901. Auty, Albert M., c/o John Smith and Sons, Ltd., Field Head Mills, Bradford, Works Chemist.

1902. Avery, D., Central Technical School, Latrobe Street, Melbourne, Vic., Australia, Teacher of Chemistry.

1910. Ayers, Gilbert F., Dynamite Factory, Modderfontein, Transvaal, Chemist.

1899. Aylsworth, Jonas W., 223, Midland Avenue, East Orange, N.J., U.S.A., Chemist.

B

1904. Babb, Edward E, (comms.) 41, Central Wharf; and (Journals) Mellin's Food Library, 291, Atlantic Avenue, Boston, Mass., U.S.A., Food Analyst.

1908. Babington, Fred. W., Customs Laby., Customs Dept., Ottawa, Canada, Analyst.

1895. Bacon, Nathaniel T., Peace Dale, Rhode Island, U.S.A., Chemical Engineer.

1897. Bacon, William N., 72, Mercers' Road, Tufnell Park, London, N., Chemist.

1897. Badock, Stanley H., Holmwood, Westbury on Trym, near Bristol, Smelter.

1898. Baekeland, Dr. Leo, Snug Rock, Harmony Park, Yonkers, N.Y., U.S.A., Research Chemist.

1903. Bailey, Prof. E. H. S., The Library, Kansas State University, Lawrence, Kas., U.S.A., Professor of Chemistry.

1885. Bailey, Edwin M., Almond Hill, Pumpherston, Mid Calder, N.B., Technical Chemist.

1908. Bailey, F. W., Overstone, Robertson Road, Buxton.

1883. Bailey, Dr. G. H., Kinlochleven, Argyll, N.B., Chemist.

1903. Bailey, Harold J., 10, Park Road, Pendleton, Manchester, Alkali Inspector.

1906. Bailey, Ralph W., 66, Cherry Street, Elizabeth, N.J., U.S.A., Chemist.

1888. Bailey, Dr. T. Lewis, 13, St. Alban's Road, Swansea, H.M. Inspector of Alkali Works.

1910. Baillie, Thomas B., c/o Henry Tate & Sons, Ltd., Love Lane Sugar Refinery, Liverpool, Analytical Chemist.

1902. Bain, Prof. Jas. Watson, Faculty of Applied Science, The University, Toronto, Ont., Canada, Chemist.

1911. Bainbridge, Edmund F., c/o American Alkali and Acid Co., Bradford, Pa., U.S.A., Chief Chemist.

1902. Baird, Dr. Julian W., Massachusetts College of Pharmacy, Boston, Mass., U.S.A., Professor of Chemistry.

1908. Baird, M. M., 18, Jedburgh Avenue, Rutherglen, Glasgow, Analytical Chemist.

1891. Baird, Wm., c/o Lewis Berger and Sons, Ltd., Homerton, N.E., Technical Chemist.

1895. Baird, W. Raymond, 271, Broadway, New York City, U.S.A., Patent Lawyer.

1890. Bairstow, John, Burley, Queen's Park, Chester, Chemical Works Manager.

1903. Baker, Arthur, 2, Carlton Avenue, Horns Cross, Greenhithe, Kent, Chemist.

1910. Baker, C. Kerslake, 16, Change Alley, Sheffield, Analytical Chemist.

1902. Baker, Chas. F., Technical College, Sunderland, Lecturer in Chemistry.

1901. Baker, F. Guy Stirling, The Brewery, Chiswell Street, London, E.C., Brewer's Chemist.

1909. Baker, Frank, c/o Nobel's Explosives Co., Stevenston, Ayrshire, Chemist.

1883. Baker, Harry, Epworth House, Moughland Lane, Runcorn, Analytical Chemist.

1899. Baker, H. Fenimore, c/o Thomsen Chemical Co., Baltimore, Md., U.S.A., President.

1904. Baker, John T., c/o J. T. Baker Chemical Co., Phillipsburg, N.J., U.S.A., Manufacturing Chemist.

1892. Baker, Julian L., Stainesbury Holt, Kingston Road, Staines, Brewing and Sugar Chemist.

1909. Baker, Robert P., Ivydene, Bexley, Kent, Technical Chemist.

1886. Baker, Theodore, Fabr. Naçional de Polvoro Piquete, Est. de Sao Paulo, Brazil, Analytical Chemist.

1910. Baker, Dr. Thos., Westville, Doncaster Road, Rotherham, Chemist and Metallurgist.

1898. Baldwin, Abram T., Solvay Process Co., Detroit, Mich., U.S.A., Alkali Manufacturer.

1903. Baldwin, F. H., Bergenport Chemical Works, Bayonne, N.J., U.S.A., Superintendent.

1903. Baldwin, Dr. H. B., 927, Broad Street, Newark, N.J., U.S.A., Chemist (Dept. of Public Health).

1903. Ball, S. F., 289, East 201st Street, New York City, U.S.A., Analytical Chemist.

1889. Ballantyne, Horatio, 75, Chancery Lane, London, W.C., Analytical and Consulting Chemist.

1903. Ballantyne, W. H., 111, Hatton Garden, London, E.C., Patent Agent's Assistant.

O.M. Ballard, Edw. G., 6, Grey Friars, Chester, Alkali Works Inspector.

1910. Baly, Prof. E. C. Cyril, 14, Sunnyside, Prince's Park, Liverpool, Professor of Inorganic Chemistry.

O.M. Bamber, H. Kelway, Outram House, Addiscombe, Surrey, Consulting Chemist.

1894. Bamber, H. K. G., Ingress House, Greenhithe, Kent, Cement Works Chemist and Manager.

1898. Bamford, Harry, 70, Duckworth Terrace, Bradford, Yorks, Dyer.

1906. Bancroft, John, Wilmington, Del., U.S.A., Bleacher and Dyer.

O.M. Banister, H. C., Elmhurst, Blundellsands, near Liverpool, Chemical Works Manager.

1890. Banks, Jno. H., c/o Ricketts and Banks, 104, John Street, New York City, U.S.A., Mining Engineer.

1895. Bannan, John F., 59, Court Street, North Andover, Mass., U.S.A., Chemist (Woollen Mill).

O.M. Bannister, W., Burvale, Watford, Herts, Manufacturing Chemist.

1910. Barbary, J. Ewart, "Vellansaundry," Camborne, Cornwall, Explosives Chemist.

1909. Barber, C. Douglas, Great Nelmes, Hornchurch, Essex, Chemist.

1908. Barber, Percy S., The Reform Food Stores, 84, Whitechapel, Liverpool, Chemist.

1901. Barber, Capt. René R., c/o Wm. Barber and Bros., Georgetown, Ont., Canada, Analytical Chemist.

1911. Barclay, Andrew, Oficina Anita, Antofagasta, Chile, Chemist.

1892. Barden, Alf., Far Bank, Shelley, near Huddersfield, Glue and Size Maker.

1907. Bardorf, C. F., c/o St. Lawrence Sugar Refining Co., Maisonneuve, P.Q., Canada, Chief Chemist.

1895. Bardwell, Fred L., 11, Chamblet Street, Upham's Corner, Boston, Mass., U.S.A., Assistant Professor of Chemistry.

1902. Barker, Hugh S., 32, Cumberland Avenue, Sefton Park Liverpool, Laboratory Furnisher.

1905. Barker, Perry, 93, Broad Street, Boston, Mass., U.S.A., Chemist.

1909. Barker, Richard F., Adams, N.Y., U.S.A., Chemist.

1895. Barlow, Clinton W., 84 and 86, Greene Street, New York City, U.S.A., Merchant.

1908. Barlow, Lt.-Col. Sir Hilaro W. W., Bart., R.A., 84, Shooter's Hill Road, Blackheath, S.E., Superintendent (Royal Laboratory, Woolwich).

1901. Barlow, John J., 177, Manchester Road, Accrington, Calico Printer's Chemist.

1899. Barlow, Wm., 2, Delamere Street, Higher Openshaw, Manchester, Analytical Chemist.

1908. Barnes, Alfred, Box 556, Pretoria, Transvaal, Dealer in Minerals.

1906. Barnes, A. G., c/o Hasland Coking Co., Grassmoor Collieries, Chesterfield, Colliery Proprietor.

1891. Barnes, Edward A., 194, Hammersmith Road, London, W., Technical Chemist.

1901. Barnes, Fred., 9, Bromley Common, Bromley, Kent, Paper Mill Chemist.

1905. Barnes, F. V., Eastcroft Gasworks, London Road, Nottingham, Superintendent.

1884. Barnes, H. J., Phœnix Chemical Works, Hackney Wick, N.E., Manufacturing Chemist.

1884. Barnes, Jonathan, 301, Great Clowes Street, Manchester, Analytical Chemist.

O.M. Barnes, Jos., Green Vale, Westhoughton, near Bolton, Lancashire, Analytical Chemist.

1902. Barnett, Marcus S., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Sugar Works Chemist.

1897. Barnett, Robt. E., 9, Virginia Road, Leeds, Headmaster (Leeds Technical School).

1904. Baron, Wm. Briscoe, c/o Vulcan Boiler and General Insurance Co., 26, Pall Mall, Manchester, Chemist.

O.M. Barr, J., Dinting Vale, Dinting, near Manchester, Chemical Manager.

1905. Barraclough, C. E., 2, Wood View Terrace, Manningham, Bradford, Chemist.

1890. Barraclough, Wm. H., Beechwood, Mortomley, near Sheffield, Analytical Chemist.

1890. Barrett, Arthur A., 139, Viale San Martino, Messina, Sicily, Manufacturer of Essential Oils.

1907. Barrett, John H., c/o Librarian, Technical School College Street, Toronto, Canada, Superintendent.

1907. Barrett, Maurice, The Leeds Fireclay Co., Ltd., Burmantofts Works, Leeds.

1890. Barrie, D. McLaurin, P.O. Box 193, Germiston, Transvaal, Metallurgist.

1910. Barrott, John R., 417, Elk Street, Franklin, Pa., U.S.A., and (Journals) Pangkalan Brandan, Sumatra, Ned. Indies, Refinery Superintendent.

1900. Barrow, Jos., 13, The Grove, Bebington, Cheshire, Chemist.

1906. Barrs, Chas. E., 3A, Downshire Hill, Hampstead, N.W., Analyst.

1905. Barry, Eugene, Ayer, Mass., U.S.A., Leather Manufacturer.
1893. Barton, G. E., c/o Whitall, Tatum, and Co., Flint Glass Works, Millville, N.J., U.S.A., Technical Chemist.
1903. Bartripp, Geo. F., 11, Mansfield Road, Wanstead, Essex, Analytical Chemist.
1905. Baruch, Edgar, 805–806, Wright and Callender Building, Los Angeles, Cal., U.S.A., Chemical Engineer.
1910. Barwick, F. W., Public Textile Testing House, Technical Institute, Belfast.
1909. Barzano, Carlo, 24, Via Bagutta, Milan, Italy, Patent Agent.
1895. Baskerville, Dr. Chas., College of the City of New York, New York City, U.S.A., Professor of Chemistry.
1910. Bassett, Frank L., 73, St. Julian's Farm Road, West Norwood, S.E., Analyst.
1884. Bassett, H., 26, Belitha Villas, Barnsbury, N.
1908. Bassett, Henry, jun., Chemical Department, University of Liverpool, Assistant Lecturer.
1899. Bassett, Wm. H., 189, Litchfield Street, Torrington, Conn., U.S.A., Chemist.
1890. Bate, William, Upton Villa, Hayle, Cornwall, Technical Chemist (National Explosives Co., Ltd.).
1903. Bateman, A. H., 34, Bridge Avenue, Hammersmith, W., Chemist.
1885. Batty, R. B., Wharncliffe, Erdington, near Birmingham, Nickel Works Manager.
1910. Battye, Horace G., 24, Malvern Road, Beeston Hill, Leeds, Chemist and Works Manager.
1903. Baty, E. J., c/o Brush Electrical Engineering Co., Loughborough, Chemist.
1903. Bauer, Geo. W., 660, Sacramento Street, San Francisco, Cal., U.S.A., Vice-President and Chemist (Hop and Malt Co.).
1900. Baur, Jacob, 440, Wells Street, Chicago, Ill., U.S.A., Liquid Carbonic Acid Manufacturer.
1910. Baxter, F. Stanley, c/o British Malt Products Co., West Barns Refinery, Dunbar, N.B., Chemist.
1898. Baxter, John G., Riverview, Burch Road, Rosherville, Gravesend, Kent, Chemist.
1899. Bayly, Francis W., Church Cobham, Surrey, Assayer.
1904. Bayly, Harold G., c/o S. Gonçalo, Semaphore, South Australia, Analytical Chemist.
1908. Bayly, Percival G. W., Mines Dept. Laby., Spring Street, Melbourne, Victoria, Government Metallurgical Chemist.
1897. Beadle, Alec A., Wenden, Dawlish, South Devon, Electro-Chemist.
1886. Beadle, Clayton, Oakbank, Lansdown Road, Sidcup, Kent, Consulting Chemist.
1908. Bealey, Herbert C., c/o A. C. Bealey and Son, Radcliffe, near Manchester, Bleacher and Chemical Manufacturer.
O.M. Beanes, E., Moatlands, Paddock Wood, Kent, Manufacturing Chemist.
1907. Beardsley, Dr. Alling P., 165, Minerva Street, Derby, Conn., U.S.A., Chemist (New Haven Gas Co.).
1909. Bearpark, Arthur F., c/o N. Haigh, 37, Mayfield Street, Hull, Works Manager.
1908. Beasley, Fred. G., 44, Green Street, Smethwick, near Birmingham, Metallurgical Chemist.
1905. Beasley, Jno. K., c/o The Borneo Co., Kuching, Sarawak, Metallurgical Chemist.
1883. Beaven, E. S., 5, Boreham Terrace, Warminster, Wilts, Maltster.
1897. Beaver, Chas. J., Holme Lea, Ashley Road, Hale, Cheshire, Chemist.
1905. Beckers, Dr. Wm., 117, Hudson Street, New York City, U.S.A., Chemist.
1909. Becket, Fredk. M., 31, Sugar Street, Niagara Falls, N.Y., U.S.A., Chief Metallurgist, Electro Metallurgical Co.
O.M. Beckett, G. H., Hartford, 35, South Beach Road, Ardrossan, Scotland, Analytical Chemist.
1898. Beckett, Jos. H., Gable End, Upton Road, Moreton, Birkenhead, Analytical Chemist.
1899. Bedford, Alf. C., 26, Broadway, New York City, U.S.A., Chemical Merchant.
1891. Bedford, Chas. S., Rocella, Weetwood, Headingley, Leeds, Manufacturing Chemist.
1891. Bedford, Jas. E., Messrs. Wood and Bedford, Airedale Chemical Works, Leeds, Manufacturing Chemist.
O.M. Bedson, Prof. P. Phillips, Armstrong College, Newcastle-on-Tyne, Professor of Chemistry.
1909. Beers, Frank T., Barksdale, Bayfield Co., Wis., U.S.A., Chemist.
1901. Beevers, Clifford J., 12, Parish Ghyll Road, Ilkley, Yorks, Analyst.
1899. Behr, Dr. Arno, 432, Arlington Court, Pasadena, Cal., U.S.A., Chemist.
1903. Behrend, F., 54, Front Street, New York City, U.S.A., Importer of Chemical Stoneware.
O.M. Beilby, Dr. George T., F.R.S., 11, University Gardens, Glasgow, Chemical Engineer.
1906. Belden, A. W., U.S. Geological Survey, 40th and Butler Streets, Pittsburg, Pa., U.S.A., Coke Expert.
1906. Bell, H. N., Company Manager.
1884. Bell, Sir Hugh, Bart., Middlesbrough-on-Tees, Soda and Iron Manufacturer.
1900. Bell, Hugh P., 17, Tothill Street, Westminster, S.W., Chemist.
O.M. Bell, J. Carter, Bank House, The Cliff, Higher Broughton, Manchester, Public Analyst.
1886. Bell, J. Ferguson, Derby Gas Light and Coke Co., Derby, Gas Engineer.
1907. Bell, Marcus, Defence Dept., Melbourne, Victoria, Chemist.
1905. Bell, Miss M. M., Tulane University Library, New Orleans, La., U.S.A., Librarian.
1903. Bell, P. Carter, Millburn, N.J., U.S.A., Chemical Manufacturer.
O.M. Bendix, D., 371, Romford Road, Forest Gate, E., Managing Chemist, British Alizarin Co., Ltd.
1897. Benfey, Dr. Hans, 65, Birchfields Road, Rusholme, Manchester, Manufacturing Chemist.
1907. Bengough, Guy D., The University, Liverpool, Lecturer on Metallurgy.
1903. Benham, Keith, Deans Hill, Stafford, Analytical and Consulting Chemist.
1902. Benjamin, Albert A., 36–37, Featherstone Street, City Road, London, E.C., Bleach and Dyeworks Manager.
O.M. Benjamin, Dr. M., Smithsonian Institution, Washington, D.C., U.S.A., Consulting Chemist.
1908. Benkert, Arthur L., c/o Cassella Color Co., 182, Front Street, New York City, U.S.A., Chemist and Salesman.
1899. Bennett, Alex. H., c/o G. H. Ogston & Moore, Catania, Sicily, Chemist.
1901. Bennett, Arnold, c/o Montreal Steel Works, Ltd., St. Patrick Street, Montreal, Canada, Chemist.
1907. Bennett, H. Garner, 18, Railway Street, Beverley, Yorks, Leather Chemist.
1902. Bennie, P. McN., P.O. Box 29, Niagara Falls, N.Y., U.S.A., Consulting Chemist.
1909. Benson, George F., Edwardsburg Starch Co., Cardinal, Ontario, Canada, President and Managing Director.
1906. Benson, Richard W., c/o Geo. Cradock & Co., Wakefield, Yorks, Analytical Chemist.
1901. Bentley, Wm. H., 12, Cromwell Terrace, Irlam, near Manchester, Technical Chemist.
1905. Berge, Henry vom, c/o Schoellkopf & Co., Perry and Mississippi Streets, Buffalo, N.Y., U.S.A., Manager.
1884. Beringer, J. J., Basset Road, Camborne, Cornwall, Metallurgist.
1893. Berk, Fred. W., 1, Fenchurch Avenue, London, E.C., Chemical Manufacturer.
1907. Berk, Paul F., 1, Fenchurch Avenue, London, E.C.
1908. Berlinerblau, Dr. Joseph, 8, Szpitalna Street, Warsaw, Russian Poland, Industrial Chemist.
1900. Bermingham, Jno., jun., 1404, Humboldt Building, San Francisco, Cal., U.S.A., Superintendent.
1889. Bernard, Jas., jun., Ranipet, North Arcot, Madras Presidency, India, Chemical Works Manager.

1897. Berry, Albert E., Ontario, Snaresbrook, Essex, Works Manager.

1911. Berry, Arthur G. V., c/o Messrs. B. and R. Redwood, 4, Bishopsgate, London, E.C., Analyst.

1906. Berry, Arthur J., 5, University Gardens, Glasgow, Chemist.

1883. Berry, E. E., Bordighera, Italy, and (Journals) c/o C. H. Grinling, 17, Rectory Place, Woolwich, S.E., Technical Chemist.

1889. Berry, G. F., 9, Musgrovo Road, Jerningham Road, New Cross, S.E., Chemical Works Manager.

1903. Berry, W. G., 329, West 83rd Street, New York City, U.S.A., Chemist.

1909. Beskow, K. J., Skanska Superfosfat och Svofvelsyre Fabriks A.B., Helsingborg, Sweden, Head Engineer.

1886. Best, Dr. T. T., Hardshaw Brook Chemical Works, St. Helens, Lancashire, Technical Chemist.

1907. Bettermann, Heinrich, Doemitz-on-Elbe, Germany, Explosives Works Manager.

1901. Betts, Anson G., Troy, N.Y., U.S.A., Chemist.

O.M. Bevan, E. J., 4, New Court, Lincoln's Inn, London, W.C., Public Analyst and Consulting Chemist.

1900. Bevan, Jno. W., Morriston Spelter Works, Morriston, R.S.O., Glamorgan, Manager of Metallurgical Works.

O.M. Beveridge, Jas., c/o Miramichi Pulp and Paper Co., Ltd., Chatham, N.B., Canada, Pulp and Paper Manufacturer.

1909. Bewick, R. M., c/o United Alkali Co., Ltd., 30, James Street, Liverpool, Traveller.

1909. Beynon, Donald E., 240, Havelock Street, Toronto, Canada, Chemist.

1898. Bhattacharyya, Haripada, Gun and Shell Factory, Ishapore, Bengal, India, Chemist.

1902. Biach, Dr. Ludwig K., t, Stetson Avenue, Norwich, Conn., U.S.A., Chemist and Colorist.

1896. Bibby, John, c/o J. Bibby & Sons, Formby Street, Liverpool, Chemist.

O.M. Bickerdike, W. E., Bryer's Croft, Wilpshire, near Blackburn, Manufacturing Chemist.

1907. Bickerstaffe, Robt., c/o Thomas and Green, Ltd., Soho Mills, Wooburn Green, S.O., Bucks., Chemist.

1903. Bierwirth, L. W., Du Pont Building, Wilmington, Del., U.S.A., Civil Engineer.

1910. Bigelow, Chas. A., c/o General Chemical Co., Bayonne, N.J., U.S.A., Superintendent.

1884 Biggart, J. Wm., 29, Cathcart Street, Greenock, N.B., Analytical Chemist.

1891. Biggart, Wm. L., Rossarden, Kilmalcolm, N.B., Public Analyst.

O.M. Biggs, B., 66, Cannon Street, London, E.C., Chemical Merchant.

1910. Biggs, J. W. H., Beaufort, Belvedere, Kent, Chemist.

O.M. Billing, H. S., 42, Kingsley Road, Mutley, Plymouth, Analytical and Managing Chemist.

1896. Billings, Edgar F., c/o Billings-Clapp Co., Boston, Mass., U.S.A., Manufacturing Chemist.

1896. Billington, Chas., jun., Heimath, Porthill, Longport, Staffordshire, Metallurgist.

1903. Binns, John H., Thornfield, Mystic Pond, Methuen, Mass., U.S.A., Dyer and Finisher.

1896. Bird, Arthur W., c/o S. Berger & Co., Bromley-by-Bow, E., Works Engineer.

1907. Bird, Charles S., jun., East Walpole, Mass., U.S.A., Paper Maker.

1896. Bird, Jno. B., 3, Brookside, Cambridge, Manure Manufacturer.

1895. Bird, Wm. R., (communications) 125, Goddard Avenue ; (Journals) Laboratory, G.W.R. Works, Swindon, Wilts, Analytical Chemist.

1902. Bird, W. Robt., 217, Newport Road, Cardiff, Oil Merchant.

1910. Birkett, Percy, 79, Argyle Road, Salteoats, Ayrshire, N.B., Engineer.

1885. Birley, R. K., c/o Chas. Macintosh and Co., Ltd., Cambridge Street, Manchester, India-rubber Manufacturer.

1883. Bishop, A. Conway, Three Mills Lane, Bromley-by-Bow, E., Manufacturing Chemist.

1884. Bishop, Fred., c/o Burmah Oil Co., P.O. Box 67, Rangoon, Burmah, Technical Chemist.

1903. Bishop, Howard B., 1054, Park Place, Brooklyn, N.Y., U.S.A., Chemist.

1903. Bishop, J. T. F., Chemical Club, Victoria Hotel, Manchester, Secretary.

1905. Bixby, Willard G., 46th Street and 2nd Avenue, Brooklyn, N.Y., U.S.A., Blacking Manufacturer.

1905. Bjerregaard, A. P., c/o Canfield Oil Co., 3216, East 55th Street, Cleveland, Ohio, U.S.A., Varnish Chemist.

1909. Blacher, Prof. Carl, Polytechnicum, Riga, Russia, Chemical Engineer.

1904. Black, J. Wyclif, 20, Mardale Crescent, Edinburgh, Analytical Chemist.

1902. Black, W. Geoffrey, St. John's House, Christchurch Road, Norwich, Chemist.

1908. Blackhall, Bertram, 48, Frontenac Street, Kingston, Ontario, Canada, Manufacturing Chemist.

1910. Blackie, Archibald, 223, James Street, Winnipeg, Canada, Chemist.

1894. Blackmore, H. S., 612, F. Street N.W., Washington, D.C., U.S.A., Industrial Chemist.

1896. Blagden, Victor, 4, Lloyd's Avenue, London, E.C., Chemical Merchant.

1883. Blagden, W. G., Down Lodge, East Harting, near Petersfield, Hants, Chemical Merchant.

1897. Blair, Andrew A., 406, Locust Street, Philadelphia, Pa., U.S.A., Analytical Chemist.

1884. Blake, Jas., Thames Sugar Refinery, Silvertown, E., Manager.

1910. Blakeley, A. G., P. and R. Coal and Iron Co., Pottsville, Pa., U.S.A., Chemist.

1890. Blakey, A. J., Dudbridge Mills, Stroud, Gloucestershire, Dyer.

1893. Blears, John, c/o Langworthy Bros. and Co., Ltd., Greengate Mills, Salford, Dyer and Calico Printer.

1908. Blichfeldt, S. H., Merston House, South Road, Southall, Middlesex, Bacteriologist and Fermentation Chemist.

1905. Bliss, H. J. W., United University Club, Pall Mall East, London, S.W., Chemist.

1889. Bloede, Victor G., Station D., Baltimore, Md., U.S.A., Manufacturing Chemist.

1908. Blomeley, Adam Y., c/o Arbuckle Bros. Sugar Refinery, Brooklyn, N.Y., U.S.A., Chemist.

1891. Bloomer, Fred. J., Penpont, Clydach, R.S.O., Glamorgan, Nickel Works Manager.

1886. Blount, Bertram, Laboratory, 76 and 78, York Street, Westminster, S.W., Analytical Chemist.

1888. Bloxam, A. G., 105, Birkbeck Bank Chambers, Holborn, W.C., Chemist and Patent Agent.

1890. Bloxam, W. Popplewell, 15, Crescent Mansions, Elgin Crescent, Holland Park, London, Scientific Adviser and Manager (Sulphate of Ammonia Committee).

1903. Blumenthal, Lionel, Ravensholme, Merry Bower Road, Broughton Park, Manchester, Chemist.

1886. Blundstone, E. R., 79, York Street, Westminster, S.W., and (Journals) Heathfield, Park Road, Hampton Hill, Middlesex, Consulting Chemist.

1908. Blyth, Jas. R., c/o Penketh Tannery Co., Penketh, near Warrington, Leather Trades Chemist.

1906. Blyth, M. Wynter, The Lodge, Ardsley, near Barnsley, Yorks, Analytical and Consulting Chemist.

1905. Blyth, Thomas R., Uphall Chemical Works, Ilford, Essex, Analytical Chemist.

1908. Blythe, Fred. C., Holland Bank, Church, Lancashire, Chemical Manufacturer.

O.M. Boake, A., Warton Road, Stratford, E., Manufacturing Chemist.

1888. Boake, Edmund J., Aberffraw, Nursery Road, Loughton, Essex, Manufacturing Chemist.

1899. Boehm, Fred., 16, Jewry Street, London, E.C., Chemical Agent and Merchant.

1910. Bochringer, Dr. Rudolph, 57, Sandford Avenue, Plainfield, N.J., U.S.A., Chemist.

1898. Bogert, Prof. Marston T., Department of Organic Chemistry, Columbia University, New York City, U.S.A., Professor of Organic Chemistry.

1903. Boissevain, Chas. E. H., 92, Van Eeghenstraat, Amsterdam, Holland, Chemical Manufacturer.

1903. Bolam, Dr. H. W., Queen Margaret College, Glasgow, Lecturer on Chemistry.

1909. Bolden, Wm., Dalmellington Iron Works, Dunaskin, Ayrshire, Chemist.

1907. Boley, Walter, Uerdingen am Rhein, Germany, Manufacturing Chemist.

1901. Bolton, E. Richards, 16, Flanchford Road, Shepherd's Bush, W., Manufacturing Chemist.

1905 Bond, John, Crowlands, Southport, Engineer.

1905. Bond, Josiah, Patagonia, Arizona, U.S.A., Mining Engineer.

1905. Bone, Dr. W. A., F.R.S., West House, Lidgett Park Road, Roundhay, Leeds, Lecturer in Chemistry and Metallurgy.

1892. Bookman, Dr. S., 46, East 82nd Street, New York City, U.S.A., Chemist.

1888. Boor, Leonard G., 21, Mincing Lane, London, E.C., Chemical Merchant.

1908. Booth, Jos. W., Atlantic Mills, Providence, R.I., U.S.A., Superintendent.

1904. Booth, N. Parr, Laboratory, Cadbury Bros., Ltd., Bournville, near Birmingham, Chemist.

1894. Booth, Robt., 110, Cannon Street, London, E.C., Engineer.

1903. Boral, Robin, Rhodes Mount, Rhodes, near Manchester, Works Manager.

1897. Borland, C. R., Concord, Mass., U.S.A., Smokeless Powder Manufacturer.

O.M. Borland, W. D., Beacon Lodge, Bean, *via* Dartford, Kent, Manufacturer of Explosives.

1906. Bornett, S., Andreaskloster 12, Köln, Germany, Technical Chemist.

1903. Boroschek, Dr. L., 24, West 82nd Street, New York City, U.S.A., Chemist.

1908. Bose, R., 92-95, Upper Circular Road, Calcutta, India, Chemical Works Manager.

1903. Bossi, Dr. Arnold L., Arnold Print Works, North Adams, Mass., U.S.A., Assistant Manager.

1890. Bost, W. D. Ashton, Cartvale Chemical Works, Paisley, N.B., Chemical Manufacturer.

O.M. Bothamley, C. H., Weston-super-Mare, Somerset, County Director of Technical Instruction.

1890. Bott, Dr. W. Norman. *See* Norman-Bott, Dr. W.

1884. Böttinger, Dr. H. T. von, Elberfeld, Germany; and (subs.) c/o The Bayer Co., Ltd., 19, St. Dunstan's Hill, London, E.C., Colour Manufacturer.

1901. Bottomley, Dr. J. Frank, c/o The Thermal Syndicate, Ltd., Neptune Road, Wallsend-on-Tyne, Consulting Chemist.

1906. Bottomley, W., c/o The United Alkali Co., Ltd., Fleetwood Salt Works, Fleetwood, Engineer.

O.M. Boulton, H. E., 64, Cannon Street, London, E.C., Chemical Manufacturer.

O.M Boulton, Sir Samuel B., Bart., 64, Cannon Street, London, E.C., Chemical Manufacturer.

1883 Boulton, T. S., 14, Freegrove Road, Caledonian Road, N., Manager.

1905. Bourne, Lyman M., c/o Goodyear Tire and Rubber Co., Akron, Ohio, U.S.A., Chemist.

1910. Bowater, J. W., Woodville, Beeches Road, West Bromwich, Works Manager.

1905. Bowen, Henry, 28, Norwood Avenue, Buffalo, N.Y., U.S.A., Secretary.

1906. Bowen, Ralph A., c/o National Aniline & Chemical Co., 36, Purchase Street, Boston, Mass., U.S.A.

1885. Bowen, S. B., Brickfield Chemical Works, Llanelly, South Wales, Chemical Manufacturer.

1888. Bower, Frank, Brewery House, Spitalfields, E., Analytical Chemist.

1909. Bower, Joshua, c/o Kynoch Ltd., Arklow, Co. Wicklow, Ireland, Chemist.

1897. Bower, Wm. H., 29th Street and Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemical Manufacturer.

1906. Bowers, H. L., Port Hope, Ontario, Canada, Chemist and Metallurgist.

1892. Bowes, Harry, Staveley, Broomfield Road, Heaton Moor, Stockport, Analytical Chemist.

1889. Bowing, Jno., Consulting Chemist.

1883. Bowley, Jos. John, Wellington Works, Battersea Bridge, London, S.W., Chemical Manufacturer.

1899. Bowley, J. Plunkett, 63, Beaufort Mansions, Chelsea, London, S.W., Varnish Manufacturer.

1908. Bowman, Fred. C., c/o Nichols Chemical Co., Tweed, Ont., Canada, Chemist.

1884. Bowman, R., c/o Bowman's Ltd., Lythgoe's Lane, Warrington, Chemical Manufacturer.

1907. Bowman, Richard S., The Cerebos Works, Greatham, *viâ* Stockton-on-Tees, Chemist.

1896. Bowman, Walker, 39, Cortlandt Street, New York City, U.S.A., Chemist.

1904. Boyce, Framroze H., 86, Hugh's Road, Chaupaty, Bombay, India, Technical Chemist.

1893. Boyce, Frank, c/o Goodall, Backhouse, and Co., White Horse Street, Leeds, Technical Chemist.

1910. Boyce, James, 225, West 18th Street, Chicago, Ill., U.S.A., Chemist.

1909. Boyd, Dr. Harold de H., 18, Creechurch Lane, London, E.C., Phosphate Merchant.

1909. Boyd, T. D., Jr., Los Mochis, Sinaloa, Mexico, Sugar Refiner.

1899. Boyes, Herb. J., c/o Boyes & Kirk, Fabrica de Tecidos Belemzinho, Sao Paulo, Brazil, Chemist.

1905. Brabrook, G. Hale, Box 333, Taunton, Mass., U.S.A., Manufacturer.

1906. Bracegirdle, Harold W., 13, Alan Road, Withington, Manchester, Chemist.

1910. Bracewell, G. A., Laboratory, King's Arcade, Market Street, Bradford, Analytical Chemist.

1885. Bradburn, J. A., 311, Montgomery Street, Syracuse, N.Y., U.S.A., Manufacturing Chemist.

1902. Bradbury, S., Ferncliffe, Milton Grove, Glebelands Road, Ashton-on-Mersey, Chemist.

1895. Bradford, Henry, Strettington, Goodwood, near Chichester, Analytical Chemist.

1896. Bragg, Everett B., 1838, Chicago Avenue, Evanston, Ill., U.S.A., Manufacturing Chemist.

1891. Braithwaite, Isaac, Holly Croft, Kendal, Westmoreland, Drysalter.

1897. Braithwaite, Jno. O., Holme Lacey, Warren Road, Chingford, Essex, Pharmaceutical Research Chemist.

1903. Brame, J. S. S., 67, Coleraine Road, Blackheath, S.E., Demonstrator in Chemistry.

O.M. Bramham, W., Bank Chambers, 300, Mare Street, Hackney, N.E., Chemical Engineer.

O.M. Bramwell, G. H., Cowley Hill, St. Helens, Lancashire, Alkali Manufacturer.

1904. Brandeis, R., Oesterreichischer Verein f. Chem. und Metall. Produkte, Aussig, Austria, Chemical Manufacturer.

1902. Branegan, Jas. Aug., 712, North 20th Street, Philadelphia, Pa., U.S.A., Chemical Salesman.

O.M. Branson, F. W., Wynncholme, Far Headingley, Leeds, Pharmaceutical Chemist.

1903. Brassard, Fred à, 46, Vicar Lane, Bradford, Yorks, Aniline Dyestuff Importer.

1901. Brearley, Harry, c/o The Amalgams Co., Ltd., Attercliffe Road, Sheffield, Analytical Chemist.

1906. Breckenridge, John E., American Agricultural Chemical Co., Carteret, N.J., U.S.A., Chemist.

1888. Breffit, Wm., Glasshoughton, Castleford, Yorks, Glass Manufacturer.

1908. Bregowsky, Ivan M., c/o Crane Co., 1214, South Canal Street, Chicago, Ill., U.S.A., Chemist.

1909. Brentnall, John, 44, Gardner Road, Prestwich, nr. Manchester, Works Chemist.

1900. Brewis, E. T., 31, Belgrave Road, Leyton, E., Chemist.

1894. Breyer, Theodor, 725, Washington Avenue, Wilmette, Ill., U.S.A., Chemist.

1885. Briant, L., 24, Holborn Viaduct, London, E.C., Analytical Chemist.

1890. Brierley, J. T., Highfield, Golden Hill, Leyland, near Preston, Lancs., Analytical Chemist.

1909. Brigden, George, 92, Bay Street, Toronto, Canada

1910. Briggs, John C., East View, Workington, Cumberland, Gas Engineer.

1893. Briggs, J. F., Auchmuty Paper Mills, Markinch, Fife, N.B., Technical Chemist.
1885. Briggs, T. Lynton, 188, Central Avenue, Flushing, Long Island, N.Y., U.S.A., Technical Chemist.
1910. Brisbane, James W., Holmwood, Byculla Road, Enfield, Analytical Chemist.
1905. Bristol, Dr. H. Stanley, Forest Products Laboratory, Madison, Wis., U.S.A., Chemist.
1886. Bristow, G. W., c/o Walter J. Crook, 10, Eastcheap, London, E.C., Chemical Manager.
1887. Broadbent, H., c/o Goodall, Backhouse, and Co., Sovereign Street, Leeds, Chemist.
1896. Broadhurst, W. Homer, 2112, Caton Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1889. Brock, Arthur, Firework Factory, Sutton, Surrey, Firework Manufacturer.
O.M. Brock, J., Gwern-Tyno, Colwyn Bay, North Wales, Chairman of United Alkali Co., Ltd.
1910. Brodribb, Noel K. S., Defence Dept., Victoria Barracks, Melbourne, Victoria, Australia, Chemist.
1909. Bronnert, Dr. E., Dornach, near Mülhouse, Alsace, Germany, Artificial Silk Manufacturer.
1896. Brooke, C. B., jun., Colne House, Brantham, near Manningtree, Xylonite Manufacturer.
1900. Brooke, Jno. R., Government Opium Factory, Singapore, S.S., Superintendent.
1884. Brookes, E. A., c/o The Chilian Mills Co., Ltd., Chiguayante, Concepcion, Chile, Chemist.
1911. Brookfield, Henry M., 2, Rector Street, New York City, U.S.A., Glue Manufacturer.
1895. Brookman, Fred. W., 6, West Street, Rochdale, Manure Works Manager.
1906. Brooks, Cecil J., Brinkstone, Bury St. Edmunds, Suffolk, Metallurgist.
1909. Brooks, Theodore, Guantanamo, Cuba, Cane Sugar Manufacturer.
1907. Broome, James S., 18, Seedley Park Road, Pendleton, Manchester, Science Lecturer.
1901. Broome, Jos., 315, Chestnut Street, Roselle, N.J., U.S.A., Chemical Engineer.
1909. Brothers, Wm., 8, Mayfield Road, Kersal, Salford, Chemical Manufacturer.
O.M. Brotherton, E. A., City Chambers, Leeds, Ammonia Distiller.
1884. Brown, Prof. A. Crum, F.R.S., 8, Belgrave Crescent, Edinburgh, Professor of Chemistry.
1905. Brown, Prof. Adrian J., West Heath House, Northfield, near Birmingham, Professor of Brewing.
1902. Brown, A. H. M., 133, Kent Street, London, Ont. Canada, Metallurgist.
1891. Brown, Cæsar R., 23, Gower Road, Forest Gate, E., Works Foreman.
O.M. Brown, D., 93, Abbey Hill, Edinburgh, Chemical Manufacturer.
O.M. Brown, D., Donaghmore, Tyrone, Ireland, Soap Manufacturer.
1890. Brown, Edw. Hilton, c/o W. Ropes and Co., St. Petersburg, Russia, Analytical Chemist.
1894. Brown, Geo. E., c/o "The British Journal of Photography," 24, Wellington Street, Strand, London, W.C., Chemist.
1910. Brown, Geo. Winslow, Assabet Mills, Maynard, Mass., U.S.A., Chemist.
1906. Brown, Harry F., Room 917, Du Pont Building, Wilmington, Del., U.S.A., Chemist.
O.M. Brown, Henry, Benskin's Brewery, Watford, Herts., Brewing Chemist.
1899. Brown, Dr. Henry C., The Chemical Works, King's Lynn, Chemical Manufacturer.
O.M. Brown, Dr. Horace T., F.R.S., 52, Nevern Square, Kensington, S.W., Brewing Chemist.
1905. Brown, Hugh B., c/o Jas. Robertson & Sons, Ltd., Thrushgrove Works, Paisley, Chemist.
1901. Brown, Jos., Ashleigh House, Saville Town, Dewsbury, Manufacturing Chemist.
1905. Brown, Nicol, 4, The Grove, Highgate, N., Mining Director.
1906. Brown, Percy S., c/o Western Electric Co., Hawthorne, Ill., U.S.A., Chemist.
1892. Brown, Reginald B., c/o Badische Co., Ltd., 2, Samuel Ogden Street, Manchester, Technical Chemist.
1901. Brown, Samuel B., Ruthven, Bowden Lane, Marple, Cheshire, Calico Printer.
O.M. Brown, Walter, c/o Jas. H. Dennis and Co., Ltd., Widnes, Technical Chemist.
1900. Brown, Walter B., Victor Chemical Works, Fisher Building, Chicago, Ill., U.S.A., Chemist and General Superintendent.
1901. Browne, Dr. Arthur L., 213, Cortland Street, Baltimore, Md., U.S.A., Analytical Chemist.
1910. Browne, Philpot F., P.O. Box 2, Mount Morgan, Queensland, Chemist.
1906. Browne-Cave, E. J. C., "Strathallan," Bootle, Liverpool, Works Chemist.
1905. Browning, Prof. K. C., Medical College, Colombo, Ceylon, Professor of Chemistry.
O.M. Browning, W., Broad Oak, Accrington, Calico Printer.
1901. Brownlie, David, 41, Corporation Street, Manchester, Chemist.
1902. Brownrigg, Marcus P., c/o Colonial Sugar Refining Co., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.
1902. Brownsdon, Dr. H. W., King's Norton Metal Co., Ltd., King's Norton, Birmingham, and (Jnls.), 81, Blenheim Road, Moseley, near Birmingham, Works Chemist.
1902. Bruce, Alex., Laboratory, Hyde Park Corner, Colombo, Ceylon, Chemist.
1911. Bruce, Joseph; Jnls. to General Manager, Cape Explosives Works, P.O. Dynamite Factory, West Somerset, Cape Colony, Secretary.
1908. Bruce, Robert, 44, High Street, Leven, Fifeshire, Works Chemist.
1910. Bruce, Rupert G., 149, Admiral Road, Toronto, Canada, Jobber.
1900. Bruce, Wm. T., 3, Lombard Court, London, E.C., Director.
1892. Bruckmann, G. T., 109, 22nd Street, West New York, N.J., U.S.A., Chemical Engineer.
1905. Bruinier, A. G., 534, Canal Street, New York City, U.S.A., Agent for Kalle und Co.
1911. Brunet, Louis, "Revue Générale des Sciences," 18, Rue Chauveau-Lagarde, Paris VIII, France, Chemist and Secretary.
O.M. Brunner, H., Holly Mount, Tarbock Road, Huyton, near Liverpool, Chemical Manufacturer.
1894. Brunner, H. Bertram, The Hollies, Hartford, Cheshire, Chemist and Electrician.
1887. Brunner, J. F. L., M.P., c/o Brunner, Mond and Co., Ltd., 39, Victoria Street, London, S.W., Chemical Manufacturer.
O.M. Brunner, Rt. Hon. Sir J. T., Bart., Silverlands, Chertsey; and (Journals) c/o Brunner, Mond, and Co., Ltd., Northwich, Cheshire, Chemical Manufacturer.
1910. Brünner, Dr. Philipp, 2, Via Ghega, Trieste, Austria, Merchant.
1902. Brunner, Roscoe, The Winnington Hall Club, Winnington, Northwich, Alkali Manufacturer.
1909. Brunner, Rudolph A. J., c/o John Bennet Lawes & Co., Ltd., West Ferry Road, Millwall, E., Engineer.
1894. Brunton, J. Dixon, Wire Mill, Musselburgh, N.B., Wire Manufacturer.
1904. Bryant, Arthur P., c/o Clinton Sugar Refining Co., Clinton, Iowa, U.S.A., Chemist.
1903. Bryant, V. Seymour, Trelawne, Crowthorne, Berks., Analytical Chemist.
1908. Bryce, Chas. C., 43–45, Great Tower Street, London, E.C., Merchant.
1905. Bryce, Clarence H., c/o Benj. Moore and Co., 244, Water Street, Brooklyn, N.Y., U.S.A., Factory Superintendent.
1894. Bryce, Thos., Tharsis Mines, Huelva, Spain, Chemist.
1897. Bryson, Jas., Pumpherston Oil Works, Midcalder, N.B., Oil Works Manager.

1892. Buchanan, D. G., (Subs.) 40, St. Vincent Place, Glasgow, and (Journals) c/o La Associacion Salitrera de Propaganda. Iquique, Chili. Analyst.
1908. Buchanan, Duncan G., 27, Woodlawn Avenue East, Toronto, Canada, Chemist (Rubber Works).
1904. Buchanan, E. F., 128, East Crescent Street, Marquette, Mich., U.S.A., Chemist.
1888. Buchanan, Jas., Caledonia Foundry, Brasenose Road, Liverpool, Engineer.
1904. Buchanan, John L., 3, The Wiend, Lower Bebington, Cheshire, Analytical Chemist.
1904. Buchanan, Joshua D., c/o Nobel's Explosives Co., Ltd., Polmont Station, N.B., Chemist.
1910. Buchanan, Walter G., 6, Doune Terrace, Gourock, N.B., Chemist.
1897. Buck, Chas. A., 521, Locust Street, South Bethlehem, Pa., U.S.A., Chief Chemist (Bethlehem Iron Co.).
1906. Buckie, Robert H., c/o West Virginia Paper and Pulp Co., Mechanicville, N.Y., U.S.A., Works Chemist.
1909. Buell, W. H., c/o Winchester Repeating Arms Co., New Haven, Conn., U.S.A., Chemist.
1909. Buggy, Thos., Butte, Montana, U.S.A., Assayer and Chemist.
1902. Bull, Irving C., 100, Maiden Lane, New York City, U.S.A., Chemist.
1899. Bult, Herbert J., 18, Billiter Street, London, E.C., Chemist.
O.M. Bumby, H., Coltness Ironworks, Newmains, N.B., Ironworks Manager.
O.M. Bunker, H. E., 19, Napier Street, Toronto, Ont., Canada, Technical Chemist.
1901. Bunting, Henry H., Oficina de Ensayes F. C. C. del P., Callao, Peru, Analyst.
1893. Burbridge, Jas., India-rubber Mills, Tottenham, N., India-rubber Manufacturer.
1910. Burbridge, Walter N., "Uplands," Foxley Lane, Upper Woodcote, Purley, Surrey, Analytical Chemist.
1886. Burdekin, G., jun., 10, Clifton Terrace, St. Helens, Lancashire, Chemical Works Manager.
1896. Burford, Samuel F., Beechworth, Stoneygate Road, Leicester, Analytical Chemist.
1889. Bürger, Dr. J., 1, Birch Avenue, Talbot Road, Old Trafford, Manchester, Technical Chemist.
1901. Burgess, Prof. C. F., University of Wisconsin, Madison, Wis., U.S.A., Electro-chemical Engineer.
1889. Burgess, Geo., Sydney Cottage, Halebank, Widnes, Chemist.
1889. Burgess, Wm. T., 20, Priory Road, Bedford Park, London, W., Analytical Chemist.
1902. Burkard, Dr. Ernst, Solothurn, Switzerland, Chemist.
1899. Burkhardt, Dr. G. A., Württembergischestrasse 32, Berlin, W. 15, Germany, Chemist.
1897. Burland, Lt.-Col. Jeffrey H., 824, Sherbrooke Street; and (Journals) c/o Fraser Library, Montreal, Canada, Paper and Card Manufacturer.
1898. Burls, Herbert T., 2, Verulam Buildings, Gray's Inn, London, W.C., Mechanical Engineer.
1901. Burnand, Sydney, Manbré Saccharine Co., Ltd., Hammersmith, W., Manager.
O.M. Burnard, R., Plymouth Chemical Works, Plymouth, Chemical Manufacturer.
1891. Burnet, Henry K., North Brook Vitriol Works, Bradford, Yorks., Sulphuric Acid Maker.
1897. Burnet, Jno. Jas., 18, University Avenue, Glasgow, Architect.
1909. Burnett, Arthur, c/o The Premier Waterproof and Rubber Co., Ltd., Bromley Street, Dantzic Street, Manchester, Chemist.
1893. Burnham, J. C., Cordite Factory, Aruvankad, Nilgiri Hills, India, Analytical Chemist.
1900. Burnside, Chas. F., Du Pont Building, Wilmington, Del., U.S.A., Chemist.
1990. Burr, Edmund C., 1722, Vallejo Street, San Francisco, Cal., U.S.A., Manufacturer.
O.M. Burrell, B.A., 8, Springfield Mount, Leeds, Analytical Chemist.
1910. Burrell, Keith, Burrell's Wharf, Millwall, London, E., Analytical Chemist.
1906. Burrough, Ernest J., Cale Distillery, Hutton Road, Lambeth, S.E., Rectifier.
1892. Burrough, Horace, jun., 509, West Lombard Street, Baltimore, Md., U.S.A., Technical Chemist.
1888. Burrows, Edw., Home Villa, Low Fell, Gateshead-on-Tyne, Alkali Works Manager.
1901. Burton, Alf., Canadian Dyers' Association, 2–16, Liberty Street, Toronto, Canada, Dyer and Finisher.
1903. Burton, Jno., 2, Green Street, Bethnal Green, E., Dye and Chemical Manufacturer.
1904 Burton, T. R., c/o Scott, Greenwood, and Son, 8, Broadway, Ludgate Hill, London, E.C., Technical Journalist.
1889. Burton, Wm., The Hollies, Clifton Junction, near Manchester, Potter's Chemist.
1906. Busby, Fred. E., Arnold Print Works, North Adams, Mass., U.S.A., Chemist.
1897. Bush, J. M., c/o W. J. Bush and Co., Ltd., Ash Grove, Hackney, E., Manufacturing Chemist.
1897. Butler, David B., 41, Old Queen Street, Westminster, S.W., Cement Expert.
1890. Butler, Paul, Lowell, Mass., U.S.A., Ammunition Manufacturer.
1885. Butler, Samuel, The Cedars, Compton, Wolverhampton, Brewer.
1905. Butler, Dr. T. H., c/o Wm. Butler and Co., Ltd., Crews Hole, Bristol, Chemist (Tar and Rosin Distillery).
1886. Butler, W. W., c/o Mitchells & Butlers, Ltd., The Brewery Library, Cape Hill, Birmingham, Brewer.
O.M. Butterfield, J. C., 79, Endlesham Road, Balham, S.W., Analytical Chemist.
1892. Butterfield, W. J. A., 66, Victoria Street, Westminster, S.W., Analytical Chemist.
1897. Butters, Charles, 54, New Broad Street, London, E.C., and (Journals) College Avenue and 59th Street, Oakland, Cal., U.S.A., Metallurgist.
1900. Butterworth, Elwell R., c/o Reversible Collar Co., 111, Putnam Avenue, Cambridge, Mass., U.S.A., Chemist.
1902. Butterworth, F. J., 34, Hawthorne Avenue, Nutley, N.J., U.S.A., Chemist.
1892. Buttfield, Horace V., 13, Wellington Road, Bush Hill Park, Enfield, N., Chemical Demonstrator.
O.M. Byard, A. G., c/o Burt, Boulton, and Haywood, Apartado 8, Bilbao, Spain, Technical Chemist.
1905. Byrne, F. A., 2, Ludgate Hill, Birmingham, Director of Chemical Co.
1899. Byrnes, Dr. Eugene A., 918, F. Street N.W., Washington, D.C., U.S.A., Patent Lawyer.
1893. Byrom, T. H., Laboratory, Wigan Coal and Iron Co., Wigan, Analytical Chemist.
1887. Bythway, M., 44, Lloyd Street, Albert Square, Manchester, Drysalter.

C

1884. Cabot, Godfrey L., 940, Old South Building, Boston, Mass., U.S.A., Manufacturing Chemist.
1907. Cabot, Samuel, 141, Milk Street, Boston, Mass., U.S.A., Chemical Manufacturer.
1906. Caddick, Arthur, Minas de Rio Tinto, Huelva, Spain, Works Chemist.
1889. Cadett, Jas., Ashtead, Surrey, Chemical Engineer.
1909. Cadman, Hal, c/o British Cigarette Co., Ltd., Hankow, China, Chemist.
1905. Cain, Dr. J. C., 28, Pembury Road, Lower Clapton, N.E., Colour Chemist.
1891. Caines, G. S. A., 7, Rochester Terrace, Camden Road, London, N.W., Analytical Chemist.
1897. Cairns, Wm., 5, Carlton Place, Glasgow, Plumber.
1907. Caistor, J. W. Y., Morro Velho, Villa Nova de Lima, Minas Geraes, Brazil, Chemist.
1891. Caldecott, W. A., Box 1167, Johannesburg, Transvaal, South Africa, Metallurgist.
1905. Calder, Prof. Edwin E., Long Meadow, R.I., U.S.A., Professor of Chemistry.

1897. Calder, W. A. S., Ormidale, Little Moor Hill, Smethwick, Birmingham, Chemical Manufacturer.

1908. Caldwell, Dr. Robert J., Coventry House, Wilton Avenue, Southampton, Chemist and Works Manager.

1888. Caldwell, Wm., Murray Street, Paisley, N.B., Drysalter.

1902. Calm, Dr. Chas. E., Lebec P.O., Kern Co., Cal., U.S.A., Manufacturing Chemist.

1904. Calvert, Dr. Harry T., West Riding of Yorkshire Rivers Board, Wakefield, Chemist.

1895. Cambier, Jacob, 1401, Carteret Avenue, Pueblo, Colo., U.S.A., Chemist.

1908. Cameron, H. Lovett, c/o Vales and Cameron, 20, Castlereagh Street, Sydney, N.S.W., Assayer.

1904. Cameron, Walter S., 239, West 136th Street, New York City, U.S.A., Manufacturing Perfumer.

1908. Cameron, Wm., Pladjoe, Palembang, Sumatra, Sugar Refinery Manager.

O.M. Cammack, J., 34, Wolseley Road, St. Helens, Lancashire, Technical Chemist.

1910. Campagne, Emile, c/o Gildermeister et Cie., Petit Ronchin (Nord), France, Chemical Engineer.

1886. Campbell, Andrew, c/o Burmah Oil Co., Ltd., P.O. Box 67, Rangoon, Burmah, and (Journals), 51, Cluny Drive, Edinburgh, Works Manager.

O.M. Campbell, Archibald, Fairview, Rugeley, Staffordshire, Technical Chemist.

1908. Campbell, Fred. A., The Working Men's College, Latrobe Street, Melbourne, Victoria, Australia, Principal.

1910. Campbell, James R., 57, Dacre Hill, Rock Ferry, Cheshire, Chemist.

1907. Campbell, John A., c/o British South African Explosives Co., Modderfontein, Transvaal, Chemist.

1901. Campbell, Kenneth F., M.Inst.C.E., 1, Peel Street, Huddersfield, Civil Engineer.

1911. Campbell, L. E., 5, St. Matthew's Avenue, Surbiton, Chemist.

1908. Campbell, Max E., c/o Union Oil Co., Oleum, Cal., U.S.A., Chemist.

1909. Campbell, Peter, The Nairn Linoleum Co., Kearney, N.J., U.S.A., Linoleum Manufacturer.

1909. Campbell, Robt., The Nairn Linoleum Co., P.O. Box 32, Newark, N.J., U.S.A., Linoleum Manufacturer.

1904. Campion, A., Technical College, Glasgow, Chemist and Metallurgist.

1909. Candee, Chas. N., 47, Yonge Street, Toronto, Canada, Rubber Manufacturer.

1897. Canfield, F. D., jun., c/o Cuban Sugar Refining Co. Cardenas, Cuba, Sugar Refiner.

1908. Canning, Ernest R., 137, Great Hampton Street, Birmingham, Manufacturer.

1909. Cannon, George O., c/o The Pacific Phosphate Co., Ltd., 465, Collins Street, Melbourne, Victoria, Analytical Chemist.

O.M. Cannon, M., 25, Stormont Road, Clapham Common, S.W., Vinegar Works Manager.

1891. Canziani, Enrico, 3, Palace Green, Kensington, W., Civil Engineer.

1891. Carden, Albert J., Dunster House, 12, Mark Lane, London, E.C., Distiller.

1893. Carey, Arthur, The Groves, Grassendale Park, near Liverpool, Chemist.

O.M. Carey, Eustace, The United Alkali Co., Ltd., 30, James Street, Liverpool; and (Journals) The Groves, Grassendale Park, near Liverpool, Chemical Manufacturer.

1906. Carey, W. Gordon, c/o The Salt Union, Ltd., Weston Point, Runcorn, Cheshire, Chemist.

1904. Cargill, J. T., c/o Finlay, Fleming, and Co., Rangoon, Burmah, East India Merchant.

1907. Carlitz, Joseph S., 159, North Second Street, Philadelphia, Pa., U.S.A., Chemist.

1896. Carmichael, Herbert, Bureau of Mines, Victoria, British Columbia, Public Analyst and Assayer.

1884. Carmody, Prof. Patrick, Government Laboratory, Port of Spain, Trinidad, Analytical Chemist.

1897. Carnell, Wm. C., c/o Tacony Chemical Works, Bridesburg, Philadelphia, Pa., U.S.A., Chemist.

1906. Caro, Dr. Nikodem, Meinekestrasse 20, Berlin, Germany, Analytical Chemist.

1893. Carpenter, C. C., South Metropolitan Gas Co., 709A, Old Kent Road, London, S.E., Civil Engineer.

1908. Carpenter, Edwin P., Culvert Works, Sheepcote Lane, Battersea, S.W., Manager of Casein, Ltd.

1900. Carpenter, Frank B., 11, South 12th Street, Richmond, Va., U.S.A., Chemist.

1900. Carpenter, Harry B., c/o Lister's Agricultural Chemical Works, Newark, N.J., U.S.A.

O.M. Carpenter, R. Forbes, 30, Buckingham Mansions, 359, West End Lane, West Hampstead, N.W., Ex-Chief Inspector under the Alkali, &c., Works Acts.

1904. Carr, Francis H., Kelvin, Church Avenue, Sidcup, and (Journals), Burroughs, Wellcome, and Co., Ltd., Dartford, Kent, Manufacturing Chemist.

1907. Carrier, C. F., jun., Sewaren, N.J., U.S.A., Manufacturing Chemist.

1901. Carson, Geo. C., Miner.

1904. Carter, A., Cuba Street, Petone, Wellington, New Zealand, Works Manager.

1905. Carter, Robert A., c/o Roessler and Hasslacher Chemical Co., Box 68, South Amboy, N.J., U.S.A., Chemist.

1895. Carter, Stewart F., c/o Garner Printworks and Bleachery Co., Wappingers Falls, N.Y., U.S.A., Technical Chemist.

1903. Carter, Thomas, West End View, Ravensthorpe, Dewsbury, Yorks, Works Chemist.

1886. Carter, W. Chas., c/o Dominion Iron and Steel Co., Sydney, C.B., Canada, Analytical Chemist.

1911. Carty, Ronald D., The Laboratories, Survey Dept., Public Works, Ministery Gardens, Cairo, Egypt, Analytical Chemist.

1889. Carulla, F. J. R., 84, Rose Hill Street, Derby, Chemical Manufacturer.

1906. Carveth, Dr. H. R., Niagara Electrochemical Co., Niagara Falls, N.Y., U.S.A., Works Manager.

1903. Caspari, Dr. W. A., Usines de Persan, Persan-Beaumont, France, Chemist and Physicist.

1899. Castro, J. Paul de, 1, Essex Court, Temple, London, E.C., Barrister-at-Law.

1895. Catlin, Chas. A., 133, Hope Street, Providence, R.I., U.S.A., Chemist (Rumford Chemical Works).

1909. Caulkin, Howard A., 24, Dairy House Road, Derby Analyst.

1896. Caven, Robt. M., University College, Nottingham, Lecturer in Chemistry.

O.M. Cawley, G., 82, Victoria Street, Westminster, S.W., Chemical Engineer.

O.M. Cawley, J., 278, Passaic Street, Newark, N.J., U.S.A., Analytical Chemist.

1897. Cawley, Thos. A., British Gelatin Works, New Bedford Road, Luton, Gelatin Manufacturer.

1902. Cerasoli, Alburto, Via Cavour 310, Rome, Italy, Engineer.

1910. Chadsey, Stanley B., 476, Brunswick Avenue, Toronto, Canada, Chemist.

1891. Chadwick, Walter M., Thorneycroft, Westoe, South Shields, Chemical Works Manager.

1910. Chakraborty, J., The Oriental Soap Factory, Goabagan, Calcutta, India, Technical Director.

1910. Challinor, Richard W., Chemical Laboratory, The Technical College, Sydney, N.S.W., Australia, Teacher of Chemistry.

1894. Chaloner, G. W., 26, Eagle Wharf Road, Hoxton, N., Chemical Manager.

1901. Chamberlain, G. E., 103, Waiola Avenue, La Grange, Ill., U.S.A., Chemist.

1910. Chambliss, Prof. Hardee, Dept. of Chemistry, Oklahoma A. and M. College, Stillwater, Oklahoma, U.S.A., Professor of Chemistry.

O.M. Chance, A. M., Chemical Works, Oldbury, near Birmingham, Chemical Manufacturer.

1909. Chance, Edwin M., 1200, Mahantongo Street, Pottsville, Pa., U.S.A., Chemist.

O.M. Chandler, Dr. C. F., Columbia University, West 116th Street, New York City, U.S.A., Professor of Chemistry.
1893. Chaplin, Dr. Edw. M., Public Analyst's Laboratory, Wakefield, Yorks, Analytical Chemist.
1890. Chapman, A. Chaston, 8, Duke Street, Aldgate, E.C., Analytical Chemist.
1906. Chapman, Arthur J., Baronsmere, Stanhope Avenue, Church End, Finchley, N., Analytical Chemist.
1906. Chapman, E. A., c/o Robert Heath and Sons, Ltd., Norton Works, Stoke-on-Trent, Works Chemist.
1903. Chapman, Geo. W., P.O. Box 21, R.F.D. No. 4, Atlanta, Ga., U.S.A., Superintendent.
O.M. Chapman, Spencer, 36, Mark Lane, E.C., Chemical Manufacturer.
1894. Charlier, A. C. J., 6, Talbot Road, South Tottenham, N., Consulting Chemist.
1902. Charlton, Thos., 141, South Cherokee Street, Denver, Colo., U.S.A., Manufacturing Chemist.
1900. Chase, March F., c/o Mineral Point Zinc Co., Depue, Ill., U.S.A., Chemist.
1889. Chase, R. L., Arnold Printworks, North Adams, Mass., U.S.A., Manager.
1898. Chattock, Herbert E., 23, Apsley Road, Clifton Bristol, Oilcake Manufacturer.
1910. Chattopadhaya, P. C., 90, Maniktala Main Road, Harrison Road P.O., Calcutta, India, Chemist.
1905. Cheesman, Frank P., 100, William Street, New York City, U.S.A., Paint Manufacturer.
1901. Cheetham, Howard, 18, St. Ann Street, Manchester Chartered Patent Agent.
1910. Cheke, Thomas W., Sawbridgeworth, Herts, Analytical Chemist.
1894. Cheney, John P., Messrs. Cheney Bros., South Manchester, Conn., U.S.A., Chemist and Silk Manufacturer.
1905. Chick, Oliver, 52, High Street, Hornsey, N., Analytical Chemist.
1890. Chorley, Jno. C., Bewsey, Oxford Road, Birkdale, Lancs., Analytical Chemist.
O.M. Christie, J., Levenfield, Alexandria, N.B., Dyer and Printer.
1903. Christie, John, c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Analytical Chemist.
1908. Christie, Malcolm, Ardenlea, Portland Park, Hamilton, N.B., Analytical Chemist.
1910. Christic, Dr. M. G., c/o The Otto-Hilgenstock Coke Oven Co., Tingley, near Wakefield, Assistant General Manager.
1898. Christison, Geo., 2, Kelvinside Gardens, Glasgow, Engineer.
1907. Christopher, George, Walkden Works, Verney Road, South Bermondsey, S.E., Consulting Chemist.
1907. Christopher, J. E., Solvay Coke Works, Kirkless, Wigan, Assistant in Charge.
O.M. Chrystal, W. J., 7, West George Street, Glasgow, Chemical Manufacturer.
1908. Chrystall, E. R., c/o Curtis's & Harvey, Ltd., Cliffe at Hoo, Kent, Research Chemist.
1904. Chubb, H. M., Kirkgate House, Tadcaster, Yorks, Brewery Chemist.
O.M. Church, Sir Arthur, K.C.V.O., F.R.S., Shelsley, Kew, Surrey, Professor of Chemistry in the Royal Academy.
1890. Church, Elihu D., jun., 63, Wall Street, New York City, U.S.A., Soda Manufacturer.
1906. Church, Sumner R., c/o Barrett Manufacturing Co., 17, Battery Place, New York City, U.S.A., Chemical Engineer.
1907. Churchill, Wm., Corning Glass Works, Corning, N.Y., U.S.A., Chemist.
1896. Claflin, Alan A., (Communications) 88, Broad Street, Boston; and (Journals) Littleton, Mass., U.S.A., Manufacturing Chemist.
1909. Claflin, Albert W., 190, Waterman Street, Providence, R.I., U.S.A., Manufacturing Druggist.
1900. Clamer, Guilliam H., 46, Richmond Street, Philadelphia, Pa., U.S.A., Chemist.
1885. Clanahan, H. C., 79, Mosley Street, Manchester, Chemical Merchant.
1901. Clapham, Henry E., 15, St. Julian's Road, Kilburn, N.W., Technical Chemist.
1905. Clapp, Geo. A., 49, Federal Street, Boston, Mass., U.S.A., Chemist.
1891. Clapp, Ralph R., c/o Standard Ammonia Co., Ltd., Sussex Wharf, East Greenwich, S.E., Manager.
1889. Clapperton, J., jun., Analytical Chemist.
1903. Clare, Henry, 23, Greenbank Road, Birkenhead, Schoolmaster.
1905. Clark, Alfred N., 920, North Washington Avenue, Lansing, Mich., U.S.A., Technical Chemist and Engineer.
1906. Clark, Allan J., c/o Homestake Mining Co., Lead, South Dakota, U.S.A., Metallurgist.
1910. Clark, A. W., c/o Heath and Milligan Manufacturing Co., 1832, South Canal Street, Chicago, Ill., U.S.A., Superintendent.
1904. Clark, Arthur W., c/o Johnson and Johnson, New Brunswick, N.J., U.S.A., Chemist and Bacteriologist.
1908. Clark, Chas. T., 1303, Sixth Street, Bay City, Mich., U.S.A., Manufacturing Chemist.
1904. Clark, Prof. Friend E., Central University of Kentucky, Danville, Ky., U.S.A., Professor of Chemistry.
1910. Clark, Henry, 25, Adelaide Crescent, Brighton, Oil Refiner.
1909. Clark, Hubert A., 83, Amherst Street, Montreal, Canada, Canner.
1900. Clark, Jno., Broadway Works, Millwall Dock, London, E., Manufacturing Chemist.
1906. Clark, M. H., c/o Boston Rubber Shoe Co., Melrose, Mass., U.S.A., Chemist.
1902. Clark, Robt. M., 138, Bath Street, Glasgow, Chemist.
1906. Clark, Wm. B., 11, Fox Street, Greenock, Chemist.
1907. Clark, Wm. H., Laboratory, Messrs. Armstrong, Whitworth, and Co., Newcastle-on-Tyne, Analytical Chemist.
1904. Clarke, Alfred R., 613–617, Eastern Avenue Toronto, Canada, Leather Manufacturer.
1908. Clarke, Arthur F., Myrtle Cottage, Guy Road, Beddington, Surrey, Analytical Chemist.
1908. Clarke, Dr. Latham, Boylston Hall, Harvard University, Cambridge, Mass., U.S.A., Instructor in Chemistry.
1903. Clarke, Robt. W., Avon House, Prince's Road, Buckhurst Hill, Essex, Analyst.
1897. Clarke, Wm. B., c/o Edison-Swan U.E.L. Co., Ltd., Ponders End, N., Electro-Chemist.
O.M. Claudet, A. C., 6 & 7, Coleman Street, London, E.C., Metallurgist.
1889. Claus, Wm. H., c/o Claus and Co., Ltd, Clayton, Manchester, Manufacturing Chemist.
1911. Clayton, Alf. J., Priory Lawn, Ellys Road, Coventry, Technical Chemist.
O.M. Clayton, E. G., Chemical Laboratory, 23, Holborn Viaduct, London, E.C., Consulting Chemist.
1909. Clayton, Ellis, Hazeldene, Deerpark Road, Belfast, Ireland, Lecturer on Bleaching, Dyeing, and Printing.
1895. Clayton, Dr. G. C., Croughton, Upton, near Chester.
1909. Clayton, H., Endcliffe, Maiden Lane, Dartford, Kent, Technical Chemist.
1894. Clayton, Robt. H., 1, Parkfield Road, Didsbury, Manchester, Chemist.
1910. Clayton, Will, Melville House, Accrington, Works Chemist.
1905. Clayton, W. E., Royal Edward Yard, Sydney, N.S.W., Australia, Superintendent.
1907. Clement, Leonard, Beamsley, Fairhaven, near Lytham, Lancs., Chemist.
1893. Clemes, J. H., Cheriton, Newquay, Cornwall.
1884. Clerk, Dugald, F.R.S., 57–58, Lincoln's Inn Fields, London, W.C., Engineer.
1905. Clexton, Thos. J., 285, Congress Street, Boston, Mass., U.S.A., Manager (A. Klipstein & Co.).
1906. Clifford, Jos., Laboratory, Survey Dept., Public Works, Ministry Gardens, Cairo, Egypt, Chemist.

1900. Clifford, Wm., Sewage Outfall Works, Wolverhampton, Sewage Works Manager.
O.M. Cloud, T. C., 479, Mansion House Chambers, London, E.C., Metallurgist.
O.M. Clowes, Dr. F., 40, Craven Street, Charing Cross, W.C.; and the Grange, College Road, Dulwich, S.E., Chief Chemist (L.C.C.).
1891. Clutton, J. H., Poste Restante, Lastours (Aude), France, Assayer.
1899. Coates, Chas. E., jun., Louisiana State University, Baton Rouge, La., U.S.A., Professor of Chemistry.
1911. Coates, Jos. E., The University, Edgbaston, Birmingham, Lecturer.
1888. Coats, Jno. T., 105, Broughton Street, Edinburgh, Manufacturing Chemist.
1893. Cobb, Jno. W., Farnley Ironworks, near Leeds, Technical Assistant to Managing Director.
1894. Coblentz, Dr. Virgil, College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Professor of Chemistry.
1899. Cochran, Alfred, 559, Madison Street, Brooklyn, N.Y., U.S.A., Chemist.
1901. Cockburn, John A., Mayville, Stevenston, Ayrshire, Analytical Chemist.
1902. Cocking, Allan T., c/o Kynoch, Ltd., Lion Works, Wilton, Birmingham, Ammunition Manufacturer.
1905. Coes, Chas. S., 119, East River Street, Hyde Park, Mass., U.S.A., Oil Chemist.
1909. Coffey, Æneas H., 21, Cardigan Road, Richmond, Surrey, Distiller.
1903. Cofman-Nicoresti, J., 24, St. Gabriel's Road, Cricklewood, N.W., Chemist.
1903. Coggeshall, Dr. G. W., Chestnut Street, Dedham, Mass., U.S.A., Chemical Manufacturer.
1887. Coghill, P. de G., Borax Works, Old Swan, Liverpool, Technical Chemist.
1884. Cogswell, W. B., Syracuse, N.Y., U.S.A., Chemical Engineer.
O.M. Cohen, Dr. J., 1, North Grange Mount, Headingley, Leeds, Professor of Organic Chemistry.
1897. Cohn, Alfred J., 122, East 74th Street, New York City, U.S.A., Chemist.
1901. Cohn, Sigmund, 13, Dutch Street, New York City, U.S.A., Metallurgical Chemist.
1904. Cohoe, Prof. W. P., 148, Van Horne Street, Toronto, Canada, Professor of Chemistry.
1903. Colbert, W., British S.A. Dynamite Factory, Modderfontein, Transvaal, Analytical Chemist.
1891. Colby, Albert L., 447, Lehigh Street, South Bethlehem, Pa., U.S.A., Metallurgical Engineer.
1899. Colby, E. A., Baker Platinum Works, Newark, N.J., U.S.A., Metallurgical Chemist.
O.M. Colby, W. H., Carreg-wen, Aberystwith, Wales.
1893. Coleman, W. H., 18, Egerton Road, Fallowfield, Manchester, Tar Works Chemist.
O.M. Collens, E., Vinegar Works, Stourport, Worcestershire, Manager.
1905. Collett, John H., Summercroft, Tuffley, and (Jnls.) The Librarian, Free Library, Gloucester, Chemical Manufacturer.
1887. Collett, J. M., Hillfield, Gloucester, Chemical Manufacturer.
1901. Colley, Bernard T., c/o Braden Copper Co., Rancagua, Chile, South America, Superintendent.
1908. Collier, F. C., 437, Lansdowne Avenue, Westmount, Montreal, Canada, Analytical Chemist.
1903. Collier, Pierre, Companhia Industrial Pernambucana, Pernambuco, Brazil, Civil Engineer.
1893. Collin, Dr. C. A., Ferguslie Threadworks, Paisley, N.B., Textile Chemist.
1898. Collingridge, Frank, 73, Fountain Road, Edgbaston, Birmingham, Chemist.
1899. Collins, S. Hoare, Armstrong College, Newcastle-on-Tyne, Agricultural Chemist.
1888. Collins, W. Hepworth. *See* Hepworth-Collins, W.
1899. Collis, Walter T., 89, Greenfield Road, Harborne, Birmingham, Chemist.
1910. Collitt, Bernard, 377, Metcalfe Avenue, Westmount, Montreal, Canada, Chemist.
1910. Colman, Fred. J., c/o Brotherton and Co., Ltd., Wear Tar Works, Sunderland, Chemist.
1891. Colman, Dr. H. G., Elmside, Worcester Park, Surrey, Analytical Chemist.
1892. Colquhoun, Ludovic, Dynamite Factory, Modderfontein, Transvaal, Analytical Chemist.
1894. Colquhoun, W., Tapton Close, Tapton House Road, Sheffield, Engineer.
1910. Colson, Prof. Albert, 21, Rue Descartes, Paris, France.
1901. Colwell, J. Kear, Finsbury Town Hall, Rosebery Avenue, E.C., Analytical and Consulting Chemist.
1906. Comber, A. W., Dinwaed, Victoria Avenue, Southend-on-Sea, Manager (Magnesite Works).
1900. Comey, Dr. Arthur M., 424, East 13th Street, Chester, Pa., U.S.A., Technical Chemist.
1906. Compton, Miss N. J., Library, University of Nebraska, Lincoln, Neb., U.S.A., Librarian.
1901. Connah, Jas., Laboratory, Custom House, London, E.C., Government Analyst.
1905. Conner, Arthur B., 217, West Boulevard, Detroit, Mich., U.S.A., Chief Chemist (Detroit Chemical Works).
1883. Connor, C. C., 10, College Gardens, Belfast, Ireland, Chemist.
1891. Conradson, Pontus H., Galena Oil Works, Franklin, Pa., U.S.A., Analytical Chemist.
1906. Conrau, Oliver, Dansk Svofvelsyre och Superfosfatfabrik, Mandelstrup, Denmark, Administrator.
1889. Conroy, Dr. Jas. T., 9, The Serpentine, Grassendale, Liverpool, Chemist.
1887. Constable, W. H., Australian Alum Works, Runcorn, Analytical Chemist.
1908. Conyngham, Wm. Boulton, c/o Benger's Food, Ltd., Manchester, Pharmaceutical Chemist.
1909. Cook, E. Bernard, 23, Cross Street, Finsbury, London, E.C., Manufacturing Chemist.
O.M. Cook, H. J., The Firs, Woodford Green, Essex, Soap Manufacturer.
1903. Cook, Jas. W., London and Provincial Dye Works, Hackney Wick, N.E., Dyer.
1899. Cook, Robt. A., Bleecker Place, New Brunswick, N.J., U.S.A., Chemist.
1898. Cook, Thos. Alex., East London Soap Works, Bow, E., Soapmaker.
1899. Cook, Walter G., 9, Hendon Lane, Finchley, N., Analytical Chemist.
1891. Cooke, Arthur W., c/o Brotherton and Co., Ltd., Holmes Street, Dewsbury Road, Leeds, Analytical Chemist.
1907. Cooke, J. J. Verdin, 9, James Street, Liverpool, Salt Manufacturer.
1904. Cooke, W. Ternent, The University, Adelaide, South Australia, Lecturer in Chemistry.
1910. Coombs, Frank A., Technical College, Sydney, N.S.W., Australia, Lecturer on Tanning.
1910. Cooper, Leonard H., Fern Lea, Trafalgar Drive, Lower Bebington, Cheshire, Assistant Chemist (Lever Bros.).
1901. Cooper, T. S., 276, Dickenson Road, Rusholme, Manchester, Calico Printing Chemist.
1891. Cooper, Walter J., The Elms, Lavernock, South Wales, Cement Works Manager.
1907. Cooper, W. F., Research Laboratory, Water Lane, Watford, Synthetic Chemist.
1890. Corcoran, Bryan, 31, Mark Lane, London, E.C., Chemical Engineer.
1905. Cormack, Wm., Rainsford Road, Chelmsford, Chemist.
1899. Cornelison, Dr. Robt. W., 150, West Cliff Street, Somerville, N.J., U.S.A., Consulting Chemist.
1909. Cornell, Fred, 61, St. Sulpice Street, Montreal, Canada, Chemical Merchant.
1906. Cornwell, R. de Vere, Salisbury, Rhodesia, Chemist.
1889. Corrie, David, c/o Nobel's Explosives Co., Ltd., Polmont Station, N.B., Technical Chemist.
1903. Cortright, R. M., Alsen's American Portland Cement Works, Alsen, N.Y., U.S.A., Chemist.
1894. Coste, J. H., 40, Craven Street, W.C., and (Journals) Utopia, Gloucester Road, Teddington, Analytical Chemist.

1891. Cotton, W. F., Hollywood, Dundrum, Co. Dublin, Gas Works Manager.
1906. Coupe, Miles, Rosebank, Thornfield Road, Waterfoot, near Manchester, Chemist.
1894. Court, Heywood, Staveley, Chesterfield, Analytical Chemist.
1898. Courtney, Samuel, Bizerta, Knockdene Park, Belfast, Ireland, Manager.
1894. Cousins, W. J., 17, Temple Chambers, Temple Avenue, E.C., Consulting Chemist and Director.
1911. Couzens, E. Gordon, 47, Allfarthing Lane, Wandsworth, S.W., Research Chemist.
1909. Coventry, Bernard O., Dehra Dun, United Provinces, India, Forest Dept., India.
1903. Cowan, A. Wallace, Bruach Mohr, Vanbrugh Fields, Blackheath, S.E., Analytical Chemist.
1906. Cowan, George D., Bridge House, Bridge Road, Millwall, E., Manager, Desilverising Works.
1893. Cowan, W. J., 12, Park Avenue, Wood Green, N., Fine Colour Manufacturer.
1910. Coward, Hubert F., Municipal School of Technology, Manchester, Lecturer in Chemistry.
1897. Cowburn, Arthur W., 20, Mount Street, Manchester, Chemical Merchant and Analytical Chemist.
1907. Cowburn, J. Robert, 10, Eastwood Road, South Woodford, Essex, Technical Chemist.
1904. Cowee, Harvey D., 161, River Street, Troy, N.Y., U.S.A., Chemist.
1891. Cowper-Coles, Sherard Osborn, Grosvenor Mansions, Victoria Street, Westminster, S.W., Metallurgical Engineer.
1905. Cox, Harold N., c/o Lalance & Grosjean Mfg. Co., Woodhaven, N.Y., U.S.A., Chemist.
1884. Craig, Geo., Chemical Laboratory, 95, Bath Street, Glasgow, Technical Chemist.
1895. Craig, Dr. Thos. J. I., c/o Peter Spence & Sons, Ltd., Alum Works, Manchester, Chemist.
1908. Craig, Wm. J., c/o Annable and Young, 114–116, Victoria Street, London, S.W., Analytical Chemist.
1901. Crane, Fred. D., 28, Hillside Avenue, Montclair, N.J., U.S.A., Consulting Chemist.
1902. Crane, Jasper E., c/o The Arlington Co., Arlington, N.J., U.S.A., Chemist.
1898. Cranfield, Wm., 11, Avondale Place, Halifax, Yorks, Teacher of Chemistry.
1903. Cranmer, Ridgeway, 170, 88th Street, Bay Ridge, Brooklyn, N.Y., U.S.A., Chemist.
1902. Craven, Alfd. B., 18, Edinburgh Road, Upper Armley, Leeds, Analytical Chemist.
1906. Craven, J. A., 119, Moorside, Armley, Leeds, Chemist.
1891. Craven, Jno., The Ark, South Bersted, Bognor, Sussex, Chemist.
1906. Craven, John L., 141, Wilmer Road, Heaton, Bradford, Chemist and Salesman.
1885. Craw, John, 15, Cadogan Street, Glasgow, Drysalter.
O.M. Crawford, D., Langdale's Chemical Manure Co., Ltd., St. Lawrence, Newcastle-on-Tyne, Manager.
1908. Crawford, Lawrence, Lugar Iron Works, Old Cumnock, Ayrshire, N.B., Analytical Chemist.
1890. Crawshaw, E., 25, Tollington Park, London, N., Dye Merchant.
O.M. Cresswell, C. G., Ermyngarth, Ashtead, Surrey; and 9, Bridge Street, Westminster, S.W., Chemist.
1901. Cribb, Cecil H., 136, Shaftesbury Avenue, London, W., Analytical and Consulting Chemist.
1909. Crichton, Charles, c/o Afrikander Mine, Klerksdorp, Transvaal, Assayer.
1908. Crighton, Adam M., Wood Cottage, Middleton, Manchester, Calico Printer's Chemist.
1910. Crighton, David T., Nobel House, 195, West George Street, Glasgow, Buying Manager.
1905. Crighton, W. H., c/o Ore Concentration Co., Ltd., Glebe Road, Kingsland Road, London, N.E., Chemist.
1890. Criper, Wm. R., c/o Messrs. D. Waldie and Co., Konnagar, near Calcutta, India, Manufacturing Chemist.
1908. Crites, Bert O., 1341, East 89th St. N.E., Cleveland, Ohio, U.S.A., Chemist.
1902. Croasdale, Dr. Stuart, 1574, York Street, Denver, Colo., U.S.A., Mining Engineer and Metallurgist.
1911. Croasdell, Jas. F., "Curhar," Cliffe at Hoo, Kent, Engineer.
1901. Cronquist, G. W., Hyllinge-Grufva, Sweden, Fire Brick Works Manager.
O.M. Crookes, Sir Wm., O.M., F.R.S., 7, Kensington Park Gardens, Notting Hill, W., Analytical Chemist.
1896. Crosby, Thos., Llanelly Steelworks, Llanelly, South Wales, Metallurgist.
O.M. Crosfield, A. L., 46, Bidston Road, Oxton, Birkenhead; (Journals) c/o Prof. B. Moore, Biochemical Dept., The University, Liverpool, Analytical Chemist and Assayer.
1896. Crosfield, Capt. G. R., Volunteer Quarters, Sankey Street, Warrington, Soap Manufacturer.
1908. Crosland, Percy F., Dyeing Department, The University, Leeds, Technical Chemist.
1884. Cross, C. F., 4, New Court, Lincoln's Inn, London, W.C., Analytical Chemist.
1894. Crossley, Prof. Arthur W., Pharmaceutical Society, 17, Bloomsbury Square, London, W.C., Professor of Chemistry.
1904. Crossley, T. Linsey, 112, St. François-Xavier Street, Montreal, Canada, Technical Chemist.
1908. Crossley, Watson, c/o Newlands Bros., 2, St. Dunstan's Hill, London, E.C., Chemist.
1908. Croston, Henry, 178, Eckford Street, Greenpoint, Brooklyn, N.Y., U.S.A., Foreman.
1894. Crow, Henry W., Abbey Creek Wharf, West Ham, E., Tar Distiller.
1884. Crow, Dr. J. K., Ivydene, Westcombe Park Road, Blackheath, S.E., Technical Chemist.
1893. Crowther, Edw., 20, Brookfield Place, Headingley, Leeds, Dyer.
1883. Crowther, Horace W., The Beeches, West Bromwich, Technical Chemist.
1906. Crowther, R. E., c/o Mark Fletcher and Sons, Ltd., Moss Lane, Whitefield, Manchester, Chemist.
1884. Crowther, Walter M., Chemical Works, Gomersal, near Leeds, Manufacturing Chemist.
1884. Crumbie, W. D., 146, Washington Street, East Orange, N.J., U.S.A., Analytical Chemist.
1906. Cruser, Dr. Fred. Van D., c/o The Diamond Match Co., Barberton, Ohio, U.S.A., Chemical Engineer.
1902. Crush, E. Hope, Mines de Pétrole d'Ain-Zeft, Saint Aimé, Oran, Algeria, Technical Chemist.
1892. Cullen, Wm., Dynamite Factory, Modderfontein, Transvaal, and (Journals) c/o British South African Explosives Co., 612, Salisbury House, Finsbury Circus, London, E.C., Chemist.
1903. Cullen, W. H., The Castner-Kellner Alkali Co., Ltd., Wallsend-on-Tyne, Engineer.
1897. Culmann, Dr. J., 116, Vanderbilt Avenue, Stapleton, R.B., U.S.A., Chemist and Colourist.
1905. Culver, Ralph F., Box 162, Norwood, Mass., U.S.A., Chemist.
1883. Cuming, James, jun., Chemical Works, Yarraville, Melbourne, Australia, Chemical and Fertiliser Manufacturer.
1905. Cuming, R. Burns, Adelaide Chemical and Fertiliser Co., Ltd., Currie Street, Adelaide, South Australia, Manufacturing Chemist.
1897. Cunliffe, Albert J., Claytonfield, Clayton-le-Woods, Chorley, Lancashire, Calico Printer.
1907. Cunningham, James E., Minas Peña del Hierro, Provincia de Huelva, Spain, Analytical Chemist.
O.M. Curphey, W. S., 87, Canfield Gardens, South Hampstead, N.W., Chief Alkali Works Inspector.
1898. Curtis, Marvin, 108, Front Street, San Francisco, Cal., U.S.A., Wine Chemist.
1903. Cushing, Robt. P., "Rocky Nook," Hingham, Mass., U.S.A., Chemist.
1902. Cutbush, Chas. G., 73, Elliscombe Road, Charlton, S.E., Electrical Engineer.
1899. Cutler, Fred. F., 183, Essex Street, Boston, Mass., U.S.A., Publisher.
1904. Cutts, Henry E., c/o Stillwell and Gladding, 181, Front Street, New York City, U.S.A., Technical Chemist.

D

O.M. Dacie, J. C., Soap Works, Putney, S.W., Soap Manufacturer.

1911. Dager, Herman J., 278, Jarvis Street, Toronto, Canada, Dominion Food Inspector.

1906. Dains, Prof. F. B., Washburn College, Topeka, Kas., U.S.A., Professor of Chemistry.

1897. Dains, Herbert H., c/o J. E. Ferguson, 2, Union Court, London, E.C., Analytical Chemist.

1908. Dale, H. Gordon, Belmore, New Barnet, Herts., Analytical Chemist.

1908. Dalton, Leonard V., 17, Gracechurch Street, London, E.C., Geologist (Petroleum).

1908. Dance, Edward L., 20, Lovaine Place, Newcastle-on-Tyne, Chemist.

1884. Daniell, Louis C., (Journals) Royal Standard Brewery, Tamworth, New South Wales; and (subs.) c/o W. T. Allen and Co., 132, Queen Victoria Street, London, E.C., Brewer.

1904. Danker, Dan. J., 247, Atlantic Avenue, Boston, Mass., U.S.A., Dyestuff and Chemical Merchant.

1903. Dannenbaum, Dr. H., c/o National Ammonia Co., Frankford, Philadelphia, Pa., U.S.A., Secretary and Treasurer.

1885. Darby, Jno. H., Crosby, Scunthorpe, Lincolnshire, Ironmaster.

O.M. Darling, W. H., 26, Dover Street, Manchester, Analytical Chemist.

1887. Davenport, Dr. B. F., 161, Tremont Street, Boston, Mass., U.S.A., Medico-legal Expert.

1900. Davidson, Alex., jun., 173, Colinton Road, Edinburgh, Analytical Chemist.

1899. Davidson, Charles, 65, Cadder Street, Pollokshields, Glasgow, Analytical Chemist.

1901. Davidson, G. M., Chicago and N.W. Railroad Shops, P.O. Station E., Chicago, Ill., U.S.A., Chemist.

1883. Davidson, J. E., 40, Percy Gardens, Tynemouth, Chemical Manufacturer.

1891. Davidson, Richard, 133, Victoria Road, Dundee, Oil Merchant's Clerk.

O.M. Davidson, R. Holden, c/o United Alkali Co., Ltd., Ammonia Soda Works, Fleetwood, Manager.

1904. Davidson, Robert, c/o Dalgety and Co., Ltd., 15, Bent Street, Sydney, N.S.W., Australia.

1911. Davidson, Thos. A., 57, Strathyre Avenue, Norbury, S.W., Chemist and Varnish Expert.

1905. Davidson, Dr. Wm. B., City Gas Works, Saltley, Birmingham, Chemist.

1889. Davies, G. W., 8, Spring Hill, Stockport, Chemical Lecturer.

1906. Davies, Harry R., 58, Hamilton Street, Readville, Mass., U.S.A., Chemist.

1898. Davies, Herbert E., The Laboratory, 28, Chapel Street, Liverpool, Analytical Chemist.

1907. Davies, James, 221, Malpas Road, Brockley, London, S.E., Scientific Apparatus Maker.

1896. Davies, Llewellyn J., 103, Bute Road, Cardiff, Analytical and Consulting Chemist.

1886. Davies, M. Lloyd, North American Chemical Co., Bay City, Mich., U.S.A., Alkali Works Manager.

1897. Davies, Saml. H., c/o Rowntree and Co., Ltd., Cocoa Works, York, Research Chemist.

1908. Davies, T. H., c/o John Cox and Co.'s Successors, Stillhouse Lane, Bedminster, Bristol, Tanner.

O.M. Davis, A. R., Sutton Grange, St. Helens, Lancashire, Analytical Chemist.

1901. Davis, Bernard F., 142, Widmore Road, Bromley, Kent, Metallurgical Engineer.

1902. Davis, Charles B., c/o National Brewers' Academy, 402, West 2[illegible]rd Street, New York City, U.S.A., Technical Chemist.

1902. Davis, Emerson, 203, Clairmont Avenue, Detroit, Mich., U.S.A. Chemist.

1908. Davis, G. Keville, 265, Strand, London, W.C., Chemical Engineer.

O.M. Davis, H. W., Government Laboratory, Clement's Inn Passage, Strand, W.C., Analytical Chemist.

1907. Davis, Robt. W., jun., Indian Head, Md., U.S.A., Chemist.

1906. Davis, V. P., 221, West Exchange Street, Providence, R.I., U.S.A., Chemist.

1897. Davis, Wm. A., 2, Ashgrove Road, Bromley Hill Kent, Chemist.

1911. Davis, Wm. C., 10, Richmond Hill, Langley, near Birmingham, Chemist.

1900. Daw, Fred W., Duffryn House, Ebbw Vale, Mon., Metallurgical Chemist.

1903. Dawes, Arthur W., 3, Madison Place, Albany, N.Y., U.S.A., Chemist.

O.M. Dawson, C. A., 32, Elm Hall Drive, Mossley Hill, Liverpool, Technical Chemist.

1886. Dawson, W. Haywood, British Alizarin Co., Ltd., Silvertown, E., and (Journals), 15, Wrottesley Road, Woolwich, S.E., Technical Chemist.

1901. Day, Dr. David T., U.S. Geological Survey, Washington, D.C., U.S.A., Geologist.

O.M. Deacon, H. Wade, 8, Ullet Road, Liverpool; and (Journals) c/o F. W. Wright, 22, Peel House Lane, Widnes, Alkali Manufacturer.

O.M. Deakin, H. T., Dewhurst, Egerton, near Bolton, Dyer.

1911. Dean, Arthur L., Sheffield Scientific School, New Haven, Conn., U.S.A., Assistant Prof. of Industrial Chemistry.

1903. Dean, Harry, Oak Villa, Greenhead Road, Huddersfield, Chemist.

1906. Dean, Harry, Armstrong College, Newcastle-on-Tyne, Demonstrator.

1899. Deane, Leopold M., 21, Station Terrace, Abbey Village, Withnell, near Chorley, Lancs., Analytical and Consulting Chemist.

1905. Dearman, E., c/o The Lavers Manufacturing Co., Ltd., Flora Street, Erskineville, Sydney, N.S.W., Australia, Tar Distiller.

1892. Deaville, B., Beech Avenue, Nottingham, Manufacturing Chemist.

1910. Deby, Bedford H., 29, Oak Hill Road, Nether Edge, Sheffield, Metallurgist and Chemist.

1899. De Castro, J. Paul. *See* Castro, J. Paul de.

1902. De Cew, J. A., 615, Canadian Express Building, Montreal, Canada, Chemical Engineer.

1893. De Clerck, Maurice, Heule-lez-Courtrai, Belgium.

1884. Deering, W. H., Chichester Lodge, Babbacombe Road, Torquay, S. Devon, Analytical Chemist.

1900. Deerr, Noel F., Experiment Station, Hawaiian Sugar Planters' Association, Honolulu, H.I., U.S.A., Analytical Chemist.

1902. Deghuée, Dr. Jos. A., 247, Harrison Street, Brooklyn, N.Y., U.S.A., Chemist.

1901. De Jonge, Cornelius, 36, Doughty Street, Brooklyn, N.Y., U.S.A., Pharmaceutical Chemist.

1893. Delahaye, Philibert, 94, Rue St. Lazare, Paris (IX.), Gas Engineer.

1909. De Laire, Edgar, 47, Quai de Moulineaux, Issy, Seine, France, Industriel.

1908. Delaney, Chas. R., c/o J. S. Young and Co., Ltd., Hanover, Pa., U.S.A., Chemical Engineer.

1901. Delany, Chas., c/o Elliott Bros., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Chemist.

1908. Dellschaft, Dr. F. H., Winnington, Northwich, Cheshire, Manufacturing Chemist.

1910. De Meeûs, Etienne, c/o Michelin Tire Co., Milltown, N.J., U.S.A., Chemist.

1888. Dempsey, Geo. C., 165, Market Street, Lowell, Mass., U.S.A., Chemist.

1909. Demuth, Rudolph, 68, Salusbury Road, London, N.W., Manufacturer.

1899. Denham, Wm. S., The United College, St. Andrews, N.B.

1891. Denison, Joseph R., c/o Denison, Preussner and Co., Valley Dyeworks, Bradford, Yorks., Analytical Chemist.

1911. Dennis, Louis, 26, Clapton Mount, Halifax, Yorks, Works Chemist.

1908. Dennis, Martin, 859, Summer Avenue, Newark, N.J., U.S.A., Manufacturing Chemist.

1907. Dennison, Henry S., South Framingham, Mass., U.S.A., Manufacturer.

1898. Dent, Dr. Frankland, Government Analyst's Dept., Singapore, S.S. and (Journals) c/o A. Dent, 145, Pilgrim Street, Newcastle-on-Tyne, Government Analyst.

1905. Derby, Wallace G., c/o Nichols Copper Co., Laurel Hill, New York City, U.S.A., Assayer.

1901. Devas, Dr. Ernest W., Fairview, Hale Grove, Edgware, N.W., Technical Chemist.

1906. Deverell, Louis C., Brantwood, Shortlands Grove, Shortlands, Kent, Chief Chemist.

1908. Dew, Joseph A., Woodside, Windsor Road, Wanstead, Essex, Varnish Manufacturer.

1898. Dewar, Alex. H., c/o The Linoleum Manufacturing Co., Staines, Middlesex, Chemist.

O.M. Dewar, Sir J., F.R.S., Royal Institution, Albemarle Street, W. (Journals); and 1, Scroope Terrace, Cambridge, Professor of Chemistry and Physics.

1889. Dewey, Fred. P., Lanier Heights, Washington, D.C., U.S.A., Metallurgist.

1904. Dewhirst, J. A., Imperial Chambers, Halifax, Yorks, Analyst.

1909. Dewhirst, Wm. B., Avenue House, William Street, West End, Paisley, N.B., Analytical Chemist.

1891. De Wilde, Prof. P., 1, Quai du Léman, Geneva, Switzerland, Professor of Chemistry.

1903. Diamond, Wm., c/o John Bowes and Partners, Ltd., Marley Hill Colliery, Swalwell, R.S.O., Durham, Works Manager.

O.M. Dibdin, W. J., 2, Edinburgh Mansions, Howick Place, S.W., Analytical Chemist.

1897. Dick, Jno., c/o Jno. Dick, Ltd., 77, York Street, Toronto, Ont., Canada, Manufacturer.

1902. Dick, Jno., Wharf Road, Cubitt Town, London, E., Manager and Chemist.

1904. Dick, W. D., c/o Hugh Baird and Sons, 29, St. Vincent Place, Glasgow, Analytical Chemist.

1898. Dickenson, F. M., c/o Broken Hill Proprietary Co., 3, Great Winchester Street, London, E.C., Secretary.

1904. Dickenson-Gair, C. J. *See under* Gair.

1902. Dickerman, Prof. Judson C., 36, North Walnut Avenue, Chicago, Ill., U.S.A., Chemical Engineer.

1893. Dickerson, E. N., 141, Broadway, New York City, U.S.A., Lawyer.

O.M. Dickinson, A. J., 178, Lewisham High Road, Brockley, S.E., Tar Distiller.

1905. Dickinson, Cyril, Southwark Town Hall, Walworth Road, London, S.E., Analytical Chemist.

1898. Dickson, Samuel, 2, Broadway, Westminster, S.W., Analytical Chemist.

1899. Dieckmann, Dr. Otto, 1180, Harrison Avenue, Cincinnati, Ohio, U.S.A., Chemist.

1908. Diekman, Dr. George C., 115, West 68th Street, New York City, U.S.A., Professor of Pharmacy.

1907. Dielman, Louis H., 106, West Mulberry Street, Baltimore, Md., U.S.A., Pharmaceutical Chemist.

1894. Diestel, Wm., 117, Hudson Street, New York City, U.S.A., Dyestuff Importer.

1908. Dill, Colby, Perth Amboy, N.J., U.S.A., Chemist.

1906. Dillon, Fred. N., 16, Prospect Street, Fitchburg, Mass., U.S.A., Engineer.

1898 Dillon, Wm., Pierremont, Denton Road, Ilkley, Yorks. Oil, Colour, and Varnish Manufacturer.

O.M. Divers, Dr. E., F.R.S., 3, Canning Place, Palace Gate, Kensington, W., Professor of Chemistry.

1903. Divine, Robt. E., 325, McLellan Avenue, Detroit, Mich., U.S.A., Chemist.

1899. Dixon, Fred. W., P.O. Box 43, Jamestown, N.Y., U.S.A., Dyer.

1888. Dixon, Prof. Harold B., F.R.S., Owens' College, Manchester, Professor of Chemistry.

1902. Dixon, Wm. A., 97, Pitt Street, Sydney, N.S.W., Australia, Public Analyst and Assayer.

1909. Dixon, W. H., c/o Bryant and May, Ltd., Fairfield Works, Bow, London, E., Match Manufacturer.

1892. Dobb, Thos., c/o J. T. Dobb and Son, West Bar, Sheffield, Pharmaceutical Chemist.

O.M. Dobbie, Dr. J. J., F.R.S., Government Laboratory, Clement's Inn Passage, London, W.C., and (Jnls.), 4, Vicarage Gate, Kensington, W., Director.

O.M. Dobbin, Dr. L., Chemical Laboratory, University, Edimburgh, Professor of Chemistry.

1908. Dobbs, Ernest J., 125, St. Asaph Road, Brockley, London, S.E., Analytical Chemist.

1907. Dodd, Arthur J., Meadholme, Blackheath Park, S.E., Assistant Works Manager.

1890. Dodd, A. J., Heathfield House, Belvedere, Kent, Works Manager.

1889. Dodd, W. Ralph, Trederwen, Village Road, Enfield, Middlesex, Chemical Works Manager.

1906. Dodds, Thos., c/o Reckitt & Sons, Ltd., and (Journals) 7, The Oval, Garden Village, Hull, Works Manager and Chemist.

1900. Dodge, Dr. Francis D., 291, Henry Street, Brooklyn, N.Y., U.S.A., Chemist.

1906. Dodsworth, Walter A., Journal of Commerce, 32, Broadway, New York City, U.S.A., Editor.

1897. Doerflinger, Wm. F., 52, Beaver Street, New York City, U.S.A., Research Chemist.

1897. Dohme, Dr. Alf. R. L., Messrs. Sharp and Dohme, Baltimore, Md., U.S.A., Manufacturing Chemist.

1905. Dolan, H., Westbourne, Belvoir Road, Lower Walton, Warrington, Chemist.

1897. Dolge, Carl B., Westport, Conn., U.S.A., Manufacturer of Instruments and Antiseptics.

1903. Donald, Dr. Jas. T., 112, St. François Xavier Street, Montreal, Canada, Consulting Chemist.

1906. Donald, Richard A., 16, King Street West, Toronto, Canada, Wood Distiller.

1900. Donald, Wm., Ridgefield Park, Bergen Co., N.J., U.S.A., Assayer and Chemist.

1902. Donaldson, Thos., c/o British South African Explosives Co., Ltd., Modderfontein, Transvaal, Chemist.

1905. Donnan, Prof. F. G., Muspratt Laboratory, The University, Liverpool, Professor of Physical Chemistry.

1886. Doolittle, Orrin S., 388, Palisade Avenue, Yonkers, N.Y., U.S.A., Chemist.

1905. Doolittle, Roscoe E., 109, Hillside Avenue, Glen Ridge, N.J., U.S.A., Chemist.

1890. Dore, Jas., Copper Works, High Street, Bromley-by-Bow, E., Distiller's Engineer.

1911. Dorée, Dr. Charles, 58, Gore Road, South Hackney, London, N.E., Head of Chemistry Department, Borough Polytechnic.

1896. Doremus, Dr. Chas. A., 55, West 53rd Street, New York City, U.S.A., Professor of Chemistry.

O.M. Dott, D. B., Ravenslea, Musselburgh, N.B., Analytical Chemist.

1911. Dougall, Jas. S. N., c/o Dougall Varnish Co., Montreal, Canada, Varnish Manufacturer.

1897. Douglas, Geo., Farfield Hall, Addingham, Yorks., Dyer.

1894. Douglas, Loudon M., 3, Lauder Road, Edinburgh, Chemical Manufacturer.

1909. Douglas, Robt. P., 26, Moray Place, Regent's Park, Glasgow, Chemist.

1884. Douglas, William, Diamond Plantation, Demerara, British Guiana, Chemical Engineer.

1900. Doulton, H. Lewis, Royal Doulton Potteries, Lambeth, S.E., Potter.

1900. Dow, Allan W., 24, East 21st Street, New York City, U.S.A., Chemical Engineer.

1898. Dow, Herbert H., Midland, Mich., U.S.A., Manufacturing Chemist.

1908. Dow, John W., 564, Park Avenue West, Mansfield, Ohio, U.S.A., Manufacturing Chemist.

1905. Dowhiggin, James, Craiglands, Albert Park, Lancaster, Chemist.

1885. Dowson, J. Emerson, 39, Victoria Street, Westminster, S.W., Civil Engineer.

1901. Doxrûd, Christian, Technical School, Christiania, Norway, Professor of Chemical Technology.

1907. Doyle, B. W., 11, Pine Street, Leominster, Mass., U.S.A., Manufacturer.

1911. Drackett, H. R., c/o Standard Explosives Ltd., Vaudreuil Station, P.Q., Canada, Works Superintendent.

1902. Drake, Bryant S., 5930, Colby Street, Oakland, Cal., U.S.A., Chemist.

1885. Drake, Chas. A., Three Mills Distillery, Bromley-by-Bow, E., Brewer.
1886. Dreaper, W. P., 68, Victoria Street, Westminster, S.W., Consulting Chemist.
O.M. Drew, D., Lower House Print Works, near Burnley, Calico Printer.
1906. Drew, W. Newton, Raincliffe, Ecclesfield, near Sheffield, Chemical Manufacturer.
1896. Drewsen, Dr. Viggo B., 5, Beekman Street, New York City, U.S.A., Wood Pulp and Paper Expert.
1909. Dreydel, Alfred J., Lamp Department Laboratory, The Edison Swan U.E.L. Co., Ltd., Ponders End, Middlesex, Works Chemist.
O.M. Dreyfus, Dr. C., Clayton Aniline Co., Ltd., Clayton, Manchester, Dye Manufacturer.
1905. Dreyfus, Dr. Isaac, 235, Oneida Street, Milwaukee, Wis., U.S.A., Chemist.
1904. Dreyfus, Dr. L. A., Maple Avenue, Rosebank, S.I., N.Y., U.S.A., Chemist.
1893. Dreyfus, S., Highfield, Osborne Road, Levenshulme, Manchester, Chemist.
1899. Dreyfus, Dr. Wm., 57, East 96th Street, New York City, U.S.A., Chemist.
1899. Drobegg, G., 11, Bartlett Street, Brooklyn, N.Y., U.S.A., Superintending Chemist.
1898. Drummond, Dr. Isaac W., 436, West 22nd Street, New York City, U.S.A., Chemist.
1910. Drury, Chas. Dru, Hendon Gas Works, Sunderland, Engineer.
1903. Dubuque, Edwin D., 416, Dillaye Building, Syracuse, N.Y., U.S.A., Chemist.
1899. Ducas, B. P., 25–27, South William Street, New York City, U.S.A., Chemical and Dyestuff Importer.
1907. Ducca, Dr. Wilhelm, c/o Morgan and Wright, Rubber Works, Detroit, Mich., U.S.A., Chemist.
1905. Duché, E., 6, Eastcheap, London, E.C., and (Jnls.) Usines Duché, Vilvorde, Belgium, Merchant.
1909. Duchemin, René P., 6, Rue Chanoinesse, Paris IV., France, Chemical Engineer.
1897. Duckham, Alex., Phœnix Wharf, West Ferry Road, Millwall, E., Works Chemist.
1908. Duckworth, G. F., North Bay, Ont., Canada, Works Manager.
1905. Duckworth, Harry S., Hamilton Printworks, Lowell, Mass., U.S.A., Printworks Chemist.
1887. Dudley, Prof. W. L., Vanderbilt University, Nashville, Tenn., U.S.A., Professor of Chemistry.
1899. Duff, Wm. S., Merrie Lands, Westbury Road, Buckhurst Hill, Essex, Manufacturing Chemist.
1905. Duffus, W. B., Las Minas de Rio Tinto, Prov. de Huelva, Spain, Chemist.
1901. Dufty, Lawrence, "Lynwood," Tom Lane, Nether Green, Sheffield, Analytical Chemist.
1905. Duggan, Edw. J., c/o Warner Chemical Co., 141, Broadway, New York City, U.S.A., Vice-President.
O.M. Duggan, T. R., 60, Foyle Road, Blackheath, S.E., Analytical Chemist.
1898. Duisberg, Dr. Carl, The Bayer Co., Ltd., (Journals) Elberfeld, Germany; (subscriptions) 19, St. Dunstan's Hill, London, E.C., Chemist.
1905. Dukes, Bernhard, 1, Great James Street, Bedford Row, London, W.C., Patent Agent.
1888. Dukes, T. William, Box 10, Vryheid, South Africa, Merchant.
1906. Duncalfe, Roger, Forge Mills, Bestwood Colliery, Nottingham, Glue Manufacturer.
1889. Duncan, Arthur W., c/o J. Woolley, Sons & Co., Ltd., Victoria Bridge, Manchester, Analytical Chemist.
1909. Duncan, Jas., c/o Steel Bros. & Co., Ltd., 6, Fenchurch Avenue, London, E.C., Merchant.
1909. Duncan, John, c/o Burroughs, Wellcome & Co., Waterloo, Sydney, N.S.W., Works Manager.
1908. Duncan, Prof. Robert Kennedy, 4715, Wallingford Street, Pittsburgh, Pa., U.S.A., Prof. of Industrial Chemistry.
1904. Duncan, W. W., 19, Upland Road, Watertown, Mass., U.S.A., Chemist (Hood Rubber Co.).
1906. Dunford, Jno. H., Trent Side Bone Works, Nottingham, Assistant Manager.
1898. Dunham, Dr. E. K., 35, East 68th Street, New York City, U.S.A., Professor of Bacteriology and Hygiene.
1905. Dunlop, Harry, 231, St. Vincent Street, Glasgow, Chemist.
1892. Dunn, Fred., 193, Collins Street, Melbourne, Victoria, Australia, Analytical Chemist.
O.M. Dunn, Dr. J. T., 10, Dean Street, Newcastle-on-Tyne, Consulting Chemist.
O.M. Dunn, P., Northern Assurance Buildings, Albert Square, Manchester, Chemical Merchant.
1908. Dünschmann, Dr. Max, c/o Meister, Lucius, und Brüning, Ellesmere Port, Cheshire, Manager.
1901. Dunsford, Geo., Laboratory, Wigan Coal and Iron Co., Ltd., Wigan, Analytical Chemist.
1907. Dunstan, A. E., Technical College, East Ham, E., Head of Chemical Department.
1907. Dupré, F. H., 2, Edinburgh Mansions, Howick Place, S.W., Analytical Chemist.
1907. Dupré, P. V., 2, Edinburgh Mansions, Howick Place, S.W., Analytical Chemist.
1897. Durant, H. T., Mining and Metallurgical Club, St. Ermin's, Westminster, S.W., Metallurgist.
1905. Durfee, Winthrop C., 516, Atlantic Avenue, Boston, Mass., U.S.A., Manufacturing Chemist.
1897. Durkee, Frank W., Tuft's College, Medford, Mass., U.S.A., Professor of Chemistry.
1911. Durkin, Jos. A., c/o Butterworth Judson Co., Newark, N.J., U.S.A., Chemical Superintendent.
1907. Durrans, Thos. H., 10, Titchfield Terrace, Regent's Park, London, N.W., Chemist.
1899. Duryea, Chester B., Room 1203, 90, West Street, New York City, U.S.A., Starch Manufacturer.
1906. Dushman, Saul, Faculty of Applied Science, University of Toronto, Canada, Electrochemist.
1891. Dvorkovitz, Dr. P., 45, St. Mary Axe, London, E.C., Technical Chemist.
O.M. Dyer, Dr. B., 17, Great Tower Street, London, E.C., Analytical and Consulting Chemist.
1907. Dyes, Dr. W. A.
1911. Dyke, F. Montague, 8, Springfield Road, Kingston-on-Thames, and Journals to 8, Eaton Road, New Ferry, Cheshire, Analytical Chemist.
O.M. Dyson, C. E., Flint, North Wales.
1902. Dyson, George W., 89, Cowlishaw Road, Sheffield, Analyst.
1892. Dyson, Septimus, Nyddcombe, Warlingham, Surrey, Manufacturing Chemist.

E

1905. Eager, Chas. E., 77, Pearl Street, Boston, Mass., U.S.A., Merchant.
1904. Eames, Charles J., 99, Water Street, New York City, U.S.A., Consulting Chemist.
1910. Eardley, J. F., Elmsdale, Broomhall Park, Sheffield, Pharmaceutical Chemist.
O.M. Earp, W. R., Preston Brook, near Warrington, Chemical Manufacturer.
1910. Easterfield, Prof. Thomas H., Victoria College, Wellington, New Zealand, Prof. of Chemistry.
1884. Eastick, C. E., 13, King Edward Street, Whitechapel, E., Sugar Works Manager.
1909. Eastick, J. C. N., 49A, Clapton Common, London, N.E., Analytical Chemist.
O.M. Eastick, J. J., 49A, Clapton Common, London, N.E., Analytical and Consulting Chemist.
1890. Eastlake, A. W., Grosmont, Palace Road, Streatham Hill, S.W., Consulting Petroleum Engineer.
1909. Eastlake, William H., c/o J. Winfield Scott, 339, George Street, Sydney, N.S.W., Chemist.
1885. Eastwood, Edw., 7, Bolton Road, Port Sunlight, Birkenhead, Soapmaker.
1902. Eastwood, Robert F., 90, Peel House Lane, Widnes Chemist.
1906. Eaton, B. J., Government Chemist.
1909. Eberlin, Leon W., 11, First Street, Rochester, N.Y., U.S.A., Chemist.

1907. Eckenstein, Thos. C., 19, Huskisson Street, Liverpool, Analytical Chemist.

1892. Eddy, Harrison P., Sewage Purification Works, Worcester, Mass., U.S.A., Superintendent.

1901. Eddy, W. Clifton, 53, Sanford Street, Dover, N.J., U.S.A., Chemist.

1885. Edge, Anthony, 79, Milton Street, Readville, Mass., U.S.A., Chemist.

1909. Edge, J. Harold, "Great Marld," Smithills, Bolton, Lancashire, Technical Chemist.

1902. Edison, Thos. Alva, Edison Laboratory, Orange, N.J., U.S.A., Inventor and Manufacturer.

1908. Edmunds, Wm. T., Church Road, Burry Port, Carmarthenshire, Assayer.

1909. Edwards, George M., 241, Pine Avenue West, Montreal, Canada, Paintworks Manager.

1902. Edwards, H. Seaton, 19, Park Road, Port Sunlight, Cheshire, Analyst.

1906. Egleson, J. E., c/o General Chemical Co., Camden, N.J., U.S.A., Chemist.

1895. Ehrenfeld, Prof. Chas. H., York Collegiate Institute, York, Pa., U.S.A., Professor of Chemistry.

1896. Ehrhardt, Ernest F., Badische Anilin und Soda Fabrik, Ludwigshafen a/Rhein, Germany, Research Chemist.

1910. Eilsberger, Dr. Ernst, Deutsche Solvaywerke, Bernburg (Anhalt), Germany, Director.

1910. Eisendrath, David B., c/o B. D. Eisendrath Tanning Co., Racine, Wis., U.S.A., Leather Chemist.

1909. Eisenhart, M. H., c/o Eastman Kodak Co., Kodak Park, Rochester, N.Y., U.S.A., Chemist.

1885. Elborough, T., 59, Mark Lane, London, E.C., Manure Manufacturer.

1901. Elkan, Leo A., Dominick Street and Webster Avenue, Chicago, Ill., U.S.A., Tanner.

1901. Elkins, Arthur W., 116, Prospect Street, East Orange, N.J., U.S.A., Civil Engineer.

1910. Ellerton, J. G., c/o Brotherton and Co., Ltd., Wear Tar Works, Sunderland, Chemist.

1884. Elliott, Dr. A. H., 165, Broadway, New York City, U.S.A., Consulting Engineer and Chemist.

1907. Elliott, George K., c/o Lunkenheimer Co., Cincinnati, Ohio, U.S.A., Chief Chemist.

1896. Elliott, Dr. J. F., c/o Grimwade and Co., 6, Trinity Square, E.C.; and (Journals) O'Connell Street, Sydney, N.S.W., Manufacturing Chemist.

1902. Elliott, Victor G., Chemical Works, Rozelle, Sydney, N.S.W., Australia, Manufacturing Chemist.

1905. Ellis, Carleton, 143, Gates Avenue, Montclair, N.J., U.S.A., Chemical Engineer.

1885. Ellis, C. J., Almorah Villa, Milngavie, near Glasgow, Technical Chemist.

1893. Ellis, E. Victor, 7, Hillside Crescent, Edinburgh, Analytical Chemist.

1894. Ellis, G. Beloe, 70, Chancery Lane, London, W.C., Patent Agent.

1910. Ellis, Ridsdale, 38, Selborne Street, Liverpool Patent Agent.

1910. Ellis, Rowland H., c/o Olympia Oil and Cake Co., Barlby Road, Selby, Yorks., Analytical Chemist.

1907. Ellis, Theodore H., East Brooklyn Station, Baltimore, Md., U.S.A., Oil Refiner.

1891. Ellis, Prof. W. Hodgson, 74, St. Alban Street, Toronto, Ont., Canada, Professor of Applied Chemistry.

1891. Ellison, Henry, Northfield, Cleckheaton, Yorks., Manufacturing Chemist.

O.M. Elmore, A. S., 72, Gloucester Terrace, Hyde Park, London, W., Electro-Metallurgist.

1907. Elms, Jas. W., c/o E. I. du Pont de Nemours Powder Co., Haskell, N.J., U.S.A., Chemist.

1907. Elsden, A. Vincent, 88, Elliscombe Road, Charlton, S.E., Analytical Chemist.

1911. Elsdon, Geo. D., City Analyst's Laboratory, Council House, Birmingham, Analyst.

1904. Elson, J. Hugh, Monroe Drug Co., Quincy, Ill., U.S.A., General Manager.

1909. Ely, Benjamin, The Limes, Pye Bridge, near Alfreton, Tar Distiller.

1910. Emanuel, Louis V., 165, Rector Street, Perth Amboy, N.J., U.S.A., Metallurgical Engineer.

1910. Embley, Dr. E. H., 245, Latrobe Street, Melbourne, Victoria, Australia.

1902. Emery, Arthur L., c/o Smith, Emery, and Co., 651, Howard Street, San Francisco, Cal., U.S.A., Chemical Engineer.

1911. Emery, Earle C., c/o American Alkali and Acid Co., 43, Main Street, Bradford, Pa., U.S.A., Superintendent.

1899. Emery, E. G., c/o Pacific Coast Condensed Milk Co., Seattle, Wash., U.S.A., Technical Chemist and Engineer.

1907. Emmons, Frank W., c/o Washburn Crosby Co., Minneapolis, Minn., U.S.A., Chemist.

1907. Emslie, B. Leslie, 1102–1105, Temple Building, Toronto, Canada, Agricultural Chemist.

1894. Enequist, John, 3710, Avenue J., Brooklyn, N.Y., U.S.A., Chemical Engineer.

1904. Englehard, Charles, 30, Church Street, New York City, U.S.A., Platinum Importer.

1895. English, Frank H., 21, Shelley Avenue, Manor Park, E., Analytical Chemist.

1899. Enright, Bernard, 4036A, Laclede Avenue, St. Louis, Mo., U.S.A., Chemist.

1906. Ephraim, Dr. Julius, Königgraetzerstrasse 69, Berlin, S.W., Germany, Chemist and Patent Agent.

1911. Epps, James W., Holland Street, London, S.E., Chemist.

1909. Epstein, Harry M., c/o Watrous Varnish Co., 20th and Tasker Streets, Philadelphia, Pa., U.S.A., Works Manager.

1907. Erdoes, Julius, 1100, Brook Avenue, New York City, U.S.A., Chemical Engineer.

1902 Erhart, Wm. H., 81, Maiden Lane, New York City, U.S.A., Manufacturing Chemist.

1904. Ermen, Walter F. A., 10, Marsden Street, Manchester, Analytical Chemist.

1905. Ernst, C. A., c/o American Viscose Co., Chester, Pa., U.S.A., Chemist.

1888. Erskine, J. K., P.O. Box 88, Benoni, Transvaal, Analytical Chemist.

1897. Escher, Paul, 1319, Pearl Street, Alameda, Cal., U.S.A., Chemist.

1884. Esilman, A., 25, Roe Lane, Southport, Lancashire, Analytical Chemist.

1910. Esslemont, Alfred S., Royal Exchange Buildings, Hood Street, Newcastle-on-Tyne, Electrical Engineer.

O.M. Estcourt, C., 5, Seymour Grove, Old Trafford, Manchester, Consulting Chemist.

1905. Etheridge, Arthur T., 19, Nithdale Road, Plumstead, S.E., Chemist.

1903. Euler, C. G., 18–20, Platt Street, New York City, U.S.A., Agent for Essential Oils.

1883. Evans, Enoch, 660, Coventry Road, Birmingham, Accountant.

1903. Evans, F. Sparke, Avonside Tannery, Bristol, Tanner.

1905. Evans, Geo. A., 832, Yonge Street, Toronto, Canada, Pharmacist.

1905. Evans, Jacob V. R., c/o Badger State Tanning Co., Shelboygan, Wis., U.S.A., Chemist.

1905. Evans, John, 67, Surrey Street, Sheffield, Analytical Chemist.

1908. Evans, Prof. Nevil Norton, Redpath Library, McGill University, Montreal, Canada, Associate Professor of Chemistry.

1889. Evans, R. E., 3, Glencoe, Stratford-on-Avon, Brewing Chemist.

1903. Evans, Wm. J., 91, Fulton Street, New York City, U.S.A., Manufacturing Chemist.

1898. Evans, Wm. Perceval, Canterbury College, Christchurch, New Zealand, Professor of Chemistry.

1909. Everette, Dr. W. E., 3512, South 11th Street, Tacoma, Wash., U.S.A., Consulting Chemical Engineer.

1910. Everitt, William, Gas Works, Ilkley, Yorks., Manager.

O.M. Evershed, F., c/o Clarke, Nickolls, and Coombs, Hackney Wick, N.E., Chemist.

1907. Eves, Archie P., 762, East Buchtel Avenue, Akron, Ohio, U.S.A., Chemist.

1894. Ewan, Dr. Thos., c/o Cassel Cyanide Co., Shuna Street, Maryhill, Glasgow, Chemist.

1904. Ewing, Dr. A. Ramsay, 2, York Terrace, Shettleston, Glasgow, Technical Chemist.

1905. Eynon, Lewis, 57, Darenth Road, Stamford Hill, N., Chief Chemist (London Beetroot Sugar Association).

F

1898. Fadé, Louis, c/o Dr. F. Stockhausen, Weissfrauenstrasse 7–9, Frankfort a/M., Germany, Chemist and Director.

1902. Fahrig, Dr. Ernst, 3642, Old York Road, Philadelphia, Pa., U.S.A., Consulting Chemical Engineer.

1902. Faill, Jas., 51, Partickhill Road, Glasgow, Technical Chemist.

1902. Fairchild, Benj. T., P.O. Box 1120, New York City, U.S.A., Manufacturing Chemist.

1910. Fairclough, Brereton, Quarry House, Appleton, near Warrington, Cheshire, Miller.

1911. Fairfield, Thos. J., Drury Lane, Solihull, near Birmingham, Analytical Chemist.

1903. Fairhall, E. J., 96, Blackstock Road, Finsbury Park, N., Chemist.

O.M. Fairley, T., 17, East Parade, and (Communications) 8, Newton Grove, Leeds, Analytical Chemist.

1901. Fairlie, Jas., Camelon Chemical Works, Falkirk, N.B., Manufacturing Chemist.

1908. Fairweather, J. H., Laboratory, 19 and 20, Aldgate, London, E.C., Analytical Chemist.

1902. Fairweather, Wallace C., 62, St. Vincent Street, Glasgow, Engineer.

1898. Falding, F. J., 55, Broadway, New York City, U.S.A., Chemical Engineer.

1908. Fales, Harold A., 308, Schermerhorn Street, Brooklyn, N.Y., U.S.A., Secretary (The W. N. Fales Co.).

1910. Farr, Harry, Free Library, Cardiff, Librarian.

O.M. Farrant, N., c/o J. Nicholson and Sons, Chemical Works, Hunslet, Leeds, Chemist.

1897. Farrell, Frank J., 54, Wellesley Road, Great Yarmouth, Analytical Chemist.

O.M. Farrington, T., 4, Waterloo Place, Cork, Ireland, Chemical Engineer.

1909. Fassett, C. M., 209, Wall Street, Spokane, Wash., U.S.A., Analytical Chemist.

1909. Fath, Dr. Arthur, 97, Lueg Allee, Düsseldorf, Obercassel, Germany, Chemical Engineer.

1908. Favre, A., 21, Mincing Lane, London, E.C., Laboratory Furnisher.

1884. Fawsitt, C. A., Atlas Chemical Works, East Nelson Street, Glasgow, Chemical Manufacturer.

1903. Fawsitt, Dr. Chas. E., The University, Sydney, N.S.W., Australia, Prof. of Chemistry.

1906. Feeley, Edward J., 88, Broad Street, Boston, Mass., U.S.A., Aniline Colour Dealer.

1903. Feilmann, Dr. M. E., 92, Victoria Street, Westminster, S.W., Chemist.

1892. Feld, Walther, Hauptstrasse 14, Zehlendorf-Warmseebahn, Germany, Chemical Works Director.

1909. Fell, Wm. M. W., 27, Clarendon Road, Garston, Liverpool, Chemist.

1905. Felton, Herbert L., 516, East Second Street, South Boston, Mass., U.S.A., Distiller.

1900. Ferguson, Prof. Geo. A., 121, West 42nd Street, New York City, U.S.A., Professor of Analytical Chemistry.

O.M. Ferguson, Prof. J., The University, Glasgow, Professor of Chemistry.

1910. Ferguson, Dr. Robert H., 9, North Munn Avenue, East Orange, N.J., U.S.A., Anæsthetist.

1902. Fergusson, Donald M., c/o Acadia Sugar Refining Co., Halifax, N.S., Canada, Analytical Chemist.

1883. Fergusson, H., Prince Regent's Wharf, Victoria Docks, E., Technical Chemist.

1905. Fernberger, Harry M., 1939, North 12th Street, Philadelphia, Pa., U.S.A., Chemist.

1909. Ferrey, Cuthbert E. C., Royal Chambers, Scale Lane, Hull, Analyst.

1908. Ferriz, Abraham, Dinamita (viâ Noé), Durango, Mexico, Government Inspector of Explosives.

1905. Fiebiger, Peter, 530, Canal Street, New York City, U.S.A., Colour Chemist.

1893. Fiebing, John H., 238, Reed Street, Milwaukee, Wis., U.S.A., Leather Trade Chemist.

1885. Field, E. W., Girton, Newark, Notts., Brewer.

1887. Field, S. S., 3, Glenluce Road, Blackheath, S.E., Manufacturing Chemist.

1891. Field, Wm. Eddington, Martin Street, Elsternwick, Melbourne, Victoria, Chemist.

1909. Fifield, Fred. A., 189, Dowling Avenue, Toronto, Canada, Superintendent.

1900. Fillis, Frank, 106, London Road, Neath, South Wales, Cement Works Manager.

1907. Finch, Archibald M., Vitriol and Chemical Works, Cwmbran, R.S.O., Monmouthshire, Chemical Manufacturer.

1904. Finch, Martin L., Vitriol and Chemical Works, Cattedown, Plymouth, Chairman of Directors.

1910. Findlater, James, c/o Price's Patent Candle Co., Ltd., Bromborough Pool, near Birkenhead, Chief Chemist.

1905. Findlay, Dr. Alex., The University, Edgbaston, Birmingham, Lecturer on Physical Chemistry.

1910. Findley, Albert E., Dept. of Applied Science, The University, Sheffield, Lecturer.

1899. Fingland, Jno. J., Kaslo, B.C., Canada, Analytical Chemist.

1904. Finn, Cornelius P., Hemsworth Colliery, near Wakefield, Yorks., Technical Chemist.

1903. Fischer, Dr. Carl, 213–215, Water Street, New York City, U.S.A., Chemist.

1903. Fish, Chas C. R., 439, Boylston Street, Boston, Mass., U.S.A., Chemist.

1905. Fish, Chas. H., Garner Printworks and Bleachery, Wappinger's Falls, N.Y., U.S.A., General Manager.

1900. Fisher, Henry, 57, East 83rd Street, New York City, U.S.A., Teacher of Chemistry.

O.M. Fisher, W. W., 5, St. Margaret's Road, Oxford, Chemical Lecturer.

1895. Fison, Jno., Messrs. Jas. Fison and Sons, Thetford, Norfolk, Chemical Manufacturer.

1904. Fitch, A. J., 1, Summerlands Mansions, Muswell Hill, N., Brewer's Chemist.

1900. Fitz-Randolph, R. B., State Laboratory of Hygiene, Trenton, N.J., U.S.A., Bacteriologist and Chemist.

1896. Flammer, E., c/o Kraemer und Flammer, Heilbronn a/N., Wurttemberg, Germany, Manufacturing Chemist.

1892. Fleming, J. Arnold, Britannia Pottery, 136, Glebe Street, Glasgow, Potter.

1903. Fleming, Jno. A., R.F.D. No. 2, Bethesda, Md., U.S.A., Engineer.

O.M. Fletcher, A. E., Coombe Lea, Dorking, Surrey, Ex-Chief Inspector Alkali, &c., Works.

1893. Fletcher, E. Morley, 30, Grosvenor Place, Newcastle-on-Tyne, Alkali Works Inspector.

O.M. Fletcher, F. W., c/o Fletcher, Fletcher, & Co., Ltd., Holloway, N., Manufacturing Chemist.

1907. Fletcher, H. T., c/o The Bauxite Refining Co., Hebburn-on-Tyne, Works Manager.

1891. Fletcher, R. Jaques, North Geelong, Victoria, Manufacturing Chemist.

1904. Fletcher, Wm. E., 38B, Hunter Street, Tamaqua, Pa., U.S.A., Chemist.

1899. Focht, Louis, 105, E. Hanover Street, Trenton, N.J., U.S.A., Civil Engineer.

1890. Foden, Alfred, 19, Lancaster Avenue, Sefton Park, Liverpool, Metallurgical Chemist.

1900. Foersterling, Dr. H., c/o Roessler Hasslacher Chem. Co., Perth Amboy, N.J., U.S.A., Chemist.

1900. Fogetti, Lucien, 7001, Narrows Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1901. Folsom, Herbert A., 112, Water Street, Boston, Mass., U.S.A., Textile Chemist.

1900. Forbes, Eli, Lancaster, Mass., U.S.A., Chemist.

1895. Forbes, Paul R., 15, William Street, New York City, U.S.A., Chemist and Assayer.

1893. Ford, J. B., jun., Michigan Alkali Co., Wyandotte, Mich., U.S.A., Secretary and Treasurer.

1889. Ford, Jno. S., Abbey Brewery, Edinburgh, Analyst.

1905. Foregger, Dr. R. von, c/o Roessler & Hasslacher Chemical Co., 100, William Street; and (Journals) P.O. Box 1999, New York City, U.S.A., Chemist.

1899. Forel. Geo., 212, Route de Vienne, Lyon (Rhône), France, Chemist.

1885. Formoy, J. Arthur, Chestham, Grange Road, Sutton, Surrey, Oil Expert.

1904. Forrest, Chas. N., Maurer, N.J., U.S.A., Chemist.

1898. Forrest, J. Kerr, 271, Carlisle Street, St. Kilda, Victoria, Australia, Manufacturing Chemist.

1890. Forrester, A. M., c/o Richmond Guano Co., Richmond, Va., U.S.A., Analytical Chemist.

1905. Forrester, H. A., Fabrica de Productos Quimicos, Acevedo 1710, Palermo, Buenos Ayres, S. America, Chemical Works Manager.

1909. Forshaw, Arthur, 104, Holly Road, Handsworth, Birmingham, Works Chemist.

1902. Forstall, Alf. E., 58, William Street, New York City, U.S.A., Consulting Gas Engineer.

1901. Forster, Miss E. L. B., King's College, Strand, London, W.C., Analyst.

1902. Forster, Ferdinand E. P., c/o Messrs. Bass and Co., 19, Guild Street, and (Jnls.) The River House, Burton-on-Trent, Chemist.

1907. Forster, Francis, Tyne Lead Works, Hebburn-on-Tyne, Lead Manufacturer.

1899. Forster, Dr. M. O., F.R.S., Royal College of Science, South Kensington, S.W., Demonstrator of Chemistry.

1884. Forster, Ralph C., c/o Messrs. Bessler, Waechter, and Co., Salisbury House, Finsbury Circus, London, E.C., Chemical Merchant.

1884. Forth, Henry, Stoke Lacy, Marple, Cheshire, Drysalter.

1907. Forward, Charles C., Dept. of Inland Revenue Laby., 317, Queen Street, Ottawa, Canada, Chemist.

1906. Foster, Robt. K., Church Street, Middle Brighton, Melbourne, Victoria, Pharmaceutical Chemist.

O.M. Foster, R. Le Neve, Fulshaw Cottage, Wilmslow, Cheshire, Manufacturing Chemist.

1888. Foster, Wm., St. Martin's Terrace, Newton Park, Leeds, Manufacturing Chemist.

1906. Foucar, J. Louis, 15, Morden Road, Blackheath, S.E., Chemist.

1904. Foust, Thomas B., c/o Red River Furnace Co., Clarksville, Tenn., U.S.A., Chemist.

1891. Fowler, Dr. Gilbert J., Broad Oak, Urmston, near Manchester, Consulting Chemist (Manchester Corporation Rivers Committee).

1898. Fowler, Theo. V., P.O. Drawer 15, Buffalo, N.Y., U.S.A., Chemical Works Manager.

1909. Fowler, Wm., Glenwood, Bearsden, Glasgow, Chemist.

1896. Fox, A. Stanley, Greycote, Westcliff, Herne Bay, Kent, Chemist (Cotton Powder Co., Ltd.).

1898. Fox, Jno., Varuna, Grappenhall, Cheshire, Analyst.

1909. Fox, J. J 9, Blackheath Rise, London, S.E., Managing Director, Tidman and Son, Ltd.

O.M. Fox, T., jun., c/o Fox Bros. and Co., Ltd., Wellington, Somerset, Wool Manufacturer.

1905. France, Edward W., Philadelphia Textile School, Broad and Pine Streets, Philadelphia, Pa., U.S.A., Director.

O.M. Francis, E. G., 29, Matheson Road, West Kensington, W., Glucose Works Manager.

O.M. Francis, G. Bult, The British Drug Houses, Ltd., 22-30, Graham Street, City Road, London, N., Wholesale Druggist.

O.M. Francis, W. H., 11, Bramham Gardens, South Kensington, London, S.W., Wholesale Druggist.

1903. Francksen, Dr. Aug., 4803, Garden Street, Bridesburg, Philadelphia, Pa., U.S.A., Chemist.

1906. Frank, Prof. Dr. A., Berlinerstrasse 26, Charlottenburg, Germany, Chemist.

1908. Frank, Dr. Fritz, Markgrafenstrasse 88, Berlin, S.W., 68, Germany, Public Analyst.

1894. Frank, Jerome W., 29, Broadway, New York City, U.S.A., Chemist.

1886. Frankenburg, Isidor, Greengate Rubber Works, Salford, Manchester, India-rubber Manufacturer.

1895. Frankforter, Dr. G. B., University of Minnesota, Minneapolis, Minn., U.S.A., Prof. of Chemistry.

1904. Frankl, A., Clothilde Chemical Works, Nagy Bocskó, Hungary, Chief Manager.

O.M. Frankland, H., Streonshalh, The Crescent, Linthorpe, Middlesbrough, Analytical Chemist.

O.M. Frankland, Prof. P. F., F.R.S., The University, Edgbaston, Birmingham, Professor of Chemistry.

1906. Fraps, Dr. Geo. S., Texas A. & M. College, College Station, Texas, U.S.A., Professor of Chemistry.

1901. Frasch, Hans A., 52, Broadway, New York City, U.S.A., Manager.

1900. Frasch, Herman, 82, Beaver Street, New York City, U.S.A., Oil Refiner.

1910. Fraser, Arthur, Casilla 1464, Valparaiso, Chile, Analyst.

1904. Fraser, Jas. D., 5, Millbrae Crescent, Langside, Glasgow, Chemist.

1891. Fraser, L. McG., 98, Commercial Road East, London, E., Chemical Engineer.

1907. Fraser, Wm. M., c/o The Texas Co., Port Neches, Texas, U.S.A., Chemist.

1902. Frederick, Geo. E., jun., P.O. Box 762, New York City, U.S.A., Chemical Merchant.

1885. Freear, H. M., Hardwick Road, Woburn Sands Beds., Analytical Chemist.

1911. Freed, John P., 45, Milk Street, Boston, Mass., U.S.A., Nickel Manufacturer.

1899. French, Alf., Dispenser.

1900. French, Thos., 1, Kelvinside Terrace West, Glasgow, Chemist.

1911. French, Wm., Meadowside, Lancaster, Manager (Jos. Storey and Sons, Ltd.).

1903. Frerichs, Dr. F. W., Herf and Frerichs Chemical Co.; and (Journals), 4320, Washington Boulevard, St. Louis, Mo., U.S.A., Manufacturing Chemist.

1907. Freytag, Henry, c/o O. Isler & Co., 35, Dickinson Street, Manchester, Chemical Merchant.

1886. Fries, Dr. Harold H., 92, Reade Street, New York City, U.S.A., Chemical Manufacturer.

1902. Fries, Jno. W., Winston Salem, N.C., U.S.A., Cotton Manufacturer.

1899. Fritzsche, Karl, c/o Schimmel und Co., Miltitz, near Leipzig, Germany, Manufacturer of Essential Oils.

1890. Frost, Dr. Howard V., 3769, Lake Avenue, Chicago, Ill., U.S.A., Professor of Chemistry.

1884. Frost, Joe, Storth's Mill, Mold Green, Huddersfield, Manufacturing Chemist.

O.M. Fryer, Dr. A. C., 13, Eaton Crescent, Clifton, Bristol, Alkali Works Inspector.

1904. Fryer, Percival J., 45, Burnaby Gardens, Chiswick, W., Analyst.

1906. Fuchs, Herman C., 744, Westminster Road, Brooklyn, N.Y., U.S.A., Dry Colour Chemist.

1903. Fudge, T., 32, West 38th Street, Bayonne, N.J., U.S.A., Chemist.

1889. Fuerst, Jos. F., 17, Philpot Lane, London, E.C., Chemical and Oil Merchant.

1895. Fuerst, W. F., 87, Nassau Street, New York City, U.S.A., Chemical Merchant.

1894. Fuller, Chas. J. P., 603, Chorley New Road, Horwich, near Bolton, Analytical Chemist.

1902. Fuller, Henry C., Bureau of Chemistry, Washington, D.C., U.S.A., Analytical Chemist.

1899. Fuller, Robt. F., Neston Park, Corsham, Wilts., Rubber Manufacturer.

O.M. Fuller, Wm., Vanbrugh Cottage, Maze Hill, S.E., Chemist.

1898. Fulmer, Elton, Pullman, Wash., U.S.A., Professor of Chemistry.

1896. Fulton-Smith, J., 20, Bold Street, Warrington Brewer.

1909. Fulweiler, W. H., c/o United Gas Improvement Co., Broad and Arch Streets, Philadelphia, Pa., U.S.A., Engineer.

1885. Fyfe, Jno., 7, West George Street, Glasgow, Oil Works Director.

G

O.M. Gabbett, E. R., 64, Vanbrugh Road, Blackheath, S.E.; (Journals) Prince Regent's Wharf, Silvertown, E., Chemical Engineer.

1909. Gaede, Chas. W., c/o National Silk Dyeing Co., Williamsport, Pa., U.S.A., Silk Dyer.

1906. Gagnebin, Chas. L., 140, Oliver Street, Boston, Mass., U.S.A., Dyestuff Merchant.

1907. Gaines, Richard H., 147, Varick Street, New York City, U.S.A., Chemist (Board of Water Supply).

1904. Gair, C. J. Dickenson, 39, Cranston Road, Forest Hill, S.E., Analytical Chemist.

1890. Gajjar, T. K., Techno-chemical Laboratory, Girgaum, Bombay, India, Consulting Chemist.

1884. Gall, Henry, 4, Rue Albert Joly, Versailles, France, Technical Chemist.

1905. Gall, J. B., c/o Callender's Cable and Construction Co., Belvedere, Kent, Chemist.

1911. Gallagher, Jas. L., c/o Lever Bros., Ltd., Sydney, N.S.W., Australia, Chemist.

1897. Galletly, J. C., Research Laboratories, The Diamond Rubber Co., Akron, Ohio, U.S.A., Rubber Chemist.

1901. Gallivan, Dr. Frank B., 184, Summer Street, Boston, Mass., U.S.A., Chemist.

1903. Gallum, Albert F., Milwaukee, Wis., U.S.A., Tanner.

1901. Gallup, W. Arthur, Arnold Printworks, North Adams, Mass., U.S.A., Printer.

1901. Galpin, Harry T., 57, West 57th Street, New York City, U.S.A., Chemist.

1891. Galt, Hugh Allen, Columbia Chemical Co., Barberton, Ohio, U.S.A., Works Manager.

1887. Gamble, Jas. N., (Journals) A. E. Anderson, Procter and Gamble Co., Ivorydale, Ohio, U.S.A., Soap Manufacturer and Oil Refiner.

1894. Gane, Eustace H., 91, Fulton Street, New York City, U.S.A., Pharmaceutical Chemist.

1901. Gansser, Dr. A., c/o Messrs. Lepetit, Dollfus, & Gansser, Garessio-Ponte (Provincia di Cuneo), Italy, Chemical Engineer.

1911. Garbutt, C. Durham, 2, Hartington Road, Garston, Liverpool, Analytical Chemist.

1896. Gardair, Aimé, 51, Rue St. Ferréol, Marseilles, France, Director of Chemical Co.

1910. Gardner, Arthur L., 233, Water Street, Perth Amboy, N.J., U.S.A., Chemical Engineer.

1907. Gardner, Edward, The Tryst, Bigwood Road, Meadway, Hendon, N.W., Metallurgical Chemist.

1909. Gardner, Henry A., 3500, Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemist.

1891. Gardner, Prof. Walter M., Technical College, Bradford, Director of Chemical and Dyeing Departments.

1897. Garfield, Jos., Thackley, Bradford, Yorks., Civil Engineer.

1888. Garibaldi, Joachim A., 21, Church Place, Gibraltar, Chemist.

1910. Garland, Charles S., 57, Garratt Lane, Wandsworth, S.W., Chemist and Works Manager.

1907. Garland, Herbert, P.O. Box 417, Cairo, Egypt, Chemist (Government Laboratory).

1905. Garle, John L., 17, John Street, Bedford Row, London, W.C., Consulting Chemist.

1890. Garrett, Dr. F. C., Armstrong College, Newcastle-on-Tyne, Teacher of Science.

1900. Garrigues, W. E., Foot of Lieb Street, Detroit, Mich., U.S.A., Chemical Engineer.

1906. Garroway, Major John, 58, Buchanan Street, Glasgow, Chemist.

1908. Garson, Jas. W., 12, Avenue Road, Crouch End, N., Managing Director, Lewis Berger & Sons, Ltd.

O.M. Garton, Sir Richard, Messrs. Hill, Garton, & Co., Southampton Wharf, Battersea, S.W., Glucose Manufacturer.

1886. Gascoyne, Dr. W. J., 27, South Gay Street, Baltimore, Md., U.S.A., Analytical Chemist.

O.M. Gaskell, Holbrook, Erindale, Frodsham, Cheshire, Alkali Manufacturer.

1902. Gaskell, Holbrook, jun., Hillcroft, Church Road, Woolton, near Liverpool, Engineer.

1908. Gatehouse, Frank B., 3, Lawrence Road, Romford, Essex, Chemist and Technical Journalist.

O.M. Gatheral, Geo., 174, Soho Hill, Handsworth, Birmingham.

1906. Gaunt, Percy, Macclesfield Corporation Sewage Works, Prestbury, near Macclesfield, Chemist.

1903. Gaylord, Wallace K., Throop Polytechnic Institute, Pasadena, Cal., U.S.A., Professor of Chemistry.

1904. Gazdar, J. J., Fox Hall, Upminster, Essex, Barrister-at-Law.

1907. Geer, William C., 50, Hawthorne Avenue, Akron, Ohio, U.S.A., Chemist.

1891. Geisler, Dr. Jos. F., New York Mercantile Exchange Building, 6, Harrison St., New York City, U.S.A., Consulting Chemist.

1901. Gemmell, G. H., 4, Lindsay Place, George IV. Bridge, Edinburgh, Analytical Chemist.

1907. Gemmell, Wm., Walpole House, Church Street, Teddington, Middlesex, Analytical Chemist.

1901. Gent, Percy W., Trentholme, Misterton, near Gainsboro', Chemist.

1897. Gent, Wm. T., Springfield, Misterton, near Gainsboro', Metallurgical Chemist.

1905. George, J. K., 345, Fifth Avenue, New York City, U.S.A., Manufacturer.

1903. Georgii, Max, 606, F Street N.W., Washington, D.C., U.S.A., Patent Attorney.

1906. Gerkensmeyer, Henry H., 210, First Avenue, Joliet, Ill., U.S.A., Chemist.

O.M. Gerland, Dr. B. W., 105, Plantation Street, Accrington, Consulting Chemist.

1910. Gessler, Dr. Albert, 59, Simonson Avenue, Clifton S.J., New York City, U.S.A., Chemist.

1905. Geussler, Dr. Otto, Tuchmanufactur Baron A.L. von Stieglitz, Narva, Russia, Chemist.

1903. Ghose, Anukul, 42, Shambazar Street, Calcutta, India, Analyst.

1908. Gianoli, Guiseppe, Piazza Cordusio 2, Milano, Italy, Chemical Engineer and Editor (L'Industria).

1911. Gibbings, Walter A., c/o Messrs. Scharff, Oil Mills, Shanghai, China, Works Manager and Chemist.

1903. Gibbings, Wm., Woodside, Halebank, Widnes, Works Manager.

1910. Gibbins, Roland B., 18, Wheeley's Lane, Birmingham, Chemical Manufacturer.

1902. Gibbon, Edw., Belvedere, Park Road, Clydach, R.S.O., Glam., Works Chemist.

1904. Gibbs, A. E., Wyandotte, Mich., U.S.A., Manufacturing Chemist.

1883. Gibbs, D. Cecil, Soap Manufacturer.

O.M. Gibbs, Wm. P., The Sulphite Pulp Mills, Hjerpen, Sweden, Analytical Chemist.

O.M. Gibson, Dr. J., Chemical Lecturer.

O.M. Gibson, J. M., c/o Buckley Brick and Tile Co., Buckley, *via* Chester, Brick and Tile Manufacturer.

1905. Gibson, John, Victorian Portland Cement Works, Burnley Street North, Richmond, Vic., Australia, Manager.

1905. Gibson, Wm. F., 18, Bushy Park, Totterdown, Bristol, Works Chemist.

1899. Gifford, Wm. E., 408, New Jersey Railroad Avenue, Newark, N.J., U.S.A., Chemist.

1892. Gilbard, J. Francis H., 245, Dalston Lane, Hackney, N.E., Analytical Chemist.

1905. Gilbertson, Isaac H., 5, Broad Street, Rhodes, near Middleton, Lancs., Calico Printer.

1903. Gilby, Joseph W., 3, Graham's Terrace, Thornhill Street, Wakefield, Works Chemist.

O.M. Gilchrist, Percy Carlyle, F.R.S., A.R.S.M., M.Inst.C.E. & M.E., Reform Club, Pall Mall, London, S.W.

1884. Gilchrist, Peter S., Charlotte, N.C., U.S.A., Chemical Engineer.

1900. Gildersleeve, W. H., Middlesboro', Ky., U.S.A., Chemist.

O.M. Giles, W. B., The Grange, Leyton, Essex, Chemical Manufacturer.

1886. Gill, Dr. Aug. H., Massachusetts Institute of Technology, Boston, Mass., U.S.A., Professor of Technical Analysis.

1909. Gill, John H., 16, Premier Road, Gregory Boulevard, Nottingham, Soapworks Chemist.

1901. Gill, Wm. S., c/o Farquhar and Gill, North of Scotland Colour Works, Aberdeen, Colour and Varnish Manufacturer.

1903. Gillean, R. Hampson, c/o The Watson Foster Co., Ltd., Maisonneuve, Quebec, Canada, Chemist.

1901. Gilles, Wm. S., The Cottage, Bocking, near Braintree, Essex, Technical Chemist.

1910. Gillett, Horace W., c/o The Aluminium Castings Co., Detroit, Mich., U.S.A., Research Chemist.

1888. Gillman, Gustave, Ferrocarril de Murcia á Granada, Aguilas, Prov. de Murcia, Spain, Civil Engineer.

1891 Gimingham, Edw. A., Croyland, Clapton Common, N., Technical Electrician.

1886. Girdwood, Dr. G. P., 111, University Street, Montreal, Canada, Professor of Chemistry.

1906. Girtin, Thomas, H. L. Raphael's Refinery, 48, Thomas Street, Burdett Road, London, E., Bullion Refiner.

1903. Gladding, Thos. S., 181, Front Street, New York City, U.S.A., Analytical Chemist.

1886. Glaeser, F. A., Carpenters' Road, Stratford, E., Varnish Manufacturer.

1906. Glasel, Dr. Chas. J., Brüderstrasse 39, Berlin, Germany, Tanner.

1889. Glaser, Chas., 22, South Gay Street, Baltimore, Md., U.S.A., Consulting Chemist.

1906. Glass, A. Melville, 37, Chancery Lane, London, W.C., Patent Agent.

1907. Gleason, Fred. J., Walpole, Mass., U.S.A., Superintendent (Mass. Chemical Co.).

1901. Glegg, Robt., Agricultural Laboratory, Marischal College, Aberdeen, Analytical Chemist.

1894 Glen, Chas., Glengowan Printworks, Caldercruix, N.B., Calico Printer.

1900. Glendenning, Arthur, 31, Bright Street, Middlesbrough, Analytical Chemist.

1884. Glendinning, H., Winnington Park, Northwich, Cheshire, Technical Chemist.

1888. Gloag, Robt. F., Lothian Road, Middlesbrough, Secretary.

O.M. Glover, G. T., 23, Craven Hill Gardens, Lancaster Gate, W., Chemical Works Manager.

1896. Glover, H., c/o Powers, Weightman, Rosengarten Co., East Falls, Schuylkill, Philadelphia, Pa., U.S.A., Chemical Works Superintendent.

1905. Glover, Nathan H., 355, River Street, Mattapan, Boston, Mass., U.S.A., Gum Manufacturer.

O.M. Glover, William, Albareda 27, Seville, Spain, Technical Chemist.

1911. Goetschius, John M., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Sales Manager.

1896. Goetz, Isidore, 48, Mapesbury Road, Brondesbury, N.W., Mine Manager.

1907. Goldie, J. H. D., Hambledon Mill, Cairns, North Queensland, Chemist.

1898. Golding, Jno., Ashby Road, Kegworth, Derby, Agricultural Chemist.

1909. Goldman, M. Leon, The Crown Cork and Seal Co., 1511, Guilford Avenue, Baltimore, Md., U.S.A., Chemical Engineer.

1906. Goldschmidt, Dr. Karl, Chemical Works, Essen Ruhr, Germany, Manufacturing Chemist.

O.M. Goldschmidt, Dr. S. A., 11, Broadway, New York City, U.S.A., President (Columbia Chemical Works).

1897. Goldschmiedt, Dr. Guido, Laboratory, II Salmgasse 1, Prag, Austria, Professor in Imperial German University.

1895. Goldsmith, Byron B., 19, East 74th Street, New York City, U.S.A., Vice-President (American Lead Pencil Co.).

1899. Goldsmith, Dr. Jno. N., 67, Chancery Lane, London, W.C., Chemist.

1906. Goodall, Wm. Leslie, Finboro' Road, Stowmarket, Suffolk, Works Chemist.

1909 Goodban, Leonard, 43, Addison Gardens, Kensington, London, W., Works Chemist.

1900. Goodchild, Wm. H., 31, Etchingham Park Road, Finchley, N., Chemist.

1906. Goodhue, Leonard H., c/o Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.

1904 Gooding, E. Claude, Willow House, Washford, Somerset, Chemical Student.

1898. Goodrich, Chas. C., Broad Exchange Building, 25, Broad Street, New York City, U.S.A., Rubber Manufacturer.

1884. Goodwin, C. C., Racefield, St. Margaret's Road, Altrincham, Cheshire, Soapmaker.

1894. Goodwin, Dr. W. L., The School of Mining, Kingston, Canada, Professor of Chemistry.

O.M. Goppelsroeder, Prof. Dr. F., Leimenstrasse 51, Basel, Switzerland, Professor of Chemistry.

1884. Gordon, J. G., Queen Anne's Mansions, Westminster, S.W., Steel Manufacturer.

1908. Gordon, Read, c/o Gordon and Dillworth, 563–5, Greenwich Street, New York City, U.S.A., Food Manufacturer.

1897. Gossage, W. Winwood, Widnes, Lancashire, and (Journals) Abbots Lea, Woolton, Liverpool, Soap Manufacturer.

1909. Gosse, Abel, 122, Boulevard St. Germain, Paris, France, Engineer (Poulenc Frères).

1904. Gotthelf, August H., Hastings-on-Hudson, N.Y., U.S.A., Chemist.

1890. Goulding, Sir Wm. J., Bart., North Wall, Dublin, Manure Manufacturer.

1903. Govers, Francis X., Tuckshoe, N.Y., U.S.A., Chemist.

O.M. Gowland, Prof. W., 13, Russell Road, Kensington, W., Professor of Metallurgy (Royal School of Mines).

1886. Goyder, G. A., 110, Gawler Place, Adelaide, South Australia, Chemist and Assayer.

1890. Grabfield, Dr. J. P., c/o Morris and Co., Chemical Laboratory, Union Stock Yards, Chicago, Ill., U.S.A., Chemist.

1906. Graesser, Norman H., Argoed Hall, Llangollen, N. Wales, Manufacturing Chemist.

1883. Graesser, R., Cefn, near Ruabon, North Wales, Manufacturing Chemist.

O.M. Graham, C. C., Oriel House, Scarborough, Yorks., and (Journals) H. C. Graham, c/o Blundell, Spence, & Co., Ltd., Hull, Technical Chemist.

1908. Graham, Chas. W., 142, Bloor Street West, Toronto, Canada, Chemist.

1883. Grandage, H., Lancaster House, 80, Princess Street, Manchester, Dyer.

1897. Granger, Dr. J. Darnell, Muggenhoferstrasse 44, Nürnburg, Germany, Analytical Chemist.

1905. Grant, Alexander, 13, Kilgraston Road, Edinburgh, Baker.

1896. Graves, Geo. H., c/o General Chemical Co., Bridgeport, Conn., U.S.A., Manufacturing Chemist.

1896. Graves, Walter G., 1950, East 90th Street, Cleveland, Ohio, U.S.A., Chemist.

1884. Gray, G. Watson, 8, Inner Temple, Dale Street, Liverpool, Consulting Chemist and Assayer.

1910. Gray, H. Le Breton, c/o Eastman Kodak Co., Rochester, N.Y., U.S.A., Superintendent, Film Department.

1907. Gray, Henry M., Broompark, Duffield, Derby, Engineer.

1904. Gray, Jas., Heymann's Laboratory, P.O. Box 3427, Johannesburg, Transvaal, Chemist.

1901. Gray, J. Campbell, The Cottage, Strines, near Stockport, Printworks Chemist.

1886. Gray, Jno., 3, Victoria Drive, Rock Ferry, near Birkenhead, Technical Chemist.

1903. Gray, Jno. Lathrop, c/o Tide Water Oil Co., East 22nd Street, Bayonne, N.J., U.S.A., Assistant Superintendent (Paraffin Works).

1910. Gray, Matthew A., c/o Ogilvie Flour Mills Co., Montreal, Canada, Chemist.

1896. Gray, Dr. Thos., The Technical College, Glasgow, Professor of Technical Chemistry.

1905. Gray, W. B., Messrs. Lever Bros., Balmain, Sydney, N.S.W., Australia, Analytical Chemist.

1903. Gray, Wm. S., 76, William Street, New York City, U.S.A., Chemical Merchant.

1908. Gray, Wm. T., Port Credit, Ontario, Canada, Starch Manufacturer.

1894. Greaves, Wm., Coppée Coke Ovens, Pinxton, Alfreton, Chemical Engineer and Chemist.

1909. Greeff, Robert, jun., 20, Eastcheap, London, E.C., Chemical Merchant.

1894. Greeff, R. W., 20, Eastcheap, London, E.C., and (Journals) Broad Oak, Chislehurst, Chemical Merchant.

O.M. Green, Prof. Arthur G., 49, Cardigan Road, Headingley, and Clothworkers' Department, The University, Leeds, Professor of Dyeing.

1907. Green, Clarence, c/o Nicholson and Co., Beaumont Works, St. Albans, Herts., Chemist.

1906. Green, Ernest, 98, Cheadle Road, Cheadle Hulme, Cheshire, Science Teacher.

O.M. Green, H., Hayle Mill, Maidstone, Paper Manufacturer.

1896. Green, Jno. Wilberforce, 42, Dunmore Road, Wimbledon, S.W., Technical Chemist.

O.M. Green, L., Lower Tovil, Maidstone, Paper Manufacturer.

1910. Green, Robert M., c/o F. Reddaway & Co., Norfolk Road, Ponder's End, N., Chemist.

1908. Green, Dr. W. Heber, Chemical Laboratory, The University, Melbourne, Victoria, Lecturer in Chemistry.

O.M. Greenaway, A. J., The Orchard, Chertsey, Surrey, Sub-Editor of Chemical Society's Journal.

1909. Greenhough, George D., 21, Mincing Lane, London, E.C., Chemical Broker.

O.M. Greenway, T. J., c/o Potter's Sulphide Ore Treatment, Ltd., 369, Collins Street, Melbourne, Australia, Metallurgist.

1902. Greenwood, Conrad V., Noyna, Dowhills Road, Blundellsands, Liverpool, Cotton Mill Manager.

1907. Greenwood, Herbert W., 16, Longland Road, Liscard, Cheshire, Metallurgical Chemist.

O.M. Greenwood, Holmes, Regent House, Hartmann Street, Accrington, Lancashire, Technical Chemist.

1897. Gref, Anthony, 117, Hudson Street, New York City, U.S.A., Patent Lawyer.

1909. Gregory, Cecil H., The Morgan Crucible Co., Ltd., Battersea Works, London, S.W., Crucible Manufacturer.

1907. Gregory, Joshua C., 128, Wellington Street, Glasgow, Analytical and Consulting Chemist.

1890. Griffin, Jno. R., Kemble Street, Kingsway, W.C., Chemical Apparatus Maker.

1886. Griffin, Martin L., c/o Oxford Paper Co., Rumford, Maine, U.S.A., Chemist.

1909. Griffiths, E., Chemical Department, The University, Sydney, N.S.W., Australia, Demonstrator.

1902. Griffiths, Manfred E., Caizley House, Temple Road, Stowmarket, Suffolk, Explosives Chemist.

1894. Griffiths, Thos., The Cedars, Clapham Common, S.W., Manufacturing Chemist.

1902. Grimwade, Wilfrid R., 335—343, Spencer Street, West Melbourne, Vic., Australia, Manufacturing Chemist.

1900. Grimwood, Robt. G., 43, Leaside Avenue, Muswell Hill, N., Analytical Chemist.

O.M. Grindley, J., Upper North Street, Poplar, London, E., Tar Distiller.

1905. Grip, August E., 495, Columbia Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.

1888. Gripper, Harold, Great Central Railway, Gorton, Manchester, Analytical Chemist.

1909. Grist, John M., 10, Cumberland Avenue, Gravesend, Kent, Explosive Works Chemist.

1906. Groenewoud, Sidney H., 36, Grosvenor Road, Highbury, N., Analytical Chemist.

O.M. Grossmann, Dr. J., 157, Plymouth Grove, Manchester, Consulting Chemist and Chemical Engineer.

1896. Grosvenor, W. M., jun., 1123, Broadway, New York City, U.S.A., Consulting Chemical Engineer.

1908. Grottanelli, Dr. F. W., Dinamite Nobel, Avigliana, Torino, Italy, Industrial Chemist.

1909. Grove, Daniel, Clarence Estate, Sarnia, Durban, Natal, Newspaper Proprietor.

O.M. Groves, C. E., F.R.S., 352, Kennington Road, London, S.E., Chemist (Thames Conservancy).

1907. Groves, J. Stuart, c/o E. I. du Pont de Nemours Powder Co., Georgetown, S.C., U.S.A., Chemist.

1899. Gudeman, Dr. E., 903, Postal Telegraph Building, Chicago, Ill., U.S.A., Chemist.

1906. Guess, Geo. A., Cerro de Pasco, Peru, South America, Chemist.

1899. Guild, Frank N., University of Arizona, Tucson, Arizona, U.S.A., Professor of Chemistry.

1909. Gullick, Wm. A., Government Printing Office, Sydney, N.S.W., Government Printer.

1906. Gulline, Percy, Merrimack Manufacturing Co., Lowell, Mass., U.S.A., Printworks Superintendent.

1904. Gundlach, Walter, 843, West End Avenue, New York City, U.S.A., Superintendent of Colour Works.

1905. Gundlich, Dr. Charles, Park Street and Central Avenue, Hackensack, N.J., U.S.A., Technical Chemist.

1903. Gunn, Gilbert, 181, Bury New Road, Heywood, Lancs., Paper Mill Chemist.

1900. Günther, Chas. E., Liebig's Extract of Meat Co., Ltd., 4, Lloyd's Avenue, London, E.C., Merchant.

1910. Gunther, C. M., Pyrmont Sugar Refinery, Sydney, N.S.W., Sugar Chemist.

1899. Gutcher, Wm., Singapore Oil Mills, Singapore, S.S., Superintendent Engineer.

1903. Guthrie, Alan, c/o Cooper, Allen, and Co., Cawnpore, India, Leather Chemist.

1901. Guthrie, John M., 199, Ferry Road, Leith, N.B., Analytical Chemist.

1909. Guttmann, Camillo J., 18, Aberdare Gardens, West Hampstead, N.W., Chemical Engineer.

1903. Guttmann, Dr. Leo F., School of Mining, Queen's University, Kingston, Ont., Canada, Research Chemist.

H

1904. Hacking, D. H., Enfield Soap Works, Clayton-le-Moors, near Accrington, Lancs., Soap Manufacturer.

1900. Haddock, Arthur G., c/o The Castner-Kellner Alkali Co., Wallsend-on-Tyne, Technical Chemist.

1887. Hadfield, Sir Robert A., Hecla Works, Sheffield; 28, Hertford Street, Mayfair, London, W., and (Journals) Parkhead House, Sheffield, Steel Founder.

1884. Hadkinson, F., Pamphila Oil and Soap Works, Mitylene, Mediterranean, Oil Refiner and Soap Manufacturer.

O.M. Hadkinson, R., Smyrna, Asia Minor, Oil Refiner.

1904. Hadley, Geo., 58, Halesowen Street, Blackheath, Staffs., Spelter Works Manager.

1902. Haff, Max M., Laboratory, 188, Metcalfe Street, Ottawa, Canada, Chemist.

1906. Hagen, Dr. Carl, c/o E. I. du Pont de Nemours Powder Co., 20, Bishopsgate, London, E.C., Representative.

1887. Haig, Robert, Dollarfield, Dollar, N.B., Chemical Engineer.

1904. Haigh, B. Wilson, By-Product Coke Oven Dept., Barnsley Main Colliery, Barnsley, Yorks., Chemical Engineer.

1896. Haigh, De Lagnel, 39, Hill Crest, Summit, N.J., U.S.A., Chemist.

1888. Hailes, A. J. de, 15, Red Lion Square, London, W.C., Analytical Chemist.

1910. Hailstone, Harold J., 44, Cordley Street, West Bromwich, Works Chemist.

1889 Haines, Reuben, Haines Street, near Chew Street, Germantown, Philadelphia, Pa., U.S.A., Analytical Chemist.
O.M. Hake, C. Napier, Oriental Club, Hanover Square, London, W. Chemical Adviser.
1903. Halbert, Thos., c/o British South African Explosives Co., Modderfontein, Transvaal, Chemist.
1888. Hale, Edw. P., Endmoor, near Kendal, Analytical Chemist.
1887. Hall, Allan T., c/o Sissons Bros. and Co., Ltd., Hull, Oil Refiner and Varnish Manufacturer.
1905. Hall, Archibald A., Armstrong College, Newcastle-on Tyne, Demonstrator in Chemistry.
1898. Hall, Clarence A., 18, McPherson Street, Mount Airy, Philadelphia, Pa., U.S.A., Chemist.
O.M. Hall, Edgar, Silver Spur, Queensland, Australia, Technical Chemist.
1909. Hall, Harold, 98, Birkin Avenue, Hyson Green, Nottingham, Analyst.
1902. Hall, Henry, c/o Booth and Co., Irk Vale Works, Middleton, Lancashire, Dyer and Finisher.
1893. Hall, Jas. W., 3, Dixon Terrace, Darlington, Linseed Oil Mills Manager.
1885. Hall, Lt.-Col. Jno. A., c/o Hamilton Powder Co., Montreal, Canada, Analytical Chemist.
1908. Hall, John S., Manor House, Overseal, Ashby-de-la-Zouch, Chemist.
1896. Hall, S. Godfrey, East London Soap Works, Bow, E., Soap Maker.
1886. Haller, Geo., Sussex House, 52, Leadenhall Street, London, E.C., Chemical Merchant.
1893. Haller, H. Loft, 26, Scale Lane, Hull, Analytical Chemist.
1895. Halliwell, Edw., c/o Ribble Joint Committee, 2, Stanley Place, Preston, Chief Inspector.
1900. Hallock, Dr. Albert P., 440, First Avenue, New York City, U.S.A., Chemist.
1892. Hamaguchi, Gihei, Hiro Mura, Arida Gori, Wakayama Ken, Japan, Soy Manufacturer.
1897. Hambly, Fred. J., Buckingham, Quebec, Canada, Chemist.
1901. Hambuechen, Carl, 217, South Mills Street, Madison, Wis., U.S.A., Consulting Chemical Engineer.
1910. Hamburg, Dr. Max, c/o The British Diamalt Co., Sawbridgeworth, Herts., Chemist and Manager.
1904. Hamilton, Edward H., Virginia Smelting Works, West Norfolk, Va., U.S.A., Manager.
1892. Hamilton, Robt., 40, Sefton Terrace, Beeston Hill, Leeds, Analytical Chemist.
1884. Hamilton, Robert, Glengarnock Chemical Co., Ltd., Glengarnock, N.B., Works Manager.
1898. Hammersley, W. Stanley, 5, Rue Seaflart, Soignies, Belgium, Tanner.
O.M. Hammill, M. J., The Gables, St. Helens, Alkali Manufacturer.
O.M. Hammond, J., Gas Works, Eastbourne, Sussex, Gas Manager.
1906. Hancock, H. Irving, Blue Point, N.Y., U.S.A., Chemist.
1905. Hancock, Thos. J., P.O. Box 692, Beaumont, Texas, U.S.A., Chemist.
1900. Hancock, Walter C., 10, Upper Chadwell Street, Myddelton Square, London, E.C., Chemist.
1896. Hand, Daniel, 30, Mount Pleasant Avenue, Newark, N.J., U.S.A., Chemist.
1889. Handy, Jas. O., 109, South Graham Street, Pittsburg, Pa., U.S.A., Chemist.
1888. Hanks, Abbot A., 630, Sacramento Street, San Francisco, Cal., U.S.A., Assayer.
1901. Hanna, Charles E., P.O. Box 2572, Montreal, Canada, Secretary.
1905. Hanna, W. W., 109, North Water Street, Philadelphia, Pa., U.S.A., Aniline Colour Manufacturer.
1905. Hanson, H. Norman, Field Head, Brighouse, Yorks., Research Assistant.
1908. Hanson, W. G., c/o United States Glue Co., Milwaukee, Wis., U.S.A.
1909. Harbord, F. W., 16, Victoria Street, Westminster, S.W., Metallurgist.
1905. Harcourt, Prof. R., Ontario Agricultural College, Guelph, Ont., Canada, Professor of Chemistry.
1904. Hard, Dr. James M. B., 2A, del Canadá, Colonia de Sta. Julia, Mexico, D.F., Chemist and Pathologist.
1901. Hardcastle, G. Fred., 29, Normanton Road, Leicester, Teacher of Science and Technology.
1894. Harden, Dr. Arthur, F.R.S., 2, Marlborough Road, Richmond, Surrey, Lecturer in Chemistry.
1910. Hardie, Thos., Newcastle and Gateshead Gas Co., Tyneside Road, Newcastle-on-Tyne, Gas Engineer.
1909. Harding, Herbert, 47, Streathbourne Road, Upper Tooting, S.W., Assistant Examiner (H.M. Patent Office).
1908. Hardman, Benj., c/o Kodak, Ltd., Wealdstone, Middlesex, Analytical Chemist.
1900. Hardwick, W. Roscoe, 13, Batavia Buildings, Hackins Hey, Liverpool, Chemist.
1905. Hardy, Chas. H., c/o Reckitt & Sons, Ltd., Hull, Chemist.
1907. Harfeld, Louis E., 10, Elsworthy Terrace, London, N.W., Merchant.
1906. Hargreaves, Frank, Hough Green, Widnes, Chemist.
1896. Hargreaves, Jas., May Villa, Peel House Lane, Widnes, Lancashire, Chemical Engineer.
O.M. Hargreaves, Jno., Widnes, Alkali Manufacturer.
1904. Harker, Dr. George, 35, Boulevarde, Petersham, Sydney, N.S.W., Australia, Chemist.
1909. Harland, Robert M., 37, Lombard Street, London, E.C., Analytical Chemist and Assayer.
1893. Harlock, E. B., Newton House, Middlewich, Chemical Manufacturer.
1898. Harman, Edw. A., Gas Works, Huddersfield, Gas Engineer, M.Inst.C.E.
1905. Harper, Dr. Henry W., University of Texas, 2216, Rio Grande Street, Austin, Texas, U.S.A., Professor of Chemistry.
1893. Harris, Arthur, 22, Marsh Gate Lane, Stratford, E., Soap Maker.
1885. Harris, Booth, jun., Beeleigh, Victoria Road, Buckhurst Hill, Essex, Soap Maker.
O.M. Harris, David, F.R.S.E., Lyncombe Rise, Prior Park Road, Bath, Chemical Manufacturer.
1897. Harris, Fred. W., 38, Cochrane Street, Glasgow, Public Analyst.
1907. Harris, John B., Danforth Avenue, Toronto, Canada, Manufacturer of Glues and Fertilisers.
1906. Harris, Jonathan W., c/o Western Electric Co., 463, West Street, New York City, U.S.A., Chemist.
1907. Harris, Thos. E., c/o The Union Acid Co., 17, Cooper Street, Manchester, Chemical Merchant.
1906. Harris, Wm. G., jun., 25 and 31, William Street, Toronto, Canada, Metallurgist.
O.M. Harrison, A., Thames Sugar Refinery, Silvertown, London, E., Sugar Works Chemist.
1905. Harrison, E. F., Langholm, Edgar Road, South Croydon, Analytical Chemist.
1909. Harrison, Edwin D., 86, Harrison Place, Irvington, N.J., U.S.A., Celluloid Manufacturer.
1883. Harrison, G. Herbert, Hagley, Stourbridge, Firebrick Maker.
1892. Harrison, Prof. John B., C.M.G., Government Laboratory, Georgetown, British Guiana, Government Analyst.
1907. Harrison, W., 14, Devonshire Place, Ardwick, Manchester, Chemist.
1898. Harrison, Wm. H., Coimbatore, India, Agricultural Chemist (Government of Madras).
1896. Hart, Bertram, c/o Tennants and Co., Clayton, Manchester, Analyst.
1886. Hart, Bertram H., Rosslyn, High Street, Sidcup, Kent, Analytical Chemist.
O.M. Hart, Dr. E., Gayley Hall, Lafayette College, Easton, Pa., U.S.A., Professor of Chemistry.
1905. Hart, George Adam, Sewage Engineers' Office, Municipal Buildings, Leeds, Civil Engineer.
1890. Hart, H. W., 5, Cambridge Road, Ansdell, Lytham, Lancashire, Analytical Chemist.
1897. Hart, Wm. Beamont, Manchester Laboratory, 8, Exchange Street, Manchester, Consulting Chemist.
1908. Hartley, Bernard C., 56, Wood View, Manningham, Bradford, Analytical Chemist.

1883. Hartley, Joseph. Avondale, Compstall Road, Romiley, Cheshire, Technical Chemist.

1905. Hartshorne. Wm. D., 40, Pleasant Street, and (Journals), Arlington Mills, Methuen, Mass., U.S.A. Agent.

1901. Hartwell, S. Warren, 120, North Fourth Street, Easton, Pa., U.S.A., Chemist.

1908. Harvey, Arthur J., 88A, East India Dock Road, Poplar, E., Chemist.

1885. Harvey, Ernest W., 11, Templeton Place, Earl's Court, London, S.W., A.R.S.M., Engineer.

1891. Harvey, Sidney, South-Eastern Laboratory, Canterbury, Analytical Chemist.

1899. Harvey, Thos. F., 69, North Road, West Bridgford, Nottingham, Analyst (Drug Co.).

1883. Harvey, T. H., Cattedown, Plymouth, Chemical Manufacturer.

1908. Harvey, Wm. Ross, c/o R. Lehmann and Co., Ltd., Peninsular House, Monument Street, London, E.C., Starch Manufacturer.

1903. Hasenclever, Max, Chemische Fabrik Rhenania, Aachen, Prussia, Chemical Manufacturer.

1906. Haskell, Walter F., 234, Bridge Street, Westbrook, Maine, U.S.A., Textile Chemist and Colourist.

1900. Haslwanter, Chas., 447, Spruce Street, Richmond Hill, Long Is., N.Y., U.S.A., Analytical Chemist.

1909. Hassan, E. A., 1211, Fifth Avenue, Spokane, Wash., U.S.A., Mechanical Engineer.

1897. Hasslacher, Jacob, P.O. Box 1999, New York City, U.S.A., President, Roessler-Hasslacher Chemical Co.

1903. Hatschek, Emil, c/o S. Bornett and Co., Ltd., 19, St. Dunstan's Hill, London, E.C., Engineer.

1887. Hatton, Wm. P., c/o W. R. Hatton and Sons, Wormwood Scrubs, W., Starch Works Manager.

1911. Haultain, H. E. T., University of Toronto, Toronto, Canada, Mining Engineer.

1906. Havercroft, Arthur E., Glenholme, Westbourne Road, Hornsea, Yorks., Chemist.

1899. Hawdon, H. S., Cleadon, near Sunderland, Manager.

1909. Hawes, Edward, 45, Howard Park Avenue, Toronto, Canada, Manufacturing Chemist.

1895. Hawker, E. W., Gladstone Chambers, Adelaide, South Australia, Metallurgist.

1910. Hawkes, Cornelius A., Dovercourt, Painswick Road, Gloucester, Analytical Chemist.

1902. Hawkins, Clement C., c/o The Texas Co., Port Neches, Texas, U.S.A., Chemist.

1905. Hawkins, Henry, Moyola Villa, Lansdown, Limerick, Ireland, Gas Engineer.

1893. Hawkins, J. Dawson, c/o U. S. Reduction and Refining Co., Colorado Springs, Colo., U.S.A., President and General Manager.

1887. Hawliczek, Josef, c/o United Alkali Co., Sullivan Works, Widnes, Consulting Chemical Expert.

1899. Haworth, Dr. Edw., Sunnyside, Norman Road, Runcorn, Cheshire, Chemist.

1903. Haworth, Herbert, Crown Works, Appley Bridge, near Wigan, Director (Grove Chemical Co.).

1910. Haworth, John, 117, Millhouses Lane, Sheffield, Chemist and Sewage Works Superintendent.

1904. Hawthorn, J. H., Municipal Technical School, Leicester, Head Master.

1895. Hay, Alex. B., Kelvindock Chemical Works, Maryhill, Glasgow, Manufacturing Chemist.

1910. Hay, J. Gordon, 37, Worcester Road, Bootle, Liverpool, Analytical Chemist.

O.M. Haydn-Morris, J., 22, Largo das Fontanhas, Lisbon, Portugal, Technical Chemist.

1909. Haydon, James R., 91, Ampthill Road, Aigburth, Liverpool, Works Manager and Chemist.

1894. Haynes, David O., 82, Fulton Street, New York City, U.S.A., Proprietor, "Pharmaceutical Era."

1902. Hays, B. F., c/o E. R. Squibb and Sons, 80, Beekman Street, New York City, U.S.A., Pharmaceutical Chemist.

1906. Hayworth, W. P., 70, Highfield Road, Dartford, Kent, Chemist.

1905. Hazard, Fred. R., P.O. Box 2, Syracuse, N.Y., U.S.A., President (Solvay Process Co.).

1903. Hazen, Chas. R., 258, Prince Albert Avenue, Westmount, Quebec, Canada, Chemist.

1894. Heal, Carlton, Dalston House, Dumfries, N.B., Tanner.

O.M. Heath, R. C., Myton Grange, near Warwick, Chemical Manufacturer.

1905. Heathcote, Henry L., c/o Rudge-Whitworth, Ltd., Coventry, Research Chemist.

1904. Heaton, Noel, Denmark House, Stonebridge Park, London, N.W., Colour Manufacturer.

1895. Hebden, Jno. C., P.O. Box 465, Providence, R.I., U.S.A., Works Manager and Chemist.

1905. Heberlein, Dr. Edw., c/o H. T. Enthoven & Sons, Ltd., 247, Rotherhithe Street, London, S.E., Works Manager.

1889. Hecht, Jos. L., c/o French and Hecht, Davenport, Iowa, U.S.A., Analytical Chemist.

1900. Heckman, J. Conrad, Larkin Soap Manufacturing Co., Seneca Street, Buffalo, N.Y., U.S.A., Chemist.

1885. Hedley, Armorer, Durrant House, Bournemouth, Hants.

1902. Heebner, Prof. Chas. F., Ontario College of Pharmacy, Toronto, Canada, Professor of Pharmaceutical Chemistry.

1903. Hegeman, John W., 102, Barbey Street, Brooklyn, N.Y., U.S.A., Chemist.

O.M. Hehner, Otto, 11, Billiter Square, London, E.C., Analytical and Consulting Chemist.

1903. Heilmann, Dr. Ernst, Güstrow, Mecklenburg, Germany, Chemical Manufacturer.

1887. Hellier, E. A., Avonside Varnish Works, St. Philip's Marsh, Bristol, Varnish Manufacturer.

1885. Hellon, Dr. R., 40, New Lowther Street, Whitehaven, Analytical and Consulting Chemist.

1903. Helps, D. H., c/o Reading Gas Co., King's Road Works, Reading, Engineer and Manager.

1908. Helps, James W., Gas Works, Waddon, Croydon, General Manager, Gas Co.

1910. Hemelsoet, M., Soc. Anon. "Superphosphates et Guanos," Nouveau Bassin, Gand, Belgium, Fertiliser Manufacturer.

1898. Hemingway, Frank C. R., 133, Front Street, New York City, U.S.A.

1883. Hemingway, H., 9, Albemarle Mansions, Hampstead, N.W., Chemical Manufacturer.

1884. Hempleman, F. S., 39, Brunswick Terrace, Hove, Sussex, Manure Manufacturer.

1903. Hemstreet, George P., Hastings-on-Hudson, N.Y., U.S.A., Mechanical Engineer.

1910. Henderson, Ernest E., c/o Canadian Salt Co., Ltd., Windsor, Ont., Canada, Vice-President and Manager.

1883. Henderson, Prof. G. G., The Technical College, George Street, Glasgow, Professor of Chemistry.

1902. Henderson, Prof. Jas. A. Russell, Chihli Provincial College, Paoting-fu, North China, viâ Siberia, Professor of Chemistry and Physics.

1900. Henderson, J. Brownlie, Government Analyst's Office, Brisbane, Queensland, Government Analyst.

1894. Henderson, Jos., Eskbank Ironworks, Lithgow, N.S.W., Australia, Blast Furnace Manager.

1894. Henderson, Norman M., Broxburn Lodge, Broxburn, N.B., Oil Works Manager.

O.M. Henderson, W. F., Moorfield, Claremont Gardens, Newcastle-on-Tyne.

1910. Hendey, Alfred E., 59, Mamaroneck Avenue, White Plains, N.Y., U.S.A.

1893. Hendrick, Jas., Marischal College, Aberdeen, Lecturer on Agricultural Chemistry.

1906. Henius, Dr. Max, 1135–1147, Fullerton Avenue, Chicago, Ill., U.S.A., Secretary, Brewers' School.

1904. Henley, Hon. F. R., 9, Beaufort Gardens, London, S.W., Brewers' Chemist.

1905. Henning, Albert, c/o Hedley and Co., 92, Harrow Road, Leytonstone, N.E., Ester Manufacturer.

1906. Henning, C. I. B., c/o E. I. du Pont de Nemours Powder Co., Haskell, N.J., U.S.A., Chemist.

1894. Henshaw, Sam., Glenthorne, Wolstanton, Stoke-on-Trent, Chemical Works Manager.

1911. Henzell, Prof. A. Willoughby, Imperial Provincial College, Chinanfu, Shantung, China, Professor of Science.

1910. Hepburn, Edward, Priory Works, Dartford, Kent, Tanner.

1888. Hepworth-Collins, W., Junior Constitutional Club, Piccadilly, London, W., Civil Engineer.

1906. Herig, Harry W., 35, Rose Avenue, Jersey City, N.J., U.S.A., Chemist.

1897. Heriot, T. H. P., Mount Edgecombe Estate, Natal, South Africa, Analytical Chemist.

O.M. Herman, W. D., Holm Lea, Rainhill, Lancashire, Glass Works Chemist.

O.M. Heron, John, 110, Fenchurch Street, London, E.C., Brewing Chemist.

1903. Herreshoff, J. B. F., 40, West 69th Street, New York City, U.S.A., Chemical Engineer.

1887. Herriot, Wm. Scott, Clarewood, Thorntonhall, Lanarkshire, Mechanical Engineer.

O.M. Herrmann, R. W., 59, Mark Lane, London, E.C., Chemical Merchant.

1891. Hersam, Ernest A., University of California, Berkeley, Cal., U.S.A., Associate Professor of Metallurgy.

1898. Hersey, Dr. Milton L., P.O. Box 554, Montreal, Canada, Consulting Chemist.

1901. Hershey, Aldus N., c/o J. L. Hopkins and Co., 100, William Street, New York City, U.S.A., Chemist.

1903. Herstein, Dr. Bernard, c/o Tariff Board, Treasury Building, Washington, D.C., U.S.A., Technical Chemist.

1906. Herty, Prof. Chas. H., University of N. Carolina, Chapel Hill, N.C., U.S.A., Professor of Chemistry.

1906. Herz, Dr. Albert, Rosemount, Hipperholm, Halifax, Yorks., Chemist.

1885. Hess, Dr. Adolph, Kirkstall Road, Leeds, Chemical Manufacturer.

1907. Hess, Arthur F., c/o A. Hess & Bro., Ltd., Kirkstall Road, Leeds, Oil Distiller.

1904. Hess, H. W., c/o Libbey Glass Co., Toledo, Ohio, U.S.A., Chemist.

1905. Hesse, Dr. Bernhard C., 90, William Street, New York City, U.S.A., Chemist.

1891. Hetherington, Dr. Albert E., Ammonia Soda Works, Fleetwood, Lancashire, Analytical Chemist.

1904. Heurich, Christian, 1307, New Hampshire Avenue N.W., Washington, D.C., U.S.A., Brewer.

1894. Hewitt, A. H., The Green Island Cement Co., Ltd., Hong Kong, China, Engineer.

1910. Hewitt, Arthur, c/o Consumers' Gas Co., 19, Toronto Street, Toronto, Canada, General Manager.

O.M. Hewitt, Dr. D. B., Grove Mount, Davenham, Cheshire, Alkali Manufacturer.

1896. Hewitt, Dr. J. Theo., F.R.S., Clifford House, Bedfont, Middlesex, Lecturer.

1890. Hewlett, John C., 40-42, Charlotte Street, Great Eastern Street, London, E.C., Manufacturing Chemist.

1907. Hewson, Geo. W., 10, Hurworth Place, Jarrow-on-Tyne, Analytical Chemist.

1893. Hey, Harry, 2, Ash Terrace, Savile Town, Dewsbury, Dyer.

1894. Heyl, G. Edward, 85, Gracechurch Street, London, E.C., Chemical and Electrical Engineer.

1906. Heys, Charles H., Toronto Arcade, Toronto, Canada, Consulting Chemist.

1906 Hibbert, John C., 19, Haddon Road, West Bridgford, Nottingham, Chemist.

1901. Hiby, Dr. Walter, c/o The Otto Hilgenstock Coke Oven Co., Ltd., Crigglestone, near Wakefield, Yorks. Chemical Engineer.

1906. Hicking, W. Norton, Queen's Road Works, Nottingham, Lace Dresser.

1906. Hickman, T. Moore, Holmdale, Penn Road, Wolverhampton, Analyst.

1897. Hicks, Edwin F., 4837, Fairmount Avenue, Philadelphia, Pa., U.S.A., Analytical Chemist.

1893. Hicks, Jas. A., c/o Sir Boverton Redwood, 4, Bishopsgate Street Within, London, E.C., Analytical Chemist.

O.M. Higgin, W. H., Hollywood, Lostock, near Bolton-le-Moors, Chemical Manufacturer.

1886. Higgins, C. L., 41, Knowsley Road, Cressington Park, Liverpool, Manufacturing Chemist.

1905. Higgins, Dr. Eric, 5, Rolleston Drive, Wallasey, Cheshire, Chemist.

1905. Higgins, John M., 39, Queen Street, Melbourne, Vic., Australia, Consulting Metallurgist.

1908. Higgins, S. H., Luncarty Bleachfield, Perth, N.B., Chemist and Asst. Manager.

1909. Higson, Frank, 52, Chapel Street, Salford, Manchester, Analytical Chemist.

1909. Higuchi, Ken-ichi, No. 9, Atagomachi Ichome, Shiba, Tokyo, Japan, Chemical Engineer, Japanese Department of Agriculture and Commerce.

1908. Hill, A. Clarence, c/o Pinchin, Johnson, & Co., Ltd., Minerva House, Bevis Marks, London, E.C., Managing Director.

1909. Hill, Arthur E., c/o Glamorgan Coal Co., Ltd., Constantinople, Technical Chemist.

1903. Hill, Chas. Alex., c/o British Drug Houses, Ltd., 22-30, Graham Street, City Road, E.C., Chemist.

1897. Hill, Dr. Herbert M., 21, Niagara Street, Buffalo, N.Y., U.S.A., City Chemist.

1907. Hill, James A., 20, Hilton Road, Runcorn, Cheshire, Technical Chemist.

1908. Hill, J. H. F., c/o Broken Hill Proprietary Co., Broken Hill, N.S.W., Australia, Mining Engineer.

O.M. Hill, J. K., 13, Osborne Place, Copland Road, Govan, near Glasgow, Manufacturing Chemist.

1892. Hill, Sydney, c/o Blundell, Spence, & Co., Ltd., Hull, Analytical Chemist.

1903. Hill, W. Basil, Foss Islands Tannery, York, Tanner.

1902. Hill, Wm. G. H., jun., c/o Apsley Rubber Co., Hudson, Mass., U.S.A., Chemist.

1898. Hill-Jones, Thos., Invicta Mills, Bow Common Lane, London, E., Manufacturing Chemist.

1894. Hills, Harold F., Commercial Gas Works, Stepney, London, E., Analytical Chemist.

O.M. Hills, W., Oxford Works, Tower Bridge Road, London, S.E., Pharmaceutical Chemist.

1899. Hinchley, J. W., 55, Redcliffe Road, London, S.W., Chemical Engineer.

1904. Hinckley, J. F., 550, East 7th Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.

O.M. Hindle, J. H., 8, Cobham Street, Accrington, Dyeworks Manager.

1909. Hinks, Edward, 16, Southwark Street, London, S.E., Analyst.

1899. Hinks, Percy J., Danger Building Dept., Royal Laboratory, Woolwich Arsenal, S.E., Chemist.

1891. Hinman, Bertrand C., Coventry House, South Place, Finsbury, London, E.C., Metallurgical Chemist.

1905. Hiorns, A. H., Riga, Gravelly Hill, near Birmingham, Science Teacher.

1909. Hirsch, Fritz, 49, Coach Road, Wallsend-on-Tyne, Analytical Chemist.

1895. Hirst, H. Reginald, Bank House, Staincliffe, Batley, Yorks, Works Chemist.

1907. Hirt, Wilhelm B., c/o Cuming, Smith, & Co., Ltd., Yarra Junction, Vic., Australia, Analytical Chemist.

1907. Hirtz, Dr. Heinrich, Kühlingsgasse 32, Duisburg, Germany, Chemist.

1896. Hislop, Geo. R., (Journals) Gas Works, (communications) Greenhill House, Underwood Road, Paisley, N.B., Gas Engineer and Manager.

1900. Hobbs, Alex. F., c/o The United States Finishing Co., Box A, North Station, Providence, R.I., U.S.A., Printworks Superintendent.

1900. Hobbs, Dr. Perry L., Western Reserve Medical College, and (Journals) 2047, East 9th Street, Cleveland, Ohio, U.S.A., Professor of Chemistry.

1906. Hobsbaum, Isaac B., c/o Lockett Bros. & Co., Iquique, Chile, Analytical Chemist.

1905. Hobson, Alfred, Dantzic Brewery, Imperial Street, Regent Street, Leeds, Brewer and Wine Manufacturer.

1907. Hochstetter, Robt. W., Oak and Bellevue Avenues, Mount Auburn, Cincinnati, Ohio, U.S.A., Superintendent.
1909. Hodgart, Matthew, Vulcan Works, Paisley, N.B., Engineer.
1894. Hodge, Andrew, Brookfield House, Whaley Bridge, near Stockport, Printworks Chemist.
1890. Hodges, Harry B., Long Island Railroad Co., Long Island City, N.Y., U.S.A., Chemical Engineer.
O.M. Hodgkinson, Dr. W. R., 89, Shooters Hill Road, Blackheath, S.E., Professor of Chemistry.
O.M. Hodgson, Chris., 33, Oakdale Road, Nether Edge, Sheffield, Metallurgical Chemist.
1897. Hodgson, Matthew, Ardmore, Church Hill, Wicklow, Ireland, Technical Chemist.
1890. Hodgson, Wm., 66, Deansgate, Manchester, Oil and Colour Broker.
1910. Hodsman, Henry J., 2, Richmond Hill, Langley, nr. Birmingham, Chemist (British Cyanides Co.).
1906. Hogarth, Julius W., The University, Sydney, N.S.W., Australia, Demonstrator of Chemistry.
1886. Hogben, W., Post Office, Port Talbot, South Wales, Chemical Expert (Celluloid, etc.).
O.M. Hogg, T. W., c/o John Spencer and Sons, Newburn Steelworks, Newcastle-on-Tyne, Metallurgical Chemist.
1905. Holcroft, Harold, Parkdale, Wolverhampton, Ironfounder.
1899. Holden, Archie Neill, c/o Hardman and Holden, Ltd., Miles Platting, Manchester, Chemist.
1887. Holden, G. H., Manchester Oxide Co., Ltd., Canal Street, Miles Platting, Manchester, Chemist.
1904. Holden, Norman N., c/o Hardman and Holden, Ltd., Colliery Lane, Clayton, Manchester, Manufacturing Chemist.
1902. Holdsworth, Ernest T., 10, Merton Road, Bradford, Dyer.
1885. Holgate, T. E., 173, Hollins Grove, Darwen, Lancashire, Metallurgist.
1884. Holgate, Thos., 5, Victoria Street, Westminster, S.W., Gas Engineer.
O.M. Holland, Philip, 22, Taviton Street, Gordon Square, London, W.C., Analytical Chemist.
1892. Holland, Philip H., 546, Sherbrooke Street West, Montreal, Canada, Merchant.
1901. Hollick, Herbert, 304, The Robeson, Camden, N.J., U.S.A., Chemical Engineer.
1909. Holliday, F. E., 81, Fulton Street, New York City, U.S.A.
1902. Holliday, Lionel B., Lunnclough Hall, Huddersfield, Chemical Manufacturer.
1896. Hollings, J. Spencer, Vrondeg, near Wrexham, North Wales, Works Manager.
1909. Hollingworth, David V., Gas Offices, Bloom Street, Salford, Gas Works Analyst.
1903. Hollinshead, Peter, The Beeches, Weston Road, Runcorn, Cheshire, Chemist.
1900. Hollinshead, Dr. W. H., Wingrove Avenue, Nashville, Tenn., U.S.A., Teacher of Chemistry.
1904. Holloway, E. G., c/o Jas. S. Kirk and Co., 360, North Water Street, Chicago, Ill., U.S.A., Chemist.
1890. Holloway, G. T., 9–13, Emmett Street, Limehouse, London, E., Analytical and Consulting Chemist.
1883. Holmes, Ellwood, Wyncote, Jesmond Park East, Newcastle-on-Tyne, Colour Manufacturer.
O.M. Holmes, F. G., Northcroft, Tewitwell Road, Harrogate, Yorks., Technical Chemist.
1900. Holthouse, Harold B., 12, Melton Grove, West Bridgford, Notts., Chemist.
1902. Holton, Alf. L., Chemical Dept., Gas Works, Bradford Road, Manchester, Chemist.
1892. Holton, E. C., 601, Canal Road N.W., Cleveland, Ohio, U.S.A., Chemist.
1910. Holzapfel, Dr. J. G., c/o Holzapfels Ltd., Felling-on-Tyne, Chemist.
1893. Holzapfel, Max, Kenton Lodge, Newcastle-on-Tyne, Manufacturer.
1893. Homfray, D., 8, Watson Road, Broomhill, Sheffield, Analytical Chemist.
1909. Hook, Russell W., 8, Holton Street, West Medford, Mass., U.S.A.
1904. Hooker, A. H., c/o Hooker Electrochemical Co., Niagara Falls, N.Y., U.S.A., Manufacturing Chemist.
O.M. Hooper, E. Grant, 16, Royal Avenue, Sloane Square, S.W., Chemist.
1889. Hooper, Ernest F., c/o Brotherton and Co., Ltd., Wear Tar Works, South Dock, Sunderland, Technical Chemist.
1888. Hope, Jas., The Nickel Co., Kirkintilloch, N.B., Nickel Works Manager.
1904. Hopewell, Fredk., 59, William Street, Montreal, Canada, Manager.
1892. Hopkins, Erastus, Geneva, N.Y., U.S.A., Consulting Chemist.
1905. Hoppenstedt, A. W., c/o Schoellkopf and Co., Perry and Mississippi Streets, Buffalo, N.Y., U.S.A., Chemist.
1895. Horne, Dr. W. D., 175, Park Avenue, Yonkers, N.Y., U.S.A., Consulting Chemist.
1904. Hornsey, J. W., 27, William Street, New York City, U.S.A., Chemical Engineer.
1900. Horsfall, Jno., 4, Grange Avenue, Rawtenstall, Manchester, Analytical and Consulting Chemist.
1901. Horton, Edw., jun., 10, Smith Street, Chelsea, S.W., Student.
1906. Hoseason, Jas. H., Sun Buildings, Bridge Street, Manchester, Chemical Manufacturer.
1890. Hoskins, A. Percy, Clonlee, Rosetta Park, Belfast, Ireland, Analytical Chemist.
1899. Hoskins, Wm., Room 54, 81, South Clark Street, Chicago, Ill., U.S.A., Chemist.
1910. Hough, Alex. T., 38, Storks Road, Bermondsey, London, S.E., Analytical Chemist.
1911. Hough, Samuel, c/o Lever Bros., Ltd., Balmain, Sydney, N.S.W., Australia, Chemist.
1899. Houlder, Bertram E., 50, Lady Margaret Road, Southall, Middlesex, Chemist.
1892. Houston, John, 26, Princess Street, Manchester, Drysalter.
O.M. Howard, A. G., Burnt House, Chigwell, Essex Chemical Manufacturer.
1901. Howard, Bernard F., Firbank, Loughton, Essex, Chemist.
O.M. Howard, D., Devon House, Buckhurst Hill, Essex, Chemical Manufacturer.
1887. Howard, D. Lloyd, City Mills, Stratford, E., Chemical Manufacturer.
1898. Howard, Henry, 36, Amory Street, Brookline, Mass., U.S.A., Chemical Engineer.
1902. Howard, Nelson A., c/o General Chemical Co. of California, 705, Royal Insurance Building, San Francisco, Cal., U.S.A., General Manager.
1904. Howard, T., Chemist.
O.M. Howard, W. D., 11, Cornwall Terrace, Regent's Park, London, N.W., Chemical Manufacturer.
1906. Howe, Chester A., 124, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.
1903. Howe, Jas. Lewis, Washington and Lee University, Lexington, Va., U.S.A., Professor of Chemistry.
1905. Howe, Roland E., 15, Highland Street, Concord Junction, Mass., U.S.A., Explosives Chemist.
1909. Howell, Harry, c/o W. C. Holmes & Co., Whitestone Ironworks, Huddersfield, Chemical Engineer.
1904. Howell, Walter L., Room U., Custom House, New Orleans, La., U.S.A., Chemist.
1899. Howles, Fred., c/o McDougall Bros., 66-68, Port Street, Manchester, Chemist.
1889. Howorth, F. Wise, 46, Lincoln's Inn Fields, W.C. Technical Chemist and Chartered Patent Agent.
1907. Howroyd, Richard R., c/o Calder Mersey Extract Co., Ltd., Ditton, near Widnes, Chemist.
1909. Howse, Geo. H., 67, Union Street, Smethwick, Birmingham, Paint Manufacturer.
1906. Hoyler, Fritz, 49, Market Street, Perth Amboy, N.J., U.S.A., Chemist.
1896. Hoyte, Percy S., Gas Works, Coxside, Plymouth, Gas Engineer.

1900. Hübner, Julius, Ash Villa, Cheadle Hulme, Cheshire, Director of Dyeing and Papermaking Departments (Municipal School of Technology).

1909. Hudson, Baker, Public Library, Middlesbrough, Librarian.

1899. Hudson, Dr. Edw. J., c/o Pioneer Iron Co., Marquette, Mich., U.S.A., Chemist.

1905. Hudson, O. F., The University, Edgbaston, Birmingham, Lecturer on Metallurgy.

1909. Huether, David J., c/o Century Rubber Trading Co., Plainfield, N.J., U.S.A., Chemist.

O.M. Hughes, J., 79, Mark Lane, London, E.C., Agricultural Chemist.

1909. Hughes, L. S., c/o Picher Lead Co., Joplin, Mo., U.S.A., Chief Chemist.

1898. Hughes, Raymond M., Miami University, Oxford, Butler Co., Ohio, U.S.A., Professor of Chemistry and Physics.

1908. Hughes, Wm. E., Chemical Laboratory, Messrs. W. Canning and Co., Great Hampton Street, Birmingham, Electro Chemist.

1906. Hulme, Robert B., c/o Phoenix Cotton Oil Co., Memphis, Tenn., U.S.A., Chemical Engineer and Manager.

1911. Hulsizer, William R., c/o Y.M.C.A., 215, West 23rd Street, New York City, U.S.A., Chemical Engineer.

1909. Hultman, G. H., Gasverket, Värtan, Sweden, Gas Engineer.

1905. Hulton, H. F. E., 11, Colinette Road, Putney, S.W., Chemist.

1905. Humel, Edward J., Lake Avenue, cor. Edward Street, Lakewood, Cleveland, Ohio, U.S.A., Chemist.

1893. Humfrey, Chas., Hilderstone, Hartford, Cheshire, Alkali Works Manager.

1901. Humphrey, Henry C., c/o Corn Products Refining Co., Room 1509, 26, Broadway, New York City, U.S.A., Chemist.

1902. Humphrey, Rich. L., 1001, Harrison Building, Philadelphia, Pa., U.S.A., Civil Engineer.

1903. Humphreys, A. C., 165, Broadway, New York City, and (Jnls.) Stevens Inst. of Technology, Hoboken, N.J., U.S.A., Engineer.

1908. Humphries, Albert E., Coxes Lock Mill, Weybridge, Surrey, Flour Miller.

O.M. Humphrys, N. H., Gasworks, Salisbury, Wilts., Gas Engineer.

1900. Hunt, Arthur V., 284, New Chester Road, Port Sunlight, Cheshire, Analytical Chemist.

O.M. Hunt, Bertram, 709, Mills Building, San Francisco, Cal., U.S.A., Technical Chemist.

O.M. Hunt, Chas., 17, Victoria Street, Westminster, London, S.W., Gas Engineer.

1909. Hunt, Edwin J., The Grange, Walsall, Staffs., Managing Director, Chance and Hunt, Ltd.

1883. Hunt, J. S., Appleton, Widnes.

1903. Hunt, P. C. Holmes, Metropolitan Gas Co., Flinders Street, Melbourne, Vic., Australia, Gas Engineer.

O.M. Hunt, W., Hampton House, Wood Green, Wednesbury, Staffordshire, Chemical Manufacturer.

1903. Hunter, H. B., Dennery Factory, St. Lucia, West Indies, Sugar Works Manager.

1893. Hunter, Prof. Matthew, Rangoon College, Rangoon, Burmah, Professor of Chemistry.

O.M. Huntington, Prof. A. K., King's College, Strand, London, W.C., Professor of Metallurgy.

1902. Huntly, Geo. N., 14a, Finsbury Square, London, E.C., Analytical and Consulting Chemist.

1904. Huntzinger, Alfred, 119, Avenue Van Becelaere, Boitsfort, Belgium, Chemist and Colourist.

1904. Hurren, F. H., c/o The Rover Co., Ltd., Coventry, Analytical Chemist.

1894. Hurry, E. H., Llanover, Churt, Farnham, Surrey, Mechanical Engineer.

O.M. Huson, C. W., 18, Batavia Buildings, Hackins Hey, Liverpool, Analytical Chemist.

1908. Hutcheson, John, c/o Farbenfabriken of Elberfeld Co., 14, Front Street East, Toronto, Canada, Local Manager.

1894. Hutcheson, Jno. F., Chemical Manufacturer.

1906. Hutchings, W. Maynard, Easedale, Elmfield Road, Gosforth, Newcastle-on-Tyne, Metallurgist.

O.M. Hutchinson, C. C., K.C., 3, Harcourt Buildings, Temple, E.C., Barrister-at-Law and Chemical Engineer.

1900. Hutchinson, E. George, Gas Dept. Engineer's Office, Workington, Manager.

O.M. Hutchinson, T. J., Aden House, Manchester Road, Bury, Analytical and Consulting Chemist.

1909. Hutchison, Chas. F., Eastman Kodak Co., Kodak Park, Rochester, N.Y., U.S.A., Photographic Emulsion Maker.

1909. Hütz, Dr. R., 32, India Street, Boston, Mass., U.S.A., Colour Chemist.

O.M. Huxley, Jas. H., c/o Vickers, Son, and Maxim, Ltd., River Don Works, Sheffield, Metallurgical Chemist.

1906. Huyett, Miles C., 1005, Morgan Building, Buffalo, N.Y., U.S.A., Mechanical Engineer.

1897. Hyams, Godfrey M., 312, Sears Building, Boston, Mass., U.S.A., Mines Manager.

1902. Hyde, Austin T., Box 98, Rumford Falls, Maine, U.S.A., Chemical Engineer.

1897. Hyde, B. T. Babbitt, 11, Broadway, New York City, U.S.A., Soap Manufacturer.

1899. Hyde, Fred. S., 215, Schermerhorn Street, Brooklyn, N.Y., U.S.A., Research Chemist.

1899. Hyde, Wm. Grantley, Garden Wharf, Church Road, Battersea, S.W., Assayer.

1901. Hyman, Leonard W., 342, South Pearl Street, Albany, N.Y., U.S.A., Analytical Chemist.

I

1900. Ichioka, Dr. Tajiro, 19, Maruyama Shinmachi, Hongo, Tokio, Japan, Chemist (Imperial Japanese Navy).

1906. Iddings, Richard P., Arlington Mills, Lawrence, Mass., U.S.A., Chemist.

1885. Idris, T. H. W., M.P., 120, Pratt Street, Camden Town, N.W., Mineral Water Manufacturer.

1909. Imison, C. S., Heatherlea, Runcorn, Cheshire, Chemist, United Alkali Co.

1900. Imrie, John, 83, Horndean Road, Firth Park, Sheffield, Producer Gas and By-Products Plant Manager.

1900. Ingalls, Walter R., (Communications) 505, Pearl Street, New York City; and (Journals) Bement Avenue, West New Brighton, Staten Is., N.Y., U.S.A., Mining Engineer and Metallurgist.

1889. Ingle, Dr. Harry, 6, Highfield Terrace, Kingston Road, Leeds, Organic Chemist.

1891. Ingle, Herbert, 18, Crown Terrace, South Cliff, Scarborough, Agricultural Chemist.

1909. Ingleby, G. W., c/o John L. Seaton & Co., Ltd., Sculcoates, Hull, Director.

1906. Inglis, Dr. Jno. K. H., University College, Reading, Berks., Lecturer.

1911. Innes, Dr. Alfred G., 30, Sorbie Road, Saltcoats, Ayrshire, Technical Chemist.

1909. Innes, R. Faraday, c/o International Salt Co., Ltd., Eden, near Carrickfergus, Ireland, Chemist.

1906. Innes, Dr. W. Ross, 9, Red Hill, Edgware, Middlesex, Chemist.

1904. Irlam, H. A., Long View Villa, 162, Hitchin Road, Luton, Beds., Manager and Chemist.

1910. Irvine, Prof. J. C., Chemical Research Laboratory, The University, St. Andrews, Scotland, Professor of Chemistry.

1884. Irving, J. M., 17a, Dickinson Street, Cooper Street, Manchester, Chemical Merchant.

1906. Irwin, John T., Cledford, Middlewich, Cheshire, Manufacturing Chemist.

O.M. Irwin, W., Inglehurst, Stand, near Manchester, Analytical Chemist.

1893. Isaac, J. F. V., Research Chemist.

1901. Isakovics, Alois von, Synfleur Scientific Laboratories, Monticello, N.Y., U.S.A., Manufacturing Chemist.
1900. Ittner, Dr. Martin H., c/o Colgate and Co., Jersey City, N.J., U.S.A., Soap and Essential Oil Chemist.
1908. Ives, Herbert, 125, Pearl Street, Boston, Mass., U.S.A., Manager (Dyestuffs, etc.).

J

1890. Jackman, E. J., 60, Belgrave Road, Ilford, Essex, Technical Chemist.
O.M. Jackson, Edward, Ravens Clift, Oxford Road, Moseley, Birmingham, Alkali Works Inspector.
1904. Jackson, Ernest W., Godrevy, Saltburn, Yorks., Analytical Chemist.
1891. Jackson, F., Smedley Bridge Works, Cheetham, near Manchester, Bleacher and Dyer.
1883. Jackson, Frederick, 14, Cross Street, Manchester, Laboratory Furnisher.
1886. Jackson, John, 98, Dobbie's Loan, Glasgow, Lubricant Manufacturer.
1901. Jackson, Percy G., c/o National Boiler Insurance Co., St. Mary's Parsonage, Manchester, Chemist.
1890. Jackson, Saml., c/o N. Rhodes, Carnatic Mill, Perambore Barracks, Madras, India, Analytical Chemist.
1902. Jackson, Samuel, c/o Wm. Metcalf, Ltd., Church, near Accrington, Director (Tar Distillery).
1898. Jackson, Thos., Thornton View, Clayton, Manchester, Chemical Manufacturer.
1900. Jackson, Victor G., 21, Frankfort Road, Herne Hill, S.E., Chemist.
1900. Jackson, Dr. W. Hatchett, Radcliffe Library, Oxford, Librarian and Science Tutor (Keble College).
1893. Jackson, Rt. Hon. W. L., F.R.S. *See* Allerton, Rt. Hon. Lord.
1899. Jackson, W. Morton, c/o British Oxygen Co., Ltd., Great Marlborough Street, Manchester, Manager.
O.M. Jackson, W. P., Saxilby, near Lincoln, Chemical Works Manager.
1900. Jacoby, Areli H., c/o American Dyewood Co., 84, William Street, New York City, U.S.A., Chemist.
1897. Jacqué, Maurice, "La Cantabrica," Galdacano, cerca Bilbao, Spain, Chemical Engineer.
1901. Jadhava, Khasberao B., Nausari, Bombay, India, Collector and District Magistrate.
1900. Jäger, B. M., c/o Geo. Jäger and Sons, 77, Burlington Street, Liverpool, Sugar Chemist.
1886. Jago, Wm., 1, Garden Court, Temple, London, E.C., Barrister-at-Law.
1883. James, E. T., British Alizarin Co., Ltd., Silvertown, Victoria Docks, E., Secretary.
1893. James, Lawrence S., 32, Hawley Street, Boston, Mass., U.S.A., Gas Inspector.
1905. James, Oscar S., 227, George Street, Toronto, Canada, Analytical Chemist.
O.M. Japp, Dr. F. R., F.R.S., The University, Aberdeen, Professor of Chemistry.
1890. Jarmain, Geo. S., Dalton Lodge, Huddersfield, Wool Extractor.
O.M. Jarmay, G., Hartford Lodge, Hartford, Cheshire, Alkali Manufacturer.
1900 Jarvie, Jas., Ferndale, Kenmure Avenue, Bishopbriggs, N.B., Chemist.
1907. Jatar, S. B., 219, Upper Brook Street, C. on M., Manchester, Student.
1910. Jayne, David W., c/o Barrett Manufacturing Co., Frankford, Philadelphia, Pa., U.S.A., Manager.
1908. Jeffery, John H., 10, Daysbrook Road, Streatham Hill, London, S.W., Chemist and Metallurgist.
O.M. Jekyll, J., Castle Moat House, Lincoln, Chemical Manufacturer.
1892. Jenkin, W. A., 5, Bella Vista, Minas de Rio Tinto, Provincia de Huelva, Spain, Metallurgical Chemist.
1905. Jenkins, Chas. D., 9, Lakeview Road, Winchester, Mass., U.S.A., Chemist.
1894. Jenkims, John H. B., Laboratory, G.E.R. Works, Stratford, E., Analytical Chemist.
1894. Jenks, Robt. L., Kasauli, Punjab, India, Chemist.
1911. Jennens, John H., 4, Highbridge Road, Wylde Green, nr. Birmingham, Analytical Chemist.
1908. Jennison, George, Derby House, Heaton Chapel, Stockport, Chemist.
1905. Jennison, Jas., Mountfield, London Road, Greenhithe, Kent, Chemist.
1907. Jensen, Chas. W. L., Collins Green Brewery, Newton-le-Willows, Lancashire, Brewer and Maltster.
1904. Jepson, John Elliott, c/o Star Paper Mill Co., Ltd., Feniscowles, near Blackburn, Chemist.
1899. Jerdan, Dr. David S., Temora, Colinton, Midlothian, Chemist (Gelatin Works).
1899. Jessop, Louis V., Holmlea, Woodville Road, Leytonstone, Essex, Chemist.
1904. Jewson, F. T., Earith, near St. Ives, Hunts., Chemist.
1896. Job, Robt., 9, Springfield Avenue, Montreal, Canada, Analytical Chemist.
1906. John, David, Haileybury, Ontario, Canada, Chemist.
1908. Johnson, Arthur, 25, Nursery Street, Pendleton, Manchester, Chemist.
1886. Johnson, A. E., Claremont, Lyndhurst Road, Wolverhampton, Analytical Chemist.
1904. Johnson, Cedric, West House, Hartford, Cheshire, Chemical Engineer.
1891. Johnson, Edmond E., c/o J. and R. Niven, P.O. Box 4022, Johannesburg, Transvaal, Chemical Engineer.
1910. Johnson, E. J., 43–44, National Bank and Loan Building, Watertown, N.Y., U.S.A., Chemist.
1908. Johnson, Dr. Edw. S., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Chemist.
1904. Johnson, Dr. F. M. G., 286, Peel Street, Montreal, Canada, Chemist.
1904. Johnson, G. B., 7, Church Street, Liverpool, Wholesale Chemist
1907. Johnson, H. Finnis, c/o Borax Consolidated, Ltd., 16, Eastcheap, London, E.C., Sales Manager.
1908. Johnson, Horton, Ridgway, Pa., U.S.A., Tanner.
O.M. Johnson, J. E. J., 133, Earlham Grove, Forest Gate, E., Manufacturing Chemist.
1895. Johnson, Jesse F., Vaudreuil Station, P.Q., Canada, Chemical Engineer.
1900. Johnson, John, c/o John Johnson and Co., 37th Street and Second Avenue, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1900. Johnson, Jno. W. H., York House, Thornhill, Dewsbury, and (Journals) West Riding Rivers Board, Wakefield, Yorks., Chemist.
1906. Johnson, Oliver L., c/o The Aspinook Co., Jewett City, Conn., U.S.A., Dye Works Manager.
1904. Johnson, S. Hearon, 7, Church Street, Liverpool, Wholesale Chemist.
1895. Johnston, Alex. R., 18, Percy Street, Ibrox, Glasgow, Analytical Chemist.
1906. Johnston, A. McA., Box 108, Germiston, Transvaal, Metallurgical Chemist.
1894. Johnston, G. Lawson. *See* Lawson-Johnston, G.
1904. Johnston, J. H., 8, Leopold Road, Wimbledon, S.W., Chemist and Bacteriologist.
1904. Johnston, Thos. J., 4, Garrioch Drive, Maryhill, Glasgow, Chemist.
1890. Johnston, Wm. A., The S. S. White Dental Manufacturing Co., Princess Bay, Staten Island, N.Y., U.S.A., Dental Enamel Manufacturer.
1894. Johnston, W. E. Lawson. *See* Lawson-Johnston, W.E.
O.M. Johnston, Wm. G., Anchor Chemical Works, 1005, Garngad Road, Glasgow, Technical Chemist.
O.M. Johnstone, Jas., Shawfield Works, Rutherglen, Glasgow, Technical Chemist.
1905. Johnstone, J. Swanston, National Distilleries Co., Bond Street, Durban, Natal, Distiller.
1903. Johnstone, S. J., 15, Springfield Road, New Southgate, N., Research Chemist.
O.M. Johnstone, W. G., Chemist.

1907. Joliffe, Ernest H., Technical High School, 149, College Street, Toronto, Canada, Works Chemist.
1905. Jolliffe, Frank, 27, Riseldine Road, Honor Oak Park, S.E., Chemist.
1908. Jones, Andrew U., c/o The Parker Foundry Co., Ltd., Montreal, Canada, Mechanical Contractor.
1909. Jones, Arthur, c/o Grout & Co., Ltd., Silk Crape Works, Great Yarmouth, Technical Chemist.
1904. Jones, Arthur B., 981, Central Avenue, Plainfield, N.J., U.S.A., Superintendent.
1902. Jones, David R., Triton Chemical Works, Upper Clapton, London, N.E., Chemical Engineer.
1908. Jones, D. Trevor, c/o Brotherton and Co., Ltd., Litherland, Liverpool, Works Chemist.
1910. Jones, E. Protheroe, The Golden Horseshoe Estates Co., Salisbury House, London Wall, London, E.C., Secretary.
1902. Jones, E. Strangways, Sulphide Corporation, Ltd., Cockle Creek, N.S.W., Australia, Metallurgical Chemist.
1909. Jones, E. Willis, 22, Coleshill Terrace, Llanelly, South Wales, Chemical Manufacturer.
O.M. Jones, E. W. T., 10, Victoria Street, Wolverhampton, Analytical Chemist.
1897. Jones, Fred. W., 39, Pembury Road, Clapton, N.E., Technical Chemist.
1896. Jones, G. Cecil, 41, London Road, Forest Hill, S.E., Consulting Chemist.
1905. Jones, Harold, Morro Velho, Villa Nova de Lima, Minas Geraes, Brazil, Analyst and Assayer.
O.M. Jones, H. Chapman, Imperial College of Science and Technology, South Kensington, S.W., Lecturer in Photography.
1907. Jones, Henry Williams, Westbourne, Gravelly Hill, Birmingham, Manufacturing Chemist.
1893. Jones, Herbert. *See* Selton-Jones, H.
1901. Jones, Herbert J., 40, Reginald Road, Forest Gate, E., Chemist.
1910. Jones, Ivor R., 54, Atlantic Chambers, Manchester, Chemical Merchant.
1905. Jones, J. E. Stacey, Masonic Buildings, Coventry, Consulting Chemist and Technical Metallurgist.
1904. Jones, J. Shirley, Moscow, Idaho, U.S.A., Chemist.
1899. Jones, Llewellyn J. W., 323, North J. Street, Tacoma, Wash., U.S.A., Metallurgist.
1894. Jones, M. W., Stonebeck, Brislington, Bristol, Manager (Oil and Colour Works).
1887. Jones, T. Tolley, Australian Explosives and Chemical Co., Ltd., 135, William Street, Melbourne, Victoria, Australia, Explosives Manufacturer.
O.M. Jones, Walter Norris, Lancashire Metal Works, Widnes, Technical Chemist.
1903. Jones, Wm. App, c/o Boston Artificial Leather Co., Metropolitan Building, New York City, U.S.A., Chemist.
1905. Jones, W. Ellis, 80, Arundel Avenue, Liverpool, Sugar Refiner.
1904. Jordan, Stanley, 100, William Street, New York City, U.S.A., Importer of Chemicals.
1908. Joselin, Percy H., 81, Bennerley Road, New Wandsworth, S.W., Chemist.
1905. Joseph, A. F., Ceylon Technical College, Colombo, Ceylon, Lecturer on Chemistry.
1900. Josephson, Edgar, c/o Pantazote Leather Co., Passaic, N.J., U.S.A.
1906. Joshua, Dr. Walter P., c/o Cordoba Copper Co., Ltd., Cerro Muriano, nr. Cordoba, Spain, Chemist.
1891. Joslin, Omar T., 3223, Spring Grove Avenue, Cincinnati, Ohio, U.S.A., Chemical Engineer.
1887. Joüet, Dr. C. H., 238, East 2nd Avenue, Roselle, Union Co., N.J., U.S.A., Technical Chemist.
1889. Journaud, Louis, Pont Evêque (Isère), France, Technical Chemist.
1910. Jouve, Adolphe, 1, Boulevard St. Germain, Paris, France, Technical Chemist.
1904. Jowett, Dr. H. A. D., Phœnix Mills, Dartford, Kent, Research Chemist.
1903. Joyce, Clarence M., P.O. Box 23, Arlington, N.J., U.S.A., Chemist.
1887. Jürgensen, Dr. Rolof, Nerudagasse 14, Prag-Weinberge, Austria, Chemist.
O.M. Justice, Philip M., 55–56, Chancery Lane, London, W.C., Patent Agent.

K

1896. Kalbfleisch, Franklin H., Metropolis Building, Broadway and 16th Street, New York City, U.S.A., Chemical Manufacturer.
1908. Kalenski, Edmund, 22, Prince's Square, Bayswater, London, W., Chemist.
1908. Kaliski, Dr. Maximilian S., 118 West 119th Street, New York City, U.S.A., Technical Chemist.
1884. Kalle, Dr. Wm., Biebrich-am-Rhein, Germany, Colour Manufacturer.
1901. Kauder, Dr. E., c/o Merck and Co., Rahway, N.J., U.S.A., Chemist.
1903. Kauffman, Milton H., American Smelting and Refining Co., Durango, Colo., U.S.A., Chemist.
1910. Kaufmann, George von, Solotwina, Ost-Galizien, Austria, Director (Austrian Petroleum Co.)
1892. Kaufmann, Dr. Herbert M., c/o Mutual Chemical Co., Jersey City, N.J., U.S.A., Chemist.
1910. Kaufmann, Dr. W. P., c/o J. J. McLaughlin, Ltd., 145–155, Sherbourne Street, Toronto, Canada, Manufacturing Chemist.
1904. Kaus, Dr. Emil, c/o Roessler and Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Chemist.
1904. Kawai, I., 54, Shirokane, Shidamachi, Shiba, Tokyo, Japan, Chemist (Camphor Monopoly).
1885. Kawakita, Prof. Michitada, Imperial Engineering College, Tokio, Japan, Professor of Applied Chemistry.
O.M. Kay, Wm. E., 349, The Cliff, Broughton Park, Manchester, Printworks Chemist.
1910. Kaye, Henry R., c/o Cuming, Smith, & Co., Port Melbourne, Vic., Australia, Analytical Chemist.
1904. Kaye, Thos., 26, Rose Crescent, Perth, Scotland, Analytical Chemist.
1884. Keane, Dr. Chas. A., Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C., Principal.
O.M. Kearns, H. W., Baxenden, near Accrington, Dyer.
1897. Kearns, Jno. S., Cowpe Mills, Waterfoot, near Manchester, Chemist and Dyer.
1894. Kebler, Lyman F., 1322, Park Road, Washington, D.C., U.S.A., Chief of Drug Laboratory, Department of Agriculture.
1908. Keeble, A. J., Wereham Hall, Stoke Ferry, Norfolk, Land Owner.
1910. Keeler, Warren J., 214, Main Street, New Britain, Conn., U.S.A., Analytical Chemist.
1908. Keiller, P. A., c/o Colombo Commercial Co., Ltd., Colombo, Ceylon, Agricultural Analyst.
1910. Keillor, John, Hamilton Gas Light Co., Hamilton, Canada, Gas Engineer.
1886. Keiser, Prof. E. H., Washington University, St. Louis, Mo., U.S.A., Professor of Chemistry.
1908. Keith, Jas. W., c/o C. Tennant and Co, Ltd., Carnoustie, Forfarshire, Analytical Chemist.
1907. Keller, Dr. Edward, P.O. Box 363, Perth Amboy, N.J., U.S.A., Chemist and Metallurgist.
1905. Keller, Robt. J., 88, Broad Street, Boston, Mass., U.S.A., Dyestuff and Chemical Merchant.
1885. Kellner, Dr. Wm., 135, Victoria Road, Old Charlton, S.E., Chemist to War Department.
1908. Kellogg, H. W., c/o National Electrolytic Co., Niagara Falls, N.Y., U.S.A., General Manager.
1909. Kelso, Jas. A., 108, Park Avenue, Montreal, Canada, Chemist.
1910. Kemmerich, Dr. Wm. E., c/o The Roessler and Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Chemist.
1907. Kendall, G. F., Chemical Works, Stratford-on-Avon, Chemical Manufacturer.
1911. Kendall, George R., McGill, University College, Vancouver, B.C., Canada, Lecturer in Chemistry.
1901. Kennedy, Alex., Kenmill House, Bothwell, N.B., Rosin Distiller.

1903. Kenyon, Percy S., Park House, Cheadle Hulme, Cheshire, Drysalter.

1889. Kenyon, Thos., The Shrubbery, Hilton Park, Prestwich, near Manchester, Manufacturing Chemist.

1906. Kepner, S. H., 149, 12th Street, Long Island City, N.Y., U.S.A., Superintendent.

1888. Ker, Alan D., 14, Wilton Mansions, Glasgow; and (Journals) c/o J. C. Barr, 180, West Regent Street, Glasgow, Chemical Manufacturer.

1899. Kern, Walter P., 275, Lafayette Avenue; and (Journals) c/o General Chemical Co., Dundee Works, Passaic, N.J., U.S.A., Chemist.

1906. Kerr, Charles H., c/o American Optical Co., Southbridge, Mass., U.S.A., Research Chemist.

1890. Kerr, Saml. T., 516, North Delaware Avenue, Philadelphia, Pa., U.S.A., Salt Manufacturer.

1897. Kerr, Wm. M., c/o General Chemical Co., 608, Philadelphia Bourse, Philadelphia, Pa., U.S.A., Manufacturing Chemist.

1896. Kershaw, Jno. B. C., West Lancashire Laboratory, Waterloo, Liverpool, Analytical Chemist.

1909. Kesava Menon, A., 86, Messina Avenue, West Hampstead, N.W., Chemist.

1902. Kessler, Henry W., 317, Electric Building, Cleveland, Ohio, U.S.A., Manufacturing Chemist.

1893. Kestner, Paul, 7, Rue de Toul, Lille, France, Chemist.

1900. Kewley, Jas., Arbory Road, Castletown, Isle of Man; and (Journals) Balik Papan, Dutch Borneo, Technical Chemist.

1890. Keys, W. H., Hall End Works, West Bromwich, Oil and Chemical Manufacturer.

1892. Kibble, W. Oakes, Charlotte, N.C., U.S.A., Chemical Engineer and City Biologist.

1900. Kilgore, Benj. W., Raleigh, N.C., U.S.A., Chemist.

1901. Kilmer, Fred. B., c/o Messrs. Johnson and Johnson, New Brunswick, N.J., U.S.A., Chemical Manufacturer.

1905. Kimball, Herbert S., 46, Cornhill, Boston, Mass., U.S.A., Mill Engineer.

O.M. Kinch, E., Royal Agricultural College, Cirencester, Professor of Chemistry.

1905. King, Capt. Alex. E., R.A., Citadel, Cairo, Egypt; and (Journals) c/o Cox & Co., 16, Charing Cross, London, W.C., Inspector of Explosives.

O.M. King, A. J., Elleray, Windermere, Bleacher and Finisher.

1907. King, C. A., c/o The Farnley Iron Co., Farnley, near Leeds, Technical Chemist.

1884. King, Col. C. M., Campsie Alum Works, Lennoxtown, N.B., Alum Manufacturer.

1905. King, Frank E., 75, Gracechurch Street, London, E.C., Analytical Chemist.

O.M. King, J. Falconer, 30, Chambers Street, Edinburgh, Consulting Chemist.

1910. King, John, 25, Wilson Patten Street, Warrington, Lancashire, Works Manager.

1895. King, Sidney J., Hazeldene, Avenue Road, Bexley Heath, Kent, Colour and Dyestuff Traveller.

1910. King, Victor L., Zum Rechberg, Hirschengraben 40, Zürich, Switzerland, Chemical Engineer.

O.M. King, Walter R., 16, Mincing Lane, London, E.C.; and (Journals) Holford Lodge, Trinity Avenue, Southend-on-Sea, Chemical Manufacturer.

1905. King, Warren C., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Salesman.

1896. Kingdon, Holman, c/o Joseph Crosfield and Sons, Warrington, Technical Chemist.

1908. Kingsbury, Percy C., 622, West 135th Street, New York City, U.S.A., Civil Engineer.

1883. Kingsford, T. P., Oswego, N.Y., U.S.A., Starch Manufacturer.

O.M. Kingzett, C. T., Newlands, St. George's Avenue, Weybridge, Surrey, and (Journals) Sanitas Co., Ltd., Locksley Street, Limehouse, E., Technical Chemist.

1906. Kinnersley, H. W., Branscombe, Merry Hill Road, Bushey, Herts, Chemist and Manufacturer.

1897. Kipping, Dr. F. Stanley, F.R.S., University College, Nottingham, Prof. of Chemistry.

1908. Kirkhope, T. Bertram, c/o Mrs. Wade, Connordowns, Hayle, Cornwall, Explosives Works Chemist.

1898. Kirkland, Archd., 78, High Street, Irvine, N.B., Baker.

1905. Kirkland, John, 105, Holmdene Avenue, Herne Hill, S.E., Technical Instructor.

1900. Kirkpatrick, Prof. Stafford F., 24, Frontenac Street, Kingston, Ont., Canada, Professor of Metallurgy.

1910. Kirwan, P. T., Junr., 6, Elmscourt Apartments, 27, Irwin Avenue, Toronto, Canada, Chemist.

1902. Kitchen, Wm. J., Port Melbourne North, Vic., Australia, Soap and Candle Manufacturer.

1891. Kitson, Rt. Hon. Sir James, Bart., M.P. *See* Airedale, Lord.

1883. Kitto, B., 26, Lancaster Road, Finsbury Park, London, N., Analytical Chemist.

1900. Kittredge, H. G., c/o The Kay and Ess Co., Dayton, Ohio, U.S.A., Chemist.

1908. Klaber, Wm., c/o Castle Kid Co., Camden, N.J., U.S.A., Chemist.

1900. Kleber, Dr. Clemens, Union Avenue, Clifton, N.J., U.S.A., Director (Fritzche Bros.' Laboratory).

1888. Kleemann, Dr. S., Farben Fabrik, Forchheim, Bavaria, Analytical Chemist.

1908. Klein, Dr. Friedrich, 762, Melrose Avenue, New York City, U.S.A., Chemist.

1909. Klemm, Wilfred E., 25, Marmion Road, Liverpool, S., and (Journal) c/o Messrs. Charles Greaves, 217, Chester Road, Manchester, Chemist.

1908. Klien, Dr. J. L., c/o Aboshi Celluloid Co., Aboshi, Kobé, Japan, Works Manager.

1903. Kline, Clarence M., 429, Arch Street, Philadelphia, Pa., U.S.A., Wholesale Druggist.

1889. Klipstein, A., 122, Pearl Street, New York City, U.S.A., Chemical Manufacturer.

1902. Klipstein, Ernest C., 116, Prospect Street, East Orange, N.J., U.S.A., Chemical Merchant.

1891. Knaggs, Alfred B., 2, Bradley Lane, Huddersfield, Technical Chemist in Dyeworks.

1911. Knapp, Arthur W., 26, Esher Road, New Ferry, Cheshire, Analytical Chemist.

1905. Knapp, Sewell A., Room 505, First National Bank Building, Oakland, Cal., U.S.A., Mine Manager.

1892. Knecht, Dr. E., Beech Mount, Marple, Cheshire, Professor of Tinctorial Chemistry.

1904. Kniffen, Frederick, Room 913, Du Pont Building, Wilmington, Del., U.S.A., Chemist.

1887. Knight, A. H., 51, Highfield Street, Liverpool, Assayer.

1903. Knight, Harley F., 64, Amhurst Park, Stamford Hill, N., Analyst.

1884. Knight, Henry, Stanley House, 73, Anfield Road, Liverpool, Colour and Varnish Manufacturer.

O.M. Knight, J. Baillie, Royal Primrose Soapworks, Silvertown, London, E., Soap Manufacturer.

1887. Knights, J. West, 67, Tenison Road, Cambridge, Analytical Chemist.

1885. Knipler, F., c/o R. Harper and Co., Port Melbourne, Victoria, Australia, Starch Manufacturer.

1907. Knoedler, E. L., c/o Welsbach Co., Gloucester City, N.J., U.S.A., Factory Foreman.

1910. Knott, Anthony F., The Priestman Collieries, Ltd., Ottovale Coke Works, Blaydon-on-Tyne, Works Chemist.

1883. Knowles, Joshua, Tottington Mills, near Bury, Calico Printer.

1904. Knowles, W. R., The Hollies, Wood Green, Wednesbury, Chemical Works Manager.

1886. Knox, E. W., Colonial Sugar Refining Co., Sydney, N.S.W.; and (subs.), c/o Parbury, Henty and Co., 20, Eastcheap, London, E.C., Sugar Manufacturer and Refiner.

1906. Knudsen, Kristian Hv., Chemist.

1905. Koch, Dr. Geo. W., 905, Willoughby Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1904. Koch, J. A., Bluff and Pride Streets, Pittsburg, Pa., U.S.A., Chemist.

1904. Koebig, Dr. J., 414, I. W. Hellman Building, Los Angeles, Cal., U.S.A., Consulting and Chemical Engineer.

1909. Koekoek, Patrick R., c/o Messrs. Colthurst and Harding, Phoenix Works, Templegate, Bristol, Works Chemist.

1904. Koerner, H. Theo., Beyerstrasse 28, Chemnitz, Germany, Student of Chemistry.

1884. Kohn, Dr. Charles A. *See* Keane, Dr. Chas. A.

1902. Kohnstamm, Lothair S., 87, Park Place, New York City, U.S.A., Chemist.

1910. Komuro, S., c/o Mrs. Ohtani, Karasumaru, Sawaragi, Nishie, Iru, Kyoto, Japan, Technical Chemist.

O.M. Kraftmeier, E., 54, Parliament Street, Westminster, S.W., Explosives Manufacturer.

1906. Krais, Dr. Paul, Tuebingen, Germany, Chemist.

1894. Krause, Dr. Albert H., 1444, West 98th Street, Cleveland, Ohio, U.S.A., Chemist (Grasselli Chemical Co.).

O.M. Krause, Prof. Dr. G., Cöthen (Anhalt), Germany, Chemist.

O.M. Krause, O. H., c/o American Sugar Refining Co., Jersey City, N.J., U.S.A., Chemical Engineer.

1898. Krebs, H. J., 806, Franklin Street, Wilmington, Del., U.S.A., Manufacturing Chemist.

1908. Kress, Otto, 438, West 116th Street, New York City, U.S.A., Teacher of Science.

1910. Krone, L. J., c/o "The Metal Industry," 99, John Street, New York City, U.S.A., Consulting Metallurgist and Editor.

1907. Kuan, C. H., 18A, Stanley Road, Hong Kong, Chemist.

O.M. Kühl, W. H., 82, Königgrätzerstrasse, Berlin, S.W. XI., Germany, Bookseller.

1900. Kunheim, Dr. Erich, Niederschöneweide, near Berlin, N.W., Germany, Chemist.

1904. Kunz, Dr. George F., c/o Tiffany and Co., 37th Street and 5th Avenue, New York City, U.S.A., Gem Expert.

1905. Kurt, Franklin T., 553, Boylston Street, Boston, Mass., U.S.A., Professor of Chemistry, B.Y.M.C.A.

1907. Kutsch, Dr. Wm. A., c/o Corn Products Manufacturing Co., Pekin, Ill., U.S.A., Chemist.

1910. Kuttroff, Arthur, 17, East 69th Street, New York City, U.S.A., Colour and Chemical Merchant.

1900. Kuttroff, Fred., 128, Duane Street, New York City, U.S.A., Merchant.

1909. Kwoh, See Kwain, c/o Ta-Chou Electrical Lighting Co., Lily Pond, Chinkiang, China, Chemical Engineer.

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1907. Kynaston, Wm. C. R., 9, Harland Road, Higher Tranmere, Birkenhead, Analyst.

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1897. Labonde, Dr. Leon, 3418, South Flower Street, Los Angeles, Cal., U.S.A., Consulting Chemical Engineer.

1906. Lacell, Harold G., Ardoch, Nether Street, Finchley, N., Chemist.

1890. Lacey, E. C., St. Julian's Lodge, St. Julian's Farm Road, West Norwood, Manufacturing Chemist.

1903. Lachman, Dr. Arthur, 3037, Wheeler Street, Berkeley, Cal., U.S.A., Chemical Engineer.

O.M. Laidler, C. P., 20, Noble Terrace, Gateshead-on-Tyne, Analytical Chemist.

O.M. Lake, G., jun., Lee Mount, Glossop, Derbyshire, Analytical Chemist.

1907. Lake, Henry B., Canadian Pacific Railway Co., Winnipeg, Canada, Chemical Engineer.

1900. Lamar, Wm. R., Lamar Chemical Works, 8–14, Johnson Street, Newark, N.J., U.S.A., President.

1898. Lamb, Morris Chas., Leathersellers' Technical College, 176, Tower Bridge Road, London, S.E., Chemist.

1907. Lancaster, Harry M., Faculty of Applied Science, The University, Toronto, Canada, Chemist.

1910. Landrum, R. D., c/o Lisk Manufacturing Co., Canandaigua, N.Y., U.S.A., Chemical Engineer.

1904. Lane, C. Cyril P., c/o The Avon India-Rubber Co., Melksham, Wilts., Chemist.

1910. Lane, J. Henry, 3, Arbour Square, Stepney, London, E., Chemist.

1903. Lane, Nathaniel J., U.S. Laboratory, 641, Washington Street, New York City, U.S.A., Chemist.

1893. Lang, Dr. Wm. R., University of Toronto, Canada, Professor of Chemistry.

O.M. Langdon, Dr. M. J., c/o Cocheco Manufacturing Co., Dover, N.H., U.S.A., Analytical Chemist.

1892. Langer, Dr. Carl, Ynyspenllwch, Clydach, R.S.O., Glamorganshire, Analytical Chemist.

1897. Langmuir, Arthur C., c/o Marx and Rawolle, 9, Van Brunt Street, Brooklyn, N.Y., U.S.A., Factory Manager.

1902. Langmuir, F. Leighton, 350, Bloor Street West, Toronto, Canada, Chemist.

1898. Langstaff, Wm., c/o Grassolli Chemical Co., Tremley, N.J., U.S.A., Chemist.

1900. Lant, Herbert, "Ivy Bank," Wath-on-Dearne, near Rotherham, Yorks., Chemist and Manager.

1909. Lantsberry, Fred. C. A. H., Birmingham Small Arms Co., and (Journal) 63, Walford Road, Sparkbrook, Birmingham, Metallurgical Chemist.

1906. Lantz, Alfred, 139, Rue La Fayette, Paris, France, Colour Works Manager.

1903. Larter, Alfred T., 86, Inderwick Road, Stroud Green, N., Chemist.

1907. Lasché, Prof. Alfred, The Lasché Institute, 2809, Vine Street, Milwaukee, Wis., U.S.A., Chemist and Bacteriologist.

1904 Lasher, F. G., 34, Bowne Street, Brooklyn, N.Y., U.S.A., Chemist.

1884 Latham, Baldwin, Parliament Mansions, Victoria Street, Westminster, S.W., Civil Engineer.

1889. Latham, J. J., Mill House, Bold, Widnes, Chemical Works Manager.

1907. Lathwood, Arthur, c/o Borax Consolidated, Ltd., 16, Eastcheap, London, E.C., Chemist.

1908. Lauder, A. Gilbert, c/o Nelson and Lauder, O'Neil Building, Binghampton, N.Y., U.S.A., Consulting Chemist.

1909. Law, Douglas J., Trent Bridge Leather Works, Nottingham, Chemist.

1907. La Wall, Chas. H., 39, South 10th Street, Philadelphia, Pa., U.S.A., Analytical Chemist.

1907. Lawrence, James, c/o W. T. Glover and Co., Trafford Park, Manchester, Chemist.

O.M. Lawrence, Jas., Box 737, Joplin, Mo., U.S.A., Explosives Manufacturer.

1904. Lawson, Jos. H. S., Britannia Mills, Hulme, Manchester, Salesman.

1900. Lawson, Wm. L., c/o Great Western Sugar Co., Sterling, Colo., U.S.A., Chemist.

1894. Lawson-Johnston, G., (Journals) 29, Portman Square, W., and 1, King's Arms Yard, London, E.C., Chairman of Bovril, Ltd.

1894. Lawson-Johnston, W. E., c/o Bovril, Ltd., 152, Old Street, London, E.C., Director.

1890. Laycock, Dr. W. F., 46, Boar Lane, Leeds, Analytical Chemist.

1907. Leach, Dr. F. P., Claremont, Penns Lane, Erdington, Birmingham, Research Chemist.

1907. Leach, Paul F., c/o Lactic Process Co., 117, Fulton Street, New York City, U.S.A., Secretary.

1908. Leake, Percy C., Deanbank Terrace, Ferryhill Village, Co. Durham, Tar Works Manager.

1898. Lean, Geo., 15, Park Terrace, Glasgow, Chemist.

1897. Leathart, Thos. H., Lead Works, Newcastle-on-Tyne, Lead Manufacturer.

O.M. Leather, Dr. J. Walter, Agricultural Research Institute, Pusa, Bengal, India, Government Chemist.

1893. Le Boutillier, Clement, c/o Taylor Iron and Steel Co., High Bridge, N.J., U.S.A., Chemist.

1907. Lecco, Prof. Marco T., Belgrade, Servia, Professor of Chemistry.

1904. Le Chatelier, Prof. H., 75, Rue Notre Dame des Champs, Paris, France, Professor (l'Ecole des Mines).

1896. Lecomber. W. G., Cambridge Works, Knott Mill, Manchester, Engineer.

1896. Lederle, Dr. E. J., 39–41, West 38th Street, New York City, U.S.A., Chief Chemist.

1892. Ledoff, Prof. A., Technological Institute, Kharkoff, Russia, Professor of Chemistry.

1895. Ledoux, Dr. Albert R., 99, John Street, New York City, U.S.A., Chemist.

1903. Ledoux, Aug. D., 15, William Street, New York City, U.S.A., Importer of Pyrites.

1905. Lee, Ashton, Lawrence, Mass., U.S.A., Manufacturing Chemist.

1905. Lee, Frank W., Lawrence, Mass., U.S.A., Manufacturing Chemist.

1905. Lee, John C., Mountford Street, Brookline, Mass., U.S.A., Assistant Engineer (American Telegraph and Telephone Co.).

1898. Lee, Jno. L., Woodfield, Lytham, Lancashire, Dyer and Bleacher.

1885. Lee, S. Wright, 6–10, Whitechapel, Liverpool, Wholesale Druggist.

1906. Lee, William, 28, Sherard Gardens, Eltham, Kent, Works Chemist.

1903. Leerburger, Henry, 295½, Pearl Street, New York City, U.S.A., Essential Oil Merchant.

1901. Leffler, Rudolf L., c/o Thos. Firth and Sons, Ltd., Norfolk Works, Sheffield, Metallurgical Chemist.

1907. Lehmann, Dr. Adolf, University of Alberta, Strathcona, Alberta, Canada, Prof. of Chemistry.

1888. Leigh, Cecil, Birmingham Metal and Munition Co., Adderley Park Rolling Mills, Birmingham, Technical Chemist.

1906. Leigh, Edw. Collier, c/o Companhia de Gaz, Pará, North Brazil, Chemical Engineer.

1902. Leighton, A. E., Dept. of Defence, Victoria Barracks, Melbourne, Victoria, Analytical Chemist.

1894. Leitch, Jno. W., Milnsbridge Chemical Works, near Huddersfield, Aniline Dye Manufacturer.

1904. Le Maistre, Fred J., Room 727, Du Pont Building, Wilmington, Del., U.S.A., Research Chemist.

1910. Leman, Sheldon D., c/o Cowell Portland Cement Co., Cowell, Cal., U.S.A., Chemist.

1898. Leman, Wm. T., P.O. Box 900, St. Louis, Mo., U.S.A., Oil and Asphalt Agent.

1908. Lemeland, Dr. P., 8, Rue Alfred de Vigny, Paris, France, Chemist.

1883. Lennard, F., Ilford Manor House, near Lewes, Sussex, Chemical Manufacturer.

1884. Leonard, Wm. J., 1, Lindfield Gardens, Hampstead, N.W., Naphtha Distiller.

1888. Lequin, E., Directeur Général des Usines de Produits Chimiques de la Société de St. Gobain, 1, Place des Saussaies, Paris (VIII^e.), France.

1904. Lesley, R. W., 604, Pennsylvania Building, Philadelphia, Pa., U.S.A., Cement Manufacturer.

1910. Leslie, A. W., 119, Stoke Newington Road, London, N., Rubber Merchant.

1907. Leslie, Dr. Fred. A., College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Chemist.

1894. Leslie, Hugh M., Marikuppam, Mysore State, South India, Chemical Engineer.

1904. Lessing, Dr. Rudolf, Southampton House, 317, High Holborn, London, W.C., Consulting Chemist.

1892. Lester, J. H., Royal Exchange, Manchester, Analytical Chemist.

1899. Le Sueur, Dr. Henry R., Chemical Laboratory, St. Thomas' Hospital, London, S.E., Demonstrator.

1909. Lever, J. D'Arcy, jun., Thornton House, Thornton Hough, Cheshire, Soap Manufacturer.

1891. Lever, Wm. H., M.P., Thornton House, Thornton Hough, Cheshire, Soap Manufacturer.

1909. Lever, W. Hulme, Thornton Manor, Thornton Hough, Cheshire, Soap Manufacturer.

1901. Levett, Walter, Holmlands, Stanford-le-Hope; and (Journals) Mines Safety Explosives Co., Stanford-le-Hope, Essex, Factory Manager.

1903. Levi, Dr. Louis E., c/o Pfister and Vogel Leather Co., Milwaukee, Wis., U.S.A., Chemist.

1906. Levinstein, Edgar, 74, India Street, Boston, Mass., U.S.A., Chemical Manufacturer.

1901. Levinstein, Dr. Herbert, Hawkesmoor, Wilbraham Road, Fallowfield, Manchester, Chemist.

O.M. Levinstein, Ivan, Hawkesmoor, Fallowfield, Manchester, Colour Manufacturer.

1903. Levy, Arthur G., 1927, Madison Avenue, New York City, U.S.A., Chemist.

1909. Levy, Louis S., 100, William Street, New York City, U.S.A., Editor, "American Perfumer."

1905. Lévy, René J., 4, St. Joseph Boulevard East, Montreal, Canada, Chemical Engineer.

1901. Levy-Mond, Dr. Albert. *See* Mond, Dr. Albert L.

1887. Lewes, Prof. Vivian B., Royal Naval College, Greenwich, S.E., Professor of Chemistry.

1898. Lewin, H. James, Royal Clarence Yard, Gosport, Hants, Analytical Chemist.

1896. Lewis, Daniel C., c/o Millville Manufacturing Co., Millville, N.J., U.S.A., Dye Works Chemist.

1904. Lewis, Edw. W., c/o J. G. Ingram and Sons, London India Rubber Works, Hackney Wick, N.E., Chemist.

1900. Lewis, Ernest A., 310, Dudley Road, Birmingham, Chemist and Metallurgist.

1905. Lewis, F. W., Aetna Powder Co., 143, Dearborn Street, Chicago, Ill., U.S.A., Secretary.

1900. Lewis, John, 35, Mundania Road, Honor Oak, S.E., Cashier (Paint Works).

1909. Lewis, Reginald J., Govt. Explosives Office, 423, Flinders Lane, Melbourne, Australia, Chemist.

1900. Lewis, Dr. S. Judd, 122, Newington Causeway, London, S.E., Analytical Chemist.

1889 Lewkowitsch, Dr. Julius, 71, Priory Road, West Hampstead, N.W., Consulting Chemist.

1907. Leyson, Lewis T., c/o Standard Bank of South Africa, Johannesburg, Transvaal, Analytical Chemist.

1901. Lichtenstein, Alf. F., c/o Geisenheimer and Co., P.O. Box 994, New York City, U.S.A., Chemist.

O.M. Lichtenstein, Theodore, Chemical Works, Silvertown, E., Manufacturing Chemist.

1904. Lichtenthaeler, Robt. A., Rhode Island Agricultural Experiment Station, P.O. Box 112, Kingston, R.I., U.S.A., Chemist.

1892. Liddle, G. A., George Hotel, Castletown, Isle of Man, Chemist, Dyewood Extract Works.

1885 Liddle, W. T., 14, Willows Avenue, Ansdell, Lytham, Chemist and Manager.

1904. Lieber, Hugo, 1, Platt Street, New York City, U.S.A., Chemist.

O.M. Liebmann, Dr. A., The Whim, Weybridge, Surrey, Consulting Chemist.

O.M. Lightfoot, T. E., Fernleigh, Accrington, Calico Printer's Chemist.

1905. Liley, Thos. A., 37, Aston Road, Bramley, Leeds, Chemist.

1909. Lillie, W. H., Merton, Marple, Cheshire, Cloth Finisher.

1898. Lilly, Josiah K., c/o Eli Lilly and Co., Indianapolis, Ind., U.S.A., Manufacturing Pharmacist.

1904. Lindemann, Ottocar, 53, Victoria Street, Westminster, S.W., Managing Director (Korting Bros., Ltd.).

1906. Linder, S. E., Leodholt, The Drive, Buckhurst Hill, Essex, Analytical Chemist.

1908. Lindfield, James H., 158, Putney Bridge Road, Putney, S.W., Technical Chemist.

1897. Lindsay, Robt., Goldenhuis Deep G. M. Co., P.O. Cleveland, Transvaal, Chemist.

1890. Ling, Arthur R., Laboratory, 74, Great Tower Street, London, E.C., Consulting Chemist.

1908. Linthicum, J. Francis, c/o The Spanish-American Iron Co., Felton, Oriente, Cuba, Chemist.

1905. Lips, Dr. Carl H., 99, Hart Street, Brooklyn, N.Y., U.S.A., Chemist.

1896. Lishman, Geo. P., Lambton Coke Works, Fence Houses, Co. Durham, Colliery Chemist.

1905. Little, Arthur D., 93, Broad Street, Boston, Mass., U.S.A., Consulting Chemist.

1889. Little, Wm. G., Chemical Manufacturer.
O.M. Littlejohn, Jas., c/o Littlejohn and Whitby, P.O. Box 849, Johannesburg, Transvaal, Analytical Chemist.
1911. Liu, Hamilton C., 401, Dryden Road, Ithaca, N.Y., U.S.A., Chemist.
1904. Livermore, W. D., Washington Mill, Lawrence, Mass., U.S.A., Chemist.
1886. Liversedge, A. J., c/o Manlove, Alliott, and Co., Ltd., Nottingham, Mechanical Engineer.
1906. Liversedge, S. G., City Laboratory, Castle Street, Dublin, Ireland, Analytical Chemist.
1904. Liverseege, J. F., Council House, Birmingham, Public Analyst.
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1907. Liversidge, Bernard, Rossholme, Clifton Lane, Rotherham, Yorks., Analytical Chemist.
1883. Livingston, W. J., 26, Osbaldeston Road, Stoke Newington Common, London, N., Analytical Chemist.
1903. Llewellyn, Ivor P., Goole Alum Works, Goole, Chemist.
1907. Llewellyn, W. B., Rock Villa, New Hey, near Rochdale, Chemist.
1899. Lloyd, Charles, (subscriptions) c/o Lake View Consols, Ltd., Salisbury House, London, E.C.; and (Journals) c/o Manager, Lake View Consols, Ltd., P.O. Box 99, Finiston, West Australia, Secretary.
1909. Lloyd, Edward, 27, Broomgrove Road, Sheffield, Chemical Engineer.
1904. Lloyd, Leonard B., Broadford Tannery, Broadford, Victoria, Australia, Tanner.
1907. Lloyd, Dr. Lorenzo L., Technical College, Bradford, Yorks., Lecturer in Chemistry.
1908. Lloyd, Capt. M. B., 3, Neville Terrace, Onslow Gardens, London, S.W., Director of Curtis's and Harvey, Ltd.
1900. Lloyd, Thos. H., c/o Quibell Bros., Newark, Analyst.
1909. Lobley, Alfred G., c/o British Aluminium Co., Ltd., Kinlochleven, Argyll, N.B., Works Chemist.
1888. Lodge, Edw., 25, Scale Hill, Cowcliffe, Huddersfield, Teacher of Wool Dyeing.
1900. Loeb, Dr. Morris, 273, Madison Avenue, New York City, U.S.A., Professor of Chemistry.
1891. Loewenthal, Dr. R., Uhlandstrasse 39, Frankfurt a/M., Germany, Lecturer on Dyeing.
1905. Lomax, Abraham, 83, Station Road, Kearsley, Farnworth, R.S.O., Potter's Chemist.
1907. Lomax, Ernest L., "Mowbreck," Farington, near Preston, Chemist.
1901. Long, Eugene J., c/o E. O'Callaghan and Son, City Tannery, Limerick, Ireland, Tanner.
1909. Long, George, Cudahy, Wis., U.S.A., Glue Maker.
1898. Longstaff, Dr. Jas. P., Chemical Department, The University, Edinburgh, Assistant.
1908. Longwell, Alex., 404, Lumsden Building, Toronto, Canada, Mining Engineer.
1902. Loomis, Henry M., U.S. Food Laboratory, 445, Arcade Annex Building, Seattle, Wash., U.S.A., Chemist.
1890. Lord, F. J., Winmarleigh, Southbourne, Christchurch, Hants., Analytical Chemist.
1896. Lord, Jno. Lloyd, 23, Park View, Elton, Bury, Lancs., Chemist and Manager.
1897. Lord, N. W., 338, West 8th Avenue, Columbus, Ohio, U.S.A., Professor of Metallurgy.
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1904. Lorimer, John H., 280, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Textile Machinist and Merceriser.
1905. Loring, Lindsley, Box 160, Boston, Mass., U.S.A., Vice-President (Cochrane Chemical Co.).
1909. Lorleberg, C., c/o R. W. Greeff and Co., 20, Eastcheap, London, E.C., Chemical Merchant.
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1904. Lossen, Dr. Clemens F., Boulevardul Independentei 8, Ploesti, Roumania, Chemist.
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O.M. Louis, D. A., 123, Pall Mall, London, S.W., Metallurgist and Mining Engineer.
1894. Louis, Prof. Henry, Armstrong College, and (Jnls.) Northern Scientific Club, Bolbec Hall, Westgate Road, Newcastle-on-Tyne, Professor of Mining.
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1899. Love, Wm., 28, Royal Exchange Square, Glasgow, Managing Director (Broxburn Oil Co., Ltd.).
1895. Lovejoy, Frank W., 22, Seneca Parkway, Rochester, N.Y., U.S.A., Chemical Engineer.
1904. Loveland, Jas. W., Prospect Avenue, Hackensack, N.J., U.S.A., Superintendent of Soap Works.
O.M. Lovibond, J. W., The Pleasaunce, Lake, near Salisbury, Tintometer Manufacturer.
O.M. Lovibond, T. W., West Jesmond House, Newcastle-on-Tyne, Brewer.
1900. Low, Prof. Wilson H., Cudahy Packing Co., South Omaha, Neb., U.S.A., Chemist.
1887. Lowe, Clement W., Thorneyholme, Knutsford, Cheshire, Manufacturing Chemist.
1905. Lowe, Houston, The Lowe Bros. Co., 450, East Third Street, Dayton, Ohio, U.S.A., Paint and Varnish Maker.
O.M. Lowe, W. F., 18, Hough Green, Chester, Analytical Chemist.
1885. Lowson, Dr. J. G. F., Snitterfield House, Stratford-on-Avon, Paper Maker.
1906. Lowson, Wm., The University, Leeds, Chemical Lecturer.
1895. Lucas, Alf., Survey Department, Giza, Egypt, Analyst.
1892. Lucas, Bernard R., Winnington Park, Northwich, Alkali Works Manager.
O.M. Luck, A. Courtenay, Laboratorio de Polvoras, Ministeria de Marina, Darsena Norte, Buenos Aires, Argentina, Explosives Chemist.
1900. Lummus, Walter E., 39, Bassett Street, Lynn, Mass., U.S.A., Manager.
1903. Lumsden, Alex. A., Forth Chemical Works, Bo'ness, N.B., Technical Chemist.
1910. Lumsden, William W., 39, Caledonia Road, Saltcoats, Scotland.
1888. Lund, Jas., 142, Hawthorne Street, Malden, Mass., U.S.A., Ammonia Works Manager.
1888. Lundholm, Carl O., 220, Winchester House, Old Broad Street, London, E.C., Explosives Works Manager.
1898. Lundteigen, Andreas, Union City, Mich., U.S.A., Chemist.
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1894. Lungwitz, Theo., c/o Chas. Pfizer and Co., 81, Maiden Lane, New York City, U.S.A., Chemist.
1885. Lupton, Sydney, 102, Park Street, Grosvenor Square, London, W.
1884. Lüthy, Otto, P.O. Box 63, Maywood, N.J., U.S.A., Analytical Chemist.
1895. Luxmoore, Dr. Chas. M., 19, Disraeli Gardens, Putney, S.W., Lecturer on Chemistry.
1899. Luxton, Thos., 116, North Boulevard, Hull, Teacher of Chemistry.
1903. Lye, Ernest B., Leagrave Hall, near Luton, Beds., Straw Plait Dyer and Bleacher.
1885. Lye, W. T., Leagrave Hall, near Luton, Beds., Straw Dyer.
1884. Lyle, James, Ardesco, West Silvertown, E., Sugar Refiner.
1885. Lyle, Jno., 21, Mincing Lane, London, E.C., Sugar Refiner.
1896. Lymn, Arthur H., 71, College Road, Bromley, Kent, Chemical Works Manager.
1899. Lynn, R. Rankine, 7, Highburgh Terrace, Dowanhill, Glasgow, Chemical Engineer.
1902. Lyon, Edwd. H., 520, West 27th Street, New York City, U.S.A., Manufacturing Chemist.

O.M. Lyon, J. G., The Aire Tar Works, Knottingley, Yorks., Tar Distiller.

1906. Lyons, Robert H., Emporium, Pa., U.S.A., Chemist.

O.M. Lytle, A. M., North of Ireland Chemical Co., Ltd., 34, Victoria Street, Belfast, Ireland, Chemical Manufacturer.

M

1908. Maas, Milton A., 100, William Street, New York City, U.S.A., Manufacturing Chemist.

1911. Mabbitt, Alan T., 3, Wallwood Road, Leytonstone, N.E., Analytical Chemist.

1887. Mabery, Prof. Chas. F., Case School of Applied Science, Cleveland, Ohio, U.S.A., Professor of Chemistry.

1891. Macadam, Herbert E., Dalkeith, Glengall Road, Woodford Green, Essex, Manure Works Manager.

1894. Macadam, Stevenson, 55, York Place, Edinburgh, Analytical Chemist.

1891. Macallan, J., 3, Rutland Terrace, Clontarf, Dublin, Analytical Chemist.

1894. McAlley, Robt., Bankside, Falkirk, N.B., Paint Works Manager.

1892. Macara, Thos., jun., 13, Ridge Road, Stroud Green, N., Chemist.

1887. McArthur, James B., Price's Patent Candle Co., Limited, Belmont Works, Battersea, S.W., Chemist.

1889. McArthur, Jno., 262, Trinity Road, Wandsworth Common, S.W., Chemist.

O.M. McArthur, J. S., 74, York Street, Glasgow, Consulting Chemist and Metallurgist.

1901. MacArthur, Jno. S., 15, St. John's Road, Pollokshields, Glasgow, Paint and Varnish Manufacturer.

1892. McArthur, Thos., 711, Tower Building, Water Street, Liverpool, Drysalter and Dyewood Extractor.

1898. MacCallum, D. A., 389, Central Chambers, 93, Hope Street, Glasgow, Chemist.

O.M. McCallum, J. M., Southdene, Paisley, N.B., Soap Manufacturer.

1894. McCann, Owen, 23, Oriel Street, Vauxhall Road, Liverpool, Printing Ink Manufacturer.

1909. McCarthy, Harold H., 9, Lordsmead Road, Bruce Grove, N., Chemist and Druggist.

1905. McCaw, Major W. D., Library, Surgeon General's Office, Washington, D.C., U.S.A., Officer, Medical Department, U.S. Army.

1905. McCleary, Wm., 61, Station Road, Pendlebury, near Manchester, Finisher.

1910. McColl, A. L., Santa Barbara, Cerro Azul, Peru, Estates Chemist.

1907. McConnan, Dr. Jas., Chemical Laboratory, Frigorifico, Campana F.C.R., Argentina, Chemist (River Plate Fresh Meat Co.).

1903. McCourt, Cyril D., c/o Radiant Heating, Ltd., Carlton Works, Armley, Leeds, Chemist.

O.M. McCowan, W., Essex Wharf, Narrow Street, Limehouse, E.

1897. McCrae, Dr. John, Government Laboratories, P.O. Box 1080, Johannesburg, Transvaal, Government Analyst.

1898. McCreath, Wm. D., c/o Quantock Vale Cider Works, North Petherton, Bridgewater, Cider Manufacturer.

1903. McCully, R. E. J., 65, Pelham Road, Gravesend, Kent, Analytical Chemist.

1909. McCune, W. H., American Sheet and Tin Plate Co., Vandergrift, Pa., U.S.A., Chief Chemist.

O.M. McDaniel, J. J., Woodlands, Bandon, Ireland, and (Jnls.) Kinsale, Ireland, Distiller.

O.M. Macdonald, A., 72, Great Clyde Street, Glasgow.

1910. Macdonald, Alexander, Brampton House, Camphill Avenue, Langside, Glasgow, Clerk.

1897. MacDonald, G. W., Geddes House, Burch Road, Gravesend, Kent, Chief Explosives Research Chemist (Curtis's and Harvey, Ltd.).

1910. Macdonald, J. L. A., 13, Howard Place, St. Andrew's, Fife, N.B., Assistant Manager, Oak Extract Works.

O.M. Macdonald, J. W., 8, Prince of Wales Terrace, Kensington, W., Analytical Chemist.

1899. MacDonald, S. Fremont, c/o Ashtabula Hide and Leather Co., Ashtabula, Ohio, U.S.A., Tanner.

O.M. McDonald, T. McG., Walilabo Estate, St. Vincent, West Indies, Sugar Chemist.

1906. Macdougald, Geo. D., City Laboratory, 13, Shore Terrace, Dundee, City Analyst.

1895. McDougall, Isaac, jun., 68, Port Street, Manchester, Chemical Manufacturer.

1890. McDougall, J. T., Dunolly, Morden Road, Blackheath, S.E., Manufacturing Chemist.

1906. McDowall, Wm., 42, Herriet Street, Pollokshields, Glasgow, Analytical Chemist.

1889. MacEwan, Peter, 64, Southwood Lane, Highgate, N., Editor of "Chemist and Druggist."

1901. McEwen, Duncan C., c/o Jardine, Matheson, and Co., No. 1, Bund, Yokohama, Japan, Metallurgical Chemist.

1908. McEwen, Stewart R., c/o Chemical Laboratories, Ltd., 148, Van Horne Street, Toronto, Canada, Chemist.

1902. McFarland, Alan R., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Works Manager.

1910. McFarlane, John, 6, Gordon Terrace, Shettleston, Glasgow, Metallurgist.

O.M. Macfarlane, R. F., Tharsis Copper Works, East Moors, Cardiff, Works Manager.

1901. McFarlane, Walter, Sunnyside, Thornliebank, Renfrewshire, Printworks Manager.

1890. McFarlane, W. W., East 20th Street, Chester, Pa., U.S.A., Dyeworks Manager.

1909. McFetridge, Jos., Acid Dept., American Sheet and Tin Plate Co., Vandergrift, Pa., U.S.A., Chemist and Superintendent.

1893. McGhie, T. Burns, c/o Quirk, Barton, and Co., Normandy Wharf, Rotherhithe, S.E., Analytical Chemist and Assayer.

1904. McGill, A., 317, Queen Street, Ottawa, Canada, Analytical Chemist.

1899. MacGillivray, Wm. A., c/o Swansea Safety Fuse Co., Pipe House Wharf, Swansea, Analytical Chemist.

1887. McGlashan, John, Cawnpore Sugar Works, Cawnpore, India, Technical Chemist.

1906. McGregor, Russell, 41, Wells Street, Scunthorpe, near Doncaster, Analytical Chemist.

1896. McIlhiney, Dr. Parker C., 7, East 42nd Street, New York City, U.S.A., Chemist.

O.M. McIlwaine, Alf. W., Stoneferry, Hull, Oil Manufacturer.

O.M. MacIndoe, G. D., Ness Street, Invercargill, New Zealand, Public Analyst and Consulting Chemist.

1903. Macintire, Benj. Gould, c/o E. I. du Pont Powder Co., Henry Clay P.O., Del., U.S.A., Chemist.

1909. McIntyre, George D., c/o Hamilton Powder Co., Montreal, Canada, Analytical Chemist.

1910. Mackay, Angus, Laboratory, Wellpark Brewery, Glasgow, Brewer's Chemist.

O.M. McKechnie, D., Heath House, Runcorn, Copper Extractor.

O.M. McKechnie, D. M., The Grange, Halewood, near Liverpool, Copper Extractor.

1904. McKechnie, R. D., Minas de Rio Tinto, Provincia de Huelva, Spain, Chemical Engineer.

1887. McKellar, W. G., c/o United Alkali Co., Ltd., St. Rollox Works, Glasgow, Technical Chemist.

1895. McKenna, Dr. Chas. F., 50, Church Street, New York City, U.S.A., Chemist.

1899. McKenzie, Alex. H., 17, North Street, North Adams, Mass., U.S.A., Colour Mixer.

1909. Mackenzie, Kenneth G., c/o The Nairn Linoleum Co., P.O. Box 32, Newark, N.J., U.S.A., Chemist.

1893. McKerrow, C. A., 56, Ramillies Road, Bedford Park, W.; and (Journals) c/o Mitchells, Ashworth, & Co., 23–24, Old Bailey, London, E.C., Consulting Chemist.

1905. McKerrow, W. J., 97, Coldharbour Road, Redland, Bristol, Analytical Chemist.

1893. McKesson, John, 91, Fulton Street, New York City, U.S.A., Manufacturing Chemist.

1891. Mackey, W. McD., Victoria Chambers, Leeds, Analytical Chemist.

1900. McKillop, George F., Broxburn Oil Works, Broxburn, N.B., Works Chemist.

1890. McKillop, Jno., 32, Aynho Road, Hammersmith, W., and (Jnls.), c/o W. Müller, 16, Grape Street, Oxford Street, W., Metallurgist.

1902. McKim, Wm., 37, Fairview Street, Yonkers, N.Y., U.S.A., Colour Maker.

1908. McLaren, Alex., 34, Moss Lane, Walton, Liverpool, Analytical Chemist.

1908. McLaren, Alex. W., 3, Hayfield Terrace, Langside, Glasgow, Analytical Chemist.

1898. McLaurin, Robt., 414, Sauchiehall Street, Glasgow, Chemist.

1909. MacLaurin, Dr. Robert D., University of Saskatchewan, Saskatoon, Saskatchewan, Canada, Chemist.

1910. MacLean, M. M., c/o Postum Cereal Co., Ltd., Battle Creek, Mich., U.S.A., Chemist.

1905. McLellan, Basil G., c/o Rowntree & Co., Ltd., The Cocoa Works, York, Analytical Chemist.

1910. MacLellan, George A., Glasgow Rubber Works, Glasgow, Rubber Manufacturer.

1910. MacLennan, Alex., c/o Commercial Bank of Australia, 1, Bishopsgate, London, E.C., Rubber Chemist.

1908. Macleod, Alex., Mount Pleasant, Old Kilpatrick, N.B., Analytical Chemist.

1892. McLeod, Jas., Gas Works, Greenock, N.B., Manager.

1903. MacMahon, F. W., Netherhay, The Common, Warlingham, Surrey, Chemist (Oxychlorides, Ltd.).

1896. McMaster, Daniel, Rumford, Maine, U.S.A., Paper Mill Manager.

1894. Macmillan, Arch., c/o Dr. Crombie, Main Street, Mechanicville, N.Y., U.S.A.

1907. McMillen, Russell H., Lock Box 15, Aspinwall, Pa., U.S.A., Chemist (Crucible Steel Co. of America).

1903. McMullan, Charles, 4, William Street Chambers, Belfast, Ireland, Chemist.

1904. McMullen, Alan, 108, James Street, Dublin, Ireland, Brewer.

1889. McMurtrie, J. M., 212, West Regent Street, Glasgow, Brass Founder.

1900. McMurtrie, Dr. Wm., 480, Park Avenue, New York City, U.S.A., Chemist.

1895. McMurtry, G. C., Templemore, Richmond, Nelson, New Zealand, Manager.

O.M. Macnab, W., 10, Cromwell Crescent, London, S.W., Analytical Chemist.

1907. McNaughton, Wm. G., Port Edwards, Wis., U.S.A., Chemist.

1908. McQueen, James, jun., Clyde House, Uddingston, N.B., Analytical Chemist.

1909. McWhirter, James, c/o Wm. Beardmore and Co., Laboratory, Parkhead Forge, Glasgow, Metallurgical Chemist.

1910. Madge, Norman, c/o Continental Rubber Co. of New York, Laboratory, 11, Vandewater Street, New York City, U.S.A., Chemist.

1901. Maertens, Emile, P.O. Box 633, Providence, R.I., U.S.A., Engineer.

1895. Magnus, Isidor, 52, Leadenhall Street, London, E.C., Chemical Merchant.

1901. Magruder, Egbert W., Department of Agriculture, Richmond, Va., U.S.A., Chemist.

1885. Mahon, R. W., N.Y. Central and Hudson River Railroad, West Albany, N.Y., U.S.A., Chemist.

1898. Main, Wm., Piermont, N.Y., U.S.A., Chemist.

1904. Mair, William, 37, Morningside Drive, Edinburgh, Chemist.

1905. Major, Ernest, "Seafield," Day Street, Drummoyne, Sydney, N.S.W., Paint Works Manager.

O.M. Major, J. Lewis, Welton Garth, Brough, East Yorks., Tar Distiller and Chemical Manufacturer.

1910. Male, C. E., 96, Bewick Road, Gateshead-on-Tyne, Chemist.

1886. Mallinckrodt, Edw., Mallinckrodt Chemical Works, St. Louis, Mo., U.S.A., Manufacturing Chemist.

1897. Mallory, J. Halsey, Drawer 69, Columbia, S.C., U.S.A., Assistant Chemist (The American Cotton Oil Co.).

1908. Mander, C. Arthur, Varnish and Colour Works, Wolverhampton, Varnish Manufacturer.

1896. Mann, E. A., Government Laboratory, Perth, Western Australia, Government Analyst.

1893. Mann, Harold H., Agricultural College, Poona, Bombay, India, Research Chemist.

1899 Mann, Jas. S., 19, Stopford Road, Upton Manor, Essex, Analyst.

1891. Mann, John C., 33, Nicholls Street, West Bromwich, Staffs., Chemist.

1903. Mannhardt, Hans, 1104, Oakdale Avenue, Chicago, Ill., U.S.A., Chemical Engineer.

O.M. Mannington, H. T., Marshlea, Beaconsfield Road, Farnworth, Widnes.

1909. Manns, Dr. J., c/o C. W. Schmidt, Varnish Works, Stratford, E., Chemist.

1892. Mansbridge, Wm., 4, Norwich Road, Wavertree, Liverpool, Chemist.

1904. Marckworth, O. S., Ohio Testing Laboratory, 426, Chamber of Commerce, Columbus, Ohio, U.S.A., Director.

1883. Markel, Dr. K. E., Tower House, Bewsey, Warrington, Technical Chemist.

1905. Marland, Percy, c/o Brotherton and Co., Ltd., Ammonia Works, Wakefield, Works Chemist.

1905. Marlatt, Wilbur T., Oakville, Ont., Canada, Leather Manufacturer.

1902. Marriott, F. Grant, 14, Selby Street, Toronto, Canada, Chemist.

1904. Marris, H. C., 68, Schlüsselberg Prospect, St. Petersburg, Russia, Analytical Chemist.

1901. Marsden, Dr. Fred., Chemist.

1906. Marsden, Oliver, Manor Road Mill, Victoria Road, Leeds, Cashier.

O.M. Marsh, J. T., Ammonia Soda Works, Fleetwood, Lancashire, Chemist.

1883. Marsh, W., Union Alkali Co., Soho Works, Ancoats, Manchester, Chemical Manufacturer.

1895. Marshall, Arthur, Waverley Cottage, Naini Tal, India, Chief Chemical Examiner.

1895. Marshall, Francis G., 91, Bewick Road, Gateshead, Technical Chemist.

1891. Marshall, Dr. Hugh, Chemical Dept., University College, Dundee, Professor of Chemistry.

1908. Marshall, John, Cudbear Street, Hunslet, Leeds, Dyeware Manufacturer.

1883. Marshall, Wm., Laboratory, Ladybrook Road, Cheadle Hulme, Cheshire, Dyer.

1884. Marshall, Wm., Barkley, Teddington, Middlesex, Analytical Chemist.

1904. Marston, John P., 247, Atlantic Avenue, Boston, Mass., U.S.A., Merchant.

1894. Martin, Alex. M., Hillview, Twechar by Glasgow, Analytical Chemist.

1895. Martin, Chas. H., 40, Bolton Road, Pendleton, Salford, Oil and Soap Works Manager.

O.M. Martin, N. H., Ravenswood, Low Fell, Gateshead-on-Tyne, Manufacturing Chemist.

1899. Martin, Wm. E., c/o Kynoch Ltd., Umbogintwini, Natal, South Africa, Chemist.

1911. Martin, Wilmot S., 2, Coronation Terrace, Truro, Cornwall, Analyst and Assayer.

1887. Martineau, Sydney, Streatham Grove, Norwood, S.E., Sugar Chemist.

1907. Martius, Dr. C. A. von, Voss Strasse 12, Berlin, Germany, Dyestuff Manufacturer.

1894. Martyn, T. Graham, Box 193, Germiston, Transvaal, South Africa, Metallurgist.

1909. Marx, Robert J., 133–139, Finsbury Pavement, London, E.C., Engineer.

1908. Mason, Douglas H. C., 477, Sherbourne Street, Toronto, Canada, Manufacturer.

1904. Mason, Dr. Edward D., 22, George Road, Edgbaston, Birmingham, Scientific Apparatus Dealer.

1911. Mason, Francis A., c/o Murphy and Lonsdale, 26A, Great George Street, Leeds, Analytical Chemist.

1906. Mason, Dr. Frederic S., 90, Beekman Street, New York City, U.S.A., Manufacturing Chemist.

1904. Mason, Glen F., c/o H. J. Heinz Co., Pittsburg, Pa., U.S.A., Chemist.

1887. Mason, J. Francis, Eynsham Hall, Witney, Oxon.

1910. Mason, James H., 180, Richmond Street West, Toronto, Canada, Metallurgist.

1906. Mason, M. Edgar, 1042, North Branch Street, Chicago, Ill., U.S.A., Consulting Chemist.

1906. Massa, Corradino, Castelguelfo Parmense, Parma, Italy, Sulphuric Acid and Fertiliser Manufacturer.

O.M. Masson, Prof. D. Orme, University of Melbourne, Victoria, Australia, Professor of Chemistry.

1908. Masson, R. Duncan, c/o Messrs. R. Silcock and Sons, Stanley Hall, Union Street, Liverpool, Analytical Chemist.

1902. Masujima, Prof. Bunjiro, c/o K. Takebe, 25, Gazenbocho, Azabuku, Tokyo, Japan, Prof. of Applied Chemistry.

1902. Masury, Fred L. M., Lock Box 144, Sharon, Pa., U.S.A., Explosives Manufacturer.

1910. Matchet, Andrew S., 13, Bute Gardens, Muirend, Cathcart, N.B., Analytical Chemist.

O.M. Mather, J., Blaydon Chemical Works, Blaydon-on-Tyne, Manager.

1904. Mather, J. Cecil, 46, Franklin Place, Washington Avenue, Montclair, N.J., U.S.A., Works Chemist.

1900. Mather, Wm., c/o The Standard Chemical Co., Longford, Ontario, Canada, Chemist.

1907. Matheson, A. Greville E., 38–40, Lloyd Street, Manchester, Engineer.

1890. Matheson, W. J., c/o Cassella Color Co., 182, Front Street, New York City, U.S.A., Chemical Merchant.

1901. Mathew, W. E. B. de Vere, Dinham, Hillside Gardens, Wallington, Surrey, Analytical Chemist.

1900. Mathews, Dr. Jno. A., c/o Halcombe Steel Co., Syracuse, N.Y., U.S.A., Works Manager and General Superintendent.

1898. Mathewson, E. P., Anaconda, Mont., U.S.A., Metallurgist.

1888. Mátos, Dr. Louis J., (Comms.) 103, North 19th Street, East Orange, N.J., and (Jnls.) c/o Cassella Color Co., 182–4, Front Street, New York City, U.S.A., Chemist.

1896. Matsui, G., c/o Japan Sugar Refinery Co., Onagigawa, Tokio, Japan, Chemical Engineer.

O.M. Matthews, Chas. G., 31, Stapenhill Road, Burton-on-Trent, Brewing Chemist.

1907. Matthews, Dr. F. E., Ashlawn, The Glebe, Blackheath, S.E., Technical Research Chemist.

1899. Matthews, Dr. J. Merritt, 12, Wiswall Street, West Newton, Mass., U.S.A., Professor of Chemistry and Dyeing.

1889. Mawdsley, W. H., c/o Gold Mining Co., Ltd., Mount Morgan, Queensland, Chemist.

1906. Mawson, Fred. E., 88, Broad Street, Boston, Mass., U.S.A., Dyestuff Merchant.

1903. Maxim, Hudson, Landing, N.J., U.S.A., Chemist and Mechanical Engineer.

1894. Maxwell, Jno., Solway Chemical Works, Silloth, Cumberland, and (communications) English Street, Carlisle, Chemical Manure Manufacturer.

1903. Maxwell, Orin P., c/o West Virginia Pulp and Paper Co., Luke, Md., U.S.A., Chemist.

1911. May, Clarence E., 320, South Walnut Street, Bloomington, Ind., U.S.A.

1897. May, George H., c/o Fabrikoid Co., Newburgh, N.Y., U.S.A., Assistant Chemist.

1884. Mayenfeld, Dr. E. von Salis. *See* Salis-Mayenfeld, Dr. E. von.

1903. Mayer, Andrew, jun., 129, York Street, Brooklyn, N.Y., U.S.A., Chemist.

1908. Mayer, Frederick J., c/o Didier-March Co., 30, Church Street, New York City, U.S.A., General Manager.

1896. Mayfield, A. S., Thirlmere, Newland, Hull, Analyst.

1892. Mayfield, H. B., Normanhurst, Mundy Street, Heanor, near Nottingham, Dyer.

1885. Mayhew, E. W. A., High Street, Freemantle, Western Australia, Manufacturing Chemist.

1900. Maywald, F. J., 89, Pine Street, New York City, U.S.A., Technical Chemist.

1909. Meanwell, Chas. W., 15, Woodlands Crescent, Muswell Hill Road, London, N., Analytical Chemist.

1898. Meeds, Alonzo D., 2424, Harriet Avenue, Minneapolis, Minn., U.S.A., Analytical Chemist.

1896. Meggitt, Loxley, Wheatsheaf Works, Alexandria, Sydney, N.S.W., Australia, Analytical Chemist.

1901. Meier, Dr. Franz, c/o Society of Chemical Industry in Basle, Basle, Switzerland, Chemist.

1888. Meikle, Jno., 8, Melrose Street, Great Western Road, Glasgow, Journalist.

1902. Melcher, Arthur C., 58, Bowen Street, Newton Centre, Mass., U.S.A., Research Chemist.

O.M. Meldola, Prof. R., F.R.S., 6, Brunswick Square, London, W.C., Professor of Chemistry.

1911. Mellerio, Lucien P., 11, Somerset Terrace, Tavistock Square, London, W.C., Technical Assistant.

O.M. Mellon, W. W., Woodlands, Blackrock, Co. Dublin, Ireland, Manufacturing Chemist.

1910. Mellor, Dr. Jos. W., 19, Villas, Stoke on Trent, Ceramic Chemist.

1884. Melville, D., 2, Melville Avenue, Delray, Detroit, Mich., U.S.A., Chemical Works Manager.

1909. Melville, Robt. L., Westfield Chem. Works, Box 665, G.P.O., Auckland, N.Z., Chemist.

1909. Menozzi, Prof. A., R. Scuola Superiore di Agricoltura, Milano, Italy, Prof. of Chemistry.

1893. Mensching, Dr. C., Mersey Chemical Works, Bromborough, Cheshire, Chemist.

O.M. Menzies, R. C., Inveresk Mills, Musselburgh, N.B., Paper Maker.

1892. Mercer, C. A., 34, Camomile Street, London, E.C., Chemical Apparatus Maker.

1886. Mercer, J. B., 4, Tabley Road, Knutsford, Cheshire.

1890. Merck, Dr. E., Darmstadt, Germany, Manufacturing Chemist.

1905. Merck, George, Merck and Co., University Place, New York City, U.S.A., Manufacturing Chemist.

1899. Merrill, Frank H., 2420, Ocean View Avenue, Los Angeles, Cal., U.S.A., Factory Superintendent.

1906. Merrils, Fred. J., 25, Figtree Lane, Sheffield, Analytical Chemist.

1909. Merriman, C. E. B., 129, Trent Boulevard, West Bridgford, Nottingham, Technical Chemist.

1909. Merriman, H. J., 244, Victoria Park Road, South Hackney, N.E., Research Chemist.

1905. Merrin, A. C., 199–200, Bishopsgate, London, E.C., Assistant Editor and Analyst.

1904. Merry, Jno. B., 74, Park Hill Road, Harborne, Birmingham, Metallurgical Chemist.

1903. Mersan, Ferdinand de, Fairfield, Chestnut Avenue, Boston Spa, Yorks., Chemist.

1905. Merz, Eugene, P.O. Box 216, Newark, N.J., U.S.A., Superintendent, Heller and Merz Co.

1897. Meslans, Prof. M., 6, Rue de Navarin, Paris, France, Professor of Chemistry.

O.M. Messel, Dr. R., 147, Victoria Street, London, S.W., Chemical Manufacturer.

1899. Metcalf, Howard F., Farr Alpaca Co., Holyoke, Mass., U.S.A.

1886. Metcalf, Jno., Moorfield Chemical Works, Altham, near Accerington, Tar Distiller.

1908. Metcalfe, Ernest D., 3, Gracechurch Street, London, E.C., Secretary.

1906. Methley, Bernard, Ferndale, Moorgate, Rotherham, Yorks., Engineering Chemist.

1898. Metz, Herman A., P.O. Box 753, New York City, U.S.A., Chemical Merchant.

1905. Metzis, Josef, Anglicia Petroleum Co., Drohobycz, Galicia, Austria, Manager of Refinery.

1900. Mewborne, Robt. G., c/o Kentucky Tobacco Products Co., Louisville, Ky., U.S.A., Chemist.

1907. Meyer, Dr. Erwin, c/o Morgan and Wright, Detroit, Mich., U.S.A., Chemist.

1898. Meyer, Dr. Franz, c/o R. Wedekind und Co., Uerdingen a/Rhein, Germany, Metallurgical and Chemical Engineer.

1904. Meyer, Prof. Dr. Richard, Technische Hochschule, Braunschweig, Germany, Professor of Chemistry.

1902. Meyrick, L. J., 137, City Road, Birmingham, Assistant Analyst.

1909. Michie, John L., 3, Townhead Terrace, Paisley, N.B.

1907. Micklethwait, Miss Frances M. G., Royal College of Science, London, S.W., Chemist.

1911. Middlemass, Alphonso, 33, Joppa Road, Joppa, Midlothian, Works Chemist.

1904. Mighill, Dr. Thos. A., 15, Exchange Street, Boston, Mass., U.S.A., Chemist.

1896. Miles, G. Wellington, 29, Central Street, Boston, Mass., U.S.A., Analytical Chemist.

1889. Milestone, W. C., 7, Heathfield Road, Wandsworth Common, S.W., Chemical Works Manager.

1899. Millar, Jas. H., Glen Afric, Paul Nel Street, Johannesburg, Transvaal, Manufacturing and Analytical Chemist.

1909. Millar, Jas. Hill, Chief Chemist's Laboratory, St. James' Gate Brewery, Dublin, Chemist.

1883. Miller, Dr. A. K., Kilvert's Buildings, Withy Grove, Manchester, Analytical Chemist.

O.M. Miller, E. V., Sugar Works, Chelsea, Auckland, New Zealand, Sugar Works Chemist.

1889. Miller, Geo., Thornlea, Beaconsfield Road, Farnworth, Widnes, Technical Chemist.

1893. Miller, Dr. Harry E., 305, Palm Avenue, Oakland, Cal., U.S.A., Chemist.

1883. Miller, Dr. H. von. *See* Miller-Aichholz, Dr. H. von.

1894. Miller, Dr. John A., 44–45, Lewis Block, Buffalo, N.Y., U.S.A., Consulting Chemist, State Analyst.

1908. Miller, Lt.-Col. John B., 98, Wellesley Street, Toronto, Canada, Lumber and Iron Manufacturer.

1894. Miller, J. Carlile, 188, St. Vincent Street, Glasgow, Manufacturing Chemist.

1888. Miller, J. Hopkins, 86, North Frederick Street, Glasgow, Dyeworks Chemist.

1889. Miller, Jno. Poynter, Sandilands Chemical Works, Aberdeen, Technical Chemist.

1907. Miller, R. H., c/o The Flavell Co., Box 924, Asbury Park, N.J., U.S.A., Chemical Manufacturer.

1901. Miller, Stuart B., c/o E. I. du Pont de Nemours Powder Co., Wilmington, Del., U.S.A., Chemical Engineer.

1901. Miller, Dr. W. Lash, 50, St. Alban Street, Toronto, Canada, Associate Professor of Physical Chemistry.

1884. Miller, W. M., Caledonia Estate, Prov. Wellesley, Penang, S.S., Sugar Chemist.

1883. Miller-Aichholz, Dr. H. von, Beatrixgasse 32, Wien, Austria, Chemical Manufacturer.

1902. Milligan, R. E., New York Continental Jewell Filtration Co., 15, Broad Street, New York City, U.S.A., Chemical Engineer.

O.M. Mills, Prof. E. J., F.R.S., 64, Twyford Avenue, West Acton, W., Emeritus Professor of Technical Chemistry and Consulting Chemist.

1909. Mills, Harry P., c/o Continental-Mexican Rubber Co., Torreon, Coahuila, Mexico, Chemist.

1904. Mills, Dr. J. E., cor. Servais and Pulaske Streets, Columbia, S.C., U.S.A., Analytical and Consulting Chemist.

1905. Mills, Wm. Henry, 45, Wall Street, New York City, U.S.A., Merchant.

1906. Mills, Wm. Hobson, Northern Polytechnic Institute, Holloway, London, N., Lecturer in Chemistry.

1905. Milne, Thomas, c/o The Gas Light and Coke Co., Ltd., 4, Fenchurch Avenue, London, E.C., Chemical Products Salesman.

1903. Milnes, Cresswell, Arlesey, near Hitchin, Herts., Cement Works Manager.

1887. Milnes, Edmund, Seedfield, Bury, Lancashire, Dyeing Extract Maker.

1902. Milnes, Ernest E., Park Print Works, Halifax, Yorks., Chemist.

1909. Mindeleff, Chas., c/o American Smelting and Refining Co., Maurer, N.J., U.S.A., Chemist.

1895. Miner, Harlan S., c/o Welsbach Light Co., Gloucester City, N.J., U.S.A., Technical Chemist.

1889. Miniati, T. K., Penketh, near Warrington, Chemist.

1895. Mitchell, Chas. A., c/o Beaufoy and Co., South Lambeth Road, S.W., Analyst.

1901. Mitchell, Frank H., 6428, North Park Avenue, Philadelphia, Pa., U.S.A., Tutor in Chemistry.

1898. Mitchell, G. D. H., c/o Ed. S. Brownson, jnr., 50, Pine Street, New York City, U.S.A., Chemist.

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1909. Mock, Hugo, 220, Broadway, New York City, U.S.A., Lawyer.

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1909. Monro, Irwin W., Manufacturing Chemist.

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1903. Mooney, F. M., 118, Pembroke Road, Dublin, Chemical Manure Manufacturer.

1903. Mooney, Geo. A., 310, St. Paul Street, Montreal, Canada, Chemical Merchant.

1902. Mooney, Luke, 13, East 52nd Street, Bayonne, N.J., U.S.A.

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1901. Moore, Dr. Chas. W., Wellcome Chemical Research Laboratories, 6, King Street, Snow Hill, London, E.C., Chemist.

1907. Moore, Ernest P., Burlington, Ont., Canada, Chemist.

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1901. Morgan, Dr. Gilbert T., Royal College of Science, South Kensington, S.W., Demonstrator of Chemistry.
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1890. Morgan, J. Jas., 14, Borough Road, Jarrow-on-Tyne, Assayer.
1907. Morgan, Leonard P., Assay Dept., Royal Mint, Ottawa, Canada, Electro-Chemist.
1906. Morgan, Thos., "Meirion," Dovedale Road, Mossley Hill, Liverpool, Manufacturing Chemist.
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1906. Morris, A. H., 72, Chorley New Road, Bolton, Lancs., Brewer.
1898. Morris, Edgar F., c/o Cornbrook Chemical Co., Ltd., Colour Works, Stockport, Research Chemist.
1897. Morris, Harry, The Hall, Hexthorpe, Doncaster, Chemical Merchant.
1890. Morris, Herbert N., Gorton Brook Chemical Works, Manchester, Technical Chemist.
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1908. Morris, Wm. J., 31, Prince Alfred Road, Wavertree, Liverpool, Chemist.
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1910. Morrison, John W. Gas Offices, Sheffield, Gas Engineer.
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1900. Munsell, Dr. Chas. E., c/o Devoe and Raynolds Co., 110, Horatio Street, New York City, U.S.A., Colour Chemist.
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1891. Myers, Dr. Wm. S., 71, Nassau Street, New York City, U.S.A., Director.

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1908. Nagle, J. C., Southampton Wharf, Battersea, London, S.W., Glucose and Starch Manufacturer.
1897. Nairn, Michael, Dysart House, Fife, N.B., Linoleum Manufacturer.
1901. Nakagawa, Sosuke, c/o Tokyo Ryusan Kwaisha, Kameido Oshimacho, near Tokyo, Japan, Chief Engineer.
1909. Nakai, S., Miike Colliery Office, Omuta-machi, Chikugo, Japan, Engineer.
1903. Nakayama, T., c/o Fuji Paper Co., Mill No. 2, Fuji Gori, Suruga, Japan, Chemist.
1901. Nanabhai, Krishnalal, Chopaty, Grant Road P.O., Bombay, India, Technological Chemist.
1893. Napier, Jno. W., Gas Works, Alloa, N.B., Manager and Chemist.
1904. Napper, Sidney S., c/o S. Courtauld and Co., Ltd., Foleshill Road, Coventry, Chemist.
1903. Nash, A. Douglas, Beech Street, Waldheim, Flushing, N.Y., U.S.A., Glass Manufacturer.
1897. Nash, Leonard M., Westlands, Princess Road, Finsbury Park, N., Works Chemist.
1910. Nash, N. C., Treleaven, Darling Street, Balmain East, Sydney, N.S.W., Works Chemist.
1905. Nash, W. A., Corn Exchange Bank, New York City, U.S.A., President, Corn Exchange Bank.
1908. Nasmith, M. E., 42, Duchess Street, Toronto, Canada, Baker.
1900. Nathan, Lt.-Col. Sir Frederic L., R.A., Ardeer, Stevenston, Ayrshire, Superintendent, Nobel's Explosives Works.
1907. Nauckhoff, Sigurd, c/o Nitroglycerin Aktiebolaget, Vinterviken, Stockholm, Sweden, Chemical Engineer.
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1909. Neal, C. S., Acme White Lead and Colour Works, Detroit, Mich., U.S.A., Manager.
1899. Neate, Percy J., 49, Frognal, Hampstead, N.W., Director of Cement Co.
1902. Neave, Dr. Geo. B., Technical College, Montrose Street, Glasgow, Assistant to Professor of Chemistry.
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1890. Neill, Geo. D., Drumslea, Greenock, N.B., Sugar Refiner.
1898. Neilson, Alex. McG., Umbilo, Durban, Natal, Analytical Chemist.
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1905. Newall, Jos., Morley Road, Runcorn, Cheshire, Chemist.
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1901. Nibelins, Axel W. T., c/o Emporium Powder Co., Emporium, Pa., U.S.A., Chemist.
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1884. Nichols, J. A., Stanley Mount, New Mills, near Stockport, Teacher of Science.
1911. Nichols, M. F., 697, Cherry Street, Grand Rapids, Mich., U.S.A., Chemist.
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1911. Norton, Samuel J., 22, Bushnell Road, Balham, S.W., Engineer and Manager.

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1899. Noyes, Henry, c/o Noyes Bros., 153–7, William Street, Melbourne, Victoria, Engineer.

1901. Noyes, Prof. Wm. A., University of Illinois, Urbana, Ill., U.S.A., Editor (J. Amer. Chem. Society).

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1888. Ogata, Saburo, Nippon Ginko, Tokyo, Japan, Assayer.

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1908. Ogilvie, Jas. P., Ashmount, Sylvester Road, East Finchley, N., Chemist.

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1905. Ohliger, Willard, c/o F. Stearns & Co., Detroit, Mich., U.S.A., Chemist.

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1910. Oliver, Willie, 11, Midland Road, Swinton, near Rotherham, Works Chemist.

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1907. Oppen, Wm. A., Vera Chemical Co., Stoneham, Mass., U.S.A., Chemist and Superintendent.

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1908. Oxley, John C., Kelcliffe House, Guiseley, near Leeds, Aniline Colour Merchant.

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1891. Parker, Edw., Laburnum House, Rushford Avenue, Levenshulme, Manchester, Analytical Chemist.

1894. Parker, Dr. J. Gordon, Leathersellers' Technical College, 176, Tower Bridge Road, London, S.E., Principal.

1897. Parker, Prof. Matthew A., University of Manitoba, Winnipeg, Canada, Professor of Chemistry.

1901. Parker, Richard H., 147, Seymour Avenue, Newark, N.J., U.S.A., Analytical Chemist.

O.M. Parker, Thos., Severn House, Ironbridge, Salop, Electrical Engineer.

1894. Parker, Thos. J., 25, Broad Street, New York City; and (Journals) Bayonne, N.J., U.S.A., Chemical Works Manager.

1903. Parker, Wm. B., 96, Murray Road, Rugby, Chief Chemist (British Thomson-Houston Co., Ltd.).

1901. Parker, Dr. Wm. Huntington, 177, State Street, Boston, Mass., U.S.A., Chemist (U.S. Appraisers).

1901. Parkes, Albert E., 43, Whitehorse Street, Stepney, E., Analytical Chemist.

1905. Parr, Prof. S. W., University of Illinois, Urbana, Ill., U.S.A., Professor of Applied Chemistry.

1898. Parrish, Saml., 80, Grange Avenue, Chapeltown Road, Leeds, Teacher of Chemistry.

1901. Pass, James, Onondaga Pottery Co., Syracuse, N.Y., U.S.A., Pottery Manufacturer.

1909. Passmore, Dr. Francis W., 63, Queen Victoria Street, London, E.C., Consulting Chemist.

1902. Patch, Prof. Jas. A., Syrian Protestant College, Beirût, Syria, Professor of Chemistry.

1910. Patch, N. K. B., c/o Lumen Bearing Co., Weston Road and C.P.R. Tracks, West Toronto, Canada, Manager.

1897. Patchett, Col. Jas., Oakworth, Hadley, Wellington, Salop, Ironmaster.

1884. Paterson, John, Belle Isle Place, Workington, Cumberland, Mechanical Engineer.

1887. Paton, J. M. C., Messrs. Manlove, Alliott, and Co., Ltd., Nottingham, Mechanical Engineer.

1886. Paton, W. Grant, Airlie, Huyton, near Liverpool, Alkali Works Manager.

1901. Patterson, Chas. A., c/o E. I. du Pont de Nemours Powder Co., Pinole, Cal., U.S.A., Analytical Chemist.

O.M. Patterson, Geo., c/o The Manbré Saccharine Co., Ltd., Fulham Palace Road, Hammersmith, W., Technical Chemist.

1909. Patterson, G. H., Ivanhoe, Linden Grove, West Hartlepool, Works Manager.

1893. Patterson, Harry J., College Park, Prince George's Co., Md., U.S.A., Agricultural Chemist.

O.M. Patterson, T. L., Maybank, Finnart Street, Greenock, N.B., Sugar Works Manager.

1902. Patterson, Wm. Hamilton, Monksferry Chemical Laboratory, Birkenhead, Technical Chemist.

O.M. Pattinson, John, 10, Dean Street, Newcastle-on-Tyne, Consulting Chemist.

O.M. Pattison, Jas., Drimnamona, Kilmalcolm, N.B., Chemical Merchant.

1889. Pattison, Percy J., St. Budeaux, Devonshire Road, Hornchurch, Essex, Technical Chemist.

1909. Patton, H. G., c/o Fred Rueping Leather Co., Fond du Lac, Wis., U.S.A., Chemist.

1904. Patz, E. O., 215, Water Street, New York City, U.S.A., Manager, Berlin Aniline Works.

1908 Paul, David M., c/o Curtis's and Harvey, Ltd., Powder Works, Tonbridge, Kent, Explosives Chemist.

1891. Paul, Jas. H., 11, Glenluce Road, Blackheath, S.E., Analytical Chemist.

1900. Paul, Dr. L. Gordon, Market Hall Chambers, King Street, Huddersfield, Consulting Chemist.

1902. Pay, Walter H., P.O. Box 943, Durban, Natal, Government Inspector of Explosives.

1904. Payne, A. G. C., 11, West Terrace, Penarth, near Cardiff, Chemist.

O.M. Payne, J. B., 13, Mosley Street, Newcastle-on-Tyne, Manufacturing Chemist.

1910. Peacock, Samuel, 414, Keyser Building, Baltimore, Md., U.S.A., Chemist and Metallurgist.

1894. Pearce, Jas. Stanley, Clements, Snaresbrook, Essex, Chemical Manufacturer.

1897. Pearce, Richard, 43, St. George's Court, Gloucester Road, London, S.W., Metallurgist.

1883. Pearce, W., M.P., Chemical Works, Bow Common, London, E., Chemical Manufacturer.

1903. Pearcy, A. C., 43, Marlborough Mansions, Cannon Hill, London, N.W., Director, Explosives Co.

1903. Pears, Thos., The Laboratory, Soap Works, Isleworth, Soap Manufacturer.

1904. Pease, Fred N., P.O. Box 503, Altoona, Pa., U.S.A., Chemist.

O.M. Péchiney, A. R., Villa Les Rochers, Hyères (Var), France, Chemical Engineer.

1898. Peck, Dr. Ernest L., 18, Woodhey Road, Rock Ferry, Cheshire, Chemist.

1909. Peck, Lieut. Sydney C., 7, Nightingale Place, Woolwich, S.E., Lieut., R.A.

1898. Peckham, Stephen F., 160, Broadway, New York City, U.S.A., Chemist.

1894 Peden, Jno., 30, Ardgowan Street West, Greenock, N.B., Analytical Chemist.

1909. Pederneiras, Lieut.-Col. A., Fabrica de Polvora, Piquete, Lorenci, Sao Paulo, Brazil, Director Smokeless Powder Factory.

O.M. Pedler, Sir Alexander, C.I.E., F.R.S., 28, Stanhope Gardens, Queen's Gate, London, S.W., Director of Public Instruction (retired).

1886. Pedler, J. R., 47, Tregunter Road, South Kensington, S.W., Clerk.

1905. Peet, Wm. J., Stockyards Station, Kansas City, Kas., U.S.A., Superintendent.

1906. Peile, Henry, Millburn House, Newcastle-on-Tyne, and (Journals) c/o Andrew Short, Patent Ovens Dept., Ottovale, Blaydon-on-Tyne, Colliery Owner.

1899. Pell, A., 7, Elphinstone Circle, Bombay, India, Chemist.

1897. Pellew, Chas. E., 111, East 78th Street, New York City, U.S.A., Adjunct Professor of Chemistry.

1904. Pelly, Russell George, 3, Wingate Road, Hammersmith, W., Analytical Chemist.

1896. Penney, Mulgrave D., 11, High Street, Hull, Analytical Chemist.

1890. Pennock, J. D., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Technical Chemist.

1885. Pentecost, S. J., Alexandra Mount, Mapperley Hill, and (Journals), Lenton Works, Nottingham, Lace Dresser.

1887. Pentermann, H. T., 37, Clifton Crescent, Peckham, S.E., Brewing Chemist.

1892. Peploe, D. H. T., Underriver House, Sevenoaks, Kent.

1899. Peppel, S. Vernon, 2437, South Robey Street, Chicago, Ill., U.S.A., Chemist.

1910. Percival, G. Arncliffe, 34, Cartwright Gardens, Tavistock Square, London, W.C., Metallurgical Chemist.

1885. Perkin, A. G., F.R.S., Grosvenor Lodge, Grosvenor Road, Leeds, Technical Chemist.

1898. Perkin, Dr. F. Mollwo, 199, Piccadilly, London, W., Head of Chemical Department, Borough Polytechnic.

1887. Perkin, Dr. W. H., F.R.S., Fairview, Wilbraham Road, Fallowfield, Manchester, Professor of Chemistry.

1903. Perkins, Frank G., Lansdale, Pa., U.S.A., Starch Manufacturer.

1893. Perkins, T. S., 30, Tiffany Place, Brooklyn, N.Y., U.S.A., Chemist.

1899. Perks, Walter G., Lisnalee, Woodcote Grove Road, Coulsdon, Surrey, Manufacturer.

1906. Perrow, Mosley G., Lynchburg, Va., U.S.A.

1901. Perry, Chas. M., Greene, Kent County, R.I., U.S.A., Bleach and Dyeworks Chemist.

1887. Perry, David, Norwood, Lenzie, N.B., and (Journals) Forth and Clyde Chemical Works, Nitshill, near Glasgow, Manufacturing Chemist.

1895. Perry, Jos. H., 276, Highland Street, Worcester, Mass., U.S.A., Teacher of Chemistry.

1903. Perry, M. J. T., Australian Drug Co., O'Connell Street, Sydney, N.S.W., Australia, Manufacturing Chemist.

1903. Perry, Robt. Swain, 3500, Grays Ferry Road, and (Journals) Station D., Philadelphia, Pa., U.S.A., President (Harrison Bros. and Co.).

1901. Persons, Ashton C., Willimantic, Conn., U.S.A., Chemist.

1897. Peter, Dr. A. H., 26, West 30th Street, New York City, U.S.A., Chemist.
1908. Peters, John M., 184, Front Street, New York City, U.S.A., White Lead Manufacturer.
1893. Pethybridge, Walter, 3, Rhodesia Road, Stockwell, S.W., Chemist and Assayer.
1909. Petrie. A. Swanston, c/o Gibbs and Co., Iquique, Chile, S. America, Analytical Chemist.
1903. Petrie, Dr. Jas. M., The University, Sydney, N.S.W., Australia, Chemist.
1902. Petsche, B. W., 60, Glenwood Avenue, Yonkers, N.Y., U.S.A., Chemist.
1906. Pettee, Chas. L. W., c/o Hartford Laboratory Co., Hartford. Conn., U.S.A., Chemist.
1892. Pettigrew, Robert, c/o Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Electro-Chemist.
1902. Pettitt, Alf., 457, State Street, Brooklyn, N.Y., U.S.A., Chemist.
1906. Peuchen, Arthur G., Standard Chemical Co., Ltd., 509, Manning Chambers, Toronto, Canada. Chemical Manufacturer.
O.M. Peyton, E. P., Chemical Works, Lister Street, Birmingham, Chemical Manufacturer.
1900. Peyton, Wm. C., c/o Peyton Chemical Co., Room 657, Mills Building, San Francisco, Cal., U.S.A., Chemist.
1888. Philip. Arnold. Chemical Laboratory, H.M. Dockyard. Portsmouth, Electro-Metallurgist and Electrical Engineer.
1908. Philip, Dr. James C., Imperial College of Science and Technology, Sth Kensington, S.W., Chemist.
1903. Philipp, Herbert, 84, High Street, Perth Amboy, N.J., U.S.A., Chemist and Electrochemical Engineer
1910. Phillips, A. W., c/o Sinnamahoning Powder Manufacturing Co., Sinnamahoning, Pa., U.S.A., Chemist.
O.M. Phillips, Harcourt, Lynwood, Turton. Lancs., Analytical Chemist.
1911. Phillips, Henry A., Royal Gunpowder Factory, Waltham Abbey, Essex, Chemist.
1910. Phillips, Prof. Percy P., Thomason College, Rurki, United Provinces, India, Professor of Chemistry.
1895. Phillips. S. Chas., 47, Cannon Street, London, E.C., Chemical Engineer.
1904. Phillips, V. C., 35, Morris Avenue, Manor Park, Essex, Chemist.
1898. Phillips, Wm. H., 100, Milton Avenue, East Ham, E., Soap Works Chemist.
1911. Philpotts, Wilfred C., 539, Sherbourne Street, Toronto, Canada, Chemist (Consumers' Gas Co.).
1894. Picard, Hugh F. K., 44, London Wall, London, E.C., Metallurgist.
1904. Pickard, Glenn H., c/o Geo. D. Wetherill and Co., 114, North Front Street, Philadelphia, Pa., U.S.A., Chemist.
1905. Pickard. Greenleaf W., Amesbury. Mass., U.S.A., Electrical Engineer.
1902. Pickard, Dr. R. H., Billinge, Blackburn, Teacher and Analyst.
1904. Pickett, Chas. E., 26, East 33rd Street, Bayonne. N.J., U.S.A., Superintendent. Borax Refinery.
1904. Pickup, Edgar H., 348, Great Clowes Street. Higher Broughton, Manchester, Calico Printer.
1888. Pilkington, G., 9, Knowsley Street, Bury, Lancashire, Analytical Chemist.
1893. Pilley, Thos. W., 33, Grove Hill Road, Denmark Hill. S.E., Analytical Chemist.
1894. Pilling. John E., 229. Hornby Road, Blackpool. Chemist.
1906. Pincott. Emile S., 222, St. James Street. Montreal. Canada, Manager (Nichols Chemical Co. of Canada. Ltd.).
1910. Pinnock, Douglas R., 93. Danforth Avenue, Greenville, N.J., U.S.A., Chemist.
1905. Pinnock, H. T., 11, Arthur Road. Edgbaston, Birmingham, Chemist.
1883. Pipe, Jas., Woodburn, Irvine, N.B., Chemical Manufacturer.
1896. Piper, Walter E., Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.
1910. Pisart, F., 34, Boulevard Sauvenière. Liège, Belgium, Chemical Engineer.
1907. Pitman, Brig.-Gen. John, 167, Berkeley Avenue, Orange, N.J., U.S.A., U.S. Army (retired).
1902. Pittard. Jno., 30, Mansfield Road, Ilford, Essex, Chemical Manufacturer.
1884. Pittuck, F. W., 19, Stratford Grove, Heaton, Newcastle-on-Tyne, Technical Chemist.
1909. Piutti, Prof. Dr. Arnaldo, Instituto Chimico-farmaceutico, R. Universita, Napoli, Italy, Director.
1899. Pizey, Jas. H., 22, Duke's Avenue, Muswell Hill, N., Chemist.
1894. Platten, Frank, 12, Montague Road. Edgbaston, Birmingham, Metallurgical Chemist.
1890. Platts, Jno. C., " Sandygate," Chapel Lane, Wilmslow, Cheshire, Metallurgical Chemist.
1896. Plaut, Albert, P.O. Box 380, New York City, U.S.A., Wholesale Druggist.
1888. Playfair, David J., 7, Victoria Crescent. Dowanhill, Glasgow, Manufacturing Chemist.
1891. Pocklington, Hy., 11, Regent Park Terrace, Leeds.
1907. Poetschke, Paul. 26, West Spruce Street, Corona, N.Y., U.S.A., Chemist.
1901. Pollard, Wm., Museum, Jermyn Street, London, S.W., Chemist (H.M. Geological Survey).
1904. Pollitt, Dr. Geo. P., Winnington, Northwich, Cheshire, Chemist.
1902. Pollitt, Jas. C. T., 7, Grosvenor Road, Handsworth, Birmingham, Managing Chemist.
1893. Pollitt, R. B., c/o Gudgeons, Peecock, and Prentice, Stowmarket, Suffolk, Civil Engineer.
1883. Pollock, A., Kirkland, Bonhill, Dumbartonshire, Dyeworks Manager.
1890. Pomeroy, Dr. Chas. T., 83, Third Avenue, Newark, N.J., U.S.A., Ink Manufacturer.
1909. Pond, Dr. Francis J., Stevens Institute of Technology, Hoboken, N.J., U.S.A., Professor of Chemistry.
1896. Pond. Prof. G. G., State College, Centre Co., Pa., U.S.A., Professor of Chemistry.
O.M. Pond. J. A., 99, Queen Street, Auckland, New Zealand. Analytical Chemist.
1906. Pont, A. Felix du, Box 31, Wilmington. Del., U.S.A., Explosives Manufacturer.
1895. Pont. Pierre S. du, Wilmington, Del., U.S.A., Explosives Manufacturer.
O.M. Pope, S., 34, Clarendon Road West, Chorlton-cum-Hardy, Manchester, Chemical Works Manager.
1899. Pope, Thos. H., The University, Birmingham, Chemist and Lecturer on Brewing.
1900. Pope. Prof. W. J., F.R.S., University Chemical Laboratory, and (Journals) Holmesdale, Brooklands Avenue, Cambridge, Professor of Chemistry.
1900. Popplewell. Jos. M., Provan Chemical Works, Provanmill. Glasgow. Chemist.
1902. Porter, J. Edw., P.O. Box 785, Syracuse, N.Y., U.S.A., Chemist.
1901. Porter. Jno. L., Water Purification Station, P.O. Box 791, Station B., New Orleans, La., U.S.A., Chemist.
1884. Potter, Chas. E., Love Lane Sugar Refinery, Liverpool, Sugar Works Chemist.
1888. Potter, Chas. J., Heaton Hall, Newcastle-on-Tyne, Cement Manufacturer.
O.M. Potter. E. P., Salwick Hall, near Preston, and (Journals) c/o E. P. Potter and Co., Ltd., Little Lever. near Bolton. Alkali Manufacturer.
1900. Potts. Geo. E., 18, Tremont Street, Pottsville, Pa., U.S.A., Explosives Manufacturer.
1910. Potts, Harold E., Hoddesdon Mount, Helsby, Cheshire, Research Chemist.
1900. Pough. Frank H., (subs.) 82. Beaver Street, New York City, and (Journals) 149. Columbia Heights, Brooklyn, N.Y., U.S.A., Assistant Secretary.
1900. Powell. Harry J., 125, Thurlow Park Road, Dulwich. S.E., Glass Manufacturer.
1884. Powell, L. S., The Old Manor House, Ashley, Stockbridge, Hants, Electrician.

1897. Power, Dr. Fred. B., Wellcome Research Laboratories, 6, King Street, Snow Hill, London, E.C., Director.

1907. Powers, Wm. A., c/o A. T. and S. F. R. R. Co., Topeka, Kans., U.S.A., Chief Chemist.

1902. Powney, Wm. E. F., 17, Nightingale Lane, Hornsey, N., Analytical Chemist.

1897. Prentice, Dr. Bertram, Royal Technical Institute, Salford, Lecturer on Chemistry.

1902. Prentice, Dr. David, The Nook, Whitefield Road, Stockton Heath, Warrington, Chemist.

1903. Prentice, Jas., Cossipore Sugar Works, Cossipore, Calcutta, India, Chemist.

1900. Prescott, Saml. C., 739, Boylston Street, Boston, Mass., U.S.A., Assoc. Prof. of Ind. Biology.

1905. Preston, Jas. F., 403, Andover Street, Lowell, Mass., U.S.A., Manufacturing Chemist.

1906. Preston-Jackson, J. W. A., 210, City Road, Bradford, Consulting and Analytical Chemist and Druggist.

O.M. Price, Arthur F., 2503, Broadway, San Francisco, Cal., U.S.A., Analytical Chemist.

1905. Price, Dr. T. Slater, The Technical School, Birmingham, Lecturer on Chemistry.

1904. Prichard, Norman B., 40, Quebec Street, Sherbrooke, Quebec, Canada, Superintendent.

1904. Prideaux, Dr. E. B. R., Muspratt Laboratory, The University, Liverpool, Research Chemist.

1905. Priest, Geo. Wesley, Mansfield, Mass., U.S.A., Manufacturer.

1899. Prinsen-Geerligs, H. C., Wanningstraat 17, Amsterdam, Holland, Director of Sugar Cane Experimental Station.

1893. Pritchard, Edgar J., 87, Gordon Road, Ealing, W., Oxalic Acid Manufacturer.

1903. Pritchard, Philip M., Chief Engineer's Office, United Alkali Co., Ltd., Widnes, Engineer.

1896. Prochazka, Dr. Geo. A., 138, West 13th Street, New York City, U.S.A., Colour Manufacturer.

O.M. Procter, Prof. H. R., The University, Leeds; and (Journals) Rowangarth, Ben Rhydding, near Leeds, Lecturer on Tanning.

1884. Procter, J. W., Skeldergate Bridge, York, Manure Manufacturer.

1890. Proctor, Miss Anne J., Free Library, Widnes, Librarian.

O.M. Proctor, C., 118, Grosvenor Road, London, S.W., Analytical Chemist.

1901. Propach, C., 146, West Kinzie Street, Chicago, Ill., U.S.A., Colour Merchant.

1907. Puckhaber, Geo. C., 805, Prospect Place, Brooklyn, N.Y., U.S.A., Glue Maker.

1906. Pudney, Sydney H., 156, Bellwood Avenue, Toronto, Canada, Foreman.

1905. Pugh, John V., Guiting House, Allesley, near Coventry, Works Director (Rudge Whitworth, Ltd.).

1899. Pullar, Edmund, Keirfield, Bridge of Allan, N.B., Manufacturer.

1894. Pullar, Herbert S., Pullar's Dyeworks, Perth, N.B., Dyer.

O.M. Pullar, Sir Robert, M.P.; Journals to Jas. Craigie, Sandeman Public Library, Perth, N.B., Dyer.

O.M. Pullar, R. D., Pullar's Dyeworks, Perth, N.B., Dyer.

1903. Pullin, Sydney R., c/o Palmarejo and Mexican Goldfields, Ltd., Chinipas, Chihuahua, Mexico, Chemist.

1902. Puntan, H. H. C., 10, London Chambers, Durban, Natal, Public Analyst.

1894. Purdie, Dr. Thos., F.R.S., 14, South Street, St. Andrews, N.B., Professor of Chemistry.

1905. Pyman, Dr. Frank Lee, Carlee, Selborne Road, Sidcup, Kent, Chemist.

Q

1903. Queeny, Jno. F., Monsanto Chemical Works, 1800, South . nd Street, St. Louis, Mo., U.S.A., Chemical Manufacturer.

1903. Queneau, Augustin L. J., 929, Chestnut Street, Philadelphia, Pa., U.S.A., Metallurgical Engineer.

1887. Quibell, Oliver, Shalem Lodge, Newark-on-Trent, Manure Manufacturer.

1902. Quinan, Kenneth B., Cape Explosives Works, Somerset West, C.C., South Africa, and (subscriptions) c/o Cape Explosives Works, Ltd., 15, St. Swithin's Lane, E.C., Superintendent.

R

1904. Rademacher, Dr. Ferdinand, Prag-Carolinenthal, Austria, Chemical Manufacturer.

1900. Radley, Ernest G., 49, Ernest Street, West Norwood, S.E.

1901. Ralston, Wm., 149, Onslow Drive, Dennistoun, Glasgow, Government Chemist.

1902. Ramsay, A. Alexander, Laboratory, Department of Agriculture, 136, George Street, Sydney, N.S.W., Australia, Assistant Chemist.

1910. Ramsay, Norman, c/o The Anglo-Persian Oil Co., Mohammerah, Persian Gulf, Works Manager.

O.M. Ramsay, Sir William, K.C.B., F.R.S., University College, London, W.C.; Journals to 19, Chester Terrace, N.W., Professor of Chemistry.

1885. Ramsay, W., c/o Cammell, Laird and Co., Ltd., Birkenhead Ironworks, Birkenhead, Chemist and Assayer.

1906. Ranck, Samuel H., Ryerson Public Library Building, Grand Rapids, Mich., U.S.A., Librarian.

1909. Randall, George, The Limes, Kenilworth, Warwickshire, Tanner.

1911. Randolph, Charles E., "Cliff Dene," Mayland Terrace, Ilkley, and (subscriptions) 26A, Great George Street, Leeds, Analytical Chemist.

1910. Ranken, Charles, 19, Stockton Road, Sunderland, Analytical and Consulting Chemist.

1901. Ransom, Francis, The Chilterns, Hitchin, Herts., Manufacturing Pharmaceutical Chemist.

1905. Ransom, H. B., St. Stephen's House, Victoria Embankment, Westminster, S.W., Consulting Engineer.

1910. Ransome, A. Oswald, Beechwood, Greenock Road, Paisley, N.B., Works Chemist.

1904. Rapelje, Walter S., 568, Jamaica Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1898. Raschen, Dr. Julius, The Highlands, Runcorn, Cheshire, Consulting Chemist (United Alkali Co.).

1905. Raschig, Dr. F., Ludwigshafen a/Rhein, Germany, Manufacturing Chemist.

1908. Rassow, Prof. Dr. Berthold, Stephanstrasse 8, Leipzig, Germany, General Secretary, Vereins Deutscher Chemiker.

1893. Ratcliff, Frank D., Medina, Widney Road, Knowle, near Birmingham, Vinegar Brewer.

1904. Ratcliffe, C. F., Haigh Park Chemical Works, Stourton, near Leeds, Tar Distiller.

1898. Ratcliffe, Walter, 21, Mawdsley Street, Bolton, Analytical Chemist.

1901. Rawlins, Herbert J. L., The Cottage, Rainhill, Lancashire, Managing Director.

1903. Rawolle, Frederick C., c/o Marx and Rawolle, 100, William Street, New York City, U.S.A., Chemist.

O.M. Rawson, Chris., Battenberg Avenue, Leicester, Consulting Chemist.

1909. Rawson, H. Wyatt, c/o Woodhead and Co., 44, Charing Cross, London, S.W.

1909. Rayner, Arthur B., Normanhurst, Alexandra Park Road, Muswell Hill, N., Chemical Broker.

1895. Read, E. J., Dart Villa, Victoria Avenue, Westgate-on-Sea: and (Journals) c/o D. G. Robertson Ltd., Kuala Lumpur, Fed. Malay States, Analyst.

1890. Reade, Thos., 20, Harborne Road, Edgbaston, Birmingham, Manufacturing Chemist.

O.M. Readman, Dr. J. B., Staffield Hall, Kirkoswald, R.S.O., Cumberland, Analytical and Consulting Chemist.

1908. Reavell, J. Arthur, 181, Queen Victoria Street, London, E.C., Engineer.

1907. Rebhun, Frank E., c/o Pennsylvania Salt Manufacturing Co., Natrona, Pa., U.S.A., Chemist.

1902. Redfern, C. G., 15, South Street, Finsbury, London, E.C., Patent Agent.
O.M. Redwood, Sir Boverton, 4, Bishopsgate, London, E.C., Petroleum Expert.
1887. Redwood, Robt., 4, Bishopsgate, London, E.C., Secretary.
1886. Rée, Dr. A., 15, Mauldeth Road, Withington, Manchester, Aniline Dye Manufacturer.
1884. Reed, Albert E., 11, Portland Place, London, W., Paper Works Chemist.
1902. Reed, Herbert C., c/o Stamford Manufacturing Co., Stamford, Conn., U.S.A., Chemist.
1906. Reed, William, Bridge House, Bridge Road, Millwall, E., Foreman (Desilverising Works).
1893. Reekie, J. A., Buckton Grange, Stalybridge, Calico Printer's Colour Mixer.
1883. Reeks, T. H., 106, Queen Victoria Street, London, E.C., Analytical and Consulting Chemist.
1897. Rees, W. H., c/o Alameda Sugar Co., Alvarado, Cal., U.S.A., Chemist.
1906. Rees, Walter J., c/o Chance Bros. and Co., Ltd., Smethwick, near Birmingham, Glass Works Chemist.
1900. Reese, Dr. Chas. L., Eastern Laboratory, P.O. Box 424, Chester, Pa., U.S.A., Chemist.
1897. Reid, Andrew, c/o L. and J. McLellan, 65, Port Dundas Road, Glasgow, Chemist.
1909. Reid, David E., Kodak Park, Rochester, N.Y., U.S.A., Chemist.
1909. Reid, Howard E., c/o Lawrence Portland Cement Co., Siegfried, Pa., U.S.A., Chemist.
1906. Reid, James, Moffat Mills, Airdrie, N.B., Chemist.
1905. Reid, Dr. John H., Cranford, Barton Heys Road, Formby, Lancs., Chemist.
1907. Reid, Robert, Agencia de Tharsis, Huelva, Spain, Analytical Chemist.
1896. Reid, Robt., Oil Mills, Horbury Bridge, near Wakefield, Chemist.
O.M. Reid, Walter F., Fieldside, Addlestone, Surrey, Technical Chemist.
1893. Reid, Wm., jun., Bombay Dyeworks, Dadur, Bombay, India, Dyer.
1907. Reimarus, Dr. C., Chemische Fabrik auf Actien (vorm. E. Schering), Müllerstrasse 170–171, Berlin, N. 39, Germany, Manager.
1904. Reinherz, Otto, 9, Heaton Grove, Bradford, Yorks., Chemist.
1906. Reinhold, Gustave, 26, Kidbrook Park Road, Blackheath, S.E., Works Manager.
1910. Reiter, Dr. Kaspar, 17, Osborne Road, Brimsdown, Middlesex, Chemist.
1898. Reitmeyer, Robt. E. D., 63, Crutched Friars, London, E.C., Chemical Merchant.
1904. Remington, Prof. Joseph P., 1832, Pine Street, Philadelphia, Pa., U.S.A., Author, U.S. Pharmacopœia.
1900. Remington, J. Stewart, Aynsome, Grange-over-Sands, R.S.O., Lancs., Consulting Chemist.
1903. Remsen, President Ira, Johns Hopkins University, Baltimore, Md., U S.A., President.
O.M. Rennie, Dr. E. H., University of Adelaide, South Australia, Professor of Chemistry.
1911. Rentschler, Mahlon J., Rossville, Staten Is., N.Y., U.S.A., Bacteriologist.
1901. Renwick, Frank F., Norland House, Avenue Road, Brentwood, Essex, Chemist (Photographic Works).
1907. Reoch, Robert A. S., c/o Pacific Mills Co., Dover, N.H., U.S.A., Printworks Superintendent.
1894. Rettie, Theodore, 16, Great King Street, Edinburgh, Metallurgical Chemist.
1895. Reubens, Chas. M., 68, Cliff Street, New York City, U.S.A., Chemist.
1905. Revis, Cecil, 5, Carlton Villas, Station Road, Barnes, S.W., Analyst.
O.M. Reynolds, Dr. J. Emerson, F.R.S., 3, Inverness Gardens, Kensington, W., Professor of Chemistry.
1908 Rhoads, J. Edgar, Box 961, Wilmington, Del., U.S.A., Leather Chemist.
O.M. Rhodes, E., c/o Thos. Vickers and Sons, Widnes, Technical Chemist.
1892. Rhodes, P. J., Bridge House, Church, Accrington, Dye and Print Works Manager.
1889. Richards, Edgar, 60, Ayrault Street, Newport, R.I., U.S.A., Analytical Chemist.
1910. Richardson, C. Gordon, 137, Jarvis Street, Toronto, Canada, Chemist.
1888. Richardson, Dr. Clifford, 30, Church Street, New York City, U.S.A., Chemical Engineer.
1903. Richardson, F. J., Chemical Works, Ringsend Docks, Dublin, Ireland, Chemical Manure Manufacturer.
1884. Richardson, F. W., County Analyst's Office, Bradford, Yorkshire, Analytical Chemist.
1900. Richardson, Jno. H., c/o H. D. Pochin and Co., Ltd., Salford, Manchester, Manager.
1905. Richardson, L. G., Newtown View, Glenpatrick, Elderslie, Johnstone, N.B., Chemist.
1889. Richardson, S. M., 415, Main Street, Bonhill, N.B., Analytical Chemist.
1891. Richardson, Walter W., Aldingham, Park View Crescent, Roundhay, Leeds, Manufacturing Chemist.
1903. Richardson, Wm., Linfield, Wood Lane, Headingley, Leeds, Drysalter.
1894. Richardson, Wm. H., Newsky Thread Mills, Malaja, Bolotnaja, St. Petersburg, Russia, Textile Chemist.
1886. Richmond, H. D., Mex, Avondale Avenue, Woodside Park, N., Chief Chemist (Aylesbury Dairy Co.).
1898. Richmond, Jno. R., The Hollies, Blurton, Longton, Staffs., Alkali Works Manager.
1901. Richmond, Sylvester O., Royal William Yard, Plymouth, Analytical Chemist.
1907. Ricketts, Guy D. *See* Bengough, Guy D.
1886. Riddell, R., 87, Horninglow Street, Burton-on-Trent, Brewer.
1884. Rideal, Dr. Samuel, Laboratory, 28, Victoria Street, Westminster, S.W., Consulting Chemist.
1905. Ridge, H. M., 62, London Wall, London, E.C., Mining Engineer.
O.M. Ridsdale, C. H., Ravenscroft, Roman Road, Linthorpe, Middlesbrough, Analytical Chemist.
1899. Riederer, Emil J., Forcite Works, Landing, N.J., U.S.A., Works Chemist.
1902. Riederer, Dr. Herman S., 251, West 95th Street, New York City, U.S.A., Chemist.
1908. Rigby, Wm. T., County Analyst's Laboratory, Temple Street, Birmingham, Public Analyst.
1907. Rigg, Gilbert, c/o New Jersey Zinc Co., Palmerton, Carbon Co., Pa., U.S.A., Chemist.
1892. Riker, Jno. J., 46, Cedar Street, New York City, U.S.A., Merchant.
O.M. Riley, E., 2, City Road, Finsbury Square, London, E.C., Metallurgical Chemist.
1905. Riley, Louis J., 8, Newton Road, London, W., Chemist.
1899. Rink, Arnold, 11, Bridgewater Street, Barbican, London, E.C., Tannin Extract Manufacturer.
1889. Rintoul, Wm., "Lauriston," Ardrossan, Ayrshire, Explosives Chemist.
1901. Ripley, Philip F., 7, Abbott Street, Andover, Mass., U.S.A., Chemist.
1909. Rising, Albert E., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.
1909. Roberts, Alfred R., c/o Kirkfield Portland Cement Co., Ltd., Victoria Road, Ontario, Canada, Chemist.
1907. Roberts, Chester, Swarthmore College, Swarthmore, Pa., U.S.A., Superintendent.
O.M. Roberts, F. G. Adair, Oak Hill Lodge, Frognal, N.W., Chemical Manufacturer.
1901. Roberts, H. E. U., c/o British Explosives Synd., Pitsea, Essex, Chemist.
1907. Roberts, Percy R., P.O. Box 62, Wilmington, Del., U.S.A., Leather Chemist.
1902. Roberts, Wm. H., 4, Sugnall Street, Liverpool, Analytical Chemist.
1891. Robertson, Alex. A., Riversdale, Cressington Park, Liverpool, Technical Chemist.

1897. Robertson, Andrew J., 2, North Ninth Street, Richmond, Va., U.S.A., Analytical Chemist.
1910. Robertson, Arthur F., National Chemical Works, 27, St. Jean Baptiste Street, Montreal, Canada, Chemist.
1910. Robertson, Charles, c/o Messrs. S. Allsopp and Sons, Ltd., Burton-on-Trent, Brewer.
1909. Robertson, F. A., 492, Euclid Avenue, Toronto, Canada, Chemist.
1900. Robertson, Jas., Barncraig, South Medrox, by Glenboig, N.B., Analytical Chemist.
1910. Robertson, Dr. Joseph G., Braidwood, Tollcross, Glasgow, Manufacturer.
1891. Robertson, Dr. Robt., Research Dept., Royal Arsenal, Woolwich; and (Journals) 29, Charlton Road, Blackheath, S.E., Analytical Chemist.
1910. Robertson, William, Chemical Dept., Central Technical College, Exhibition Road, London, S.W., Lecturer and Research Assistant.
1910. Robin, Alex. G., Castlehill, Hamilton, N.B., Chemical Merchant.
1897. Robinson, Clarence J., Westerleigh, West New Brighton, N.Y., U.S.A., Chemist.
1902. Robinson, Hy. Fishwick, Culcheth Chemical Works, Newton Heath, Manchester, Manufacturing Chemist.
O.M. Robinson, H. H., 42, Penywern Road, Earl's Court, S.W., Analytical Chemist.
1907. Robinson, Herbert W., Robinson Bros., Ltd., Ryders Green, West Bromwich, Staffordshire, Tar Distiller.
1911. Robinson, Jas. H., 11, East Street, Rugby, Analytical Chemist.
O.M. Robinson, Jos., Farnworth, Widnes, Chemical Manufacturer.
1887. Robinson, Thomas, (Journals) 401, West Street, Glasgow; and (communications), The Villa, Nitshill, N.B., Chemical Works Manager.
1902. Robitschek, Carl, 200, Worth Street, New York City, U.S.A., Scientific Brewer.
1884. Rodger, Edw., 1, Clairmont Gardens, Glasgow, W.
1904. Rodger, Robert, Government Laboratory, Clement's Inn Passage, Strand, London, W.C., Chemist.
1905. Rodger, R. L., Suffolk House, Cannon Street, London, E.C., Manager (Peña Copper Mines).
1909. Rody, Franz A., 104, Condit Street, Hammond, Ind., U.S.A., Chemist.
1904. Roeber, Dr. E. F., 239, West 39th Street, New York City, U.S.A., Editor (Metallurgical and Chemical Engineering).
1903. Roelofsen, Dr. J. A., c/o Coal Distillation Co., Middlesbrough, Yorks., Works Manager.
1910. Roessler, Dr. F., 89, High Street, Perth Amboy, N.J., U.S.A., Chemist.
1905. Rogers, Dr. Allen, Pratt Institute, Brooklyn, N.Y., U.S.A., Research Chemist.
1900. Rogers, Geo. J., Pembrey Copper Works, Burry Port, South Wales, Chemist.
1890. Rogers, Harry, 5, Stoke Newington Common, London, N.
1908. Rogers, Harry V., Ash Street, Ilkeston, Derbyshire, Engineer.
1907. Rogers, Henry L., Analytical Dept., Alianza, Ferro Carril de Buenos Aires al Pacifico, Argentina, Analytical Chemist.
1909. Rogers, Herbert, Stenning House, Cobwell Road, Retford, Notts, Rubber Works Chemist.
1899. Rogers, John, c/o Nobel's Explosives Co., Ltd., Nobel House, Glasgow, Chemist.
1910. Rogers, L. Joslyn, Chemical and Mining Building, The University, College Street, Toronto, Canada,
1907. Roller, Frank R., 525, 31st Street, Oakland, Cal., U.S.A., Powder Works Superintendent.
1898. Roller, H. C., 493, Central Avenue, Newark, N.J., U.S.A., Superintendent.
1899. Rollin, Chas., Bylton, East Jarrow-on-Tyne, Chemical Manufacturer.
1909. Rollin, Hugh, Overdene, Riding Mill-on-Tyne, Chemical Manufacturer.
O.M. Rollin, J. C., 1, St. Nicholas Buildings, Newcastle-on-Tyne, Chemical Manufacturer.
1907. Rolph, George M., c/o California and Hawaiian Sugar Refining Co., Crockett, Cal., U.S.A., Sugar Refiner.
1905. Romanes, J. W., Casa Colon, Huelva, Spain, Chemical Engineer.
O.M. Roscoe, Rt. Hon. Sir Henry, F.R.S., 10, Bramham Gardens, South Kensington, S.W., Consulting Chemist.
1904. Rose, Jno., Wicken House, Stretton, near Warrington, Technical Chemist.
1901. Rose, Jno. Leonard, 45, De Parys Avenue, Bedford, Chemist.
1902. Rosebrugh, Prof. T. R., 150, West Newell Street, Syracuse, N.Y., U.S.A., Professor of Electrical Engineering.
1897. Rosengarten, Dr. Geo. D., P.O. Box 1625, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
1896. Rosenheim, Dr. Otto, Holly Terrace House, Holly Hill, Hampstead, N.W., Research Chemist.
1887. Ross, Alex. J. J., Tayavalla, Camelon, Falkirk, N.B., Chemical Manufacturer.
1893. Ross, Arthur, 1, Glengall Road, Old Kent Road, London, S.E., Analytical Chemist.
1900. Ross, Raymond, Public Analyst's Office, Burnley, Lancashire, Analytical Chemist.
1910. Ross, Thos. M., c/o Burmah Oil Co., Ltd., Rangoon, Burmah, Analytical Chemist.
1911. Ross, Prof. W. J. Clunies, 12, Church Street, Ashfield, Sydney, N.S.W., Australia, Prof. of Chemistry (Sydney Technical College).
1910. Rossati, Guido, 226, Lafayette Street, New York City, U.S.A., Agricultural Chemist.
1906. Rossi, Auguste J., c/o Roessler Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Mining Engineer.
1911. Rossi, Dr. Carlo, Legnano, Milan, Italy, Electrochemist.
1906. Rossi, Louis M., c/o General Bakelite Co., Perth Amboy, N.J., U.S.A., Works Manager.
1906. Rossiter, E. C., 4, Park Road, West Smethwick, Birmingham, Chemical Engineer.
1888. Rothwell, C. F. Seymour, Photographic Works, Mobberley, Cheshire, Chemist.
1905. Rothwell, Robert R., 88, George Street, Moss Side, Manchester, Chemistry and Physics Teacher.
O.M. Rottenburg, Dr. Paul, 55, West Regent Street, Glasgow, Chemical Merchant.
1899. Rouse, H. W., Anglo-Continental Guano Co., Victoria Docks, E., Foreman.
1903. Rouse, Wm., 46, Hermitage Road, Crumpsall, Manchester, Chemist.
1906. Rowell, Herbert W., "Iveah," Ferens Avenue, Hull, Analytical Chemist.
O.M. Rowland, W. L., 4800, Chester Avenue, Philadelphia, Pa., U.S.A., Chemist.
1904. Rowley, Ernest W., Chemical Laboratory, Locomotive Department, North Eastern Railway, Gateshead-on-Tyne, Analytical Chemist.
1908. Rowley, Frank, 4, Doughty Street, London, W.C., Metallurgist.
1901. Rowley, Walter Eugene, c/o National Aniline and Chemical Co., 100, William Street, New York City, U.S.A., Chemist.
1904. Rowling, S. R., 1, Beechwood, Kendal, Westmoreland, Chemist.
1896. Royal-Dawson, H., 6, Wimbourne Road, City Road, Edgbaston, Birmingham, Chemist.
1898. Royle, Chas. L., 1, Wigram Road, Wanstead, Sugar Chemist.
O.M. Royse, S. W., St. Andrew's Chambers, 20, Albert Square, Manchester, Chemical Engineer.
1902. Rücker, Dr. Hermann von, 91, Lancaster Avenue, Buffalo, N.Y., U.S.A., Chemist.
1896. Ruddock, Fred. G., Corporation Street, Warrington, Analytical Chemist.
1895. Rudge, Alfred, Sutton Alkali Works, St. Helens, Lancs., Analytical Chemist.
1908. Rudolf, Prof. Norman S., Dept. of Applied Chemistry, Indian Institute of Science, Bangalore, India, and (Journals) Royal Societies Club, 62, St. James Street, London, S.W., Professor.

1909. Rudorf, Dr. G., 34, Cranley Gardens, Muswell Hill, London, N., Manufacturing Chemist.

1884. Ruffle, Jno., Musley, Ware, Herts., Consulting Chemist and Electrician.

1905. Rüger, Richard, 389, New Chester Road, Rock Ferry, Cheshire, Chemist.

1898. Ruhl, Louis, c/o Roessler and Hasslacher Chemical Co., P.O. Box 1999, 100, William Street, New York City, U.S.A., Chemical Merchant.

1909. Ruiloba, J. A., c/o U.S. Steel Corporation, 71, Broadway, New York City, U.S.A., Engineer.

1910. Rule, Alexander, The University, Liverpool, Lecturer in Chemistry.

O.M. Rumble, C., Belmont Works, Battersea; and (Journals) 154, Valley Road, Streatham, S.W., Candle Works Chemist.

1899. Rumbold, Wm. R., Calverley Lodge, Tunbridge Wells, Kent, Electro-Metallurgist.

1895. Rump, Ernest, The Leeds Phosphate Works, Hunslet, Leeds, Manager.

1903. Runyan, Elmer G., Hutchins Building, Washington, D.C., U.S.A., Chemist and Gas Inspector.

1899. Rushby, Wm., Oak View, Batley, Yorks., Analyst.

1906. Russell, David, Cadham, Markinch, Fife, Scotland, Paper Maker.

1910. Russell, William, 146, Peel House Lane, Widnes, Lancashire, Chemist.

1901. Rust, Robt. R., 312, West 97th Street, New York City, U.S.A., Chemist.

1905. Ruttan, Prof. R. F., Medical Faculty, McGill University, Montreal, Canada, Professor of Chemistry.

1909. Ryall, W. E., 9, Bradgate Road, Nottingham, Soapworks Chemist.

1905. Ryan, Prof. F. G.; (Journals) c/o Parke, Davis, and Co., Detroit, Mich. U.S.A., and (subscriptions) c/o Parke, Davis, and Co., Beak Street, Regent Street, London, W., Manufacturing Chemist.

1910. Ryan, Leo G., 27, Bishop Street, Montreal, Canada, Druggist.

S

1895. Saalfeld, Adolphe, 2, South King Street, Manchester, Chemical Merchant.

1895. Saarbach, Dr. L., 114, Pearl Street, New York City, U.S.A., Consulting Chemist.

1905. Sabin, Alvah H., 432, Sandford Avenue, Flushing, N.Y., U.S.A., Chemist, Varnish Works.

1883. Sadler, A. E., Sand Hall, Ulverston, Lancashire, Manufacturing Chemist.

O.M. Sadler, Sir Samuel A., Middlesbrough-on-Tees, Colour Manufacturer.

1908. Sadtler, Philip B., 945, Monadnock Building, Chicago, Ill., U.S.A., Consulting Chemist and Engineer.

1884. Sadtler, Dr. S. P., 145, North 10th Street, Philadelphia, Pa., U.S.A., Consulting Chemist.

1896. Sadtler, Dr. S. S., c/o Samuel P. Sadtler and Son, 39, South 10th Street, Philadelphia, Pa., U.S.A., Analytical and Consulting Chemist.

1897. Sage, C. Edward, 41, Cheapside, London, E.C., Consulting Chemist.

1902. Sahm, Louis N., 22, Cliff Street, New York City, U.S.A., Chemist.

1907. Saiki, Kenkichi, c/o Kikuchi Law Office, Uchisaiwai-cho, Kojimachi, Tokyo, Japan, Chemist.

1884. Salamon, A. Gordon, 1, Fenchurch Avenue, London, E.C., Consulting Chemist.

1885. Salamon, Jno., Rainham, S.O., Essex, Manufacturing Chemist.

1884. Salis-Mayenfeld, Dr. E. von, 966, Madison Avenue, Albany, N.Y., U.S.A., Technical Chemist.

1907. Samuel, Marcus R. A., c/o Compania General de Tabacos Filipinas, 37, Fenchurch Street, London, E.C., Merchant.

O.M. Samuel, W. Cobden, 66, Croxted Road, West Dulwich, S.E., Analytical Chemist.

1896. Samuelson, Francis A. E., Sir B. Samuelson and Co., Ltd., Middlesbrough, Ironmaster.

1904. Sand, Dr. Henry J. S., University College, Nottingham, Lecturer and Demonstrator.

1909. Sandberg, Sixten, Skutskärs Sulphite and Sodapulp Mills, Skutskär, Sweden, Chemist and Mill Manager.

1910. Sandeman, Archibald, Ruchill Oil Works, Glasgow, Chemist.

1906. Sanders, J. McConnell, P.O. Box 3033, Mexico, D. F., Analytical and Consulting Chemist.

1902. Sanders, Warren W., 127, Vernon Street, Gardner, Mass., U.S.A., Chemist.

1895. Sanderson, John, c/o B. S. Cohen, Ltd., 15, Clerkenwell Close, London, E.C., Chemist.

1898. Sanderson, T. Crisp, Dubois Avenue, West New Brighton, N.Y., U.S.A., Chemical Engineer.

1907. Sandig, A., P.O. Box 702, Chicago, Ill., U.S.A., Sales Manager.

O.M. Sanford, P. Gerald, 14, Wellington Road, Croydon, Public Analyst and Consulting Chemist.

1890. Saniter, E. H., Strafford Villa, Moorgate, Rotherham, Analytical Chemist.

1901. Sargent, Dr. Geo. W., c/o Crucible Steel Co. of America, Oliver Building, Pittsburgh, Pa., U.S.A., Chemist and Metallurgist.

1909. Sargent, Ledyard W., 10, Dana Street, Suite 508, Cambridge, Mass., U.S.A., Chemist.

1910. Sargent, R. N., 115, State Street, Perth Amboy, N.J., U.S.A., Chemical Engineer.

1910. Sauerschnig, José, P.O. Box 313, Mexico City, Mexico, Acid Manufacturer.

1911. Saunders, A. G., 73, Alexandra Road, Hampstead, N.W.

1903. Saunders, Lewis E., 123, Buffalo Avenue, Niagara Falls, N.Y., U.S.A., Electro-Chemical Engineer.

1896. Saunders, Walter M., 20, Dewey Street, Olneyville, R.I., U.S.A., Analytical Chemist.

1895. Sawers, Wm. D., 7, Minard Road, Partick Hill, Glasgow, Chemist.

1907. Saxe, Joel B., P.O. Box 554, Montreal, Canada, Chemist.

1898. Saxe, Sigmond, 107, Manhattan Avenue, New York City, U.S.A., Manufacturing Chemist.

1895. Sayer, Harry, 5, Orchard Road, High Barnet, Herts., Metallurgical Chemist.

1890. Sayers, Jos. J., Nobel Villa, Stevenston, Ayrshire, Explosives Chemist.

1899. Schaak, Dr. Milton J., 108, Penn Street, Brooklyn, N.Y., U.S.A., Chemist.

O.M. Schack-Sommer, Dr. G., 87, Victoria Street, London, S.W., Sugar Refiner.

1908. Schad, Dr. Philip, Winnington Park, Northwich, Cheshire, Manufacturing Chemist.

1910. Schaefer, Dr. George L., New York Quinine and Chemical Works, 105, North 11th Street, Brooklyn, N.Y., U.S.A., Chemist and Technical Manager.

1899. Schaefer, Dr. L., Maywood, N.J., U.S.A., Manufacturing Chemist.

1903. Schanche, H. G., 3401, Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemist.

1908. Schatzmann, Dr. Paul, Isleben bei Fluelen, Switzerland, Chemist.

1908. Scheele, Edward H., 3, Lloyds Avenue, London, E.C., Chemical Merchant.

1903. Scheidel, Dr. Aug., Mutual Life of New York Building, Martin Place, Sydney, N.S.W., Australia, Managing Director.

1886. Schellhaas, Henry Alf., Thornhill, Beech Road, Hartford, Northwich, Mechanical Engineer.

1904. Schenck, Henry, 15, University Place, New York City, U.S.A.

1894. Schidrowitz, Dr. P., 57, Chancery Lane, London, W.C., Research Chemist.

1905. Schill, Dr. Emil, c/o Opal Leather Co., Manchester, N.H., U.S.A., Chemist.

1909. Schlagintweit, Theo., 94, Market Street, Manchester, Imperial German Consul.

1902. Schlegel, Jno. Wm., New York Sugar Refinery, Long Island City, N.Y., U.S.A., Chemist.

1893. Schleicher, Francis J., 38, West Tenth Street, Long Island City, N.Y., U.S.A., Technical Chemist.

1902. Schlesinger, Barthold E., 68 Northampton Street, Boston, Mass., U.S.A., Chemist.
1901. Schlichting, Emil, 38, Cranberry Street, Brooklyn, N.Y., U.S.A., Chemist.
1905. Schmidt, Herman B., 2523, Essex Place, East Walnut Hill, Cincinnati, Ohio, U.S.A., Manufacturing Chemist.
1906. Schmidt, J., 52, Camberwell Green, London, S.E., Works Manager.
1907. Schmitt, Charles A., The Carter's Ink Co., 172. Columbus Avenue, Boston, Mass., U.S.A. Chemist.
1906. Schneible, Joseph, 842, Elk Street, Buffalo, N.Y., U.S.A., Chemical Engineer.
1901. Schneider, Edw. J., c/o Electro-Metallurgical Co., Niagara Falls, N.Y., U.S.A., Chemist.
1899. Schniewind, Dr. F., c/o German American Coke and Gas Co., 17, Battery Place, New York City, U.S.A., President.
1904. Schniewind, Heinrich, Jun., Susquehanna Silk Mills, 18, West 18th Street, New York City, U.S.A., Vice-President and Treasurer.
1907. Schober, Prof. W. B., Lehigh University, South Bethlehem, Pa., U.S.A., Professor of Chemistry.
1897. Schoder, Dr. Robt., Chemist.
1904. Schoeller, Dr. Walter R., (subsn.) 27, Rue de la Justice, Antwerp, Belgium, and (Jnls.) c/o Alff and Co., Hankow, China, Analytical Chemist.
1902. Schofield, Jas. A., The University, Sydney, N.S.W., Australia, Lecturer in Chemistry.
1908. Scholefield, Fred., c/o R. P. Lawson and Sons, Britannia Works, Hulme, Manchester, Works Chemist.
O.M. Scholefield, H. E., Edge Hill Chemical Works, Liverpool, Chemical Manufacturer.
1906. Schroeder, C. M. E., 221, Pearl Street, New York City, and (Journals) Rutherford, N.J., U.S.A., Analytical Chemist.
1895. Schroeder, E. August, c/o Church and Dwight Co., 36, Ash Street, Brooklyn, N.Y., U.S.A., Chemist.
1908. Schüll, Gustav, Messrs. Carl Schleicher & Schüll, Düren, Rheinland, Germany, Filter Paper Manufacturer.
1906. Schulten, Dr. C., P.O. Box 279, Calcutta, India, Analytical Chemist.
1904. Schultz, Carl R., 440, First Avenue, New York City, U.S.A., Mineral Water Manufacturer.
1901. Schultze, Wm., c/o General Chemical Co., Laurel Hill, Long Island, N.Y., U.S.A., Chemist.
1893. Schüpphaus, Dr. R. C., 1466, Dean Street, Brooklyn, N.Y., U.S.A., Consulting Chemist.
1893. Schwab, Dr. L. C., Sedanstrasse 53, Bernburg, Anhalt, Germany, Technical Chemist.
1908. Schwalbe, Dr. Carl G., Rossdorferstrasse 86, III, Darmstadt, Germany, Professor (Technische Hochschule).
1907. Schwamm, Chas. A., c/o Antoine Chiris, 20, Platt Street, New York City, U.S.A., Chemist.
1902. Schwarz, Gustav A., Grasselli Chemical Co., 60, Wall Street, New York City, U.S.A., Manager.
1889. Schweich, Emile. *See* Mond, Emile S.
1894. Schweitzer, Dr. H., 427, West 117th Street, New York City, U.S.A., Chemical Expert.
1906. Schwerin, Lorenz R., c/o Casein Co. of America, Bainbridge, N.Y., U.S.A., Vice-President, Casein Co.
1906. Scott, Alex. C., c/o Messrs. Haslam and Schentheil, Western Mail Chambers, Cardiff, Explosives Manufacturer.
1891. Scott, Andrew, Royal Gunpowder Factory, Waltham Abbey, Essex, Analytical Chemist.
1906. Scott, A. Putnam, c/o Allegheny Steel Co., Breckenridge, Pa., U.S.A., Metallurgist.
1889. Scott, Ernest G., c/o George Scott & Son (London), Ltd., Northern Assurance Buildings, Albert Square, Manchester, Soap Works Chemist.
1898. Scott, Jas., Cawnpore Woollen Mills, Cawnpore, India, Chemist.
1894. Scott, Jno. Gillespie, Annislea, Clermiston Road, Corstorphine, Edinburgh, Analytical Chemist.
1902. Scott, Walter, c/o The Powell Duffryn Steam Coal Co., Ltd., Aberaman, near Aberdare, Chemist.
1907. Scott, Wm. F., c/o Madison Woollen Co., Madison, Maine, U.S.A., Manager.
1894. Scott-Smith, G. E., 67, Surrey Street, Sheffield, Analytical and Consulting Chemist.
1889. Scovell, M. A., Agricultural Experiment Station, Lexington, Kentucky, U.S.A., Agricultural Chemist.
1904. Scoville, Wilbur L., c/o Parke, Davis, & Co., Detroit, Mich., U.S.A., Analytical Chemist.
O.M. Scudder, F., Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Chemist.
1906. Seabury, Richard W., c/o Boonton Rubber Co., Boonton, N.J., U.S.A., Factory Superintendent.
1909. Seager, Dan G., Box 57, Thebes, Ill., U.S.A., Chemist.
1889. Searl, Albert, Montreux, Victoria Road, Sidcup, Kent, Technical Chemist.
1898. Searle, Alfred B., Cliftonville, Claremont, Sheffield, Analytical Chemist.
1905. Seaver, Joshua, 7, West Seventh Street, South Boston, Mass., U.S.A., Dealer in Dyestuffs and Chemicals.
1901. Sederholm, Erik, K. Flottans Varf, Stockholm, Sweden, Chemist (Royal Navy Board).
1905. Seebohm, H. C. A., 117, Hudson Street, New York City, U.S.A., Importer of Dyestuffs and Chemicals.
1905. Seeker, A. F., 160, Midwood Street, Brooklyn, N.Y., U.S.A., Food Analyst.
1907. Seelemann, Dr. A., Uhlenhorsterweg 3, Hamburg, Germany, Managing Director of Explosives Works.
1893. Sefton-Jones, Herbert, 285, High Holborn, London, W.C., Chemist and Patent Agent.
1907. Seidensticker, Lewis J., c/o Warner Sugar Refining Co., Edgewater, N.J., U.S.A., Chief Chemist.
1896. Seldner, Rudolph, 1395, Dean Street, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1904. Seligman, Dr. Richard, Point Pleasant, Putney Bridge Road, Wandsworth, S.W., Chemist.
1908. Sellen, Elijah, Gasworks Laboratory, M.L.H. & P. Co., Elm Station, Montreal, Canada, Chemist.
1905. Sellers, Geo. E., Rock View, Milnsbridge, near Huddersfield, Aniline Colour Maker.
1911. Sellers, N. Burdett, Townhead House, Rochdale, Lancashire, Analytical Chemist.
1898. Sen (Gupta), Nagendra Nath, 19, Lower Chitpur Road, Calcutta, India, Physician and Chemist.
1910. Sen, Prof. Rajendara Nath, Engineering College, Sibpur, Bengal, India, Professor of Tinctorial Chemistry.
1899. Senior, Francis L., Box 31, Sanford, Maine, U.S.A., Mill Chemist.
1906. Setz, C. F., Herculaneum, Mo., U.S.A., Chemist and Metallurgist.
1905. Sewell, B. F. Brooke, P.O. Box 70, Washington, D.C., U.S.A., Chemical Engineer.
1896. Seyler, Clarence A., Public Analyst's Office, Nelson Terrace, Swansea, Chemist and Assayer.
1907. Seymour, Tom G., 26, Karslake Road, Wavertree, Liverpool, Analytical Chemist.
1903. Shacklady, T. G., Hope House, Cliffe at Hoo, Kent, Technical Chemist.
1906. Shah, Prof. S. J., Dhanasutar's Street, Dehra's Pole, Ahmedabad, India, Professor of Science.
1905. Shainwald, R. L., jun., Papenhuderstrasse 3, Hamburg, Germany, Chemist.
1906. Shankland, George A., Edge Hill, Mansfield Woodhouse, Notts., Manager.
1892. Shanks, Arch., Mount Pleasant, Dalry, Ayrshire, N.B., Chemist.
1908. Shanks, John, Dalmeny Park, Barrhead, near Glasgow, Sanitary Engineer.
1883. Sharp, James, Shirley Manor, Wyke, near Bradford, Yorks., Dyer.
1904. Sharples, G. H., Laburnum Villas, Sutton Lane, Middlewich, Cheshire, Works Chemist.
1905. Sharples, Philip P., 22, Concord Avenue, Cambridge, Mass., U.S.A., President (Natl. Coal Tar Co.).

1884. Sharples, Stephen P., 26, Broad Street, Boston, Mass., U.S.A., Analytical Chemist.
1911. Sharrock, Charles W., Lion Works, West Thurrock, Grays, Essex, Cement Manufacturer.
1900. Sharwood, Wm. J., c/o Homestake Mining Co., Lead, South Dakota, U.S.A., Metallurgical Chemist.
1900. Shattuck, A. F., c/o Solvay Process Co., Detroit, Mich., U.S.A., Chemist.
1908. Shaw, Dr. T. P., 1022, Dorchester Street West, Montreal, Canada, Doctor of Medicine.
1904. Shedden, Frank, 659, Foleshill Road, Coventry, Science Master.
1903. Sheldon, Dr. N. L., Cordite Factory, Aruvankad, Nilgiri Hills, India, Works Manager.
1911. Shelton, James, 52, Stokenchurch Street, Fulham, S.W., Chemist.
1892. Shenton, Jas. P., 37, Torbay Road, Chorlton-cum-Hardy, near Manchester, Analytical Chemist.
1889. Shepard, Dr. Chas. U., (communications) P.O. Box 42, Summerville, S.C.; and (Journals) P.O. Box 284, Charleston, S.C., U.S.A.
1906. Shepard, Jas. H., Experiment Station, Brookings, S. Dak., U.S.A., Agricultural Chemist.
1907. Shepheard, Fred. G., 5, University Road, Galway, Ireland, Chemist.
1904. Shepherd, A. B., Copenhagen Oil Mills, Limehouse, London, E., Analytical Chemist.
1900. Shepherd, E. Sanger, 68, Adelaide Road, London, N.W., Scientific Instrument Maker.
1893. Shepherd, H. H. B., Northcote, Mount Pleasant Lane, Upper Clapton, N.E., Chemist.
1898. Shepherd, Reginald des F., Central Laboratory, Rhodes, Manchester, Printworks Chemist.
1909. Shepherd, Stephen W., Bradford Corporation Chemical Works, Frizinghall, Bradford, Yorks., Works Manager.
1899. Shero, John E., c/o Aluminium Co. of America, Niagara Falls, N.Y., U.S.A., Chemist.
1906. Sherwin, R. S., c/o Aluminium Ore Co., East St. Louis, Ill., U.S.A., Chemist.
1893. Shields, Dr. John, Minas de Rio Tinto, Prov. de Huelva, Spain, Chemist.
1907. Shilstone, Herbert M., c/o Penick and Ford, Ltd., 416, South Front Street, New Orleans, La., U.S.A., Analytical Chemist.
1896. Shimomura, Prof. K., Shinkarasumaru Kojinguchi Sagaru, Kyoto, Japan, Professor of Chemistry.
1886. Shimosé, Masachika, 110, Hakusan-Gotenmachi, Koishikawa, Tokyo, Japan, Chemical Engineer.
1888. Shishkoff, Sergius A., Mojga, Government of Viatka, Russia, Glass Manufacturer.
1905. Shoffstall, Arthur S., 1, Park Street, Tarentum, Pa., U.S.A., Chemist.
1899. Sholes, Chas. E., 164, Front Street, New York City, U.S.A., Chemical Agent.
1900. Shonk, Albert, 10, Dartmouth Road, Hendon, N., Analytical Chemist.
1897. Shores, Dr. Jeff. H., King's Road, Wallsend-on-Tyne, Chemist.
1904. Short, Andrew, Starling House, Choppington, Morpeth, Works Chemist.
1902. Shoubridge, Sydney Y., M.I.C.E., Gasworks, Lower Sydenham, S.E., Gas Engineer.
1910. Shrimpton, Jno. K., Redshaw House, Ripon, Yorks., Works Manager.
1907. Shuey, P. McG., c/o Savannah Guano Co., Savannah, Ga., U.S.A., Chemist.
1901. Shukoff, Dr. Alexis A., Borowaja No. 86, St. Petersburg, Russia, Technical Chemist.
1899. Shuler, Darius P., Sudbury, Ont., Canada, Chemist.
1890. Shutt, Frank T., Central Experimental Farm, Ottawa, Canada, Agricultural Chemist.
1906. Shuttleworth, E. B., 220, Sherbourne Street, Toronto, Canada, Chemist.
1901. Siau, Raymond L., Springfield Brewery, Wolverhampton, Research Chemist.
1902. Sibley, Samuel E., Hawthorne, King Street, Randwick, Sydney, N.S.W., Australia, Technical Chemist.
1907. Siebel, Fred. P., 960-962, Montana Street, Chicago, Ill. U.S.A., Analytical Chemist.
1902. Siebold, Alfred, 59, Elms Road, Clapham Common, S.W., Technical Chemist.
1901. Silberrad, Dr. Oswald, Sunny Croft, Buckhurst Hill, Essex, Research Chemist.
1892. Silvester, Harry, 78, Holyhead Road, Handsworth, Birmingham, Analytical and Consulting Chemist.
1901. Sim, Wilfrid A., c/o Wm. Sim and Sons, 40, Jane Street, Leith, N.B., Colour Manufacturer.
1911. Simmons, Thos. A., 67, Hollingbury Road, Brighton, Analytical Chemist.
1903. Simmons, Wm. H., Oakleigh, Stoke Newington Common, N., Analytical Chemist.
1898. Simon, Dr. A., 80, Bishopsgate, London, E.C., Chemical Engineer.
1890. Simonds, Dr. F. M., 60, Wall Street, New York City, U.S.A., Mining Engineer and Assayer.
1905. Simons, Albert J., Pontianak, Dutch West Borneo, via Singapore, S.S., Engineer.
1902. Simonson, Wm., 126, West 9th Street, Cincinnati, Ohio, U.S.A., Chemist.
1905. Simpson, Henry, 34, Kimbolton Avenue, Lenton Sands, Nottingham, Works Chemical Assistant.
O.M. Simpson, W. S., The Gables, Cannon Hill, Southgate, N., Analytical Chemist.
1900. Sims, W. Edgar, c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Assistant Manager.
1894. Sinclair, Dr. W., 250, Ferry Road, Leith, N.B., Chemist.
1890. Sindall, R. W., 201, Wellmeadow Road, Catford, S.E., and (Journals) Oxford Court, Cannon Street, E.C., Paper Chemist.
1911. Singh, Shersingh W., c/o Thomas Cook and Son, Ludgate Circus, London, E.C., Engineer.
1899. Singmaster, J. Arthur, c/o New Jersey Zinc Co. of Penna., Palmerton, Pa., U.S.A., Chemist.
1901. Sinnatt, Frank S., 321, Great Clowes Street, Higher Broughton, Manchester, Demonstrator of Chemistry.
1905. Sjöström, Waldemar L., 37, Farnham Street, Laurence, Mass., U.S.A., Dyeworks Superintendent.
1885. Skaife, Wilfred T., 3, Trafalgar Avenue, Montreal, Canada, Sugar Chemist.
1894. Skelton, John R., c/o Norwich Crape Co., Ltd., St. Augustine's, Norwich, Managing Director.
1897. Skertchly, W. P., Laboratory, 11, Billiter Square, London, E.C., Analytical Chemist.
1891. Skilton, C. F. E., c/o Beamish and Crawford, Ltd., Cork, Ireland, Brewer.
1901. Skinner, Hervey J., c/o A. D. Little, 93, Broad Street, Boston, Mass., U.S.A., Chemist.
1908. Skinner, Wm., 38, Sauchiehall Street, Glasgow, Analytical Chemist.
1904. Skirrow, Dr. F. W., School Row, Mellor, Derbyshire, Research Chemist.
1904. Skowronski, S., c/o C. L. Constant Co., 42, New Street, New York City, U.S.A., Chemist.
1891. Skurray, Thos., The Brewery, 40, Ock Street, Abingdon, Berks, Brewer.
1904. Slator, Dr. Arthur, The Priory, Burton-on-Trent, Lecturer and Demonstrator.
1906. Sleeper, Robt. R., 112, Charles Street, Lowell, Mass., U.S.A., Instructor in Dyeing.
1895. Slocum, Dr. Frank L., 401, South Linden Avenue, E.E., Pittsburg, Pa., U.S.A., Chemist.
1883. Smail, J. I., Warren Wood, Hayes Common Beckenham, Kent, Chemical Manufacturer.
1908. Small, Bertram G., Beechlands, Timperley, Cheshire Engineer.
1898. Small, Fritz H., 28, Berwick Street, Worcester, Mass., U.S.A., Chemist.
1904. Smart, Bertram J., Chem. Research Laboratory, Royal Arsenal, Woolwich, S.E., Chemist.
O.M. Smetham, A., 16, Brunswick Street, Liverpool, Analytical Chemist.
1905. Smith, Prof. Albert W., Case Library, Cleveland, Ohio, U.S.A., Prof. of Chemistry.

1898. Smith, Alf. B., Ryecroft, Glossop, Derbyshire, Bleacher and Dyers' Manager.

1897. Smith, Allan, c/o Kellner-Partington Paper Pulp Co., Hallein, bei Salzburg, Austria, Chemist.

1896. Smith, Andrew T., c/o Castner-Kellner Alkali Co., Ltd., 43, Castle Street, Liverpool, General Manager.

1905. Smith, Arthur, Town End Chemical Works, Bramley, Leeds, Chemical Manufacturer.

1893. Smith, Edgar B., c/o Dominion Tar and Chemical Co., Box 445, Saulte-Ste.-Marie, Ont., Canada, Manager.

1906. Smith, E. A. Cappelen, c/o Baltimore Copper Smelting and Rolling Co., P. O. Station J., Baltimore, Md., U.S.A., Metallurgical Engineer.

1895. Smith, Dr. E. Ellsworth, 26, East 29th Street, New York City, U.S.A., Consulting Physiological Chemist.

1892. Smith, Ernest A., The Assay Office, Leopold Street, Sheffield, Assayer.

1903. Smith, Ewing, c/o Continental Mexican Rubber Co., Torreon, Coahuiala, Mexico, Analytical Chemist.

1911. Smith, E. Woodhouse, 43, Cornwall Buildings, Newhall Street, Birmingham, Research Chemist.

1903. Smith, F. M., 100, William Street, New York City, U.S.A., President (Pacific Coast Borax Co.).

1891. Smith, Francis P., 24–26, East 21st Street, New York City, U.S.A., Chemist.

1907. Smith, Frank Morse, 100, William Street, New York City, U.S.A., Chemical Merchant.

O.M. Smith, G., Rosehall Terrace, Falkirk, N.B., Explosives Works Manager.

1908. Smith, George A., 1433, President Street, Brooklyn, N.Y., U.S.A., Chemist (Printing Ink Manufacturing).

1907. Smith, George D., 216, Milk Street, Boston, Mass., U.S.A., Salesman.

1897. Smith, Sir Geo. J., c/o Bickford, Smith, and Co., Ltd., Tuckingmill, Cornwall, Fuse Manufacturer

1890. Smith, Harry, Tower House, Freshfield, near Liverpool, Cons. Chemist (Paints and Pigments).

1890. Smith, Harry E., 36, Beersford Place, East Cleveland, Ohio, U.S.A., Analytical Chemist.

1904. Smith, Henry, 83, Brownlow Road, Horwich, Bolton-le-Moors, Lancs., Analytical Chemist.

1902. Smith, Hy. Geo., Technological Museum, Harris Street, Ultimo, Sydney, N.S.W., Australia, Assistant Curator and Chemist.

1905. Smith, H. Melville, Ammunition Works, Abbey Wood, Kent, Engineer and Superintendent.

1901. Smith, H. Procter, Shotton Lane, Shotton, Flintshire, Metallurgical Chemist.

O.M. Smith, H. R., 1, Aubert Park, Highbury, London, N., Analytical Chemist.

1905. Smith, Hugh Dunford, 8 and 10, The Side, Newcastle-on-Tyne, Analytical Chemist.

1906. Smith, Irwin J., P.O. Box 506, Troy, N.Y., U.S.A., Salesman.

O.M. Smith, Jas., Ash Grove House, Radcliffe, Manchester.

1897. Smith, James, Sunnyside, Groes Road, Cressington, near Liverpool, Analytical Chemist.

1903. Smith, James, Brentwood, Frodsham, and (Jnls.) Ditton Copper Works, Widnes, Metallurgist.

1907. Smith, Jas. C., c/o Edward Ripley and Son, Ltd., Bowling Dyeworks, Bradford, Dyer.

1893. Smith, Jas. F., 41, Grange Avenue, Scarborough, Yorks, Analytical Chemist.

1901. Smith, J. Cruickshank, 126, Argyle Road, West Ealing, W., Technical Chemist.

O.M. Smith, Dr. J. H., 60, Rue de la Côte St. Thibault, Bois Colombes, Seine, France, Chemist.

1888. Smith, J. Tertius, Richmond House, Plaistow, Essex, Technical Chemist.

O.M. Smith, Jno. W., 7, Brookfield Street, Roslindale, Boston, Mass., U.S.A., Analytical Chemist.

1890. Smith, J. Wm., Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Works Manager.

1910. Smith, L. Hewgill, The White House, Norwood, Beverley, Yorks, Technical Chemist.

1898. Smith, R. F. Wood, 9, Lower Thames Street, London, E.C., Consulting Chemist.

1890. Smith, Dr. R. Greig, Linnean Society's House, Elizabeth Bay, Sydney, N.S.W., Bacteriologist and Chemist.

1890. Smith, R. W., c/o New Transvaal Chemical Co., Delmore, Transvaal, S. Africa, Chemical Works Manager.

1911. Smith, Stuart, c/o Marquette Cement Manufacturing Co., La Salle, Ill., U.S.A., Chemist.

1897. Smith, Theophilus R., c/o Brotherton and Co., Ltd., The Wear Tar Works, South Dock, Sunderland, Chemist.

1907. Smith, Thorn, 33, Mullet Street, Detroit, Mich., U.S.A., Chemist.

1910. Smith, Vincent, 256, Halifax Old Road, Huddersfield, Technical Chemist.

1896. Smith, Walter E., 141, Cypress Street, Providence, R.I., U.S.A., Instructor in Chemistry.

1903. Smith, Dr. Warren R., Lewis Institute, Chicago, Ill., U.S.A., Teacher.

O.M. Smith, Watson, 34, Upper Park Road, Haverstock Hill, N.W., Editor of Society's Journal.

1908. Smith, Dr. Watson, jun., Cape Explosives Works, Somerset West, C.C., South Africa, Chemist.

O.M. Smith, Wilfred, 182, West Street, Glasgow, Chemical Manufacturer.

1910. Smith, W. C., c/o The Anchor Cable Co., Leigh, Lancashire, Analytical Chemist.

1909. Smith, Wm. G., c/o R. W. Greeff and Co., 20, Eastcheap, London, E.C., Chemical Merchant.

1896. Smith, Dr. W. Stanley, Dunston House, Nailsea, Somerset, Brewer.

O.M. Smithells, Prof. A., F.R.S., The University, Leeds, Professor of Chemistry.

O.M. Smithers, F. O., Dashwood House, 9, New Broad Street, London, E.C., Chemical Agent.

1902. Smoot, Albert M., 99, John Street, New York City, U.S.A., Analytical Chemist.

1909. Smoot, Chas. C. III., c/o C. C. Smoot and Sons Co., North Wilkesboro', N.C., U.S.A., Tanning Chemist.

1902. Smythe, Dr. Jno. A., Armstrong College, Newcastle-on-Tyne, Demonstrator in Chemistry.

1902. Smythe, Dr. J. S., Rantallard, Lance Lane, Wavertree, Liverpool, Analytical Chemist.

1888. Snape, Dr. H. Lloyd, Balholm, Lathom Road, Southport, Director of Education for Lancashire.

1908. Snell, Professor John F., Macdonald College P.O., Prov. Quebec, Canada, Professor of Chemistry.

1896. Snowdon, J., jun., Messrs. Snowdon, Sons & Co., Millwall, E., Chemical and Oil Manufacturer.

1900. Sodeau, Dr. Wm. H., Derwent, Eastwood Road, South Woodford, Essex, and (Journals) Torpedofabrik, Fiume, Hungary, Chemist.

1903. Sohlman, Ragnar, Bofors, Sweden, Manager (A. B. Bofors Nobelkrut).

1894. Sohn, Chas. E., 52, Fore Street, London, E.C., and (Journals) 82, Wightman Road, Harringay, N., Analyst.

1906. Solomon, M., Bradley, Grange Lane, Erdington, Birmingham, Manager (Carbon Works).

1895. Solvay, Armand, 25, Rue Prince Albert, Brussels, Gérant de la Société Solvay et Cie.

1884. Solvay, Ernest, 43, Rue des Champs Elysées, Brussels, Alkali Manufacturer.

1897. Somerset, H. St. John, jun., Mount Morgan Gold Mining Co., Mount Morgan, Queensland, Australia, Assayer.

1884. Sommer, Adolf, Corner 1st and Binney Streets, East Cambridge, Boston, Mass., U.S.A., Pharmaceutical Chemist.

1909. Sommer, Dr. Albert, 17, Battery Place, New York City, U.S.A., Engineer Chemist (The Texas Co.).

1904. Southall, A. W., Lower Priory, Birmingham, Manufacturing Chemist.

1904. Southerden, F., 11, Gordon Road, Exeter, Teacher of Chemistry.

1892. Southern, Thos., Wheathill Chemical Works, St. Simon Street, Salford, Manufacturing Chemist.

1883. Soward, A. W., 28, Therapia Road, Honor Oak, S.E., Principal Clerk (Legacy Duty Office).

1890. Sowerby, Thos. H., Canal Soap Works, Verney Road, Rotherhithe, S.E., Soap Manufacturer.

O.M. Sowerby, W. M., c/o United Alkali Co., Ltd., Allhusen Works, Gateshead-on-Tyne, Manager.

1887. Spackman, Chas., Rosehaugh, Clitheroe, Lancashire, Portland Cement Manufacturer.

1910. Spackman, Henry S., 42, North 16th Street, Philadelphia, Pa., U.S.A., President of Engineering Co.

1904. Sparre, Fin, 606, West 20th Street, Wilmington, Del., U.S.A., Chemist.

1904. Speiden, C. C., 46, Cliff Street, New York City, U.S.A., Chemical Merchant.

1905. Speight, W. E., Sewage Works, Deighton, Huddersfield, Chemist.

1909. Speirs, Wm., c/o W. N. Gemmill and Co., 142, Queen Street, Glasgow, Chemical Broker.

1883. Spence, D., Manchester Alum Works, Manchester, Alum Manufacturer.

1911. Spence, Dr. David, c/o The Diamond Rubber Co., Akron, Ohio, U.S.A., Director of Research Laboratory.

1900. Spence, Howard, (Journals) Audley, Broad Road, Sale, Cheshire; and Alum Works, Manchester, Chemical Manufacturer.

1909. Spence, Jno., 113, West Regent Street, Glasgow, Analyst.

1883. Spence, Jno. W., Tiviot Colour Works, Manchester Road, Stockport, Drysalter.

1903. Spencer, A. Gordon, 601–603, Canadian Express Building, Montreal, Canada, Chemist.

1909. Spencer, George, c/o The Gorton Rubber Co., Ltd., Openshaw, Manchester, Managing Director.

1902. Sperry, Elmer A., 100, Marlborough Road, Prospect Park South, Brooklyn, N.Y., U.S.A., Electrical Engineer.

1897. Sperry, Erwin S., "The Brass World," 260, John Street, Bridgeport, Conn., U.S.A., Metallurgist and Editor.

1884. Spiegel, Dr. Adolf, Messel, bei Darmstadt, Germany, Analytical Chemist.

1903. Spielmann, Dr. P. E., 21, Cadogan Gardens, London, S.W., Chemist.

1906. Spiera, Dr. V. G., Hotel des Boulevards, 9, Place de la Commune, Antwerp, Belgium, Chemist.

1889. Spies, Adolph, 102, Fenchurch Street, London, E.C., Chemical Merchant.

1889. Spies, Hermann, 102, Fenchurch Street, London, E.C., Chemical Merchant.

1885. Spiller, A., Edison-Swan Electric Co., South Benwell Works, Newcastle-on-Tyne, Electrician.

O.M. Spiller, J., 2, St. Mary's Road, Canonbury, London, N., Consulting Chemist.

1896. Spoor, J. L., Rede Court, Rochester, Kent, Portland Cement Manufacturer.

1909. Sprague, F. O., c/o A. C. Lawrence Leather Co., Peabody, Mass., U.S.A., Chemist.

1900. Spurge, Edw. C., University Club, Niagara Falls, N.Y., U.S.A., Chemist.

O.M. Squire, P. W., 413, Oxford Street, London, W., Pharmaceutical Chemist.

1910. Stadler, Hans, c/o Dr. Lewkowitsch, 71, Priory Road, London, N.W., Technical Chemist.

1896. Stafford, Chas H., c/o The Birkacre Printing Co., Chorley, Lancs., Colourist.

O.M. Stahl, Dr. K. F., 57th Street and A. V. Ry., Pittsburg, Pa., U.S.A., Chemical Works Manager.

1905. Stahl, Dr. Paul G., 13, Square de Jussieu, Lille (Nord), France, Chemical Manufacturer.

1905. Stalmann, Otto, 317, McCornick Building, Salt Lake City, Utah, U.S.A., Metallurgical Engineer.

1904. Standfast, Jno. T., Prince Regent's Wharf, Silvertown, E., Chemist.

1910. Stanford, Dr. R. V., Chemical Laboratory, City of Cardiff Mental Hospital, Whitchurch, near Cardiff, Research Chemist.

1906. Stanley, Wm., Great Barrington, Mass., U.S.A., Engineer.

1888. Stantial, Frank G., c/o Cochrane Chemical Co., Everett, Mass., U.S.A., Technical Chemist.

1885. Staples, H. J., The Old Hall, Spondon, Derby, Colour Manufacturer.

O.M. Stark, J. F., Rosedale, Bromborough, Cheshire, Works Manager.

1896. Statham, Noel, 46, Landscape Avenue, Yonkers, N.Y., U.S.A., Engineer.

1908. Statiropoulos, Dr. John G., Anatolia College, Marsovan, Turkey-in-Asia, Chemist.

1907. Staud, Joseph E., c/o W. W. Lawrence & Co., Pittsburgh, Pa., U.S.A., Chemist.

1904. Stauffacher, W., 64, Oberwilerstrasse, Basle, Switzerland, Chemical Works Manager.

1908. Staye, Charles A., 8, East Center Street, South Manchester, Conn., U.S.A., Silk Colour Mixer.

1895. Stead, J. Christopher, 55, Chancery Lane, London, W.C., Technical Chemist.

O.M. Stead, J. E., F.R.S., 11, Queen's Terrace, Middlesbrough-on-Tees, Analytical Chemist.

O.M. Stebbins, Dr. J. H., 3, West 29th Street, New York City, U.S.A., Analytical Chemist.

1896. Steel, Fred. W., c/o General Chemical Co., Ltd., Clyde, Sydney, Australia, Works Manager.

1900. Steel, Jno. S., Achernar, Blackburn, Melbourne, Vic., Australia, Chemist.

1884. Steel, R. Elliott, Cameron House, Sherborne, Dorset, Headmaster.

O.M. Steel, Thos., Colonial Sugar Refining Co., O'Connell Street, Sydney, N.S.W., Australia, Sugar Chemist.

1906. Steers, Thornton, 19, Brevoart Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1909. Stehle, Chas., 5010, Penn Street, Frankford, Philadelphia, Pa., U.S.A., Proprietor of Dye Works.

1905. Steiger, George, c/o U.S. Geological Survey, Washington, D.C., U.S.A., Chemist.

1897. Stein, Sigmund, 214, Upper Parliament Street, Liverpool, Sugar Refinery Manager.

1897. Steinhart, Dr. Oscar J., 2 and 3, West Street, Finsbury Circus, London, E.C., Consulting Metallurgist.

1903. Stell, S. F., 25, Henry Street, Keighley, Yorks, Teacher of Chemistry.

1887. Stenhouse, T., 166, Drake Street, Rochdale, Analytical Chemist.

1908. Stenhouse, Thos., jun., Chemical Laboratory, H.M. Dockyard, Portsmouth, Analytical Chemist.

1904. Stephen, A. E., Rydal Mount, Webb's Avenue, Ashfield, Sydney, N.S.W., Australia, Analytical Chemist.

1884. Stephens, H. Chas., Avenue House, Finchley, N., Ink Manufacturer.

1892. Stephens, M. E., 57–60, Aldersgate Street, London, E.C., Ink Manufacturer.

1909. Stephenson, Henry H., Royal Doulton Potteries, Lambeth, S.E., Technical Chemist.

1909. Stephenson, Herbert F., 7, Winifred Road, Merton Park, S.W., Analytical Chemist.

1889. Stern, Arthur L., 148, High Street, Burton-on-Trent, Brewing Chemist.

O.M. Steuart, D. R., Osborne Cottage, Broxburn, West Lothian, N.B., Oilworks Chemist.

1903. Steven, A. B., The Technical College, Glasgow, Lecturer on Dyeing.

1907. Steven, Michael M., c/o The Distillers' Co., Ltd., 12, Torphichen Street, Edinburgh, Analytical Chemist.

1899. Stevenot, G. A., c/o H. A. Metz Co., 122, Hudson Street, New York City, U.S.A., Chemist.

1898. Stevens, Arthur F., 96, Newgate Street, London, E.C., Paper Examiner.

1902. Stevens, Dr. Hy. P., Laboratory, 15, Borough, London Bridge, S.E., Consulting Chemist.

1894. Stevens, Jno. H., 295, Ferry Street, Newark, N.J., U.S.A., Manufacturing Chemist.

1908. Stevens, J. Venn, c/o Central Chile Copper Co., Panulcillo, Coquimbo, Chile, Analytical Chemist.

1902. Stevens, M. White, H.M. Patent Office, Chancery Lane, London, W.C., Chemist.

1903. Stevens, T. R. B., P.O. Box 57, Kalgoorlie, West Australia, Metallurgical Chemist.

1884. Stevens, Wm., The Native Guano Co., Ltd., 29, New Bridge Street, London, E.C., Secretary.

O.M. Stevenson, W., Standard Works, 95A, Southwark Street, London, S.E., Chemical Manufacturer.

1901. Stewart, David B. D., Aberdeen Comb Works, Hutcheon Street, Aberdeen, Managing Director.

1903. Stewart, Jas., "The Gas World," 8, Bouverie Street, Fleet Street, London, E.C., Editor.

1909. Stewart, Jeffrey, India Refining Co., McKean and Swanston Streets, Philadelphia, Pa., U.S.A., Works Manager.

1890. Stewart, Robt., 46, Westbourn Road, Luton, Chemical Works Manager.

O.M. Stewart, S., c/o Michael Nairn and Co., Ltd., Kirkcaldy, Fife, Technical Chemist.

1906. Stickland, Oliver W., c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Works Chemist.

1904. Stieglitz, Dr. Julius, University of Chicago, Chicago, Ill., U.S.A., Associate Professor of Chemistry.

1904. Stiff, John T., 60, Parrock Street, Gravesend, Kent, Works Chemist.

1908. Stillman, Dr. Thos. B., Stevens Institute of Technology, Hoboken, N.J., U.S.A., Professor of Engineering Chemistry.

1903. Stillwell, Albert G., 164, Front Street, New York City, U.S.A., Chemist.

1903. Stingelin, Dr. Fritz, c/o Dr. E. Bänziger, Romanshorn, Switzerland, Chemist.

1886. Stirk, Jos., The Sunnyside Hydro, Southport, Brewer's Engineer.

1893. Stock, F. W. Keating, County Analyst's Office, Darlington, Analytical and Consulting Chemist.

1900. Stockdale, Edgar, c/o R. Dewhurst and Co., Ltd., Printworks, Batley, Yorks, Colour Mixer.

1888. Stockdale, Wm., Rosebank Printworks, Ramsbottom, near Manchester, Calico Printer.

1887. Stocks, H. B., 12, Victoria Road, West Kirby, Cheshire, Analytical Chemist.

1903. Stoddard, Jesse D., Detroit Testing Laboratory, 1111, Union Trust Building, Detroit, Mich., U.S.A.

1885. Stoddart, F. Wallis, Grafton Lodge, Sneyd Park, Bristol, Analytical Chemist.

O.M. Stoker, G. N., 9, Lessar Avenue, Clapham Common, S.W., Analytical Chemist.

1899. Stokes, Alf. W., Laboratory, Town Hall, Paddington Green, W., Public Analyst.

1910. Stokes, Edward S., c/o Metropolitan Board of Water Supply and Sewerage, Pitt Street, Sydney, N.S.W., Australia, Medical Officer.

1906. Stokes, Francis J., 17th and Cambria Streets, Philadelphia, Pa., U.S.A., Manufacturing Chemist.

1900. Stone, Geo. C., c/o New Jersey Zinc Co., 55, Wall Street, New York City, U.S.A., Engineer.

1899. Stone, I. F., 100, William Street, New York City, U.S.A., Chemical Merchant.

1888. Stone, Thos. W., Chemical Works, St. George, Bristol, Chemical Manufacturer.

O.M. Storey, I. H., Haverbreaks, Lancaster, Chemical Manufacturer.

1902. Storr, Bertram V., 147, Coventry Road, Ilford, Essex, Chemist.

1888. Stowe, W. T., Government Laboratory, 280, George Street, Glasgow.

1909. Strachan, Jas. T., c/o Hendon Paper Works Co., Ltd., Sunderland, Works Chemist.

1883. Strangman, J. Pim, 9, Clydesdale Road, Notting Hill, W., Bleacher.

1908. Stratford, Alfred W., Alexandra Road, King's Langley, Herts, Chemist.

1903. Strayer, D. W., 428, West King Street, York, Pa., U.S.A., Chemist.

1903. Strickler, Emerson H., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemist.

1909. Strivens, Percy R., Oil Mills, Horbury Bridge, near Wakefield, Analytical Chemist.

O.M. Stuart, C. E., 29, Moseley Street, Newcastle-on-Tyne, Chemical Apparatus Dealer.

1905. Stuart, H. E., 176, Purchase Street, Boston, Mass., U.S.A., Vice-President, Mercantile Corporation.

1896. Stuart, Harry T. R., Know Mill House, Entwistle, near Bolton, Printworks Manager.

O.M. Stuart, T. W., 7, Livingston Drive, Sefton Park, Liverpool, Alkali Works Manager.

1896. Stubbs, Augustus J., Claris 111, Barcelona, Spain.

1890. Studer, Jos. S., Helvetia, Stockton Heath, near Warrington, Consulting Chemist.

1903. Sturrock, Capt. G. C., R.A., Indian Cordite Factory, Aruvankad, Nilgiris, India, Assistant Superintendent.

1911. Stut, John C. H., 417, Montgomery Street, San Francisco, Cal., U.S.A., Consulting Engineer.

1908. Suart, Arthur B., c/o Johnson and Sons' Smelting Works, Paul Street, Finsbury, London, E.C., Bullion Refiner.

1896. Suckert, Dr. J. J., 30, Church Street, New York City, U.S.A., Manufacturing Chemist.

1895. Sudborough, Dr. J. J., Edward Davies Chemical Laboratories, Aberystwith, Lecturer in Chemistry.

1889. Sulman, H. L., 44, London Wall, London, E.C., Chemist and Metallurgist.

1910. Sulzer, Albert F., 41, Gorsline Street, Rochester, N.Y., U.S.A., Chemical Engineer.

1895. Summers, Bertrand S., c/o The Summers Fiber Co., Port Huron, Mich., U.S.A., Electro-Chemist.

1907. Sundarram, Minakshi, c/o Parry & Co., Ranipettai, N. Arcot, Madras, India, Agricultural Chemist.

1896. Sunderland, A., The Moorlands, Cullingworth, near Bradford, Yorks., Teacher of Chemistry.

1899. Sundström, Carl, c/o Solvay Process Co., Detroit, Mich., U.S.A., Chemist.

1906. Sutermeister, Edwin, c/o S. D. Warren and Co., Cumberland Mills, Westbrook, Maine, U.S.A., Chemist.

1884. Sutherland, D. A., 26, Victoria Street, Westminster, S.W., Consulting Technical Chemist.

1909. Sutherland, Daniel M., Ashgrove, Sunbury Common, Middlesex, Works Manager.

1894. Sutherland, Geo., Croft Cottage, Bonhill, N.B., Chemist.

1887. Sutherland, Jas., c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Chemist.

1906. Sutherland, John, The British Aluminium Co., Ltd., Baker Street, Greenock, N.B., Manager of Carbon Factory.

O.M. Sutherland, R. M., Lime Wharf Chemical Works, Falkirk; and Solsgirth, Dollar, N.B., Chemical Manufacturer.

O.M. Sutton, Dr. Francis, Norfolk County Laboratory, Redwell Street, Norwich, Analytical Chemist.

1886. Sutton, F. Napier, 6, Grosvenor Gardens, Cricklewood, N.W., Alkali Works Inspector.

1900. Sutton, W. Lincolne, Hillcroft, Eaton, Norwich, Public Analyst.

O.M. Swan, Sir Jos. W., F.R.S., Overhill, Warlingham, Surrey, Chemist and Electrician.

1906. Sweet, Everell F., 52, Union Street, Boston, Mass., U.S.A., Importer.

1905. Swenarton, W. Hastings, Broadway Chambers, 277, Broadway, New York City, U.S.A., Patent Lawyer.

1904. Swindells, Seth, Liverpool Road, Kidsgrove, Stoke-on-Trent, Chemist.

1901. Swinton, Ralph S., c/o W. J. Bush, Incorporated, Linden, N.J., U.S.A., Analytical Chemist.

1902. Sylow, Paul L. P. G., Ostersögade, Copenhagen, Denmark, Analytical Chemist.

O.M. Syme, W. B., Elm Cottage, Addiewell, West Calder, N.B., Oil Works Chemist.

1906. Symes, Langford P., Belfast Freezing Works, Christchurch, New Zealand, Chemist.

1906. Symonds, Abram E., Wick Lane Colour Works, Old Ford Road, Bow, E., Colour Manufacturer.

1910. Szilagyi, L. F., 13, St. Helen's Place, London, E.C., Consulting Engineer.

T

1895. Taber, G. H., 814, Frick Building, Pittsburg, Pa., U.S.A., General Manager (Gulf Refining Co.).

1910. Tainsh, Peter, 8, Franklin Street, Saltcoats, Ayrshire, Technical Chemist.

1909. Tait, Walter Scott, 1000, Massachusetts Avenue, Cambridge, Mass., U.S.A., Works Manager.

1896. Takagi, T., 10, Nishikatamachi, Hongo, Tokyo, Japan, Chemical Engineer.

1910. Takahashi, Kakuichiro, c/o Hazel-Atlas Glass Co., Clarksburg, W. Va., U.S.A., Chemist.

O.M. Takamatsu, T., 13, Nishikatamachi, Hongo, Tokyo, Japan, Analytical Chemist.

O.M. Takamine, Dr. Jokichi, 550, West 173rd Street, New York City, U.S.A., Engineer.

1890. Takayama, Jintaro, Nando Machi 26, Ushigome, Tokyo, Japan, Director (Imperial Industrial Experiment Station).

1905. Talbot, Prof. Henry P., Mass. Institute of Technology, Boston, Mass., U.S.A., Professor of Inorganic Chemistry.

1910. Tanahashi, Dr. T., 30, Minamimachi, Takanawa, Shibaku, Tokio, Japan, Manufacturing Chemist.

1898. Tanaka, Keishin, Matsuba Hotel, Kudansaka, Uye, Tokyo, Japan, Chemist.

1900. Tankard, Arnold R., City Analyst's Office, 40, Lowgate, Hull, and (Journals) 12, Feren's Avenue, Cottingham Road, Hull, Analytical Chemist.

1907. Tartar, Herman V., Corvallis, Oregon, U.S.A., Analytical Chemist.

O.M. Tate, F. H., 9, Hackins Hey, Liverpool, Analytical and Technical Chemist.

1910. Tatlock, Chas. S. A., 156, Bath Street, Glasgow, Analytical Chemist.

O.M. Tatlock, R. R., Kilarden, Rosneath, Dumbartonshire, Consulting Chemist.

1902. Tatters, Hugh Lee. 10, Birchfield Road, Widnes, Analytical Chemist.

1906. Tattersfield, Frederick, 96, Bewick Road, Gateshead-on-Tyne, Analyst.

1907. Taussig, Dr. Rudolf, Würthgasse 8, Vienna XIX., Austria, Chemist.

1905. Taveau, René de Mortemer, "The Preston," Preston and Guildford Streets, Baltimore, Md., U.S.A., Chemist.

1901. Tayler, Jno. Bernard, Anglo-Chinese College, Tientsin, North China, Chemist.

1903. Taylor, Alvin M., c/o General Chemical Co., Hegewisch, Ill., U.S.A., Chemist.

1902. Taylor, Arthur P., c/o John Taylor and Co., 531, Front Street East, Toronto, Ont., Canada, Soap Manufacturer.

1907. Taylor, C. Marshall, Sewaren, N.J., U.S.A., Chemist.

1902. Taylor, Edward R., Penn Yan, N.Y., U.S.A., Manufacturing Chemist.

1886. Taylor, G. Crosland, Ravenscar, Helsby, near Warrington, Electrical Engineer.

1894. Taylor, G. Midgley, Caxton House, Westminster, S.W., Analytical Chemist.

1893. Taylor, G. W., Dinting Vale Printworks, Dinting, near Manchester, Printworks Chemist.

O.M. Taylor, H. E., 1, Alexandra Park Gardens, Glasgow, Lead Works Manager.

1883. Taylor, Jas., "Adderton," Dundas, N.S.W., Australia, Government Metallurgist.

1898. Taylor, Jas. M., Tynevale, Groes Road, Cressington, Liverpool, Analytical Chemist.

1901. Taylor, Jno., Tar Works House, Litherland, Liverpool, Chemist.

1888. Taylor, J. Scott, North London Colour Works, Spring Place, Kentish Town, N.W., Technical Chemist.

1896. Taylor, Martin, "The Clough," Buckhurst Hill, Essex, Chemical Works Manager.

1901. Taylor, Sidney H., 65, Newbridge Road, Weston, Bath, Works Chemist.

1898. Taylor, Walter, 475, Grosvenor Place, Limefield, Bury, Lancs., Technical Chemist.

1905. Taylor, Wm. H., 36, Glenhouse Road, Eltham Park, Kent, Chemist.

1887. Teanby, G. W. A., Elvin Lodge, East Dereham, Norfolk, Analytical Chemist.

1899. Teas, Wm. Holmes, Ridgeway, Pa., U.S.A., Chemist.

O.M. Teed, Dr. F. L., Chem. Laby., 9, Mincing Lane, London, E.C., Analytical Chemist.

1905. Teeple, Dr. J. E., 50, Church Street, New York City, U.S.A., Director.

1908. Teichfeld, Arnold, Pruszkow, near Warsaw, Russian Poland, Chemist in Ceramic Industry.

1904. Teller, George L., The Columbus Laboratories, 103, State Street, Chicago, Ill., U.S.A., Chemist.

1906. Tempany, Harold A., Government Laboratory, St. John's, Antigua, West Indies, Analyst.

1884. Tennant, Jas., Alex. Fergusson and Co., Ltd., 34-48, McAlpine Street, Glasgow, Lead and Colour Manufacturer.

1896. Tennille, Geo. F., c/o Southern Cotton Oil Co., 206, Bay Street East, Savannah, Ga., U.S.A., Chemist.

1908. Terleski, Fred. H., 40, Hugh Oldham Drive, The Cliff, Manchester, Technical Chemist.

1911. Terrey, Augustus G., 47, Cann Hall Road, Leytonstone, N.E., Asst. Chemist (Sanitas Co., Ltd.).

1884. Terry, Hubert L., (Journals) 3, Herbert Street, Moss Side, Manchester; and (Laboratory) 23, Hopwood Avenue, Manchester, Technical Chemist.

O.M. Tervet, R., 68, Windsor Road, Leyton, Essex, Oil Works Manager.

1893. Tetley, C. F., Messrs. Jos. Tetley and Son, The Brewery, Leeds, Brewer.

1897. Tetlow, Dr. Wm. E., Ash Cottage, Ashfield, Dunblane, N.B., Chemist.

1908. Thatcher, Dr. C. J., 1352. Hudson Terminal Building, New York City, U.S.A., Consulting Chemist and Patent Expert.

1903. Thatcher, Ed. J., The Manor House, Chew Magna, near Bristol, Merchant and Manufacturer.

1909. Thaxter, Gerald N., c/o Brewer and Co., Worcester, Mass., U.S.A., Chemist.

1908. Theis, Dr. Friedrich C., Konigsteinerstrasse 60, Höchst a/Main, Germany, Chemist.

1908. Thiele, Dr. Ludwig, Holland, Mich., U.S.A., Manager, Holland Gelatine Works.

1910. Thom, T. Mathieson, Woodlands, Cheshunt, Herts, Chemical Engineer.

1908. Thom, Wm. H., 78, Dunn Avenue, Toronto, Canada, Chemist.

1911. Thomas, Benjamin F., 650, McCallie Avenue, Chattanooga, Tenn., U.S.A., President, Cocalola Bottling Co.

1894. Thomas, H. Russell, Broad Plain Soap Works, Bristol, Soap Manufacturer.

1909. Thomas, John, Avondale, Bent Street, Brierley Hill, Staffs., Analytical Chemist.

1911. Thomas, J. Herbert, 1, Campfield Villas, Truro, Cornwall, Analytical Chemist.

O.M. Thomas, J. W., Overdale, Shortlands, Kent, Analytical Chemist.

1902. Thomas, Nehemiah M., Roseville Avenue, Pymble, N.S.W., Australia, Inspector.

1901. Thomas, Octavius, Gas and Water Offices, Pentre, Glamorganshire, Gas and Water Engineer.

1908. Thomas, Oswald J. D., The International Cement Mill, Hull, Quebec, Canada, Analytical Chemist.

1888. Thomas, S. Percy, 3, Coleridge Road, Crouch End, N., Technical Chemist.

1898. Thomas, Wm. Harrison, jun., 224D, Peel Street, Montreal, Canada, Printworks Chemist.

1905. Thomlinson, Wm., Seaton Carew Ironworks, West Hartlepool, Ironmaster.

1905. Thompson, Alf. J., c/o R. W. Greeff and Co., 20, Eastcheap, London, E.C., Chemical Merchant.

1885. Thompson, Prof. Claude M., 38, Park Place, Cardiff, Professor of Chemistry.

1898. Thompson, Edw. C., Froyle House, Westcombe Park Road, Blackheath, S.E., Manufacturing Chemist.

1909. Thompson, Edwin, 1, Croxteth Grove, Liverpool, Manufacturing Chemist.

1893. Thompson, G. Rudd, 69, Dock Street, Newport, Mon., Analytical and Consulting Chemist.

1895. Thompson, Gustave W., 129, York Street, Brooklyn, N.Y., U.S.A., Chemist.

1907. Thompson, Jas. G., Donegall Quay Mills, Belfast, Ireland, Corn Miller.

1903. Thompson, Jno. T., Corporation Sewage Works, Knostrop, Leeds, Analyst.

1907. Thompson, Milton S., 72, Broad Street, Boston, Mass., U.S.A., Manufacturer.

1885. Thompson, W., Sankey Hill, Earlestown, Lancashire, Sugar Refiner.

O.M. Thompson, W. P., Patent Office, 6, Lord Street, Liverpool, Patent Agent.

1896. Thomsen, Alonzo L., Maryland Club, 1, East Eager Street, Baltimore, Md., U.S.A., Manufacturing Chemist.

1884. Thomson, G. Carruthers, 53, Bedford Road, Rock Ferry, Birkenhead, Engineer.

1907. Thomson, H. N., P.O. Box 188, Tooele, Utah, U.S.A., Metallurgist.

1891. Thomson, Jas. M., Royal Gunpowder Factory, Waltham Abbey, Essex, Manager (Cordite Branch).

1910. Thomson, John R., 156, Bath Street, Glasgow, Analytical Chemist.

1884. Thomson, Robt. T., 156, Bath Street, Glasgow, Analytical Chemist.

1899. Thomson, Thos., c/o Waterproofing Co., Barrhead, near Glasgow, Manufacturer.

O.M. Thomson, W., Royal Institution Laboratory, 79a, Princess Street, Manchester, Analytical and Consulting Chemist.

1890. Thomson, Wm. Thos., Royal Gunpowder Factory, and (Journals) Broom Hall, Waltham Abbey, Essex, Explosives Chemist.

1902. Thorburn, Jas., 30, Cromartie Avenue, Newlands, Glasgow, Analytical Chemist.

1910. Thorne, Carl B., c/o Riordan Paper Co., Hawkesbury, Ontario, Canada, Manager.

O.M. Thorne, Dr. L. T., 2, Denbigh Gardens, Richmond-on-Thames; and (Journals) Southampton Wharf, Battersea, S.W., Technical Chemist.

1907. Thornewell, A. R., 66, Marshall Street, West Smethwick, Birmingham, Works Chemist.

O.M. Thorneycroft, Wallace, Plean House, Plean, Stirling, Technical Chemist.

1904. Thornley, Thomas, 19, Hope Street, Glasgow, Chemical Manufacturer.

1887. Thornton, H., Redbourn, Ashford, Middlesex, Analytical Chemist.

1910. Thornton, Horace M., 24, Coventry Road, Ilford, Essex, Gas Engineer.

1899. Thornton, Wm., c/o J. S. MacArthur and Co., Porcupine, North Ontario, Canada, Chemist.

1895. Thorp, Dr. Frank H., Mass. Inst. of Technology, Boston, Mass., U.S.A., Assistant Professor of Industrial Chemistry.

1907. Thorp, Thos., Moss Bank, Whitefield, near Manchester, Engineer.

1906. Thorp, Walter, Sorrentoville, Dalkey, Co. Dublin, Ireland, Analytical Chemist.

O.M. Thorpe, Sir Edward, C.B., F.R.S., 61, Ladbroke Grove, Notting Hill, W., Professor of Chemistry.

1905. Thorpe, Dr. J. F., F.R.S., 5, Endcliffe Hall Avenue, Sheffield, Lecturer.

1905. Thresh, Dr. John C., Chelmsford, Essex, Medical Officer of Health and Sanitary Expert.

1902. Thurlow, Nathaniel, 78, Warburton Avenue, Yonkers, N.Y., U.S.A., Chemist.

1898. Thurnauer, Dr. Gustav, c/o Aurora Metal Co., Aurora, Ill., U.S.A., Chemist.

1904. Thurston, Azor, Grand Rapids, Ohio, U.S.A., Chemist.

1909. Thwaites, John, c/o Mount Hope Finishing Co., North Dighton, Mass., U.S.A., Textile Finisher.

1908. Thwaites, John H., Market Chambers, Peterborough, Chemical Engineer.

1904. Tickle, Thos., Laboratory, 83, Queen Street, Exeter, Analyst.

O.M. Tilden, Sir William A., F.R.S., The Oaks, Murray Road, Northwood, Middlesex, Professor of Chemistry.

1908. Tillberg, Erik W., Westervik, Sweden, Extract Manufacturer.

1900. Tilley, Jas. W., 95a, Southwark Street, London, S.E., Research Chemist.

1906. Tillson, Henry E., 223, South 61st Street, Philadelphia, Pa., U.S.A., Dyer.

1901. Timmans, W. G., The Basford Chemical Co., Ltd., Basford, Nottingham, Chemical Manufacturer.

1905. Tindall, W. B., 39, St. Mary Street, Toronto, Canada, Secretary and Treasurer.

1907. Tingle, Dr. J. B., McMaster College, Toronto, Canada, and (Journals) Y. L. Kwong, Tao Tai, Colliery, Ping Hsiang, Hunan, China, Professor of Chemistry.

1908. Tingle, J. Grantley, c/o Pacific Phosphate Co., Ltd., A.M.P. Building, Collins Street, Melbourne, Victoria, Assayer.

1894. Tipler, Fred. C., 48, Brooklyn Street, Crewe, Analytical Chemist.

1907. Tischbein, Dr. Robert, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.

1890. Tobey, C. H., Burks Falls, Ontario, Canada, Tannery Chemist.

1911. Tobitt, Miss Edith, Omaha Public Library, Omaha Neb., U.S.A., Librarian.

1894. Toch, Maximilian, 52, 9th Street, Long Island City, N.Y.; and (Journals) 320, Fifth Avenue, New York City, U.S.A., Chemist.

1886. Todd, A. M., c/o The A. M. Todd Co., Kalamazoo, Mich., U.S.A., Manufacturing Chemist and Distiller of Essential Oils.

1905. Tolson, Stanley, The Croft, Abbey Wood, S.E., Chemist.

O.M. Toms, F. Woodland, States Analyst's Office, St. Heliers, Jersey, Analytical Chemist.

1902. Tone, Frank Jerome, c/o The Carborundum Co., Niagara Falls, N.Y., U.S.A., Manager.

1909. Tonry, Wm. S., 58, Euclid Avenue, Hackensack, N.J., U.S.A., Chemical Engineer.

1907. Torrey, Dr. Joseph, Craigie Lea, Blundellsands, Liverpool, Engineer.

O.M. Towers, J. W., Widnes, Lancashire, Analytical Chemist.

1907. Towler, A. E., c/o Sulphide Corporation, Cockle Creek, near Newcastle, N.S.W., Australia.

1909. Townend, Harry, Public Library, Bury, Lancashire, Librarian.

1897. Towse, Walter, Elswick Leather Works, Newcastle-on-Tyne, Technical Chemist.

1904. Toyne, Francis D., c/o Kelsall and Kemp, Ltd., Woodhouse Mills, Norden, near Rochdale, Chemist.

1910. Tracy, Theron H., Durostone Co. of America, 1330, B. Street, San Diego, Cal., U.S.A., Stone Manufacturer.

1899. Trantom, Dr. Wm., Chemist.

1894. Traphagen, Dr. Frank W., Colorado School of Mines, Golden, Colo., U.S.A., Professor of Metallurgy and Assaying.

1900. Traquair, Jno., Glenfield Starch Works, Paisley, N.B., Analytical Chemist.

1904. Trautwein, A. P., Carbondale, Pa., U.S.A., President (Carbondale Instrument Co.).

1906. Travell, Norman E., 1, Grosvenor Avenue, Ebers Road, Nottingham, Lace Dresser.

1893. Travers, Prof. Morris W., F.R.S., Indian Institute of Science, Bangalore, India, Professor of Chemistry.

1889. Trechmann, A. O., Halling Lime and Cement Works, near Rochester, Kent, Cement Manufacturer.

1911. Trechmann, C. T., Warren Cement Works, Hartlepool, Cement Manufacturer.

1895. Treharne, F. Gwilym, Wrangbrook, Llanishen, near Cardiff, Analytical Chemist.

1885. Trewby, Herbert, Albion Mills, Tenter Street East, London, E.C., Analytical Chemist.

1909. Trier, Thorvald G., 237, West 22nd Street, New York City, U.S.A., Technical Chemist.

1901. Trigger, Oliver, Chem. Dept., Royal Arsenal, Woolwich, S.E., Analytical Chemist.

1898. Tripp, Dr. E. Howard, 26, Chaucer Road, Bedford, Science Master.
O.M. Trobridge, A., c/o Trobridge and Co., Ltd., Heworth Shore, Felling-on-Tyne, Technical Chemist.
1897. Trotman, Saml. R., The City Laboratory, 1, Regent Street, Nottingham, City Analyst.
1900. True, Percival E., 279, Douglas Avenue, Elgin, Ill., U.S.A., Chemical Engineer.
1887. Tsukiyama, S., 2nd of No. 2116, Fukiai-chō, Kobe, Japan, Paper Mills Chemist.
1894. Tucker, Alex. E., 55, Station Street, Birmingham, Metallurgist and Chemist.
1897. Tucker, Samuel A., Columbia University, New York City, U.S.A., Tutor in Industrial Chemistry.
1886. Tuer, Arthur H., Douglas House, Worthington, near Wigan, Analytical Chemist.
1903. Tufts, C. G., c/o Semet-Solvay Co., Syracuse, N.Y., U.S.A., Chemical Engineer.
1909. Tulloch, Capt. T. G., 54, Parliament Street, London, S.W., Director of Public Companies.
1901. Tulloch, Wm. F., 30, George Square, Glasgow, Merchant.
1909. Tunks, Dr. F. R., Borthwen, Minffordd, N. Wales, Manager, Steelite Explosives, Ltd.
1904. Tunnell, Raymond W., 251, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Manufacturer.
1899. Turnbull, Dr. Andrew, 18, Hackins Hey, Liverpool, Consulting Chemist.
1888. Turnbull, G.W., Ash Cottage, North Road, Carnforth, Lancashire, Metallurgical Chemist.
1904. Turnbull, R. H., c/o MacAndrews and Forbes Co., Camden, N.J., U.S.A., Analytical Chemist.
1884. Turnbull, W. S., 38, Bath Street, Glasgow, Chemical Manufacturer.
1902. Turner, Basil, 83, Pitt Street, Sydney, N.S.W., Australia, Metallurgist.
1902. Turner, Jos., c/o Read Holliday and Sons, Ltd., Huddersfield, Chemist.
1905. Turner, Prof. Thomas, Springfields, Selly Hill, Birmingham, Professor of Metallurgy.
1897. Turney, Fred. N., 10, Dieghem Straat, Saventham, near Brussels, Belgium, Leather Dresser.
1887. Turney, Sir J., Trent Bridge Leather Works, Nottingham, Tanner.
1908. Turnill, Thos. W., Stibbington, Wansford, Northants, Works Chemist.
1903. Tutton, Henry Ralph, 12, Woodland Place, Penarth, S. Wales, Chemist.
1905. Tutwiler, Carrington C., 1706, North Broad Street, Philadelphia, Pa., U.S.A., Chemist.
1890. Tweedy, Jas., 245, Burdett Road, Limehouse, E., Metallurgical Chemist.
1905. Twigg, Geo. F., 77, Arthur Street, Derby, Gas Works Chemist.
1891. Twitchell, E., Wyoming, Ohio, U.S.A., Candle Works Manager.
O.M. Twynam, T., Wynyard House, Coatham Road, Redcar, Yorks., Metallurgist.
1904. Tyler, Chas. R., c/o Dr. Francis Wyatt, 402, West 23rd Street, New York City, U.S.A., Analytical Chemist.
O.M. Typke, P. G. W., Lawn House, New Malden, Surrey, Chemical Manufacturer.
O.M. Tyrer, Thos., Stirling Chemical Works, Stratford, E.; and (Journals) 14, Sandwell Mansions, West End Lane, N.W., Chemical Manufacturer.
1899. Tysoe, Jos., South Metropolitan Gas Co., East Greenwich, S.E., M.Inst.C.E., Gas Engineer.

U

1907. Udal, John P., Ridge Road, Berea, Durban, Natal, Engineer.
1894. Uhlig, E. C., Citizens' Gas Works, Fifth and Hoyt Streets, Brooklyn, N.Y., U.S.A., Chemist.
1900. Uhlig, W. C., c/o Hygeia Distilled Water Co., 349, West 12th Street, New York City, U.S.A., Chemist.
O.M. Umney, C., (communications) Fernbrake, Branksome Wood Road, Bournemouth; and (Journals) 48, Southwark Street, London, S.E., Manufacturing Chemist.
1905. Umney, John C., 48, Southwark Street, London, S.E., Wholesale Druggist.
1889. Underhill, Thos. J., "Stanley," Quernmore Road, Bromley, Kent, Inspector of Stores.
1885. Underwood, G. R., 4, Emerson Street, Peabody, Mass., U.S.A., Glue Works Chemist.
1908. Underwood, Norman, Bureau of Engraving and Printing, Treasury Dept., Washington, D.C., U.S.A., Chemist.
1908. Upton, Wm. C., Sara Cook Street, Rawdwick, N.S.W., Australia, Soap and Candle Manufacturer.
1904. Uyeda, Toyokitsu, Takasago, Harima, Japan, Chemist.

V

1907. Vail, Jas. G., c/o Philadelphia Quartz Co., Delaware Avenue and Howell Street, Chester, Pa., U.S.A., Chemist.
1896. Van der Linde, Harold, c/o Continental Rubber Co., 111, Broadway, New York City, U.S.A., Vice-President.
1895. Vanderpoel, Dr. Frank, 175, Park Avenue, Orange, N.J., U.S.A., Chemist.
1903. Van Dyck, Edwin M., c/o Ault & Wiborg Co., 534, Pearl Street, New York City, U.S.A., Chemist and Ink Maker.
1907. Van Essen, E. C., 54, Cannon Street, London, E.C., Analytical and Consulting Chemist.
1897. Van Gelder, Arthur P., c/o E. I. du Pont de Nemours Powder Co., Landing, N.J., U.S.A., Superintendent.
1891. Van Gundy, Chas. P., Laboratory, B. and O. R. R., Baltimore, Md., U.S.A., Metallurgical Chemist.
1896. Van Laer, Norbert, Truman's Brewery, Burton-on-Trent, Brewer and Chemist.
1897. Van Marken, J. C., 73, Elgin Crescent, Ladbroke Grove, London, W., Chemical Engineer.
1910. Van Ryn, Dr. J. J. L., 50, Mount Park Road, Ealing, W., Netherlands Agricultural Commissioner.
1888. Vargas-Vergara, J. M., Apartado No. 237, Bogota, Colombia, S. America, Metallurgical Chemist.
1905. Varshnei, Ishwar Das, Talegaon, G. I. P. Railway, Poona District, India, Chemical Engineer.
1910. Vass, David, Mossneuk, Airdrie, N.B., Gasworks Manager.
1898. Verity, Ben, Magog, Prov. Quebec, Canada, Print Works Chemist.
1897. Verity, Victor, 10, Minot Street, North Woburn, Mass., U.S.A., Chemical Works Foreman.
1910. Verner, E. P., Parker Laboratory, 40, Broad Street, Charleston, S.C., U.S.A., Chemist.
1904. Vernon, R. H., Chemie Gebäude, Polytechnikum, Zürich, Switzerland, Student.
1908. Vickers, Benj. Threlfall, Gascoigne Street, Boar Lane, Leeds, Oil Merchant.
O.M. Vickers, Wm., c/o Thos. Vickers and Sons, Miles Platting, Manchester, Chemical Manufacturer.
1907. Vietinghoff-Scheel, Dr. Karl Freiherr von, "Chemiker-Zeitung," Cöthen (Anhalt), Germany, Editor in Chief.
1908. Vieweg, Dr. Walter, Gross-Auheim, bei Hanau a/M., Germany, Chemist.
1909. Virolleaud, Leopold, 16, Quai de Suresnes, Suresnes, Seine, France, Chemical Engineer.
1897. Vlies, Leonard E., Belmont, Gowan Road, Alexandra Park, Manchester.
O.M. Voelcker, E. W., 22, Tudor Street, London, E.C., Analytical and Consulting Chemist.
1887. Voelcker, Dr. J. A., 20, Upper Phillimore Gardens, Kensington, W., Agricultural Chemist.
1901. Vogel, G. C., c/o Pfister and Vogel Leather Co., Milwaukee, Wis., U.S.A., Tanner.

1897. Vogel, Julius L. F., 27, Old Jewry, London, E.C., Engineer.

1899. Vogeler, Gustav, 17, Philpot Lane, London, E.C., Merchant.

1897. Voorhees, Louis A., 111, Carroll Place, New Brunswick, N.J., U.S.A., Agricultural Chemist.

1899. Voorhees, Samuel S., Bureau of Standards, Washington, D.C., U.S.A., Chemist.

1902. Vorisek, Dr. Anton, College of Pharmacy, 115–119, West 68th Street, New York City, U.S.A., Instructor.

1888 Vörster, Fritz, Cöln-Marienburg, Germany, Manufacturing Chemist.

1885 Voss, Hermann, 19, Beckenham Road, Beckenham, Kent, Manure Works Manager.

1899. Voss, Walter A., Carlton Chemical Works, Glengall Road, Millwall, E., Manufacturing Chemist.

W

1896. Wachtel, Gregory, Alexandrowski Prospect 21, St. Petersburg, Russia, Chemical Engineer.

1905. Waddell, Montgomery, 1, West 101st Street, New York City, U.S.A., Consulting Engineer.

1902. Wade, Frank, 26, St. Ronan's Avenue, Southsea, Analytical Chemist.

1890. Wade, Jas. L., 28, West Kensington Gardens, London, W., Chemical Manufacturer.

1889. Wadman, W. E., 102, Lord Avenue, Bayonne, N.J., U.S.A., Manufacturing Chemist.

1897. Wagner, Dr. Theodore B., 746, Marquette Terrace, Chicago, Ill., U.S.A., Chemist.

1893. Wagner, W. G., 12, North Common Road, Ealing, W., Manufacturing Chemist.

1906. Wagstaffe, Dr. E. A., 22, Blackfriars Street, Manchester, Analytical Chemist.

1906. Wahl, Dr. Robert, 1135–1147, Fullerton Avenue, Chicago, Ill., U.S.A., President, Brewers' School.

1903. Wainwright, J., 15, Bolton Road, Port Sunlight, near Birkenhead, Soap Works Manager.

1884. Wainwright, Dr. J. H., 40, Wall Street, New York City, U.S.A., Analytical Chemist.

1906. Wainwright, R. E., Woodside Dyeworks, Horsforth, near Leeds, Dyer.

1895. Wainwright, Wm., c/o Spooner and Bailey, Manure Works, Eling, near Southampton, Chemist.

1908. Wait, Douglas, c/o R. Gay and Co., Ltd., Langthorne Works, Stratford Market, London, E., Analytical Chemist.

1901. Waite, C. Nelson, c/o The Jessup & Moore Paper Co., Delaware Mills, Wilmington, Del., U.S.A., Chemist.

1899. Wakefield, Wm. C., Savile Town, Dewsbury, Chemical Manufacturer.

1905. Waldenberger, Dr. C. A., c/o Independent Baking Powder Co., 322-328, Warren Street, Jersey City, N.J., U.S.A., Chemist.

1894. Waldman, Louis J., P.O. Box 162, Albany, N.Y., U.S.A., Aniline Dye Manufacturer.

1895. Waldstein, Dr. Martin E., 100, William Street, New York City, U.S.A., Manufacturing Chemist.

1887. Walker, Archibald, Newark Castle, Ayr, N.B., Distiller.

1908. Walker, George, c/o Burmah Oil Co., P.O. Box 67, Rangoon, Burmah, Analytical Chemist.

1897. Walker, H. V., 193, Lincoln Avenue, Newark, N.J., U.S.A., Chemist.

1894. Walker, Dr. Jas., 5, Wester Coates Road, Edinburgh, Professor of Chemistry.

1897. Walker, Jas. W., Marine Lodge, Irvine, N.B., Chemical Manufacturer.

1906. Walker, Jas. W., Stonydale, Oakamoor, Stoke-on-Trent, Assayer.

1902. Walker, Jno. H., Gourepore Works, Naihati, E.B.S.R., Bengal, India, Chemist.

1910. Walker, John S., Hiratsuka, Sagami, Japan, Chemist.

1884. Walker, S. R., Fern Bank, Starling Road, Radcliffe, Manchester, Foreman Dyer.

1900. Walker, Dr. Wm. H., Mass. Institute of Technology, Boston, Mass., U.S.A., Chemical Expert.

1895. Walker, W. Sloane, c/o Walker, Ltd., Litherland, near Liverpool, Tanner.

1897. Wallace, Edwin C., 306, South Street, Jamaica Plain, Boston, Mass., U.S.A., Chemist.

1883. Wallace, Robert, 20, Murrayfield Avenue, Edinburgh, Distiller.

1897. Wallace, Robt. A., 12, Avonmore Mansions, West Kensington, W., Chemical Manufacturer.

O.M. Waller, Dr. Elwyn, 7, Franklin Place, Morristown, N.J., U.S.A., Professor of Chemistry.

1906. Wallerstein, Leo, 24–26, West 30th Street, New York City, U.S.A., Chemist.

1899. Wallerstein, Dr. Max, 24–26, West 30th Street, New York City, U.S.A., Chemist.

1886. Walsh, F. T., 12, Valentine Street, West Newton, Mass., U.S.A., Colour Printer.

1901. Walsh, Lionel O.P., c/o Dominion Tar and Chemical Co., Ltd., Sydney, Cape Breton, Canada, Chemist.

1903. Walsh, Peter H., P.O. Box 569, Magog, Quebec, Canada, Analytical Chemist.

1904. Walther, Wm., Holzapfel's Compositions Co., Ltd., Heworth Shore, Felling-on-Tyne, Chemist and Works Manager.

1908. Walton, Robert H., Railway Stores, Eveleigh, Sydney, N.S.W., Analyst.

1902. Walton, Thos. U., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.

1895. Want, W. Philip, 194–200, Bishopsgate, London, E.C., Pharmacist and Editor.

1901. Warburton, Frank, 50, Rosebery Road, Muswell Hill, N., Manager.

1904. Warburton, George H., 77, Kingsgate Road, West Hampstead, N.W., Analytical Chemist.

1896. Warburton, Thos., 14, Sunny Bank Road, Rusholme, Manchester, Chemist.

O.M. Ward, Geo., Messrs. Hirst, Brooke, and Hirst, Ltd., Millgarth Mills, Leeds, Chemical Manufacturer.

1891. Ward, G. J., Hallam Fields, Ilkeston, Notts., Civil Engineer.

1898. Ward, John, Barnstone Blue Lias Lime Co., Ltd., Barnstone, Notts., Manager.

1899. Ward, Wm. J., 11, Manor Road, Sale, Manchester, Chemist.

1908. Wardleworth, Theo. H., 168, Côte Saint Antoine Road, Westmount, Montreal, Canada, Manufacturing Chemist.

1902. Waring, W. Geo., Webb City, Mo., U.S.A., Metallurgical Chemist.

1899. Warnes, Arthur R., c/o Josiah Hardman, Ltd., Aston Church Road, Nechells, Birmingham, Chemist.

1890. Warren, Fiske, c/o S. D. Warren and Co., Cumberland Mills, Westbrook, Maine, U.S.A., Paper Manufacturer.

1901. Warren, Jno. E., Eagle Chemical Works, Barchester Street, Poplar, E., Tar Distiller.

1907. Warren, W. H., Gas Works, Beckton, E., Gas Engineer.

1885. Waterfall, W. B., c/o Avon Manure Co., Bristol; and (Journals) Thirlmere, Clavering Road, Redland, Bristol, Manure Manufacturer.

1902. Watkins, E. J., Works Chemist.

1898. Watkins, Willard H., c/o Schoellkopf, Hartford, and Hanna Co., P.O. Drawer 57, Buffalo, N.Y., U.S.A., Chemist.

1894. Watmough, Benj., 1, Ryeburn, Stanley Road; and (Journals) c/o Brotherton and Co., Ltd., Ammonia Works, Wakefield, Chemist.

1884. Watson, Chas., Fairfield, Washwood Heath Road, Birmingham, Manufacturing Chemist.

1894. Watson, Chas. Ernest, 28, Highfield Road, Stretford, Manchester, Chemical Assistant.

1908. Watson, C. I. Wilkinson, 20, Finlay Drive, Dennistoun, Glasgow, Chemist.

1890. Watson, Eric E., c/o Straits Trading Co., Butterworth, Penang, S.S., Chemist.

1901. Watson, Herbert J., 38, Peel House Lane, Widnes, Chemist.

1903. Watson, H. W., Rose Villa, Roper Avenue, Gledhow, Leeds, Analytical Chemist.

1903. Watson, Hugh M., 22, Coleraine Road, Blackheath, S.E., Paint Manufacturer.

1894. Watson, Jas., Tyne View, Hebburn-on-Tyne, Alkali Works Manager.

1905. Watson, James, 62, Goddington Road, Strood, Kent, Manager.

1891. Watson, Jno., Langdon, Beaconsfield Road, Blackheath, S.E., Analytical Chemist.

O.M. Watson, Jno. C., P.O. Box 523, North Adams, U.S.A., Printworks Chemist.

O.M. Watt, A., c/o Macfie and Sons, 34, Moorfields, Liverpool, Sugar Works Chemist.

1901 Watt, Francis L., 10, Northcote Chambers, Reiby Lane, Circular Quay, Sydney, N.S.W., Australia, Analytical Chemist.

1906. Watt, Dr. H. E., Blandfield Chemical Works, Wheatfield Road, Edinburgh, Chemist.

1910. Watt, John D., 21, Kiukiang Road, Shanghai, China, Superintendent, Foreign Y.M.C.A.

1893. Watts, Jno. Isaac, Fairleigh, Hartford, Cheshire, Alkali Works Manager.

1908 Watts, Jno. Wm., Newcastle Tar Works, Blaydon-on-Tyne, Manager.

1910. Watts, Reginald H. Pole, 26, Cardiff Road, Luton, Beds., Research Chemist.

1907. Waumsley, Harry, Hanley Lodge, Springfield Road, Chelmsford, Chemical Engineer.

1903. Wayland, Wm. A., 12, Albert Road, Brockley, S.E., Manufacturing Chemist.

1906. Webb, Frank H., 7, Dustin Street, Haverhill, Mass., U.S.A., Chemist.

1905. Webber, W. J., 40, Central Street, Boston, Mass., U.S.A., Manufacturing Chemist.

1901. Webster, Geo. J., 115, Delaware Avenue, Toronto, Canada, Secretary.

1902. Webster, Jno., Laboratory of Pathological Chemistry, St. Mary's Hospital, London, W., Analyst.

1906. Weddell, George, 20, Grainger Street West, Newcastle-on-Tyne, Manufacturing Chemist.

1904. Wedekind, Rud., Uerdingen, Niederrhein, Germany, Manufacturer of Alizarin and Bichromates.

1897. Wedge, Utley, Pennsylvania Salt Manufacturing Co., Philadelphia, Pa., U.S.A., Chemist.

1902. Weed, Hy. T., 181, Prospect Park West, Brooklyn, N.Y., U.S.A., Teacher of Chemistry.

1893. Weeks, H. B., 2, Infield Park Road, Barrow-in-Furness, Analytical Chemist.

1898. Weeple, Lawrence, Pinchin's Wharf, Stratford, E., Colour Works Chemist.

1904. Weil, Jacob A., c/o The Power Gas Corporation, Ltd., Stockton-on-Tees, Chemist.

1910. Weinberg, Dr. Arthur von, "Buchenrode," Forsthaus-strasse, Frankfurt a/M, Germany, Dyestuff and Chemical Manufacturer.

1906. Weir, James, c/o Imperial Varnish and Color Co., 6–24, Morse Street, Toronto, Canada, Chemist.

1902. Weiskopf, Dr. Erich, c/o Japanese Explosives Co., Ltd., Hiratsuka, Japan, Works Manager.

1910. Weiss, John M., c/o Barrett Manufacturing Co., Chem. Dept., Frankford, Pa., U.S.A., Chemist.

1908. Weissmüller, Edward F., Hill Crest, Runcorn, Cheshire, Chemist.

1905. Weissmüller, Ernest C., Hill Crest, The Heath, Runcorn, Cheshire, Research Chemist.

1910. Welch, Bertie M., 35a, Bligh Street, Sydney, N.S.W., Australia, Assayer.

1899. Weldon, Leonard E., 154, Egypt Road, New Basford, Nottingham, Dyer.

1907. Welham, Samuel D., 24, Letchmere Road, Grangetown, Sunderland, Technical Chemist.

1903. Wellcome, Henry S., Snow Hill Buildings, London, E.C., Manufacturing Chemist.

1891. Wells, Jas. Gray, Carlton Lawn, Chester Road, Stretford, Manchester, Brewing Chemist.

1894. Wells, Pierson L., 86, Joralemon Street, Brooklyn, N.Y., U.S.A., Patent Lawyer and Engineer.

1885. Welsh, Jas., Standard Mills, Ferguson Road, Bombay, India, Printworks Manager.

1890. Welsh, Thos. L., 3, Prince's Gardens, Dowanhill, Glasgow, Analytical Chemist.

O.M. Welsh, W., Holt Town Oil Works, Manchester.

1905. Welt, Dr. Ida, 35, West 96th Street, New York City, U.S.A., Chemist.

1906. Wenger, Francis E., Clivedon, Wolstanton, Stoke-on-Trent, Ceramic Colour Manufacturer.

1909. Wentworth, Henry A., c/o Huff Electrostatic Separator Co., 60, India Street, Boston, Mass., U.S.A., Mining Engineer.

1909. Wescott, J. P., jr. 55, Washington Park, Newtonville, Mass., U.S.A., Manager, Atlas Chemical Co.

1903. Wesener, Dr. John A., 103, State Street, Chicago, Ill., U.S.A., Consulting Chemist.

1889. Wesson, D., c/o Southern Cotton Oil Co., 24, Broad Street, New York City, U.S.A., Technical Chemist and Cotton-Oil Expert.

1908. West, Chas. A., c/o American Camphor Refining Co., 14, Fulton Street, Boston, Mass., U.S.A., President.

1903. West, Leonard, "Ashfield," Duffield, near Derby, Manufacturing Chemist.

1909. West, Percy C. H., 12, Goldington Crescent, Crowndale Road, London, N.W., Analytical Chemist.

1900. Westenfelder, B. D., 1414, Race Street, Cincinnati, Ohio, U.S.A., Chemist.

1885. Westmoreland, J. W., 12, Arthington Terrace, Hunslet, Leeds, Metallurgical Chemist.

1898. Weston, David B., Sharon, Mass., U.S.A., Chemist.

1894. Weston, Robt. S., 14, Beacon Street, Boston, Mass., U.S.A., Chemist and Bacteriologist.

1885. Weston, Wm., 2, Ulundi Road, Blackheath, S.E., Analytical Chemist.

1890. Wetter, Jasper, 37–39, Essex Street, Strand, London, W.C., Patent Agent.

O.M. Whalley, L. J. de, 18, Brandram Road, Lee, S.E., Sugar Chemist.

1909. Wharton, Fredk. M., 14, Council Road, Tientsin, North China, viâ Siberia, Chemist (Imperial Mint).

1908. Wheaton, H. J., 21, Chesterton Road, Cambridge, Chemical Engineer.

1909. Wheeler, Edward, 3, Melville Road, Coventry, Demonstrator of Chemistry.

1898. Wheeler, Dr. Edwd. J., 79, Chapel Street, Albany, N.Y., U.S.A., Analytical Chemist.

1903. Wheeler, Ernest, 4, Fairfield Terrace, Higher Openshaw, Manchester, Metallurgical Chemist.

1906. Wheeler, Frank G., Trenton, Mich., U.S.A., Chemist.

1907. Wheeler, R. Vernon, The Colliery, Altofts, near Normanton, Chemist.

1895. Wheelwright, Dr. E. W., 24, Stanmore Road, Edgbaston, Birmingham.

1909. Wheelwright, Franklin R., 311, Banigan Building, Providence, R.I., U.S.A., Paper Makers' Materials Manufacturer.

1905. Whetton, John, 77, Front Street East, Toronto, Canada, Manager of Canadian Branch of Read Holliday & Sons, Ltd.

1909. Whiffen, G. Goodman, Lombard Road, Battersea, London, S.W., Chemical Engineer.

O.M. Whiffen, Thos. J., Cerris House, West Hill, Putney, S.W., Manufacturing Chemist.

O.M. Whiffen, W. G., Lombard Road, Battersea, London, S.W., Manufacturing Chemist.

1893. Whitaker, Alf., Waltaire, Horsforth, Leeds, Dyer.

1899. Whitaker, Milton C., Columbia University, New York City, U.S.A., Chemist.

1895. Whitaker, Thos., Aire Vale Dye Works, Newlay, near Leeds, Dyer.

O.M. Whitaker, Thorpe, (Journals) Bradford Dyers' Association, Ltd., and 35, Pemberton Drive, Bradford, Yorks., Dyer's Chemist.

1893. White, Arthur F., 2, Melbourne Grove, Thornbury, Bradford, Yorks., Manufacturing Druggist.

1910. White, G. D., 45, Washington Avenue, Newark, N.J., U.S.A., Manager.

1901. White, H. Graham, Hillside, Boundary Road, Birkenhead, Works Chemist.

1889. White, Henry, 245, Western Road, Crookes, Sheffield, Manufacturing Chemist.

1898. White, Jno., County Offices, St. Mary's Gate, Derby, Public Analyst to County of Derby.

O.M. White, Paul T., Hortonfield House, West Drayton, Chemical Manufacturer.

1910. White, P. Winzar, Hortonfield House, West Drayton, Middlesex, Manufacturing Chemist.

1911. White, Walter W., c/o Citro Chemical Co., Maywood, N.J., U.S.A., Secretary and Manager.

1905. White, William, Beloeil Station, Province Quebec, Canada, Chemist.

1903. Whitehouse, P. L., c/o W. H. Keys, Ltd., West Bromwich, Staffordshire, Oil Chemist.

1909. Whitehouse, Wm., Albany House, Bradmore, Wolverhampton, Lecturer on Chemistry.

1906. Whiteley, C. E., 21, Brudenell View, Leeds, Demonstrator of Chemistry.

1885. Whiteley, R. Lloyd, The Institute, West Bromwich, Staffordshire, Principal.

1892. Whiteside, Jno. L., 376, St. Helen's Road, Bolton-le-Moors, Chemical Lecturer.

1885. Whittaker, C. J., Winthrop, Ansdell Road, Lytham, Lancashire, Chemical Engineer.

1904. Whittier, Charles T., 78, Brinkerhoff Street, Jersey City, N.J., U.S.A., Manager.

1901. Whitton, Jas. T., c/o Nobel's Explosives Co., Ltd., Ardeer, Stevenston, N.B., Chemist.

1884. Whowell, F., Croich Hey, Tottington, Bury, Lancs., Bleacher.

1910. Whymper, R., St. Clare's, St. Mary's Road, Ditton Hill, Surbiton, Chemist.

1899. Wiarda, Jno. C., 259–273, Green Street, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.

1908. Wickes, Clarence S., 28, Franklin Avenue, Merchantville, N.J., U.S.A., Factory Superintendent.

1905. Widmann, Eugene A., 495, Eighth Avenue, Brooklyn, N.Y., U.S.A., Dyestuff Merchant.

1904. Wieler, Eric E., Northern Assurance Buildings, Albert Square, Manchester, Chemical Merchant.

1906. Wiflen, Henry J., 17, Albany Road, Manor Park, Essex, Manufacturing Chemist.

1883. Wiggin, W. W., Wiggin Street Works, Birmingham, Nickel Refiner.

1908. Wiggins, Elmer W., c/o E. I. du Pont Powder Co., Souviers, Douglas Co., Colo., U.S.A., Chemist.

1897. Wigglesworth, H., 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.

O.M. Wightman, C., 12, Palmeira Court, Hove, Sussex, Chemical Merchant.

1906. Wikner, Sigurd A., 103, Moston Street, Birches Head, Hanley, Tar Works Chemist.

1899. Wild, Roland C., The Grange, New Eltham, Kent Analytical Chemist.

1893. Wilder, F. L., Morro Velho, Villa Novo de Lima, Estado de Minas Geraes, Brazil, Assayer.

1902. Wilder, Salmon W., jun., 33, Broad Street, Boston, Mass., U.S.A., Treasurer.

1902. Wiley, Dr. Harvey W., Bureau of Chemistry, Department of Agriculture, Washington, D.C., U.S.A., Chief.

1906. Wilke, Wm., 86, Norwood Avenue, Buffalo, N.Y., U.S.A., Chemical Engineer.

1899. Wilkens, H. A. J., 30, Church Street, New York City, U.S.A., Mining Engineer.

1903. Wilkie, Jno. M., 38, South Road, West Bridgford, Nottingham, Analytical Chemist.

1885. Wilkin, Sir Walter, K.C.M.G., Appold Street, Finsbury, E.C., Yeast Manufacturer.

1895. Wilkins, Charles, 40, Church Lane, Hornsey, N., Manufacturing Perfumer.

1904. Wilkinson, Prof. J. A., Transvaal University College, P.O. Box 1176, Johannesburg, Transvaal, Professor of Chemistry.

1886. Wilkinson, J. B., Tong Street, Dudley Hill, Bradford, Yorks., Chemical Manufacturer.

1906. Wilkinson, John E., 69, Lombard Street, Toronto, Canada, Gold and Silver Refiner.

1903. Willard, C. T., c/o The Singer Manufacturing Co., Elizabethport, N.J., U.S.A., Chemist.

1893. Willcox, Benjamin, 47, Lincoln's Inn Fields, London, W.C.; (Journals) 34, Hamilton Terrace, St. John's Wood, N.W., Patent Agent.

1911. Willcox, Stuart J., 46, Mulgrave Street, Liverpool, Chemist.

1903. Williams, Chas. E., Thornhayes, Sleaford, Seed Crusher.

1895. Williams, David T., 42, Finsbury Square, London, E.C., Chemist and Assayer.

1891. Williams, Henry J., 161, Tremont Street, Boston, Mass., U.S.A., Chemical Engineer.

1908. Williams, Herbert E., 23, Kenilworth Road, Beckenham Road, Penge, Chemist.

1904. Williams, Jno. T., 55, Liberty Street, New York City, U.S.A.

1904. Williams, Naboth, 28, Rolleston Street, Warrington, Technical Chemist.

1902. Williams, Percy, c/o The Wilhelmina Co., Pontianak, Dutch West Borneo, *viâ* Singapore, Chemist.

1910. Williams, Percy E., Gasworks, Poplar, E., Gas Engineer.

1885. Williams, Rowland, Hale Cote, Albert Park, Lancaster, Analytical Chemist.

1900. Williams, Saml. H., Glastonbury, Conn., U.S.A. Soap Manufacturer.

1903. Williams, S. M., 269, Springdale Avenue, East Orange, N.J., U.S.A., Chemist.

1885. Williams, T. Howell. *See* Idris, T. H. W.

1884. Williams, Prof. W. Carleton, Broomgrove, Goring-on-Thames, Professor of Chemistry.

1902. Williams, Walter Scott, 24, Marion Street, Dedham, Mass., U.S.A., Textile Engineer.

1887. Williams, W. Collingwood, 36, Dansie Street, Liverpool, Analytical Chemist.

O.M Williams, W. J., 5004, Franklin Street, Frankford, Philadelphia, Pa., U.S.A., Analytical Chemist.

1894. Williamson, J. Alex., The Croft, Chase Court Gardens, Enfield, N., Analytical Chemist.

1911. Williamson, John, junr., Alne Hill, Camp Road, Maryport, Cumberland, Tanner.

O.M. Williamson, Robt., Low Walker, Newcastle-on-Tyne, Technical Chemist.

1903. Wills, J. Lainson, 1508, Republic Building, Chicago, Ill., U.S.A., Technical and Brewing Chemist.

1905. Wills, Wm. H., 162, Main Street, Waltham, Mass., U.S.A., Dyer.

1895. Willson, Thos. L., St. Catherine's, Ont., Canada, Electrical Engineer.

1884. Wilson, Anthony W., Low Slack, Queen's Road, Kendal, Colour Works Manager.

1888. Wilson, Cecil H., c/o Sheffield Smelting Co., Ltd., Royds Mills Street, Sheffield, Chemist.

1888. Wilson, Dr. David, Carbeth, Killearn, by Glasgow.

1910. Wilson, Dr. Forsyth J., Technical College, Glasgow, Lecturer.

1885 Wilson, Frank, 7, Bedford Square, London, W.C., Brewer.

1903. Wilson, Geo. C., Mysore Mine, Marikuppam, Kolar Gold Field, Mysore State, India, Chemist.

O.M. Wilson, G. E., The Chemical Works, Oldbury, near Birmingham, Chemical Manufacturer.

1902. Wilson, Geo. W., Simmondley, Glossop, Derbyshire, Works Chemist.

1899. Wilson, Gordon, Benallan, Kirkintilloch, N.B.; and (Journals) San Dimas, Durango, Mexico, Chemist and Assayer.

1886. Wilson, Jno., Tyneside, Hagley Road, Birmingham, Technical Chemist.

1896. Wilson, Jno., The Vines, Oxford Road, Runcorn, Chemical Engineer.

1909. Wilson, Jno., Battersea Polytechnic, London, S.W., Head of Chem. Dept.

1905. Wilson, J. E., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemical Salesman.

1906. Wilson, J. Murray, c/o Hamilton Powder Co., Beloeil Station, Prov. Quebec, Canada, Technical Chemist.

1902. Wilson, Leonard P., 8, Chester Street, Coventry Technical Chemist.

1910. Wilson, Leslie, West Bank, Doxey, near Stafford.

O.M. Wilson, R. H., Egglecliffe P.O., Co. Durham, Chemical Manufacturer.

1900. Wilson, Walter A., P.O. Drawer 50, Nanaimo, B.C., Canada, Chemist.

1909. Wilson, Wm. J., 12, Vicarage Park, Plumstead, Kent, Chemist.

1908. Wilson, William James, c/o Wilson's Portland Cement Co., Ltd., Warkworth, Auckland, New Zealand, Cement Works Manager.

1890. Wilson, W. W., Dalmonach House, Alexandria, Dumbartonshire, Analytical Chemist.

1911. Wilton, Norman, c/o The Chemical Engineering Co., Hendon, N.W., Chemical Engineer.

1884. Wilton, Thos., Winsor House, Beckton, E., Tar Works Manager.

1892. Wingfield, T. R., 5, Bromwich Street, Bolton, Brewer.

O.M. Wingham, A., 57, Victoria Road South, Southsea, Hants, Metallurgical Chemist.

1908. Winkler, Hermann, Metallgesellschaft, Frankfurt a/Main, Germany, Merchant.

1906. Winkler, S. M., 38 and 40, Main Street, Cincinnati, Ohio, U.S.A., Chemical Merchant.

O.M. Winser, P. J., Heath House, Knutsford, Cheshire, Consulting Chemist.

1907. Winsloe, Louis S., 1, Booth Street, Manchester, Manufacturing Chemist.

1892. Winstanley, W. Hy., Bridge House, Cheadle Hulme, Cheshire, Technical Chemist.

1886. Winstone, E. H., Members' Mansions, 36, Victoria Street, London, S.W., Ink Manufacturer.

1907. Winther, Dr. A., Chemische Fabrik Griesheim-Elektron, Werk Oehler, Offenbach a/Main, Germany, Chemist.

1892. Wirtz, Dr. Quirin, 28, Great Ormond Street, London, W.C., Consulting Chemist.

1889. Wishart, Jno., 39, St. Vincent Place, Glasgow, General Manager (Oakbank Oil Co., Ltd.).

1902. Withers, Prof. W. A., State A. and M. College, West Raleigh, N.C. U.S.A. Professor of Chemistry.

1906. Withey, Wm. S., Eldorado Mine, Lomagundi, South Rhodesia, Chemist.

O.M. Witt, Dr. Otto N., Ebereschenallee 10, Westend, bei Berlin, Professor of Chemistry.

1892. Witthaus, Dr. R. A., Cornell Medical College, 470, First Avenue and 28th Street, New York City, U.S.A., Professor of Chemistry.

1904. Wolf, August S., 206, West 95th Street, New York City, U.S.A., Chemist.

1903. Wolf, Jacques, c/o Jacques Wolf and Co., Passaic, N.J., U.S.A., Manufacturing Chemist.

1903. Wolton, Wm. R., c/o Joseph Fison and Co., Ltd., Ipswich, Manager.

1906. Wood, E. Escott, Hurricane House, Brymbo near Wrexham, North Wales, Chemist and Metallurgist.

1900. Wood, Frank, Osborne House, Barnsley, Yorks, Assistant Manager (Glass Works).

1901. Wood, Frank S., Chin Chu, Heathcote Street, Newland, Hull, Cement Works Chemist.

1909. Wood, Hubert R., c/o Fenner and Alder and Co., Fenner's Wharf, Millwall, E., Works Chemist.

1887. Wood, Jos. T., 62, Park Road, Nottingham, Tanner.

1886. Wood, Wm., 20, Rue Général van Merlen, Antwerp, Belgium, Bleacher and Dyer.

1906. Woodall, Corbet, Palace Chambers, Westminster, London, S.W., Civil Engineer.

1908. Woodbridge, Walter B., c/o Macleod and Co., 213, East Pearl Street, Cincinnati, Ohio, U.S.A., Chemist.

O.M. Woodcock, R. C., c/o Sanitas Co., Ltd., Locksley Street, Limehouse, London, E., Technical Chemist.

1910. Woodhead, Arthur E., Dyeing Dept., The University, Leeds, Research Student.

1902. Woodhead, Chas. E., 458, Edge Lane, Droylsden, Manchester, Chemist.

1884. Woodhead, Jas., Inglewood, Slaithwaite, near Huddersfield, Tar Distiller.

1900. Woodrow, John, 84, Harpenden Road, Manor Park, E., Chemist.

1906. Woodward, Horace A., 58 Cowell Avenue, West Orange, N.J., U.S.A., Chemist.

1904. Woolcott, Geo. H., Lady's Well Brewery, Cork, Ireland, Brewer's Chemist.

O.M. Woolley, G. S., Victoria Bridge, Manchester, Pharmaceutical Chemist.

1905. Woore, N. L., P.O. Box 12, Mount Morgan, Queensland, Australia, Assayer.

1901. Worden, Edw. C., c/o Clark Thread Co., Newark, N.J., U.S.A., Analytical Chemist.

1909. Work, Charles O., 22, Cambridge Road, Great Crosby, Liverpool, Analytical Chemist.

O.M. Worrall, H., Crimsworth, Upper Chorlton Road, Manchester, Dyer.

1903. Worstall, Robt. A., 121, La Salle Street, Chicago, Ill., U.S.A., Paint and Varnish Specialist.

1900. Worthington, Arthur, Lynwood, Green Lane, Bolton, Chemist and Sub-Manager.

1896. Wrampelmeier, T. J., 2253, Piedmont Avenue, Berkeley, Cal., U.S.A., Chemist.

O.M. Wray, O. J. P., Hazlemere, Coleraine Road, Blackheath, S.E., Technical Chemist.

1904. Wright, Allister M., Box 617, G.P.O., Christchurch, N.Z., Chemist (Christchurch Meat Co.).

1895. Wright, Arthur C., c/o Turner, Morrison, and Co., 6, Lyons Range, Calcutta, India, Chemist.

1908. Wright, C. Harold, Government Laboratory, Port of Spain, Trinidad, B.W.I., Analytical Chemist.

1904. Wright, Chas. L., c/o U.S. Geological Survey, 40th and Butler Streets, Pittsburg, Pa., U.S.A., Chemical Engineer.

1908. Wright, Gilbert, Chemical Laboratory, University of Sydney, N.S.W., Demonstrator in Chemistry.

1901. Wright, Harold E., c/o Sir B. Samuelson and Co., Ltd., Middlesbrough, Chemist.

1907. Wright, John Henry, 16, Norwood Avenue, Shipley, Yorks., Technical Chemist.

1885. Wright, Jos., 19, Arboretum Street, Nottingham, Lace Dresser.

O.M. Wright, L. T., c/o The Mountain Copper Co., 150, Pine Street, San Francisco, Cal., U.S.A., Chemical Engineer.

1910. Wright, Robert, 122, York Street, Jarrow-on-Tyne, Blast Furnace Manager.

1900. Wright, Walter J., c/o "M. B." Powder Co., Greenhill, Stirlingshire; and (Journals) Ardgour, Burnhead Road, Larbert, N.B., Works Manager and Chemist.

1890. Wülffing, Dr. Charles, Hönningen a/Rhein, Germany, Technical Chemist.

1907. Würster, Oscar H., The M. Werk Co., 411, Poplar Street, Cincinnati, Ohio, U.S.A., Soap Works Chemist.

1906. Wuth, Dr. Berthold, 6, Wettsteinplatz, Basle, Switzerland, Chemist,

1890. Wyatt, Dr. Francis, 402, West 23rd Street, New York City, U.S.A., Consulting Chemist.

1905. Wyer, Malcolm G., The Library, State University, Iowa City, Iowa, U.S.A., Librarian.

O.M. Wyld, Jno., The Avenue, Lidgett Park, Roundhay, Leeds, Chemical Works Manager.

1908. Wyler, Dr. Max, 165, High Street, C. on M., Manchester, Manufacturing Chemist.

1906. Wynne, Prof. W. Palmer, F.R.S., The University, Sheffield, and (Journals) 17, Taptonville Road, Sheffield, Professor of Chemistry.

Y

900. Yamaoka, S., 10, Nishikatamachi, Hongo, Tokyo, Japan, Chief Engineer.

1901. Yardley, Frank, c/o Henry Jutson and Sons, Liverpool Street, Birmingham, Chemical Manufacturer.

1897. Yates, Wm. H., 10, Curzon Road, Southport, Lancashire, Technical Chemist.

1911. Yearsley, W. D., junr., c/o Geisenheimer and Co., 181, Front Street, New York City, U.S.A., Colour Chemist.

1910. Yeb, T. H., 51, Charlotte Road, Edgbaston, Birmingham, Student.

1906. Yerkes, Leonard A., c/o Jos. Bancroft and Sons Co., Wilmington, Del., U.S.A., Bleacher and Finisher.
1898. Yetton, Thos., 86, Bow Road, London, E., Consulting Distiller's Chemist.
1894. Yocum, Dr. Jno. H., 359, Halsey Street, Newark, N.J., U.S.A., Chemist.
1886. Yoshida, Prof. H., Imperial University of Kyoto, Kyoto, Japan, Professor of Chemistry.
1900. Yoshitake, E., 18, Tatsuokacho, Hongo, Tokyo, Japan, Chemist.
1885. Young, Alfred C., 17, Vicar's Hill, Lewisham, S.E.
1885. Young, Brougham, 2A, Sigdon Road, Dalston, N.E., Analytical Chemist.
1902. Young, Chas. C., c/o Farbenfabriken of Elberfeld Co., 117, Hudson Street, New York City, U.S.A., Colourist.
1890. Young, Dr. Geo., Bradda, Church Crescent, Church End, Finchley, N., Chemist.
1904. Young, James, 2, Montague Terrace, Kelvinside, Glasgow, Chemist.
O.M. Young, Jno., 2, Montague Terrace, Kelvinside, Glasgow, Technical Chemist.
1886. Young, Jno., Claremont House, Beverley Road, Hull, Gas Engineer.
1909. Young, John, Diamond, Demerara, British Guiana, Analytical Chemist.
1904. Young, Jno. H., c/o The Cassel Cyanide Co., Ltd., Shuna Street, Maryhill, Glasgow, Technical Chemist.
1898. Young, J. W., 22, Maxwell Drive, Glasgow, S., Inspector under Alkali Acts.
1909. Young, R. F., c/o Abosso G. M. Co., Abosso, Gold Coast, West Africa, Chemist and Metallurgist.
1883. Young, Prof. Sydney, F.R.S., University Chemical Laboratory, Trinity College, Dublin, Professor of Chemistry.
O.M. Young, W. C., Laboratory, 24, Aldgate, London, E.C., Gas Examiner and Consulting Chemist.
1898. Young, W. Gathorne, Analyst's Dept., G.N.R., Doncaster, Yorks., Chief Chemist.

Z

1899. Zabriskie, C. B., c/o Pacific Coast Borax Co., 100, William Street, New York City, U.S.A., Manager.
1897. Zacharias, Dr. P. D., Philhellinon Street 22, Athens, Greece, Industrial Chemist.
1906. Zaremba, Edw., 1044, Ellicott Square, Buffalo, N.Y., U.S.A., President (Zaremba Co.).
1906. Zdanowicz, Joseph, 9, Knaresborough Place, Earl's Court, S.W., Chemical Engineer (Artificial Silk).
1899. Zilz, Henry, 20–26, Brunswick Place, City Road, London, E.C., Agent (Badische Anilin und Soda Fabrik).
O.M. Zimmermann, A., 3, Lloyd's Avenue, London, E.C., Chemical Agent.
1905. Zimmermann, Chas., 9 & 10, St. Mary-at-Hill, London, E.C., Chemical Merchant.
1897. Zinsser, Dr. Fred. G., Hastings-upon-Hudson, N.Y., U.S.A., Manufacturing Chemist.

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